German-Japan Forum
on
Information Technology

April 27th, 1984

Keidanren Kaikan

Japan External
Trade Organization

Japan Information Processing
Development Center

Japan Electronic Industry
Development Association

Japan Information Processing Development Center (JIPDEC) was established in 1967 with the support of the Government and related industrial circles. JIPDEC is a non-profit organization aimed at the promotion, research and development of information processing and information processing industries in Japan.

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German-Japan Forum on Information Technology

(Members List)

Japan | Federal Republic of Germany

Chairman

Japan

Prof. Dr. Hisayoshi Yanai

Professor Emeritus, University of Tokyo
Professor, Shibaura Institute of Technology

1920	Born
1942	- B.S. Degree in Electrical Engineering, University of Tokyo - Assistant Professor, University of Tokyo
1947	Associate Professor (Electrical Engineering)
1953	Received Ph. D. from University of Tokyo
1960	Professor (Electronic Engineering)
[Since 1966, Visiting Professor at Technical University of Münich, Stuttgart and Braunschweig]	
1981	Retired from University of Tokyo to assume present position

Federal Republic of Germany

Prof. Dr. Walter L. Engl

Professor, Technical University of Aachen (RWTH Aachen)
Director, Institute for Theoretical Electro-technology, Technical University of Aachen (RWTH Aachen)

	Born in Regensburg, Germany
1946	(–1949) Studied Phisics at Technical University of Munich
1950	Siemens Instrument and Control Division at Karlsruch
1953	Dr. rer. nat. degree from the Technical University of Munich
1961	Received the "Venia legendt" from the Technical University of Karlsruch
1963	Professor at the Technical University of Aachen
[Since 1967, Visiting Professor at University of Arizona, Stanford University, and University of Tokyo]	
	(Research interests) Theory and application of integrated electronic theory of electromagnetic field and networks and electrical instruments

New Media

Japan

Prof. Dr. Hiroshi Miyakawa (Chairman)

Professor, Department of Electrical Engineering, University of Tokyo

1931	Born
1953	Graduated from University of Tokyo
1958	Ph. D. (Engineering),Instructor, University of Tokyo (Electrical Engineering)
1959	Assistant Professor
1970	Present position

Prof. Dr. Takanori Ohkoshi (Reporter)

Professor, Department of Electronic Engineering, University of Tokyo

1932	Born in Tokyo
1955	Graduated from University of Tokyo (Electrical Engineering)
1960	Ph. D. (Electrical Engineering)
1961	Associate Professor, University of Tokyo (Electronic Engineering)
1963	Bell Laboratories (U.S.A.)
1972	Visiting Professor at Technical University of Munich
1977	Present position (Research interests) Optical fibers, optical fiber communications, microwave planar circuits, optical memories

Dr. Iwao Toda (Speaker)

Deputy Director General, Research and Development Bureau, Nippon Telegraph and Telephone Public Corporation

1934	Born
1956	Graduated from University of Tokyo (Electrical Engineering)
1958	- M.S. Degree from University of Tokyo - Electro-Communication Laboratory, NTT
1964	- Ph. D. (University of Tokyo)

Federal Republic of Germany

Prof. Dr. Clemens Baack (Chairman)

Scientific Director, Heinrich-Hertz-Institute of Telecommunication (HHI)
Professor, Technical University of Berlin

1937	Born in Meschede
1959	B.S. Degree in Electrical Engineering
1967	M.S. Degree in Communication Engineering
1968	Hahn-Meitner-Institut
1970	- Research Associate at the Technical University of Berlin - Ph. D. (Phased-Array-Antennas-Theory)
1974	. Forschungsinstitut für Funk und Mathematik
1975	Heinrich-Hertz-Institut
1982	Appointed as Professor at the Technical University of Berlin

Prof. Dr. Karl-Ludwig Plank (Speaker)

Member of the Board of Directors, Telephonbau und Normalzeit AG

1929	Born in Geßen/Lahn Studied at the Technical University of Aachan where attained his doctorate
1959	R&D department at Telefonbau und Normalzeit
1972	- Responsible for the entire development operations within the TN Group - Board of Directors of Messrs. Friedrich Merk-Telefonbau GmbH - Chairman of the Telenorma Entwicklungesellshaft bmH
1980	Honorary Professor at the Technical University of Aachen

Prof. Dr. Max Syrbe

President, Fraunhofer Research Association

1966	(–1973) Member of the Fraunhofer Research Association

	- Visiting Lecturer at University of Calif. Berkeley
1979	Director, Data Communication Systems Development
1983	Present position at NTT (Research interests) Computer architecture, computer communication technology

(Mr. Kenjiro Sakurai)

Director, Optoelectronic Industry and Technology Development Association

Mr. Eiichi Sawabe

Deputy Director, Technical Research Laboratories, Japan Broadcasting Corporation

1933	Born
1955	Graduated from University of Tokyo (Electrical Engineering) Japan Broadcasting Corp. (NHK) (Radio frequency broadcasting equipments, broadcasting satellite, etc.)
1973	NASDA
1983	Present position (Research interests) Satellite broadcasting system, advanced broadcasting system

Mr. Yuzo Tsukamoto

Executive Director, Japan Information Processing Center Association

1917	Born
1938	Graduated from the Japan Naval Academy
1958	Director, Tokyo Electronic Computing Service Co., Ltd.
[Since 1961,	Managing Director, C. Itoh Electronic Computing Service Co., Ltd. (Altering name of the company), Senior Managing Director and President, respectively]
1971	Altering Company name to present company

Dr. Seibei Tachikawa

Director, Business Development Department, Headquarters-Information Network Systems Development, Mitsubishi Electric Corporation

1928	Born in Hyogo
1953	- Graduated from Osaka University - Mitsubishi Electric Corp.
1962	Ph. D. (Osaka University)
[Since 1969,	engaged in designing of antenna of terrestrial microwave transmission line, Deputy General Manager of Communication Equipment Works, Present position (1983) respectively]

Dr. Yutaka Matsushita

General Manager, Development Department, Computer System Division, Oki Electric Industry Company Limited

1939	Born
1963	- Graduated from Keio University (Electrical Engineering) - Oki Electric Industry Co., Ltd.
1968	M.S. Degree (Computer Science) from University of Illinois (Research interests) Distributed database system design, workstation with new man-machine interface

1968	(–1972) Chairman VDI/VDE Group of Control Engineering
1970	(–1973) Member of the Board VDI
1971	(–1973) Deputy Chairman of the Scientific-Technical-Council Fraunhofen Research Association
1971	(–1980) Chairman of the Expert's Circle, Computerized Process Control, Federal Ministry of Research and Technology
1973	(–1983) Member of Board, respect. of the Advisory Board VDI/VDE Society of Measuring and Control Engineering
1980	(–1983) Member of the Presidency Society of Information

Dr. Eckart Raubold

Director, Institute for Systemtechnics, German National Research Center for Mathematics and Dataprocessing (GMD)

1938	Born Ph. D. in Physics at Hamburg-University
1974	Head of DP Department of DESY (Deutsches Elektronen-Synchrotron), Hamburg Head of Institute for Systems Technology, GMD

Dr. Bernd Schönwald

Director, Research and Development, Krupp AG

1973	B.S. & M.S. Degrees in Communications Engineering from the Technical University of Aachen
1980	- Research into remote-sensing at the Fraumhofen-Society and the Max-Planck-Society - Ph. D. at the University of Hamburg
1981	Present position

Mr. Franz-Josef Winkel

Managing Director, Informatik-GmbH

1940	Born in Illingen/Saar
1963	R&D Technician, Telephone, Telegrafic Communication Systems
1966	Studies in Computer Technology in Frankfurt (R&D Trian-Trafic-Control-Systems)
1969	Consultant for Computer Technology and Process-Control Systems
1972	Foundation of Informatik-Systemtechnik together with Dr. Juergen Haemer in Stuttgart (Research interests) LAN, fiber optics, industrial applications, realtime OS, etc.

Computer

Prof. Dr. Tohru Moto-oka (Chairman)

Professor, Department of Electrical Engineering, University of Tokyo

1929 Born in Tokyo
1952 Graduated from University of Tokyo (Electrical Engineering)
1957 Faculty of Engineering, University of Tokyo
1958 Ph. D. (Engineering) from University of Tokyo
[Since 1961, Visiting Research Assistant Professor at the University of Illinois, Visiting Professor at Washington University, present position (1967), respectively]
(Research interests) Computer architectures, distributed computer systems, artificial intelligence

Prof. Dr. Hideo Aiso (Reporter)

Professor, Department of Electrical Engineering, Keio University

1957 - M.S. degree (Electrical Engineering) from Keio University
- Researcher, Osaka University
- Electrotechnical Laboratory
1960 Computer Research Laboratory at the Illinois University (R&D on transistor computer)
1971 - Ph. D. (Engineering)
- Present position

Dr. Hiroshi Kashiwagi (Speaker)

Chief, Computer Systems Division, Electrotechnical Laboratory

1934 Born
1960 M.S. Degree (Electrical Engineering) from Keio University
1964 Electrotechnical Laboratory
1967 Ph. D. (Electrical Engineering)
[Since 1973, Chief, Laser Section, Radio and Optoelectronics Division, Chief of Research Planning Office, present position (1981), respectively]

Mr. Kazuhiro Fuchi

Director, Institute for New Generation Computer Technology

1936 Born
1958 - Graduated from University of Tokyo (Applied Phisics)
- Electrotechnical Laboratory
[Since 1972, responsible positions in various fields such as voice recognition, inference mechanism, pattern information etc.]
1982 Present position at ICOT

Dr. Hidetoshi Kawai

Director, Software Technology Center of Information-Technology Promotion Agency, Japan

1934 Born
1956 - Graduated from Hokkaido University (Science)
- Sapporo District Meteorological Observatory
1961 Electrotechnical Laboratory
1969 Research Associate at the National Bureau of Standards (U.S.A.)
1978 Director, Mathematical Engineering, Information Sceince Division
1981 Present position
1983 Ph. D. (University of Tokyo)

Prof. Dr. Norbert Szyperski (Chairman)

Managing Director, German National Research Center for Mathematics and Dataprocessing (GMD)
Professor, University of Köln

1931 Born in Berlin
1957 Diploma at Freie University of Berlin
1961 - Dr. rer. pol., Berlin
- Scientific Assistant at Institut für Industrieforschung, Berlin
1962 German Eisenhower Exchange Fellow, U.S.A.
1963 Assistant Professor of Management at the University of Florida
1968 Research Director of Institute for Organization and Automation, University of Köln
1970 Professor, Applied Economics, University of Köln
1981 Present position at the GMD
(Research interests) Planning theory and applies information

Mr. Klaus Fritsch (Speaker)

Director, Research and Development, Triumph-Adler

1938 Born
1966 Graduated from Technical University of Aachen (Electronics)
1967 AEG-Telefunken: development engineer, working on TR440
1969 Nixdorf Computer AG (Development division for CAD and Fault Diagnose Systems, Development of DDP System and SBC)
1982 Present position at Triumph-Adler AG

Prof. Dr. Wolfgang K. Giloi

Professor, Technical University of Berlin
Director, GMD Laboratory for Innovative Computer Systems and Technology (GMD FIRST)

1930 Born in Sobernheim
1957 Diploma in Electrical Engineering, University of Stuttgart
1960 - Ph. D., Electrical Engineering, University of Stuttgart
- General Manager, AEG-Telefunken, Computer Division
1965 Professor, Technical University of Berlin (Electrical Engineering)
1971 Professor, University of Minnesota, U.S.A. (Computer Science)
1977 Professor, Technical University of Berlin (Computer Science)
[Since 1966, Visiting Professors at the National University of Mexico, MIT, UCLA, etc.]
1983 Present position at the GMD

Dr. Günter E. W. Möller

Managing Director, Office and Information Technique, German Machinery Manufacturers and Plant Makers Association (VDMA)

1971 Director of VDMA, Brussels Office
Participation in the EC-Commission's preparatory work for the future ESPRIT-Programme
1979 Executive Director of the German Branch Association

Mr. Kouichi Kishida

Chairman, Software Technology Committee, Japan Software Industry Association

1936	Born - Studied Astronomy at University of Tokyo - Oki Business Machine Co., Ltd. - Computer Systems Co., Ltd.
1967	Accompanied to establish the Software Research Associate
[Since 1967, Chairman of the Software Technology Committee, JSI, President, Japan Unix Society, etc.]	
	(Research interest) Software development methodology, support equipment for software engineering

Mr. Shigeru Sato

Deputy General Manager, Computer System Division, Fujitsu Laboratories Limited

1935	Born
1958	- Graduated from University of Tokyo (Electrical Engineering) - Fujitsu, Ltd. [Computer basic technology (circuit, design automation, etc.), system development (DIPS II, M Series)]
1982	Present position (R&D for basic technology on new generation computer systems)

Mr. Tsuneo Uraki

Manager, Product Planning Department Kanagawa-Works, Hitachi Limited

1936	Born
1959	- Graduated from University of Tokyo (Science) - Hitachi Ltd.
[Since 1962, worked at Kanagawa Works (Development of HITAC 8000 Series and M Computer System) Now, responsible for product planning for IP system]	

1980	- Secretary General of the European Association - Founding member of the International Information Industries Congress (IIIC)

Dr. Günther Groh

Managing Director, Philips Data Systems

1933	Born in Kiel
1961	Studied (Physics, Mathematics, Chemistry and Oceanography) at University of Kiel
1963	- Graduated with a dissertation - Assistant Scientist at the Institute for Applied Physics at the University of Kiel
1966	Philips Research Laboratory (Solid state, application of laser beams, holography)
1970	- Appointment to "Fellow of the Optical Society of America" - Head of the Research Department "Technical Systems" at Philips
1974	Head of Philips Research Laboratory
1980	Present position

Dr. Erwin Königs

Director, Technical Development, Nixdorf Computer AG

1950	Born
1974	Diploma, Phisics at the Technical University of Aachen
1978	- Ph. D. (High energy phisics experiment) - Nixdorf Computer AG (Supporting and improving software development environment) (Evaluation of CAD tools for printed-circuit-board-layout and VLSI components)

Semiconductor

Prof. Dr. Hisayoshi Yanai (Chairman)

Professor Emeritus, University of Tokyo
Professor, Shibaura Institute of Technology

Prof. Dr. Takuo Sugano (Reporter)

Professor, Department of Electronic Engineering, University of Tokyo

1931	Born
1954	Graduated from University of Tokyo (Electrical Engineering)
1959	- Ph. D. (Electrical Engineering) - Instructor at University of Tokyo
1960	Associate Professor (Electrical Engineering)
1971	Present position

Prof. Dr. Shoji Tanaka (Speaker)

Professor, Department of Applied Physics, University of Tokyo

1927	Born
1950	Graduated from University of Tokyo (Engineering)
1955	Ph. D. (Applied Phisics) from University of Tokyo - Instructor at University of Tokyo (Engineering)

Prof. Dr. Ingolf Ruge (Chairman)

Director, Institute of Solid State Physics, Fraunhofer Research Association
Professor, Technical University of München

1934	Born in Schweidnitz
1959	Diploma in Electrical Engineering, Technical University of Munich
1964	Ph. D. from Technical University of Munich
1967	Appointed as the Professor for the field of Electronics
[Since 1969, Professor and Department Head at the Institute of Technical Electronics, Chairman of the Department of IC, Present position (1974), respectively]	
	(Research interests) Solid-state technology, semiconductor measurement techniques, circuit engineering, digital and analog IC, medical electronics

Dr. Kurt Garbrecht (Speaker)

Director, Research and Development on IC and Electronic Components, Siemens AG

1932	Born in Wittstock
1958	Diploma, Engineer in Telecommunications Technical University of Dresden

1957	Associate Professor
1959	Researcher at Purdue University (U.S.A.)
1968	Present position

Prof. Dr. Kiyoshi Takahashi

Professor, Department of Physical Electronics, Tokyo Institute of Technology

1934	Born
1957	Graduated from Tokyo Institute of Technology (Electrical Engineering)
1962	Ph. D. (Electrical Engineering) Assistant Researcher, Tokyo Institute of Technology
1964	Associate Professor
[Since 1973, Visiting Professor at the Institute Politecnico National in Mexico and Universidade de Sao Paulo)	
1977	Present position (Research interests) Solar cells, sensing devices, heterojunctions and semiconductor metals

Dr. Shoei Kataoka

Chief, Electronic Device Division Electrotechnical Laboratory

1929	Born in Fukushima
1953	- Graduated from University of Tokyo (Electrical Engineering) - Electrotechnical Laboratory
1966	Ph. D. (University of Tokyo)
1978	D. Sc. (University of London)
[Since 1953, R&D on compound semiconductor devices, in particular, galvanomagnetic devices, transferred electron devices, and high-speed logic devices)	
	Present position

Dr. Takashi Ishidate

Associate Chief Engineer, Electron Device Group, NEC Corporation

1932	Born in Tokushima
1955	- Graduated from Tokyo Institute of Technology (Electrical Engineering) - NEC Corp.
1964	Ph. D. (Tokyo Institute of Technology)
[Since 1968, Manager, Memory Circuit and Assistant to Executive V-Pat Central Research Lab.]	
1980	Manager, First Circuit Design, NEC Microcomputer Systems, Ltd.
1983	Present position

Dr. Kaishiroh Odagawa

Assistant Group Executive, Semiconductor Group, Toshiba Corporation

1929	Born
1952	- Graduated from University of Tokyo (Electrical Engineering) - Toshiba Research Laboratory
1961	Ph. D. (University of Tokyo)
1965	Semiconductor Department (R&D on IC, LSI, VLSI)
[Since then, Technical Manager of IC etc., Chairman of IC Center, present position within Toshiba, Respectively]	
	(Research interests) VLSI (Memory, gate array, custom VLSI)

1960	SEL, Pforzheim, Germany (Development of radio relay systems)
1962	Siemens Aktiengesellschaft, Munich Central Laboratories
1965	Dr. Ing. Technical University of Munich
[Since 1967, Manager Microwave Systems in Central Lab., Siemens, Development Director Semiconductor Plant, Present position (1979), respectively]	

Prof. Dr. Walter L. Engl

Professor, Technical University of Aachen (RWTH Aachen)
Director, Institute for Theoretical Electrotechnology, Technical University of Aachen (RWTH Aachen)

Dr. Michael Schädlich

Manager, Product Planning/Control Process Data Systems, Krupp Atlas Electronic German Association of Electrical Engineers (ZVEI)

	Course of study in Physics and Computer Technology at the University of Hamburg and German Electron Synchrotron (DESY)
1977	Personal Assistant to Herrn Berthold Beitz, Chairman of the Board of Fried Krupp GmbH
1980	Present position

Plenary Session

Mr. Yukiharu Kodama

Deputy Director General, Machinery and Information Industries Bureau, Ministry of International Trade and Industry (MITI)

1934	Born in Hiroshima
1957	Ministry of International Trade and Industry
[Since 1974, Responsible at Data-Processing Promotion Division, Policy Planning Office, Minister's Secretariat, General Affairs Division, Machinery and Information Industires Bureau, Economic Cooperation Department, present position (1983) within MITI, respectively]	

Mr. Uwe Thomas

Deputy Director General, Bureau of Information Technology and Production Technology, Ministry of Research and Technology (BMFT)

1938	Born in Dresden
1964	Diploma in Phisics, University of München
1965	Research Institute of AEG-Telefunken in Berlin
1967	Project Leader for Computerization Projects in German Patent Office and in German Federal Press Office
1969	OECD in Paris
1971	Chancellors Office in Bonn, Members of Project Group for Reforms in Government and Administration
1973–	Ministry for Research and Technology

Dr. Siegfried von Krosigk

Director, Japan Relation Offices, German National Research Center for Mathematics and Dataprocessing (GMD)

1932	Born in Potsdam
1952	Diploma in Civil Engineering, Technical University of Karlsruhe
1964	- Dr.-Ing, Scientific Assistant, Institute of Hydrodynamics, Technical University of Karlsruhe - Deputy Head Watermanagement Projects, German Technical Aid to Afghanistan
1969	OECD, Paris
1970	Federal Ministry of Interior Environment Directorate
1976	- Federal Ministry of Research and Technology - Federal Ministry of Foreign Affairs, Embassy Tokyo, Science Counsellor
1982	Present position

CONTENTS

GERMAN-JAPAN FORUM ON INFORMATION TECHNOLOGY

April 27th, 1984

Keidanren Kaikan

10:00—

Plenary Session (I): Room 1001

MODERATOR (NAKAYAMA): Good morning, ladies and gentlemen. At this time I would like to call to the order the German-Japan Forum on Information Technology.

First of all, I would like to explain to you about the channels of the receivers: Channel 2 is English; and Channel 3 is Japanese.

First of all, I have been assigned to the job of the Moderator, and I myself is Nakayama, Managing Director of JIPDEC. I am very glad to meet with you. And first of all, on behalf of the sponsors, I would like to invite Mr. Shoichi Akazawa, President of JETRO, to give you an opening remark.

S. AKAZAWA: Your Excellency, Ambassador Brech, of the Federal Republic of Germany, Professor Walter Engl, the Honourable Parliamentary Vice Minister for International Trade and Industry, Professor Emeritus Yanai of Tokyo University, Distinguished Guests and Ladies and Gentlemen:

It is a great pleasure for me to be able to see that the First German-Japan Forum on Information Technology is going to be held under the sponsorship of Japan Information Processing Development Center, Electronic Industry Promotion

Association, and Japan Export Trade Organization. And I would like to express my sincere appreciation on behalf of organizing groups for your participation.

It was in August last year when the Honourable Minister Riesenhoover, the Minister for Research and Technology of the Federal Republic, came to visit our Minister Uno of International Trade and Industry, and agreed to establish this Forum, to facilitate the cooperative relationship in the information technology field between our two countries.

In recent years, we have witnessed tremendous progress in data processing and communication technologies. All industrialized countries are moving into the age of sophisticated information society.

Both in industrialized countries and in developing countries, these technologies will become the mainstay of society and economy in the future. Looking into the forthcoming 21st century, we must do our utmost to develop technologies in this field.

Ladies and gentlemen, it is my conviction that without competition, there can be no progress in technology. At the same time, in the basic fields of technological development, there must be many aspects in which every nation can cooperate with each other.

The Government of the Federal Republic of Germany recently formulated a plan for research and development in information technology by spending 3 billion Deutsche-marks until the year 1988. Japan has also started back in 1982 a ten-year plan to develop the fifth generation computers.

Under these circumstances, it is most significant that leading scientists, engineers get together under one roof for exchange of information and technologies from our two countries, which are locomotives for the development of information technologies in the world.

I believe at the same time that this Forum will give a new impetus for the technological exchange internationally and to contribute greatly to the world economy.

We at the JETRO are shifting our weight in activities towards the promotion of industrial cooperation and technological exchange, in order to contribute to the reactivation of the world economy.

Finally, I offer my good wishes for the success of this Forum, and hope that this Forum will contribute significantly to the ever-closer economic and technological relations between our two countries.

Thank you very much.

MODERATOR: Next is the Welcoming Speeches from our Honourable Guests. First speaker is the Honourable Parliamentary Vice Minister of MITI, Mr. Ohki.

MR. OHKI: Ambassador Brech, Mr. Nakazawa, Mr. Engl and Mr. Yanai, ladies and gentlemen. On the occasion of the opening of the German-Japan Forum on Information Technology, on behalf of the Ministry of International Trade and Industry, allow me to extend a few words of greetings.

I should like to first of all pay my deepest respects to His Excellency Ambassador Klaus Brech and others of the Federal Republic of Germany, who have made enormous efforts in order to make this Forum possible. And to those of you who have come to Japan to attend this Forum, we extend our heartfelt welcome.

As a result of the recent rapid progress in the area of technological innovation, we are entering into a new period and age of change. And this change will affect not only industrial structure but will have far-reaching effects on society and cultures, and it will indeed have an impact on the world as a whole. It is a period of great change.

Now, the great strides we have made in the area of information technology in the field of computers and semiconductors, and the spread of this technology, is exerting influences on the industry and societies and all aspects of life of the respective countries, as well as to the international society.

Germany and Japan both have strong technological and economic capabilities, and both countries enjoy a leading position among the countries of the international society. So, both countries have a responsibility through cooperation in the area of information technology to pave the way for future prosperity and to strive to bring affluence throughout the world. Since previous times, both countries have actively pursued research and development in the various circles including universities, government institutions, and the industry. But for both countries, to further step up research and development efforts in this field, and for both countries to make contributions to the world, it becomes indispensable for both of us to make for even closer ties and closer exchange and cooperation.

Now, viewed in this light, the convening of this Forum which materialized as a result of the meeting which took place between His Excellency Minister Riesenhoover and our MITI Minister Mr. Uno, and which is a place where members of the industry, academia and the governments of both countries can get together, is most appropriate.

The Ministry entertains great expectations of the outcome of this Forum, and intends to make its best efforts to even further promote exchange and cooperation in this area.

I would like to conclude by appealing to those of you in attendance today to render this Forum successful through active exchange of views. Thank you very much.

<u>MODERATOR:</u> Thank you very much, Mr. Ohki.

I would now like to ask Your Excellency Dr. Brech, Ambassador of the Federal Republic of Germany.

H.E. AMBASSADOR BRECH: Mr. Vice Minister, Mr. President, Chairman, Gentlemen: It's a great privilege for me to address this small but highly qualified group of academic and industrial experts of information technologies from Japan and Germany.

It assembles in a relatively small framework men of the highest qualification in their field. I hope that your discussions today will be fruitful. And I do hope that they lead to better understanding and eventually to an even more increased cooperation between our two countries.

Forty-three years ago, the first programme of the digital computer was constructed: At that time, on the basis of electro-mechanical relay. Twenty years ago, the revolution of electronics began with the broad application of transistors. Close technologies have fundamentally effected our economic and social life.

On the basis of such technologies, Japan has built up industrial capacities, which have essentially contributed to bring Japan into the realms of one of the important exporting nations, together with the United States and with my own country, the Federal Republic of Germany. If my country wants to maintain the traditional strength of its industry on world markets, it depends decisively on the innovative application of new technologies, in particular, of information technology.

Here, we are on common grounds with our Japanese friends. We both are nations without natural resources on which we could rely. For our viability as industrial nations, we have to rely on the minds, brains and hearts of our people: --their imagination, their intellectual resources, their experiences are our only commodities. And we can exploit them only by renewing them continuously.

Coming back to the particular field of information technology, I have to say our two countries have their achievements; both countries are tackling similar problems --not always identical, but leading into the same direction. I am therefore convinced that the work done in both countries can and should be complementary. And more important still, both countries have a vital interest in the preservation of a flourishing and free world trade.

Friendship is unconceivable without mutual appreciation. Out of this understanding, the Minister of International Trade and Industry on the Japanese side, and the German Federal Minister for Research and Technology have agreed to organize this Forum for representatives of science, industry, and government. It is a great pleasure for me to extend the best wishes of Federal Minister Dr. Heinz Riesenhoover for a successful proceeding of today's first meeting of the Forum. And I want you to know that everything what I have been saying here about the present state of our relations and about our hopes as to the future developments fully reflects his own thinking. Governments alone cannot organize cooperation in the management of technological development. It is important--essential, therefore, that representatives of the scientific community as well as representatives of private industry from both countries get together in a regular and well-prepared manner with two-fold purposes to identify possible fields of cooperation and to discuss them in the spirit reflecting the amities that have been existing between Japan and Germany.

I am profoundly grateful to our Japanese friends and to our two Chairmen, Professor Yanai and Professor Engl, for having prepared the First Session so thoroughly.

Let me conclude by stating my belief that this forum of discussion will, by discovering new and promising areas of possible joint initiatives, indeed contribute a great deal to the strengthening of our scientific and technological ties. Thank you very much.

MODERATOR: Thank you very much, Mr. Ambassador, for your words. Now, then, we would like to have co-chairmen from both delegations to give us a few remarks.

First, Professor Engl, from the German Delegation.

PROF. ENGL: —(IN JAPANESE)—

I would like to express my appreciation to the representatives of the Japanese Government and the German

Government present here. As a result of your devoted efforts we have been able to get together here, today.

We have a great number of good and old friends gathered here in this room, because of your preparation for this Forum. Professor Yanai is authority on semiconductors; he is an old friend of mine, and I am very pleased to see him again. As you see, Professor Yanai has retired from public work, but he is still keeping very busy schedule of activity. For that reason, he has not been able to open a Japanese restaurant in the City of Aachen, which he planned to do.

When I was young I didn't have time to study foreign languages, and that is the reason that I am reading a halting Japanese text on this occasion.

Before I break your eardrums by my speech, I would like to conclude my remarks; I would like to switch to my broken English, which is the common language for scientists and engineers all over the world.

MODERATOR: Thank you very much, Professor Engl. Now, then, I would like to ask Professor Yanai of the Japanese Delegation.

PROF. YANAI: Thank you very much for the introduction.

Your Excellency Ambassador, Professor Engl, and other German representatives, Mr. Ohki and other representatives of the Japanese side, ladies and gentlemen:

Professor Engl spoke to us in Japanese, and I am at a disadvantage. I am supposed to speak in German then, but I didn't know Professor Engl was doing homework preparing his Japanese speech. But lacking the German text, I have to speak in Japanese.

Certainly all of the world technologies are progressing rapidly; particularly, in the field of semiconductors and computers and communications, many countries are pressing forward the technologies which will be utilized in the 21st century. Certainly, technologies are basic necessities for us just as solar energy is. Development and innovations in technological fields, in the field of information, is called the "Third Industrial Revolution".

In this context, the information technologies have great bearing not only on technological fields but also on social living. Consequently, for us to advance these technologies, we must join hands with engineers and scientists of many countries. In particular, the Federal Republic of Germany and Japan are two nations blessed with high levels of technological capabilities. And we are placed in the similar positions among the industrialized countries of the world. Historical background, culture, language, and philosophies, may in many instances differ between these two countries, and we can play a complementary and supplementary role to each other in many fields of endeavour.

Therefore, we must take advantage of this complementality of our two nations, so that we can utilize the strong points of the other and alleviate the weak points of ourselves.

Against this backdrop, we are to form the German-Japan Forum on Information Technology for the exchange of information and exchange of persons in government, industry and academia, so that we can build up closer cooperative relations between our two nations for the advancement of not only technology but also society. This Forum, therefore, is very significant in many senses of the world. And I feel it a great honour for me to be able to act as Co-Chairman for this Session. Particularly, Professor Engl, who is the Co-Chairman of the German Delegation, as he stated, is an old friend of mine. And many members of the German delegation are personal acquaintances of mine for many years. For this and other reasons, I am sure that we can operate in a most beneficial manner the forum we are to establish today.

Professor Engl gave us a speech in Japanese. And it would be a boon for us if you all can speak Japanese. But the Japanese might be too difficult for German participants, and the same thing applies to us. If we could speak German, the fruit of the conference would be greater. At any rate, when you handle information, you cannot avoid the problem of language. The language is a basic means of exchanging information; and we think in terms of language. Language is a very important element in information exchange. Lack of commonality of languages is regrettable, and it is also regrettable that we have to use English as our common language for this forum. We shall have general discussion in the morning and in the afternoon we will have more detailed and specific areas to be tackled by several panels. And I hope that we can overcome the difficulty of language in making our views known to each other.

This Forum is designed to promote closer relations between our two countries. Since this is the first forum--meeting, we must tackle the problem of finding a suitable form of exchange to be effected between our two countries. And if we are to cooperate in industrial sectors, what we should do to build up the suitable framework for such exchange. All these basic issues must be tackled in this meeting. Certainly, time is limited in this conference, but I hope that general guidelines might emerge from our discussions today for technical cooperation between our two countries.

Professor Engl and German delegation members, Japanese delegation, would all, I hope, cooperate in attaining our objective of our Forum. Thank you ver much.

MODERATOR: Thank you very much. As for the proceedings from now on, I would like to ask the two Co-Chairmen to proceed. And Dr. Yanai, please.

DR. YANAI: Please allow me to speak while I sit. I have been assigned to the job of the moderator, and I would like to proceed abiding by the programme which has been distributed to you earlier. I had spoken with Dr. Engl before, and I would serve as a moderator in general terms; and whenever necessary, I would consult with Dr. Engl. So, I hope I can have your cooperation.

We are now organizing at the German-Japan Forum on Information Technology. This is the forum whereby Germany and Japan meet once a year to discuss what is happening in the research and development field as well as exchange of views in this regard. And the venue for the forum is to be held alternately between Japan and Germany. And this has been basically determined already. And this is the very first forum that we are having today, so this morning, the time will be devoted to receiving the Plenary programme. And in the afternoon, we will have the Workshops as well. And general issue will be discussed during the afternoon at the Plenary Session.

So, during the morning, we will receive the keynote speeches to be delivered by Mr. Kodama from MITI, by Professor Motooka from Tokyo University, and Dr. Thomas, the Ministry of Research and Technology of Germany. And after receiving those keynote speeches, in the afternoon, from 1:00 o'clock to 3:15, we will have three working sessions going on simultaneously regarding the topics of "New Media", "Computer", and "Semiconductors". And later on, around 3:35, we will convene once again at the Plenary Session, and receive the reports from respective Workshops. And also we will have the general discussions and try to reach at a conclusion for today. And I hope this proceeding meets with your agreement, Dr. Engl? Thank you very much.

Then, following this, I would like to introduce the members who are participating at this Forum. And may I ask Mr. Nakayama to introduce the members? And when your name is called, please stand up; please rise when your name is called.

MR. NAKAYAMA: First of all, may I introduce the members?

