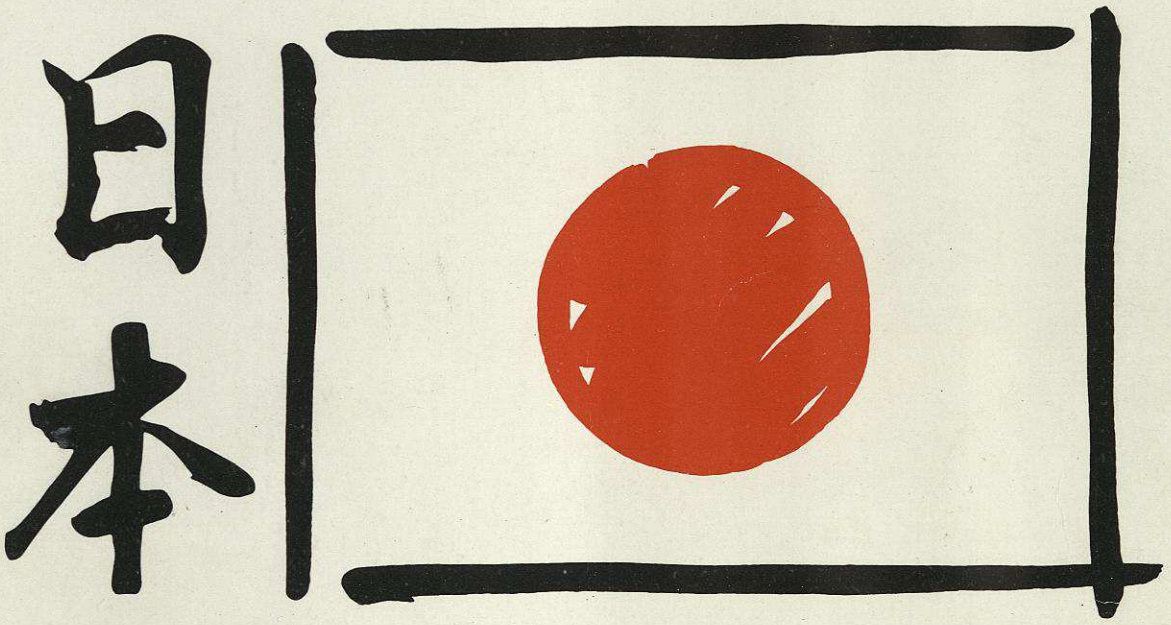
Presentation Summaries

BUTLER COX FOUNDATION



Study Tour Japan 1986

DSS

1986 STUDY TOUR OF JAPAN

Introduction

This document has been produced as an aide-memoire for the participants in the Butler Cox Foundation 1986 Study Tour of Japan. Each section records the details of the visits made during the tour.

The information presented here is essentially that provided by the host organisations at the time of the visits. Care has been taken to reflect this information as faithfully as possible, although working from spoken presentations, and without a full transcript, neither completeness nor total accuracy can be guaranteed. Each of the host organisations provided Butler Cox with copies of any visual aids used during the presentations, and a selection of these has been included where appropriate.

Some of the host organisations were prepared to discuss particular information that they would not want to see recorded formally. We have endeavoured to respect these wishes wherever they have been brought to our attention.

We would again like to record our thanks to all of the organisations and individuals we visited. We believe that these notes will help the delegates to derive the fullest benefit from a very informative and highly intensive tour.

Corrections on Fujitsu session

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THE BUTLER COX FOUNDATION

1986 STUDY TOUR OF JAPAN

CONTENTS

MONDAY 14 APRIL

NEC CORPORATION

NEC is 87 years old, and has offices in 140 countries. It has seven plants in Tokyo, 45 subsidiary plants, 100 offices throughout the world, 90,000 employees, and has annual sales of $9 billion.

MODERN COMMUNICATIONS SYSTEMS

The first presentation, by Mr Usukura, described NEC's 'modern communications system: C&C'. C&C stands for communications and computer technology, and is concerned with the application of computer technology to communications facilities. Representative applications are:

—ISDN (integrated service digital networks).

—VAN (value added networks).

—OA (office automation).

Figure 1 shows that there are three main elements to modern communications. Conventional communications only encompasses information transfer, whereas data processing handles mainly numerical data from its generation to its storage. Figure 2 shows how C&C embraces both conventional communications and data processing and will expand to encompass all information handling functions and all information media.

Figure 1 Elements of modern communications

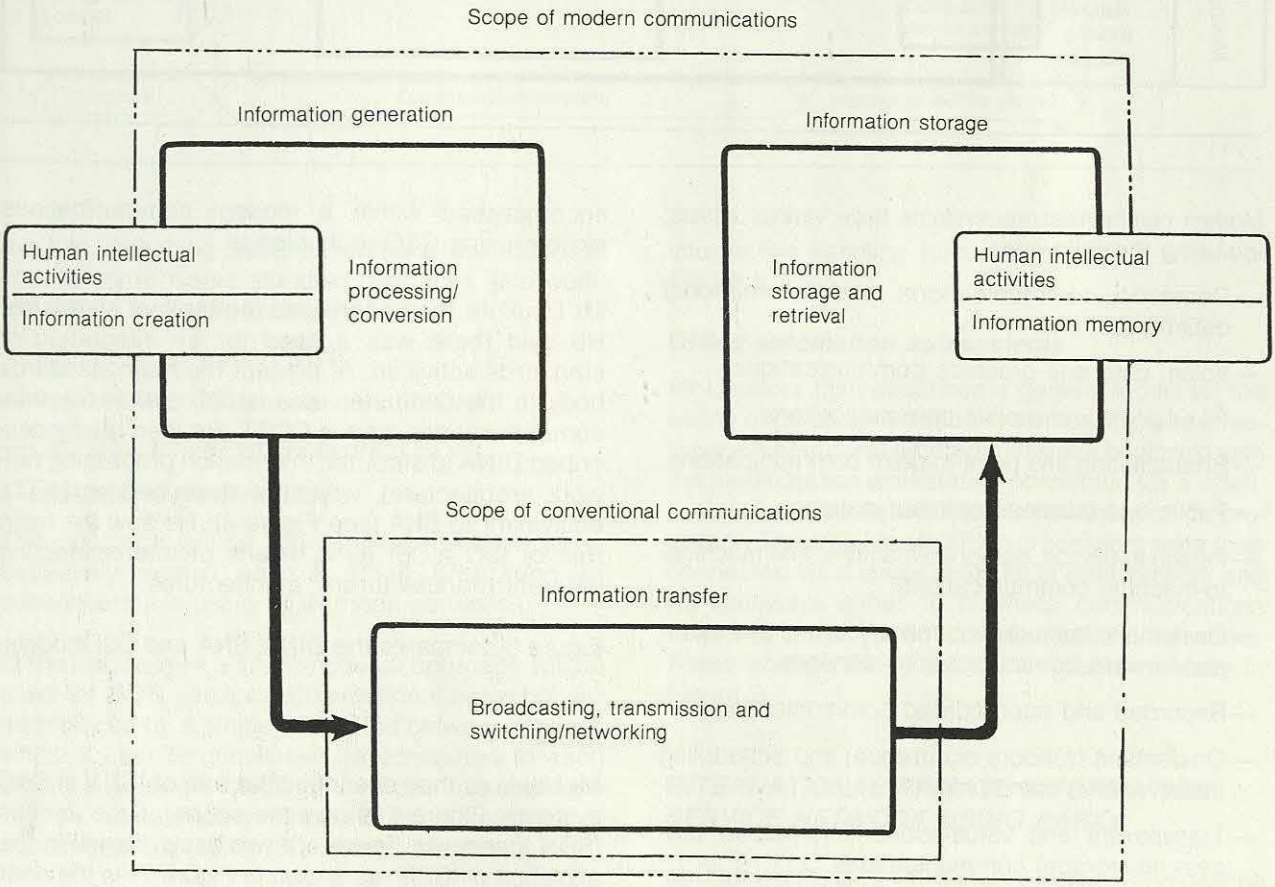
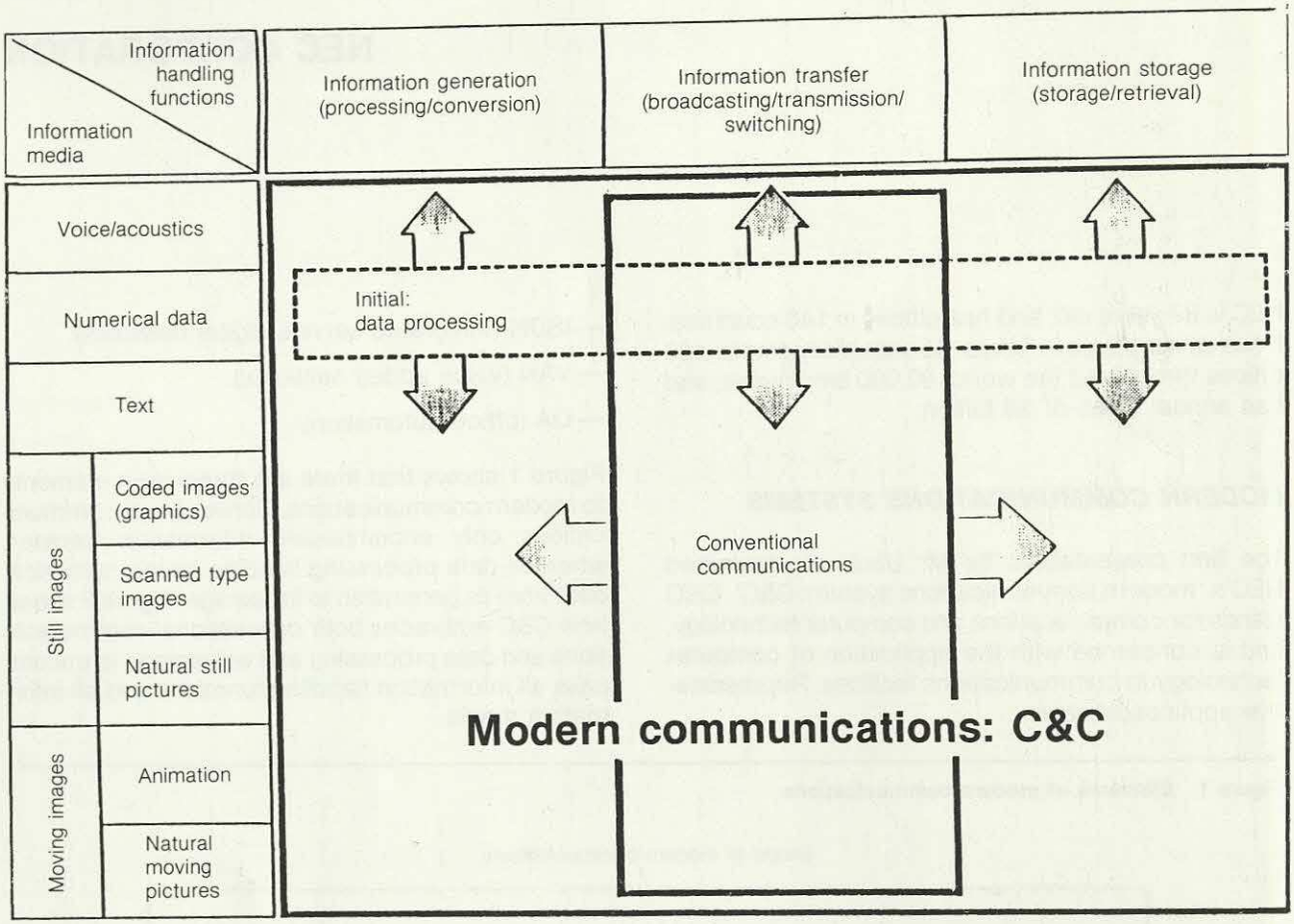


Figure 2 Modern communications showing functional areas of C&C



Modern communications systems have various assets, including the following:

—Domestic communications and international communications.

—Voice, data and graphics communications.

—Fixed-point and mobile communications.

—Broadcasting and point-to-point communications.

—Public and business communications.

—Person-to-person, person-to-machine, and machine-to-machine communications.

—On-demand immediate communications and store-and-forward communications services.

—Recorded and nonrecorded communications.

—On-demand (random occurence) and scheduling (reservations) communications.

—Transparent and value-added (information processing/storage) communications.

Figure 3 shows how many of these assets can be encompassed within a modern communications system using C&C technologies.

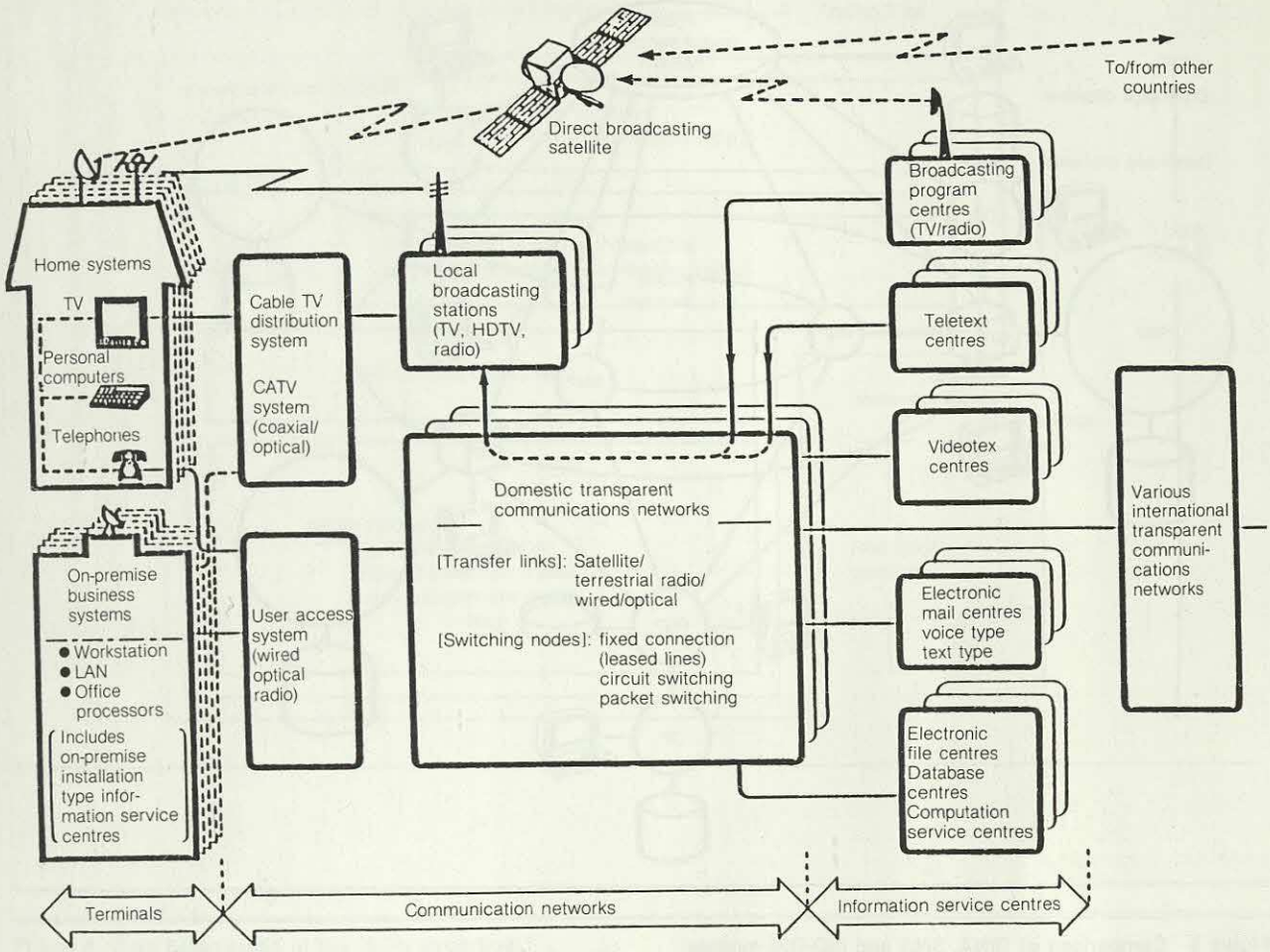
Mr Usukura then addressed the topic of standards. He said there was a need for an integration of standards activities. At present the main standards body in the computer area is ISO and in the telecommunications area is CCITT. He then briefly described DINA (distributed information processing network architecture), which he described as NEC's equivalent to SNA (see Figure 4). He saw the main role of ISO's OSI as a means of interconnecting different manufacturers' architectures.

Figure 5 compares the DINA, SNA and OSI models.

ISDN

Mr Usukura than described the role of ISDN in C&C systems. Figure 6 shows the scope of the various ISDN standards. There are two basic stages in the evolution of ISDN, as shown in Figure 7. In the near future, ISDN services will be able to interwork with

Figure 3 Overall composition of modern communications systems possible with C&C technologies



existing switching systems without the need to change conventional, standard interfaces. Interworking will be available to the:

—Telephone network (PSTN).

—Packet-switched data network (PSDN).

—Circuit-switched data network (CSDN).

—Leased-line network (LLN).

This approach will be economic in the short term, especially where only a small proportion of subscribers are using ISDN-mode services.

In the longer term a single-network approach will be used for ISDN services. Conventional networks will be replaced by a single integrated network. Various kinds of user terminals will be connected to each other via the single integrated network. This approach will be economically viable when a majority of subscribers are using ISDN-mode services.

The scope of ISDN in terms of the three fundamental information handling functions of C&C is shown in Figure 8.

Office automation sub-systems

Mr Usukura then described a general model for the wiring of office automation systems. This was effectively a hierarchy of different networks beginning with the multifunction workstation connected via a small-scale local area network to a small-scale office processor. The small-scale office processors were then connected via a larger scale local area network and via gateways either to business communications networks or to public communications networks. These configurations are shown diagramatically in Figure 9.

INTERNATIONAL PRIVATE INFORMATION SERVICE NETWORK USING PABXs

Mr Gotaro Sugiura, systems manager, engineering corporate information systems division, described

Figure 4 NEC's DINA (Distributed Information-processing Network Architecture)

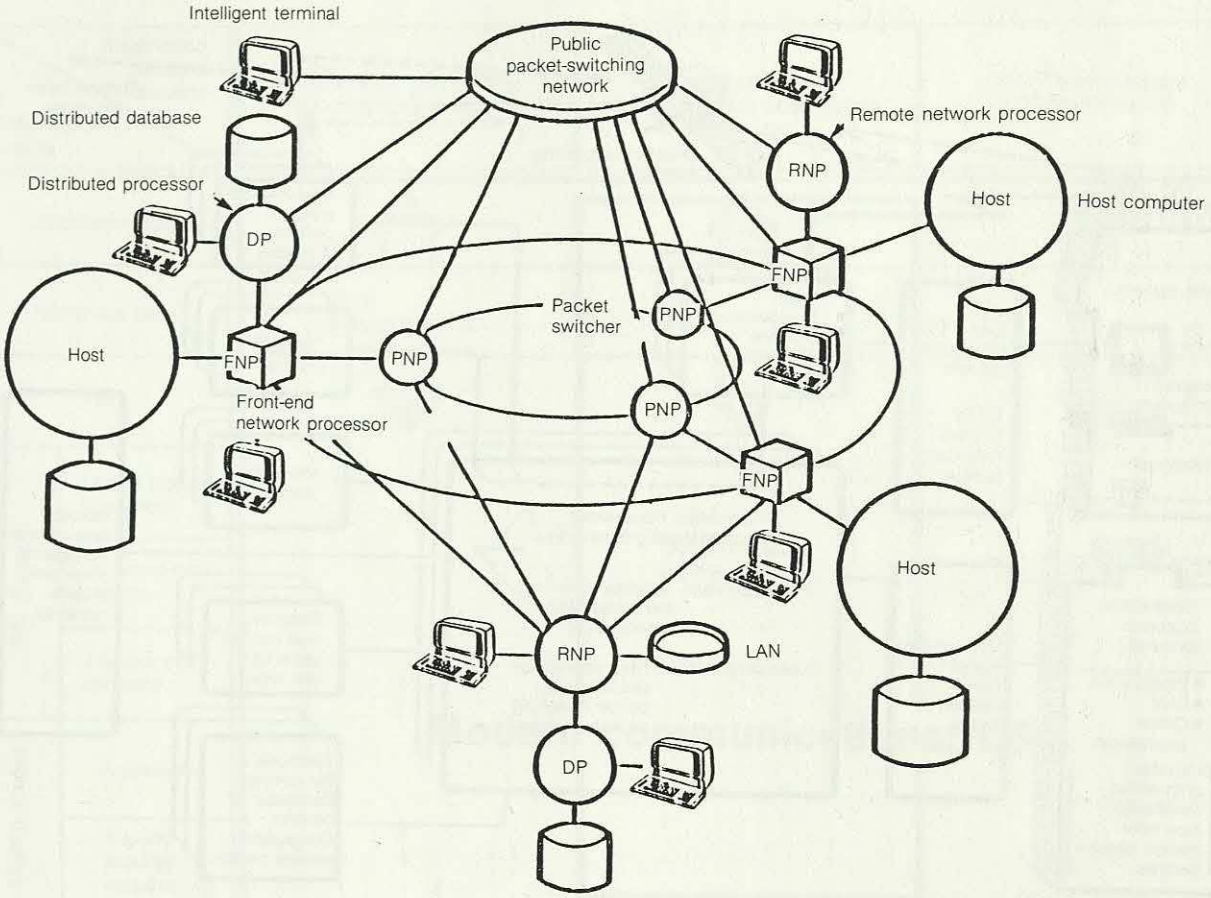


Figure 5 Comparison of DINA, SNA and ISO-OSI models

DINA		ISO	SNA	
Application		APPLICATION PROCESS (out of definition)	End user	
		APPLICATION		Service manager
Functional control	Presentation service	PRESENTATION	Functional management	Presentation service
	Data flow control	SESSION		Data flow control
		TRANSPORT		Transmission control
Transmission control		NETWORK	Transmission subsystem	Path control
Link control		DATALINK		Data link control
Physical control		PHYSICAL	Physical control (out of definition)	