First of all, from the Japanese side, may I introduce? Next to right of Dr. Yanai, we have Mr. Ohki, Parliamentary Vice Minister, who has given you the opening remarks. And the next to him is from MITI, Mr. Kodama, Deputy Director-General of the Machinery and Information Industries Bureau. And from JETRO we have Mr. Akazawa, the President.

And next are the members who will be attending the Workshops. The member list has been distributed to you already, so please refer to it as I introduce. First of all, regarding "New Media Workshop": First of all, the Chairman will be Prof. Miyakawa, Professor of University of Tokyo, Department of Electrical Engineering. And also, Prof. Ohkoshi from the University of Tokyo, Professor, Department of Electronics Engineering. And from Nippon Telegraph and Telephone Public Corporation, Research and Development Bureau, we have Dr. Toda. And also, Mr. Sakurai, from Optoelectronic Industry and Technology Development Association. Maybe he is not here with us? And also, from Japan Broadcasting Corporation we have Mr. Sawabe with us. And from Japan Information Processing Center Association, Mr. Tsukamoto. And from Mitsubishi Electric Corporation, Dr. Tachikawa. And from Oki Electric Industry Company Limited, Mr. Matsushita.

And from the German side attending the "New Media" are the following people: First of all, from Technical University of Berlin, Professor Baack. And also from Telephonbau and Normalzeit Company, Prof. Plank. And from Fraunhofer Research Association, Prof. Syrbe. Institute for Systemtechnics, German National Research Center for Mathematics and Dataprocessing, Dr. Raubold. And from Krupp, we have Dr. Schönwald. And from Informatik, we have Mr. Winkel. From GMD, we have Mr. Evers, also.

Next is the Workshop on "Computer". The chairman would be served by Professor Moto-oka from University of Tokyo. And from Keio University, Department of Electric Engineering, we have Professor Aiso with us. And from

Electrotechnical Laboratory, Dr. Kashiwagi. And also from Institute for New Generation Computer Technology, Mr. Fuchi. And Dr. Kawai from Software Technology Center of Information Technology Promotion Agency. Software Research Associates; from there we have Managing Director as well as Mr. Kishida, the Software Technology Committee of Japan Software Industry Association. From Fujitsu Laboratories Limited, Mr. Sato. And from Hitachi Limited, Mr. Uraki.

Next, the German delegation attending the Workshop on Computers: From German National Research Center for Mathematics and Dataprocessing, Prof. Szyperski. From Triumph-Adler, Mr. Fritsch. From Technical University of Berlin, Prof. Giloi. And German Machinery Manufacturers and Plant Makers Association, Dr. Möller. And from Philips Data Systems, Dr. Groh. Nixdorf Computer, we have Dr. Königs. And from German Cultural Information Center, Mr. Watterberg.

The next is the Workshop on "Semiconductors". The chairman is served by Mr. Yanai, and the reporter is served from Tokyo University by Prof. Sugano. And also from University of Tokyo, Department of Engineering, Mr. Tanaka. And also Professor Takahashi, Tokyo Institute of Technology. From Electronic Device Division, Electrotechnical Laboratory, Dr. Kataoka. And from Nippon Electric Corporation, Dr. Ishidate. And from Toshiba Corporation, Semiconductor Group, Dr. Odagawa.

And the German side: Chairman will be served by Prof. Ruge, from Technical University of Munich. And from Siemens, Dr. Garbrecht. And from Krupp Atlas Electronics, Dr. Schädlich. And from Philips Telecommunications Industry, Mr. Lorenz.

And lastly, may I introduce the German members who are sitting at the main table. First of all, next to Dr. Engl is Honourable Ambassador Dr. Brech. And also, we have Mr. Thomas from the Ministry of Research and Technology, Deputy Director-General. And from GMD, Japan Relation Offices, Dr. Krosigk.

So, that completes my introduction of members. Thank you very much.

DR. YANAI: Thank you very much for your cooperation. We would now like to receive the keynote speeches. Our first speaker is from MITI, Mr. Kodama, and he will speak to us regarding the "Current Status and the Future Prospect of Japanese Informatization".

MR. KODAMA: Ambassador Brech, Professor Engl, Professor Yanai, and the distinguished guests, ladies and gentlemen:

This is the first German-Japan Forum on Information Technology, and it is a great opportunity and honour for me to be able to address to you at this first Forum. And for the opening of this Forum, as it was mentioned before, last year there was this meeting with the Minister of MITI, Mr. Uno, and Mr. Riesenhoover have made a discussion last year. And as a result of this meeting and discussion, and with the kind support and cooperation of all of you from both countries, we were able to hold this German-Japan Forum on Information Technology.

The world has now come to the dawn of the information society. And the innovation of the information-related technology such as in the areas of computers and semiconductors becomes a prime force for the revitalization of the world economy. At the same time, it is instrumental to construct a society filled with humanistic needs and affluence. And in this connection, it is quite timely to hold this German-Japan Forum on Information Technology aimed at exchange of the information technology between both countries.

And first of all, I would like to make an introduction of the state of the information-oriented society in Japan, and the challenging items in order to make a speedy progression into this information society.

From the end of 1960's towards 1970's, we have faced this first information revolution centering around introduction of computer technology and dissemination of the information. But we have afterwards observed the rapid improvement of the information processing technology in the areas of VLSI and microcomputers, and at the same time, rapid strides have been made in the area of communication technology for optical fiber and communication satellite. And those two technologies have been combined to disseminate network in the area of information.

And we are facing the secondary information revolution, and it's quite different from the primary form of the information technology. First of all, this area of the information society is expanding into various fields, and much less limited than in the first revolution. And the first revolution was only limited to the industries, but now, it's expanding to the various sectors of society and families, and not only in the metropolitan areas, but also in the rural regions--in the diversified areas and diversified facets of life.

And secondly, the content of the information disseminated is becoming more and more qualitatively improved. In the past computers were utilized for simple computing and simple clerical job. However, with the sophisticated technological advancement of computers, it is possible to use computers as an incorporated element of the network. And the highly sophisticated applications are becoming more and more feasible.

And thirdly, new media came to play an important role in this information era, including the technologies of the interactive CATV, videotex, and such. And new media is going to be the area of the emphasis in the future. And it can be understood as an important tool to construct the information society in a more complete form.

And of course, this type of the information society that I have been elaborating on is not self-evident a fact. We have to make efforts to promote this type of society in various factors of the society and industry. And the information must be disseminated in various factors; and there are six themes:

One is the promotion of technological development. Two: Infrastructure must be improved. Three: Foundation of the system. Four: Public acceptance. Five: Information-related industry must be established. Six: International promotion. These six are very important. And I would like to elaborate on each.

First point or the challenging item is the promotion of the technological development. And the prime force of the information dissemination and development is the technological development, of course. And the needs for information system and established software are going to be increased. It is self-evident, and it's becoming more and more diversified needs. And we have to tackle with this effort more and more.

However, in Japan, the private sector has been taking the initiave for the technological development. And social needs have been becoming more and more demanding. And it requires long development period and a massive investment. And for that purpose, it is extremely important for the Government sector to support this private efforts.

And we can focus on the next five important items that we should keep in mind to promote technological advancement. One is the technological development with the purpose of the knowledge information processing. And highly sophisticated man-machine interface technology should be developed for the areas of the speech, characters, graphics, and image. And the knowledge information processing computer development, that is the fifth generation computers, centering around the enormous strides in the area of computer application areas.

And No. 2 is interoperability should be developed. And the technological development should be made with this objective. So far, we have been developing the computers--such devices and systems; and they have to be inter-linked and they must be incorporated into the overall network. And this is a new tendency. So, from the initial stage of this type of technological development, it's very important to put emphasis on the interoperability connecting these various types of systems.

And in concrete terms, the standard interface--standard protocol should be developed. And that is the interconnection between devices and systems with the standardized interface protocol.

And also, we have to be able to supplement the areas where there is no standardization yet. And the conversion system should be developed as well. For this purpose, we need to develop technology related to high speed large capacity transmission technology, and high speed digital exchange technology, including very basic technology.

Fourthly, with respect to technological development, for the purpose of facilitating software production. In the highly information-oriented society, there will be diverse needs for information and in order to meet this need, we would have to speedily produce abundant and good quality information. And for this purpose, we need to provide technological support for production of software and facilitating the production of software. And therefore, emphasis must be placed on the development of the information inputting technology and image processing technology and information recording technology.

Next, with respect to the technological development to provide for security: We must prevent leakage of corporate and private secrets as well as preventing--when systems go down, to prevent the damage systems to the society and to corporate activities. And for this purpose we need to develop highly reliable technology and technology for creating codes and technology for enabling individual identification.

Next, with respect to the improvement of infrastructure: Improving infrastructure for the information society and for establishing optical fiber networks would require a large amount of investment and time. And therefore, for this purpose we need to predict what the demands would be and what the technological trends would be, and to try to make improvements ahead of time. The services will be determined by the infrastructure; so therefore, the infrastructure must reflect accurately the demands and needs of the users.

Thirdly, with respect to establishment and improvement of the system: Presently, the communication system--under the present communication system, the Nippon Telephone and Telegraph has a monopoly with respect to public telecommunication services, and various restrictions are imposed with respect to the use of communication lines. However, in order to bring about the truly information-oriented society, we need to create a foundation whereby the private industry can give full play to their creativity and ingenuity. For this purpose, the Government has decided to privatize the NTT, and has to introduce competition. And inter-government coordination work has been completed, and two draft bills have been submitted concerning Nippon Telephone and Telegraph Incorporated, and concerning the telecommunication services.

We need not only to look at communication-related regulations and laws, but we need to actively engage in the task of formulating new rules which are suited to the advanced information society, such as that of providing legal protection of software.

Fourthly, the gaining efforts must be made to gain public acceptance. Some entertain an unnamed fear with respect to the progress of the information-oriented society. And some point to the evils of the controlled society. Some point to the computer security issue, and infringement on privacy. Now, these may be unseen factors existing behind the progress of the information society. But only a nation-wide consensus can pave the way to such progress.

We need to create the correct awareness with respect to the advancement of the information society, and we need to gain public acceptance through such enlightenment.

Fifthly, the improvement of the foundation for information-related societies: From collection and compilation of information and to the utilization of information, the information-related industries and various sectors of the industry are closely related to one another. For the healthy growth of the information society, the various sectors must complement one another so as not to hinder the growth of the industry as a whole, and to bring about a balanced growth.

Now, viewed in this light, information collection and compilation sectors need to be further improved; for example, the data base.

The sixth task involves international development. The progress of the information society is taking place on a global scale. And for progress to take place, international cooperations to institutions, industrial cooperation, technological exchange should take place, so that the world as a whole can progress in the field of the use and supply of information. And from such a standpoint, this Forum is very significant.

Now, I have outlined six tasks related to the highly information-oriented society. All of the tasks are very important, and all are interrelated. And it is not always easy to solve the issues which exist in the tasks I have mentioned.

But if both countries cooperate to tackle these common issues, we may be able to make one big stride toward the materialization of the highly information-oriented society. And the Ministry of International Trade and Industry intends to make its best efforts to this end. Thank you very much.

DR. YANAI: Thank you very much. Following that, we should like to call upon Dr. Moto-oka to address the "Research and Development Activities Related to the Fifth Generation Computers". Dr. Moto-oka, please.

PROFESSOR MOTOOKA: Thank you very much. It is a great privilege for me to be able to make a presentation today on the state of the development of the fifth generation computers in Japan.

I have made a presentation on this subject on several occasions, and I am sure some of you have already heard my presentation on previous occasions. But for those of you who have never had the occasion to hear my presentation before, I would like to present the outline of this project so that I will be able to give you some basic idea as to the underlying concept behind this project, FGCS Project.

As you are aware, when we talk about the "fifth generation computers", we are talking about the computers that are conceived to be prevalent in the world in the 1990s, and we are focusing on that type of future computers and what types of R&D activities are supported by the Japanese Government.

This project was initiated with the objective of the appropriate assistance that ought to be given by the Japanese Government to promote this type of development, and now in this process of the development here you are seeing in this slide the major problems that we must be able to break through.

The first problem generates from the complexity and the difficulties of preparing appropriate programs, and No. 2 is the problem related with the so-called "software crisis" that accompanies the various types of difficulties and enormous efforts to make appropriate software, and it is no easy task.

The third problem is the incapability of processing handwriting, voice and pictures that are the basic means of communication for human beings. The great task is how to make the computers understand and recognize such basic means of communication for people, and there is a lack of technological advance in this area.

The fourth problem is the limitation placed on computer operating speeds by sequential processing.

So with these challenging items in mind, what are the countermeasures that should be considered to break through the situation, and these are the available means to break through the situation.

In the aspect of software advancement, software engineering is the area of much research and various types of ideas have been presented so far, and also the utilization of VLSI technology is extremely important in order to manufacture sophisticated computers at reasonable cost.

In order to manufacture computers at low cost, various types of proposals and ideas have been presented for new types of computers using various types of VLSI, and the parallel processing is an important technology to this end.

Turning to the language of the computers, the logic programming is important. The conventional language describes procedures, but instead specifications are prescribed in this logic programming, and this is the new method of programming.

There is now a possibility of the commercialization of this type of logic programming. And also no numerical data which is/by used our daily activities, such as sentences, graphics, these must be interpreted by the computers in the future as well in order to support the intellectual activities of man, and it is called "artifical intelligence", and this is another area where we are seeing much achievements in the area of R&D.

We can compile all these different aspects of technological innovation in order to develop new areas of application of the fifth generation computers.

From the aforementioned perspectives, we have initiated activities of the Study Committee for fifth generation computer systems from 1979, and this is this main body which has promoted the research activities of the FGCS.

For architecture the Working Group is led by Professor Aiso, and for the logic side Professor Fuchi was the leader of this type of research, and these two professors are present here in this forum.

So, in short, the fifth generation computers are used in order to promote the KIPS, that is the knowledge information processing system, so the main objective is to realize knowledge

knowledge information processing system, abbreviated as KIPS, and by realizing KIPS what can we achieve. We can summarize it into these two areas of achievement. One is that we will be able to have access to the friendly computers, so-called, that means anybody can use the computers at ease. Number two, potential achievement is the pioneering of the new applications for computers, that is non-numerical computing is included in order to support various types of the human intellectual activities.

First of all, let me elaborate on this first objective, how to develop easier-to-use computers. For the non-experts in computer science we have to be able to make the computers easy to use and easy to be accessed. So natural man-machine interface must be developed, and when man provides a question or problem that should be solved then the suggestion for the problem solving can be made by the computer, and this is the type of man-machine interaction.

Another important aspect is the easy use for the experts as well, that is in the aspect of the easy programming, and that should be provided and various types of interface should be used. And also the existing software should be applied as well, and that type of support should be provided.

The second major objective is the development of new applications for computers. The computers should be able to handle various types of intellectual activities, such as listed here: The processing of natural language and understanding of natural language is a require capability. Also the translation of the German and Japanese languages can be made by computers, and if we could commercialize this we will be able to have a smoother exchange of views without language barrier. Also the design aspect can be improved. That includes planning in diverse fields and the experts have the expertise and that type of expertise can be also equipped by the computers, and this is another potential application.

Also the enhancement of the reliability of the various types of systems so that maintenance and repair can be facilitated and diagnosis and consultation system is important.

Programming software should also be developed, and it is an important area of development as well.

The lowest level, automatic programming, can be made available, and that is the ideal type of system that we would like to support.

So easy-to-use and new applications, these two are important objectives of the development of the computer technology in the future, so we are putting much emphasis on the development of intelligent programs, programs equipped with human intelligence. In order to achieve this purpose, the computers must be able to obtain the inference capability and the knowledge management capability. These two are inevitable in order for the computers to obtain intelligence.

This is the summary of what I have mentioned so far. I am sorry that it is quite difficult to read, but this middle circle indicates the description of the software system. The circle on the righthand side is the hardware system, and this red circle indicates the users that actually use this system, and what this graph is trying to say is that the users must use the interface to have access to the software system, natural language picture, graphics. Let us take the example of natural language. Using the knowledge required for the natural lanauge, the analysis is made so that the computers will be able to handle this at ease, so these are the specifications developed based on this process. The top half is the intelligent system, programming system, and the bottom half is the knowledge-base system, and in the core is the problem understanding capability, so the specifications using knowledge are analyzed, and in order to process this information the processing specifications are then developed, and these specifications are converted into the processing specifications, and here the hardware system is described, and here located in the center is the inference machine.

In order to understand and interpret the inference machine, the logic language, appropriate program should be developed corresponding to the logic language, and the synthesis of the program is indicated here.

In order to make the synthesis use the knowledge, machine model knowledge, the program synthesis and optimization can be made, and this inference machine is interrelated with the symbol manipulation machine, numerical computation machine, data base machine, and using those machines then the response is made to the users in an easily understood form, and that is in the form of image. The response comes out to the users, and right now the hardware is supporting this portion, and of course the software varies case by case, but the existing man-machine interface is at the stage of this type of interaction now that I have just indicated.

Now, with hardware support up until this section, the hardware comes closer to the human functions, and the software enables the interface between man and machine is rendered very natural. That is the basic concept.

This knowledge information system, to realize such a system, we are using VLSI technology, and to effectively use VLSI we have made for a highly parallel computer architecture, and using this highly parallel computer architecture logic programming can be performed efficiently, and this is the inference machine.

On the other hand, we have a knowledge base which enables us to manage knowledge efficiently, and on top of this and through this we will be implementing and realizing the knowledge information processing system.

Presently I have explained a concept, and in order to realize and to implement such a concept, MITI has the following structure and system. Now we have the Institute for New Generation Computer Technology or ICOT. This organization has been set up, and this is headed by Mr. Fuchi. Under ICOT we have various research institutes and we have the computer industry and universities. These entities cooperate to perform studies and research.

Within MITI there is an advisory committee which promotes the entire project and provides the necessary support.

MITI has a general contract with ICOT, and here in the righthand side we have ETL which is a research institute for MITI, and we have over here NTT, Electric Communications Laboratory, and then we have on the lefthand side industry, and the third sector JIPDEC and JEDA would fall into this sector, and various persons from the different sectors would come to ICOT to provide the necessary support.

You don't find the university in this framework. University researchers belong to the advisory group, and via this advisory group contribute to the research activities of ICOT.

Under the Project Promotion Committee we have the parallel processing mechanism, and we have an advisory group centered around the parallel processing mechanism, and we have high order inference and FGKL which is a kernel language which decides the boundary between hardware and software. We are trying to formulate a language which will enable us to do so.

Now, language processing involves understanding of natural languages and processing of such natural languages, and then we have the consultation system and a group which studies the basic theory of computers and, lastly, a group which promotes new software technology such as logic programming. It formulates activities for promotion.

Aside from that, from a broader standpoint, not only fifth generation computers but computers in general are studied and researched under the theme of "New Trends" and there is a specific group who are doing this, and this is headed by Dr. Aiso.

And then we have another group which studies the social impact headed by Dr. Karatsu.

Now the fifth generation computer project is performed under the following plan. We have a 10-year plan. We have the initial stage, intermediate stage and the final stage, so it will be implemented in three stages. We are presently in the initial stage. At the end of this fiscal year 1984 the initial stage will be concluded and the results of our work will be announced in FGHS '84 International Conference. We shall be convening this conference in November, and we shall be reporting on the results of our work during our initial stage then.

To give you a broad outline of the plans for our R&D work, largely it can be divided into inference machine system related work. This concerns hardware, so this is the inference machine. Then we have the knowledge base machine, and I have here "TOOL" which involves tools for development of software, tools for software R&D.

The inference machine consists of the parallel inference machine and basic research concerning this machine.

With respect to the knowledge base machine we have presently the relational data base machine. In the intermediate stage we shall be converting this to the knowledge base machine. As for tools, we have sequential inference machines, and as hardware this is complete. That is the present state of our R&D work.

In correspondence with this, we have software. We are also performing software work, and we have on the left high level utility system which we are working on. This is application related, and we are also working on basic software, and we are working on this also in the initial stage of our work.

In the initial stage we will be mainly working on basic module development which will be used in the final system. This will be combined to create a subsystem in the intermediate stage. At the final stage we shall be combining all of this to create a final system. We are presently working on the sequential inference machine and the relational data base machine in order to create the intermediate and final stage systems. These will be used for the final system.

We have the architectural hardware work which will also be incorporated into the entire work toward the later stage, and we are also working on software.

I do not have time to go into specifics but the basic concept is as I have just outlined, and toward the intermediate stage we shall be promoting our project.

So, thank you very much, ladies and gentlemen.

CHAIRMAN: Thank you very much. Following that we should like to call upon Dr. Thomas to address the Future of Information Technology in the Federal Republic of Germany. Dr. Thomas, please.

DR. UWE THOMAS: Mr. Chairman, gentlemen: My talk is about Future Aspects of Information Technology in the Federal Republic of Germany, and I may start with a little warning to the interpreters. From time to time--I shall indicate when I do it--I will leave my manuscript and make a few remarks in between.

Let me start first with a preliminary remark on public opinion. Information technology has become the motor of technical and economic development. Nobody doubts that. Everybody agrees to that. The spectacular success of Japanese export industries today is closely connected with this key technology. If, for example, American industry were reduced by the share accounted for by information technology, what would remain of the economic strength of American industry?

Nothing exceptional compared to other industrialized countries.

Now, if we look at the present situation in public opinion, which is important for politicians in bureaucracies, let me show you a picture which I found in a medieval manuscript. Let us look together at the fortune wheel of this medieval manuscript with the goddess of information technology at the top. I hope you agree to that. We still find the United States and close to it Japan reaching for the insignia of power, while the European nations may be found on the declining side of the wheel. I leave the manuscript for a sentence. What we want to do is to turn that a little bit in the other direction. (LAUGHTER) It's very difficult.

This is how public opinion sees and discusses the situation in the field of information technology, and it is therefore not surprising that at the present time many European governments have started intensive political discussions about competitivity and R&D in this field.

The Federal Republic of Germany is no exception to the rule. Public opinion in Germany is alarmed that at present our industry, above all in the field of microelectronics and in the field of electronic data processing, plays no particularly active role in the world market while Japan, at least in micro-electronics, has already achieved significant success in world markets. We would like to congratulate you for this because we know how much hard work and courageous decision making by the companies has been necessary to achieve leadership in micro-electronics and conquer foreign markets, particularly the American market.

It seems to me important in this context to note that although our trade structures, Japanese and German trade structures, differ considerably, although Japan's trade in information technology at present is growing much faster than ours, both countries have by and large in general experienced a similar trade development since the/last oil price crisis. Both economies have been producing rapidly increasing trade surpluses since 1981.

Let me show you a picture which I have brought with me. I beg your excuse for the quality of the picture. I have put here for you the whole trade surplus per capita. This was the oil crisis before in 1980, the second oil crisis. And what you can see here, 1982-83, everybody knows about that. This is Germany. We were not so much hit by the oil crisis because we were relatively strong in investment goods, industry, and we could always sell that to the countries who export oil. Good advantage.

But, of course, you are growing faster as we see. 1982-83, trade surplus.

I leave the manuscript for a second time to say a few sentences about the German economic policy. As you have seen from the figures, an economist in Germany doesn't worry at all about the German economic situation, and if there wouldn't have been the fifth generation computer project we never would have convinced our politicians that information technology is a very important subject to think about. Thank it for that.

You always have to remember that in terms of trade, in general the German-Japanese relation is not so important except very few industries. Our trade surplus with France is higher than the whole trade with Japan, just to give an indication why in Germany economists do not worry so much about technology. That is the reason for that.

Let me say a few words to the situation of the German information technology industry and start with a few remarks on the structure of foreign trade of German industry in this specific field of information technology.

According to our definition, information technology comprises:

1. Telecommunications
2. Consumer electronics
3. Electronic data processing - hardware and software
4. Measuring and control techniques
5. Electronic components, in particular semiconductor components.

Now, picture 2 shows the current trade balance for these five fields. You can see that there are two fields where the trade balance is largely positive, communications technology and the important field for the investment goods industry, measuring and control techniques, and you can see what everybody knows, the semiconductors mainly dominated by integrated circuits in this case there is a weak position, and high imports mainly from the United States at present. I am sure you are coming in that field.

Data processing and consumer electronics also show deficits. This is new. Sometime ago this was one of our strong points. I shall not go here into the reasons for this greatly differing development in the various fields of information technology, although it is a very interesting subject, but it is not our subject today. However, nobody doubts that government influences on research and development as well as buyer's and seller's markets with monopolistic structures have played a considerable role in the past and continue to do so.

Now, let me come to our main field of the forum, and this is research, research in the Federal Republic in the field of information technology. When we look at government-funded research in the Federal Republic of Germany from a general point of view, and at information technology as just one subject among many others, you may find three characteristics particularly striking:

First, basic research, which I may define as research just directed at broadening human knowledge without direct application goals. This kind of basic research can rely on quite considerable budget funds at the Max-Planck Society. In addition, there are some large research centers and, of course, the universities. However, the Max-Planck Society carries on information technology research at only one single institute at present-- this may change--being as excellent as it is, the institute of Professor Klausen in Stuttgart. Many of you will know him.

Second, in Germany more application-oriented basic research has for many years been dominated by nuclear research. Many of the excellent physicists of my generation, if I may say so--I do not belong to the excellent physicists--but many of the excellent physicists went into nuclear research centers. They stood there for 15-20 years. If we would have been able to put them in information technology that would have been an interesting experience, I would say. So more application-oriented basic research has for many years been dominated by nuclear research, but now information technology is catching up fast. Taking as an example the Fraunhofer Gesellschaft with its growing Institute for Microelectronics, taking another example the Gesellschaft für Mathematik and Datenverarbeitung, and the third one the Heinrich Hertz Institute for Communications.

They all show quite disproportional growth and they are gradually connecting their research work more and more closely with the research laboratories of German and European industry.

These were just some examples. There is a wave of change in that field.

However, an evaluation of the state of the art of German research in this very complex field, as it was made yesterday in some areas in the colloquium on information and production technology must, of course, comprise industrially supported and government supported efforts at the same time.

Here, again, if you will allow me I would like to ask your attention for three factors which may be taken into consideration.

The first everybody knows, in our country stronger than in yours. The market leader in data processing is able to maintain in absolute terms an enormous research and development activity, although related to sales they put maybe one-half or even less in R&D in relative terms compared to European and I think to some Japanese companies. And, of course, the market leader, the most interesting research centers, are in the United States.

Second--and this seems to me even more important--American and Japanese telecommunication service companies maintain significant research potentials. To give you an example, NTT's Electrical Communication Laboratories dispose of a higher budget than all institutes of the famous Max-Planck Society together. The ECLs are bigger than the whole Max-Planck Society for basic research.

The German PTT, on the other hand, has to subsidize the yellow mail, letters and parcel services with great deficits.

It cost them 3 to 4 billion DM per year to subsidize it, whereas their own R&D laboratories have a budget which is less than 5 percent of ECL's budget, less than 5 percent, although the role should be about the same.

Third, defense research, I think 40 percent of all R&D T&E, as it is called in the United States, research development and what can be connected to that, 40 percent of all defense money goes into information technology. That is one of the most important technology as we all know for defense. Of course, it makes a considerable contribution to industrial application or basic research.

Yet, this one takes almost exclusively a place in the United States, and if we take this analysis together--and of course we made that in the last years and have taken some conclusions from that--information technology is a field which is different from other technologies in a way that a small leeway in R&D and subsequent commercialization causes companies in this field high losses, while a small headway may bring high profits.

Keeping these considerations in mind, I will now summarize some strengths and weaknesses of German research in the field of information technology. This cannot be exhaustive. It is just to give an indication.

Let me begin with a few strong points.

First, on the whole, our institutions of higher education and, in particular, our technical universities are quite efficient.

Second, in the combination of mechanics and electronics, the leading position of German machinery, plant construction and car electronics corresponds to that of a number of outstanding research centers, four of them alone being important institutes of the Fraunhofer Society.

Third, in communications German industry had always a strong market position. It ran into problems a few years ago in some of their development in switching technology but, in the meantime, it has developed very advanced digital technology. By the way, this may have to do with the traditionally strong developed software technology in Germany.

As I said, this enumeration is by far not complete. It is just to highlight that the combination of mechanics and electronics as well as the development of complex systems solutions are strong points of German R&D.

Weak points, on the other hand, are to be found above all sometimes in the quick conversion of R&D into new products. That is a management problem, but it seems to change.

Second, weak point in the manufacturing technology for integrated circuits, not so much in systems, in integrated circuit systems.

Third, in the development of very large computers, and

Fourth, in the industrialization of optical communications, in particular of the components required by it.

One may get the impression that some German weaknesses may correspond with Japanese strengths and vice versa, but to prove this we would perhaps have to make a far more detailed analysis than is possible in this talk.

Now, after having made this very short analysis, let me give you a few indications in the time left on the Federal Government's concept for the promotion of microelectronics and information and communication technologies.

This concept was indicated in the declaration of government of Chancellor Kohl last year, and it has been decided 14th of March this year. It includes five fields which correspond to various ministries. Before naming these five fields let me say the strategic goal of the concept.

The strategic goal of the concept is strengthening our investment goods industry in using modern information technology. That is the main strategic goal.

Now these five fields:

First, improvement of general economic conditions in order to strengthen competition within the Federal Republic and within the European Community. There are many technical ways to strengthen competition. One was mentioned by my colleague Mr. Kodama, the whole interface question, the whole standardization question. What we want in this part of the concept is more market opening. We want to support innovation-oriented public procurement. We want to develop risk capital structures in order to speed up application of information technology.

The second part of the cconcept, motivation of human resources to face the technological challenge, first by information of the public but in a more wider context by introducing information technology in all sectors of the educational system, educational and training system with particular emphasis on professional training which made our industrial strength in the past, and if we can adapt that to the new technologies it will help.

Third, stimulation of innovation-oriented markets by means of the future-oriented expansion of telecommunication infrastructure and by means of related innovations in the field of terminals. We believe very much that the speedy investment and fast introduction of ISDN networks with its new features may be a very great stimulus for the whole field of office communication, maybe the most important one, and in the long term, of course, the introduction of fiber optic systems.

Fourth, broadening the technological basis for securing the Federal Republic's long-term capability of defending itself. There is now a lot of discussion about technologies for defense which have to be related, of course, to the strategic goals of defense which in Germany are very well defined, and it seems that these strategic goals are very much supported by development of information technology. I will not go into detail in that field.

Fifth, strengthening and concentrating research capacities of the Federal Republic in the field of information technology. You will find in my paper some comments to two particular fields in these five measures which we have, one related to communications, page 8, and another related to R&D, but in order not to get in trouble with our Chairman I have to stop in a minute so I will stay away from the manuscript a little bit more.

We have not a fifth generation computer project. We did not try to define a general goal where information technology may be heading to and use that in order to develop a number of related technologies from VLSI over some specific hardware development, some software ideas, and maybe applications. Although, of course, all the elements which are present in this concept Professor Motooka has presented to us are evident also in our program, we have, if I may say so, more specific industrial goals in that case. I may name three goals.

First, we want to be present at the end of this decade in world markets of integrated circuits, not in very specific areas where you have a need and go into that but be present full scale. This is a very ambitious goal. We are very glad that a few financially and technologically capable companies are going together and exchanging research work, partitioning the workload, and then leaving each other and competing in the world market.

The second goal, which is almost I think close to be reached, is that the penetration of information technology in traditionally mechanics-oriented industries is so fast that we do not have problems with our export statistics in five years, but it is about the same as that which I showed you today. This concerns, of course, machinery, car manufacturing, but also chemical industries, etc., that additional strength of German industry.

There are some R&D programs, but what is more important for this goal is that German management finds the people for doing that, and it looks quite good at the moment.

The third goal is that we have a harmonious development of our telecommunications infrastructure and our office organization, that both give each other incentives that the systems which are becoming more and more complicated are developed in a way that it fits together, which is one of the greatest challenge, in our opinion. If you think about ISDN, if you think about all the new services possible in the office, we are not going to try to be competitive in all fields. If we do not have super computers with the highest operations in the world, we do not mind. If we have one of the more intelligent solutions how to use an algorithm to translate it into a computer architecture, and then to apply it on a broad scale, that would be fine.

You have heard the figure the government has earmarked about 3 billion DM for the five years 1984-1988. In fact, it is 3.6 if you include the institutional research in that. In addition, industry will spend between 6 and 7 billion on R&D in this field. Of course, it is always a question of what you include, what you do not include.

Now, it seems to me that we will have only a chance-- and it will take me another 30 seconds if you will allow me, Mr. Chairman--to succeed with that concept if we are able to maintain free world trade in this field. There are many governments who try to change that, and even the strongest country in the world at the moment it is attacked in one field, very fast sometimes asks for protectionism.

I think that Japan and Germany should go together to fight this because nobody is helped by protectionism as long as fair competition takes place. We should keep free markets open.

We are convinced that we can rely on the creative potential and the will of the individual confronted with the challenge of modern society. Our industry will not be protected against competition because this is the only way to remain a strong export nation, but our scientists and engineers in public institutes as well as in industry will be ready for international cooperation.

Germany is bound to Japan by old ties of friendship, and we would be pleased to see a new spirit of cooperation emerge by joint work in the field of information technology. This is above all a task for science and industry. All the government can do is give it its blessing, and this is what our ministers did last year in crea ing this forum on information technology.

Now, let us see whether we find sufficient mutually useful areas of cooperation. I am quite optimistic, and I want to express my thanks to our Japanese friends for organizing today's meeting.

Thank you very much.