Figure 6 Scope of various ISDN versions

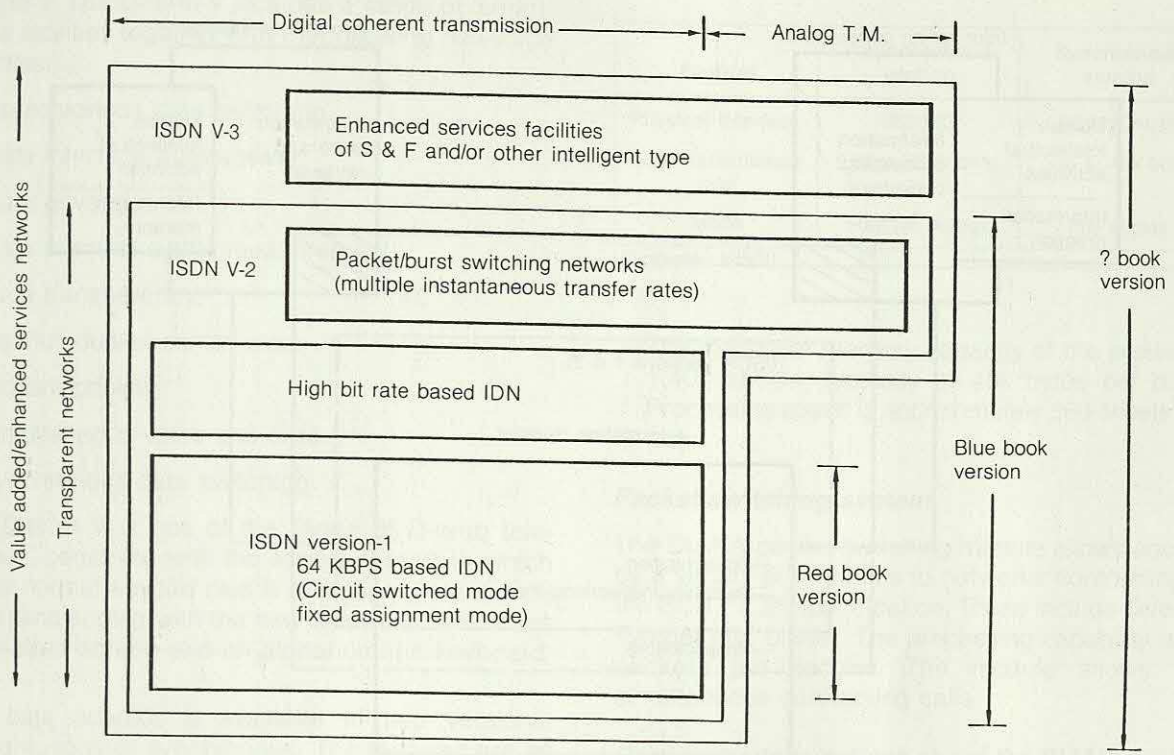


Figure 7 Two basic steps of the ISDN evolution

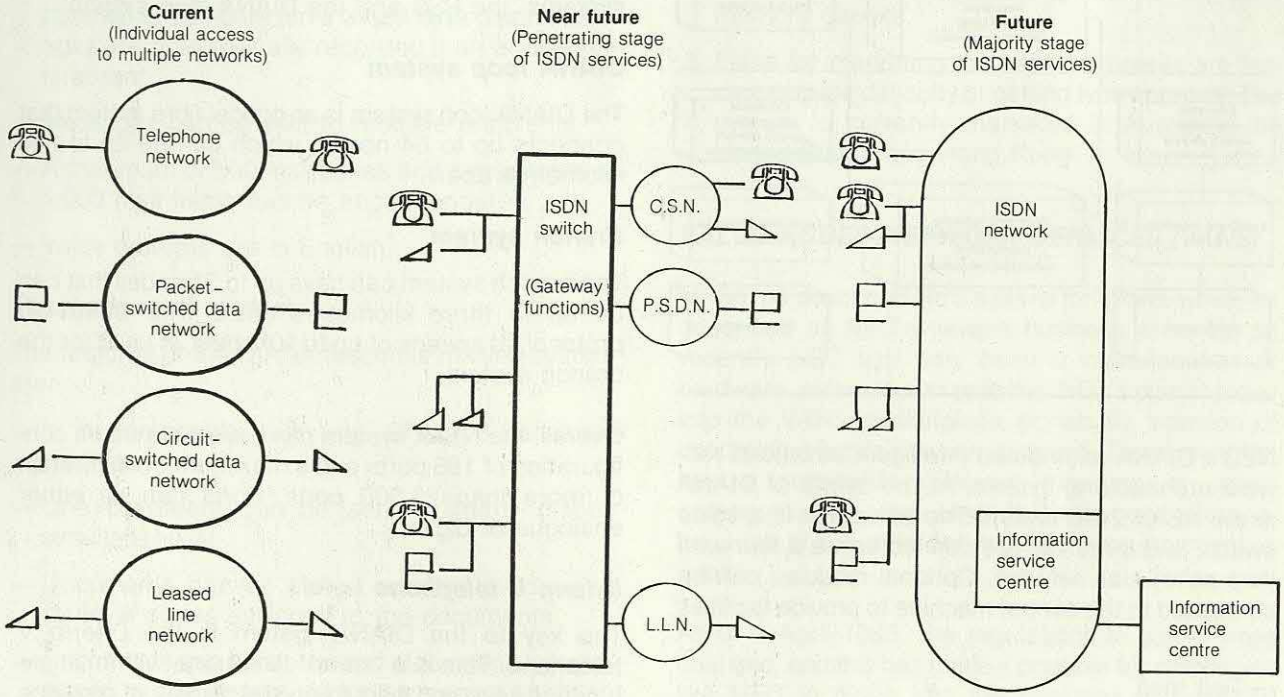


Figure 8 Scope of ISDN versions in terms of three fundamental information handling functions of 'C&C'

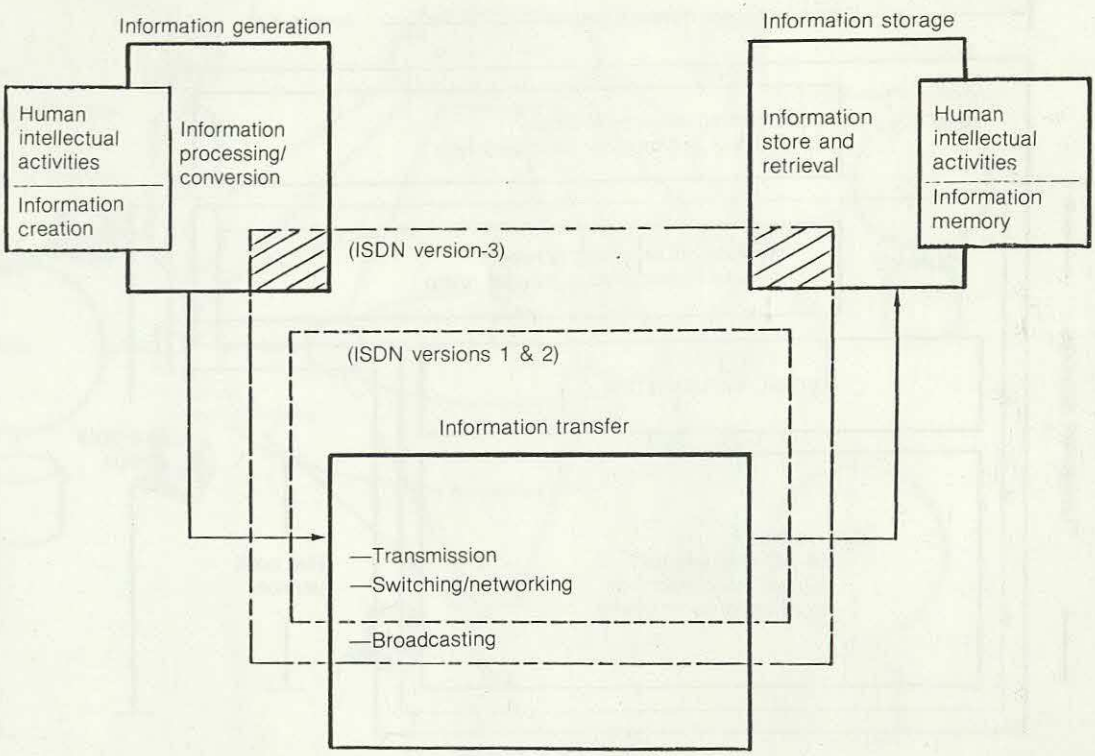
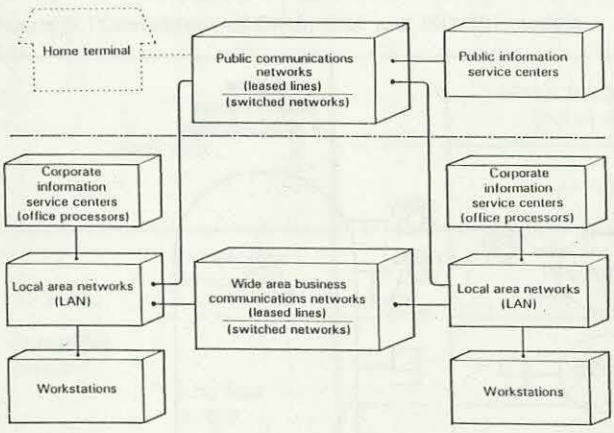


Figure 9 General model for wiring office automation systems



NEC's DIANA (distributed intelligent advanced network architecture) system. At the centre of DIANA is the NEAX 2400 switch. The basic unit is a voice switch, and terminals are connected via a four-wire (two pairs) star network. Optional modules can be connected to the central machine to provide facilities for:

—Text mail.

—Voice mail.

—Facsimile mail.

—Emulation of terminals.

In addition, communications facilities are provided to connect to store-and-forward systems, branch systems, the PSS and the DIANA loop system.

DIANA loop system

The DIANA loop system is an optical fibre system that connects up to 64 nodes, which can be up to two kilometres apart.

Branch system

The branch system can have up to 31 nodes that can be up to three kilometres apart. The CSMA-CD protocol, at speeds of up to 10M bit/s, is used for the branch system.

Overall, the NEAX system can have a minimum configuration of 186 ports and a maximum configuration of more than 23,000 ports. Ports can be either analogue or digital.

D-term V telephone

The key to the DIANA system is the D-term V telephone. This is a 'smart' telephone with multiple function keys and a liquid crystal display. It provides a highly intelligent interface to the NEAX. It also

allows a terminal or PC to be connected, though a separate data adaptor can be used instead of a D-term V. The D-term V includes a range of 'smart' voice facilities together with the following non-voice facilities:

—Asynchronous data switching.

—Data interface auto-answer.

—Data privacy.

—Data terminal traffic measurement.

—Data transparency.

—Half/full duplex switch over.

—Modem pooling.

—Simultaneous voice and data.

—Synchronous data switching.

The D-term V is one of the range of D-term telephones, beginning with the simple D-term II, which has a normal keypad plus a message waiting indicator, and ending with the new D-term X, which has a full-sized screen and an alphanumeric keyboard.

The data adaptor is available in two versions, asynchronous or synchronous. The features are as shown in Figure 10.

Figure 10 Features of NEC's data adaptor

Feature	*Asynchronous version*	*Synchronous version*
Physical interface	RS232C	RS232C/V.35
Data transmission rate	Up to 9600 bit/s	Up to 48k bit/s
Mode	Half/full duplex	Full duplex

Voice mail system

The features of the DIANA voice mailing system are as follows:

—Analogue voice signals are converted into digital signals for storage. The maximum recording duration is 16 hours (on a 340M byte disc). Messages are automatically recorded if an addressee is absent.

—Messages can be sent to multiple recipients.

—A maximum of 500 mail boxes and a maximum of 1,000 mail items can be accommodated.

—Voice prompts are in English.

Facsimile mail system

The features of the DIANA fascimile mailing system are:

—It is compatible with any Group 3 facsimile machine.

—One document can be sent to many places simultaneously.

—Documents can be stored and retrieved using retrieval codes assigned to the documents.

—Documents can be stored and automatically transmitted by the system, reducing manual attention considerably.

—The maximum memory capacity of the system is 1,400 sheets, typically at 40k bytes per page. Processing speed is approximately 360 sheets per hour.

Packet-switching system

The DIANA packet-switching module allows access by a variety of terminals to networks conforming to the CCITT X.25 specification. These include Telenet, Tymnet and Uninet. The processing capability is 50 packets per second. The module allows 100 simultaneous connecting calls.

Responses to questions about the DIANA system

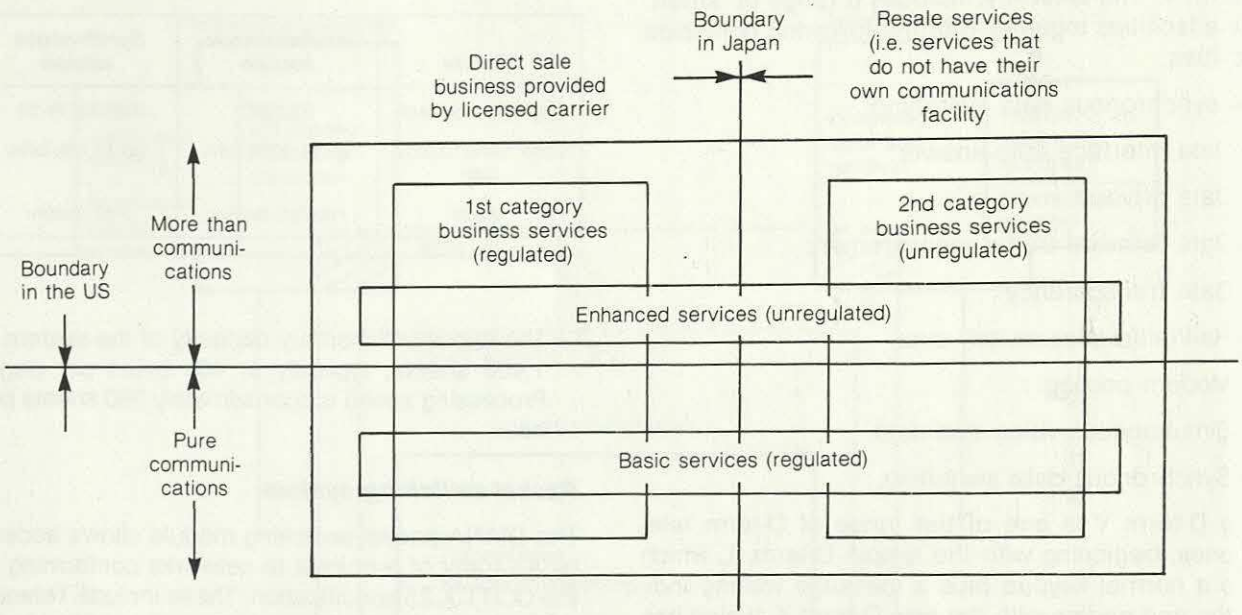
1. There is no integration between the facsimile system and the mail system. In other words, the network is transparent to data and cannot convert a mail document created on a terminal to a facsimile document.
2. There are numerous options for disaster recovery, including duplicate power supply and duplicate memory circuits.
3. Plans for marketing the NEAX overseas are hindered by the difficulty of getting type approval. The system is currently marketed in Australia, the United States and Hong Kong.

VALUE ADDED NETWORK SERVICES (VANS)

Mr Shima described NEC's plans for VANS, which he described as NEC's newest business area. Up till recently NEC has only been a manufacturer of hardware, software and systems. NEC's plan to move into the VANS marketplace signals its intention of becoming a service business as well. The term 'VAN' has a somewhat different meaning in Japan compared with the United States and Europe, because of the different regulatory environment in Japan.

As of 1 April 1985, the regulations in Japan were changed, and this has made it possible for companies like NEC to move into the business of providing services based on computers and communication

Figure 11 Comparison of Japanese and American models for deregulated VAN services

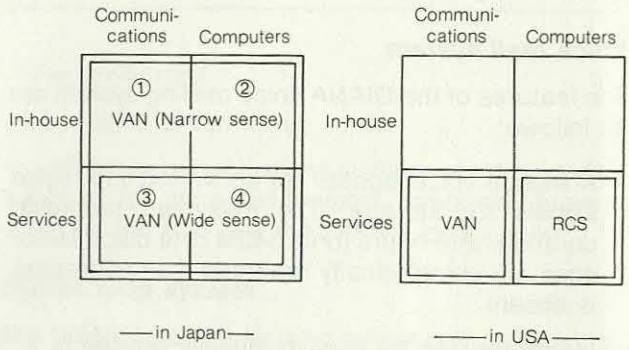


(C&C). There are considerable differences between the Japanese and American deregulation models, however (see Figure 11). In the United States, the boundary between deregulated and regulated services is determined by whether a service is pure communications or provides enhanced communications. In Japan the boundary is determined by whether the service is provided by a telecommunications carrier that is using its own communication facilities, or by a service provider that is reselling communications facilities, and is adding value to them in the process. Thus in Japan, it is permissible for a VAN operator to resell communications facilities that have been purchased from the licensed carriers. (NTT no longer has a monopoly for national telecommunications; a total of six organisations have now been licensed by the government.)

For international services, however, Japan's VAN operators are governed by international regulations (CCITT D.1). This means that NEC is forced to rent circuits from KDD for any international services.

When comparing the American and Japanese markets for VANS it is important to bear in mind the different views about VANS in the two countries (see Figure 12). In the United States, the term VAN is used to describe external communications services. In Japan, the term (even in its narrowest sense) includes what in America is known as 'remote computer services'. In its widest sense, 'VAN' in Japan also includes inhouse systems using communications and computers. The growth of the two markets between 1983 and 1990 is shown in Figure 13. Figure 14

Figure 12 Views on VAN

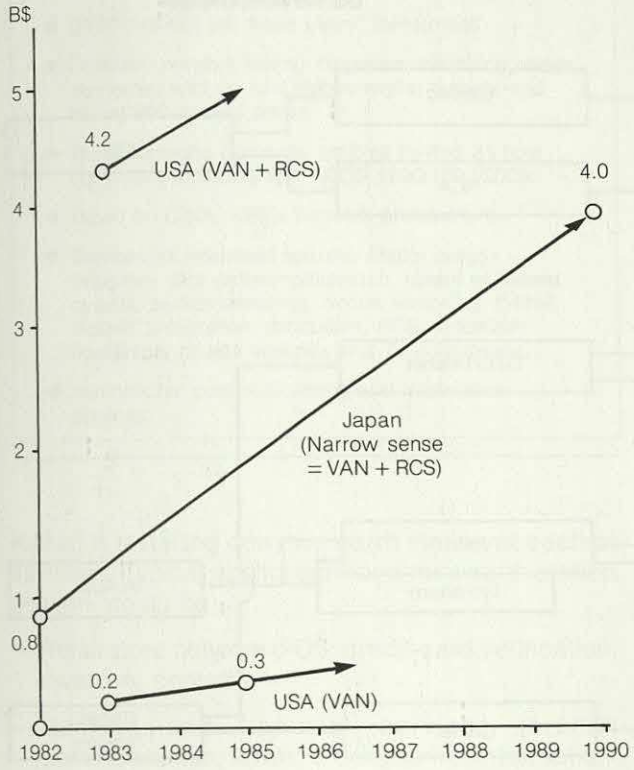


(RCS = remote computer services)

shows the estimated Japanese market sizes in 1982 and 1990 for the four segments shown in Figure 12 (the figure also shows Japan's GNP for the same year). The amounts show that the VAN market will clearly be very large. At present, it is dominated by NTT (for historical reasons), but the size of the market will grow very quickly.

Figure 15 shows a breakdown of the reasons why organisations will use VAN services. Some will use them to reduce the charges they pay for telecommunications circuits; others will use them because they will find the additional 'value' to be of benefit. The latter category can be further divided into three types: those who will use a common, general service; those who will use VAN services to supple-

Figure 13 Growth of American and Japanese VAN markets



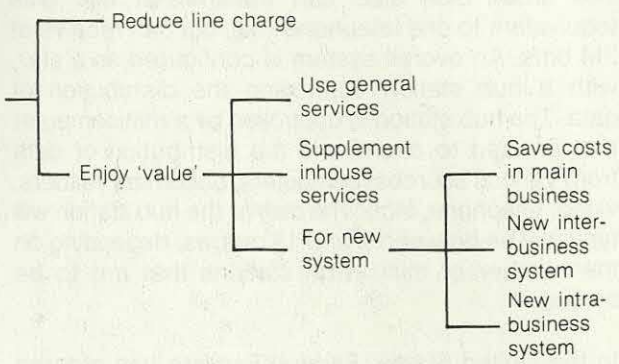
(RCS = remote computer services)

Source: USA: Yankee Group. Japan: MITI

Figure 14 Japanese VAN market size and annual growth rate

VAN market segment (see Figure 12)	*1982*	*1990*	*Annual growth rate*
① + ② + ③ + ④ (¥bn)	3,065	7,442	11.7%
② + ④ (¥bn)	934	474	22.5%
④ (¥bn)	161	807	22.3%
GNP ¥(tn)	205	280	4%

Figure 15 Reasons why VAN services will be used



ment/extend their existing inhouse networks; and those who will use a VAN service because it provides a new type of system service. Again, the new services will be of three types: those that save costs; those that provide new intercompany services (for banks, for example); and those that provide new intra-company services.

Many different companies are planning to enter the rapidly developing VAN market. Providers of 2nd category business services (see Figure 11) can be divided into two types: providers of general services; and providers of special services (a special service is defined as a service with more than 500 lines operating at speeds of greater than 1200 bit/s). There are already 85 providers of general services, but only a handful of suppliers of special services (NEC, INTEC/Telenet, Fijitsu, JEIS/Sumito Bank, Hitachi, Kyodo, ENS/AT&T, OKI and NWS/Tymnet, etc.). These Japanese organisations have formed alliances with various American suppliers and network services to form joint venture companies in Japan. Figure 16 shows the relationship between the Japanese and American service providers. Time will tell whether the market can support each of the special service providers shown in Figure 16.

NEC's VAN services commenced operation in October 1985, and the company's plans are shown in Figure 17. The high bandwidth circuits will provide integrated, multimedia wide-area services. By the end of the century, NEC's target is to provide realtime voice translation (Japanese to English and vice versa) as part of its VAN services. Mr Shima said that real-time document translation will be available from October 1986, however.

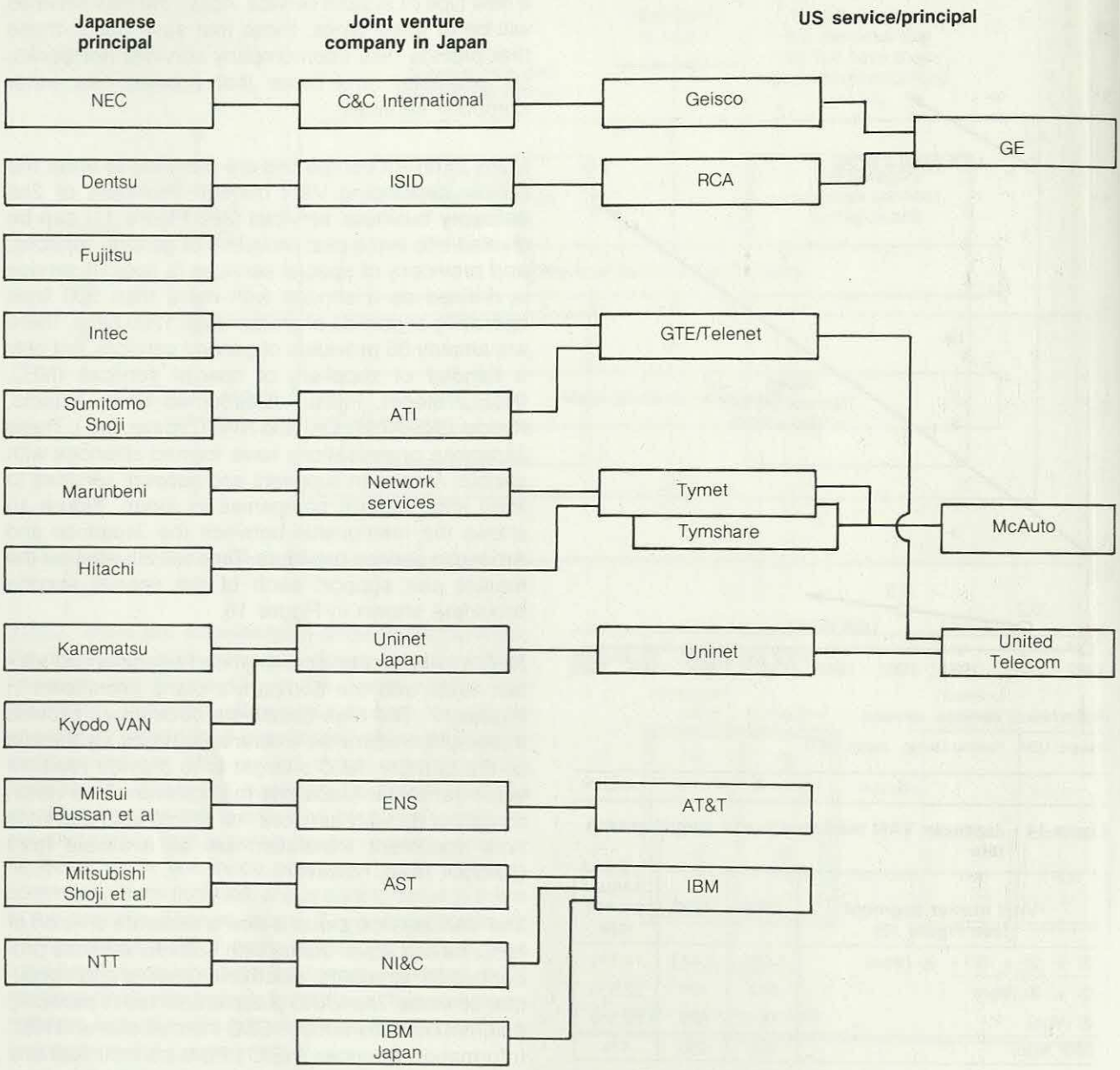
The VAN service group is now a separate division of NEC, having equal status with communications products, EDP products, electronic devices and consumer services. The VANS group is oriented to providing external services through C&C International and NEC Information Services (NEIC.) Pure communications services will also be provided, and NEC's VAN services will be available via Geisco's network.