CHAIRMAN: Thank you very much, Dr. Thomas. This concludes the morning session of our forum. We should like to make an announcement concerning lunch. Lunch will be served in a room on the left side outside of this room, and on the 11th floor there will be subcommittee meetings starting at 1:00 o'clock this afternoon. Please assemble punctually at 1:00 o'clock in the afternoon. Thank you very much.

(END OF FIRST PLENARY SESSION)

GERMAN-JAPAN FORUM ON INFORMATION TECHNOLOGY

April 27, 1984
Keidanren Kaikan

WORKSHOP 1: "NEW MEDIA"

Co-Chairmen: Professor Dr. Miyakawa
Professor Dr. Baack

PROF. MIYAKAWA: Gentlemen, because time is limited I think we will start now. It is my great honor to be Co-Chairman of this session with Professor Baack. First I would like to discuss how to proceed with the discussion in our session. I talked with Professor Baack during lunchtime about this matter. Our proposal is that first we would like to begin with self-introduction for several seconds, name, institution and main interests and, then, second, the main speech. We have already asked Professor Plank and Dr. Toda for main speeches covering about 20 minutes each, and after that the floor is open to all members for several seconds each. We have already asked four Japanese members to give us a speech for four minutes each, and also after that this session is open to the German delegation for each member, maybe for three or four minutes each, and then we will dicuss how we will proceed in the next year because General Chairman Professor Yanai asked us to propose three or four topics as our future mutual project, research project.

If there is no objection on this we would like to start immediately.

(FOLLOWED BY SELF-INTRODUCTIONS)

PROF. MIYAKAWA: Shall we ask the first speaker Dr. Toda to give his speech. Because the time is limited I am very sorry to ask you to give your speech in exactly 20 minutes, within 20 minutes.

DR. TODA: Thank you very much for the introduction, Professor Miyakawa. This is a session on New Media. I would like to tell you the current status of services and technologies involved in this field.

In 1983 we commemorated the World Communication Year of the United Nations, and we started full-scale service using the practical communications satellites for the first time. This is going to be the first year of the Year of New Media in Japan. Newspapers and magazines are featuring New Media, and we have a new magazine published under the title of NEW MEDIA, and many glossaries have been published on New Media. This is what we call "New Media fever" in Japan. "New Media" is almost a household word in Japan, but no clear definition has been given in any precise form. Therefore, let me tell you the definition as "new services or systems for telecommunications and new technologies related to these fields."

First, for new services and systems, we have these services: VIDEOTEX, CATV, TELETEXT, VIDEO RESPONSE SYSTEM, VIDEO CONFERENCING, VAN, INS. These are the topics that I would like to tell you something about.

You may have difficulty reading small print. First VIDEOTEXT was started in the United Kingdom in 1979, and since then this has been getting attention as a new information media. Bildschirm text is the form of VIDEOTEXT in West Germany.

In our country, the Ministry of Post and Telecommunications and NTT started to experiment the CAPTAIN system in Tokyo in 1979. This stands for Character and Pattern Telephone Access Information system. We have about 200,000 pictures which have been prepared. We have about 2,000 terminals connected to this system.

In November this year commercial service will be started on the CAPTAIN system. At the beginning we expect to have about 10,000 terminals, and in ten years several hundred thousand terminals will be operating on this system.

TELIDON developed in Canada has been operating in the in-house systems in some of the private companies in Japan since last year.

Now, the second item is CATV. Primarily these systems are used for transmission to poor reception areas. With a total of about 4 million people subscribing to these systems, about 200,000 people are using two-way CATV systems which will be expanded in usage in the future for diversified services.

The HI-OVIS system, which stands for Highly Interactive Optical Visual Information system, supported by the Ministry of

International Trade and Industry, is a two-way CATV system using optical fibers. The test service is provided with 160 terminals at the present moment.

At the same time, the ACCS system run by the Ministry of Posts and Telecommunications is using coaxial bi-directional CATV. At the present time 3,500 terminals are connected for this system.

The third item is TELETEXT. NHK has been experimenting with this system for character multiplex broadcasts since 1983 in Tokyo and Osaka for people who have hearing difficulties. The present system is operated on the pattern method, but test broadcasting will be started on the code method of transmission in which graphs and pictures are transmitted in code. The test will begin in 1986.

The next item is VIDEO RESPONSE SYSTEM, or VRS. In contrast to the CAPTAIN system which relies on existing telephone circuits, it uses broadband communication network to provide sophisticated video services including natural pictures, moving pictures and voice communications. We are now conducting test services with 40 terminals at the present moment.

Another video service is the TELEVISION CONFERENCING. Since March of this year, NTT has started to provide this service, and at the present moment four companies are using this service.

For the TRUNK TRANSMISSION system we have digital transmission circuits of 6.3 mb/sec, and for subscriber loops we use analog transmission lines of 4 mHz, four-color moving picture service.

For the VANS, at the present moment under the law we can provide services for only small-size businesses. About ten VAN systems are in operation in Japan at the present moment. Next year we expect a new law on telecommunication businesses will be enacted and nationwide VAN services across the borders of individual companies will be provided.

In addition, NTT has been providing various sophisticated communications system services, for example, for banks for transfer of exchanges as part of its normal services.

Now, let me tell you something about the INS, Information Network System. You have a brochure on this system and I hope you can read it at your leisure. The INS is designed to attain the ISDN and integration of communications and information processing in Japan under the sponsorship of NTT. INS is to provide telecommunication services, inexpensive, convenient and abundant communication services without regard to the distances to be covered on a fair and equitable basis.

The following philosophy has been established for the construction of the network for INS. The first feature is digitalized communication. At the present time, telecommunication networks primarily rely on analog technology, and the new INS system will have digitalized networks. By digitalization we can use this system for the transmission of telephone messages and non-telephone messages such as facsimile data and video for efficient and economic transmission.

In the INS we envision to use transmission channels, two types of transmission channels: one, 64 kb/sec and 16 kb/sec, and another the broad band system of 0.77/1.5 mb/s line.

The second feature is network integration. At the present moment the telecommunication networks depend on individual networks using different signalling systems, numbering systems and tariff systems for various communication media and services. In the INS, through digitalization these services or networks can be integrated so that various services can be sent on a single and same network.

The final feature is the sophistication of network functions to express various nodes with functions for protocol conversion, media conversion and data base clearing, enabling the communication functions for convenient connections of various terminals, data service support and efficient transmission and storage of messages efficiently. These functions will be required as an essential part of new media network.

To confirm the technology for the INS and in order to assess the social impacts of the system, we are using a model system to make these assessments. This shows the schematic diagram of the model system. Metallic circuits and optical fibers are used for subscriber loops. We can connect varied equipment from digital teleposing (?) for subscriber lines and digitalized terminals through subscriber switching and broad band switching equipment. Selective connections can be made with a variety of digitalized equipment; digitalized switching and digital trunk line switching and communication processing will be provided.

In this system, certainly connections can be established with various information processing centers, efficiency of communication and ease of communication will be improved. Certainly this system can be connected with existing analog nationwide networks.

By using this model system we have about 340 companies applying for becoming information providers, and about 2,000 people will become monitors to receive the test services. The services would include home shopping, firm banking and public administration information system to provide various government information, and learning systems for students. The operation will start in September of this year.

Next, I would like to elaborate on the new technologies related with New Media centering around the discussion of LSI, optical fiber, satellite communication, and the compression of the pictures and speech and also the data base. I shall touch upon these subjects.

The LSI progress is the prime force that can sustain the improvement of the various types of technology. The LSI makes remarkable strides, and the chip density of most LSI memory is showing a remarkable improvement, especially in terms of the integration of LSI, and in five years it has shown a progress of more than one digit, and I think this is a sustaining trend.

Next, the optical fiber transmission. In 1970 Corning announced the new optical fiber of about 20 dB loss per kilometer, and ever since the loss is decreasing and making tremendous progress, and in less than ten years it has almost reached a theoretical limit.

The NTT, with the backdrop of the optical fiber technological advancement, has developed and is commercially testing the long haul trunkline using the 400 mega system that can accommodate telephone lines of about 6,000 lines, and using this system, the F400 m system, next year the NTT plans to spread this trunk route connecting both ends of Japan from north to south, from Sapporo to Fukuoka, and for short haul trunk, the medium capacity of 100 Mb and 32 Mb systems are under usage for 32 regions, and for small capacity 6 Mb system they are commercially tested in seven regions. For super large capacity optical transmission system of 1.6 giga Bit is under research right now.

Next, let me touch upon the satellite communication technology. Last year the domestic communication satellite CS-2 was launched, and this uses the unprecedented technology of sub-milli wave band (30/20 GHz) and also microwave band (6/4 GHz), and this is used for emergency communication and communication with remote islands and remote places, and various types of communication experiments, and in the future image communication, data communication, such new service applications can be conceived, and CS-2 will reach this limit, life maturity, in 1988, and larger scale CS-3 will be launched.

With regard to broadcasting satellite, the world's unprecedented practical broadcasting satellite BS-2 was launched, and NHK television broadcasting will use this system for poor reception areas and for emergency communication starting from May this year, and in 1989 we are going to observe the launching of BS-3 and that will provide still picture broadcasting for television broadcasting and facsimile broadcasting and news service applications. From NHK Mr. Sawabe will be touching upon these applications.

Next is picture compression. The broad band transmission service necessary for TV transmission and picture transmission will have to eliminate the major problem of high cost of transmission, and of the picture data that has much information in it we must first of all develop the technology to compress data, and the intra-frame correlation coding and inter-frame correlation coding are important areas of technology for transmission and information; the interrelationship in those inter and intra-frame correlation coding is important. For motion picture service that has much motions, the intra-frame correlation coding is applied for 32 Mb/s, and the band compression has been achieved down to that level.

For teleconference and still picture, small motion services, inter-frame correlation coding is applicable, and this compression is made down to 6.3/1.5 Mb/s and for speech compression the band compression technology is advanced, and wave form coding system, APC-AB system, can maintain a good quality without any problem even at the level of 16 Kb/s.

For mechanical voice, analysis synthesis system has enabled compression down to 8-4Kb/s, and for vowels, the law of the Japanese vowel structure, that is the relationship between vowel and consonant, that is the area where research was promoted and further band compression was enabled.

I have touched upon the various types of New Media services and most of them are related with the data base, and the larger capacity of data base and the complexity of the interrelationship of different data base would require technological advancement of data base, all these types of new service.?

The storage media, we have to commercialize the read disc with one spindle of 400 Mb and that is the conventional one. With ? read disc the recording density is at present 10^5-10^6 power bit/cm^2, and using the optical recording in principle it is possible to have the recording density of above 10^8/power bit, and digital audio disc and picture file are practically used in this sense, and the data base architecture has this problem of data input. With diversified information input, pattern recognition technology has to be enhanced and OCR technology must be developed as well.

I have been mentioned about this New Media, and in order to gear the New Media development to the social needs, it is important to have a good foundation in the aspect of information and communication infrastructure to sustain the progress, and the information network system must be able to be promoted to gear to the development of the infrastructure of the highly sophisticated information society.

In Germany I understand that BIGFON is being developed and the satellite communication and the broad band fiber network. Therefore, I think it is a good arena in this forum to exchange our views to this end. Thank you very much.

PROF. MIYAKAWA: Thank you very much. Now I would like to ask Dr. Plank to make his report.

PROF. PLANK: Gentlemen, my report on the Status Quo in the Field of New Media in the Federal Republic of Germany will cover four major topics, namely

1. Switched telecommunication network
2. Audio and TV distribution networks
3. Private communication networks and, finally,
4. On the other hand, services handled in these networks.

Insofar, Mr. Toda, I think we have very similar types of speeches, naturally.

As you perhaps know--and I start with Switched Telecommunication Networks--Germany operates networks of remarkable high quality and with high penetration in the fields of wireless radio transmission for audio and TV distribution and for telephone and data switching.

The telephone network serves about 28 million stations, one-third of them supplied over private branch exchanges--the latter used for commercial or administrative purposes. The networks in Germany operate fully automatically. Even about 98 percent of all outbound calls are established by automatic procedures.

The dedicated telex network in Germany is already substituted by a very versatile network called IDN, so-called Integrated Data Network, which consists of a digital long distant network and fully digitalized switches. This network is prepared to handle data rates up to 48 kBits/s at the present time and will be extended to the rate of 64 kBit/s this year. To the customer it provides line-switched as well as packed-switched facilities using the HDLC procedures of X.21 and X.25, respectively. With the availability of the 64 kBit/s Rate, the German Bundespost decided to offer a so-called "Modellnetz" as a forerunner of the ISDN, which is scheduled to go into an experimental state of service next year. Thus, we get the following development in networks as I want to show on the following picture.

The early beginnings were the dedicated networks for telephone and telex and a wireless network for radio or broadcast distribution. At the present time the telex network has developed to the IDN and is in that way operational, and value adding is put to the telephone network concerning facsimile and BTX, in German BILDSCHIRM TEXT, and in your expression VIDEOTEXT.

The VIDEOTEXT in Germany, the German name means a text transmission via wireless ways using the black area of the picture frame.

So both networks will now come together to a small band ISDN during the years 1985-1990, and we are very hopeful to have here in operation in 1990 nationwide service on the ISDN basis using latch B and latch D, either. These are the access points to subscribers so that they are fully digitalized and have 2 times 64 kBit available plus 60 kBits for signalling and data and telemetry transmission and in addition a so-called wideband access of 2.048 mBit/s mainly for local area networks of PBXs.

A further development then will go over to a fiber optic base broad base ISDN which we expect to have in operation during the next decade, that means in the area of 1990 to 1995 on the basis that it can be offered nationwide. This broadband ISDN--and here the regulation practice is somewhat other than in your country--can also substitute a lot of the broadcast networks which are scheduled to be for the time being on the radio wave basis, on the CATV basis which is being pushed rapidly at the time being and on a satellite basis which is under design, but the fiber optics will go together.

I am trying to abbreviate my presentation somewhat so I speak briefly.

The German Bundespost decided to introduce ISDN last year as quick as possible. It will start, as mentioned before, in 1985 in an experimental phase and will be regionally available in the standard version in 1987. The digitalization of the German telephone network began in November 1983. It is based on the switching systems EWS-D developed by Siemens, DeTeWe and TN, and on a competing system named System 12, developed by SEL, a German affiliate to ITT. ISDN, as I mentioned, will be available nationwide in 1990, and in the meanwhile we started with an experimental phase of the broadband ISDN under the name of BIGFON which Mr. Toda mentioned already. BIGFON went into experimental operation in November last year and February of this year, respectively, in six places in the Federal Republic of Germany, and you should consider this BIGFON installation as a means to study the acceptance of such a combined telecommunications network and not so much as a basis of technological final solution. It will be changed somewhat in the different solutions.

My next topic which I announced is a look to the distribution technics for audio and television. The CATV network will be expanding rapidly as it is being pushed by the present

German government. Additionally, the satellite distribution will become an essential part of new offers for TV programs. Using the new ways of distribution, value adding methods will give improvement of quality for the TV presentation.

With respect to bandwidth economy in CATV and satellite TV networks, here a fundamental improvement will not occur. More or less all improvements must be based on the same transmission capacity and thus on the same number of effective lines per picture and the same number of changes of pictures per second. And we use furthermore the line interlacing mode as today.

Additionally in the beginning of digitalization of the control-circuitry in the receivers, the picture tube will become more flat and rectangular. Probably the use of TV receivers for additional purposes, for example, for VIDEOTEXT, will rapidly expand. The use of picture memories will bring possibilities to increase the picture sequence for better images.

With the coming of a broadband ISDN in this area, the realization of a real high or ultra high quality TV will become possible because in this area the bandwidth economy will no longer govern what happens in picture frames.

So we expect and we are working in the field of high revolution cameras using standards up to about 1300 lines and 75 interlaced pictures per second. The transmission will be handled in the area of about 280 MBits/s via fiber optics, including redundancy-reducing methods in digital signal coding. The TV receiver will become more and more a multi-functional terminal in a switched fiber optics network. Although for the time being no concrete standards have been set or proposed, I am sure that Germany is prepared within three years to decide on the new distribution TV standard which will be harmonized with the requirements of the other visual services for a broad-band network with fibers, including the picturephone service, and which will increase quality widely compared with ultra high quality TV and HD TV.

Digital audio is another topic in the development of fiber optic broadcast. Here the improvement achieved with the compact disc can even be enlarged by using digital methods from the microphone to the loudspeaker, thus avoiding all distortions of analog amplification and giving the sound more transparency.

For satellite TV and wireless TV distribution, we hope to solve the problems of reducing the transmission rates by using advanded semiconductor technology as a mass product, but is up to now not fulfilled, and it seems to be less expensive to increase the available bandwidth by introducing fiber technology than to use high transmission rate reductions per each receiver.

The procedures for transmission rate reduction are very useful in case of individualized picturephone services or in case of long distance TV transmission, but for the time being this is not applicable for TV receivers. Solutions like

C-MAC are mainly useful for wireless TV distribution or CATV, respectively, wherever bandwidth problems force to save transmission capacity. They can be means to overcome bottlenecks during the period where fiber optic is not available nationwide in industrialized countries, and they will be helpful in countries which cannot provide at any place a switched broadband network.

Additionally, in case of satellite transmission, highly specialized procedures of redundancy reduction, e.g. transformation coding of TV signals, will be useful and the German research teams at the technical universities of Hannover and Aachen do a lot of work in this field.

Now, I come to the third topic, private communication networks. Gentlemen, allow me to cover this third topic, the area of private communication networks. It is very often said that the German federal laws do not allow to operate private networks and to have competition in the field of private communication. As far as public networks with the possibility of nationwide operation are concerned, this is correct that the German government in this case has the monopoly. But since in 1900 the German Emperor declared with the so-called "Golden Amtsblatt" that it should be allowed to everybody to operate communication equipment inside his estate or inside his company, Germany has a well developed PABX technique and also the possibility to install local area networks. Only if somebody wants to connect such a network to the public network he has to accept certain restrictions in order to avoid unacceptable reactions in the public network.

My compamy is one of the major suppliers with PABXs in Germany. If you take into account that one-third of all installed telephone stations are operated via PABX and that more than 60 companies are licensed to instal such PABX equipment together with public networks, you may imagine how hard competition is in this field. The geopolitical structures in our country force companies to operate their private networks together with the public networks.

Services are only widely accepted if they are available at least in Germany and, if possible, in Western Europe. Here you find the importance of standardized access to the networks--very different from the relations in the USA or from countries like yours which has an insular structure.

Germany's communication system is closely woven into the European Community. Nearly 10 percent of all calls being established in Germany are outbound calls. From this point of consideration you can understand the importance of regulations which are defined basically by the CEPT as the operators of the public networks or of ECMA, respectively, for data services and interfaces data transmission.

If I consider PABX as the major part of private networks in Germany, I want to point out that we have left the situation that PABXs are telephone networks only. For example, one of the most successful PABX systems of my own company is able to handle telephone calls, facsimile and BTX as well, but calls to the telephone network as well as to the IDN, to both existing switch networks.

The laboratories of my company operate a non-speech network integrated via a solid state switch with the public telephone and data network between Frankfurt, Munich and Dusseldorf consisting of three DEC 2060 systems, a Siemens 7738 about 180 terminals, and about 20 terminal adaptors, including computer power.

The ISDN network, which will be introduced by all European telecommunication administrations, will solve a lot of such problems as interfacing computers one with the other, serving a powerful network with clearly defined interface conditions for access.

LAN, the local area networks, become really important as branches of such PABX networks, and here a lot of work is done everywhere.

Let me now consider services in future telecommunication networks, and I want to demonstrate first the service evolution in Germany with a short picture. The introduction of the international standards, as I mentioned before, has in private and public networks a very high priority. Services for office automation will dominate the next years of communication evolution against the evolution of speech communication which is going to a certain type of saturation already. The ISDN will mainly submit the evolution of the non-voice services.

Additionally, to communication services the so-called bearer services will have increasing importance. Perhaps you know the "bearer services" are defined as services which only use the transportation capacity of the network, and the algorithms of changing from information to useful signals which are to be transported is up to the customer and not up to regulation by postal or other institutions.

Dedicated networks, even in the data transmission area, will probably be substituted by transportation systems and multi-functional terminals. That means we are going away where the terminal/on the desk of an office man normally shall share the different services in the network and shall not be specialized for one service in the normal case.

What is done in the European standardization in this field? I start with one picture which may give a rough look at what is happening. You find the regulations of CCITT and then I have put on this part of regulation which are separated from the whole quantity by CEPT, that means the European Post and Telecommunications Administration. The yellow disc is the free room for development of national standards, and now I have put a line, a dotted line, separating the specification between non-voice specifications against voice specifications, and you can see the different national reactions in the European Community. United Kingdom has a nearly balanced rating of non-voice and voice services. France, already operating a semi-digital speech network, telephone network, put the majority of the rates to the non-voice services by selecting their specifications, and Germany, which wants to set up the ISDN on the existing telephone network and to develop it from there put more importance to the voice specifications.

In the next picture I want to make that even clearer by just regarding what happens in the public network and what happens in the PABX or in the private network area. You see here that the specification of the Federal Republic of Germany, demonstrated here in yellow, is even more mainly than in the general specification given to voice specification for the main access.

On the other hand, in the field of PABX where commercial use is governing the traffic where non-voice services are of higher importance, you will find that the decisions are made more for non-voice specifications and a bit less for voice specifications because there are installed very modern PABX specifications which can serve the speech conversation and so on further on.

So this is the state of the art and this is the state of standards. What services do we expect? I think there are three groups of services, the so-called telecommunication services, the office technology and computer data handling technology which merge and which come together in the ISDN, using services as mentioned here, starting with the telephone service as the basis for telecommunication, then added by image communication, voice and telewriting, but also electronic mailbox, telēfax, teletext and telex which are in the limit to office technology between telecommunication and office technology must be considered.

Then we provide text editing, filing systems and graphics, finally in the limit between computer and office technology, in turn text processing, billing, information retrieval, graphics processing, and finally the personal computer of course, the desk-top calculator, but also the large sized computers, computer terminals and computer network terminals must be considered.

So a large part of this is already in operation. I want to show what we handle for the time being, so we have telephone, image communication, we have a part of voice communication, we have teletex and telex, telefax and electronic mailbox in operation.

The office technology is relatively poor with respect that the facsimile is not here. It is up tight ? with image communication interpreted. Text processing, billing, information retrieval and graphics processing are not yet in the network, and also the area of the computer techniques is only given to the idea in the first step and will be introduced to the ISDN probably between 1987 and 1990.

So I hope I gave you a short look at what is going on in Germany.

Thank you for your attention.

PROF. MIYAKAWA: Thank you, Dr. Plank. I have asked four Japanese delegates to give additional short speeches. Because time is very limited, before discussion I would like to ask for short speeches, and also the German delegates for short speeches and then discussion will follow. The first Japanese additional speech is by Mr. Sawabe.

MR. SAWABE: Thank you very much for your introduction. Mr. Toda earlier explained the Japanese New Media systems under development and in operation, and I would like to devote my attention to high resolution television which was not included in his remarks.

The current television system was developed, as you know, about 40 years ago based on the technology existing then. There is a great deal of room for improvement using current technologies. The so-called "high definition television" has been under development since 1970 in my laboratory as the next generation color television. Therefore, the high definition television has much visual impact and gives you a greater sense of being there in TV pictures. We have had to analyze the human visual acuity, faculty and even psychology of viewers. As a result of psychological studies, the high definition television must have a minimum of 1,000 scanning lines and at least $1m^2$ of picture area and aspect ratio of 3 to 5 or 3 to 6.

As a result of this study of the psychology of human beings, the Japan Broadcasting Corporation has temporarily established standards as shown here in this slide. The scanning lines will be twice as many as in existing systems, 1,125, and the aspect ratio under our standard will be 3 to 5, about 25 percent longer on the horizontal access. The optimal distance of viewing will be 3 times the height of the picture in contrast to the 7 times the height of the picture for the current system.

You can move up closer to the television screen. Therefore, the angle of view will be greater at 30 degrees, which will give a better psychological impact. The amount of information handled will be five times as much as the current system, as shown here. Bandwidth will be wide at 20 MHz. It may be difficult for you to understand if I explain it by using words. You have to see it to understand it, but I cannot show it to you here. Therefore, I am going to use some slides to compare the new system with the existing television system.

First slide, please. On the righthand side is the picture shown on a regular television, and on the lefthand side high definition television.

Next slide. Cherry blossoms are shown. On the righthand side the current television, and high definition television picture on the lefthand side.

This is the standard television system showing various items. This is a new television, high definition television picture.

The contrast is not as clear as in reality.

Next picture, please. This is the high definition television in a standard drawing room, 1.4 m across is the size of the picture. The present television system is equivalent to a 16 mm movie, whereas the high definition system corresponds to a 35 mm movie film in terms of definition.

Therefore, in addition to broadcasting, the printing industry and movie industry are interested in this high definition television system. We have five times as much information built into one picture. Therefore, for transmission we must have five times wider bandwidth required for the present system. We developed a bandwidth compression system for satellite broadcasting using just one channel. Therefore, we are one step closer to implementation for actual broadcasting. In five years we are trying to put this system into practice by use of broadcast satellite No. 3. For about six months starting next year, at Tsukuba we will hold the SCIENCE EXPO, and in the government-sponsored multi-media hall we will use a 8 x 4.8 m screen to display high definition television. Receiver sets will be placed in several locations in the EXPO to receive test broadcasts, and we are contemplating the use of optical fibers for transmission purposes.

The high definition television is drawing much attention across the world, and the International Radio Consultative Commission is trying to come up with a set of standards for this high definition television. In Japan our Radio Technology Council has started to study the standardization. We are planning to use the unused hours of the broadcast system to conduct some tests.

PROF. MIYAKAWA: Thank you very much. Then I would like to introduce the next speaker, Dr. Tachikawa, please.

DR. TACHIKAWA: Thank you very much for your introduction. I would like to now discuss about the Japanese Local Area Network (LAN). As you are well aware, rapid progress in the technology of office automation, factory automation and laboratory automation was observed and this has enabled us to use the system as a whole in addition to the function of each equipment through the connection using the communication path of these various types of equipment within this system.

When we look at the companies and businesses, we see much concentration on the specified areas of their business for the usage of this type of communication, and especially much has been expected for the development of the new types of networks such as digital PBX and LAN.

Now, digital PBX and LAN at a glance may seem like they are in competitive positions with each other. However, it is not quite so because in the future as well as in the past, the core of the exchange of information in the office buildings is the communication using voice, and for terminals the most frequently used terminals are the telephone sets. Therefore, PBEX has the upper hand as far as the voice is concerned.

As for LAN it is high speed and the intelligent work station equipped with high resolution display, and in this connection LAN takes the upper hand, and the connection of the device that requires large capacity data transmission, LAN takes the precedence.

Therefore, in this connection digital PBX and LAN are not in competitive positions with each other but they are in complementary positions with each other. Therefore, they can peacefully coexist with each other.

The chart indicates the future picture of the office work in the next five years. For the time being the telephone sets and facsimiles are connected with the PBX, so you can see the black lines or path indicate the connection with PBX.

On the other hand, data terminal equipment, DTE, or work station, data file, and such are connected with LAN.

As for the types of LAN in terms of network architecture, these are the familiar terms: Bus type, Star type, Loop type and Ring type. What are the differences in the application? They are based on reliability, transmission capacity, accessibility and maintainability, I believe, out of which the Ring type LAN does not have much restrictions in terms of transmission distance and transmission speed. So, basically, the Ring type LAN is distributed processing and will play an important role as the center of the large-scale LAN in the future.

On the other hand, the Bus type LAN is also distributed processing. However, with Bus type LAN it is easy to add or to remove nodes. However, there are some restrictions in the transmission distance and the accessible terminals, the number of accessible terminals. However, I believe it is quite effective for LAN with a size of less than medium scale.

On the other hand, Ring type and Bus type each has its own advantages, so we should make most of each advantage and link with the node of the Ring type to the Bus type. I think it is one effective way of linkage.

This indicates 14 types made outside of Japan and 29 domestic types, and network architecture, access scheme, transmission medium are compared for the domestic models and foreign models.

For network architecture, Japan has the characteristic of having many Loop type and Ring type. However, each Japanese manufacturer manufactures Ring type and Bus type, but there is a greater menu of Ring type. This is a characteristic in Japan.

As for the access scheme, in Japan because of the familiarity with the Ring type, token passing is adopted more prevalently and it is natural.

The conspicuous feature of Japanese LAN is that as a transmission medium optical fiber cables are used very frequently, and that is the characteristic. It is because less emphasis is placed on the transmission speed and more emphasis is placed on the factory layout. Because of the installment of this system within the factory floor, electromagnetic interference is the emphasis area. That is the reason.

Thank you very much.

PROF. MIYAKAWA: Thank you, Dr. Tachikawa. The next speaker is Dr. Matsushita.

DR. MATSUSHITA: I have my text in English. I was going to originally use the Japanese language because I thought there was going to be German translation, but I am going to use the English text.

Mention has been made about the development of LAN (Local Area Network) using optical fiber and multi-functional work stations. This time I would like to present my feeling for designing man-machine interface through my experience.

While much is written about the desire of human interface and the desired functionality and ease of use are frequently discussed. Very little experimentation in determining the optimal man-machine interface has been done. A typical interface design is based not on concrete experimental results but on market pressure regarding timeliness and cost. The designers are then forced to devote a large amount of time to modeling the user interface to the constraints of particular classes of limited input/output devices, producing far from optimal interface.

Therefore, the starting point should be "What is the desirable human interface? What is the desired functionality, and what is the ease of use?"

Hence, I would like to review briefly the history of man-machine interface. The first man-machine interface as key interface. In principle, we want each token appearance and meaning to be ambiguous in all contexts, and it is user image to be unique, easily remembered. For private common language this is not the case. The user must correctly spell or abbreviate the tokens and the system must be in the appropriate common mode so that common tokens are accepted as such and not as a written out text.

In control key interfaces, the tokens are completed by overloading, the alpha numerical keyboard waits control key.

The function of key interface assigns a token to a particular key. The flaw in this technique is that the number of function keys grows linearly with the number of tokens. So one-third of the interface that begins to satisfy the criteria ... tokens without incurring the expense of the linear growth of the ... device is a menu interface, as shown in this slide. In general, Menus supply composed tokens in a form easily recognized. No memorization of tokens is needed. The menu presents to the user only those tokens that are ... of any particular time unlike the function keyboard. However, hierarchical menu structure is sometimes very complex. A user has to use often "Help Command".

While in key interface the user must correctly spell or abbreviate the needed token, namely the user must remember those tokens and type in an ICON interface. The user only sees the screen and points to a particular man using the appropriate pointing device.

However, some problems are often indicated on the complex hierarchical structure of the ICON if the number of the ICONs grows.

Thus, man-machine interface has been slowly refined. However, few have been designed by rigorous examination of reasonable choices in interface and functionality. Even fewer are backed by a well defined conceptual model.

Therefore, I think it is time that man-machine interface designers commit their conceptual models and interface to paper before implementation.

Finally, I would like to propose particularly important four points in designing man-machine interface:

The user should simply point to specify the task they want to invoke, rather than remember commands and type key sequences, namely seeing and pointing is much preferable to remembering and keying.

The second point is an orthgonal set of commands across all user domains is critical, is crucial. For example, the copy command in the text format should have signal semantics to one in the statiscographic package.

The third point is the system should be designed to operate by "progressive disclosure", namely the system should present the user with only those command choices that were given reasonably at any given juncture.

The fourth point is screen quality should be close to what the final document will look like. This point is fairly important nowadays because we have so many office automation devices such as facsimile, printer, CRT. All densities are different. Density convergence is quite important in this situation.

Finally, I would like to show the appearance of our multi-functional work station, so that is my final remark.

Thank you very much.

PROF. MIYAKAWA: Thank you, Dr. Matsushita. Thank you so much. The final Japanese speaker is Professor Okoshi, please.

PROF. OKOSHI: Since time is limited I will use just three minutes. New Media networks and social infrastructure are the topics that I would like to comment on here.

For the next 30 years, the Federal Republic and Japan and other industrialized countries will have to build strong technological infrastructure. Japan has a rather poor history in this regard. Let me show you some pictures.

This is the current status of power transmission in Japan. This is very close to the heart of Tokyo and this is a common scene that you can see in Japan. I stayed at Braunschweig in West Germany and this is Braunschweig. Unfortunately there is a vast contrast between these two pictures.

Certainly we are very good at producing products, goods, but very poor at building large social systems, and in this regard the Germans are far better than the Japanese.

We are talking about this type of problems increasingly these years and cooperation with you in these fields of social systems will become more important in the ensuing years, and I and many other people have rather high expectations about this.

Since time is limited I used two minutes. Thank you very much.

PROF. MIYAKAWA: Thank you, Professor Okoshi, for your very interesting presentation. The speeches by the Japanese side are finished, and I would like to ask Professor Baack to preside over the presentations from the German side.

PROF. BAACK: Thank you, Mr. Miyakawa. I would propose that Mr. Raubold should give some very short remarks with respect to ISDN. Please, Mr. Raubold.

DR. RAUBOLD: I didn't prepare a talk because I didn't know how this session here would be organized, so let me just give you some comments concerning the topics of ISDN, PABX and local area networks.

As you have heard, in Germany the introduction of ISDN will be along the line of substituting of the existing analog telephone network, but the PABX, which is already now a very important device in Germany, provides the possibility to integrate different services already now in the in-house area.

In our view, and that is the GMD view, the only people I can speak for, the PABX will even before the existence of ESDN integrate data services and speech text and what-have-you services in the in-house area. This indication is starting already now.