There are also plans to allow companies such as NEC to provide international services as well. At present KDD is the only authorised international carrier, but the American and Japanese governments are discussing the conditions under which other Japanese carriers will be permitted to provide services to the United States. NEC believes that such permission will be granted "within a year".

PRIVATE SATELLITE NETWORKS

Mr Hasaka, Manager 2nd Department of Satellite Business Systems said that NEC is involved with

Figure 16 Relationships between Japanese and American VAN service providers



INTELSAT, and is a major worldwide supplier of earth stations (1,392 larger stations, and about 27,000 ministations). The earth stations range from the very large (30 to 40 metre dishes) to the very small (60 cm dishes), which can receive only, and at low bit rates). Mr Hasaka's presentation was concerned with dishes in the range 1.2 to 1.8 metres — the mini earth stations that can be used to set up corporate networks for intercompany communications. These earth stations (marketed under the 'Nextar' name) are easy to install — it requires little more than digging a hole to stand the dish in, and running a cable to connect the dish to the indoor control box, which in turn is connected to a terminal or PC.

The small dish size can transmit at 64k bit/s (equivalent to one telephone line), but can receive at 2M bit/s. An overall system is configured as a star, with a hub station controlling the distribution of data. The hub station is controlled by a minicomputer that is used to coordinate the distribution of data from various sources (computers, document readers, video, telephone, etc.). The dish at the hub station will typically be between 5 and 13 metres, depending on the number of mini earth stations that are to be served.

In the United States, Federal Express has ordered 25,000 earth stations (one for each of its offices), and

Figure 17 NEC's VAN services plans

- BY60 (M$300) per three years' investment.
- Domestic network having 10 packet-switching nodes connected with up to 6.3Mbps digital circuits and having 200 access points.
- Three domestic computer centres having 21 host computers including four ACOS 1000/1500/2000.
- Based on DINA, NEC's network architecture.
- Services as industries specific and/or cross industries data gathering/dispatch, resale of leased circuits, packet switching, circuit switching, E-Mail, Host-PC integration, databases, RCS, automatic translation, private videotex and TV conference.
- International communications and information services.

K-Mart is installing one mini earth station at each of its stores. Typical application for a mini earth station network could be:

—Retail store network (POS, credit-card verification, inventory control).

—Banking and financial services (branch communication, ATMs, stock market information.

—Hotel reservation network.

—Personal computer network.

—Training and educational network.

—Electronic mail.

—Teleconferencing (full motion could be broadcast from the hub station; freeze-frame video could be transmitted in the reverse direction).

—Remote voice access for oil rigs, remote rural areas, remote islands, etc.

Federal Express has justified its installation on cost-reduction grounds. The other advantages of using a satellite-based network compared with conventional land lines are:

—Higher reliability and quality.

—Direct access is available to any point.

—The network can be implemented very quickly (the earth stations are held in stock by NEC).

—Various bit rates (from 1200 bit/s to 56k bit/s) can easily be accommodated.

—Various protocols (SNA/SDLC, Bisynch, Asynch, X.25, etc.) can easily be accommodated.

—The flow control protocol adopted by NEC (AA/TDMA – adaptive assignment/TDMA) provides dynamic flow control for various types of communication traffic (interactive data, batch data, etc.). The AA/TDMA protocol is unique to NEC.

—Centralised network monitoring and control can be carried out via a terminal at the hub station.

—The network can easily be expanded.

The cost of mini earth stations depends on the number ordered. A single unit could cost about 7 million yen; for 1,000 units, the cost per unit is halved to 3.5 million yen. A hub unit could typically cost 400 million yen.

At present, the regulatory environments in the United States and Australia allow Nextar networks to be established. It is possible that British Telecom will provide a similar service in the United Kingdom in the not too distant future.

TUESDAY 15 APRIL

NTT

Mr Nishina (General Manager) described NTT and its services. Telecommunications services in Japan are provided at present by two organisations – KDD, which handles international traffic, and NTT, which handles domestic traffic. The telecommunications industry was deregulated as of 1 April 1985, when NTT became a private company. (Details of the structure of the deregulation and the controls that apply to telecommunications suppliers are included in the notes on the visits to NEC and Fujitsu.) In summary, there are two groups of suppliers: first class suppliers who provide circuits, and second class communications enterprises who lease circuits from the first class suppliers and sell on the services. NTT is a first class supplier and, so far, is the only one in this class. In the near future, however, several other first class competitors are expected to be licensed. For example:

- The Electric Power Company already has a network, and may lay optical fibres in power ducts.
- The railways have routes throughout the country and may lay circuits along the railroad.
- The Japanese Public Road Corporation may lay circuits along its network of routes.
- Satellite companies may also enter the market.

The main problem for NTT's competitors is local domestic connection. Competitors need to be linked to NTT to achieve this. The government is currently considering the regulations and tariffs for such connections.

A five-year statistical summary of NTT's business is shown in Figure 1. The employees of NTT have decreased from 327,000 to 314,000 during this period, but NTT is still the second largest employer (after the government) in Japan. The telegram and telex services are declining but facsimile and telephone are taking their place. Of particular note is the fact that the number of facsimile subscribers doubled in 1985. Data communications services are also showing substantial growth.

The financial performance of NTT is shown in Figure 2.

DATA COMMUNICATIONS SERVICES

NTT's data communications services began 20 years ago and there are now 88 kinds of service organised as four groups: Public, ANSER, CAFIS, and customised services.

Public services

The public system provides ready-made data communications services; customers jointly share facilities established by NTT. At the end of 1984, about 4,500 subscribers were using the public system. Currently, there are two main types of public system services: DEMOS, and DRESS.

Public system services are provided nationwide through a network of 75 centres and subcentres located in major cities all over the country. Both DEMOS and DRESS services are mutually accessible; that is, data required for processing at a DEMOS centre can be sent from a DRESS centre, and vice versa.

It is also possible to connect general-purpose computers to the public system network to form a nationwide system. This technique is employed by many customers, when, for example, their head office wants to collect data from branch or business offices for central processing.

DEMOS

DEMOS provides high-level technical calculation services through program libraries set up to calculate building structures, for CAD, for LSI logic design, and so on. The SCORE service provides access over the public switched data network to a Cray-1 supercomputer. This service allows DEMOS subscribers to carry out complex technical calculations.

DEMOS also provides a software storage and distribution service that enables shared use and distribution, through the network, of software developed by a customer. Typical applications are retrieval of data (including graphs or drawings) by facsimile machines through interconnection with the facsimile network, and viewing data on a television screen through interconnection with the videotex network.

Figure 1 NTT five-year statistical summary

Years ended March 31	*1981*	*1982*	*1983*	*1984*	*1985*
Telephone services					
Telephone subscriber lines (thousands)	39,052	40,276	41,501	42,879	44,435
Telephone subscriber lines per 100 persons	33.3	34.1	34.9	35.8	36.9
Telephone sets (thousands)	48,947	50,561	51,990	53,470	54,758
Public telephones (thousands)	882	914	928	931	935
Public telephones per 1,000 persons	7.5	7.7	7.8	7.8	7.8
Mobile telephone services:					
Automobile telephone services:					
Subscribers	6,406	13,275	19,804	27,198	40,260
Districts	86	149	203	329	453
Pocket pager subscribers (thousands)	1,089	1,241	1,431	1,646	1,886
Push-button telephone sets (thousands)	3,287	3,718	4,523	5,744	7,069
Home telephone sets (thousands)	954	1,120	1,269	1,435	1,555
Business telephone sets (thousands)	4,008	4,139	4,114	4,088	4,063
Private branch exchange sets (thousands)	20	18	16	14	12
Centralised extension systems	857	951	1,070	1,245	1,462
Telegraph services					
Telegrams (thousands)	41,036	41,961	43,306	44,529	41,684
Telex subscribers (thousands)	58	52	47	41	34
Leased circuit and data communication services					
Leased circuit lines (thousands)	404	426	450	475	500
Circuit services:					
Specific-use (thousands)	100	115	131	146	191
Public-use (thousands)	34	44	58	77	100
Facility services:					
Customised data communications services	55	60	65	73	80
Public data communications services	3,252	3,651	3,784	4,048	4,587
Digital data exchange (DDX) services:					
Circuit-switching services:					
Lines	106	391	770	1,595	2,677
Districts	4	19	69	107	149
Packet-switching services:					
Lines	59	171	758	3,007	6,626
Districts	7	30	129	206	300
Facsimile network services:					
Subscribers	—	790	2,603	9,551	18,214
Districts	—	5	13	21	294
Facsimile units (thousands)	15	30	58	86	106
Videoconference subscribers	—	—	—	7	10
Videotex terminals	—	—	—	—	5,320
Employees (thousands)	327	327	323	318	314

Figure 2 NTT financial highlights

	Billions of yen		*Percent change*	*Millions of U.S. dollars*
Years ended March 31	*1984*	*1985*	*1985-1984*	*1985*
For the year:				
Total revenues	¥ 4,552.4	¥ 4,756.2	+4.5%	$18,836.3
Total expenses	4,168.4	4,428.5	+6.2	17,538.7
Net income	384.0	327.6	−14.7	1,297.6
Capital investment	1,682.1	1,722.6	+2.4	6,822.2
Research and development expenditures	93.9	126.6	+34.8	501.4
At year-end:				
Total assets	¥ 10,521.9	¥ 10,791.7	+2.6%	$42,739.6
Total liabilities	5,599.3	5,578.0	−0.4	22,091.1
Total capital	4,922.6	5,213.7	+5.9	20,648.5

Note: $1 = 252.5 yen

Customers who are not subscribing to DEMOS may still access it on an ad hoc basis by using terminals set up at NTT public stations

DEMOS services

The DEMOS network provides a large program library covering construction, civil engineering, mechanical and electronic calculation and statistics, and other areas of expertise. Users are free to select facilities that best suit their needs. Recent additions to the library include underground drainpipe design and business graph preparation programs. In the near future, a capability will be added to output processing results as graphs and drawings.

DEMOS also provides a software storage and distribution service. NTT assumes full responsibility for proper control and for the confidentiality of the software stored in this system. By making valuable software available to others, wasteful duplication of development effort and investment can be avoided.

The DEMOS network can also be used to access a news retrieval service based on Nihon Keizai Shinbun newspaper articles (NEEDS-IR), a company information service (TSR-BIGS), and a company financial data service (TSR-FINES) supplied by Tokyo Shoko Research (Tokyo Industry and Commerce Research), and other databases as well. In the near future, a wider variety of information providers will be able to offer their databases for public use through the DEMOS service.

DRESS services

DRESS applications include the transmission of business transactions between companies, reservations for the service industry, and various inquiry services. These applications make use of DRESS networking facilities as well as its data collection and distribution capabilities, and of new data input/output equipment capable of distributed processing. For example, an information network service has been established for different companies in the distribution industry. This service provides centralised processing for transaction data, such as the receiving and issuing of orders, and shipping and receiving of goods, as well as invoicing and payments. Manufacturers, wholesalers and retailers can all be interconnected via this service.

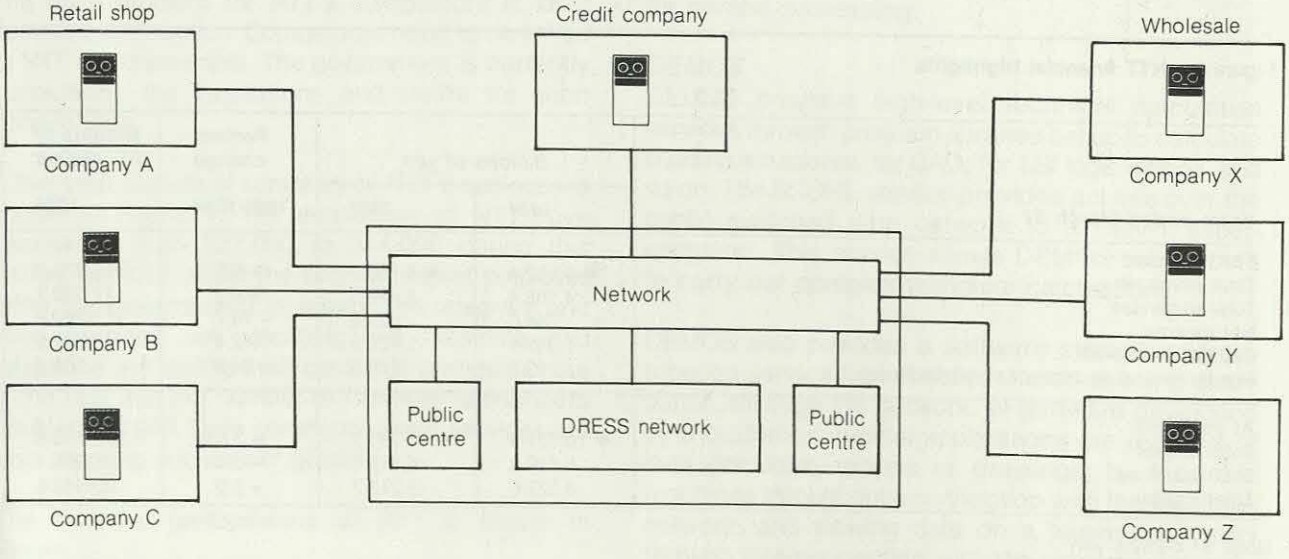
These services are called 'super network services'. An 'integrated shop service' is also available. There are also new services for home shopping that can receive orders from household telephones, with the response being provided by an automatic voice answering system. A large number of data processing services, including online realtime processing, remote batch processing, data collection/distribution, and file transfer services, can also be provided through DRESS.

Department stores, supermarkets and other large retail outlets use NTT's DRESS public system services for intercompany online transmission of orders. Wholesale or manufacturing companies can receive orders from any customer (retailer) in the format of their choice. A schematic layout of this type of intercompany services is shown in Figure 3.

ANSER

ANSER (automatic answer network system of electrical request) has centres located in major cities throughout Japan. This service allows automatic notification over telephone circuits of customer

Figure 3 Inter-company information network service



inquiries and purchase orders, and can provide answers in response to these inquiries in either voice or text form. The ANSER service is accessed from telephones, data telephones and facsimile machines (see Figure 4).

There are two versions of ANSER: one with followup notification, and one without. The former was started as a bank balance inquiry and account transfer notification service in 1981. Securities companies also use this form of ANSER. The latter version is now widely used in the distribution industry for receipt of orders in 'shopless' sales networks.

CAFIS

CAFIS (Credit And Finance Information System) links credit companies with shops honouring their cards. The convenience of credit card shopping has increased greatly with the spread of CAFIS. Checks of card validity, credit verification, and after-sales clerical tasks have been streamlined by the system. Terminals installed in shops can process cards issued by a variety of credit companies, thereby saving sales counter space. A schematic of the CAFIS system is shown in Figure 5.

Figure 4 ANSER (automatic answer network for electrical request

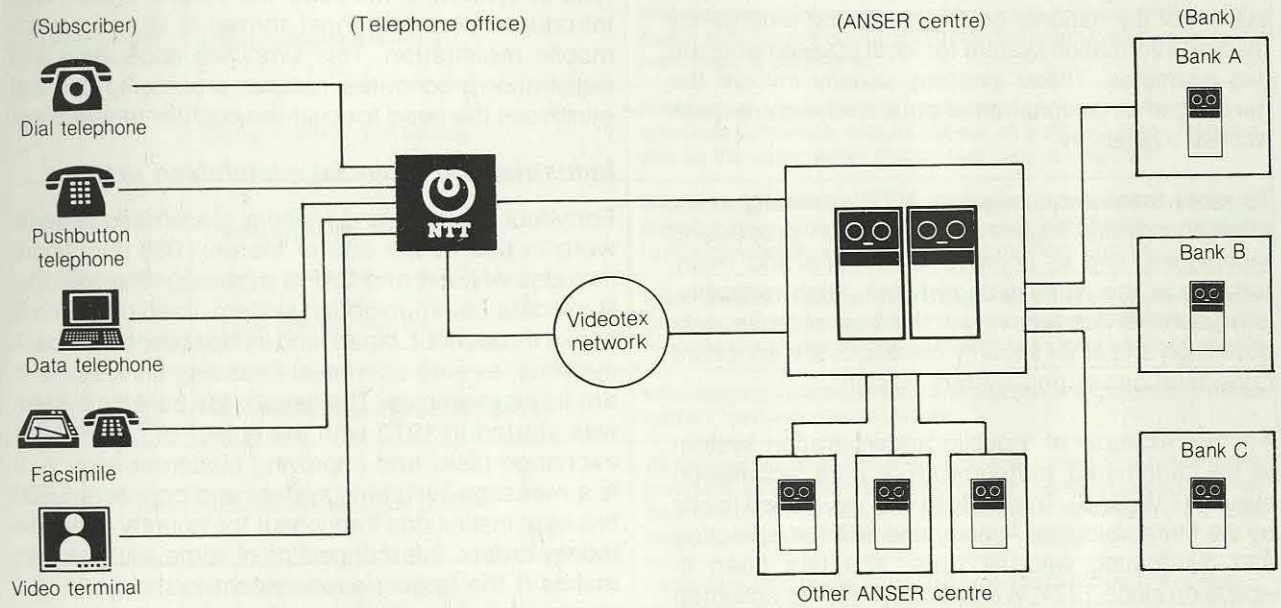
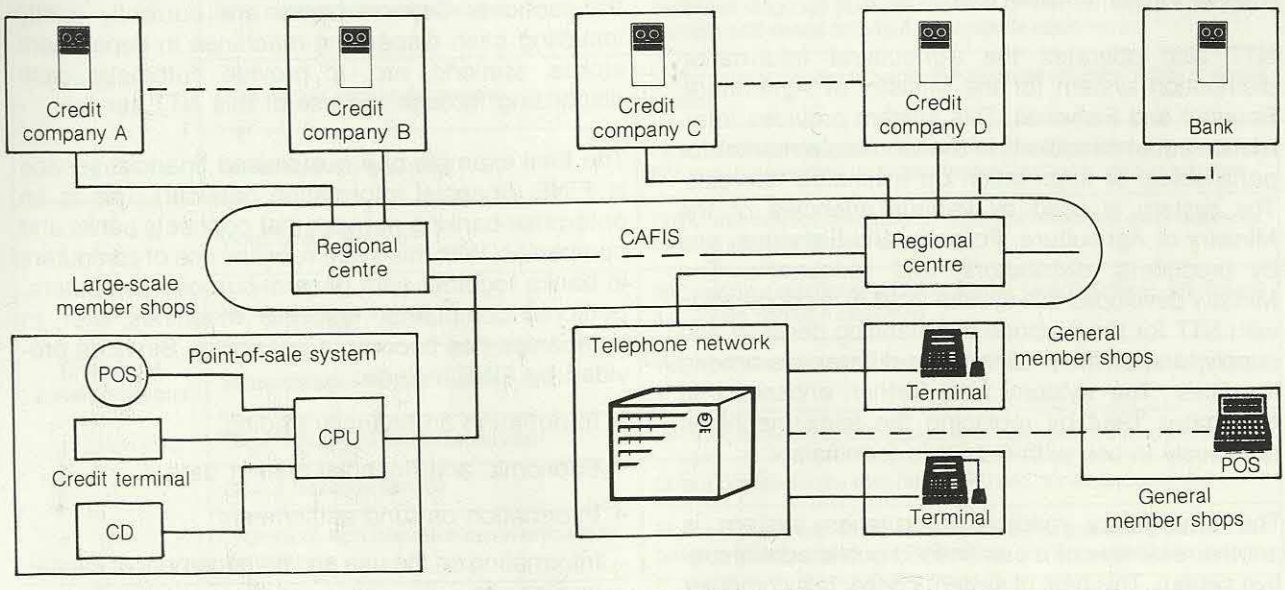


Figure 5 CAFIS (credit and finance information system)



CUSTOMISED SYSTEM SERVICES

Made-to-order system services provide data communications networks designed by NTT to meet each customer's specific data communications needs. Custom-designed data communications services now available may be roughly divided into two categories: public administrative systems designed to promote social development, the national welfare, and administrative efficiency; and business and finance systems designed to improve industrial and financial productivity.

Public administrative systems

Thirty-six public administrative systems were in use at the end of March 1985. The social insurance system of the national government, and emergency medical information system for local governments are two examples. These systems usually involve the handling of large volumes of data, and require quick access availability.

To meet these requirements, NTT is making every effort to develop high-level information processing techniques, and to improve operations and maintenance in the nationwide network. High reliability, immediate service recovery in the case of faults, data protection and other security measures are important considerations during system design.

Another example of a public administration system is the automated meteorological data acquisition system (AMEDAS). This system was developed jointly by the Meteorological Agency and NTT for collecting and distributing weather data, and has been in operation since 1974. Weather data can be collected hourly over telephone lines from 1,400 observation stations located at key positions throughout the country. This system operates 24 hours a day, 7 days a week throughout the year.

NTT also operates the agricultural information distribution system for the Ministry of Agriculture, Forestry and Fisheries. This system provides information about conditions in the wholesale market for perishables, or information on estimated harvests. The system is used by various agencies of the Ministry of Agriculture, Forestry and Fisheries, and by producers, distributors, and consumers. The Ministry developed this system in 1976 in cooperation with NTT for the purpose of balancing demand and supply, and of minimising price differences among localities. The system was further enhanced in November 1984 by replacing the telex machines previously in use with facsimile terminals.

The emergency medical information system is another example of a customised public administrative system. This type of system connects a computer centre, an emergency medical information centre, hospitals, and fire and ambulance stations via communications circuits. Information is collected 24 hours a day about available beds, as well as about blood and serum inventories. The first service was started in Kanagawa Prefecture in 1976, and 22 such systems are now contributing to medical activities in different communities.

NTT also operates a motor vehicle registration and inspection system for the Ministry of Transport. In 1970, all of the 86 Land Transport Offices (including branch offices) in the country were connected by this system, thus making rapid processing of vehicle registration and inspection tasks possible. To handle the large volume of information resulting from this type of system, a full-scale file control system was introduced. A mark sheet format is used for automobile registration. This simplifies application and registration procedures, reduces processing time and minimises the need for over-the-counter transactions.

Industrial and financial customised systems

Forty-four business and financial customised systems were in use at the end of March 1985 (this figure includes ANSER and CAFIS systems). The National Bank data communication system, used by different banks throughout Japan, and independent local bank systems, as well as mutual financing bank systems are three examples. The nationwide banking system was started in 1973 with the object of rationalising exchange tasks and improving customer service. It is a message-switching system and connects 5,500 financial institutions throughout the country to handle money orders. Interconnection of some 40,000 banks makes it the largest such system in the world.

NTT also provides an automatic cash dispensing system that interconnects cash dispensers in each member bank so as to permit interconnected online transactions. Several banks are currently jointly installing cash dispensing machines in department stores, stations, etc. to provide automatic cash dispensing through the use of this NTT service.

The final example of a customised financial service is FINE (financial information network). This is an enterprise-banking network that connects banks and companies. With this system, online use of computers in banks together with general-purpose computers, personal computers, fascimile machines, etc., in companies has become a possibility. Services provided by FINE include:

- Information on financial trading.
- Economic and financial market data.
- Information on fund settlements.
- Information on the use and management of capital and assets.

Various banking transactions previously carried out manually are now processed online using the FINE system.