The question is--and that is what is of most interest to us, to people who are concerned with standards--which protocol standards to use in order to bring existing data processing standardization, the new world of ISDN and the PABX functionality together in the in-house area.

In our view, the so-called CCITT regulated services, that is TELETEX as the most important one, but following now the TEXFAX, the mixed text and fax service, will inevitably move CCITT standards in the in-house area and, therefore, from our point of view it is the TELETEX line of protocol standards which will also be used in the in-house area. Precisely it is the TELETEX recommendation S-70 which covers the way how different network technologies should be used in order to provide common network service and define transport protocol on top of it.

So, from our point of view, the protocols to be used in the in-house area and protocols which should be met onto ISDN services are the ones defined in the CCITT recommendation

S-70 in order to provide the integration of CCITT regulated services into the in-house set of services.

What we did in order to test this kind of development is we started collaboration with a German firm, Siemens--I think it is well known even in Japan--to map the S-70 protocols onto the ESDN set of protocols. To be more specific, to map the connection setup phase of the S-70 protocols onto the signalling system No. 7 used in ESDN and to map the network connection of the S-70 protocol onto a 64 Kb ESDN connection.

We do this as well for S-25 type of network services as for S-21 type of network services so that from the point of view of an ESDN PBX there is no difference between virtual circuit and a physical circuit. From the ESDN point of view or from the PABX point of view, it is always 64 Kb switched connection run with an HDRC ? protocol on top and things like that.

Okay. This is the one aspect, ESDN plus CCITT standards for protocols, but now how to LANS (Local Area Networks) come into this picture? From our point of view, there are two different ways of using a Local Area Network. One is to connect a cluster of EP devices coming from one manufacturer, a cluster of maybe UNICS ? machines running under the new connection type of software or a cluster of machines from XEROX work stations and file service and print service, that is machines from one manufacturer connected with manufacturers' specific protocols, and this will stay this way and we don't think that standardization will really be able to define all the necessary standards to interconnect machines within manufacturers' specific cluster in a compatible way, I mean compatible across manufacturers' boundaries.

But there is a second way of how to use LANS, and that is to communicate from local device to external services using ISO or CCITT defined standards. As you know, the usual number quoted is the ratio 8 to 2 for the ratio between external and external traffic, traffic within a firm to the traffic going external.

So the 20 percent of usage of devices connected to a Local Area Network are these types of applications which want to communicate with external services, from our point of view mainly CCITT recommended services. So this second way of using LAN is for existing external services, and we think that for the purpose of this access, one should implement protocols on a Local Area Network which can be mapped onto CCITT standardized protocols in a gateway device as easy as possible. So the question is what does "as easy as possible" mean. So what we did in order to find out how to do this is we started, in cooperation with a group of firms organized by VDMA. I don't know how the translation into English reads, but it is the Office of Information Techniques Group within the German Machinery Manufacturers and Plant Makers Association. We had a contract with these people to study and propose a set of protocols on top of a Local Area Network, I should say on top of the so-called medimm access control interface defined by a E802. This is a medium independent interface, so to define a set of protocols on top of this interface which makes it easy to build a gateway between a Local Area Network and public network services.

If you follow this path, on one hand using an ESDN PBX with the S-70 type of protocols for data communication, and use a Local Area Network with protocols which can be easily mapped onto CCITT protocols, it is no problem at all to connect a Local Area Network through a local PABX to public services, which means that in the long run the typical configuration in the in-house area probably will be several office specific Local Area Networks, not only one but one per organization within the company, tied together by the local PABX and connected through the PABX to the public network which will in the long run be an ESDN network.

So that is what I wanted to say. I didn't give you very much of the reasons. I simply told you what we are doing, and I hope that you will believe me that what we are doing we are doing out of some good reasons.

Thank you.

PROF. BAACK: Thank you, Dr. Raubold. Now I would like to ask Professor Plank to give us some information about the different kinds of services in the discussion of today.

PROF. PLANK: Thank you. As I mentioned before, we have introduced services in Germany as telephone, telex, teletex, the videotex, telefax service in two steps, Grade 2 and Grade 3, and starting this year texbox, that is electronic mailbox, let's say, public electronic mailbox.

Our videotex for the time being is of a set standard, that means it consists of 4,800 picture modules per screen.

Introducing ISDN, we will add on texfax--which Dr. Raubold has already mentioned. Probably we will get a high solution TELIDON similar definition of a new videotex system, including the possibility of one-ninth of the picture frame by moved elements. Then we will have a 1.5 to 2 second facsimile. We will have speech mailbox, we will have slow scan picture transmission, and what is very important is that two channels are available. We are able to handle two services at the same time via one connection consisting of twice 64 Kb/s.

I think, and many people in Germany think, that one of the main tasks for this area will be to harmonize different services in that way that either the receiver is designed for paper or for a display but then using all services on this display, all graphic or all visual services. That means we have to harmonize the framework and standards of the services going into the ISDN in this direction for making sure that somebody who has in operation a picture display tube, can take part as well in a facsimile service as in a teletex service or in a mailbox service or something like that or slow scan picture transmission. That is one of the most important tasks of the future and I think we should speak about that. That is beyond all the standards of voice and the main standards of alpha numeric transmission.

Thank you for your interest.

PROF. BAACK: Thank you very much, Prof. Plank. Now I would like to ask Dr. Winkel to give some comments to the Local Area Networks. Mr. Winkel has prepared a very long manuscript--I could observe him--but I believe due to the time shortage he only will give a very short abstract.

MR. WINKEL: I will give you a short overview about the Local Area Network situation in West Germany. I think this is installed in West Germany, and I would like to give you the classification.

The first, most types today are computer-manufactured oriented systems which have very quickly changed the first name "management information system" to "Local Area Network" system. I think this is the first type.

Second, I would say the father of the West German fiber optic ring system, network, is here, Professor Syrbe from Fraunhofer Gessellshaft. He developed in 1979 I think the first German optical fiber system for industrial application. The name is RCD system. This system was started in 1979, and he has some installation in very big industrial application in West Germany.

Now we have the second system based from line from Fraunhofer Gessellshaft, the system named LIPSI, LIPSI based also optical fiber and also token passing developed from Informatique System Technique, Stuttgart City, and for typical applications small industrial process control, communication systems for printer, personal computer and tool machines. The communication protocol for this system is in the ISO layer 2 through 3, ARDLC, and in the ISO layer 4 through 7, X.25,
-terminal
and we take X.28 for terminal/communication, and we take X.29 for communication to computer-computer.

We have installed 12 systems based fiber optical in the last year in the area from Stuttgart. So as a classification I think it's the PAS system based VISENET with coax cable and CSMA CDX. This Local Area Network application to connect main frame to main frame computer is connection for high speed capacity installation in West Germany. I think it is old technique with new clothes, and in West Germany most people like VISENET based because the new technology in West Germany is not too popular.

So, thank you very much for your attention.

PROF. BAACK: Thank you, Dr. Winkel, for your speech. Please let me make some final remarks to two very important points of research in Germany. I mean the field of integrated optics as well as the field of high definition television. Both fields have a very high prominence in the research funding of the government.

Some remarks to integrated optics. Integrated optics in our sense means integration of optical as well as electronic devices on indium phosphate substrate, and there are several fields of application in the far future, and I believe the most important field is the subscriber area of public systems, and another very interesting field would be the in-house communication. It is comparable to your activities in the MITI-controlled auto system or the auto project.

Other fields followed by us are high speed signal processing, and later on we want to go in the field of sensor or fiber sensor techniques. For the time being we are installing a new division for integrated optics, and at the present time about 40 employees are working in this field, and this department should be extended to about 80 employees within the next two years.

Another field is related to high definition television. As Mr. Sawabe told before, we are nearly following the intention of NHK and Sony. That means we want to apply a double line rate and an aspect ratio of 3 to 5 and an interlace ratio of 1 to 2, but there are some differences. We are trying to diminish the distance between the viewer and the picture from 3 times the height in your system to 2 times the height in our systems. We believe it is very necessary to get the impression of tele presence instead of television of today.

There is another very important difference related to the terminal to a future mass produced terminal. You are following the concept of CRTV terminal with 3 different tubes, color tubes, and we are following the one beam light wave projector, high resolution, wide screen light wave projector, and we want to realize within the next year a prototype of such a projector, and after that we hope German industry will take over the results for mass production.

In parallel to these activities of high definition television, we are investigating the problems of transmission. At the moment the only possibility to transmit high definition television signals is given by fiber optics because we have no capacity for satellite transmission. It is a different situation to your country.

On the other hand, you have established very interesting solutions for transmission high definition via a small satellite channel, and it could be a solution for European countries, too, because we have very high shortage of capacity in satellite communication.

So far some very short remarks to the integrated optics and high definition television. Thank you very much.

PROF. MIYAKAWA: Now all the presentations are finished. Even I have many questions I want to ask, but even a single topic requires more than one hour to discuss fully. We regret that very much.

This year is the first time we are getting together, and the main objective today is to communicate with each other and to know the situation in each country. It is the first step.

The second job we must do is to select several topics which could be nice subjects to discuss maybe next year or in the future. The General Chairman Professor Yanai suggested we list maybe three or four topics. Maybe it will be discussed in the following sessions. Therefore, if everyone agrees, I would just want to discuss what could be the future problems in the medium session, in our sessions.

PROF. BAACK: The German delegation has some proposals for such a future meeting, and one proposal goes in the direction. In future communication it is intended to communicate between networks of Europe or U.S.A. and Japan networks but, on the other hand, we have the very tremendous problem that different standards in both networks are present or are growing up, and it could be one topic to study how can we overcome the problems of the different standards and how can we overcome the resulting problems of blockaded exporting and importing of the different countries. At lunch I had a speech with Mr. Miyakawa. He told me another topic from your side which is related to the acceptance of the different services in your country and in our country, and I believe both topics could be correlated and we should discuss if that might be possible from your side or it is impossible to discuss about problems of standards at all.

PROF. MIYAKAWA: Are there any questions to the proposal done by Professor Baack?

DR. MATSUSHITA: Briefly. Many people mentioned the local in-house networking, Local Area Network and PABX, so we would like to discuss the potentiality which is bigger between the two systems, Local Area Network and PABX. That is the crucial point for in-house networking system, so we would like to communicate with each other, so one of the titles I think for discussing between the two countries, I think.

PROF. MIYAKAWA: It's another proposal.

DR. MATSUSHITA: Another proposal, right.

PROF. MIYAKAWA: Addition to the proposal by Prof. Baack.

PROF SYRBE: I also will make a spontaneous remark. Mr. Matsushita and Mr. Tachikawa told us some problems in the pre-area of standards, on the one hand LANS, many types of LANS, and man-machine interface in the other case.

We have seen in the European Community that it will be good to have theoretical models which describe these systems to find out which data must be standardized and which are not, and that's a possible theme to discuss such theoretical models for that reason. We have some experience in the European Community on that.

PROF. MIYAKAWA: Do you mean that in the European Community you have already done some...

PROF. SYRBE: That's the same problem.

PROF. MIYAKAWA: The same problem. I think it is a comment to the proposal by Dr. Matsushita.

PROF. SYRBE: No, my proposal was to discuss theoretical models, to describe LANS, on the first hand, and man-machine interfaces on the other hand.

PROF. MIYAKAWA: Especially you are just pointing to the man-machine interface or not LANS in general.

PROF. SYRBE: The possibility to do both.

PROF. MIYAKAWA: In that sense I just mentioned that your proposal is related with LAN, maybe closely connected.

PROF. SYRBE: That's one point, yes.

PROF. MIYAKAWA: Therefore, maybe closely connected to Dr. Matsushita's proposal.

PROF. SYRBE: Yes.

PROF. BAACK: We could follow that in different ways in discussion. We could make a specific proposal and could discuss this proposal with a final result. On the other hand, we could make several proposals in advance, and after that discuss the value or not, and you would prefer the last way, Professor Okoshi?

PROF. OKOSHI: Yes, I think the second method might be better.

PROF. BAACK: Okay. If I am allowed, I would give you some more proposals from our side, and some of them were discussed yesterday evening with Prof. Okoshi, and with Prof. Miyakawa at lunch, and other proposals could be high definition television, what are the different strategies with respect to signal transmission, analog digital, what are the different strategies with respect to the terminal, etc., satellite communication and fiber communication.

Another point of interest could be the fiber optics in the subscriber area. Both countries have at the present time not an actual solution for introducing the fiber in the subscriber area. All have a lot of ideas how could it be made, but the final solution nobody of us could prefer.

Another topic was given by Prof. Syrbe. It is related to the theoretical models, and another point--but it is more future oriented--could be integrated optics. I am familiar with the activities in your country, especially the joint lab in Kawasaki and by NTT, and we are growing up such an activity, and I believe it could be a point of common interest.

The last point from my list could be coherent transmission, coherent optical transmission in two different directions. Coherent optical transmission has two main advantages. The first one, one can establish optical multi-carrier system with a very high number of carriers. It is very attractive for broad band distributing network. Another advantage of coherent transmission is the high sensitivity, and this could be very interesting for long distance trunks. So far the list from my side.

PROF. MIYAKAWA: I would just like to write down the titles which have been proposed. (BLACKBOARD)

1. Standard
2. Import/export
3. Acceptance
4. PABX vs LAN
5. HD-TV
6. Subscriber loop using optical fiber
7. Integrated optics
8. Coherent optics and transmission
9. Theoretical modeling of man/machine LAN before standardization.

PROF. BAACK: Integrated optics is related to 3 and 5. Integrated optics may be important for LANs, optical LANs and for subscriber loops in the public networks and for coherent optical transmission, too.

PROF. RAUBOLD: In the pre-area of standards, if you add "theoretical modeling" of man-machine and LANS in the pre-area of standards.

PROF. MIYAKAWA: Pre-area?

PROF. BAACK: Before defining standards.

PROF. MIYAKAWA: Before standardization.

PROF. RAUBOLD: The blackboard is filled up already and I'm sorry I have another topic to suggest which has not been talked about in this session here but which was mentioned at least broadly by Mr. Kodama this morning. This is the question of technological development for security, and I think that has very much to do with New Media and acceptability for New Media. From my point of view I think within the next three years this topic really will be invented as a very important one. There have been some preliminary discussions in Germany during the introduction phase of VISIONTEX when all this ruling necessary in order to make VISIONTEX a public service was discussed in Germany.

My proposal would be to put it under the general topic of "Security, Integrity, Authenticity and Privacy of Electronic Transactions". You see, these are four different dimensions which are separate and have to be discussed separately: security, integrity, authentication or authenticy and privacy of electronic transactions. More significantly, electronic signature, electronic money, all topics like these belong to such problem area.

PROF. OKOSHI: Then I propose No. 10, Infrastructure. Anyway, 17 minutes from now I have to give the report, and may I propose one way of processing this data? It seems to me now I am afraid that we will not get to the conclusion in the limited time period. If it is not possible, one method would be to present everything in parallel and propose to have more time to discuss, for example, until August when Professor Engl will come to Japan next time.

We can decrease it a little more.

PROF. BAACK: Yes, we should make a list of priorities, yes.

PROF. PLAMK: Let's try to combine the one or other points.

PROF. BAACK: Yes, we could combine. For instance, the first proposal could be to combine points 6 and 7 to one, integrated optics and coherent optical transmission. On the other hand, it could be possible to combine points 1 and 2. I am not sure, Mr. Raubold, whether it is possible to combine PABX and LAN together with your proposals of security.

PROF. RAUBOLD: No, it is not possible. They are quite different subjects.

PROF. MATSUSHITA: Security is usually required for wide area network, not private network.

PROF. BAACK: It's overlapping.

PROF. RAUBOLD: One could combine 2 and 9.

PROF. MIYAKAWA: I suggested the second is a ninth topic, but maybe 2 and 9 are the same, acceptance and how to utilize, maybe banking system, use of New Media to include teleshopping.

DR. WINKEL: But 9 is a technical aspect of 2.

PROF. SYRBE: In order to proceed is to make at home a decision about priorities, and you write together or phone together, and we think about the priorities in the next two weeks or three weeks.

PROF. BAACK: That is a very good proposal, but I have a very general question to the Japanese delegation. It is possible to discuss point No. 9, or are there some problems for you if we are discussing the problems of standards? Would it bring some problems for you to discuss the very political question of standards, or is it free to you to discuss such problems?

PROF. MIYAKAWA: Personally I feel so because there are many international organizations discussing standards, and I think most of the members belong to ISO Subcommittees or CCITT or CCIR. Therefore, to discuss standards here in this meeting, maybe we have to look at different views not in the same field, in the same point of view as CCIR or ISO. Then there is no progress. No new results will be obtained. Maybe we would do the same discussion as ISO or CCIR. Therefore, if you want to discuss standards here we have to look at the standards from a different point of view.

PROF. BAACK: But can we reach any results that might be important for the development of telecommunications at all?

DR. TODA: I think the standardization of telecommunications system should be discussed on a separate occasion.

PROF. RAUBOLD: What could be discussed is the area of application for international experiment, and in such a framework then the question would have to be asked which of the existing or upcoming standards to select in order to make the thing work. So it is not a question of creating standards but it is a question of maybe a common international experiment, and then the selection of the proper standards for it. So in this sense

I would think the topic "standards" would make sense, but only in this, not by doubling the efforts of ISO or CCITT.

PROF. MIYAKAWA: I am of the same opinion.

PROF. BAACK: Due to the very short time, we have only five minutes, therefore I would like to come back to the proposal from Professor Syrbe to make a list with all the different points, and within the next weeks everybody has time to think about the different points and we should make a list of priorities, and I believe some of the objects will be cancelled due to any problems we cannot see here, for instance the problem of standards or so.

On the other hand, every side has the possibility to bring in new ideas, and therefore my proposal would be to make a list with specific priority, and this list we want to offer the Co-Chairmen with the comments that that list must be corrugated and supplemented within the next weeks.

PROF. MIYAKAWA: If it is done by mail it is better, by correspondence.

PROF. BAACK: By correspondence, yes.

PROF. MIYAKAWA: Anyway, Professor Okoshi must report the results of our discussion, just report all of the ten topics to the general session, and we would like to elaborate in the next few weeks.

PROF. OKOSHI: I have combined already 6 and 7. 1 and 2 are also combined. Are they different? Should I separate them?

So we have nine.

PROF. PLANK: I could imagine one other combination which for me seems somewhat better, to have point 1 as it is written here, Standard and import/export, and perhaps to ask acceptance and use of New Media in commercial communication. That will involve the other question of PABX and LAN, commercial communication to reduce the list.

PROF. MIYAKAWA: You mean you want to restrict the New Media to commercial network?

PROF. PLANK: To put together points 2 and 3 on this list because PABX and LAN are typical for commercial use.

PROF. MIYAKAWA: Maybe it will require a long discussion. Therefore, this time I just propose to separate 1 and 2 and list it just as it is. The remaining problem is how to obtain each group.

PROF. SYRBE: Each group thinks about the priority, the German and Japanese groups interchange.

PROF. MIYAKAWA: And with detailed comments, detailed problems which should be discussed. This is just the title. That is very interesting.

DR. MATSUSHITA: That is a big job, I think. We have two Chairmen, so I think that job is two Chairmen's job.

PROF. MIYAKAWA: And maybe we will consult with Professor Yanai and Professor Engl. I think everything we had to do is finished, and if there is no other comment or opinion I would like to close our session.

(SESSION CLOSED AT 3:30)

GERMAN-JAPAN FORUM ON INFORMATION TECHNOLOGY

27th April 1984
Keidanren Kaikan

WORKSHOP 2 : "COMPUTER"

1:00--3:40 P.M.
Room 1005

CHAIRMAN: Prof. Tohru Moto-oka

CHAIRMAN: Prof. Norbert Szyperski

MOTO-OKA: As it is time, we should like to start the Session. My name is Moto-oka. I shall be serving as Chairman of this Session along with Dr. Szyperski. Now, we have already introduced the members, so I believe there is no need to do it again here. We have already introduced our members in the Morning Session, so I do not believe we need to do that again at this place.

Within a very limited period of time we have to finish our discussions. So, according to the schedules that we have established, perhaps we could go into R & D reports 20 minutes each for each country. And as for the free discussions, on the Japanese side, each speaker will speak about--for about 5 minutes concerning the related field in which he is engaged, and comment on the subject. That is what we have in mind on the Japanese side.

Now, after that, we will have reports from the German side. And then, following that, we shall ask the Rapporteur, Dr. Aiso, to formulate the concluding remarks or concluding summary for this Session.

So, Dr. Szyperski, is that agreeable to you--the procedure?

SZYPERSKI: Thank you very much. As we have gathered with you today here, I think we have to say that it is a pleasure for us to discuss with you current and future aspects of computer;--computer architecture, and maybe computer use, too.

We feel in our country that there is a new challenge for computer industry world-wide, and for research and development in that area. Because of the fact that within the world of microcomputer, microprocessors, we have had only new chances, but we have new freedom of designing hardware and systems. And that is something what is stimulating on one side, and on the other side, it looks like that we will have to discuss many parts of the environment that may shape the future requirements for that architecture and the implementation work.

So, we are looking very much into the future;--discussing that with you, and so we can agree with your procedure. We would like to have the main statement given by Mr. Fritsch, and then, later on, we can pick up some of the questions you brought up in your short statements, and each of us will then answer one or the other part, or add something to our common understanding.

So, thank you again, and may I turn it over again to you the tool.

MOTO-OKA: Then, we should like to start with a Japanese speaker, Dr. Hiroshi Kashiwagi, from the Electrotechnical Laboratory. Dr. Kashiwagi is involved in the fifth generation computer--the "Super Computer Project". So, he shall be addressing both subjects.

KASHIWAGI: The time given to me is 20 minutes, is that right?

MOTO-OKA: Yes, twenty minutes.

MÜLLER: May I have a question, please? Will we be given the short reports in a written way afterwards?

KASHIWAGI: We will be providing you with the OHP copies --OHP copies will be provided.

KASHIWAGI: Since the time is limited, I would like to go directly into my presentation.

The current projects undertaken in Japan, I would like to briefly go over these projects. As has been mentioned by Professor Moto-oka, the National R & D Programs for the large-scale project: It is officially called "High-Speed Computer System for Scientific and Technological Uses". To be short, it is called "Super-Speed Computer Project". It has started from fiscal 1981, and will go through fiscal 1989. The budget is 23 billion yen. In terms of U.S. dollars it is 100 million dollars. Well, in terms of Deutsche-mark I have not calculated; so I hope you would calculate on your own.

And as for the development of the Super-Speed Computer

Project, the development of devices to be used for this Project is what is called the basic technology for future industries. And out of this, there are some devices called new functional devices. There are three of these.

The first one is the super-lattice devices; the second is the three-dimensional devices. And thirdly, refractory semiconductor devices. As in the super-speed computer project, the period for this development is from fiscal 1981--it has been started in fiscal 1981. And in my data shown, I have shown the research budget up till 1984. The total is shown in the slide.

And apart from these, as has been mentioned this morning by Professor Moto-oka, there is one called "Fifth Generation Computer Program"; it's officially called Research and Development on Basic Technology for Computer Systems. This is the official name given by the Ministry of International Trade and Industry. And Dr. Fuchi will be introducing this later on. Started in 1982, and it will go up till 1991. And as has been mentioned earlier by Professor Moto-oka, the first phase or the basic phase is from 1982 up till 1984. The budget up till--the research budget up till 1984 amounts to 8,260 million yen. Isn't it so, Dr. Fuchi? And as for the research budget--total for the 12 years--is, I hear, 100 billion yen.

And as to other computer-related projects, as listed on the slide, the MITI, IPA and JSD--excuse me, this "JSO" should be "JSD"--these institutions are conducting software development projects. 2.52 billion yen has been allotted for the budget for this year. And in relation to the Ministry of Education and Culture and Science, there are some related research activities conducted in universities. And as to this, Professor Aiso will be introducing later on. And the Nippon Telegraph and Telephone--NTT--conducts the project for INS computer. And this morning he mentioned as for the policy taken by the MITI;--a new policy of new media has been taken up. And up till this day, about 120 million yen is given as the budget for the survey or the feasibility study. And this is to be started from this year.

And besides these projects, there are some special research projects related to national institutes, and there are some information processing related projects.

And for your reference, up till this time, some of the large scale projects are completed already. I will give you two examples: First is the Super-high Performance Electronic Computer;--Is it Super-speed Super-high Performance Electronic Computer, isn't it? This is the project already completed. And after this, there was a project from 1971 to 1980 on the Pattern Information Processing System.

And here, I will talk only about the High-speed Computer System, or the Super-speed Computer Project. I would like to give you details on this project.

First of all, what is referred to many of you is the organization: I would like to briefly explain on the Organization. The Ministry of International Trade and Industry has the Council for Industrial Technology under its jurisdiction. And under this, there is the Committee of National Development Program. And here, Professor Moto-oka is, of course, a member of this Committee. And under the Ministry of International Trade and Industry there is the Agency of Industrial Science and Technology; and my Institute --the Electrotechnical Laboratory is under the jurisdiction of this Agency. And the research contract is given from the Agency to the Scientific Computer Research Association. This Association, as shown here, is constituted from six companies.

Now, as to the target values for the supercomputing in Japan, how have we set the targets? In Japan, currently, aerodynamics, meteorology, nuclear energy--these big large areas are the major application fields for supercomputers. The current computer's capacity is 3 to 7 mega-flops. And it's 1 hour per case or 0.5 hours per case--is needed for the computation. Therefore, in two or three years from now, the capacity--computer capacity of 100 to 1,000 mega-flops will be required. And later, Mr. Sato from Fujitsu Limited will explain in detail. Fujitsu VP-200 or Hitachi S-810;--these computers have been already launched into the market on commercial basis. And in addition to that, SX-2 by NEC, with the 1.3 giga-flops capacity, is already sold in the market.--(Excuse me:) It's not yet sold, but it's announced that it will be sold in the market in the future. It's not yet commercially launched. It's not in the market yet. But in the near future it will be in the market. Therefore, in 5 to 10 years from now, we make the prediction that the capacity of 1,000 to 10,000 mega-flops capacity will be required. So, 1 giga to 10 giga-flops of capacity will be required. So, we have set this as the target for this project.

Now, in creating this kind of computers, what should we do? First of all, we have devices, the architecture, and total system; we have divided our project into these three areas.

How many minutes left? Up to 1:30? So, I have 9 minutes to go.

On the High-speed Logic Memory System and target, we have as for this logic device per chip over 3 kilo gates. And the other units are expressed in these terms. On the low temperature device a high speed is required. On the memory device, integration of over 16 kilo bits per chip is required. As for architecture, parallelism is required; software improvement is also necessary.

On the total system, the speed will be 10 billion flops.

Large Capacity Memory Device is in existence, and its specification will be over 4 kilo bytes, and transmission speed is over 2 giga bytes per second--over 2 giga bytes per second. And maximum would be 4 times the amount;--four times the speed. Later on, I would like to present the total system. The distributed parallel system--distributed parallel processing system that we have in mind is something in the range of 100 mega flops. So, this is the direction in which research and development work is being pursued.

Now, as for the respective---R & D with respect to the respective devices; now we have material and fabrication process, and device structure and circuit design, packaging, cooling and testing--basic study concerning this; these are presently being conducted. MSI level devices are being --test production of MSI level devices is being done.

Now, looking at the respect of new devices, Josephson, HEMT, and gallium arsenide devices, the research items with respect to each respective device are as follows:

On the Josephson device, we are studying tunnel barrier formation, and reliability against thermal cycling, and improvement or enhancement of electrical characteristics.

On the HEMT, we are studying the HEMT crystal formation, and threshold voltage control--how to control the threshold voltage.

And on gallium arsenide, we are studying the improvement of process yield, and surface state control.

Now, from the standpoint of architecture, we are analyzing the user code. Meteorology, aerodynamics, nuclear energy and molecular science; and the application code in each field or the analysis of parallelism of the code is being conducted in respective fields, and algorithms are also being analyzed. And we are studying what the ideal form --ideal architecture should be.

One; with respect to meteorology--the architecture with respect to meteorology would be multi-pipeline, which would be appropriate. And for aerodynamics, the flow dynamics--SIMD-like architecture would be appropriate-- fluid dynamics, SIMD-like aerodynamics code will be appropriate. For nuclear energy, MIMD-like architecture would be appropriate. And for molecular science, hierarchical memory is considered to be very effective.

Now, to satisfy all of these conditions, is there an answer which satisfies all of these requirements? It's very difficult. Where should we focus on in order to decide on an architecture? That is a task for the future.

The important thing is that we have the conventional architecture in existence, and the physical phenomena that we have in mind or we have set as an objective;--to fill the gap, we have to improve on the numerical algorithms. And we have a very large application code now. How to transfer all of these to the right-hand side would be the key in our research work.

Now, the final system is as shown here. I refer to distributed parallel processing. This is the pre/post processing system, as is shown here. Image pattern processing system;--it's a dedicated system--system for processing patterns and images.

This is the schedule for development. With respect to the architecture and software, basic research has been conducted until 1983; and full scale work on specifications, logic design, logic simulation has been started as from this year. From the middle of this year, specifications, logic design will start; in the middle of this fiscal year.

As for new devices, new materials, fine and final device evaluation will come at the end of fiscal year 1985. Fiscal 1985 would be March of 1986.

To summarize information concerning this project, what we need is as shown on the OHP. Stable supply of new devices; and new methods regarding logic design and packaging and cooling; optimized architecture for various problems; efficient software which is suited for parallel processing; and suitable algorithms for parallel architecture. I think the requirements can be summarized in the following way.

This is the development work done by Fujitsu under a contract; and it's an example of the HEMT which Fujitsu is developing.

And this has been developed by Toshiba; 1 kilo-bit S-RAM--an example of 1 kilo-bit SRAM.

And this is an example of the Josephson junction--JJ. 1 kilo-bit RAM. And this is a full adder--an example of a full adder.

So, these are samples or test products, and on top of these, we have a three-dimensional device or a battery device, which are being developed in the course of our basic technology development work. With respect to superlattice, we have in mind what I am showing up here. This is the three-dimensional device that we are attempting to develop.

I am running out of time.

Now, this is the dream of the device-makers; how the three-dimensional device would--what the three-dimensional device would come to resemble in the future. With respect to the INS computer, if I may make a brief remark regarding that, INS computer will be based on DIPS 11-B--DIPS 11-B. And CPU would be 20,000 gates per chip LSIs. It consists of 20 thousand billion chip LSIs. It has to have continuity and compatibility with the existing system, which we have at present, and services as well. So, we have in mind a system which would be consistent with what we have at present.

MOTO-OKA: Thank you very much. If there are questions, we would like to entertain them at this point.

GILOI: Did I understand it right that the final decision as to the architectural structure has not been made yet? And that the follow-up;--When do you think such a decision will have been made?

KASHIWAGI: The final evaluation -- that will come when we evaluate--make the final evaluation for the device. That is, when we make the decision. Now, this subject--in this project Dr. Moto-oka is deeply involved as well, and he considers this to be a headache issue as well. It's a very difficult issue.

The vendors would like to come up with something that is a continuation of the traditional--conventional technology, but what we have in mind--we would like to propose a completely new technology. So, how to coordinate the two demands or the two things that we--both sides have in mind will be the key issue.

MOTO-OKA: That is very difficult but interesting point.

KÖNIGS: I would like to ask two points; one is the software, one is hardware concerned.

The software question, first. If you think of using this machine in conventional applications, and just the acceleration of the today's applications, you should be able to be compatible to current operating systems, like the IBM, MBS(?), and things like that, the main frame area. So, the question is: Have you already concepts how to migrate or how to cope with current applications on the operating system side?

KASHIWAGI: Well, we have to finalize from now on. At this stage we have no any clear answers to that question yet. However, earlier as shown in the overhead OHP slides, the massive codes for FORTRAN should be smoothly transferred; so the system we have to aim at is that the FORTRAN system should be smoothly transferred.

KÖNIGS: Then, concerning the hardware design: If you think of this complex and large gate devices, you should be able to have a new design methodologies, new design aid tools and new ways of simulation and testing--this logic; how far are these ideas or concepts already?

KASHIWAGI: Well, up to what stage, I think, is a bit difficult to answer. You mean for new devices? JJ, HEMT, gallium arsenide;--on which device are you talking about?

KÖNIGS: I think of the logic device and the memories. If you think of the Josephson junction effect, for example, you have very very dense and complex high gate count devices. And I guess that it would be very difficult to design or to test with the conventional methods and conventional test tools, for example. So, you should have new tools, new methods, and the question is how would they look like?

KASHIWAGI: Well, in various institutes and laboratories, they utilize new methodology; they have their own methodology.

And especially, concerning the JJ device, we are not thinking that JJ will have higher integration compared to the other devices. The merit or the advantage of JJ device is that with the same level of integration, the speed could be improved; so, the speed would be faster.

Well, concerning this, as to the methodology, we have just started the R & D on the methodology for this device. So, up till ten layers--device of up till 10 layers have been already verified that it is able to fabricate. So, we have already had the data that it can be fabricated. And especially on the vertical direction, the junction or the conjunction on the vertical side is the problem we have.

MOTO-OKA: I am sure you have a lot of other questions in mind, however, there are lots of other matters to be discussed. So, may we move to the next item? And if we have some time later on, we will have further discussion on this matter.

Next, may I ask from the German side? I would like to ask Dr. Fritsch to speak. Well, could you introduce Dr. Fritsch for us?