INTEGRATED NETWORK SERVICES

Mr Nishina then went on to describe NTT's plan for ISDN services. At present, there are four separate nationwide networks provided by NTT: telephone, telex, digital data exchange, and facsimile. NTT's future task is to integrate these into a single nationwide digital network known as INS (information network system). The INS project began 18 months ago and a test is being carried out in the city of Mitaka, in which some 600 subscribers are being monitored. The objective of the test is to study the

Figure 6 Services available with NTT's model INS system

Type of service		*Basic service features*
Digital telephone service		Displaying caller's number, charges, etc.
64 Kb/s system	Digital facsimile service (1)	Greatly shortened transmission time and finer print quality thanks to digital processing. (4 sec. for A5 sheets, 6 sec. for A4.)
	Digital videotex service (1)	Wide varieties of information can be supplied in 'dialog' fashion. High-quality pictures are output, and guidance is provided in voice form. Hard copy is obtainable.
	Digital sketchphone service	Hand-written diagrams and characters can be transmitted simultaneously with voice. Images appear on a display at the receiving end as the caller writes them. Hard copy is obtainable.
16 Kb/s system	Digital facsimile service (2)	Shortened transmission time owing to digital processing. (8 sec. for A5 sheets, 12 sec. for A4.) Can simultaneously send the same message to multiple addresses using a network memory function.
	Digital videotex service (2)	Information can be supplied in 'dialog' fashion as either characters or simple colour drawings. (Faster than the present CAPTAIN system.) Procedural guidance is provided in voice form. Hard copy is obtainable.
64 Kb/s 16 Kb/s system	Multi-media database access service	Wide-ranging varieties of data are supplied in a multitude of media formats from information centres.
Multi-media communications service		64 Kb/s system and 16 Kb/s system services can be received simultaneously at different destinations over the same subscriber line. Several different 64 Kb/s services can also be received over the same line at a single destination.
Digital public telephone service		Telephone set displays remaining time and called-party's number.
Integrated business office telephone service		Networking of non-telephone equipment (facsimile, etc.) and functional pushbutton phones.
DDX service	DDX network exchange service	Suited to transmission of large quantities of data at high speeds. Japanese language texts put together off-line can be transmitted to multiple addresses or output by facsimile equipment.
	DDX packet exchange service	Suited to transmission of comparatively small volumes of data at slower speeds.
	Teleconferencing service	Pictures of each party are transmitted at the same time as their voices. For teleconferencing up to four terminals can be used at one time.
Broadband communications service	Video circuit service	Colour motion-picture signals can be transmitted over great distances. Various applications are possible.
	Video response system	Information is supplied in a 'dialog' format. Motion pictures, still pictures and sound can be transmitted.
	Video storage and distribution system	Video software is stored and distributed in response to subscriber's choice.
	Ultra high speed facsimile service	A4-sized monochromatic documents can be sent in two seconds.
	Colour facsimile service	Colour copies can be sent rapidly (40 sec. for A4 documents.)
	High-resolution television communications service	Motion pictures with 4.6 times the resolution of present TV pictures can be transmitted using special TV cameras and a special display system.

social impacts of an advanced digital service. The services available in the model system are shown in Figure 6.

The 1986 capital investment in digitising the network is 860 billion yen ($3.4 billion). The plan is that by the end of 1987 all major cities in Japan will be linked by digital networks and that 85 per cent of subscriber equipment will be digital by 1995.

Delegates saw demonstrations of many of the facilities to be provided by the INS network. These included:

- Ditgital videotex.
- Colour facsimile.
- High speed A3 facsimile.
- Digital sketch phone.
- Teleconferencing – both fixed units and portable units.
- The CAFIS credit checking system. At present almost all major credit companies are connected and there are a total of 30,000 terminals installed.

QUESTIONS

In response to questions from delegates the following points were made:

1. NTT is developing its own network protocol (DCMA). Experiments are being carried out to ensure that DCMA is compatible with SNA.
2. The results of field tests on public teleconferencing services were poor and the public service will be discontinued. Future emphasis will be on teleconferencing centres within companies.
3. NTT's forecast profit for 1986 is 300 billion yen.
4. The reaction to privatisation by employees has been positive, but there has been public criticism of the aggression shown by the new company.
5. Two-thirds of the shares of NTT are to be sold to the public in August 1986. No foreign ownership of shares will be allowed but NTT will try to persuade the government to lift this restriction.
6. NTT is not developing a teletex service because, for Japan, facsimile is better.
7. NTT tariffs have to be approved by the Ministry of Post and Telecommunications.
8. NTT has no plans for overseas business, but a company (NTT International) has been formed. In addition, a joint venture between NTT and IBM is being established. We were unable to obtain any details about this joint venture.

SEMINAR BY PROFESSOR HIDEO AISO

Doctor Aiso is Professor of the department of Electrical Engineering at Keio University (Japan's oldest university) and Director of Keio Institute of Information Science. From 1957 to 1967 he was a research engineer at MITI's Electrotechnical Laboratory (ETL) — although from 1960-1962 he was research assistant at the University of Illinois' Digital Computer Laboratory. From 1967 to 1971, he was Chief Engineer of ETL's Digital Computer Section. Since 1971, he has been professor at Keio University, and has been Director of the Keio Institute of Information Science since 1981. Between 1982 and 1983 he was a visiting Fellow at Downing College Computer Laboratory, University of Cambridge.

Professor Aiso is Chairman of the Fifth Generation Computer Project, and served as a member of the Machine Architecture Group from 1979 to 1983, as a member of the Technology Forecasting Committee from 1982 to 1985, and is currently a member of the Fifth Generation Steering Committee. He is also Chairman, and a member of the Steering Committee, of the Supercomputer Project.

Professor Aiso described the 11 major R&D projects for future information technologies that have been, and are currently being, undertaken by Japan (see Figure 1). The first five of these have now been completed. Figure 1 shows two types of projects — national projects and subsidy projects. Direct expenses for national projects are funded completely by the Japanese government, and all resulting patent rights belong to the government. Subsidy project are usually funded equally by the government and the contractors working on the projects, although the contractors have to refund some of the subsidy when a profitable product is produced.

JAPAN'S NEED FOR RESEARCH AND DEVELOPMENT IN COMPUTERS

Japan has few natural resources such as oil or other mineral materials, and it is imperative that, in order to maintain comfortable and basic living conditions, Japan should be a highly industrialised and technology-oriented country. The Japanese have, therefore, made every effort to exploit the intellectual resources that might compensate for the lack of natural resources. Some of these intellectual resources are concerned with modern electronics, computers, robots, and communications. In particular, Japan has recognised that computer technology is one of the most important basic technologies for future modern Japanese industries. It is believed that computer technology will be the base for next-generation industries.

The Japanese have recognised that the development of high technologies, such as computer technology,

Figure 1 Major R&D projects for future information technology

Title	*Period*	*Budget (in 10^9 yen)*
1. Very high-performance computer system	1966 – 1971	10
2. Pattern information processing systems (PIPS)*	1971 – 1980	22
3. VLSI technology	1976 – 1979	30
4. Basic technology for next generation computer systems (fourth generation computer systems)	1979 – 1984	22
5. Optical measurement and control systems (optoelectronics application systems)*	1979 – 1986‡	18
6. Basic industrial technology for the next generation*	1981 – 1990	100
7. Very high-speed scientific computing systems (supercomputers)	1982 – 1991	23
8. Fifth generation computer systems (FGCS)*	1982 – 1991	100
9. Robotics for work in extreme conditions (JUPITER)*	1984 – 1991	20
10. Software industrialised generator and aids (SIGMA)	1985 – 1989	25
11. Inter-operable database systems*	1985 – 1992	20

Note: Title* = National project
Title = Subsidy project
‡: This project was originally scheduled to be completed in March 1986; for political reasons it was terminated in March 1985

is characterised by the following features:

- Depends on the results of basic research.
- Requires long lead times, large research budgets, and is accompanied by high risks.
- Can be achieved only through international co-operation and interdisciplinary collaboration.
- Has strong impacts on a wide variety of industries.
- Can contribute to developing countries through the transfer of high technology.

Like other advanced countries, Japan is set to become an information-oriented society, and computer technology will play a key role in the future. It is also widely accepted that this trend will create many crucial problems that will have to be overcome to realise a really comfortable society. The problems include:

- Privacy and security.
- Computer crimes.
- Unemployment caused by the use of microelectronics and robots.
- The need for continuing education and retraining in order to narrow the gap between specialists and non-specialists.
- The unbalance of social systems in a computerised society.

Japanese government policy

In the light of the above circumstances, the Japanese government has been carrying out the following policy:

- Establishment of free competition and an equally open market: the privatisation of public corporations such as NTT is aimed at creating a new economic order and maintaining an equally open market.
- Promotion of research and development activities in the private sector: because of the large government deficits in recent years, and the necessity for cultivating various high technologies, the government considers it vital to provide incentives for research and development activities in the private sector.
- Establishment of national and subsidy projects: national or subsidy projects are restricted to the most advanced high-technology areas, particularly to precompetitive research areas. These projects apply only to research and development that exceeds the level that individual companies can afford independently, and only to cases where it would be almost impossible for the private sector to fund its own research and development activities. The results expected to be obtained from the projects should not cause any economic conflicts in the future world market.
- Provision of support to non-profit research organisations: financial support has been given to non-profit organisations such as universities and national research institutes. This support takes the form of, for example, grants-in-aid for special research by the ministry of education, or the replacement of equipment required for research.
- Encouragement of international contributions: international contributions, through technology transfer and advanced education, are encouraged, and the government considers that the formation of effective environments for the internationalisation of private industries is a key issue.
- Promotion of cooperation among universities, industry, and the government: collaboration is vital for the success of large-scale research projects, because individual industries cannot afford to pay for developing high technologies.

INFORMATION TECHNOLOGY RESEARCH AND DEVELOPMENT ACTIVITIES

The three major partners in the information technology research activities are the government, through MITI (Ministry of International Trade and Industry) and its Electrotechnical Laboratory (ETL), NTT's Electrical Communication Laboratories (ECL), and the ten major computer suppliers (Fujitsu, Hitachi, Mitsubishi, Nippon Electric, Oki Electric, Toshiba, Matsushita Electric, Sanyo Electric, Sharp and Sony). Professor Aiso then described briefly the background and present status of the eleven projects, listed in Figure 1.

Very High-Performance Computer Systems (1966 – 1971)

The main objective was to promote essential hardware and software technologies for computers used in the 1970s, and to catch up with the world's leading computer technology (in reality, IBM). A large-scale computer having the world's best performance level was developed on the basis of multiprocessor architecture and advanced LSI technology (high-speed ECL gates, with 100 gates/chip. This computer had performance equivalent to an IBM 370/168, although it was not compatible with the 370 range.

PIPS – Pattern Information Processing Systems (1971 – 1980)

Various pattern recognition problems including those concerned with printed and handwritten characters, graphics, images, voice, three-dimensional objects, and natural language understanding, were studied in this project. A prototype system incorporating all of

the developments was produced and demonstrated. The main contractor was Toshiba.

VLSI technology (1976 – 1979)

This project focused on sub-micron lithography techniques for VLSI semiconductors, and the common and basic properties of silicon crystals as the raw material for semiconductors. N-MOS and C-MOS technologies were studied, and fabrication processes were developed, together with supporting systems (controllers and VLSI testers). The contractor was NEC.

Fourth Generation Computer Systems (1979 – 1984)

This project aimed at supporting the development of basic software systems and intelligent terminals for near-future computer systems. The most important research subject in this project was Japanese language processing, because this is the major factor inhibiting the increasing use of computers in Japan. Basic software systems were:

- One-level storage management.
- Complex computer control.
- Functionally distributed networks, and network gateways.
- Database machines and distributed databases.
- Integrated virtual machines.
- High-level programming languages.
- Japanese word processors and Japanese databases.

Intelligent terminals able to input and output Japanese were developed, including voice input and OCR devices. Large magnetic discs and bubble memory technologies were also developed.

The Fourth-Generation project was managed by a small joint office in Tokyo staffed by representatives from the six largest computer suppliers.

Basic Industrial Technology for the Next Generation Industries (1981 – 1990)

This programme focuses on four different areas:

- Development of new materials such as fine ceramics, high-function polymers, and highly crystalline alloys.
- Study of biotechnology, including bioreactors, mass cell cultivation technology and recombinant DNA.
- Development of new function materials such as super-lattice devices, three-dimensional VLSI devices, and devices resistant to adverse ambient conditions.
- Investigation of biocomputers to mimic the human brain in such functions as pattern recognition, reasoning, and learning.

In the area of three-dimensional VLSI, the aim is to produce devices with ten layers by the end of the 1980s. One such chip (or 'cube') will be able to store 4,500 kanji characters, compared with 100 with today's two-dimensional chips, and will lead to the development of a portable Japanese word processor. Another application is illustrated by Toshiba's high-speed optical sensor (see Figure 2). The ultimate aim is to be able to simulate the retina of the human eye (see Figure 3).

The biocomputer group has also just begun a ten-year project (with a budget of 8 billion yen) to carry out basic research into the development of a new computer architecture using the human brain as a model. Specific research activities include:

- The study of the neural systems of lower animals.
- Development of biochips using organic materials.

Figure 2 Basic structure of the high-speed image processor

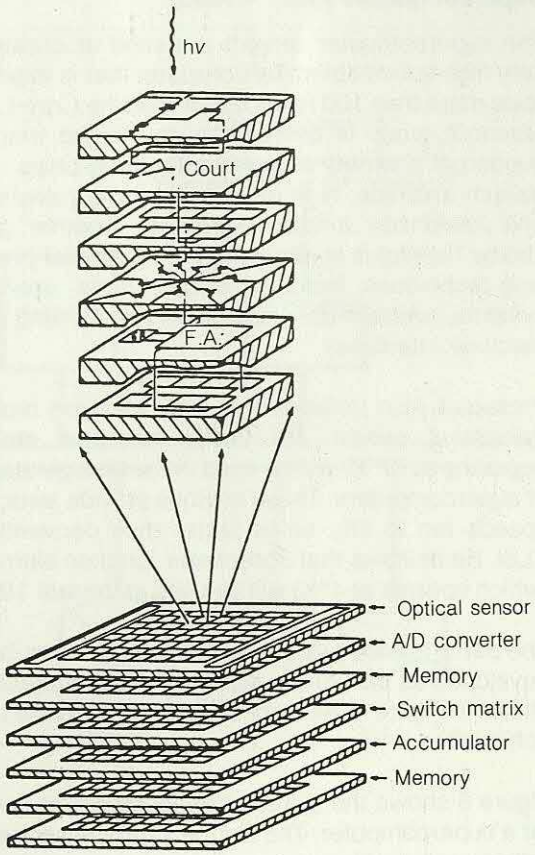
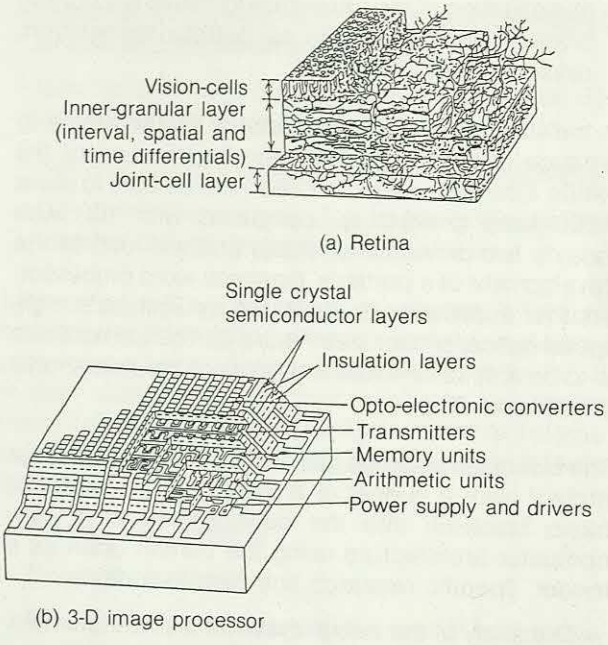


Figure 3 Planning to simulate structure of human retina



– Development of non-destructive and non-contact methods for measuring human brain activity.

Supercomputers (1981 – 1989)

The supercomputer project is aimed at creating a very high-speed scientific computer that is expected to be more than 100 times faster than the Cray-1. One research group is devoted to developing trial production of a variety of highly integrated chips using gallium arsenide, high electron mobility transistors, and Josephson Junction elements. Another group (led by Fujitsu) is investigating ultra-parallel processing techniques, including architectures, operating systems, problem-description languages, and man-machine interfaces.

Professor Aiso believes that high electron mobility transistors (which are low-temperature devices operating at 77°K) will be used in the next generation of supercomputers. These devices provide switching speeds ten to fifty times faster than conventional VLSI. He believes that Josephson Junction elements (which operate at 4°K) will be used in the late 1990s.

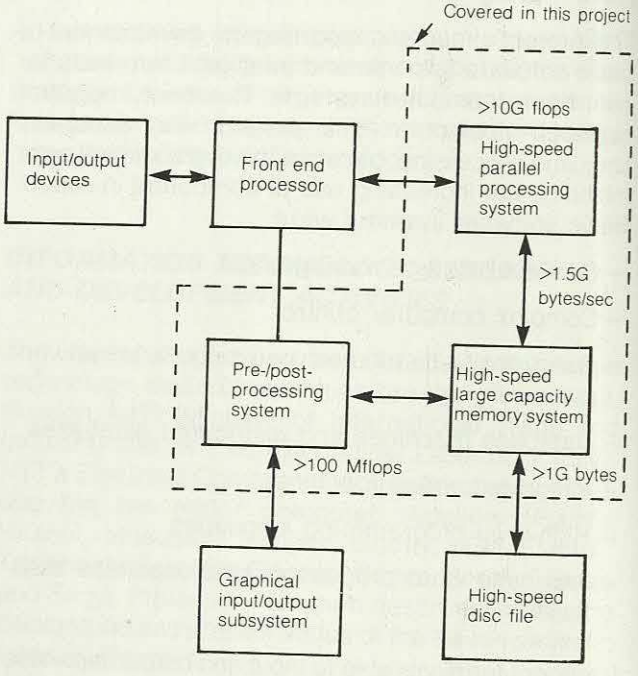
The performance targets for the new devices being developed as part of the supercomputer project are shown in Figure 4. All of these targets have now been achieved.

Figure 5 shows the system configuration envisaged for a supercomputer. The front-end processor will be based on a multiprocessor architecture, whilst the graphical input/output subsystem will be based on an array-processor, perhaps a special-purpose signal processor.

Figure 4 Targets of new devices (Supercomputer project)

Devices	Requirements
Logic	Delay Time: <10 ps/gate (JJ, HEMT) <30 ps/gate (GaAs) Integration: >3,000 gates/chip
Memory	Access Time: <10 ns Integration: >16 Kbits/chip

Figure 5 System configuration of a supercomputer



Fifth Generation Computer Systems (1982 – 1991)

The FGCS project is the most ambitious and most important of the projects. Fifth Generation Computer Systems are defined as computers to be used predominantly in the early 1990s. They are expected to be revolutionary systems that incorporate and exploit the concepts of artificial intelligence, and they will be substantially different from traditional von Neumann computers. They will be much more human-like in their capabilities than today's state-of-the-art computers, and they are expected to be in use and essential tools in all areas of business, scientific and social activities in the 1990s.

ICOT is responsible for the execution of the Fifth Generation Computer Project. There are 65 full-time

researchers and ten administrators drawn from MITI's ETL and NTT's ECL, eight manufacturers (Fujitsu, Hitachi, Matsushita, Mitsubishi, Nippon Electric, Oki, Sharp and Toshiba), and from JEIDA (Japan Electronic Industry Development Association) and JIPDEC (Japan Information Processing Development Center).

The major research results so far can be classified into four types:

- Inference subsystems; including parallel inference schemes such as reduction schemes (used in AI applications).
- Knowledge-base subsystems, including a relational database machine (Delta).
- Basic software systems: logic programming language (KL-1), knowledge programming language (Mandala), relational database management program (Kaiser), syntactic analysis program (BUP).
- Pilot models for software development: sequential programming languages (KL-O and EPS), sequential inference machine hardware (PSI), sequential inference machine software (SIMPOS).

PSI is a workstation for Fifth Generation researchers. It has been built by Mitsubishi and costs 30 million yen. (A schematic of PSI is shown in Figure 6.) PSI is equivalent to the DEC 20/60 in Prolog executing power. NEC plans to build an equivalent workstation that is ten times faster. SIMPOS, which is written on Prolog, is the operating system for PSI.

The functional requirements for Fifth Generation computer systems have been defined as:

- Problem-solving and inference functions: 100 million to 1G lips (logical inferences per second).
- Knowledge base management functions: 100 to 1,000 gigabytes for storage and retrieval systems for 'rules', as well as facts.
- Intelligent interface functions: speech, graphics, natural language.
- Intelligent programming functions: the aim is to relieve humans of the boredom of programming.

Taken together, these functional requirements define the requirements for a knowledge information processing system.

A schematic representation of an 'ideal' Fifth Generation Computer System is shown in Figure 7.

The applications envisaged for Fifth Generation Computer Systems include:

- Machine translation (English/Japanese, German/Japanese, Korean/Japanese).