SZYPERSKI: Mr. Fritsch, as you have read before, was formerly with--after his study time--with AEG-Telefunken in the very early years of computer design; then, he was working in the development with Nixdorf for many years. And now he is with the Triumph-Adler Organization, and he is in charge of the development of new systems.

KLAUS FRITSCH: Before I will start to give you a short overview about German research and development in computer discipline, I have to apologize to the translators, because I will not be able to hold me correctly onto my text because I have to show here something, and so I cannot correlate. But the sense will be the same.

We see examples of an integrated information processing world in the office of tomorrow, where the today's elements; dedicated workstations, distributed data processing systems and the mainframes--here very little shown--are connected to new integrated workstations, server structures, and gateways to the outside world, are connected via a multi-network that represents an intelligent coupling of PABX--Private Automatic Branch Exchange Systems, Local Area Networks, and Processor-Processor-Coupling nets.

In Germany, now, some elements--the red ones here--are taken with special account. I will discuss--I will tell to you those items in two directions; in the architectural direction, and especially in software technology direction.

In architectural approaches, we in Germany have main efforts in two directions. With the today's VLSI technology, we are more and more capable to give the user a complete CPU with a complete operating system and complete applications software packages onto his desk. So, we leave the traditional shared logic architecture, where many dumb terminals have to share one intelligent CPU and come to the so-called "shared resources architecture", where only resources have to be shared, such as common data bases, server structures and gateways, as I showed you in the first picture.

The second item is multiprocessor architecture. Here, our main efforts lie in the fault tolerant systems that have the additional capability to simply upgrade the performance by plugging in simply additional CPU-board. The Nixdorf System 8832 is a typical example for such a structure.

In the universities, on this item emphasis lies on data flow architectures. And here, the "Gesellschaft fur Mathematik und Datenverarbeitung" and the Laboratory for Innovative Computer Systems and Technologies, Professor Giloi, who is here with us, is on the front in designing architectures that are capable to avoid the "von Neumann bottleneck" even on the physical level, by having an architecture that is able to represent and to process data for architecture on machine level as machine data structure types: First with his system "STARLET"; then, today with his system "APA", that is able to communicate in its special notes within a special net, with a speed of 280 mega-bit per second, and with a cooperation project that he does with a British company, Ferranti, called the "ARGOS-1,000 FT Project";

Professor Giloi follows those multiprocessor efforts.

In the area of networks, main efforts are tokened to local area networks, and to those ones that first are capable to adopt very easily to the outside world, that means, to public services, to private automatic branch exchange systems and to other local area networks; that are secondly able to follow very easily all the standards in hard- and soft-ware that are seen today, as for example, the carrier sensitive multiple access method of Ethernet or Omninet, or the Token approach , or especially, in software standard, the ISO-7-level reference model; and that are thirdly, very easily capable to connect subscribers of very different types each other, for example, simple electronic typewriters connected via gateways to mainframes connected to wordprocessing system and to file server structures.

Those networks, in addition, are capable to emulate the shared resources architecture.

In the world of Private Automatic Branch Exchange, we in Germany have changed from the pulse amplitude modulated one to pulse code modulated digital ones that are very easily able to switch--integrate speech, data, and image, and to prepare to the coming Integrated Services Digital Network standard.

The ISDN will work with two 64 kilo-bit per second channels for speech and with two 8 kilo-bit per second channels for data and control information. Here, Siemens SEL and of course the Deutsche Bundes Post are on the leading edge.

In software technology, besides the fact that more and more standard operating systems in distributed data-processing, especially UNIX and its derivates are used, and besides the fact that in the tool area--in the software tool area, we switch from comfortable software designing tools to very comfortable software production. The main focus in Germany lies on expert systems and on a complete new generation of programming systems.

In the area of expert systems of knowledge-based systems, I have shown here two special examples that are in development and are supported by the Ministry of Research and Development, by the Institute of Mathematics and Data-processing of Professor Szyperski, and by the University of Stuttgart, Professor Fischer. One project is driven by Nixdorf Computer Company, that is this one. It is an expert system that supports the Nixdorf Remote Fault Diagnosis System for field maintenance. And the other one is driven by Triumph Adler Company, and is dealing with the support of a man-machine interaction in an office automation system by a dialogue expert system.

I will go a little more in detail in the dialogue expert. In the office of the future, the "knowledge worker" as we will call--the man in the office can be assisted by an expert system very effectively in the symbiotic cooperation between himself and the computer. The many-layered, and not unforeseeable functions in the office environment, can very effectively be supported by a knowledge base. And we all are aware that with such systems the structures of office work will change, and therefore, the acceptance speed of such systems will be limited.

The today's state of the art in man-machine interaction is the software ergonomics. You see an example--you all know, I think, the APPLE-LISA and the XEROX-STAR, where the complete office environment is simulated on the screen --on the CRT. This was a step to broaden the explicit communications channel between man and machine.

With knowledge about the problem-area in the office and with knowledge about the process of communication between man and machine, we now are in the stage in Germany to open the implicit communications channel between man and machine.

The last point I mentioned was the new programming system. We all know that COBOL was invented 25 years ago. And COBOL, for example, is completely inadequate to describe the working world in the office. Many years ago;--I think in the late 1960's, in Xerox Park in Palo Alto, there started people to develop small talk. And those kinds of systems are that what we now are doing in Germany, called "object oriented programming" combined with relational data bases that are capable to store and to have an access formated and unformated data in equal manner. With those systems, we think we can do an additional step besides the application of expert systems to develop ease-of-use computers in Germany.

Thank you.

SZYPERSKI: May I add just some remarks on the projects on the way to be started this year or at the beginning of next year. I heard about the programme that was discussed in the morning by Mr. Thomas. And out of that programme, I will give you six examples of larger projects; that means projects in the size of 50 to 100 million D-mark for the time frame of three to five years.

Two projects are on the way related towards computer architecture. One is within the field of artificial intelligence architecture, looking for PROLOG machines, with the special idea of serving again for knowledge worker on his desk. The second project in architecture is a high-performance numerical scientific computer. And we are trying;--not to understand the new technology right now, but we are interested in the relation between algorithm and the optimal architecture or a set of architectures you would like to combine. In the moment, we are very good at development within the field of numerical algorithm to speed up the solving time by a factor of 1,000. And now, in combining that type of multigrid approaches with some type of parallel or multilayer cube architecture should answer the question in which maybe we can combine both features--very intelligent algorithm and very fast and appropriate computer architecture.

The third project centers around the methodology of expert systems design, and expert systems development. So, we do not have only to develop expert systems, but we need expert systems to develop a lot and quite a number of expert systems in itself.

The fourth project group is centered around software technology, especially a UNIX-oriented. So, we will re-design the UNIX kernel, and producing and using the tools for the UNIX production system.

Then, the pattern and image understanding is the fifth group of project, especially oriented towards application within manufacturing industries.

And last, but not least, VLSI, CAD, and CAM simulation and testing devices are on the way to be developed.

For all of these projects, it is typical that we will combine the research institutes, like our GMD, for instance, or the Fraunhofer Gesellschaft, on the one hand, industry--groups out of industry, better than just one company on the other hand, and as much as possible universities, too. So, maybe the next time, we really can present the plans and the structure of these projects. Today I can only announce it. So we are three years ahead; by thinking, not by doing.

Thank you so much.

MOTO-OKA: Thank you very much. I wonder if there are any questions from the Japanese side?

GILOI: One thing which is I think of interest for you because it has some connotation with your plans, and that is the R & D with the emphasis on natural language understanding systems course which goes into the direction of fifth generation computer.

MOTO-OKA: Thank you very much. Now, any questions from the Japanese side?

KISHIDA: Dr. Fritsch mentioned "object-oriented programming", and I was very much interested in this. In Japan there is a heightened interest concerning this. I would like to hear your views on the new object-oriented programming style. Is this different from the conventional style? Will it replace the conventional style, or will this be applied to new application areas?

And do you think that COBOL and FORTRAN will continue to exist as separate from the new application areas and the new style? Do you think will they be replaced or will they continue to exist separately?

GILOI: If I may answer the question: The object-oriented programming is not specifically addressing itself to new applications, but it is an alternative in programming style. And, for instance, I personally I see it as an interesting alternative to the functional programming approach;--trying to solve the same problems which the functional programming or applicative programming approach is trying to solve.

Examples of the past are small talks, but you may also consider AIDER (?) as an object-oriented language; as a spaced and abstracted type philosophy. And the STARLET computer which Mr. Fritsch has been mentioning is the machine whose machine language is already a higher-level object-oriented language of that type; very similar to a language developed at MIT called "CLU"--C-L-U.

KISHIDA: Yes, I understand all that, but the conventional programming languages are so much popular now, that it might be difficult to change the lifestyles of the people that have been using the conventional languages. What do you think of that?

GILOI: Just one comment. You need someone like the Department of Defense of the United States, to enforce the use of such a language. --(LAUGHTER)--

KISHIDA: Yes. I think in Japan there is no DOD. That's the problem.

GILOI: Well, there is a market out there.

SZYPERSKI: You might look into the future and ask the question to--who is programming what? As you mentioned in the morning, the difference between the novice and the expert in programming--producing really an industrial product called "software". They will have different approaches and different languages.

But on the other hand, in the development of personal computers--very very powerful, and doing not only the numerical but especially the text work, too, you will not be able to handle any type of programming problem easily with the given languages.

So, starting with a new type of object-oriented language, you will open the field of what can be programmed, rather easily, by the problem-solving people by themselves. And if you take the window technique, and you will combine both, then you can see that the style of handling the interface is changing very dramatically.

MOTO-OKA: What you just showed--the O.H.P., which you just showed, if we could have copies of that, we would be very appreciative.

Dr. Fritsch, you made mention of implicit communication in man-machine interface. Is the atmosphere such that it is close to becoming specifically realized? Could you elaborate on that subject, please? Is it close to being materialized? Could you elaborate on the implicit man-machine interface?

FRITSCH: The explicit communications channel, that means the window technique and the simulation of the office environment onto the screen is verified yet, that is, derived. The implicit communications channel where we have the dialogue expert system in the background will be delivered in the mid of next year.

KAWAI: On the electronics desk, in the distant future, when laymen or novices use computers, and when we offer the high level expert systems, in what way should this ideally be utilized such a system? That is; would people talk to computers the same way they would talk to another human being? Or, would communication methods to a newly made machine be something different, and it's something that the human beings will have to learn, that is, how to communicate with these very high level machines?

FRITSCH: The goal is that the machine would adapt to the human beings, and not vice versa as it is today. How far we will come is not sure today. Okay?

MOTO-OKA: I am sure there will be many many questions from our side, however, since all of you have prepared to make some comments, so may we move to the next item? would that be all right, Dr. Szyperski?

Then, Professor Aiso?

AISO: No. I would like to be the last one to speak.

MOTO-OKA: Please limit your talk within 5 minutes.

FUCHI: I would be appreciative if you would raise questions after I give you my entire talk.

On the Fifth Generation Computers, Dr. Moto-oka has referred to this, and many of you I think have much information on this. So, I would like to supplement--to give in a very brief manner some supplementary remarks.

Now, as reference material, if I could explain about the handouts that have given you. This you have with you; this is the project plan--outline of the project plan. And this is the Research Report, and it's stated "summary". And there is one for 1983 and one for fiscal year 1984. It summarizes the activities which have taken place during the two years. And the fiscal 1984 booklet we schedule to be completed next week, so there is no cover on it, but I brought it along just for this conference. And this is the ICOT Journal, which is an official publication of ICOT. There is the digest version of ICOT 1 to ICOT 3, which was only completed yesterday.

This is the entire research theme, and classification of the themes. The sequential inference machine--the hardware part of this, test production was completed last year, --end of last year. And an operating system for this--dedicated to this--is being contructed at present. The first version is scheduled to be made September/October of this year, so perhaps at the First International Conference we will be able to give a demonstration.

If I may add, the kernel language, which is an extension of PROLOG; we call "KL-0". And above this we have the ESP language for system programming. It's a macro-processor which is a language similar to PROLOG. By making use of this macro-functions, many things can be performed--many things can be done. Functional notation is also possible--can be used. So, on the surface it can do almost the same things any functional language can do.

And by defining macro-functions, object-oriented language--something similar to object-oriented language can also be realized. There is a technical report on this, so if you would look at this during your leisure time.

This ESP language; we can use this to write as the OS for SIM. We are presently using this to write OS for SIM. Now, when we finish writing this, logic language or object-oriented language--through a combination of these, we can write the first programme of this kind.

I have also said this at the previous--last conference --international conference. With respect to functional programming style or object-oriented language style, it can be easily incorporated into the framework of logic programming languages. And I would like to demonstrate this.

There was a question posed from the Japanese side regarding new languages. The young programmers acquire the technique to use new languages very speedily, but what do we do about the aged and old programmers; that is the question: --That is how the question should have been worded. (LAUGHTER)

There are many points I would like to have added. This relational data base machine model--the hardware part of this, is being test-produced. We have already completed test production last week or the week before last. This was brought into ICOT; it was delivered to ICOT. It was this week--this week; sorry. Anyway, everything is in the "ing" tense.

At the next international conference or the next Japan-German Information Forum, perhaps I could give a more detailed report. I have used up/all my five minutes, haven't I?

Thank you very much.

MOTO-OKA: Dr. Kawai, please?

KAWAI: I would specially like to touch upon the technical level of the software. I would like to point out that in Japan the software technology level is not yet advanced. So, I would like to mention two points.

First of all, this is the program sales. This is the total sales turnover. This is the total sales volume. And the figures here; for soft house--there are around 4,000 soft house companies. I have taken up only about a 100 of them. However, the 80 percent of the sales of the soft house belongs to the top 100 companies. So, the total sales for the soft houses will not be nearly the double of this figure.

As to these white circles, or white squares, these show the proportion or the share of those sales for the packages. One problem here is that although we make many packages by selling many packages, the shares for the new programmes have been decreased. And so, the excessive staff or labour force and resources for the development of new programmes should be dedicated to the newer ones.

Another problem is that how to make good software programmes. In order to make good software, basic academic research is needed. And the actual programmes to be used in the industries as well as the users; how to combine these two aspects is another issue. So, the people in the industry and the staff as well as the users and the developers of software programmes should combine their efforts in achieving good programmes.

To give you some example, I would like to mention the IPA. This is the Information Technology Promotion Agency, Software Technology Center, which I belong. I would like to show you how we conduct our programmes. We have been given some fundings from the industry, and we have started to develop actual software programmes. And here, the people from academic field,/the users and industry have gathered, and they cooperate with each other to conduct research and development. And the results of the R & D are distributed to the public, and utilized in the various fields. So that the technology developed should be distributed; and this is one of the example, and how it should be done.

This is all from me.

MOTO-OKA: Thank you very much. Then, may I ask Dr. Kishida?

KISHIDA: I have too many hats. I am serving as Chairman of the Software Technology Committee of the Japan Software Industry Association, and also I am managing a small software house, and also I am directing the Government-supported joint projects at the JST Corporation, and also I am the President of the Japan Unix Society--it's just one year old. So, I am very happy to hear that the UNIX is a hot topic in Germany also. But today's talk will be--I will take this hat.

From the industry standpoint, I think the technology transfer is the key issue of the software technology today. This diagram shows the result of a survey conducted two years ago by one of our working groups. We sent out about 500 questionnaire forms to the programmers who are working in the software industry. And 200 returns we got. And this shows various kinds of the development support tools, and the availability of these tools, and the actual usage of the tools, and the needs for the tools.

This is the sea level. As you see, in the various conferences or the technical journals and literatures in software engineering, these tools are the most important topics. But in the industry, they are far under sea level. They are not available, and they are not practically used. But people want to use these tools.

So, this is I think the reason why--this is the present situation--there is some problem in the community between the R & D community and the industry. And so, our Committee in the Software Industry Association wants to promote the technology transfer from around the community-tooled industry.

And our approach is to set up some kind of joint activities of the people. So, our principle is mixing or shuffling people, just like this. And these three items show the physical mechanisms to do the joint research or development activities.

One is the small working groups in our Committee. And the other is the project at the IPA Software Technology Center. It's Dr. Kawai's place. And third one is the more large-scale real project funded by MITI.

And these are the activities within our Committee. All these working group activities are supported by the MITI, but the amount of money is rather small. Mainly we are planning to do some technical status survey in the industry.

This is a list of the projects which Software Industry

Association is doing in Dr. Kawai's Center. One major project is called "STAR", which stands for the Software Tools Archives. "Archives" means dead inventory of something. It's somewhat an ironical naming. But at present, there are many tool directories;--some in printed form, some in machine knitted forms: But people in the industry rarely use these tool directories. So, in this project we have developed some experimental intellectual retrieval system for tool directories. And in this year we do some final evaluation. Anyway, that is the project.

And finally, at the strange company called JSD, there are many projects. First one was from 1975 to 1981; this is the total budget. This project was the project to develop the various kinds of development support tools. But all of these tools were somewhat batch-oriented package tools.

And now I am managing this project--"SMEF". It stands for the Software Maintenance Engineering Facility. So we are now developing the support tools for application software maintenance, and we want to integrate these tools to an integrated environment upon UNIX. And some other projects are running on.

And my point is; we found many problems in performing technology transfer. One is how to get funds. Sometimes we must use some tricky strategy. For example, in the case of SMEF, I have no interest in the software maintenance. But the "maintenance" was a good key word to get fund from the Government. So we selected "maintenance", and we did the environmental development project. Formerly focussed on the maintenance, but it is useful also for development. Such kind of technique would be needed to get fund.

And second would be how to establish strong leadership. In my opinion, I think we need some strong person to lead the joint efforts. In the case of these two projects, I am the leader of these projects. I decided to play a role as a strong leader. Because, in former projects there was no leader. So, this was a joint project;but it was actually not the joint project but the collection of the tool development. So, the second point is how to find out a strong person.

And the third point is: It's very difficult to get people who is working in the real industry situation, and to let him or her include the joint research project. Because good people are always very busy; and the managers don't want to release them. So, I think the third point is very difficult, and we are trying very hard; but not so successful.

Thank you.

MOTO-OKA: Next, may I ask Mr. Sato?

SATO: There are some copies for the reference materials. Since I have already handed out the reference materials, I would like to make my speech very short.

Here, I would like to talk specially about the General Purpose Computers. I would briefly talk about General Purpose Computers. This is the list of the general purpose computer systems operating in Japan, and the value of the installments already done in Japan. As of fiscal 1983, it's around 5 trillion yen;--it's more than 5 trillion yen.

This is the sales turnover for the various computer companies in Japan. This is not only for the general purpose computers but also including personal computers. So, the figures also include the personal computers. As shown from the slide, the Fujitsu has exceeded IBM several years ago. So, Fujitsu, Hitachi, NEC are the three major companies, with IBM--competing with IBM; or with each other.

I have no specific comments to make for this. The NEC, Hitachi, and Fujitsu are dealing with the large-scale computers up to small-scale computers, and very peripheral equipment and OA equipment, middle-scale and small-scale are made by the other companies.

And here I would like to briefly comment that out of the general purpose computers, I would briefly comment on the high-end general purpose computers. Mainly, the major three top companies are making efforts to aiming at the fastest performance and aiming at the largest system. And they are competing with each other to materialize this. And mainly they are making efforts at high speed/high density

LSI and packaging manufacturing, and now they are aiming at high performance operating system.. And apart from this, they are also aiming at the highest reliability for RAS. And they are emphasizing on this. And international cooperation is also emphasized, but this will be touched upon later on.

These are the largest scale computers for the major three companies, which are summarized here. So, I have no special comments to make. However, I would just like to point out that a number of companies are competing with each other. And this fact has raised or upgraded the level of quality and the level of production of the computers in Japan.

And especially for the large-scale computers, we are proceeding with the international cooperation. And especially Fujitsu is cooperating with Siemens in Germany, or ICL in U.K., or AMDAHL in the United States. So, we are cooperating with these major companies in other countries in OEM or OEM supply or software technology tie-ups, software technology manufacturing, and so forth. And Hitachi Corporation is also cooperating with BASF in Germany and Olivetti in Italy, and NAS in the United States. They have OEM contract with these companies. And in the same way, NEC has a cooperation with a French company, BULL, and an American company, HIS. They are supplying large-scale computers or have cross-licensing contract with these companies.

And as shown in the list, I should have added Nixdorf Company under Fujitsu. However, this was announced just a few days ago in the newspaper. So, I should have added Nixdorf in the list of the companies in cooperation with Fujitsu.

Next, may I make some comments about Super Computers. As has been mentioned earlier by Dr. Kashiwagi of the Electrotechnical Laboratory, there are some other--further national projects as well. These are the super computers--the projects on super computers which are under way right now. In the area of super computers, the U.S. force has been the leader in this area. And for the Japanese group, FACOM, although the performance level is very low, we have created FACOM 230/75 APU, and we have further developed some other projects. And we were able to create a computer approximately the same level as of the U.S. force. And Hitachi has HITAC S-810, and NEC has the SX model.

This is the last chart to show you. These are the super computers developed by the three companies. For Fujitsu and Hitachi, the first models have been already delivered. For NEC, SX, in the first quarter of 1985, the first delivery will be achieved. In all of these models, the target is very high speed, and the highest or the maximum is 1.3 giga-FLOPS. In terms of architecture, this is the pipeline architecture--in the extension of the multiple pipeline architecture which is used in the conventional computers.

So, we would be utilizing high-end general purpose computer technology as much as possible. However, if it is necessary, large capacity main memory, for instance, high-speed MOS static RAM will be used;--64 kilo-bit MOS will be used. And the conventional software technology should be utilized as much as possible. So, we have a powerful FORTRAN compiler attached to the computer.

So, although it's very brief, I have briefly explained about the general purpose computers, especially emphasizing on the high-end general purpose computers.

MOTO-OKA: The next, Dr. Uraki, please.

URAKI: A short speech under the theme of OA is very difficult to give. Japan has a 0.3 percent of the total area of the world, whereas the population is about 3 percent of that of the world. And the GNP is about 10 percent of the entire world. We have a limited land, so we are dependent on imports for a lot of our food and natural resources. So, improvement of productivity is a very significant task for us.

Now, in the secondary industry area, product quality and improvement of productivity;--in these areas we have one very good reputation. However, when we look at the office side--OA side, we are not advanced at all. We have 25 million white collar workers and 60 percent of these workers work in offices. The improvement of productivity in offices;--since there is a large gap between productivity in the factory and in the offices, in order to continue our growth, improving productivity in the offices becomes--seems very much significant.

Now, the word "OA" is a type of buzz-word, and its concept and definition is rather vague. But I believe it's something based on business communication and data processing product. And based on these products, through incorporation of new technology to make for improvement of productivity in the offices; and it will gradually come to be integrated and systematized; and this entire process, I believe, is referred to as Office Automation.

Now, the term "OA product" has been coined, and in Japan, the personal computers and word processors and facsimiles are called the three major products--three major OA products. And the demand growth for these products has been very drastic indeed for the past several years.

Now, the mainstream of OA products at present are mainly stand-alone and single-function. But gradually they will come to see multi-functions and will be integrated and gradually to form networks, or a LAN

What I would like to refer to today--mention today--is that OA targets will aim to improve productivity concerning various activities of man. So, it will inevitably be influenced by the language or the office environment.

So, I would like to illustrate how the characteristics of the Japanese language will affect OA. In written form, the Japanese language is a mixture of KANJI and KANA. KANJI is based on Chinese characters, and it's an ideographic character. We normally use the characters in the range of 2,000 to 3,000. If we include names of persons and places, we have over 10,000 characters. Now, KANA are phonetic letters, and there are two different classes of these characters. And the form of KANJI--or the form of the character of the KANJI is very complicated, and some KANJI contain over 30 elements.

Now, the third characteristic is that Japanese in the spoken form is phonetically rather simple. There are about 112 syllables. Considering the fact that the European languages have syllables in the range of a few thousand to twenty to thirty thousand, it is rather simple. And from the standpoint of voice recognition, the Japanese language is quite simple.

The fourth characteristic is that the character set is large; and this makes inputting extremely difficult. So, for this reason, the diffusion rate of typewriters, compared to Europe or the United States, has been very low.

Code inputting of the Japanese sentences would involve the foreign procedure. We would arrange on a tablet 1,000 to 3,000 letters, and we would input through the pentouch, or we would use the touch method typing method where we designate a combination of two to three strokes, and through practice we make possible this touch method typing. From the keyboard, we have the KANJI-KANA translation. We would use KANA, which is a phonetic letter, and we would input in units of a single word or a clause, and we would translate using Floppy Disk or Read Only Memory. And this method is becoming very popular.

In the Japanese language, we have very many homonyms. So, various ways have been devised and various ways have been studied regarding the appropriate ways of selection.

Because the diffusion rate of typing--or typing is not very popular, a lot of handwritten documents are being circulated in companies. So, that is why we have a very high diffusion rate of facsimile, which enables handwritten documents to be transmitted in its original form.

Because we have a complicated character form, we would require high resolution in our printers and display. To express KANJI, even if we allow for some simplification, we would require 16 by 16, or an average quality we would require 24 by 24, and high quality we would require 32 by 32.

This is one of the characteristics of Japan: We have entered the post-industrial society, and we have very many printed materials and written documents, and over-abundance of this in offices. And to try to do away with some of these or to make a less-paper office is becoming a very important goal for office automation in Japan. One solution would be to store image information--code information--in the hybrid form, and to create an image filing system which would enable the effective retrieval of this information. And for this purpose, optical disk development is being conducted by several companies. And a filing system enabling the storage of 20,000 to 100,000 documents of A-4 size is just about--close to coming to be realized. This is the HIT-FILE we are developing. In the optical disk, 20 to 30 thousand documents can be stored in this HIT-FILE.

This is a very simple structural configuration of this filing system. It will come to assume multi-functions or connection with LAN would probably be added in the later years. And this type of product, I would not go so far as to say it's unique to Japan, but it will be readily welcomed and accepted in Japan. Thank you very much.

MOTO-OKA: Dr. Aiso, please.

AISO: I would like to explain about the information technology--the relation between the information technology and the university activities.

Here, I have shown some figures. This has been announced by the Ministry of Education and Culture and Science last year. This is the statistics distributed from the Ministry of Education.

Briefly explained; the number of the undergraduate schools in Japan is given. The "National" means the universities belonging to the state; and the "local government universities" belonging to the local governments; as well as the "private" owned schools. The total number is 455. And out of this, about 21 percent are the national schools. So, most of them are private-owned universities.

And apart from this, there are some technical colleges of two years. There are around 20, besides these figures. It's not included in the figure.

And of these universities, those with graduate schools are given in the next column. Could you refer to this later on in your leisure time?

The next list shows the number of students in the universities. Students in the undergraduate course are around 1.8 million. This includes all the faculties;--Faculty of Law, Faculty of Literature, and so forth. And out of this, about 22 percent are females. Well, I cannot give you the detailed statistics for the students who take computer science. I think it will be around several percentage points. So, I think the situation at the present time is that the university is not meeting the needs of the Japanese society. As to the Engineering Faculty--Engineering Department, the largest number of students is in the Machine Engineering; and the next comes the Science Engineering--

various sciences, and then comes Electric Technologies. So, the computer-related faculty or department is very small in scale.

However, the computer science includes electro-technical departments, electronics, and mathematics engineering, numerical engineering. So, computer sciences are also taught in some of the other departments. So, if we include the numbers of students in these other departments, I think the total number would be much larger.

And there are also the numbers of students in the graduate courses given in the column below. I would like to explain about this later on.

This is the number of students in science and technology department. The proportion of science is 3.2 percent. Engineering is 19.4 percent. As for the numbers in the graduate course; in the Master's Course is around 10 percent of the total, and as for the Engineering, it's about 41 percent. So, of the total number of students in the Graduate Course;--in the Master's Course, the 41 percent study engineering or technology.

Well, this is a number of staff or faculty members, and so forth. First of all, research related staff, as given here, about 100,000. And the column below are the administration staff;--about 150,000, the total number. So, this has been the summary of the situation in the universities.

This shows the overview of the research activities in science and technology. These are the national laboratories; the number of researchers in the national laboratories; and the number of researchers in universities; and the number of researchers in the industries.

And this is the amount of the research and development budget.

In the Japanese universities, all the universities are under the jurisdiction of the Ministry of Education and Culture and Science. Therefore, the large-scale research projects under MITI--Ministry of International Trade and Industries--such as Super-Computer Project; the budgets for these projects are not given directly to the universities. In principle, the MITI cannot give direct grants to the universities. Even for ICOT, it's very difficult for ICOT to obtain direct grants from MITI. Professor Moto-oka and myself--people say that Professor Moto-oka and myself are given much support from ICOT. However, that is not true.

However, the Ministry of Education gives some subsidies to research and development objectives. And this is called the "Grants-in-Aid" for Scientific Research. These are figures for the 1982. The number of applications submitted from the universities is around 43,000 themes. And out of this, around one/third has been given the Grants-in-Aid, that is to say, the number of application adopted is around 13,000. And the total amount of budget is 38 billion. This is the budget for one year. But this is the total amount; so, for information technology, the proportion will be much smaller, or the figure will be much smaller.

As for information technology, recently it has been designated as important priority project; so, being given special subsidies. And this will start from this year on, for three years. So, special budget is allotted to information technology projects.

And the theme, as shown here, is the "Intelligent Processing"--and the official name is very long: It says: "Intelligent Processing and Integration of Knowledge Information in Multi-Media". It's a very long name. Well, this is related to the Fifth Generation Computer Projects under MITI. So, this has reflected the activities in the fifth generation computer projects. So, the Ministry of Education and Culture has also taken up this theme in relation to the project by MITI.

And these are the four major subjects. The research period is three years. And the number of researchers participating in the project; there are 32 research groups participating. And of course, Professor Moto-oka is a member, and I myself am also a member. Besides that, we have an open application; we are attracting lots of attractive themes or subjects to be included in the research subjects. Around

10 to 12 applicants for each group, and around 20 groups
all
will be gathered for/this research from the public.

Well, the budget is for 1984 is 210 million yen; and for the three years total, it's 570 million yen. So, it's not a very large amount.

So, this has been a brief report. And since the budget or the funds available for the universities are very limited, so, for the high technology areas the Ministry of Education cannot involve themselves freely in these research projects.

And lastly, I would like to mention that in the areas like the information technology where the progress is very rapid, the research made in the universities is not sufficient enough. And the most important things is that the training and education in the industries: Industry training and education have various forms, in that the companies themselves would be very active in training. And another form is that the special schools specializing in training--there are a large number of these kinds of schools who are specializing in training for people in the industry.

This was a brief overview of the situation that the Japanese universities are placed.

SZYPERSKI: We could add some aspects? Professor Giloi, Dr. Groh, and Dr. Konigs would like to give you some short aspects.

MOTO-OKA: 15 minutes;--so, five minutes each.

GILOI: So, I have to try to go through the whole complex topic in five minutes? The topic is our considerations in the realm of the development of parallel processing architectures. And there is a number of design decisions to be made before you can start out building such a machine.

And the first one is whether you want a decision as to whether you want to use parallelism implicitly as a data flow machine does by performing a data dependence analysis at one time, or whether you want to use the explicit or a priori known parallelism of structure data types and their operations.

And connected with this decision, of course, is the decision as to whether you use the data flow control scheme, or what we call the "data structure architecture" approach. Now, the data flow is the more general scheme, but it also has much higher overhead. Because this data dependence analysis, of course, causes a considerable overhead, the token tagging, which is now the prevalent scheme, requires associative search and memory, etc., etc.

In addition, the data flow machines lack the ability to efficiently handle data structures;--large data structures.

Then, there are some more decisions, like: Do you build a strongly coupled or loosely coupled system? The answers depend on the requirements. And here I have listed some of the requirements which in our opinion future systems will have to meet all of them, or at least some of them.

First: We want to obtain for cost effectiveness reasons we want to obtain high performance, some parallel operation rather than expensive super computer technology. There is one exception, that is, your very high speed computers which require the use of new technologies in order to make the giga-FLOPs feasible. But here I am talking about a more modest range--performance range.

We require the modular extensibility of a system, and that has to be software transparent. We require fault tolerance. In many applications in a few years from now, people will not accept computers that have the potential of failing.

We require that the operation system functions and the crucial system functions should be better protected. And one way is to migrate them into hardware and firm-ware, or to distribute the functionality of a computer overhaul hierarchy of machines--dedicated machines.

And of course we have to resolve the software requirements somehow. We talked about that before.

Now, this is a graph which shows performance divided by cost, or the specific cost per operation, versus performance. It's an interesting figure, because down here, at the relative specific cost, Figure 1, we have the mini-computers on the low-end side, and the conventional mainframes towards the high-end side. Almost one order of magnitude higher, we have the specific cost per operation---"better" I should say, than "higher"--lower---of the personal computers, the multi-microcomputer systems which are on the same range, providing--because they have the same cost--providing only a higher performance, and interestingly enough, the super-computers, at approximately the same range of specific cost. Now, how is that?

Microcomputer technology requires--needs all the requirements of a cheap technology. It's produced in a high volume; you have a high degree of integration, so that you don't need very large packaging of thousands of ICs; and there you have a simple cooling problem. So they are low power.

Supercomputer technology is exactly the opposite: Low degree of integration, high power, expensive cooling systems, and low volume. Yeh.

And how come that they are on the same range, nevertheless? The answer is because of the architectural advantages of SIMD machines or pipeline machines. So, even if you have a very expensive technology, you get the same specific cost, and a very high performance.

And now comes our point, which is the main thrust of our work, and that is combined this with that, and you are up here. You get another order of magnitude in performance--

in specific
/cost decrease. But of course, you cannot reach the performance of such a supercomputer you have been talking about. The sound barrier here somewhere is around a 100 mega-FLOPs. Its memory bandwidth is limited. You can always match your processing bandwidth to the memory bandwidth--the maximum memory bandwidth which is obtainable. Okay.