Figure 6 PSI fifth-generation workstation

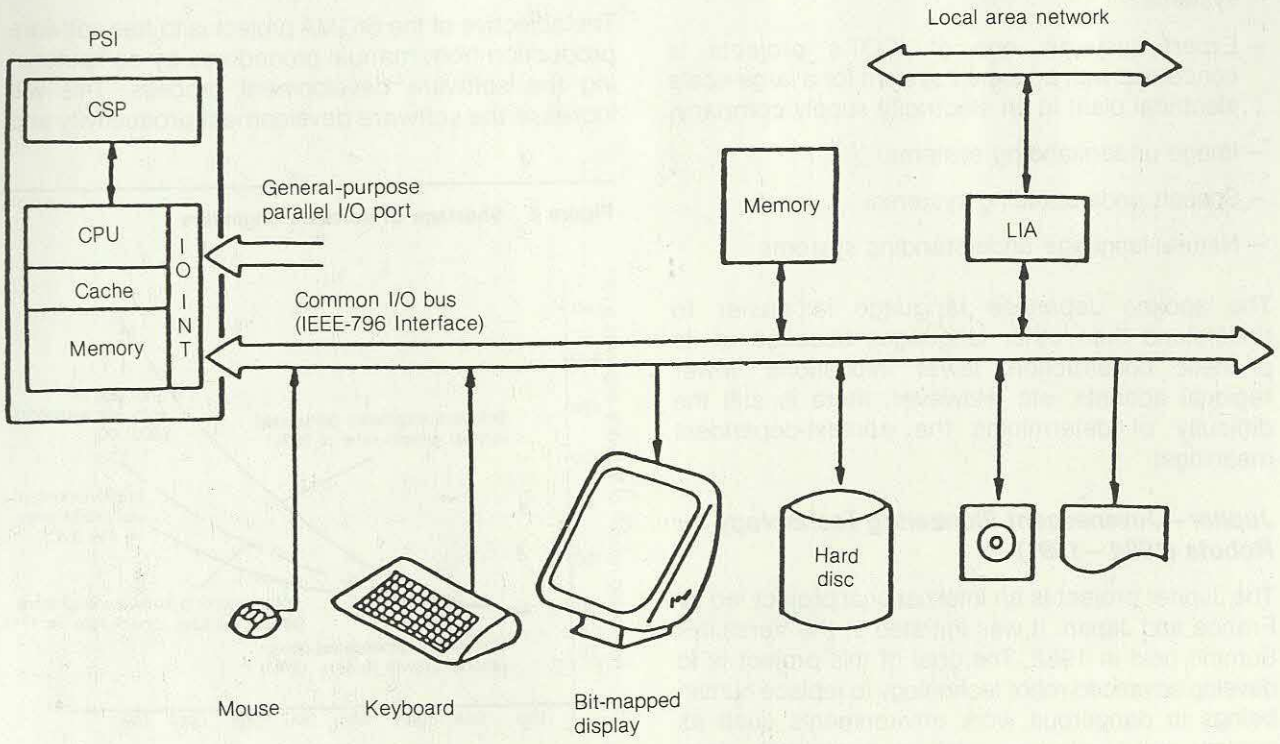
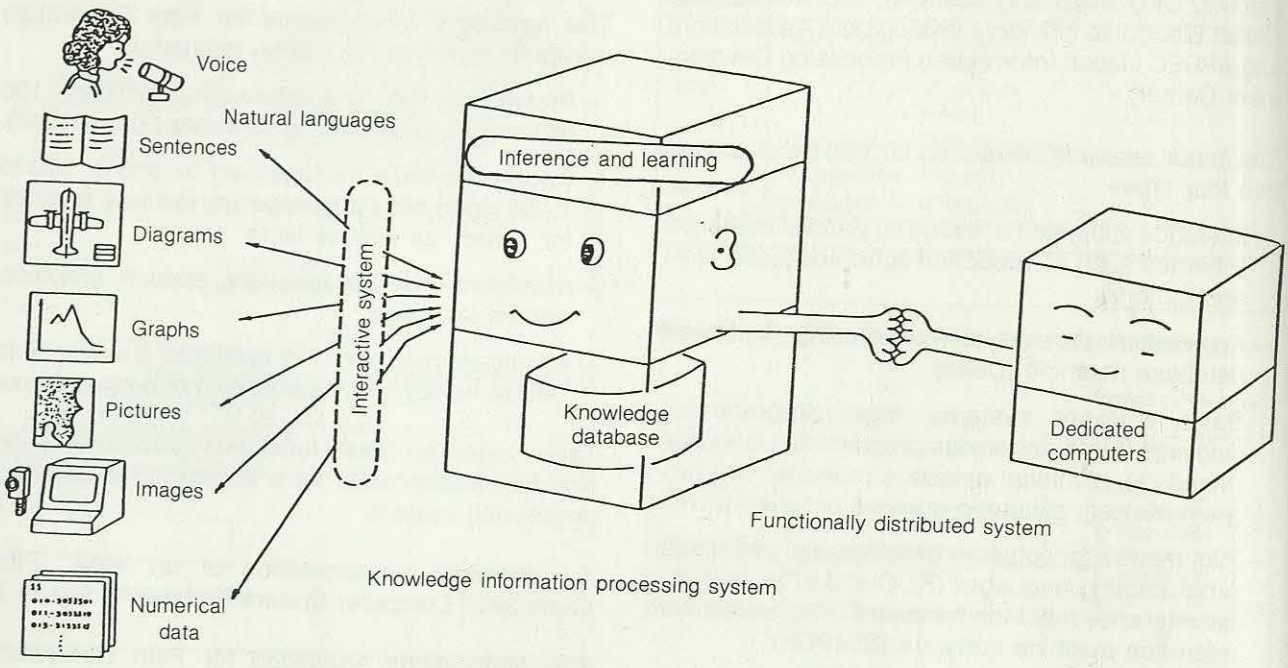


Figure 7 Ideal image of fifth-generation computer system



- Intelligent CAI, office automation, and CAE systems.
- Expert systems: one of ICOT's projects is concerned with an expert system for a large-scale electrical plant in an electricity supply company.
- Image understanding systems.
- Speech understanding systems.
- Natural-language understanding systems.

The spoken Japanese language is easier to understand than other languages because of its phonetic construction, fewer intonations, fewer regional accents, etc. However, there is still the difficulty of determining the context-dependent meanings.

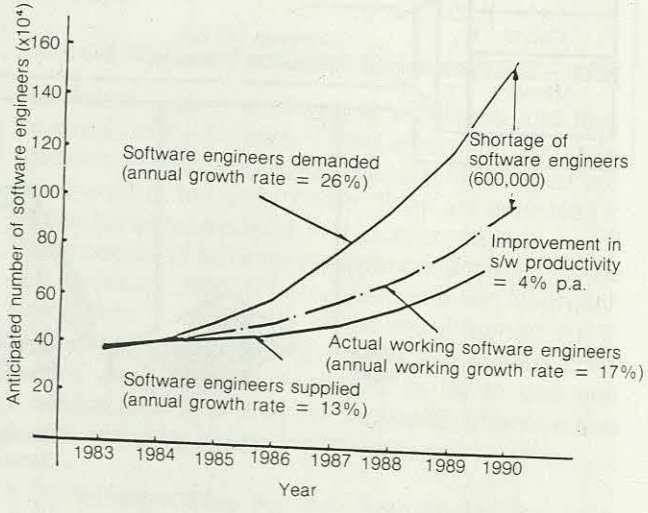
Jupiter – Juvenescent Pioneering Technology for Robots (1984 – 1991)

The Jupiter project is an international project led by France and Japan. It was initiated at the Versailles Summit held in 1982. The goal of this project is to develop advanced robot technology to replace human beings in dangerous work environments such as nuclear power plants, undersea operations, deep mining and disaster relief operations.

SIGMA (1985 – 1989)

The objective of the SIGMA project is to free software production from manual procedures by computerising the software development process. This will increase the software development productivity and

Figure 8 Shortage of software engineers



the reliability of software. The need for the SIGMA project is brought about by the anticipated shortfall in Japan of 600,000 software engineers by 1990 (see Figure 8). SIGMA was described in more detail later in the tour by Professor Ohno, who is leading the project.

During the question session, Professor Aiso said that MITI is trying to establish a training school for software engineers, offering a two-year course. (In Japan, the term 'software engineer' includes everything from applications programmers to systems programmers.)

Inter-Operable Data Base Systems (1985 – 1992)

Technologies for distributed database systems and system compatibility are essential prerequisites for a future computerised society. This project may include the following:

- Development of distributed database systems.
- Enabling databases with different operating systems to exchange information.
- The implementation of multi-media processing capability (text, voice, image, etc.).
- Enabling global and local area networks to intercommunicate. In effect, this project is addressing the standards issues at the top layers of the OSI seven-layer model.

WEDNESDAY 16 APRIL

MATSUSHITA GROUP

Matsushita markets its products under the well-known brand names of National, Panasonic, Technics, and Quasar. Matsushita has over 40 factories in Japan and over 100 offices worldwide. Our visit was to Matsushita Graphics Communications Inc. The focus of the visit was facsimile developments, and the particular interests were products that were as yet only available in the Japanese market. Many of the products were demonstrated to the delegates.

At the end of 1985 the worldwide installation of facsimile equipment was 1.8 million units, compared with 1.2 million for telex. However, these figures are somewhat misleading as there were 1 million facsimile machines installed in Japan as opposed to 0.1 million telex units, leaving the rest of the world with only 0.8 million facsimile units compared with 1.1 million telex. The world facsimile population forecast up to 1990 is shown in Figure 1.

According to Matsushita, Japan now accounts for 95 per cent of the world production of facsimile machines with the remainder being produced in France. Forecasts of facsimile machine production in Japan are shown in Figure 2.

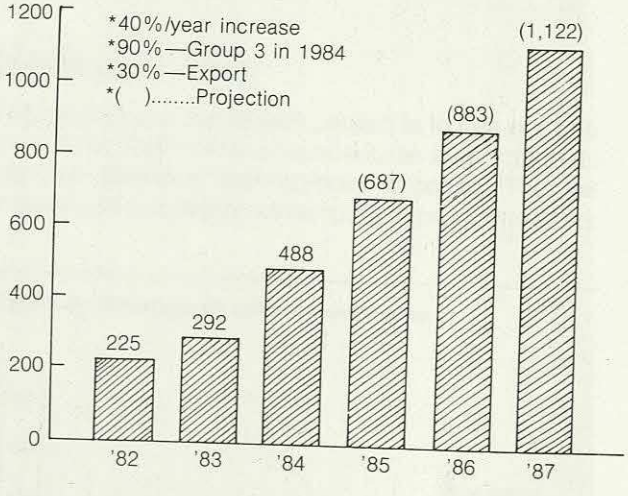
The market trends in facsimile encompass a wide range of products. At the high end of the market, products include store-and-forward memory, broadcasting to multiple receivers, mail box, high resolution, plain-paper recording using laser-beam printing, mailing system, and Group 4 digital facsimile. At the low end, the trend is towards a standard specification with products incorporating automatic dialling and a hand-set.

Applications for three products were described in some detail. These were Panamail, Group 4 and Panamemo.

Figure 1 World facsimile population forecast x 1,000 units

	1984	*1985*	*1986*	*1990*
Japan	680	980	1,350	2,200
N. America	450	590	790	1,600
Europe	120	180	260	440
Others	95	120	160	300
Total	1,345	1,870	2,560	4,540

Figure 2 Facsimile machine production in Japan x 1,000 units



Panamail

The Panamail system is an electronic mailing system incorporating the following features:

- Simultaneous broadcasting to multiple locations.
- Store-and-forward.
- Time-transfer functions, (the ability to instruct the machine when to transmit). This type of system has been installed at the Tokyo Broadcasting Company (see Figure 3).

Each day, the broadcasting company transmits to multiple locations details of news headlines, time schedules, and emergency information, and receives instant reports on, for example, elections. Before installing Panamail, transmission of documents to 24 stations took up to 50 minutes. The advantage of Panamail is that it reduces the time to make these

Figure 3 Facsimile configuration for Tokyo Broadcasting Company

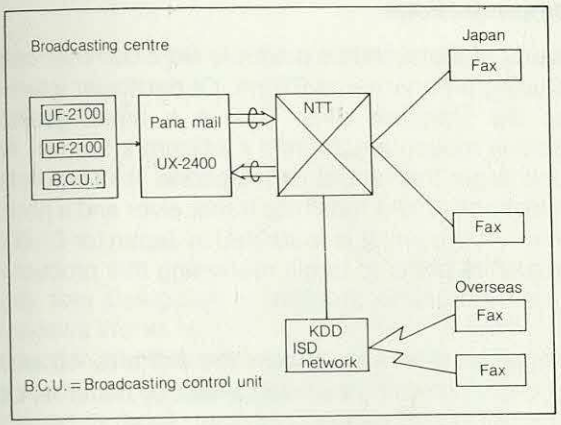
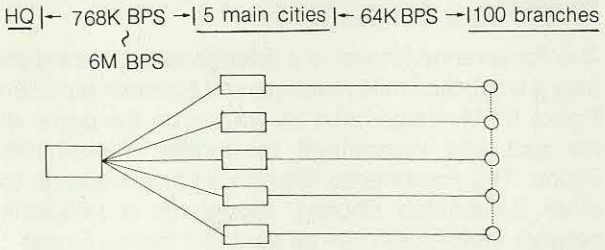


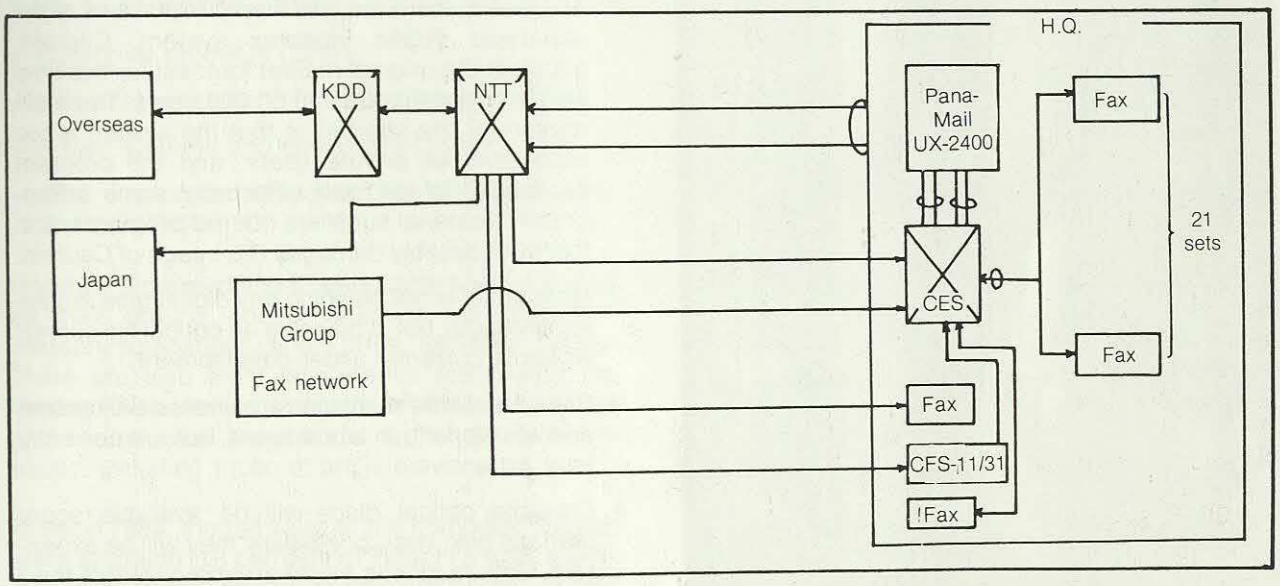
Figure 5 Digital facsimile network system (security company)



- Terminal: G4 Fax · Data · Voice
- Packet-switching system

- Total investment: ¥4,000 million
- Reduction of communication cost: ¥500 million
- Quick information supply at cheaper cost

Figure 4 Facsimile system configuration (Mitsubishi Heavy Industry)



simultaneous transmissions to four minutes. Moreover, the system ensures that no locations are missed by accident.

Another example of the use of Panamail is in Mitsubishi Heavy Industry (see Figure 4). Approximately 15,000 documents per month are transmitted on plant and design changes, both within the company and to customers. The Panamail system reduces the need for human operators considerably, and the store-and-forward facilities permit 24-hour unattended operations. There is a considerable saving on international trunk charges because cheap overnight rates can now be utilised.

Group 4 digital facsimile

The Group 4 standard has recently been defined by CCITT. The standard is for transmission at 64k bit/s and allows one A4 page to be transmitted in five seconds. At present there is no demand for stand-alone units because digital lines are not available generally. However, Group 4 facsimile is used in corporate digital networks. An example is the use by one of Japan's security companies that has 100 branches arranged around five main cities (see Figure 5).

The network is used both for Group 4 facsimile and

for packet switching. The terminal is a PC incorporating a facsimile machine.

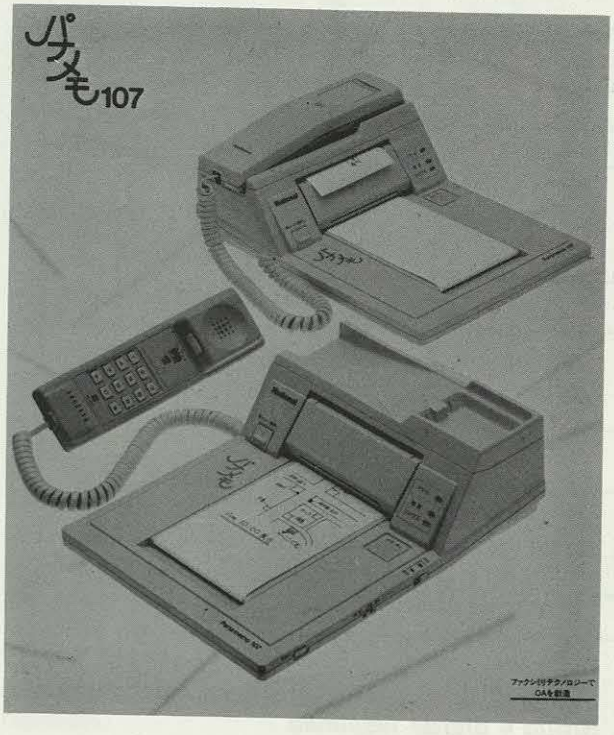
Panamemo

The Panamemo Phone is a telephone that incorporates a small facsimile machine and a sensor pad (see Figure 6). Messages can be written on the paper of the pad and transmitted to another Panamemo Phone. The Panamemo Phone can only transmit to other Panamemo Phones, though on a facsimile network information can be sent to it from a Group 2 or Group 3 machine.

The future workstation

Matsushita sees the future workstation as a PC with a facsimile scanner and printer. It can be used as a facsimile machine or as a copier, or the printer can be used as a printer for the PC. (This concept was described in Foundation Report No. 4, published in 1977.)

Figure 6 Panamemo Phone



Demonstrations

Several of Matsushita's products were demonstrated, including a Panamemo Phone. Of particular interest was the Panafax UF5. This is a small desktop machine measuring 310mm x 248mm x 130mm, not much larger than a feature telephone. It incorporates a telephone, an A4 facsimile transceiver and a photocopier. At present it is marketed in Japan for £1,600. Matsushita plans to begin marketing this product in Europe in autumn of 1986.

Delegates were also shown the Panafile 10 word processor, which has an optical disc system that can store 15,000 A4 pages.

Discussion

The following points were made during the question and answer session:

1. At present, there are less than 10,000 users of the Japanese public videotex system, Captain, although the original market forecast for this time was between 50,000 and 60,000 users. The main reason for the shortfall is that the system is too expensive for private users, and the program availability is too poor. Recently some pornographic material suppliers offered programs, and this considerably damaged the image of Captain.
2. Matsushita is not planning any digital tape archiving products, but is planning an optical file server, which is currently under development.
3. Colour facsimile machines are under development and are working in laboratories, but are currently very expensive.
4. Erasable optical discs will be available soon, perhaps next year, but initially they will be expensive. Opto-magnetic media are more reliable than pure optical media.
5. At present there are 20,000 Panamemo Phones installed. Deliveries began in December 1985 and are currently running at 3,000 per month. Most have been installed in small shops.

HITACHI LIMITED

Study tour delegates were welcomed to Hitachi's Kanagawa Works by Mr O Arai, department manager, production administration department. Mr Satoh, from the computer division planning department, then provided a brief introduction to Hitachi (84,000 employees, net sales of $12 billion for year ended March 1984, net income of $422 million). The company is a diversified electronics concern with its income coming from the following areas:

- Information and communications systems and electronic devices (30%).
- Consumer products (22%).
- Industrial machinery, including robotics (30%).
- Power systems and equipment (14%).
- Wire and cable, metal and chemicals and other products (18%).

Hitachi is organised into a headquarters in Tokyo and six main groups, one of which is the Computer, Telecommunications and Office Systems Group. There are also eight laboratories responsible for various R&D activities. In Japan, Hitachi has 21 plants and centres, and there are a further 39 overseas plants, including those of affiliates.

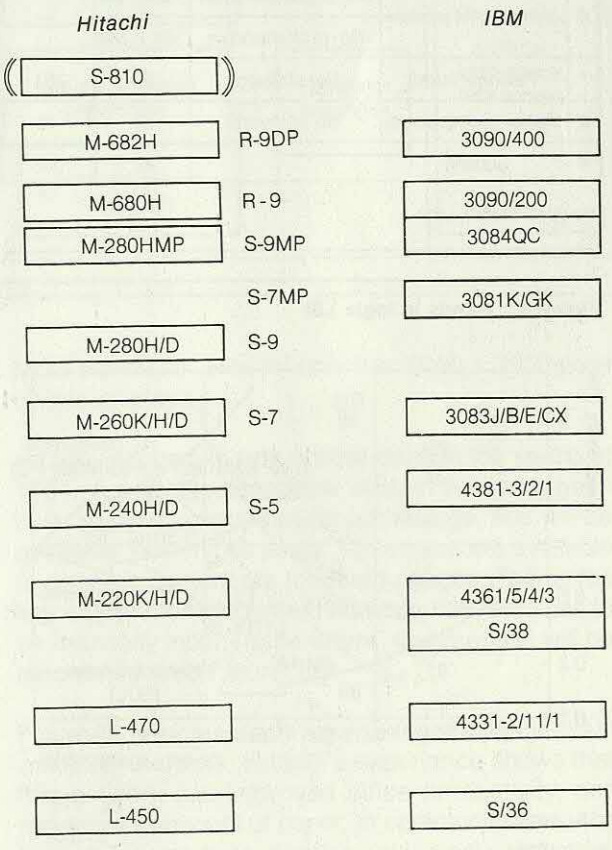
In fiscal 1984, the net sales of the computer division were $2 billion (18 per cent of Hitachi's total sales). Between 1979 and 1984, the compound annual growth rate of the computer division was 20 per cent, compared with 13 per cent for Hitachi overall. These figures illustrate why Hitachi is deliberately shifting its focus from power systems and consumer products toward electronics and computers.

Kanagawa Works is one of the computer division's nine main centres. Kanagawa is responsible for the development and manufacture of CPUs, terminals, packet-switching systems and systems integration. In Japan, Hitachi provides complete systems; overseas, the emphasis is on selling as an OEM.

Hitachi's self-sufficiency in the computer business was emphasised, with all of the major components being produced by the various plants. Hitachi manufactures the complete range of computer systems, from the S-810 supercomputer to terminal and office automation equipment. Mr Satoh emphasised the focus on inspection and quality control. Hitachi's manufacturing concept is that these procedures will produce highly reliable equipment that does not break down. Various other computer-related products (process computers, PCs, word processors, facsimile machines, switching systems, bubble memory, etc.) are produced by other Hitachi divisions.

Figure 1 shows Hitachi's range of processors. The middle column show the PCM equivalents, and the righthand column shows the approximate IBM equivalent. The R-9, which is Hitachi's response to IBM's

Figure 1 Hitachi's range of processors



(Source: Hitachi, Ltd.)

Sierra range, will soon be shipped overseas. The S-810, at 630 megaflops/sec, is faster than the Cray-1. At present the S-9 is Hitachi's top-of-the-range PCM processor, and Figure 2 compares the technological characteristics of the R-9 with the S-9. The S-9 has twice the speed of the R-9.

Figure 3 depicts the major trends in LSI logic, and shows that Hitachi's technology is considerably more advanced than IBM's. In particular, IBM's ECL Sierra chips are approximately equivalent to Hitachi's 21H chips, which were originally available in 1981.

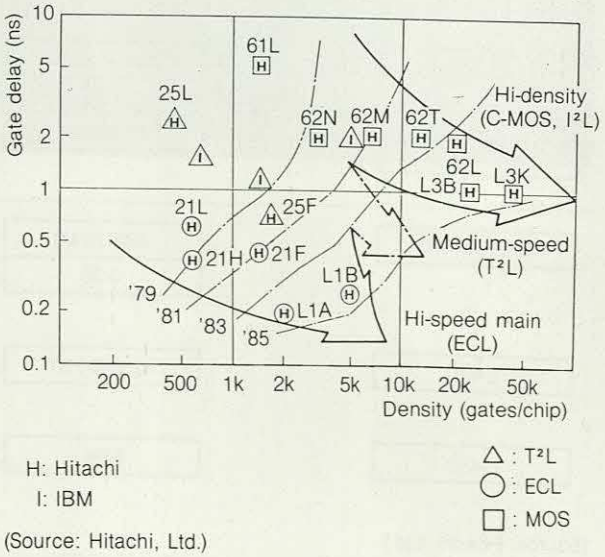
Mr H Hirai, Chief Engineer at Kanagawa Works then outlined the worldwide growth of the computer industry (Figure 4). The total market is expected to grow by between 11 and 12 per cent per year from $112.3 billion in 1985 to $350 billion in 1995. The major factors promoting this growth, and the resulting user requirements in the 1990s, are shown in Figure 5.

Figure 2 Technological characteristics of Hitachi's R-9 and S-9 processors

#	Item			R-9		S-9	
1	Logic LSI	ECL	Max. No. of gates/chip	2K	5K	550	1.5K
			Switching speed (ns)	0.2	0.25	0.35	0.45
2		CMOS	Max. No. of gates/chip	24K	40K	—	
			Switching speed (ns)	1	1		
3	Memory LSI	Bipolar	No of bits/chip	4K	16K	4K	
			Access time (ns)	4.5	12	7	
4		NMOS	No. of bits/chip	256K		64K	
5	Logic-in-memory LSI		No. of gates/chip	1.2K		770	
			No. of bits/chip	7K		6K	
6	Hybrid RAM module		No. of gates/module	700	700	—	
			No. of bits/module	32K	128K		
7	Package (card)		No. of layers	20		10	
8	Platter (motherboard)		No. of layers	22		18	
9	Cooling			Air		Air	

(Source: Hitachi, Ltd.)