So, these are some:--Now, here is a list of possible machine data types which we have been implementing in one or the other of our experimental systems, working on implementing. Type matrix with the typical matrix operation: Type grayscale image representation, which is also matrix; grayscale values with typical operations of image preprocessing segmentation, feature extraction and so on; all the standard operations in the iconic domain: Type Fast Fourier Transform with the respective operation. But these are all still matrices.

But we have been successfully trying to generalize this so that we can have dynamic structures and less regular structures than matrices. And so, you can come up with the type LIST, that has LIST operations: Or type general set of terms; we call it the "unification objects"; the set of attributes and attributes being a set of terms, again, with the unification as operation.

The next question is strongly coupled versus loosely coupled: I will just give some cases in point. There is no general answer; it depends on your requirements. This is a typical example for a strongly coupled system. This is an image analysis system which we have already developed. And the point is that, of course, the data--the objects of these specific data types called "grayscale matrix" are not in the main memories of the machine; they are on dedicated memories called "frame buffer" memory. And the data flow is not via general system path, but via very special very high speed DMA channels, connecting processors and memory directly. And we can plug in up to 4 processors. And each processor can perform up to 100 million fixed point operations per second or 25 million floating point operations per second in the case of FFT. And these processors are multi-function. You see here a whole list of image analysis operations.

This is the concept of a 100 mega-FLOP work station, or you may say "personal computer" we are planning to build; something you can have next to your desk for scientific applications: Partial differential equation solving, simulation; strongly coupled system. There is no way to obtain the same performance at the same cost with data flow or any such thing. Okay.

This is a typical example of a loosely coupled system. You have many notes, processor memory pairs connected through one of these famous interconnection networks like

N-cubes, hyper-cubes or what have you. However, if you look into the feasibility of such a network, and you take such mundane things like pin limitation, etc., and to account, you find out that you can--if you want to combine--to connect 1,024 nodes--and that's what people typically are talking about;--you can hardly build anything but a bit-serial network. And a bit-serial network issues at best about a mega-byte of interconnection bandwidth. The IN-MOS transputer gives you one and a half mega-bytes; that's the fastest device on the market at the moment.

So, our solution to a loosely coupled system is different. It's based upon the 280 mega-bit bus, which we developed; it's (slotted? wing) bus, collision-free protocol, guarantee-to-aid of 25 mega-bytes per second, connecting a number of nodes, and each node is a cluster of processors, again;--16 or whatever, or 64--whatever to ensue on; connected to a very high speed parallel bus. And now you can match the transmission bandwidth of your parallel bus; that can never be made very long; it has to be very short;--to the inter-node connection speed, which is of 25 mega-byte per second, which is much more than any industry standard parallel bus provides at the moment.

So, these are all solutions which more or less exist, or at least, are in the state of coming to existence within the next year and a half, or a year or two, based upon the kind of experience we have obtained with the previous projects. Thank you very much.

SZYPERSKI: Dr. Groh, please.

GROH: Mr. Chairman, gentlemen: I would like to just make some a little bit more general remarks. Having observed this very interesting discussion of these days, I noticed two different streams, obviously heading at different objectives.

One is of course the technology-driven stream which we have seen and been told by you people in a very impressive way, and I hope you also have understood from our presentation, for example, of Professor Giloi's just recently, that we have also research and development activities going in that line. And I myself having managed research for quite a couple of years I highly appreciate what is going on in your country, and I think we have also quite some positive results to show.

But on the other hand, I now have become more down to earth Manager of a big technical operation, development and manufacturing computers for today's office automation. And even today, an increasing number of computers has been used, and of course, they are also very much more down to earth with all the disadvantages which we all know and which we sure will overcome with all these beautiful objectives. But we have, as an industry;--and I guess some of you are also coming from industry--also to survive today in this difficult task of data processing.

And the challenge, that is our experience in Germany, and Europe in particular, for the time being, is certainly on hardware; but much more, by orders of magnitude more on software. And when I am talking on software, I mean just one very, I can say, down-to-earth problem-area, that is, office automation, where problems have to be solved by means of computer, by people who are not at all technical. They have normally no technical education whatsoever. They are administrative people; they are lawyers; they are businessmen; and all these. And some of them even don't like technology. So, they want to make use of computer systems in a similar way like we are making use of these things of such a projector. And I well understand that, of course, the research tasks are going in that direction.

But nowadays, you have to live with a limited hardware capability, with a limited software, and in particular, with software which has been developed with huge investment for different lines of business. The lawyer needs the different type of application software package rather than the man who is running a small repair shop for motor-cars or something like that. This is what we call "lines of business". And these lines of business represent an investment volume which is by orders of magnitude higher than what is being--what was the development cost of some of these fine nice hardware things.

So, whatever we have in mind, we have to invent by looking at the far future, a migration path, how to migrate what is existing in the field, to their future system. And if you like it or not, the present-day situation is determined by software packages which are available, which have been developed, say, on COBOL;--everybody says COBOL is a bad language, but it's existent. If you look for the person who knows computer well, people have decided for good or bad reason, but it is the side of the market who decides it; not the scientists, to select for CBM type of basic--it's a nasty language, but it's in consistence.

And now, the UNIX is coming up. That is also very questionmark whether UNIX is a best one. But obviously, it's moving in a direction that it's becoming a standard. And we have to live with those standards. I think the only chance which we have--you people being more futuristic and we people living in the present situation--to meet this common challenge to move from this situation in the future one.

So, it's a little bit a warning, with all appreciation, not just to always look into the future and forget for the present.

SZYPERSKI: Thank you. Yes, Dr. Konigs, please.

KONIGS: So, I will try to keep very short because of the short time. But I would like to say a few comments on one issue that has been mentioned by Mr. Fritsch and Professor Giloi, which is fault tolerance.

We think in Germany that fault tolerance architectures will become very very important within the next decade. There are predictions saying that by 1990-1995, about 90 percent of all computer applications will be fault tolerant. And it doesn't really matter whether these applications are technical, engineering, or commercial. So, we believe that all new architectures should really rely on fault tolerance principles. And in Germany, there are some activities going on;--having been mentioned by Mr. Fritsch--one is going on at Nixdorf, and let me say a few words on that because of the architecture of that thing.

You know that fault tolerant systems have been invented primarily for systems that are really intended to be failure safe;--things like system for air traffic control, military application, and so on. And these systems that have problems that they have a very high degree of hardware redundancy, so they are very expensive. And they will keep to be very expensive; also, if ESI technology is being used.

So, we believe that new concepts, so-called "active redundancy", which means software redundancy, will catch up to this hardware redundancy system. And concepts that we follow are looking like this, that you have loosely and tightly coupled classes of computers, saying you have two complete--at least two--complete computer systems that are loosely coupled by peripherals; so, they are in principle independent of each other. The peripherals--let's say, the disks and the file storing devices are at least accessed or equipped with dual port access methods. The processes will always run on just one machine. This makes it very economic. And the synchronization mechanisms that you can synchronize these kinds of methods or tasks and processes from time to time.

And the very important point, we believe, is that in future, any user of this kind of system can run his today's applications without any change. So, for example, we have decided to use the standard operating systems;--in that case, it's UNIX, and which very much applies to Mr. Kishida where your UNIX is today. We see it is kind of architectures; in every kind of future applications, it's in the engineering area--things like plant controls, process controls.

I am getting the sign, Mr. Chairman. I will be finished just in a second.

But we also see these applications in the commercial world; things like banking organizations, where they have 24 hours service, and so on.

So, I personally believe that these kind of concepts should be introduced in any kind of future application systems. Thank you.

SZYPERSKI: Maybe a last comment on our side.

MOLLER: Thank you, Mr. Chairman. I will be very short because I have prepared some paper for you.

Dr. Groh spoke about the marriage of the actual needs of today with the business, and the business of today with the future requirements to technology of computer and software. These are the aims which we have put to our Association work in research and development in Germany. And we are carrying out a series of very pragmatic research projects on the basis of common research of our companies; some together with the GMD and other Institutes; some paid by our companies themselves; some funded by 50 percent by the German Ministry of Research and Development. One of the projects has been started a year ago, and it aims at a gateway for all kind of local area networks to the PTT. We will give you a short description of this project. And the other project has been launched on the 1st of April of this year, and it aims at a joint research project for portable software tools.

So, I just hand you over the material. Thank you.

SZYPERSKI: Just one last remark on our situation; just a last remark on our situation. We did not mention all the research projects on-going at the universities.

In the twenty universities, they are providing computer science education; they have a lot of computer science research tools. And right now, most of those research projects are financed by the German Research Association. And members of that Association are the universities, and they will get the money from the Federal Government.

On the other hand, the Government has just spent 100 million D-marks for computer science research within the next three years for that very body of self-organized research work.

So, it would be a broad theme to give you an idea what's going on in the different universities. Maybe we can make that next time.

So, may I just give it over to you?--To answer the question we have.

MOTO-OKA: From various standpoints differing subjects have been addressed. And we feel that more information exchange should take place; we should spend more time for dialogue, and perhaps through such activities we will be able to achieve more.

This afternoon, I think we share the common impression that such future efforts should be made--such future efforts in this direction should be made. From such a standpoint, if this forum is continued next year as well, and into the future, and if we exchange more information so that both sides will come to understand one another; and in the process of doing so, we will probably come up with a theme for joint research.

Now, in carrying out our activities in the future, if we focus on a few themes we will be able to carry out research in depth. But I feel that before we narrow down on just several themes, before we come to actually select the themes, we should make a broad framework so we can incorporate various areas later on as they come, and prepare for the next meeting in such a manner.

I wonder if we may have your agreement on that.

GROH: I have one comment. I fully agree that. I think the scope of what has been discussed in these days was very very broad, and it gave us an impression of the richness of the menu. But of course, you shouldn't eat everything on the menu; you have to make a choice. And I think that it would help in digesting to concentrate on a few subjects; and I even would, within the computer area, I would sub-divide. And "sub-divide" maybe--and it is a question then which to discuss in more detail in the first round; whether we should put more emphasis on new technologies, futuristic technologies, for certain type of computer application in the technical world or in the more business world, or whether we should just restrict to business world type of computer applications with all the ins and outs, a little bit more on the present situation, then coming to rather practical today's problem of networking, for instance, of software developments, which are real problem areas for all of us; or whether we should more discuss in the, say, pre-competitive area of futuristic systems available later on for marketing them.

<u>SZYPERSKI</u>: I think we should take into account what we could achieve with a forum like that. We should not think of it instead of a special congress or special workshop on a very special technical question. Because there are so many international workshops we wouldn't have to add one. But it might be that it is of interest to pick up questions that are of interest to the public;--I mean, the interest to the public in both of our countries. So, a question like --as you mentioned, man-machine interaction is something of great interest for almost everybody. Fault tolerance, and the question of transparency of computers used within organizations, are something that is of interest, too; regardless of type of architectures, it might be solved.

So, I would like to put the finger on the inter-relation between the forum of that type and the media that we can use in order to prevail some ideas later on--not from that first meeting but later on--into our own public.

And then, of course, may I add that there are more and more hidden questions within the scene of standardization, and it is not just the communication aspect, but it is the software's operating systems aspect, and there are so many questions not solved and not handled actually in the Standardization Committees. And it would be maybe worthwhile to do that on a bi-national level, at least, if you can't find a solution in the international level so easily.

MOTO-OKA: Any one of the Japanese participants would like to express their views?

MOLLER: Mr. Moto-oka, before we made a trip here, we had a short meeting with some of our interested members in the German industry, and I can tell you that there was a very positive attitude towards this meeting. And as Mr. Thomas said today, the main interest in these activities should be taken by industries and to the research laboratories.

And our understanding was that this meeting was a first meeting in order to get a general overview of the situations in the two countries, but that there should be in not too far distance;--one year may be a little bit too long--a second meeting which should focus down to one--at the utmost two--subjects. And there should be more expertise discussions on these one or two subjects.

And one of the main subjects which was reported to me from our point of view of interest could be the powerful fault tolerant multi-computer systems replacing existing mainframe computers related to software problems, compatibility question, and so on. If this could be a subject, which also is of interest to you, we should think that we could have a very fruitful one-day discussion during the next meeting, bringing the right people together. Of course, this should be prepared very well before. Maybe we could form a little group of preparation, meeting three months before, and then, really bring the experts together and have a one-day discussion, or even two days, if necessary, about this specific topic.

But we would also like to hear your suggestions. You certainly have thought it over, too.

MOTO-OKA: Fault tolerant system is a very important subject, and we appreciate this. On the Japanese side, we have an expert group on this subject. We don't have members of this expert group in attendance today.

But, fault tolerant systems, depending on what you have in mind--the objects you have in mind, can be very different. So, what you have in mind as fault tolerant systems has to be more specifically explained and specified. What type of fault tolerant systems do you wish to emphasize? Do you have something--papers which indicate that? If so, if you would send this to us, it would make it easier for us to consider.

KASHIWAGI: From what I gather today, German's is market-push type, whereas in Japan, we have the market-pull type of discussion which took place. German suggestion was very realistic; it was down to earth. And competition between private industries would be involved in this, so that detailed discussion would be rather difficult to conduct because of that. That is the way I feel.

So, rather than that we should perhaps find a common theme which is more market-pull oriented, that is, on a bilateral basis this market-pull type of theme would be more suited. That is my impression.

KAWAI: For example, man-machine interface should be a good example.

KASHIWAGI: Man-machine interface is more down to earth; more realistic. When we would be speaking of private firms it would perhaps touch upon private firms' know-how; so, detailed discussion would be very difficult because we would infringe upon the private firm's know-how.

MOTO-OKA: But if we restrict ourselves to intelligent man-machine interface, perhaps we would not infringe upon such privacy.

KAWAI: Talking about man-machine interface, psychological effects, and how to determine the psychological effects might--or to quantify the psychological effects would be a subject which is very forward-looking.

MOTO-OKA: I think it's about time we close.

Fault-tolerant systems, man-machine interface;--these were subjects which have been brought up. At this present stage, we should simply be satisfied with the fact that we took these examples and we discussed them. And at the next meeting;—because of the limitations in time we did not decide on the themes which should be taken up at the next meeting.

Through future correspondence;--I don't know what decisions the Plenary Session will make. But between myself and Dr. Szyperski, we will try to sum up the views of the participants of both countries to work out and finalize our discussions. So, that would be the conclusion for today's discussion.

Would that satisfy all the participants?

Thank you very much.

(APPLAUSE)

WORKSHOP 2 : COMPUTER ADJOURNED

(3:40 P.M.)

WORKSHOP 3: "SEMICONDUCTORS"

RUGE: May I introduce you Mr. Schung from the German Embassy. Since he is a physicist he wanted to join our group, since he worked on the semiconductor areas formerly.

We have to stay here and discuss problems of the future for mutual interactions and according to the program two gentlemen will give introductory remarks on the situation of semiconductors. Prof. Tanaka from the Japan side and Dr. Garbrecht from Siemens from the German side.

This is to warm up for the subject, what we will discuss here. And I would suggest that after these talks we shall define the areas or better we shall define the borders of mutual interest, or better let's say mutual interactions' or cooperation's borders. That means, we cannot discuss subjects which are under way in production or going into production next year or two years from now. So, we shall define where we should start for cooperation subjects and where there will be an open end on, shall we define, let's say, not more than ten years in advance. If we agree, we will proceed in this way.

And our goal shall be to have at least two or three topics of mutual interest, where we should start cooperation on our forthcoming meetings.

Prof. Tanaka, may I ask you to give the talk?

TANAKA: First of all, I would like to talk about the following topic. As to the semiconductor industry, I would like to touch upon the characteristics. And also in Japan I would like to tell you what is happening as far as the semiconductors are concerned. And also in Japan I would like to talk about the trend of R&D in semiconductor industry in Japan.

The characteristic of semiconductors is such that technology is progressing as a very rapid pace. And also the expansion of the market is simultaneously going on. That is the characteristics of the worldwide semiconductor market. And I would like to cite some of the examples.

As you may know this is what all of you are familiar with. This is an LSI, one chip. How many transistors are mounted on one chip. And you see the number of transistors mounted is increasing year by year. Presently, we have 256 Kb, which has been commercialized. And beginning this year one mega bit has been introduced or announced. And its commercialization is expected in more times to come. And also presently, Japan-U.S.-Germany by around 1988 we would reach the stage of 4 mega bit memory. And all of the countries concerned are proceeding in this line. And also on the other hand, let us look at how the market is growing and this shows the growth of the market.

As indicated here, this is Data Crest's Company's data. This is the demand forecast. According to this forecast, you can see that the market is growing very rapidly. In 1989 the 256 Kb chip will be produced in the number of 2 billion. So, this is the production that we must achieve. And more surprisingly, in ten years to come, in 1993, one Mb chip

--in 1991, one Mb chip will be produced in 4 billion and 1993 6 billion chips must be produced. Therefore, by 1991 or 1992, the worldwide semiconductor market will achieve the proportion of 1 trillion. And if that is converted into Deutsch Mark, it is equivalent to 100 billion DM.

Presently, the 64 Kb DRAM is being produced in the world. And we are about at that stage. So, I think this forecast is rather correct in its direction.

Not, the chip but I would like to focus on the total dynamic RAM bit figures, which is this diagram, Expected Need of the DRAM. The total bit number produced in the world will show a very beautiful curve of exponential curve. And this dotted line, if that is to be extended on the straight forward manner, then in the year 2000 and onward we will have a very new market. And we expect very much that the new technological breakthrough will be made. In that case the 100 Mb chips must be made in ten billion pieces. But that is one of the dreams that we have. So, that is the current picture of the worldwide semiconductor industry.

Also as to the Japanese current status about the semiconductor industry, that is the U.S., and the total is the world production of IC (integrated circuits) and the white bar represents the U.S. That part corresponds to Japan and this part, the white part on the top, is Europe and others. And the production is growing worldwide. And presently, in 1982, the U. S. had 59% of the share of the production, Japan 33%, and Europe about 8% share, in the total production of the integrated circuits. And I do not know how this proportion will change in the future, but anyhow it is showing a very rapid progress and growth in its sales.

Let us look at the future prospect. One reference material we can use in this regard is this. This is the sales of the IC in Japan and R&D as well as investment for factories. And it shows the changes that had taken place over time. The white part represents sales. This part on the left side, on the white part, is the investment made into factories and plants. And the black one represents R&D. As indicated here, as of 1983, approximately 30% of the total sales is allocated to the investment in equipment and plants. And about 10% or 15% is devoted to R&D. That is the current picture of Japan. That is a quite significant amount. And in FY 1984 this investment in factories would be double that figure, 700 billion yen. That is to say, that figure is indicated in that bar graph. So, that is why the semiconductor industry is growing very much.

So, what concerns us is that 10% of the total sales is allocated to the R&D. Then we would have the shortage of the number of researchers. So, that is the concern we have in Japan.

Let us look at the trend. This is the change in the production volume. In 1986 it is expected that the industrial use ICs is going to increase in number and ICs for consumer electronics will go down proportionately. That is to say, in the overall electronics industry, same thing can be said. The industrial electronics is really over-riding consumer electronics and the industrial use is growing very much over the consumer electronics.

One more interesting point I would like to mention is that--this is the sales of ICs. On the horizontal line you have the sales of IC. And on the vertical line, out of the sales, MOS LSI proportion is represented. As you may know, the MOS LSI is such that it does have a relatively high integration including memory. So, it does indicate a sophisticated form of the element. And as the semiconductor industry we are expecting that the sales is large, and also that MOS ratio is desirable to be high. Because that is the evidence that the sales and sophitication of the technology can be shown in terms of the proportion of MOS. And this indicates the U.S. industry. So, the U.S. companies. And the red ones represent Japanese companies. Pardon me that I used green for Europe. As indicated here, that "U" represent MOS, like 100%. That means only MOS is made. That is 100% level. But except for that the MOS ratio of the Japanese industry is moving toward the upper portion and the U.S. industry has the large sales but the MOS ratio is lower. That is to say, the U.S. has tendency to make--easier to make integrated circuits rather than sophisticated ones. But in a few year time I expect that this picture will change drastically. But, anyhow, this is the technological content of the Japanese semiconductor industry at this time.

And I only have a few minutes left, so I will just go over quickly.

As to the trend of the Japanese semiconductor industry, I would like to show you the following. This is a well known fact.=Also, this one is the transistor feature size, and this is the years. And this is the trend in the past. Presently, 1 Mb chip is produced on a trial basis in Japan. And including that, then, on top of that that would be plotted. That is to say the current progress in the research is going on rather smoothly.By around 1988 0.07 micrometer size is likely to be produced on trial basis. So, we are following exactly this trend plotted here.

Let us look at what is happening to 1 megabit chip. This is the chip size, and this is the cell size. This is 256 K and the values are filled in already and by way of scaling law , we made an estimate. This is 75 sq. mm. 36 micrometer^2. But what was made actually was this, 50. In 256K the chip size is equivalent to that of the 256K and also the cell size is much lower and much smaller than the scaling law. It shows the progress made in the device. Also the capacitors or new capacitors have been made with great efforts. And that expalins for the great progress made here.

And surmising from this aspect, the chip size is 64 Mb, 300 square millimeters, but maybe the size can be reduced to a half. That is to say, 12 millimeter square will be the likely size. That is to say, if that is achieved, then the chip will be very much easy to be used.

With that I have covered the memory of the VLSI so far.

And as to the development trend in Japan, the VLSI is becoming very larger in its capacity and in its memory. And also the high speed logic is one of the direction taken. And those two directions are the conspicuous directions seen in Japan. So far we only have the values at the laboratory basis.

In the silicon bipolar device, this is the NTT's ECL's publication or the published figure, which is becoming very fast. 50 P/sec per gate. And as to the GaAs (gallium arsenite) integrated circuits, on the laboratory basis, a 4 kB has been made, about 50 picosecond to 100 picosecond, somewhere in between 50 to 100 picosecond per gate. The other one, HEMT--I must mention HEMT. This is what has been developed in Japan. Liquid nitrogen temperature, 10 picosecond per gate, has been achieved under that environment. But anyhow those values are the laboratory figures. So, it is not the commercialized figure. And this is 1 Kb HEMT memory cell, which was recently published.

And the last thing I must say is what Mr. Kataoka is going to mention. As one of the national projects, the three-dimensional device is going on in its research. This is a high speed logic, parallel processing type. So, this is a new type of device. So, there is a possibility for developing new type of device in terms of the three dimensional devices, which is going to be mentioned by Mr. Kataoka. And the rest of it, Mr. Sugano and Mr. Takahashi will make a comment. And summarizing the trend, I plotted this diagram. This is the highspeed version. This is the silicon bipolar. And the dotted circle represents 1980 and the black circle represents 1990 estimates. But recently, as I said, in case of silicon bipolar it has reached that level. And on the laboratory basis we had already exceeded the target estimate for 1990. And in case of HEMT, it is going around there. That is to say, the high-speedness of each device has reached somewhat its limit. So, what can exceed that limit is this, which is the three dimensional device. There is a great possibility that the three dimensional device can exceed that limitation of speed.

As I said before, this is what we have, that information revolution is going on and many possibilities are there.

As for the camera technology and photograph technologies, and so forth, we expect that drastic changes will be introduced in those areas. So, the year for film is going to be terminated.

As to the application, Mr. Odagawa as well as Mr. Ishidate will speak about that later on.

Thank you for your listening. Sorry I have exceeded some time.

RUGE: Thank you, Mr. Tanaka. Let me just give you a private comment. It was only one and a half year ago. A talk from one of your famous colleagues, Mr. Makimoto from Hitachi---by colleague I mean the semiconductor physicist---from Hitachi at the International Electron Device Meeting in San Francisco. And he had given an introductory talk. The first speaker was Mr. McLaudy (?) from IBM. And the second was Makimoto. And as you know, at the international meetings the speakers always end with some picture as a joke or something like that. Mr. Makimoto was talking on the automation factory or the automated factory.

And he ended with a picture showing that a lot of money should go into the automated factory because it is very costly, and out came a 4 megabit and a 16 megabit memories. 4 and 16. And when he mentioned those names, 4 and 16 megabits, 2,000 people laughed. At that time. You see. It was one and a half year ago. People laughed because he mentioned 4 and 16 megabit memories. No one at that time could imagine that it will ever be built. You see. This was just a private comment. It will go on. Two or three years ago people said in the United States and even in Europe people mentioned that one megabit will be the end.

So, should we go on with the other talks? Or should the Japanese colleagues....?

YANAI: Mr. Garbrecht, first.

GARBRECHT: Gentlemen, after the introduction, I would like to mention the R&D, industrial production, markets and the spirit of people, where the traditions are the interrelated subject.

Good and leading position in R&D, the subject for today, is possible only if the strong position in production, market, and spirit are provided. Spirit of people in my personal belief is the major force behind R&D and the subsequent production and market penetration. Therefore, I think I should spend a few words on the spirit of the Japanese and German people and its change over time.

Japanese people know--and this is supported by tradition--the only way to stay in progress is hard work. German people again basically have the same experience being one of the fundamental of Japanese and German friendship. In recent years, German people after a highly successful period of national economy had an experience of limitations of their natural resources and the limitations on the best role the country is able to carry. As a result German people had to restructure their thinking, their industry from energy consuming heavy industry to brain consuming electronic and associated industries. This restructuring has now progressed in Germany to a large extent. Microelectronics being the unbeloved juggler a few years ago now has top proirity. It can be everyday in German newspapers.

The industry invests heavily in microelectronics both in R&D and capital investments. The universities and the R&D centers shift more and more to microelectronics. The number of students in electronics and associated disciplines grows remarkably. And at the last Hannover Fair microelectronics was the hit of the total Fair.

Now, I found this essential because this is the happy and remarkable change which has taken place in the last one to two years in Germany.

I would like to describe R&D and business concept of my company and microelectronics. Because Siemens by far has the largest idea and production activities in integrated circuits within Germany, and therefore I think this kind of our concept stands for the concept of maybe other companies also.

I would lkke to start with the picture which is opposite of what you showed us. You see also that we know that at the time being most European companies only produce 8 percent of the world demand of ICs. You see Philips being the largest one, while Signetics is a 100 percent donor of Philips and is shown as a well spaced company. Putting both together, Philips is one of the largest producer of ICs. Now, Siemens being No. 2 in Europe and No. 1 in Germany, I like to show you and tell you why this is and what we are doing in order to change.

Our concept is similar, very similar to the concepts of NEC, Hitachi, Toshiba, Fujitsu and others. First, our intent is to strengthen the business, the system business of our main customer by providing them with application oriented ICs.

Second, we use memories as the pilot product for process development, manufacturing volume, yield and quality, and hence production costs and market and customers development. And certainly over the borderline of the worldwide standardized microcomputer, in our case, we still follow the inter family.

Now, let's look into memories. And also I have something similar to what you showed. We expect one megabit to have a volume production of at least a few hundred thousand per month per company beginning 1987. And although it is not shown here, we believe the same to be happening with 4 megabit in 1989 timeframe.

Now, this is our 256 KREM and it has almost the same figure as you yourself showed of the size of 90 square milli and the chip size of 45 square millimeters. This is the device which now goes in volume production. And I would like to show you a selected number over 20 million devices, long term reliability we received of 20 fit. And we achieved the infant mortality or early failure rate of 0.02 percent. I think the ones who are familiar with those figures will agree that those figures will not be beaten by any other producer. Now, those reliability data only can be achieved, as you know, by having high yields. And we have achieved new figures in production, the volume production, which are now similar to yields we know from the Japanese producer.

Now, I would like to show you this figure. Because this is something which we dedicated from the source of MITI and own sources. And if the capital investment in the time frame of 1973-1975 is taken as 100, then the Japanese companies--and this is an average of 13 Japanese companies--started investing in 1978, quite fast. And this is the sales which follows. I would say this is two years' delay and the same rate.

Now, our investment it was like this. And we are starting in 384 and this rate. And all we had to really decide was whether to follow this line or to follow this line. And our decision is to invest in the same rate as the Japanese rate, although it is with a delay of some years.

Now, the reason behind this was the Japanese producer received high yields in memory production in 1978 with 4 K memory, first time with the 4 K memroy. Now, I must say that we achieved similar yields not before 1982 with a 16 K memory. But now we are able to invest, and our target is the following.

We had a two year delay in offering the 64 KREM. We probably will have a one to two year delay with the 256. This is because we cannot bring fast enough the production capacity. But we will bring this down to half a year and to zero year with 1 and 4 megabit memories respectively. Because we already now are making an investment and building the manufacturing lines well in advance of the associated development acitivies.

Now, this is probably, I think, the same as you do. Those are the generations of processes. Now, the time being the 256 K is in pilot production, the 1 megabit is in development, and 4 mgabit is in research, now this is a photograph of 1 megabit memory. And those showing our activities in lithography, where we are going from

3 to 1 micron, and those are research work with X-rays conducted jointly with the Hannover Institute. And it shows 0.3 micron structures.

Our company by means of this investment in the next three years will triple its MOS production capacity and we are now going to double our engineering forces in the same period of time.

Now, this program is sponsored by the German Ministry of Research and in parts of the program done in cooperation with Philips.

Now, we are open and interested to find some kind of cooperation in the field of memories. And this might be process steps, trench capacity, CD structures, X-ray. This might be 4 megabit or 16 or beyond. This might be given cell architectures. Nobody as yet knows which one will be probably even in 1 megabit but for sure 4 megabit--nobody today knows what will be the optimized cell architecture. And the same is with associated eqüipment and automatization.

Now a small comment on microcomputers. As I told you we decided to offer a line which is worldwidely standardized. And it follows IBM competitive computers; we will follow into competitive microcomputers, as several Japanese companies do also. And we have co-operation inter-based on a case by case exchange of products. For the time being we offer almost the whole line up to 16 bits.

All the green ones are the production. Now the red product, which is 1982-1986, with the advanced 16 bit micro computer that now is under development, will be offered at the end of the year. Those are the expansion of the one chip microcomputer. And we are negotiating a 32 bit computer with exchange with Intel. Now, I would say, as far as the Japanese companies' activities, they go in the same direction as ours. So, we are open and interested in cooperation with Japan. In fact we recently agreed on our first product exchange with one of the leading Japanese company or corporations. As I could see the creation of the worldwide standards, because all the standards up to now were created by American companies, it seems that may be the first effort to create our own standard. But we might more easily by joining forces be creating worldwide standards. Because we--and if we go together with Philips for sure--can get the standardization in Europe. And you can of course standardize Japan. So, this is almost more than a half of the world.

In addition, of course, an exchange of products and joint activities towards aspects like copyright also would be something which we should consider.

Now, in application oriented ICs, I would like to briefly cover the areas of telecommunication and maybe say a few words to entertainment and others.

Now, in telecommunications we decided to develop and to offer on a worldwide basis product families, IC families, for ANALOG digital telephone circuits for ISDN, first beginning with what we call the small band ISDN with the 64 kilobit ISDN system, which then develops into the so-called broad band ISDN which is the fiberoptic system with 1.6 gigabits per second. The first generation of the products is the ANALOG digital circuit. And as an example I will show the circuits which are on the subscriber line boards, because those are of the highest volume and it is of utmost interest. And we develop this chip set and have given the second source rights to enter into Philips in order to form a bender clap. And we are now going to conquer the main portion of telecom companies. And we have a good chance, because six out of the ten large telecom producers are European companies. Siemens especially is very strong, because it has in Europe the strongest combination of the integrated circuits and telecommunications under its roof.

Now, cooperation plays a very important role and I think in our parallel group of new media we will discuss on services, standardization of buses, protocols, interfaces. While all those interfaces are standardized, maybe we will have a conference where the bus standardization will be offered to the world from Siemens with bus concepts supported by Philips, Erickson, Siemens, Intel, AMD, and others. This is something where we have in the past had almost no contact with japan. And I think this is something which we should consider and improve. As an example, Philips contributes the whole system by its strength in entertainment. And this is an example for what we call the VISUAL TEXT, which was introduced last year in Germany. And Philips developed a large display IC called OERON(?). And of course it is not just an IC. It is a whole architecture and protocol conception. And this is the associated chip. It is a very large chip, though the question is whether this kind of IC concept and architecture is going to be standardized not only in Europe but also in Japan and elsewhere.

Now, in entertainment, I would just like to state that, maybe it is not so much known, but most of innovations in entertainment integrated circuits are European based. And many of the products are now being produced also in Japan of European origin. And if I compare the standards, you see they are all the LOGIC standards. TTR and Si-MOS series in microcomputers and initial memories have been introduced by the United States, while in Western Europe it is mainly Siemens and Philips who have introduced all those chips for entertainment. But Japan is mainly strong in all bodies in high volume production. But of course, based on these now coming are the huge amount of chip sets in all other areas.

I only like to show you this slide. This is the chip set from Siemens TV set, and Philips probably has even more chips to offer.

Now, in entertainment, I think it is very difficult to cover all of them, so I would like to just say that we have a strong position there and probably the cooperation in this field is more coming from the equipment side, where we have to see how we can come out with our fight. And I think it is worthwhile on the equipment side to discuss. Because as you know the United States almost don't play any role in the entertainment field.

Now, I would like then to come to semi-customs. In my definition, the semi-customs are the methods of chip designs by customers. And as cut tools develop, semi-customs will play an ever increasing role. One key of success for semi-custom could be the standardization of these tools and interfaces. It should be worthwhile to learn how Japan is going to solve the problem of standardization. Because I know you all are competing very heavily and maybe miss to talk to each other whether there is an advantage to standardize. Now, if we learn that you are going to standardize, then we are interested to discuss with you whether we should agree on a joint standard. Otherwise, maybe, the industry in its whole may make a mistake.