Figure 3 Trends in logic LSI



H: Hitachi
I: IBM

△ : T²L
○ : ECL
□ : MOS

(Source: Hitachi, Ltd.)

Figure 4 Worldwide growth of the computer industry

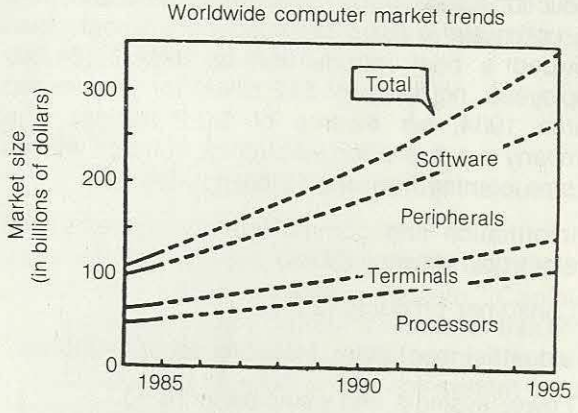


Figure 5 Major factors for the growth of the computer industry

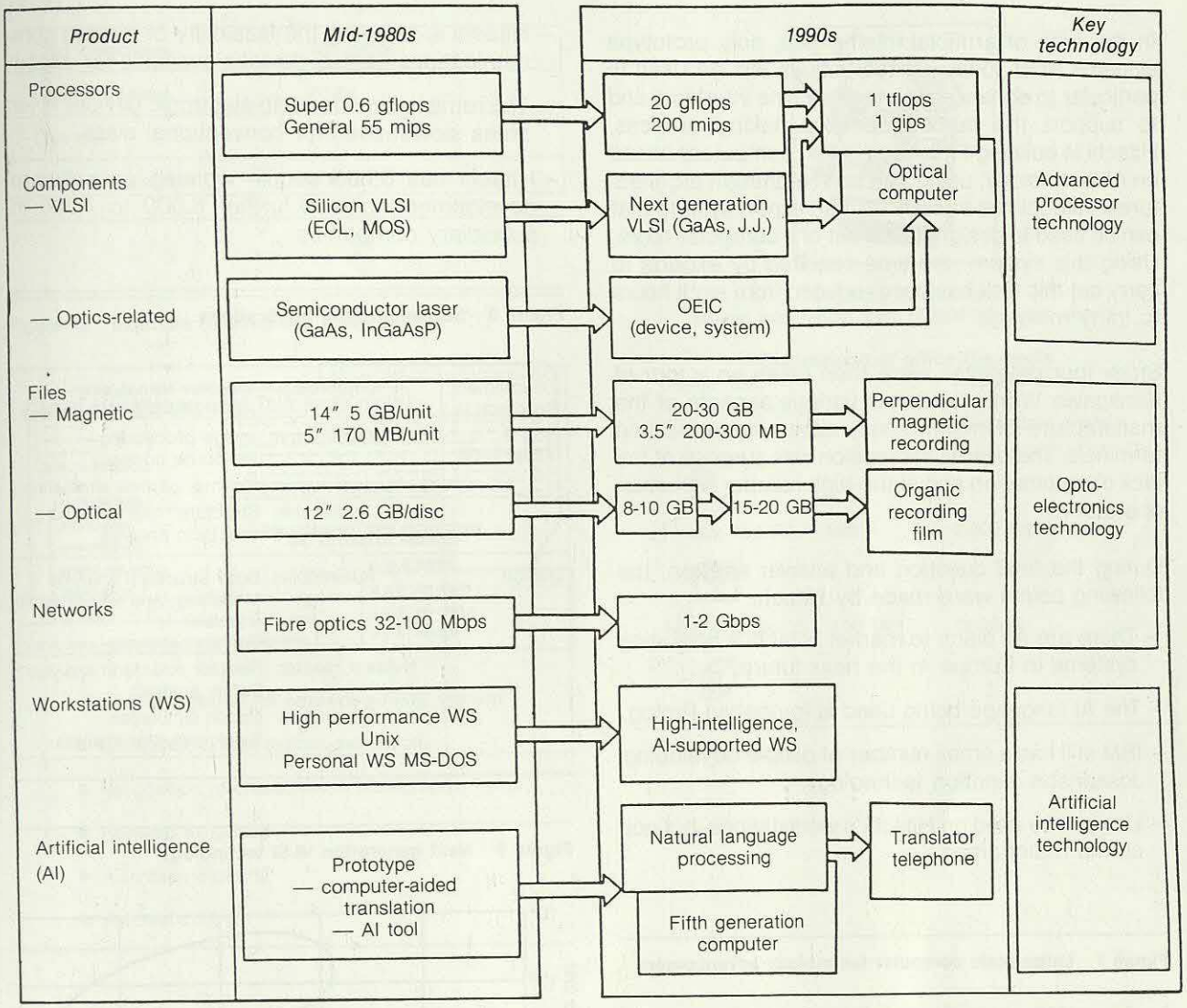
Rapid growth of sophisticated computer applications

- Expanding complex applications
  — computer simulations
- Data processing by end users
  — management support system
  — paperless, automated office
- System integration by network
  — intra- and intercorporate networks
  — multimedia communications systems

User requirements in the 1990s

- Making use of computer capabilities more freely and flexibly
- Implementation of high-level man-machine interface
- Freer utilisation of computer networks

Figure 6 Hitachi's major computer products for the 1990s



Mr Sakai, Overseas Operations Department, next reviewed Hitachi's product development objectives and Hitachi's future computer-related technologies. The slides used during the presentation are reproduced in Figures 6 to 29.

The key technologies for future products will be advanced processor technology, opto-electronics technology and artificial intelligence technology. Hitachi is developing gallium arsenide devices and Josephson Junction (JJ) devices. In fact, Hitachi now has JJ gate-array devices and these will be used in the supercomputers of the future (probably at least ten years from now).

Graphics will also be an important area – particularly 3-D graphics, which might be used to determine the piping construction layout for a chemical plant or to simulate and analyse the potential distribution of a MOS transistor. Hitachi now has 2000 x 2000 pixel colour displays.

Hitachi shipped its first optical discs in the spring of 1984. A prototype erasable system has now been built, using magnetic-optical technology, and will be available "within five years". Scanners are available to connect documents to stored images. Today, the key information (document number, title, etc.) has to be manually input. In the future, this process will be automated (see Figure 12).

Figure 16 depicts Hitachi's own integrated large-scale computer network. Hitachi's experience shows that this network has improved office productivity, and reduces the amount of paper. In communications, the next challenge is to develop multimedia networks. Opto-electronics will be a vital feature of the future, and Hitachi is developing OEICs (opto-electronics

integrated circuits). The aim is to be able to transmit a bit stream of at least 1G bit/s.

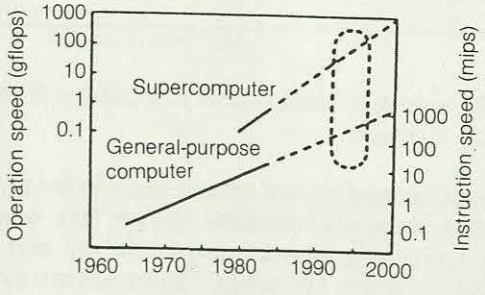
In the area of artificial intelligence, only prototype systems exist today. AI techniques will be used in particular to enhance the man-machine interface, and to support the human decision-making process. Hitachi is building Fifth Generation computers based on AI-technology, using non von Neumman architectures. Hitachi has already built an expert system that can be used to design the layout of a computer room. Using this system, the time required by experts to carry out this task has been reduced from eight hours to thirty minutes.

Study tour delegates were then taken on a tour of Kanagawa Works, and saw various aspects of the manufacture of mainframes, supercomputers and terminals. The overall impression was surprise at the lack of automation and at the high number of human operators.

During the final question and answer session, the following points were made by Hitachi:

- There are no plans to market Hitachi's operating systems in Europe in the near future.
- The AI language being used is (probably) Prolog.
- IBM still has a small number of people developing Josephson Junction technology.
- Unix will be used on Hitachi's workstations, but not on the mainframes
- Fibre optic disc channels will be available in "the very near future".
- Hitachi is studying the feasibility of making communications control devices available for export.
- The retrieval time for opto-electronic devices is ten times slower than for conventional discs.
- Hitachi has 6,000 people working on software development, plus a further 6,000 to 7,000 in subsidiary companies.

Figure 7 Large-scale computer technology advancement



Computer system in the first decade of the 21st century

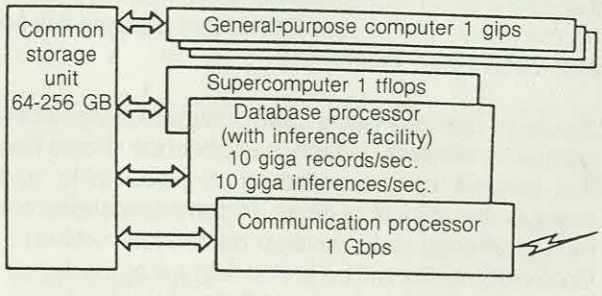


Figure 8 Supercomputer applications

Environment: Research in natural phenomena	Meteorology:	Weather forecasting Hurricane path forecasting
	Ocean/land:	Image processing Resource control
	Nuclear fusion:	Plasma, particle simulation
	Atoms, molecules:	Structure, reaction, and spectrum analysis
Design	Automobile:	Body structural analysis Modelling, and aerodynamic analysis Collision analysis
	Nuclear reactor:	Reactor structural analysis Safety analysis
	Electronics:	Circuit simulation Semiconductor analysis

Figure 9 Next generation VLSI technology

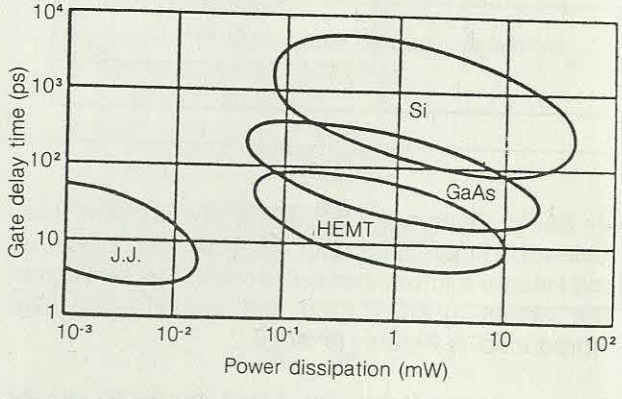


Figure 10 GaAs device

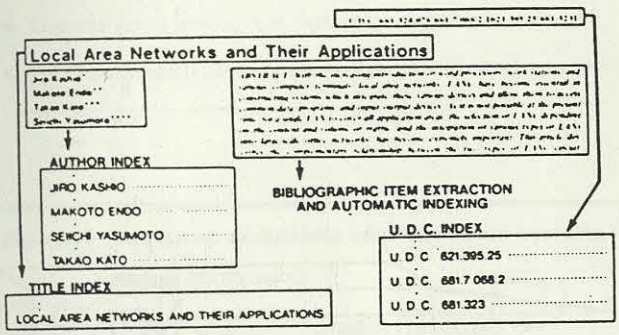
GaAs SRAM

Chip integration	4 Kbits
Access time	2.2-3.0 ns
Chip size	4.68 x 3.68 mm²
Power dissipation	1.0 W

Figure 11 Josephson logic gate array

Chip integration	768 gates
Gate delay time	20 ps
Chip size	5 x 5 mm²
Power dissipation	3 mW

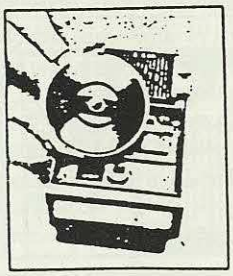
Figure 12 Example of advanced filing system



Features required for advanced filing system

- Bibliographic item regions extraction
- Recognition of characters in bibliographic items
- Keyword extraction
- Automatic indexing
- Automatic filing

Figure 14 Optical disc storage



Capacity 2.6 GB/disc
storing information from 60,000 letter-size sheets

Comparison of office file media

Optical disc	1 optical disc
File cabinet	10 standard drawers
Floppy disc (5″, 1 Mb)	2,600 floppy discs
Magnetic disc (5″, 100 Mb)	26 discs

Figure 13 Optoelectronic product technology objectives

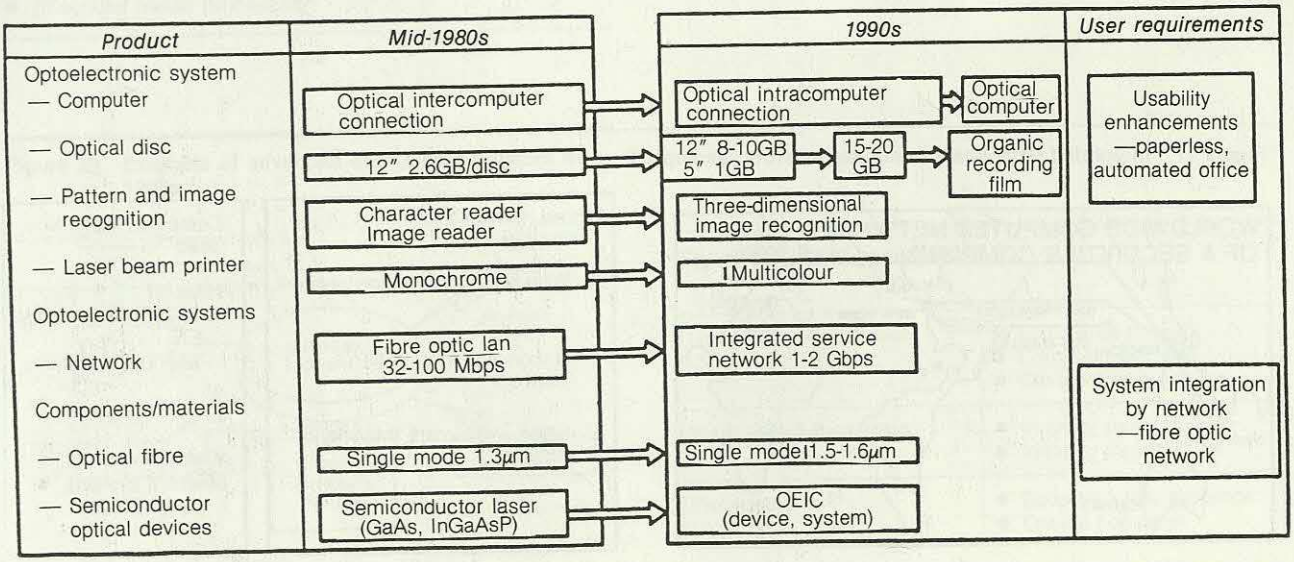


Figure 15

Future network requirements

- Integration of large-scale networks
  - — interconnection of different types of computers and terminals
  - — internetwork connection (connection of local area networks and wide area networks)
- Implementation of multimedia communication networks
  - — voice, coded data, still and moving pictures

Technological objectives

- Network support according to OSI standard
- Integrated network management
- Fibre optic integrated service networks
- Utilisation of OEIC

Figure 16 Integrated large-scale computer network, example 1

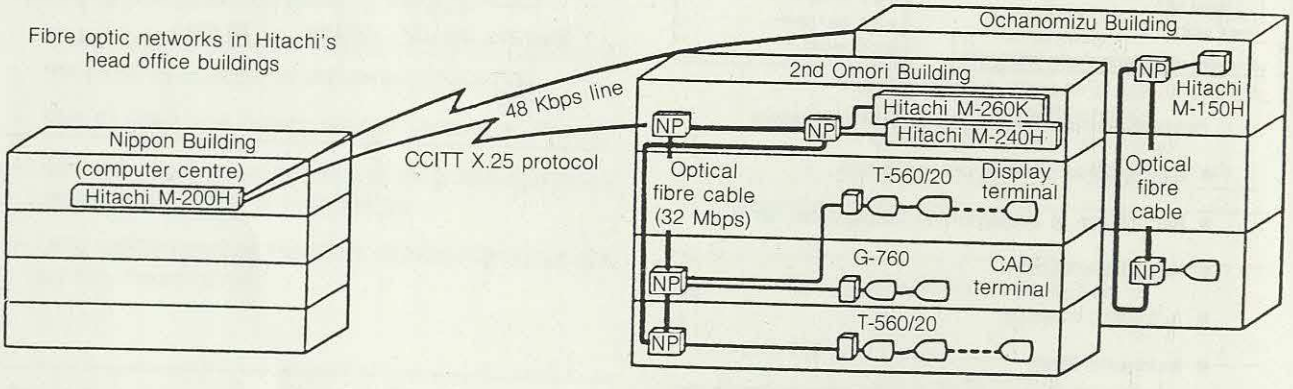
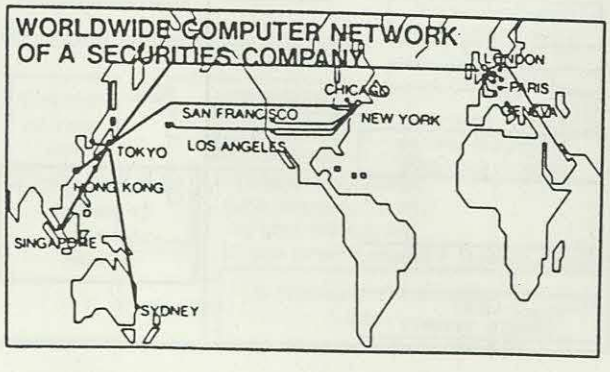


Figure 17 Integrated large-scale computer network, example 2



Three networks

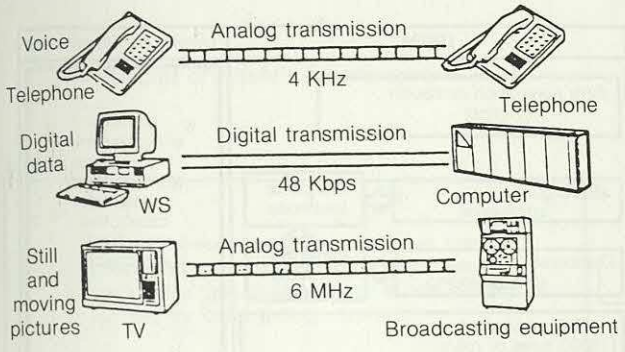
1. Worldwide information network
2. Nationwide information network
3. Stock investment information network

Computer systems used

Hitachi
M-280H 5 systems
M-200H 3 systems
M-170 2 systems

IBM, Univac and others 7 systems

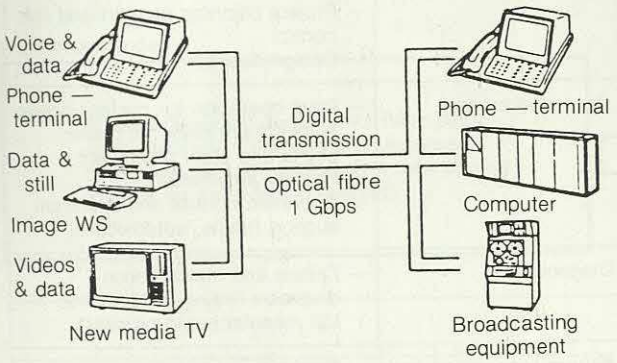
Figure 18 Existing multimedia communication systems



Independent network service

- Coexistence of analog and digital transmission
- Data transmission using different types of media and networks

Figure 19 Advanced multimedia communication systems



Integrated network service

- Digital transmission using ISDN procedures
- Integrated data transmission
- Integrated media processing

Figure 20 Example of advanced multimedia network in 1990s

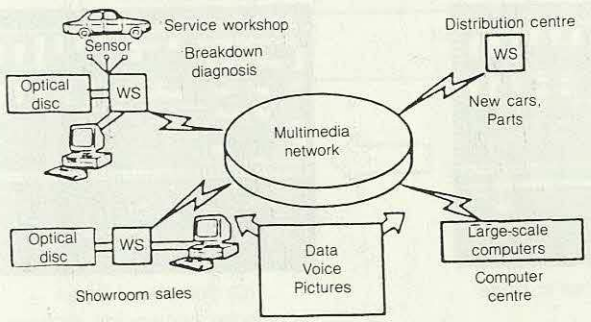


Figure 21

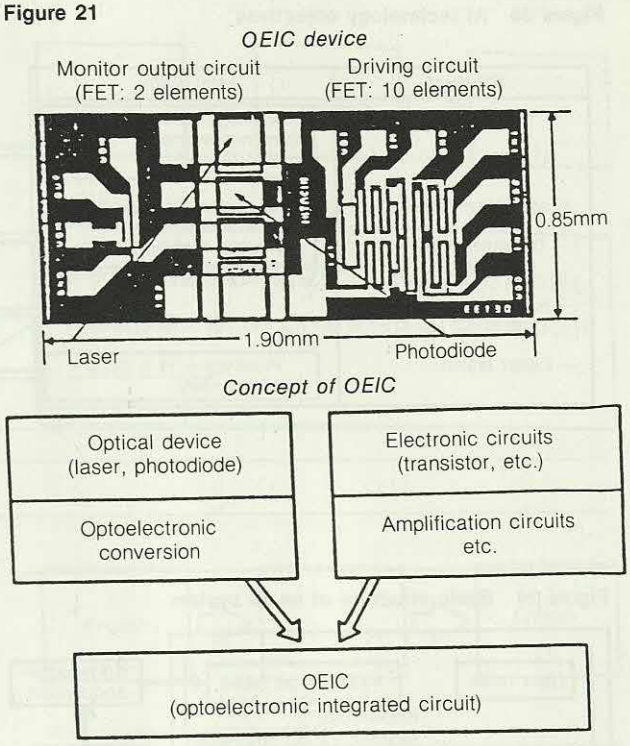


Figure 22 OEIC applications

Local area transmission	• Local area network • Computer circuitry • Car-electronic circuitry
Wide area transmission	• Intercity transmission • Intracity transmission
Processing	• Optoelectronic exchange • Optical computer

Figure 23 AI technology objectives

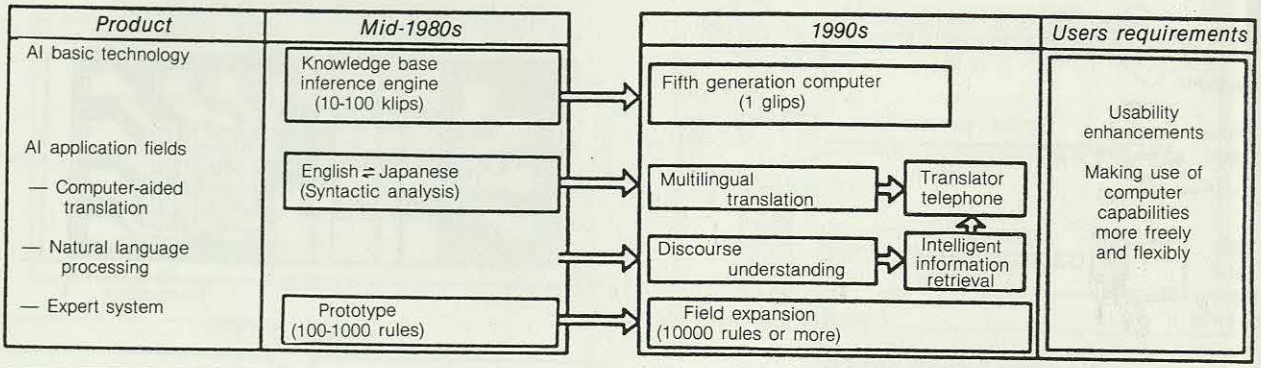
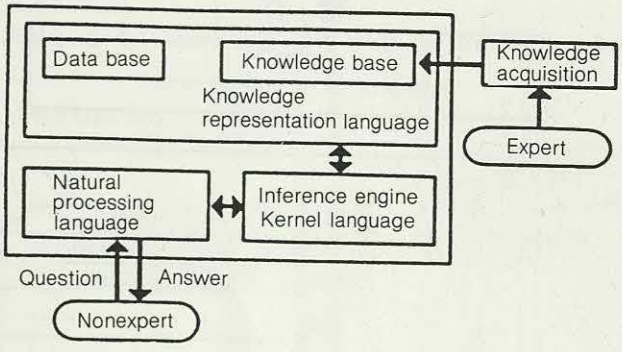


Figure 24 Basic structure of an AI system



Technological objectives

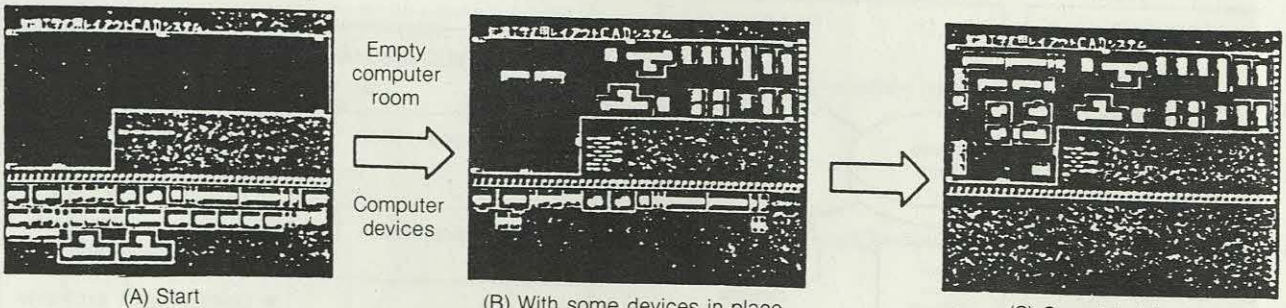
- High speed
  1 glips (10^9 logical inferences per second)
- Parallel inference capability
- AI language-oriented architecture
  (support of languages such as Lisp or Prolog)

Figure 26 Expert system applications

Planning and design	— Layout CAD — Project planning support and risk control — Design support
Operation control	— Plant operation for nuclear power plants, thermoelectric power plants and steel plants, etc. — Factory automation — Operation control and operation support (trains, automobiles)
Diagnosis	— Failure and maintenance diagnosis (trains, automobiles, LSI manufacturing process)
Pattern recognition and understanding	— Search for resources — Robotic transport

Figure 25 Example of expert system

AI used for computer room layout



(A) Start

(B) With some devices in place

(C) Completed layout

Computer component diagram

Figure 27 Example of computer-aided translation

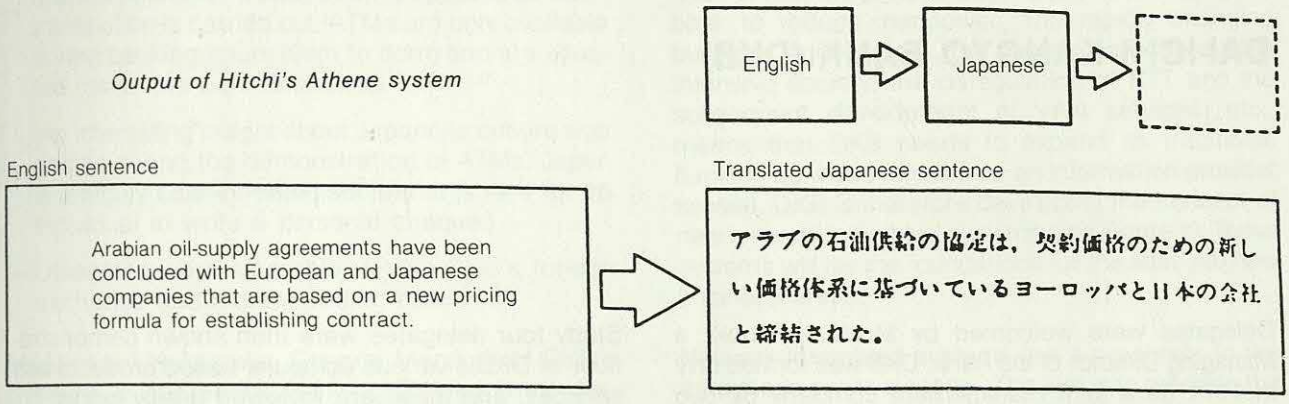


Figure 28 Example of computer-aided translation

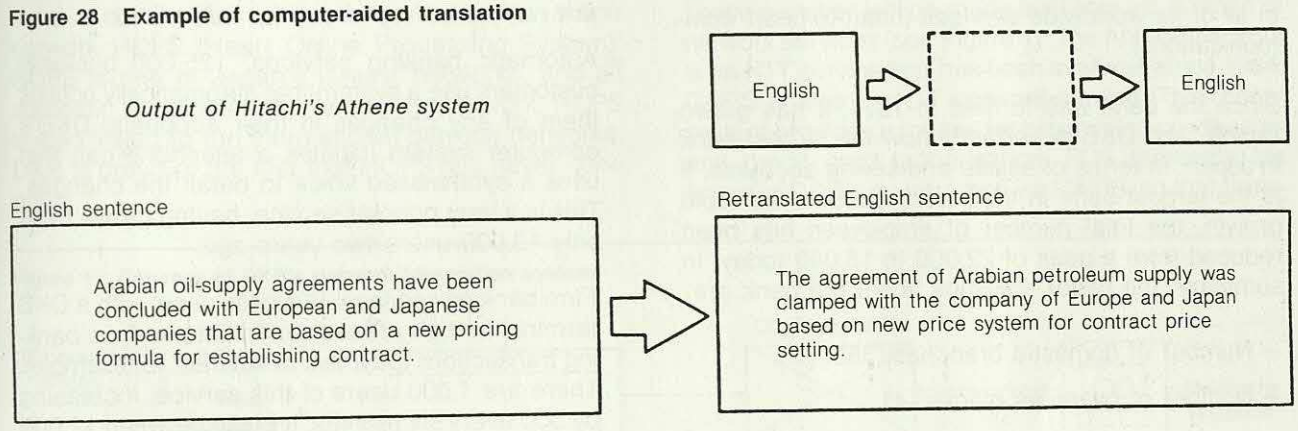
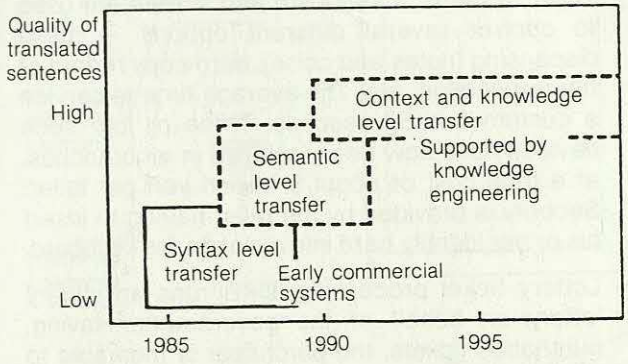


Figure 29 Technological advancements of machine translation



THURSDAY 17 APRIL

DAI-ICHI KANGYO BANK (DKB)

Delegates were welcomed by Mr Akira Unoki, a Managing Director of the Bank. DKB was formed only in 1971 as a joint management company by two banks, and is a young and growing bank. The symbol of the bank is a heart, which is meant to represent the emphasis the bank places on human relationships in all of its worldwide services (heart-to-heart communications).

Since the bank was formed in 1971, it has grown rapidly, and DKB is certainly now the largest bank in Japan. In terms of assets and saving accounts, it is the largest bank in the world. Despite the rapid growth, the total number of employees has been reduced from a peak of 22,000 to 18,000 today. In summary, the major statistics about the bank are:

- Number of domestic branches: 353.
- Number of overseas offices: 41.
- Average number of customer visits per day: 756,000.
- Number of current deposit accounts: 11,000,000.
- Number of debit cards issued: 6,500,000.
- Number of cash dispensers and ATMs: 1,500.

Mr Unoki said that the bank's sophisticated computer systems had meant that DKB had been able to offer a range of new services and products in a rapidly changing business, legislative and social environment. The bank's third-stage online systems were now being developed, and these would allow the bank to be even more flexible in developing new products and services. Employees from all levels of the bank, from top management downwards, are involved with the development of the new systems. The aim is to provide effective management tools and a means to supply a wide range of user services via network systems.

DKB is aiming to provide a total financial service to domestic and business users. For business users, this will mean providing a total financial information service as well as conventional banking services, and the third-stage online systems are being built with this aim in mind.

Study tour delegates were then shown demonstrations of DKB's various computer-based products and services, and these are reviewed briefly below:

- DKB is involved with the Captain videotex system, but has not met with much success. Consumers are not yet willing to pay for information.
- Automatic banking services. 125,000 business customers use a system that automatically notifies them of any changes in their accounts. DKB's computer system initiates a telephone call that uses a synthesised voice to detail the changes. This is a very popular service, having grown from only 13,000 users two years ago.
- Firm banking services. Business users with a DKB terminal in their offices can initiate various banking transactions (payment of salaries, for example). There are 1,000 users of this service, increasing by 500 every six months. It costs between 12,000 and 13,000 yen per month. Security is provided by passwords and an automatic call-back facility. Users can also make transfers between their own accounts.
- Teller systems: a keyboard and screen are used to control several different options – cash dispensing (notes and coins), hard-copy record of the transaction, etc. The average time to service a customer is 60 seconds. Three or four such devices have now been installed in all branches, at a total cost of about 5 million yen per teller. Security is provided by the teller having to insert his or her identity card into a slot on the keyboard.
- Lottery ticket processing: DKB runs an instant lottery on behalf of the government. Having, purchased tickets, the purchaser is then able to have them read automatically by a machine provided free-of-charge by the bank, which determines if any of the tickets is a winner. DKB claimed not to make any money out of the lottery, but delegates were highly sceptical of this claim.
- ATMs: DKB's ATMs provide withdrawal and depositing facilities. Eighty per cent of the bank's customers use ATMs to withdraw cash and 30 per cent use them to pay in cash as well. The machines can read the bank notes deposited (and count

the coins) to verify the amount deposited is correct, and the customer's pass book is updated as each transaction is carried out. ATMs are only available during banking hours (9am to 6pm) and are situated inside the bank branches.

(An interesting insight about Japanese culture was gained during the demonstration of ATMs. Japan is a highly cash-oriented society. It is rare for an individual to write a personal cheque.)

– Delegates were also able to visit DKB's foreign exchange and money trading room.

Mr Michaiki Nakazawa, General Manager of DKB's Systems & Operations Planning Division, next described the development of the bank's third-stage online systems, and set these developments in the context of the evolving electronic banking environment in DKB. The bank has an extensive online network HOPS (Heart Online Processing System). HOPS is one of Japan's largest networks, and all domestic branches are linked to the network. HOPS is also linked to the international banking networks. DKB is proud of the fact that HOPS has never gone down.

Electronic banking in DKB is supporting the development of new products and services and is helping the bank to reduce manpower. The rapidly changing business environment, the move to an information intensive society, the deregulation of NTT and the subsequent development of VAN services, etc., means that DKB needs to expand its traditional banking activities to become an information provider as well. DKB is therefore developing the concept of new network integrated systems (see Figure 1). These systems will lay the foundations for the shift into new business areas.

Network integrated systems are a precursor to the third-stage online systems. The aim is to promote the use of firm-banking and home-banking services made available through host computer-computer links, host computer-PC links, host computer-facsimile links, etc. These services will be made available via a range of network services (see Figure 1). The ANSER network is an NTT service that has been available since 1984. CAFIS is also an NTT network service. This 'open' system provides a means for processing credit sales and credit card authorisation. POS terminals are linked to DKB's mainframes via CAFIS, so that trans-

Figure 1 Concept of DKB's network integration system

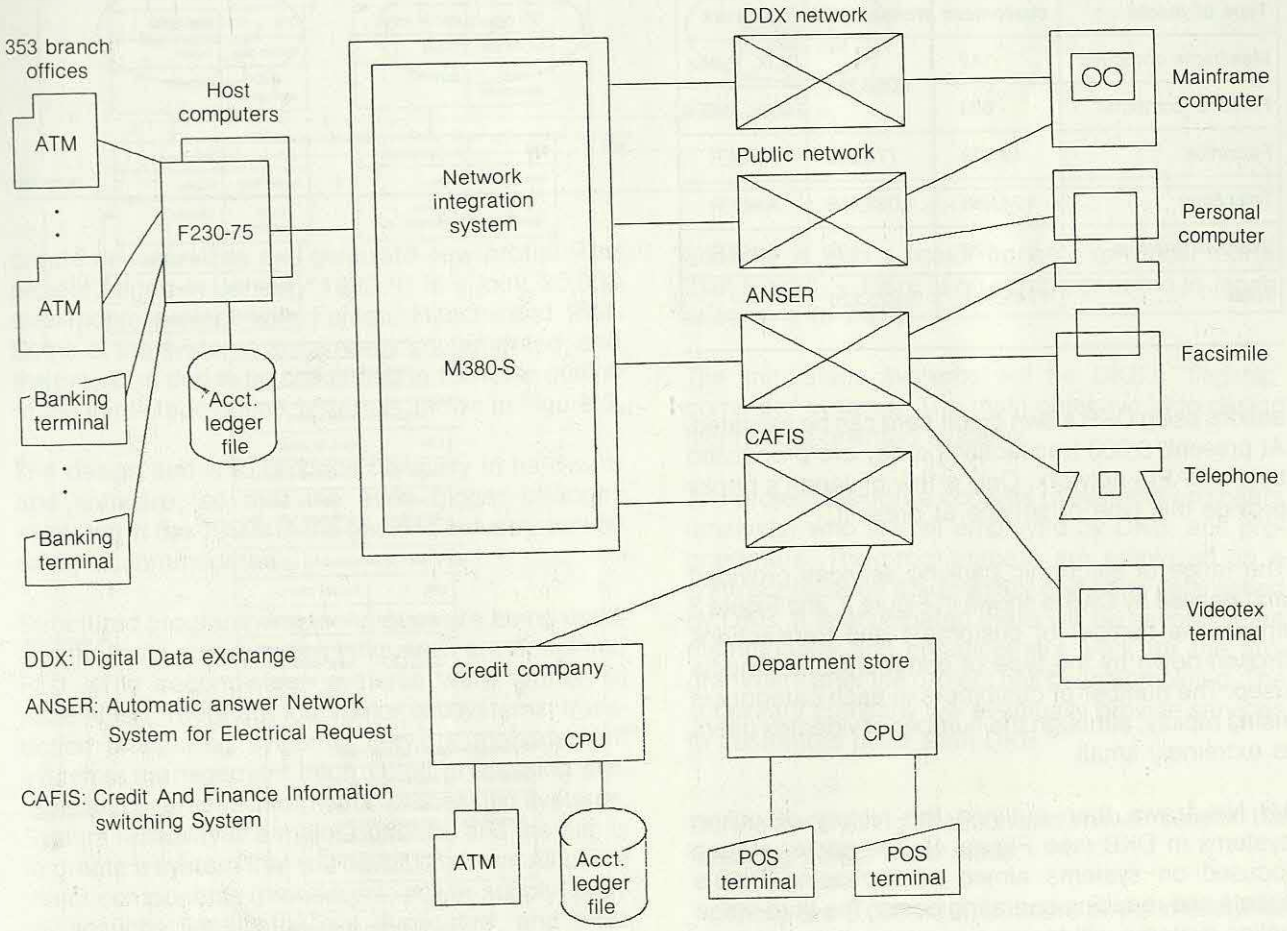


Figure 2 DKB's electronic banking services

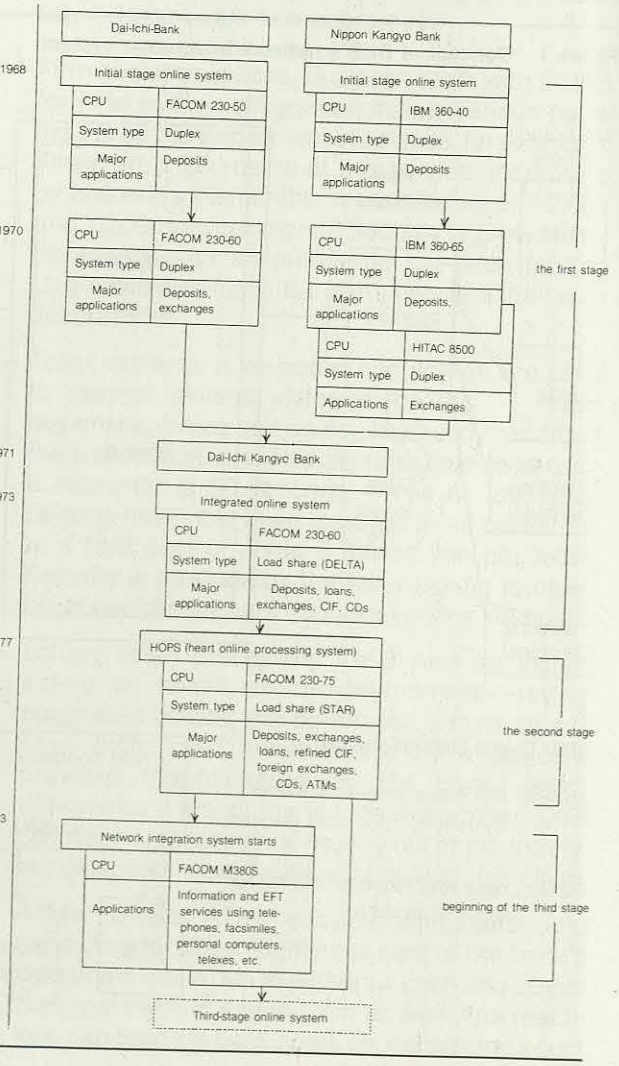
Type of services \ Communication media	Mainframe computer	Personal computer	Facsimile	Telephone	Videotex terminal
Transaction data reporting service					
Credit advice	○	○	○	○	○
Account transaction detail	○	○	○		△
Foreign exchange transactions detail	○	○			
Account balance inquiry		○	○	○	○
Batched data receiving service					
Direct crediting of wages and salaries	○	○			
Payment and transfer	○	○			
Electronic funds transfer service		△	○	○	○
Information service					
Interest rates information		○	○		○
Foreign exchange information		○	○		○
General financial and monetary information		○	○		○
Business and investment information		○			

○ services supported △ to be supported

Figure 3 Summary of electronic banking services in DKB

Type of media	Number of customers	Number of data transactions	Access network
Mainframe computer	142	1,058,281	DDX, Public
Personal computer	689		Public, ANSER
Facsimile	19,559	776,290	ANSER
Telephone	124,986	1,088,456	ANSER
Videotex terminal	128	199	ANSER
Total	145,504	2,923,226	—

Figure 4 History of online systems at DKB

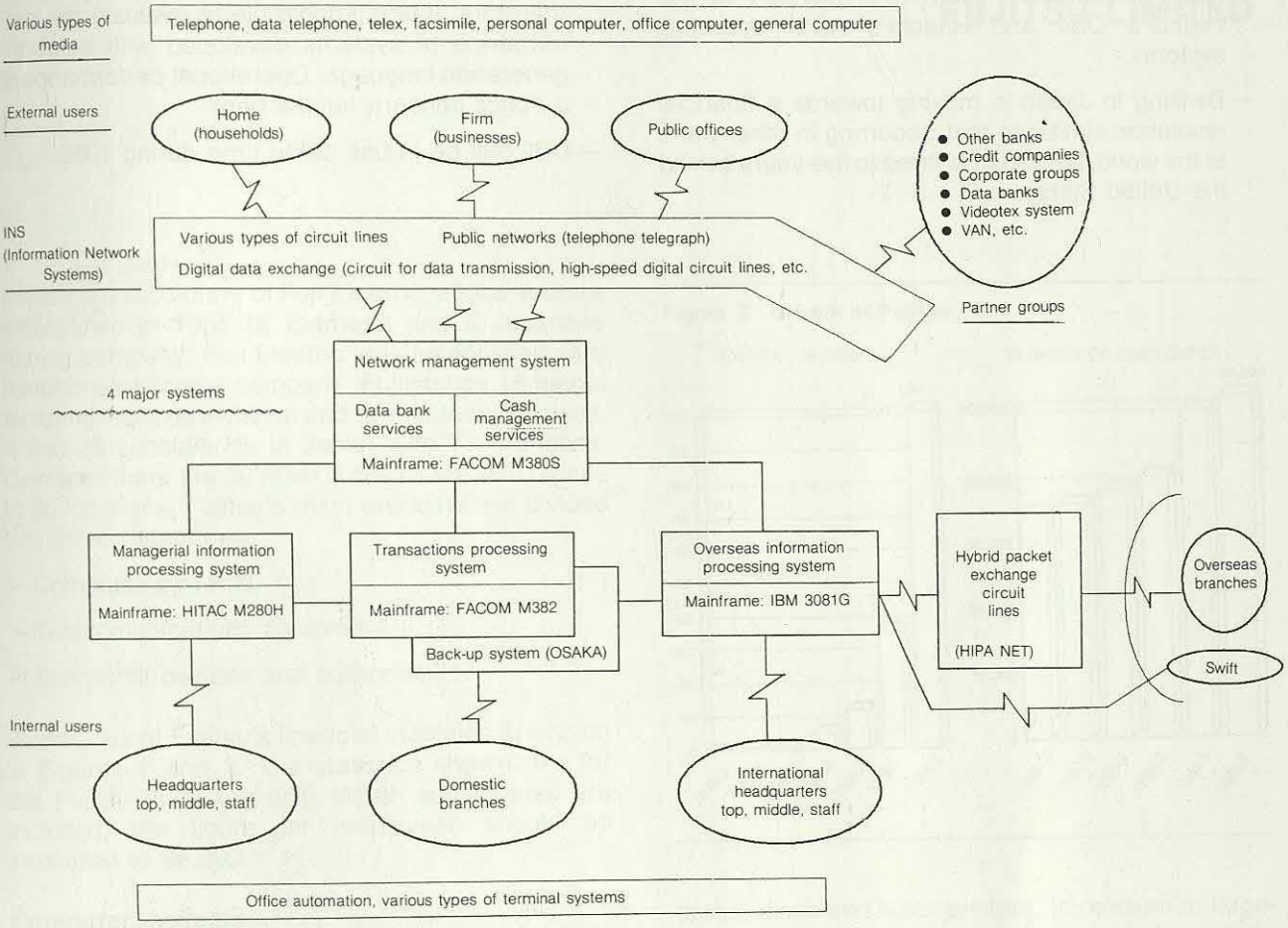


actions using DKB's own credit card can be validated. At present, 3,000 transactions a day are processed by the CAFIS network. Only a few of Japan's banks provide this type of service at present.

The range of electronic banking services provided and planned by DKB is shown in Figure 2, and Figure 3 shows the number of customers and transactions broken down by the type of communication media used. The number of customers in each category is rising rapidly, although the number of videotex users is extremely small.

Mr Nakazawa then outlined the history of online systems in DKB (see Figure 4). The earlier stages focused on systems aimed at increasing DKB's assets and reducing operating costs. The third-stage online systems will focus on systems that can help

Figure 5 Outline of DKB's third-stage online system



create new services and generate new profits. The project began in January 1982. It is a joint 20,000 man-month project with Fujitsu, Hitachi and IBM. Some of the systems are already implemented, and the project is due to be completed in 1987. An outline of the third-stage online system is shown in Figure 5.

The design aim is to produce flexibility in hardware and software, so that the even bigger changes expected in the 1990s in the banking industry can be easily accommodated.

Structured programming techniques are being used, and the main programming languages are Cobol and PL/1. (The second-stage systems were written in Assembler). There are four major subsystems: transaction processing systems, network management systems, management information processing systems and overseas information processing systems. System reliability is a major concern, and the aim is to create a system that will never go down. All of the major components (processors, power supply, communications lines, etc.) are duplicated, and triple backup systems are provided.

Security is also a major concern (physical, rather than logical – there is no computer crime in Japan, according to DKB).