Now, the last word to bi-polar. Those are the

ECL gate arrays which we are having production and development. This is now in pilot production. We have a 350 picosecond gate array 2,500 gates. We develop a 200 gate array, 200 picosecond gate array, 8,000 gates, with 360 pins. When I compare those figures with 50 picosecond you mentioned, then I have to say those gate arrays/are over the entire gate array and not one single unloaded gate. And to my knowledge those can well be compared with whatis produced in Japanese companies. To my knowledge it is even more advanced.

I would like now to come to the conclusion. I did not touch the activities of the German universities and institutes. And I did this not, because Prof. Engl yesterday has covered this to a good extent, and it might be extended during our discussions. So, I would like to summarize. The spirit of German people has changed recently from being uninterested or even against microelectronics into giving much support to the new technology today. Germany plays the most important role in Europe both in market and production of microelectronics. Philips and Siemens are the major force in microelectronics R&D and production in Europe. Siemens has committed large capital and R&D invesmtnets in the 1 megabit and 4 megabit memory segments. Similar activities are going on within Philips. This is based on high yields and quality achieved with the previous generations. Microcomputer standard families, telecom and semiconductor products of main interest, each one with specific technology and market targets.

Now, the remaining question: Should Japan and Germany as No. 2 and No. 3 in the world economy again join their forces? This time in technology extending human brain in order to solve the future problem of industrialization and mankind. And my personal answer is, "Let us try."

Thank you.

RUGE: Thank you Mr. Garbrecht. And according to our schedule, we should now have a free discussion.

YANAI: Now, we will go into the free discussion. As far as the Japanese side is concerned, as Dr. Watanabe mentioned earlier, the Japanese participants would like to make some comments. First of all, we would like to start with Dr. Sugano. Could you please give us a short comment?

SUGANO: Dr. Tanaka made a presentation earlier concerning various delay time in ICs and how such a delay in IC will be improved in the future.

In discussing future problems, the size of the device and also the circuit voltage or the change in the voltage has to be taken into consideration in the discussion of the future problems. Now, I would like to show you some of the results of our study in our Institute concerning SiMOS scaling down. This has nothing to do with the proposal given by IBM. We have not used the methodology of IBM in scaling down, the reduction of scaling.

We have tried to maintain the electronic field in the device and, in such a sense, the method that IBM used for scaling down was quite similar to our method.

In the process of scaling down, the foreign particles or impurities increased in substrate. Also at the source, parasitic resistance increased and such influence has been taken into consideration. This shows the length of the gate. This is 1 micron. This is 0.1 micron. And NMOS inverter or NMOS gate when fan? mount is 1--and as to NMOS and SiMOS, suppose the temperature in the room is 77° K we obtain the following result. Up to about 1 micron this change or move in scaling down is quite proportionately going on. But when the gate length is less than one micron and becomes closer to 0.1 micron, switching delay did not decrease in length as we expected as the length of the gate decreased. This is because the resistance of the source increases. Also at the same time we have to be careful that here circuit voltage also scaled down. According to the theoretical calculation, here, the voltage is at 0.25 V. As the length of the gate becomes smaller, in the case of SiMOS, a very fast gate delay like 50 picosecond occurs. And this almost corresponds to the graph shown by Mr. Tanaka. And one thing we have to keep our attention to is that, as the voltage decreases, subthreshold current increases. That means the influence given by the subthreshold increases. This is 1 micron here. And when we consider 1 micron gate, even though there is a SiMOS, standard power becomes great. Therefore, whether a SiMOS technology is more meaningful than NMOS technology, that is quite doubtful.

This vertical access shows standard power, which is the power normally required. And as to the power required for SiMOS, as you know, this is a little clock frequency. And for instance we take about 100 mega hertz, 0.05 micro watt per gate is the consumption of power. As we make a comparison with that of NMOS, the result is almost the same. If we take a 0.1 micron gate, if we consider the meaning of SiMOS, the meaning is quite doubtful. In 0.2-0.3 micron area both SiMOS and NMOS move quite rapidly.

Yesterday, as Dr. Engl mentioned and also today we received a speech by Dr.Garbrecht, lithography is widely or extensively studied in Germany. By using such lithography studied in Germany, 0.1-0.2 micron MOS FET or the movement of MOS FET should be studied further with collaboration of the two countries.

What is very important here is that as the scale reduces the circuit voltage has to be considered. As you know, the standard is 5 V. With the consideration of compatibility of TTL, if we consider the compatibility of TTL, it is very difficult to change this standard voltage. These days there is an opinion that this standard should be 3 V instead of 5.

In operating MOS a high electric field effect, the voltage has to be reduced. But only one enterprise cannot reduce the voltage. There has to be some kind of international agreement in order to reduce the standard. Otherwise we cannot reduce the voltage, unless we have an international agreement.

In designing an LSI, I think there should be some kind of international agreement. And I think there is a possibility to enter into an international agreement in reducing the power at the source.

Thank you very much.

YANAI: Dr. Takahashi.

TAKAHASHI: Thank you. My name is Takahashi. I would like to take this opportunity to introduce the superlattice device.

As you know, from 1981 as a Japan national project we started the Future Electron Devices Program, taking a ten year period of time. And there are some projects in here. One is the superlattice device. No. 2 is the three-dimensional IC. And the third is the fortified ICs for use under extreme conditions. And Dr. Kataoka would be explaining on the third program later. And I would like to take this opportunity to explain about No. 1 and No. 2.

The size of the device was taken up in the discussion.

And this is the size from horizontal or the horizontal size and the vertical size. And this is the horizontal size of the MOS. And this is the depth. Anyway, when you look at the horizontal size, 1 micron or 2 micron has been raised. Looking at the depth, we are looking at the thick depth. The control is about 1,000 angstrom. And when we go up to ion plantation, the precision is higher, up to 100 angstrom. And transistors are used in this area. And if we increase the precision further, NBE or MOCVD technology will be involved. As such the vertical size, i.e. the thickness, would be reduced. And as the thickness is reduced, many kinds of devices will appear. And suppose the lower part would be the classifical devices, the upper part shows the new type of devices. And we are going to take ten years in order to develop two new devices. That is the national project.

What are the new devices? First of all, take the example of the superlattice devices. There are four devices here. This is block oscilations superlattice device proposed by Dr. Ezaki. And the second is a two-dimensional device which is already in production. And the third -- the sub-energy band is used and a very positive study is going on for the third lattice devices. And the fourth is the metal semiconductor. Without depending on DCS technology, a super-conductive semiconductor.

Since time is limited, I would like to move onto the next slide.

Next is the superstructure device. Suppose we can control vertically, longitudinal structure or devices can be developed. Bi-polar transistors are excluded here. MOS transistor is included, and Bi-polar is included here. For the future devices, these kinds of devices can be considered.

For instance, MES FET. MES FET is already produced on commercial basis. And this is the horizontal basis and HEMT. HEMT is under development and in the near future we are expecting to appear on a commercial basis. And at present SIT is under development now.

Aside from these devices, hetero-bipolar transistors or metal based transistors or channel based trnsistors, the idea on these transistors appeared about 20-30 years ago. But in the past we did not have the technology to realize these devices. These days such technology has been developed. Therefore, in the future such devices would be appearing.

Also other types of devices, such as PBT in the category of SIT, ballistic transistors--these transistors will attract the attention as the highspeed transistors. And the reason why such vertical devices are attractive is because the connection with OEI is possible. The vertical type is easy to be used. So, these kinds of devices will be appearing in the future.

Lastly, the forecast of the future taking lattice device as an example. When we look at the present lattice device, the control of energy level in real space is conducted. Laser diodes are used or subband is used. And in the future we will go into this direction. If I say this, you might burst into laughing, but I really hope that this would be realized in the future. The energy level at the lower level can be controlled if the precision becomes very high. In that case, an effective mass can be controlled. And if that is possible, the mobility of IC can be controlled. The semiconductor can be controlled.

I would like to show you a comic here. MBE is very good in controlling and MOCVD is also good at controlling. We will take the advantage of both,MBE and MOCVD. And one of the expectations in the future is that MOMBE will be an advantage on both sides. As this grows--this is the next comic--as MBE grows, photo-MOBDE will be very important with the technology of MOMBE and photo-CVD. 10 angstrom control or less than 10 angstrom control would be the target in the future. And the Japanese enterprises are in the process of studying toward that direction.

Thank you very much.

YANAI: Thank you very much. Because of the limitation of the time, we woud like to continue. Speech by Dr. Kataoka.

KATAOKA: As was mentioned by Dr. Tanaka, I would like to touch upon the future prospect and possibility, namely the three-dimensional IC. And briefly I would like to introduce three-D ICs to you.

In 1981, as was mentioned by Dr. Takahashi, the future electron device research has been launched. And as a project for future prospect, with the cooperation of many people, we have been proceeding with this project of developing future electronic devices. And one of the efforts is this 3-D IC. And as you may know, presently, in terms of the industrial basis the IC production is going on such that on the surface the elements or devices are integrated onto the substrate. That is what we are doing now. But there are many other electronic possibilities that can be extracted. That is to say, we can extract some advantages out of making some depth. And in the direction of the depth or the longitudinal direction, we can make some improvements and expect some more elements and we can improve the performance in this regard. And there are three possibilities. And we are targeting at three objectives.

The first objective is that the packing density can be made higher. That is to say, that was the plan made four years ago. And as of four years ago, 16 mega memory per chip has been envisioned four years ago. This is pertaining to high packing density.

The second goal or the second purpose was to take a stereotype positioning, so that the shortest connection can be found for high speed logic. And this possible shortcut connection can or might speed up the logic. The speed is less than 100 picosecond. That was our estimate.

Thirdly, by integrating many things onto the substrate, we wanted to make something very intelligent. That is to say, we wanted to make intelligent sensors in particular. And combining with the intelligent sensors we wanted to realize this intelligent sensor most of all. For example, this is the case. As you are well aware of, the lefthand side is the retina structure of human. There is a receptor cell, a photo-sensor, located there. Under it the signals are processed underneath. That is to say, there is a signal processing mechanism built into the human retina. And it will be conveyed to the nerves. And the nerve system is connected to the brain. And by having a three-dimensional IC, we wanted to assimilate or simulate what is happening in the human retina. That is the CCD or the photosensor array type is mounted there. And we have the transfer gate or the memroy of the logic, whatever, that can be mounted on and then stacked. So, this is a parallel processing of the signal. And by having this kind of mode, we wanted to make new types of intelligent, integrated circuits. And we identify some possibility there.

And the key technology pertaining to this is the stacking of the technology. That is, there is the insulation layer. And on top of the insulation layer, insulators, the semiconductor would be mounted. So, the insulator technology is the main stay technology. And the device must be kept intact without destroying that. On the lower temperature in the local processing it is needed vitally. That is to say the locally deposited polysilicon is re-crystalized and made into a single crystal. For this purpose, the laser beam is needed and also the electron beam is needed. So, such a technology will need to be developed further.

Toward these objectives, in Japan, we are making efforts, and I would like to introduce to you some of the efforts undertaken in Japan. This is merely one example.

About 2-layer or 3-layer devices have been made on trial. For example, this is a cross-section. This is the active device, two layers of active device. In Japan up to two layers we can handle it. But material-wise we can make up to three layers. And this is the connection. So, one by one, devices are mounted onto the substrate.

And this is an unclear picture. But this is the electron beam scanning. By using that, recrystalization is made locally by way of electron beam. For example this is one of the example--this is how the deposit looks like. This is the polysilicon deposited. The polysilicon layer is recrystalized and made into a single crystal. So, this is where the devices are imbedded. This is the double layer or two layer Si-MOS shift resister. And this is the example of such.

And this is the enlarged picture. So, this is a very unclear picture but this is what it looks like. You can see underneath, the underneath devices, underneath the top layer. Because it is transparent.

In Germany X-ray lithography is making much progress. But as one of the basic technology, this is what has been done in ETL. This is the storage ring. The diameter is 10 meters. And this is the storage ring we have. And the synchrotron radiation is used. And lithography is developed there and studied here. This is the ring. From the ring the lights are emitted. In that light soft X-ray components are used. This is the mouth of the furnace. The pattern embedding is done. This is what we have been making. This is in the order of 0.3 to 0.5 microns. The thickness is about 10 microns. And I think in Germany you have similar efforts. But this is one of the future topics for development.

This is the superlattice I have shown. And this is something very similar to human tissue and human mechanism. So, we are exploring the possibility of making the 3-D ICs having a certain depth. During 1990s I think this can be one of the seeds that can be planted for 1990s for technology. So, we arenot attempting to run a vehicle on an outbound at a high speed, but rather we would like to go and drive along the Romanstrasse instead.

That is what we are thinking.

Thank you very much.

YANAI: Thank you very much. The next presentation is from Toshiba, Mr. Odagawa. Please try to keep it short.

ODAGAWA: Many presentations have been given so far. This is 1 mega and 4 mega and it's the 0.8 micron or 0.7 micron; up to that point the step under repeat optics can be used. And from 16 mega we do not know whether the optics can be used or not. And from there on, from 64 mega or 256 mega, when it comes to that stage, the optics or the light cannot handle such a large size. In that case X-ray is needed, or electron beam is needed, or electron flood or X-ray lasers are needed. So, we have to find something new to handle that situation. And this is the fundamental area where we can have some kind of cooperation. Is it not? Because you do have a strong basic technology in Germany. So that I hope that we can find some area for cooperation.

The second topic, this is the last one that I will show you.

This pertains to the industrial area or the electronics industry. This is the proposal that I have concerning the cooperation of electronics industry. This is a logic IC and this is the future consumptions trend of logic ICs. There is a standard logic such as TTL, but no progress is expected much. And the full-custom and semi-custom LSIs, particularly gate arrays, growth is expected much larger in future.

As to the gate arrays, in Japan, particularly, Toshiba is concentrating its effort on Si-MOS. Presently 10,000 gates per chip have been achieved. In future, 10,000 arrays or pieces are going to be achieved in future. As to the speed, it is going less than 1 nanosecond, and we are now going below the nanosecond. 0.1 nanosecond, and so forth. This is the range we are entering.

As was mentioned by Dr. Garbrecht, the ECL is the strong point of Siemens. But in the area of Si-MOS, Toshiba is rather competitive here. So, maybe this is one area for cooperation.

And the system engineers and the design engineers--I think there are 1,000 times larger manpower available for system engineers. So that the German system engineers can design maybe the Si-MOS gate arrays, so that the German engineers can learn how to make Si-MOS gate arrays. And maybe one week is needed for learning that expertise. So that it can be helpful. That is to say, if the gate array is used, compared with the full-customs, I think the time needed will be less than 1 digit. And also R&D cost as well as the design manpower can be reduced very significantly. So that, within a few months, new LSIs have to be made. So that the competitive electronic equipments can be made, which is very small in size and cost efficient. And this is a very good way to revitalize the electronics equipment industry.

That is all I have to say.

RUGE: What do you mean by "flooding"?

KATAOKA: Electron flood like photo-cathode, and gold metal imaging, fine imaging and UV light.

RUGE: Okay, thank you.

YANAI: Thank you very much. Next is Mr. Ishidate.

ISHIDATE: This is the title of my presentation.

This is the future situation. This is the title of my presentation in past, present, and future situations.

Japan has started the development of microcomputer systems in a comparatively early stage. This is the Intel products. This Intel product was produced under the request of the Japanese electronic calculator manufacturers. Therefore, Japan has gone into development of microcomputers about the same time as the United States has started to develop its own microcomputer systems.

This is the present situation. This is the 4th quarter of 1982. And this is the 3rd quarter of 1983. And this shows the share in volume. We are occupying about one third (1/3) of the total production in the growth.

As to single chips, in this field, Japan is occupying a very large proportion specially in the area of 4-bit. These are all original products of Japan. That is to say, Japan is the first country that developed these products. In Japan, VCR (video cassette taperecorder) and Japanese-made electric appliances for consumer use, these products us these 4-bit single chips. So, in Japan we made the effort to let the consumers use microcomputers in the consumer area. But in the 16-bit our effort is not sufficient yet. As you see here, U.S. original products occupy a large proportion. This is the future situation. As you see here, in order to utilize the existing software, it is necessary to let the popular microprocessors to be compatible. But that is not enough. A higher performance microprocessor has to be developed. And also as a lot of transistors would be integrated, Si-MOS has to be used in the future. So, a very unique architecture or circuit for Si-MOS will be necessary. Of course, this kind of problem like the copyright problem is a controversial issue at the present, as well.

We are trying to develop a new microprocessor or a Japanese original microprocessor. And this is what we are attempting to do in order to do that. This says

NEC. But this kind of thing is also carried out by other companies in Japan beside NEC. But as far as I know NEC is the only company. So, I am giving the example of NEC as trying to move toward this direction. And this is 16 bit and that is 32 bit.

For instance, the new area--this is Intel's 8088 upward compatibility. ALU from this side, data is fed simultaneously from both sides, and by using this method the speed is reduced. And the effective address generator here, this reduces the time as compared to the existing devices.

Let me come back to this transparency again. Of course, we do not think that we can grasp wide users if only one company make efforts. We have to have efforts with all of the companies. And we have to find the new users. For this end we would like to cooperate with you and cooperate with other companies for future microprocessors.

YANAI: This concludes the presentations and comments from the Japanese participants.

In Japan, optical devices like laser devices, opto-electronic devices are making progress these days, aside from what was mentioned in the comment. And also the integrated optics is making progress. But since time is limited, with the consideration of the fields of the participants involved, I would like to have discussions further in the future.

Dr. Engl, could you please give us some comments? And also we would like to welcome your comment, if there is any comment from the German side.

Dr. Ruge, do you have any comment?

RUGE: I could give a lot of comments with a big variety, from Dr. Kataoka with three dimensional work which I am also involved, as you know---maybe you know Dr. Wisler(?) will visit you next month--- to X-rays, and finally to the scaling problems. I think I should give by myself comments and then ask my colleagues if they want to comment. And finally I think what we should do is that you give some suggestions, all speakers give some suggestions for topics, for possible cooperation. Garbrecht gave suggestions. How about Lorenz, Schadlich and Engl for any suggestions? But at least this was my comment.

I would say that we can divide these suggestions into material science including X-ray, which is also material science, device concepts like microprocessors, also design concepts like the suggestion of Toshiba gentleman Odagawa to learn the Si-MOS design. I believe we can work on these three.

LORENZ: One point I would like to add to the suggestion of Prof. Ruge that is the proposal already made by Mr. Garbrecht and I would like to underline this because of the following reason.

In all major countries at the moment a new communication infrastructure is established. And this structure should be worldwide and open structure. In our countries we have to work on the worldwide standardization to achieve this aim of an open structure. But the bases are the ICs for the public networks and also for the private network, with an example of LRNs and PIBXs and all of the terminal equipment. So, Mr. Garbrecht has proposed: Do you see the need for cooperation to standardize the bus in the proposed big communication system proposed by Mr. Garbrecht, to standardize secondly the tools and interfaces especially for semi-cutomized ICs, and thirdly if there is a possibility of a worldwide standard with respect to the proposed ion for interactive Videotext?

It would be nice to hear the comments of the Japanese friends.

YANAI: Do you think the Japanese side should comment immediately? Maybe we can say our opinions during our discussion period.

LORENZ: Because it was in addition to the proposal by Dr. Engl.

YANAI: Dr. Ruge, so far many presentations have been given. And out of those presentations, what is the view of Germany? That is to say, what problems do you see as the mutual interest between the two countries? And what items can we possibly take up mutually?

So, could you just specify the possible topics from the German side first?

RUGE: Again I would suggest that we divide---not areas but topics--well I will speak for myself now, not as the Chairman.

I would say that 3-dimensional silicon layers, since we have experienced on that, we have made transistors, Si-MOS, and so on, and we developed the recrystalization method, because as you know I worked on ion plantation. I have to check whether we can cooperate also on the synchrotron source. I have to check this, because this is not only done in my institute alone. This is done in cooperation with five German companies. At least let me give you the goal. Maybe Engl told it yesterday. The goal is to have a synchrotron with a diameter of 1.6 meters with the radius of 0.8 meters for soft X-rays for lithographic purposes. This would be an interesting area at all. But I cannot suggest it by myself.

And the third cooperation could be, as I mentioned already yesterday evening at the dinner, the integrated sensors; the three dimensional layers and then the sensor technique. Because I think and I believe that silicon will be used not as the media for electrode hole move and for single processing, silicon is very well suited also for measuring pressure, humidity, temperature, and so on. And there is coming up a new field that is called micro-mechanics. Now that we do the micro-mechanics, so I agree fully to your idea of integrated,multifunctional integrated sensors and signal processing devices in the '90s. Therefore, at this point, I would also suggest the cooperation, the idea for cooperation. Hopefully, I hope someone has written down what I suggested.

SUGANO : I would like to propose a conceptual classification of our discussion. So far, we have had many discussions. And I can classify it into these following categories.

First of all, as the potential field for cooperation, we have fundamental process technology first. So, with regard to the fundamental process technologies, we have one class or one category for possible cooperation. Out of that, particularly, many of the people discussed the X-ray lithography. The German side had been conducting joint research on Bessy? And also in Japan in the Electro-Technical Laboratory, etc., high energy physics research institute facilities are used in order to conduct research on X-ray lithography. Not on SOLE basis but by having the strong X-ray emission devices the research is going on. I don't know whether the SOLE method is appropriate or not or maybe the rotating target type X-ray emission device might be appropriate--I do not know which one is better. But anyhow, those are the possibilities that we can pursue. And X-ray lithography can be one of the concentrated area where we can carry out our mutual cooperation.

In addition to that, as was mentioned by Dr. Odagawa, and as proposed by Dr. Odagawa, we can tackle or take up broad processing technology. On that broad aspect we can also carry out some cooperation. And as was mentioned by Dr. Ruge and Dr. Kataoka, we can take up three dimensional silicon layers. That is one of the possibilities, of course.

And the second large category we can make is the standardization. Particularly the global or worldwide standardization. And I think most of you have agreed that the microprocessors standardization is one of the high potential. As was mentioned by Mr. Garbrecht as well as Mr. Ishidate from NEC, they made the similar proposal. Presently, the general purpose microprocessors' specifications have been moving or centering around the United States. The U.S. has been taking initiative in this respect. So that, maybe, Japan and Europe must get together and try to standardize the microprocessor's field. So, I think it would be a good idea and significant effort to collaborate with Europe and Japan. In relation to this, in custom LSI field, in particular the design tools and the interface related to that, the custom LSI field designing methodology is also the possible area for introducing standardization. Maybe the compatibility of the specifications of the countries concerned is one potential.

As was mentioned by Mr. Odagawa, Siemens is strong in ECL technology and Japan is strong in Si-MOS technology. Maybe one can take advantage of that respect, combining the best of the two worlds. This may not be a large topic. But as I said before the circuit voltage standardization can also be attempted between Germany and Japan, to see the possible area for having consultation between the two countries.

As to the new area for research and study, Mr. Ruge has proposed the sensor related field. Particularly in Japan, as was mentioned in the Electro-Technical Laboratory Mr. Takaoka has been taking the initiative in this research and carrying out extensive studies in this field. This field is full of potentials and we are only at the fundamental stage of finding out and specifying what potentials are available. So that the study level cooperation can be achieved in this area.

Listening to all of you speak, I have taken the liberty of summarizing the discussion in this way.

<u>YANAI:</u> Any other supplementary remarks to be made?

<u>ENGL:</u> I have tried also to make summarization. And my list which I have compiled coincides almost completely with your list. But I would place some thing a little bit

differently. According to what was said by Odagawa-san we don't know which way the production means will be for 16 megabit memory.

ODAGAWA: You have to have the 16 megabit memory technology?

ENGL: No, I would just increase the scope from X-ray lithography, which might be probably the most likely contender to broaden the scope and to see what other competitive possibilities would exist.

SUGANO: This is only one of the progressing process technology.

ENGL: Yes, I viewed it from a different point. And I viewed it from the point saying for the 4 megabit memory the time is already too far advanced to start the cooperation until we see something coming along. Things must be almost developed for the market. But the 16 megabit would leave us enough time and it might be at that time that also in Japan you may find out that despite the different companies in this area who I know are very competitive, each single company may perhaps lack resources to tackle the next generation, like that which is done between Siemens and Philips for the 4 megabit RAM. It may perhaps happen for the 16 megabit RAM somehow in Japan, to which extent of course I cannot or I am not a prophet. So, cooperation in the 16 megabit could perhaps also somewhat lift the fence between the competitive Japanese. Seen also by them the basic problem is of course the product development in this area. So that was my scope.

The X-ray lithography, I would rather like to imbed in also a more general area, which I would like to call equipment development. I just heard an official opinion yesterday of Mr. Thomas who said that he would not hesitate to make the compatson-thretron (? ?), which as I mentioned in my talk yesterday is to go into experimental trial phase by the end of 1985; access to Japanese industry in that cooperation we would like to establish. This might be extended towards other areas of mutual equipment development.

Finally the standardization question I have the same on my list. The question of voltage standardization, the question of telecom standardization which was brought up as well by Dr. Garbrecht and Dr. Lorenz. But I would like to add two items. (1) New devices and device limits of present devices, and (2) finally the area of superlattice structure, of which excellent work in my opinion was carried out in Stuttgart, would naturally lend itself also to cooperation in the field of basic research. So, I will spend my passion to bridge from industrial 16 megabit memory to basic research. And I think what we have now on your sheet, Sugano-Sensei, the relative wide list of topics --from which we can select and give some priority in the time left for discussion. Not that we should decide but but just collect opinions about priority. Not decision but some weights we put in the time left.

I forgot one topic which I think is a very important one. This is what the Americans would say a go-West approach of NEC in the microprocessor field. I have heard last week during my visit to NEC about these endeavors and I think that looking into--I am not permitted to talk for Siemens but--the efforts at the Siemens research lab on the 32 bit PP4, in this area, there could be perhaps some cooperation in not just standardization but future trends which could lead to a more balance. I would not say to cut the close ties every country has in this area to the United States, but to generate a more balanced situation to get away from the one-way street that is presently in this area.

YANAI: Thank you.

Let me make my personal comment. As Prof. Engl mentioned on new devices, you have introduced new devices here. And on the new devices--what you call the new devices are the transistors, vacuum tubes or rather the new versions of such transistors and vacuum tubes already existent. To make a new version of such traditional, active elements, the basic function of logic circuit just is switching. When we look at a switch, the switch means to connect two separate things or to make contact with those two things. And we have to think about the new devices from such a viewpoint. That is my comment No. 1.

And my second comment has to do with the standardization of microprocessors and also architecture. When it comes to the processing of signals, we have to consider the function which is absolutely needed in the device. Considering the new devices we have to think about such new signals or signal that is required for the processing of new devices. And I hope you would have that view in considering the new devices.

In addition to that I would like to add some dream for the future. The function of human brain. If we can realize the devices which can realize the function of the brain, we can form a network and such a network would be expanded. But we don't have to go such far. But if a basic realization can be achieved, new architecture can be considered to form a new network to realize a more simple network. In other words, we have to take a standpoint from the viewpoint of the function in developing new devices. And I hope that you would take the direction to see the new devices from the viewpoint of function.

That is just my request, personal request. When you say a "new device" I just hope you would take into consideration my comment.

Here, I think we should put priority.

SUGANO: First of all, let me confirm once again. I think we can divide into five areas regardless of orders. One is the fundamental process technology, second is standardization, third is sensor, fourth is the limit of the function of existing devices, and the next is the new devices including the superlattice devices. As Prof. Yanai has mentioned, the device of new function would be included. Therefore we can divide the area into five. If you agree with such a division, we can put priorities. Do you agree, Prof. Ruge?

YANAI: Dr. Garbrecht, could you please give us your comment?

GARBRECHT: I would add the sixth which is the manufacturing automatization. And I could make a proposal, but we will not go into more depth.

RUGE: This is a very good question, whether we should add the automation of the publication processes. As you know there is a big rumor going on. It started in California, United States, whether there would be a full vacuum process or a new area of designs of basic cells. There is a rule that all the chips over[?] 50 sq.mm. cannot be produced with high enough yield. Multilith Center[?] is always telling this. And as you pointed out, a new paper showed a 16 M, and 64 M with 200 and 300 sq.mm. So, what should we do? Work within the vacuum? And then we have to change all the processes. Because the process by itself is producing dust. These are very big problems. The company should check whether this could be a point of cooperation.

Secondly, of course, always a good cooperation is when you begin a new area. Remember in the middle of 1960s, end of 1960s, small groups from Europe, Denmark, and the United States developed a theory of ion plantation. You remember this. And the theory was then the ground for the technology. And we are talking about three-dimensional layers. And you have experimental results and we have experimental results with Walt? Gibbons?, and Stanford has experimental results. But one thing should start as soon as possible. And this could be a good cooperation. With the theory of CAD (computer aided design), how should we design it? We had not been able to decide on two-dimensions and now we are getting three, especially in respect of speed. Because this is the beginning of the theory.

GARBRECHT: Because I brought up the subject of automatization, a kind of dream of an engineer, I make a comparison with photographs. You know the photographs in former days were something very difficult to make. And you have gotten in big equipment setup. But now you have something which you might click and then ready the picture comes out. So, why should we not produce an automat? I mean, you type into a transistor circuit, and it prints immediately like a xyrox copy on integrated circuit. So, when this can be done, you just take or maybe start out with the gate arrays, and then print one or two levels of the matter, which must be--if you are not going to the highest integration--a very good solution. So, this is one kind of automatization I had in mind.

And another one, of course, may be going to automated assembly lines or process automatization.

YANAI: Mr. Ishidate, you are not involved in the actual production, but do you have any comment?

SUGANO: I think there are many good things here. I think there is a possibility of cooperation. The combination of cooperation is left to each enterprise. But the fundamental technology should be created. And I think the creation of such fundamental technology is the area where we can co-operate.

What I would like to say here is that there are two kinds of cooperation, cooperation among countries and cooperation among enterprises. And I think we should have separate views on this. Unless we have the separate view it is hard, and as to enterprises it is very hard to make a decision on how we should proceed with the co-operation. I don't think we can make a decision here at this table. But we can say that there are many ways and there are many possibilities in the way where we can make cooperation on these subjects. And there are cooperations between countries or among countries, and also as a different dimensional I think there is a cooperation between enterprises. And we would like to focus on the possibility of cooperation here.

YANAI: So, today, as Dr. Sugano mentioned we will limit ourselves to explore possibilities of the area where we can cooperate. But the cooperation depends on the area or fields. So, we would like to leave that issue to the next meeting. And at the next meeting we would like to have the discussion once again to decide specifically in what area or in what field we can actually cooperate. Here, we would like to set a guideline as Prof. Engl mentioned. And according to the guideline, in the case of enterprise cooperation, the decision whether or not they should follow the guideline would be absolutely left to the companies.

It is very hard to set or define the priority but roughly we would like to set the priority. Dr. Ruge or Dr. Engl, can we just make rough priority? Do you agree? So, I think there can be two subjects of top priorities.

SUGANO: Shall we vote?

ENGL: ....giving personal opinion about quantifying just to get the rule, or voting is better......

YANAI: Easier I think, Prof. Sugano pointed out that we--probably the participants can raise hands when they feel the subject should be of the highest priority. We have six subjects. Why don't we set a rule in which a participant can raise hands for three subjects.

ENGL: As you know, the technology is moving extremely fast. If we now meet in a year again, it would be better that we don't meet, because we cannot catch up fast enough in our discussion. Therefore, it would be rather worthwhile to pick the two or three items out of the list, and then not wait for the year but maybe we can agree on rather fast actions. Maybe I pick two, I would pick 16 megabit memory technology and I would pick the microcomputer standardization.

YANAI: Shall we deal with such small items?

ENGL: Lithography, laser, X-ray, and EB.

SUGANO: You have pointed out very specific and detailed subjects. Shall we discuss about such detailed subjects or shall we put priority on broader subjects with regard to the possibility of cooperation? I think it is quite different.

ENGL: I would like to make a short remark about what the chairmen of respective working groups have discussed at dinner last night. This is also a partial answer to what Dr. Garbrecht had said, that we should not sit back during the meantime until the next meeting, but the result which we achieve at the respective four working parties should be screened by the respective Chairmen, Yanai-Sensei and myself, getting contact individually with scientists and industry and getting their perspective on what we have said and done here. And then we would meet, he is coming to Germany in September, and I shall come to Japan again in August, and exchange the different views and try to find sub-sets of intersection, and then feed this information back, and in a continuous process try to avoid what you saw as a danger here. Still, since we cannot try to find a decision now, it is really in my opinion not necessary that we actually vote for priority, but get some feelings especially from industrial partners at this table here what might be of special interest to them. Because I said last night that the next meeting will be in Germany and two respective representatives of the governments have pointed out that the governments more or less can only bless what the individuals or the organizations have agreed to, and perhaps smoothen by governmental assistance or paving the way towards bilateral cooperation and assisting to respective organizations, to say in Japanese terms to act as O-miai between two companies. It could be our function here to try to encourage these kinds. And that is my answer.

I don't believe in the cooperation of country to country. Because there is no Japan Incorporated and there is no Germany Incorporated. We are not the Eastern block countries. There it would be possible. But in our situation it would certainly not be.

SUGANO: I support Prof. Engl.

YANAI: Will the Japanese participants, colleagues, agree with Dr. Engl? I think we should follow what was mentioned by Dr. Engl and proceed with our activity toward next year. And we don't have time to hear your opinion on priorities. We will be meeting with Dr. Engl this year again in August and September. So by that time we would have discussions with Japanese members and we will formulate Japanese opinion. And we hope that you would consolicate your opinion on the German side. And in August first of all we would like to have the first discussion with Dr. Engl concerning the result. And I will be visiting your country in the end of September. And at that time I would like to take the opportunity to talk about the selection of the topics there. Do you agree?

SUGANO: I would like to make the explanation in the following session about this.

YANAI: Now, we would like to move onto the Plenary Session. Thank you very much.

(AJOURNED AT 15:22.)

GERMAN JAPAN FORUM ON INFORMATION TECHNOLOGY

Keidanren Kaikan

April 27, 1984

PLENARY SESSION (II)

(The Session was convened at 15:55 with Dr. Yanai assuming the Chair.)

CHAIRMAN: I am sorry for the delay. But since almost all of you have come back here, we would like to begin the plenary session in the afternoon. And first of all I would like to invite each workshop reporter to make the workshop report. First of all, Prof. Ogoshi to give a report on the New Media Session.

OGOSHI: Thank you very much for your introduction. I am from the University of Tokyo, Ogoshi. I would like to give the report on the first session which lasted from one o'clock to three p.m. (1:00-3:00 p.m.) and from three o'clock (3:00 p.m.) we have extended the discussion for 20 minutes to summarize how to make the report of our session. And I would like to point out the items that are to be discussed as the future theme.

Our session started off with two keynote speeches from Japan Mr. Toda, NTT, and Dr. Plank from the Federal Republic of Germany. And after that Mr. Sawabe from NHK has given a talk on the television network. And then we have heard from other members from both countries. And if I were to summarize the presentations, I think I can summarize into the following three items. (1) Public

Telecommunication Network related discussion, and ISDN (Integrated Services Digital Network), and that is I believe the appropriate summary of this type of discussion.

(2) Secondly, in-house network LAN was discussed. Small-scale future oriented communication network was discussed.

(3) And thirdly, the third area of discussion was the high definition television, since this happens to be an area of keen interest expressed by both countries.

So, these are the three categories we have discussed about and I would like to focus on some of the intriguing issues that might be of your interest.

First of all, Dr. Toda discussed about information network system in Japan. And it is to start the operation this year in 1984. And the preparatory work has been proceeding. This was discussed about the state of the work and the future forecast. And as far as the ISDN in Germany is concerned, Dr. Plank has talked about the linkage of telex and telephone, integration of those two since 1985 to 1990. And this would be considered as the primary form of ISDN. And then a wireless form of communication is combined. And from 1990 then the wide band ISDN would be emerged. And that is what he discussed. And BIG FON that we know of belongs to this second stage large scale ISDN in West Germany.

Secondly, as far as the in-house network or LAN is concerned, the West Germany delegates have expressed something very intriguing to Japan. And that is in 1900 the Emperor had ordered that the communication should be completely deregulated within the public areas. And ever since the more and more integrated nationwide network should be developed. Therefore, the protocol becomes very important in order to make this feasible. And that was pointed out by the German delegate. And from the Japanese side,on LAN,optical fiber network is being used more and more frequently than in other countries, that was pointed out. # And on the high definition TV, Mr. Sawabe from Japan has expressed that the research has started in 1970. And he has traced back upward the history of the research about this HD TV.. And also the CCITT they are to take up the development of this HDTV, it was discussed. And from West Germany the keen interest was expressed on the development of high definition TV. And at present a single tube type is being developed to further the technology of HDTV. Because of thelimited time we could not discuss in detail about each subject. So we have decided to skip the in-depth discussion and rather discuss about the future items to be discussed. And we had a very active exchange of our views as to the focal issues that should be left for the future theme.

And we have nine items listed here. And as far as how to deal with each item concerned, I would like to briefly go over our concept.

In brief, one item that was pointed out is the standard and export/import. In order to expand the new media worldwide it is very important to consider the standardization in export/import and secondly the acceptance and use of new media. How is the new media going to be accepted by the general public? This is the area of research. And thirdly, the PABX (private and automatic branch exchange) versus LAN (local area network) is to be discussed. In other words, would there be a compatible situation and how? And fourthly, high definition TV. Fifth, security integrity authentification. So, security related issues should be discussed, it was suggested. And the subscriber loop using optical fibers was also pointed out. The usage of optical fibers would bring out how much advantages and effects? That should be discussed. And we know from certain stage that it is going to be switched to the usage of lead wire. But this kind of process should be scrutinized. And then integrated optics and coherent optical communication, and this is a new technology--a part of the optical communication. And this type of latest optical communication should be perceived. And then theoretical modelling and man-machine interface and LAN before standardization. Before the standardization of LAN is realized, then the theoretical modelling should be made. And then finally infrastructures, specially putting emphasis on the underground network. CATV network in Japan is being constructed above the ground. In Japan that is the tendency here. But in Germany from the initial stage it is done underground. So, I think we should have a lot to learn from the practice in West Germany.

So, these are some of the items pointed out by the delegates as the future themes. I believe that we should pick out about two or three items and identify them as the areas of discussion. So, by mid June both parties' delegates should be able to submit the priority list and the chairman of each country should correspond with each other through letters and summarize and compile important items to be discussed.

So, my time is up and this concludes my brief summary. Thank you very much.

CHAIRMAN: Thank you very much. I would like to have the report from the Computer Subcommittee, Dr. Aiso, please.

AISO: Thank you very much. I should like to report on the results of the discussions of the Computer Subcommittee. We were very limited as to time, so that we gave an overview of the R&D activities that are taking place in both countries. We took a lot of time to discuss this and based on this we have decided to select on the themes which will be taken up in the discussion in the next meeting.

From the Japanese side, we had Dr. Kashiwagi from the Electro-Technical Laboratory who gave a report on the national project of MITI. Already in 1966 MITI had already embarked upon the national project for information processing. On computer related projects and outlines of these projects or targets of the work and results and those projects which are under way, with respect to these projects the present state or the present situation or the present progress of the work has been outlined.

On the German side, we had Mr. Fritsch who has given a report on the German computer R&D work, its organization system, and where the emphasis lies following upon Dr. Thomas' report this morning.

To briefly summarize the two reports, from the German side, multi-network software-oriented new computer architecture and the down-to-earth software technology themes were being emphasized. And Dr. Szyperski explained about the project groups which were carrying out the practical work. Computer architecture group was one. High performance, numerical computation group was another. The third group was the expert system design and development, or the methodology for development work has been conducted by the third group. The fourth group was working on the present software technology. The fifth group was working on pattern and image processing. The sixth group, VLSI, CAD CAN research.

And the seventh group on natural language understanding. So, these are the project groups which are in existence today.

Following the two speakers' reports, the members in the respective roles and positions explained the situation prevailing in their respective countries. From the Japanese side, Mr. Fuchi, Director of ICOT, addressed the fifth generation computers and the present state of these computers, and the recently developed sequential inference machine, and the relational data base machine. These were addressed. And Dr. Kawai spoke on the software technology related issues, and what measures are being taken in order to solve the related issues. Mr. Kishida spoke on how to transfer the software technology and what efforts are being made in this direction. From the manufacturer side, we had Mr. Sato from Fujitsu on commercial computers including the subject of supercomputers. From Hitachi Mr. Uraki spoke on office automation (OA) taking place in Japan. That is to improve efficiency within the offices in Japan what sort of work is being done. And I have also made a contribution on Japanese technology and university research work and the relationship between the university work and other research work which is going on.

From the German participants, some issues related to parallel processing issues were addressed. And fault tolerant computing--the importance of fault tolerant computing was stressed. And how to marry the present technology with the future technology, these subjects were addressed. It was the view of Mr. Kashiwagi that Japan's R&D is future oriented. That is the research work which is pulling the industry. Whereas in Germany the problem is being viewed in a more down-to-earth manner. So, the Japanese research work is more futuristic, where the German's research work is more down-to-earth.

Now, as to what sort of issues should be studied in the future by both countries, when we came to that issue, we were running out of time. So, we could not reach a conclusion. But the following views were raised.

Firstly, it was stated that it was very important to conduct information exchange, and through such information exchange we would probably come to arrive at a common theme. And in deciding on a theme we should decide upon whether we should focus on new technology or whether we should focus on the type of research work which is taking place in universities, or whether we should focus on more practical issues. Further discussions should be conducted regarding this question.

So, some of the candidates for future discussion or the candidate themes for the future discussion were to discuss man-machine interface, fault tolerant computers which may be of more interest to the general public, or the hidden issues. Out of the hidden issues, some issues which the International Standardization Committee has not taken up--to address these issues.

So, although we have not reached the conclusion, we have cited some examples that may be discussed. And in the future Dr. Szyperski from Germany and from the Japanese side Prof. Motooka will be discussing to come up with themes for the next meeting.

Thank you very much.

CHAIRMAN: Next is a report about the workshop on semiconductors. Mr. Sugano would be the reporter.

SUGANO: I am Sugano from Tokyo University. As far as Semiconductor Workshop was concerned, in the likewise manner, we received keynote speeches both from Germany and from Japan. And first of all Dr. Tanaka spoke on the characteristics of the semiconductor industry, like pointing out the fact that the growth rate is very fast and also that the technological development is going on very fast. So, those points have been made by Dr. Tanaka. And also, particularly in Japan, the semiconductor industry of Japan, its research and development work has been touched upon. And following that from Germany, Dr. Garbrecht made his presentation. Also he touched upon the general, technological trend of the semiconductors. Afterwards, particularly, the semiconductor industry situation in Europe has been emphasized. And also the particular characteristics found only in Europe have been emphasized.

And later on from the Japanese side the participants of Japan made brief comments or short talks one after another. Mr. Takahashi first of all talked about the superlattice. Using the superlattice the device can be made. And also particularly with regard to wafers, on the vertical direction the current can be flowed, in the vertical direction to wafer. This is one of the optical integration possibilities. And this is one of the interests. Also from ETL Dr. Kataoka spoke about the three-dimensional integrated circuits. This is what has been done in Japan. And experiments and trial production of three dimensional ICs have been made in Japan. And the reference was made by Dr. Kataoka. From Nippon Electric Company, Mr. Ishidate talked about the microprocessor R&D status in Japan. He touched upon the past picture as well as the current picture. In addition to that he touched upon the future prospect. Also, particularly, he had cited the example of NEC (Nippon Electric) and spoke about the standardized form of the microprocessor and the unique development that has been conducted in NEC. So, this has been touched upon. From Toshiba, Dr. Odagawa made his short comment regarding the large capacity memory chip. And the processing technology of that large capacity memory chip has been touched upon and the trend has been presented. In particular the semi-custom Si-MOS IC has been touched upon. Semi-custom LSI using Si-MOS has been touched upon. And the importance of them has been emphasized. And lastly I myself made a short comment regarding Si-MOS and NMOS scaling down issue. Intercircuit voltage standardization was one of the important point that I considered.

Now, the major objective of the workshop today was that both Japan and Germany were doing something and we wanted to find out and identify the possible areas for cooperation. So, using what time left available we continued our discussion to focus on the potential fields for cooperation. And I would like to use the bibliograph to show you what we have discussed.

First of all, the fundamental process technology. As I mentioned before, there is a large capacity memory technology existent. But not only that technology but also the general fine pattern lithography has to be taken into consideration also. And one example is lithography. So, this has been pointed as one of the example. In particular, the X-ray lithography has been emphasized. Because Messy ? of Germany is conducting X-ray lithography experiment using the SOL . And there has been made joint effort among the five different companies in Germany concerning lithography, And also in ETL, which is Electro-Technical Laboratory in Japan, it has also been using SOL for the purpose of research. And also at the High Energy Physics Research Institute they are also using the SOL to conduct the research on X-ray lithography. Therefore, things like X-ray lithography can be one of the candidates for, and the important candidate for that matter, mutual cooperation. So, I think that was the general agreement reached.

Also further in addition to the X-ray lithography a comment was made that the etching and pattern transfer technology is not the only thing that matters. There was a comment that equipment related to that must also be developed. And the discussion took onto a wider context of discussing about the equipment side as well.

The second example I can name is, as was mentioned by Dr. Kataoka in his presentation, there is a 3-D IC (three dimensional integrated circuits). And the technology related to that can be also one of the mutual cooperation area. Particularly, what is called the three-dimensional integrate circuit designing is also one of the important problems to be pursued in the future. And also the device can be arrayed in two dimensional phase at this time. But we are having difficulty at the point of the two-dimensional; so, if we are to add one more dimension to make it a three-dimensiona you can easily imagine how much difficulty we have to face in future.

With regard to the 16 megabit memory technology, the optics is one of the technologies that we can use but optics technology might be difficult, so that X-ray lithography has the highest likelihood for implementation. So, this is the memory chip which can make use of the X-ray lithography. So that, as far as the 16 megabit memory technology is concerned, there were some possibilities mentioned.

Also, secondly, as to the production process, the automation of the production process has been pointed out, as well. Of course, in the mass production facility the automation can be conducted. But that is something to be handled by each enterprise and each individual company. So that there are some problems foreseen among and between the individual enterprises. However, there is some basic nature of the problems concerned in the production automation, which one can address. That is to say, one process can be enclosed in a vacuum environment. And if that is a case, then if this production process become possible, then what process technology we have at the present has to be changed drastically in future in order to cater to this new mode of production. Therefore, this area has also been discussed as the potential field for mutual cooperation.

Also presently, particularly with regard to the silicon device, the size is becoming smaller and smaller. But what will happen if the silicon device is made to the smallest? Along with the compactization of the silicon devices, there are problems associated, like performance related problems which will receive some impact. And what is the limitation to making the silicon device smaller in size? This is a very highly academic issue, where we can also pursue a possibility of cooperation.

In addition to that, in the electronics and mechanics, the marriage between the electronics and mechanics can be seen. If that is to be conducted, then the sensor technology will come into the picture as one of the important elements. In Japan, in the ETL and others--mainly around ETL--the sensor-related development has been going on in a concentrated manner. Therefore, the research on sensor is one more possibility of having the mutual cooperation.

In addition to that, we do have the conventional approach of gates. But rather than that in terms of system requirements there are certain functions which one can expect. That is to say, the conventional mode of identifying the function has been such but perhaps there is going to be a new functional device which will fulfill the new functions for future. This is a totally new field, and a totally new field for academia. Therefore, this field would also deserve much wide attention between the two countries for possible cooperation.

Going on further, maybe it is one of the practical things but as one of the international cooperation, the standardization is very important in terms of the international cooperation. The general purpose microprocessors and others, the specifications of which have been uniform or standardized under the initiative of the United States. But perhaps Germany and Japan can unite together and have a large share in the world market combined. Therefore, we also touched upon the possibility of standardizing the new areas as well, in addition to microprocessors.

As I have mentioned before, as to the semi-custom LSIs, presently each country and each enterprise are working on the design methodology on the individual basis. But there are design tools and interfaces which must also be standardized if possible. For this matter, perhaps Japan and Germany can also collaborate in order to bring about standardization. Also with regard to Si-MOS and NMOS, as one goes on the scaling down, the circuit voltage will go down and will be reduced. So that the conventional type of TTL compatibility must be discarded at one point or another. Therefore, this is not something which can be handled by one enterprise or one country. Therefore, here we see the necessity to have the international, multilateral consultation.

Also in the field of telecommunication equipment, such a standardization effort is redeemed to be desirable. So, this has been the discussion at the workshop.

The important issue here is that we are talking about the possible joint effort. And it is easy to enumerate the possible topics and themes. But implementation is the important thing---much more important thing than just listing up possible topics. Of course, the governmental level cooperation is one of the possible areas. That is inter-governmental cooperation. But there are so many difficult problems associated with it. Therefore, on the individual enterprise levels, also inter-enterprise collaboration can be foreseen, as a result of negotiations between or among the corporations concerned.

After the workshop was over, I was talking with Mr. Engl and he was kind enough to give me a suggestion, that between Japan and Germany the harmonious relationship can be pursued and, if such a collaboration is made between Japan and Germany, we must be careful not to frighten other countries which are outside of our cooperation. And also in the semiconductor workshop we were fortunate to have Dr. Engl and Dr. Yanai as Chairman. And Dr. Yanai was the Chairman of the Semiconductor Workshop. And between Dr. Engl and Dr. Yanai the concrete terms for carrying out such a harmonious collaboration would be discussed. So that there is going to be a continuing discussion between the two gentlemen. And during this summer both doctors are expected to visit each other at each other's countries. So, by autumn or some time in autumn, I think we can come up with a concrete idea as to how to go about in bringing about the actual cooperation. And I think an agreement can be reached by then.

That is all I have to report.

Thank you very much.

CHAIRMAN: Thank you very much. So, with this we finish the reports from each workshop. We are now about to enter into a general discussion period. But we only have little time left. But if you have any comments you are welcome to give it. Dr. Engl, do you have anything to say?

ENGL: At the moment all I can say is that I am surprised myself about the manifold of topics which could be at least touched in such a short amount of time. That at least proves the fact that the right kind of people were sitting together. And in the future we have to do some screening function. Because if we meet only once a year, we must rely on a few individuals who carry the ball along in the meantime. Otherwise, we perhaps treat only history, and really climb not to the point where we look into the far reaching future together. And it will be the task of Yanai-Sensei and myself to keep the ball rolling. But we ask the assistance of the chairmen of the working groups and the members and organizations which they are representing here to help us to bring these collaborations about to the benefit of the people of the both respective countries.

Thank you.

CHAIRMAN: Thank you. Does any participant have anything to say? If you have any short comments, please raise them.

The German chairmen who have served chairmanship for each work shop, I would like to ask some of the views from them. So, from each of the German chairmen who have served for the work shop--for the first workshop Mr. Baack, would you have anything to say, any comments or any observation? Dr. Baack, please.

BAACK: Thank you. Mr. Chairman, I believe all subgroups have the same problem. In every subgroup so large a number of topics have been found and we in our group had the special problem to select the most important problems. I believe all the other groups had the same problem. I think it should be the best way to think about the different problems within the next weeks, to find out the priority of the topics. With specific collaboration between the different delegates, Japanese and German delegates, we must find relatively small scale of topics that could be worked out together. Otherwise, if we could get the problem--that is, a very large amount of topics could be in the field and nothing could be realized elaborated from them--we must find in our group about two or three problems that could be really carried out. On the other hand, we found that there are two different types of problems. The first type is strongly related to the more scientific area, and the other one is more user oriented. Therefore, it should be useful to find, I would say, two different groups. The first group could be related to the question, in our group for instance, of integrated optics and coherent optical transmission. These are typical scientific works. On the other hand, in the group of more user-oriented problems, they could handle the problems of standards and local area networks and so on. All together, I would say that in the next time we must build two different groups. One for the scientific-oriented problems, and the other one for the user-oriented problems. And within these groups we must find one or two topics that could be elaborated within the next time.

Thank you.

CHAIRMAN: Thank you very much.

Next, I would like to invite Prof. Szyperski to comment. Please comment about the second workshop.

SZYPERSKI: Thank you so much, Mr. Chairman.

As you could understand out of the presentation and the report of our group, we had an overwhelming flow of different aspects and the complexity of the theme "computer", from the super computer to the personal computer, from the technical aspect to the man-machine aspect. There were really fields of subjects rather than only a set of them. So, one conclusion that came out is that we have to prepare a meeting of that type after getting acquainted, maybe, with the forum we are dealing with at this time. We should prepare in the time in between the smaller groups the work and the discussion for the next meeting.

By discussing the question of what type of subjects we should choose, we have to take into account on the one hand that the subject should be of interest to the industry and the research organization as well. And that, of course, is the implicit question: What are the research-oriented topics the industry and research organization are cooperating on?

On the other hand, to get a special feature out of that type of meeting, we should make clear that that is not a normal workshop or another congress on a special subject, but to find out subjects of importance to the economy of both of our nations. So that it would be able to have some impacts out of the German-Japan Forum on Information Technology on the public in our own countries.

Thank you so much.

CHAIRMAN: Thank you very much. I would next like to invite Prof. Ruge to give your comment on the session on semiconductors. Or you could give an overall comment as well.

RUGE: At the beginning of our discussions, we found out that we have to be careful to choose subjects which are too short ranged, that means, which are in the development or maybe soon in production at the industry. Because as you know this is a very rapid moving area-- our semiconductor device or integrated circuits area. So, as Dr. Sugano told you, we found out some area topics and areas of mutual interests, and also areas where we can work on a give-and-take basis. That means, the work is done in Germany as well as in Japan in several laboratories. And we found out those subjects which will be of industrial interest, let's say, starting within six years or five years, and which will be of industrial interest starting in ten years. As I have the feeling we covered a broad area of forthcoming subjects also of industrial interests in the semiconductor region.

Thank you.

CHAIRMAN: Thank you very much. We have just heard from three chairmen from West Germany. I would like now to invite any other comments from the floor, and please feel free to express yourselves now.

From the New Media Session and also from the Semiconductor Session, chairmen from each session have mentioned about how we should proceed in the future. And Prof. Sugano has mentioned this, but Prof. Engl will be visiting Japan in August. And also I would have to visit West Germany from the end of September to October. So, with Prof. Engl I would have an opportunity to discuss about the procedure in the future at least in two occasions. So, I would like to take advantage of those occasions and discuss about these sessions composed of the members from both countries. And we should take up some important issues with the objective of stepping up the cooperation on the bilateral basis. I think it will be very important to do so. From the New Media, the Chairman mentioned that around June the Chairman should be able to summarize the important issues to be taken up for the next meeting. So, about the specific workshop, I would like to urge everyone of you to examine about the future themes to be discussed. Then, as a result, after receiving your comments, I would like to discuss about what to be discussed with Prof. Engl on a personal basis. And then I would like to feed back your views and our views. And I will be bringing those comments from you to Germany when I visit Germany in October. And at that time I would like to discuss about what to be taken up for the next year's meeting around October this year.

And do you have any comments about this, Prof. Engl? Or I could hear from the floor.

ENGL: This is the way of operation which we reached in our personal discussion. So no further comment to that from my side.

CHAIRMAN: Prof. Thomas.

THOMAS: Thank you. As I said, the government will not intervene which kind of discussions may come up following this forum. But I would like to bring up a procedural question, if you allow me, Mr. Chairman.

CHAIRMAN: Yes, please.

THOMAS: For each of the three groups it is very important to have a common understanding about possible themes. This is not fully reached today. It is partly reached. Some of the groups have well defined themes, others may work a little bit more on that.

To define the theme shouldn't take, let's say, not much more than six weeks. Because, when we have reached that stage, it is necessary, I think in both countries, to communicate with those who are not able to be here but should have a word on what is happening in the forum, and in particular also the people from industry, of course, in order to find out which of the themes find most enthusiastic support in particular by industry.

So, we may begin with 10 or 15 themes, it doesn't matter, and maybe then the Japan side comes over with four and we come over with four. But they are different but maybe two are matching. And then we are through with the procedure. We have to have the procedure which really involves science and industry who are not present. At least this is for Germany the case. Therefore, I say we have to have a clear definition within six weeks of themes and try to use the time in asking our respective siience, so that when Prof. Engl is coming to Japan he brings already with him the German view and may hear in Japan about the Japanese view. So that after this intervention process, latest in October we are fully clear what are the themes and who are the interested people and companies to join in these themes, which is very important. For example, I imagine that we are going to ask in Germany the companies we think in some way or in other way connected to the themes which are defined in the beginning. We will ask them, "Would you like to join? And what is the level you would like to join?" And if we see that there are not many or not much interest, we would of course recommend not to take that up. And if we see there is an overwhelming interest, we will try to convince you to take that topic up.

In this way we may have a procedure where we may have a consensus in October, which has already a broad base in order that the attendance of the next forum is as well as for this first forum, which I find extremely interesting and I was very thankful for this kind of participation on both sides.

This is what I wanted to say for procedural question, not interfering with the themes themselves.

CHAIRMAN: Thank you very much. We have just heard from Mr. Thomas about the procedural issue. And that I think corresponds with our idea as well as what I have discussed with Prof. Engl. So, that procedural issue is now taken care of , and I am sure we can accept your idea. As you mentioned, the Japanese side also feels that not all the members were able to participate or not all the companies have taken part in this forum. So, also in Japan I would like to encourage the participation of more companies and have more basic consultations about the themes to be taken up with more participation. So, for that purpose more than six weeks should be needed. And that I think is understandable. By the end of June-- Mr. Thomas insinuates that we need that much time to consult among ourselves. And I think it is well taken. And perhaps we can give it more time till July. Then we will have more than two months to have internal consultation in each country. And we have the summer break. So, perhaps July is not a good month. At least we should allow more than six weeks time. During this time period, in both specific countries we should discuss with the companies concerned about the future forum. And within August we can come to some sort of an agreement and understanding. And in September--well it may be about six weeks or so, but we can have the second process of discussion, consultation. And I think we can follow this suggested schedule that Mr. Thomas has mentioned. Would that be all right? So far is it acceptable? So, by October we should be able to identify the issues to be taken up for the next year's forum and we can start working on various types of preparatory work for the next forum by October.

Any other items should be taken up? Anything else from the floor? Yes.

MOTOOKA: I think we have to consider the characteristics of the themes. And when we consider the characteristics of the themes, we have to consider that this forum is the government based forum. So, we have to decide whether the themes should concern the governmental concern or the concern of the private sector. Which perspective should we take? The private sector oriented themes or the government sector oriented themes? So, I think there are two different characteristics if we stand on the perspective of the public sector vis-a-vis the private sector. So, I think we should clarify which perspective or what perspective we should take. So, in this plenary session, I believe it is important to have some sort of directioning at least.

Thank you very much.

CHAIRMAN: This I believe is a suggestion made from the floor. From the Japanese delegates, from MITI, I would appreciate it if you could give some comments in response to this suggestion. But prior to that, this forum was initiated from the German Agency of Science and Technology. So, perhaps we should hear from the German governmental sector. So, now, I would like hear from Mr. Thomas, representing the Ministry of Research and Technology. Could you respond to this suggestion about the characteristics of the themes? When we select the themes, what type of perspective we should have, could you elaborate on your point of view?

THOMAS: Well, there are two dimensions which you can use. One is the government-private industry dimension and the other is maybe the time dimension or the time horizon. If you want to express the idea that is for a long term development like your fifth computer generation, this is a government type. Whereas the more short term is the private industry type. I would agree with the government type. But if you want to say with that that the government should decide about the themes and it should be mainly government influence for this discussion, I would not agree. I think the basic idea of the forum is that those themes are such that are very interesting for companies. Because if they want to survive and still be alive in ten to 15 years, they have to think about it today. This is the kind of themes we should like to have. Now, of course, in many cases companies try to survive in next three years and not in the next 10 and 15. This is right. But I think it is just the question of priority. We should not take up, as was discussed several times, any theme which is interesting for the industry in the next two or three years. But it is our view that we should not take up themes which are not interesting to the industry. So if you take the two sets together, and where they match we find the areas. It seems to me in particular in the groups of New Media and Semiconductors that they have identified a number of such themes. It seems to me that if the group of Computers would have had another hour to talk, it would also have identified such themes.

I also heard it was more difficult because the Japanese side presented a very streamlined approach and the German side presented a mosaic type approach. But still maybe after another hour they would have reached a consensus.

So, I am very optimistic that we find themes which are future oriented but interesting for industry and science at the same time, if we accept what I have said.

CHAIRMAN: Thank you very much, Mr. Thomas. Prof. Motooka, please.

MOTOOKA: Yes, in basic terms, I understand what Mr. Thomas suggests. Let me cite an example. In the Federal Republic you have started a few new projects and in Japan we have a few new projects under way in the technological fields interesting to us. Between the government and industry there must have been a discussion in the Federal Republic before you chose such topics for research projects. Take for example, for computer development the fifth generation computer project is under way in Japan. And the development of supercomputers is another project in Japan. You have in Germany similar projects for these technological areas. Then we might consider possible cooperation within the framework of these projects, simply because both nations have considered these areas to be important technological areas and both nations are interested in these projects already.

CHAIRMAN: Would that be agreeable or do you have any comments on that approach? Mr. Thomas, do you have any additional comments to make in response to Mr. Motooka's suggestion?

THOMAS: I have to withstand the temptation which is to take up themes and say what I think would be most interesting. I will not do that. But may I say the following?

It is not necessary that all three groups are present in the next forum meeting. But let's find those themes, let's try to find those themes where there is a well defined, already well defined give-and-take basis.

Secondly, it is my feeling that maybe in two or three years in the themes which are connected to the fifth computer generation as you define it, perhaps in two to three years there is a give-and-take basis.

Today it doesn't seem clear enough. It might be but it does not seem clear now. Whereas in other fields I see this common interest much more clearly. So, what I thought would be a practical solution. We have from two other groups very elaborate and well understood proposals. If Prof. Motooka and Prof. Szyperski could come together and try to find out whether there are two or three things where common interest is probable, where the common interest is clear enough, then let's try and follow our procedure. It is not necessary to go too deeply into the subject now.

Thank you.

MOTOOKA: Thank you very much, Mr. Thomas again. It seems that the Computer group has had difficulty in finding suitable topics. We are not saying that we do not have any problems to be studied jointly. But we are simply stating that we have had difficulties in selecting from a multitude of problems that we can possibly pick up. Fault tolerant computers would be one topic and machine-man interface and super computers can be another topic. The parallel processing is another. And the problems associated with gate ways to LANs--there are many topics. Therefore, please do not misunderstand us. Because we have a multitude of problems that we can work on together.

CHAIRMAN: Well, there might have been some misunderstanding but generally speaking I believe Prof. Motooka understands what Mr. Thomas proposes. And I think we can narrow down the range of topics. We have too many at the present moment. So, we can narrow down the range of topics for possible discussion and work jointly. Would that be a satisfactory approach?

Now, gentlemen, are there any comments from the floor? Seeing none, I would like to close the forum at this moment. But before doing that, I would like to say a few words.

Even though the time was limited today, I appreciate your active participation in the forum sessions today. We have, I believe, completed the forum discussions as we scheduled. On the basis of the discussion which took place today I would like to present you a few personal impressions as a means of concluding or summarizing the discussions.

As the economic and social conditions in the world seem to be moving toward society hinged on sophisticated information systems, semiconductors, computers and new media are all part of new technologies which are revolutionalizing our society and would provide the motive power for the revitalization of the world economy in the future. The expanded use of information at all levels of the society would contribute to the building of an affluent society for mankind. As I said in the morning, the Federal Republic of Germany and Japan are both keenly interested in the sophisticated usage of information. And I believe it is necessary or incumbent upon us to cooperate in this field.

As was indicated in the reports from the subgroups activities in both countries in the field of information technology have been very active and have obtained a remarkable achievement. The Federal Republic of Germany and Japan belong to the free economic regime of the world. And the principles of competition can be given the maximum room of operation. As Mr. Thomas pointed out there are some countries prone to protectionism. Nevertheless, Japan and Germany must aim for open economy and markets. I sincerely hope that our cooperation would be condusive to the progress in that direction.

In basic technological fields, Germany and Japan stand in the positions of complementality to each other. Therefore, this mediates for strong cooperative relationships between our two nations. In this context the forum that we have had today and similar opportunities on an expanded basis would be useful for the mutual cooperation in these fields between our two countries.

Sets of topics have been suggested by the subgroups of this forum today. A large number of topics, subject matters are of interest to each group of this forum. I would urge you to boil down and narrow down the range of topics for joint consideration to be performed in our forum next year. So that we can be as useful as possible for the two nations.

I am gratified by the fact that we have attained the objectives of this first forum today. I have been talking with Prof. Engl about the approaches to be taken for the next forum. And I am sure that we can come up with a good set of approaches for the next forum, which will be held next year in the Federal Republic. I look forward to seeing you all in West Germany next year and to have fruitful and informative discussions on these topics again.

I thank you for your attention and participation in this forum.

Now, gentlemen, about the date of the next forum to be held in Germany next year, Mr. Thomas, do you have any idea about the specific date for the next meeting or the next forum? Or Prof. Engl?

ENGL: The proposal was made that we should set up the date such that it somehow, before or after the Hannover Fair, would allow the participants to take advantage of this event. There are some problems with respect to to the Easter period in Germany. So, we have not yet a clear picture. We would work towards this goal, if you think--and I would like to have your comment--that we should try to achieve this. If you this this is an important issue, then we of course cannot change the Easter date, that's fixed in the calendar, but we could try to somehow move around and find a nice place and try to find some compromise. Is there any opinion? If any I would like to get from you now.

So, we have some opinion here before the Fair. That, of course, is always a problem with the industry. They are busy before the Fair and exhausted after the Fair. So, there is a problem at any rate.

CHAIRMAN: During the Fair, we think, is also good.

ENGL: We would like just to have an opinion from the Japanese side if you would consider this an important issue or if we would rather have some more quiet period and we would all be locked up in a nice location--that is the essential question. Because the Hannover Fair is always a very busy time. I personally do not earn too much those monster shows. I clearly prefer a more quiet atmosphere for coming together. So, we will try to get some opinions about it. We are not in the position to make a decision off hand now. So, let me also make some closing remark just touching a completely different topic.

My topic will be very short now. I think we all had a hard working day and so we deserve now enjoying the reception and use this possibility to get better acquainted on a person to person basis. And so let me close by saying, "Ikimasho." Let's go.

(APPLAUDS)

CHAIRMAN: We have prepared a reception. The reception will start at 5:30. The room is the same as where we had lunch. Thank you very much.

(ADJOURNED AT 17:10 P.M.)