The third-stage systems will be DKB's 'flagship' computer systems. The main objective is to design highly user-oriented systems.

The project taskforce consists of systems engineers (analysts) who are all employed by DKB, and programmers. The programmers are employed on a contract basis by a subsidiary company established by DKB. It is anticipated there will be several years maintenance and enhancement work for the programmers after the project has been completed. The subsidiary company will eventually provide services to customers other than DKB.

During the ensuing question and answer session the following points were made:

– There are 3,000 internal users of the managerial information processing system.

- DKB claimed it did not know the cost of each banking transaction processed.
- IBM's MVS/IMS is used. It is planned to use Fujitsu's OS4 and Hitachi's ADM operating systems.
- Banking in Japan is moving towards a financial revolution similar to that occurring in other parts of the world, but Japan is three to five years behind the United States.
- Cobol and PL/1 were chosen in preference to a fourth-generation language because "the software house know how to use these languages". Furthermore, it was impossible to evaluate the performance of systems developed with a fourth-generation language. Operational performance is a major concern for the bank.
- DB2 will be in use some time during 1986.

FUJITSU LIMITED

Fujitsu is a subsidiary of Fuji Electric, a joint venture established in 1935 by Siemens and a Japanese mining company. Fuji Electric was established as a telephone switching company. Fujitsu has 15 manufacturing facilities in Japan and ten in other countries. It has 38 subsidiaries in Japan with 73 branches. Overseas there are 30 other subsidiaries with offices in 20 locations. Fujitsu's main products are divided into three categories:

- Computer systems.
- Telecomunications equipment.
- Electronic devices and components.

Summaries of Fujitsu's financial statistics are given in Figures 1 and 2. The statistics shown are for the Fujitsu company only. When subsidiaries are included, the figure for employees should be increased to 98,000.

Figure 1 Fujitsu's sales trend

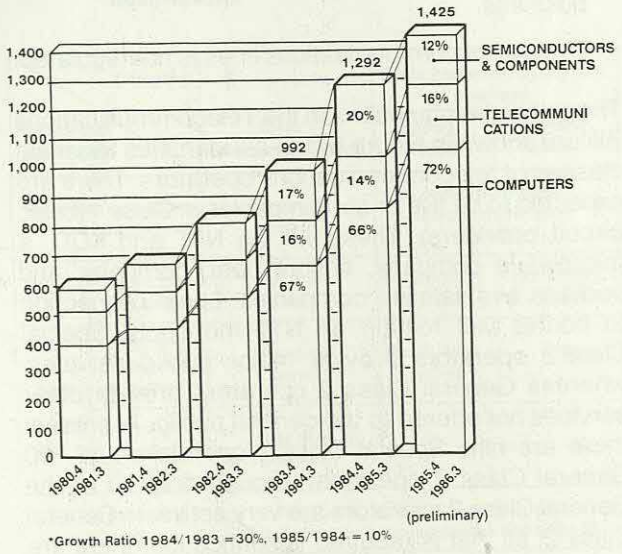
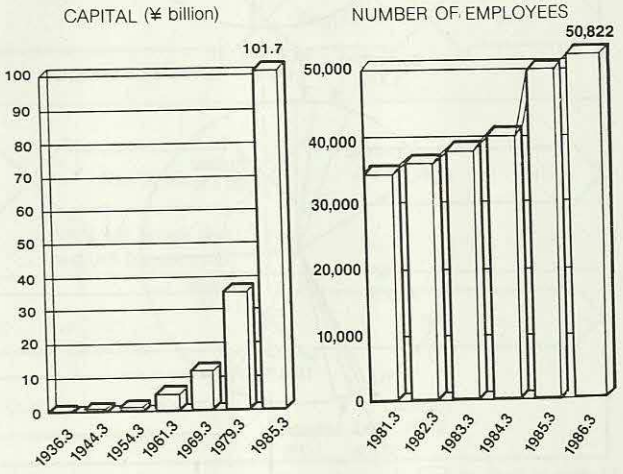


Figure 2 Growth of Fujitsu



Computer systems

Fujitsu's products range from supercomputers through to minicomputers, word processors and computer peripherals – the latter including magnetic tapes, discs and laser printers. In medium to large-scale computers, Fujitsu has the largest share of the Japanese market (in terms of number of systems) and is approximately equal to IBM in terms of value of systems (see Figure 3). When small-scale systems are added, Fujitsu's share clearly excedes that of IBM (see Figure 4).

Telecommunications equipment

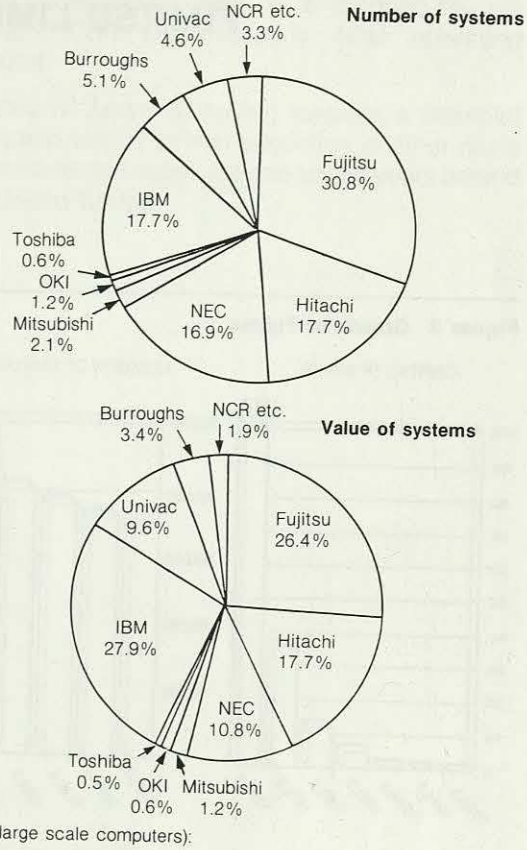
Fujitsu's telecommunications products range from digital switching systems through satellite and submarine communications systems to radio and transmission equipment.

Electronic devices and components

Fujitsu manufactures MOS dynamic RAM, EPROM, CMOS, GaAs, and FET semiconductor components. In addition, bubble memory, plasma displays and many other components are manufactured.

Performance of the semiconductor products division in 1985 was very poor because the world price had fallen to ten per cent of that of the previous year, but Fujitsu is still continuing to provide this essential technology. The main effort is on GaAs devices, invented by Fujitsu. Another key area is bubble

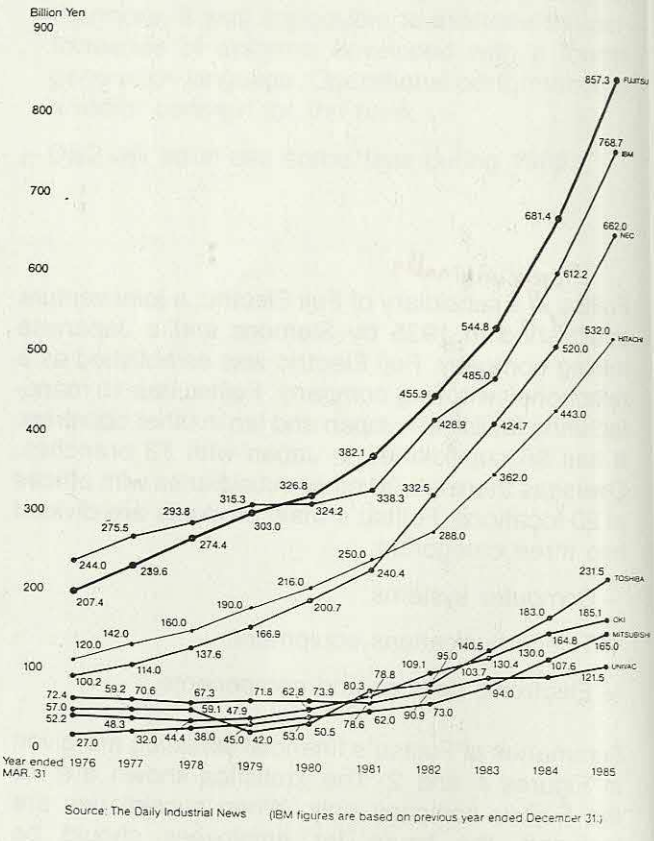
Figure 3 Japanese computer market breakdown (as of January 1986)



(Medium to large scale computers):

(Source: Sannô College)

Figure 4 Recent sales trends of major computer manufacturers in Japan



Source: The Daily Industrial News (IBM figures are based on previous year ended December 31.)

memory, even though IBM has abandoned its development in this field.

FUJITSU'S STRATEGIES IN THE NETWORK BUSINESS AGE

Mr Okada, General Manager of the VAN system division in the systems engineering group described Fjuitsu's plans for network services. The systems engineering group has 5,000 direct employees and a further 5,000 in subsidiaries. Mr Okada spent 15 years in charge of R&D for NTT (the public telephone system), and for the past ten years has been concerned with the marketing and systems engineering of private corporate networks and VANs.

The deregulation of the Japanese communications industry has presented significant opportunities for many companies. In particular the Telecommunications Business Bill, which became law on 1 April 1985, has permitted many new companies to enter the telecommunications supply and service business. The changes are summarised in Figure 5. Services to the left of the dotted line marked X in Figure 5 are controlled by the Ministry of Post and Communications; services to the right are controlled by MITI.

The main features of the new telecommunications bill are:

- The introduction of the principle of competition in every field of telecommunications.
- The minimum of regulations compatible with the sound development of the telecommunications business.
- The use of communications lines is not regulated.

The principle regulations in the Telecommunications Bill are shown in Figure 6. The bill identifies two main classes of telecommunications operators. There are expected to be five or six companies in Class 1 (basic circuit providers). These will be NTT and KDD, a microwave company, a fibre optic company, and perhaps two satellite companies. Local connection to homes will remain an NTT monopoly. Special Class 2 operators provide major public services, whereas General Class 2 operators provide other services not offered to the general public. At present there are nine Special Class 2 operators and 190 General Class 2 operators, though only 20 of the General Class 2 operators are very active. In General Class 2, all that is required is notification; there are no inspections.

Figure 5 Changes in the legal system (Japan)

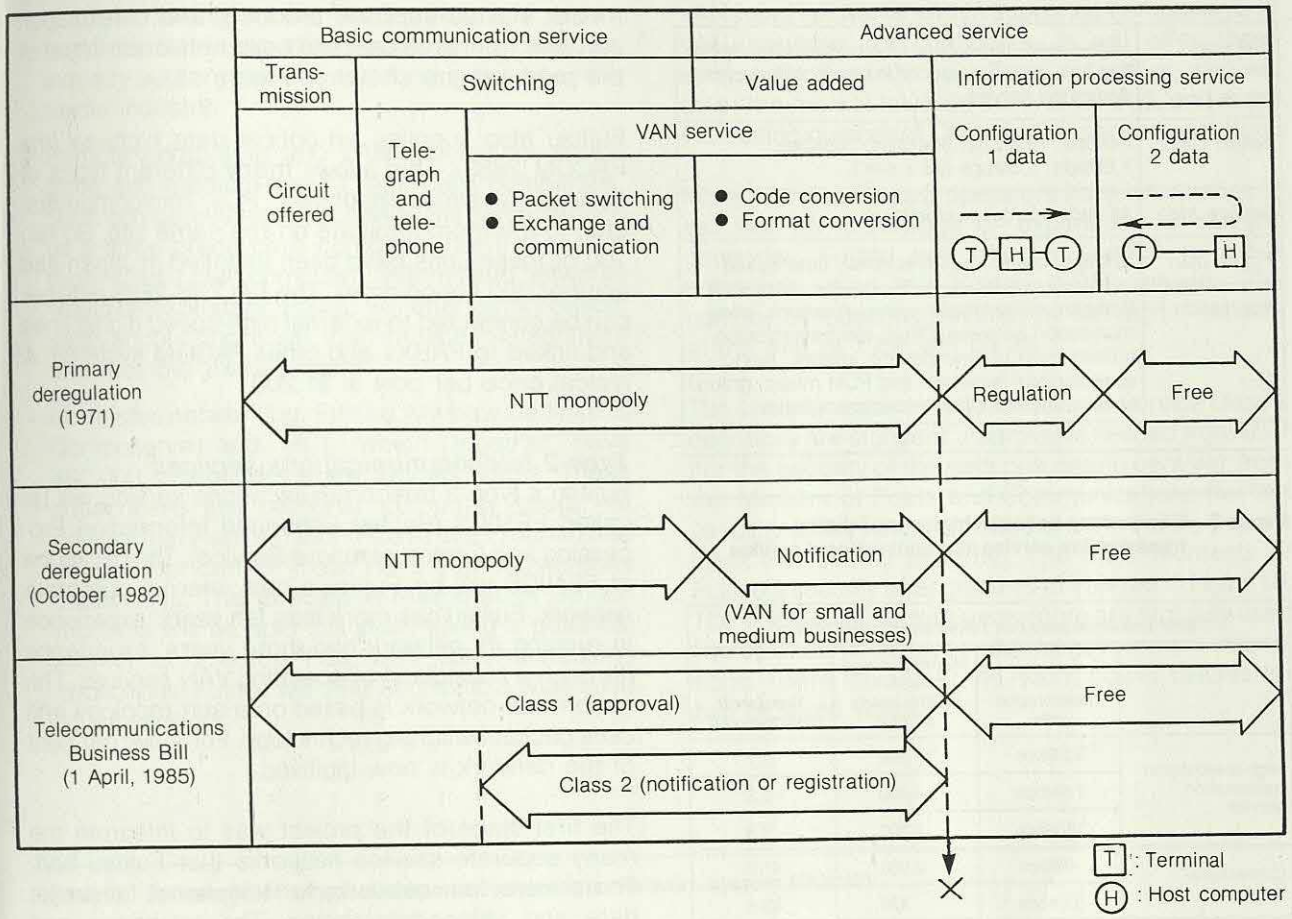


Figure 6 Principal regulations in Telecommunications Business Bill

Category / Feature and restrictions		Class 1 telecommunication	Class 2 telecommunication business: Special class 2	Class 2 telecommunication business: General class 2
Telecommunications line facilities		Personally owned	Leased from class 1 telecommunication vendor	
Restrictions	Start of operations	Licence system	Registration system	Notification system
	Condition for offering (fees and other)	Approval system	Notification system	Free
	Foreign capital ratio	Less than one-third	Free	
Details of service offered		Telephone, facsimile, data, van, etc. (No distinction between class 1 and class 2)		

Fujitsu's network business project

Two key factors led to the initiation of Fujitsu's project to develop a network business. These were the deregulation of telecommunications in 1985 and the availability from the NTT of high-speed digital transmission services. These were first made available in 1984 and at present there are 600 lines installed with a further 1,000 on order from 280 companies. Most of the installed lines are either 380k bit/s or 768k bit/s links.

The main features of NTT's high-speed digital transmissions service are summarised in Figure 7, and the clear cost benefit of using the new services is shown in Figure 8. Fujitsu expects that when new Class 1 carriers enter the market early in 1987, prices will drop by 20 per cent.

Fujitsu is developing its network business in three main areas:

- Corporate INS (COINS).
- Type 2 telecommunications services.
- Support to newcomers in the telecommunications business.

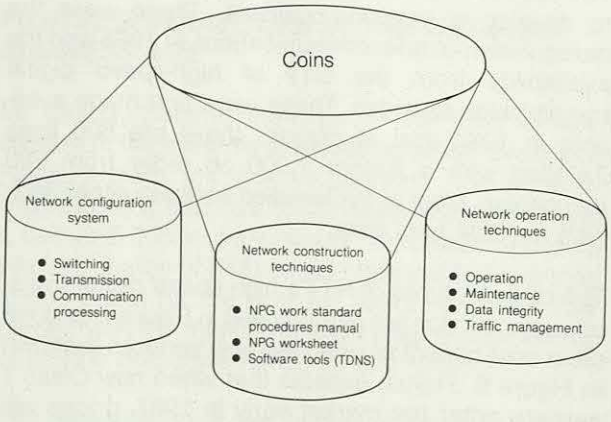
Figure 7 High-speed digital transmission service

Features	High-speed, large capacity, high-quality digital one-link, network synchronisation, full duplex dedicated service
Speed class	64Kbps, 192Kbps, 384Kbps, 768Kbps, 1.5Mbps, 6.3Mbps (96 x 64K)
Service area	All Japan (order-customised)
Future plan	32Mbps, branch, unidirectional, time based
Application	Complex multiple/split communications, communication between CPUs, file transmission, transmission of newspapers, images, high-speed/colour facsimile, and PCM music, ground access lines to satellite communication

Figure 8 Comparison between high-speed digital transmission service and conventional service

Communication between Tokyo and Osaka (500km)			
	Transmission rate	*Monthly charge rates (in thousands of Yen)*	*Yen per bit (relative rate)*
High-speed digital transmission service	6.3Mbps	11,000	1.7
	1.5Mbps	4,400	2.9
	768Kbps	2,800	3.6
Conventional service	48Kbps	2,300	47.9
	9.6Kbps	420	43.8

Figure 9 Concept of Coins



COINS

Within the COINS project, Fujitsu will supply equipment for corporate digital data networks, methodologies for digital network design and consultation services for network construction and operation (see Figure 9). A schematic of a typical corporate information network is shown in Figure 10.

Digital technology allows voice, text, data, facsimile and video all to be carried on the same transmission media. Fujitsu supplies products and consultation services to enable users to build networks. Some of the products are shown in Figure 11.

Fujitsu also supplies an optical data highway (the FACOM 2883). This allows many different types of devices (facsimile machines, PCs, minicomputers, etc.) to intercommunicate on the same site. So far, 100 of these units have been installed in Japan and another 200 are on order. The FACOM 2883 network can be connected to external high-speed digital lines and linked to PABXs and other FACOM systems. A typical price per port is $1,200.

Type 2 telecommunications services

Fujitsu's type 2 telecommunications service will be called FENICS (Fujitsu Enhanced Information Processing and Communications Service). The backbone of FENICS will be Fujitsu's own internal corporate network. Fujitsu has more than ten years' experience in running its network and three years' experience (through a subsidiary) of operating VAN services. The nationwide network is based on a star topology and uses packet-switching technology. Forty-five per cent of the network is now digitised.

The first stage of the project was to integrate the many separate service networks that Fujitsu had. There were four networks for telephone, facsimile, data and videoconferencing. The telephone and facsimile networks were controlled by the general services department, whereas the data network was controlled by the systems department. Now, the unified network is controlled by a single entity. The aims of the project were:

- To reduce line costs by 30 per cent.
- To provide more advanced and diversified services.
- To improve communications quality.
- To improve network operation monitoring, administration and maintenance.
- To extend the geographic range.

The results of the first stage of the project are shown in Figures 12 and 13. Note that the first phase bettered its cost reduction target of 30 per cent. The second stage was to expand the network, as shown in Figure 14.

The opportunities for suppliers of VAN services to large corporate customers are shown in Figure 15.

Some of the features that Fujitsu expects to offer through FENICS include:

- Transaction data exchange services. Examples include: linking supermarkets with their headquarters; linking shops, wholesalers and manufacturers; and providing services for specific industry sectors such as the food industry or the textile industry.
- Remote computing and VAN service for small-sized and medium-sized credit card companies. Such companies have to provide the same service as a large credit card company, but the cost of running their own computer systems and networks would be exorbitant. Fujitsu will offer authorisation, sales accounting, cash, loan service management and member management.
- Computer networking. Fujitsu will provide links to Compuserve and MCI, which together have 480,000 subscribers in the United States. These subscribers are personal computer users. At present there are 4 million PCs in use in Japan and about 5 per cent of these have communications capabilities. The forecast is that another 50,000 modems will be sold this year, giving a potential market of 250,000 PCs with communications capabilities. Fujitsu will offer access to a wide base of subscribers.

Support to newcomers

Fujitsu has very considerable experience in operating VANs and networks and in supplying components of VAN services and networks. It will offer these services both to the new Class 1 carriers, who will enter the market towards the end of 1986, and to the increasing number of Class 2 VAN service operators.

Many of these Class 2 operators have information to sell but no knowledge or experience of running networks. Fujitsu will offer a service to these operators using the Fujitsu ISDN network. The number of locations covered by the digital network at the end of 1986 will be 85.

The security requirements for Special Service Class 2 operators are stringent. Approval is needed from MITI (for the security of the data processing centres), from the Ministry of Posts and Communications (for the security of the network), and from the Police Department (for overall security). The main elements of Fujitsu's security arrangements are shown in Figure 16. The 1,000 KVA backup generators are typically used two or three times a year during government inspections. There have been no mains power failures for two or three years.

Figure 10 Schematic of a typical corporate information network system (COINS)

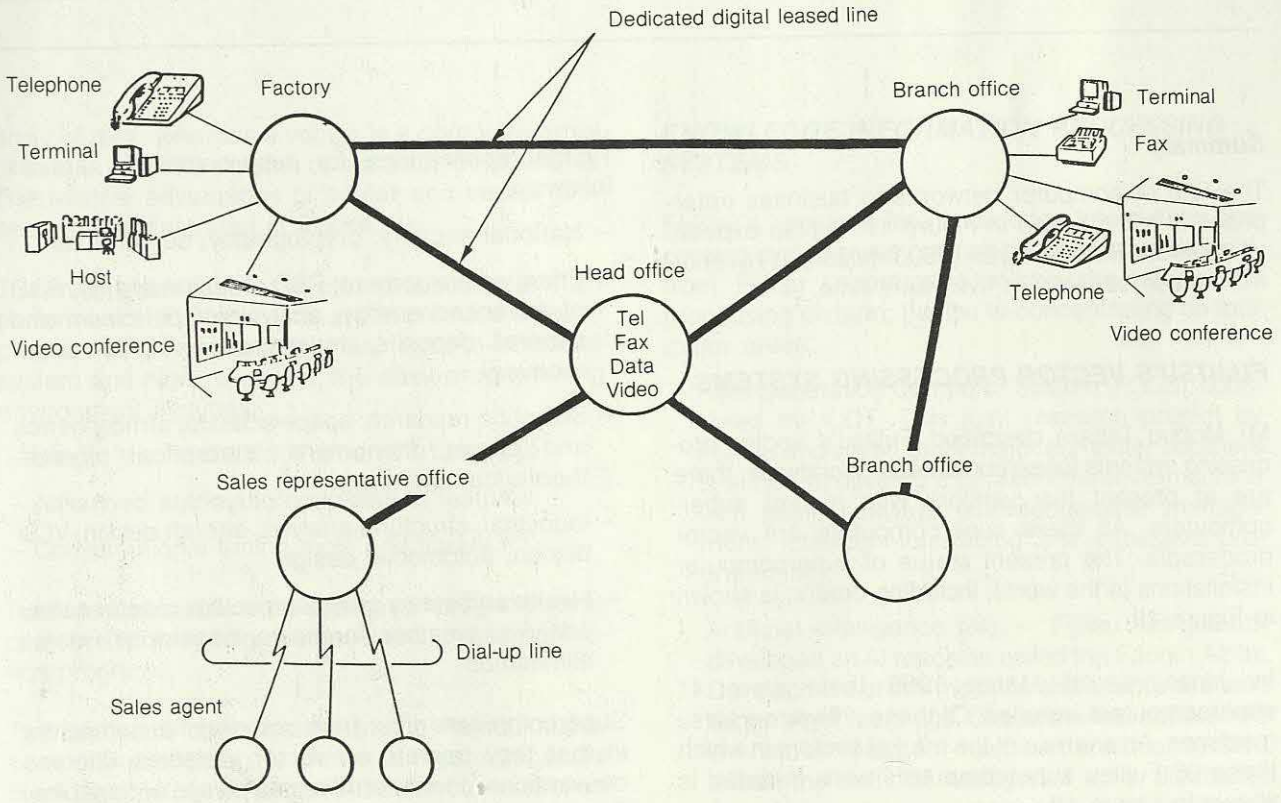
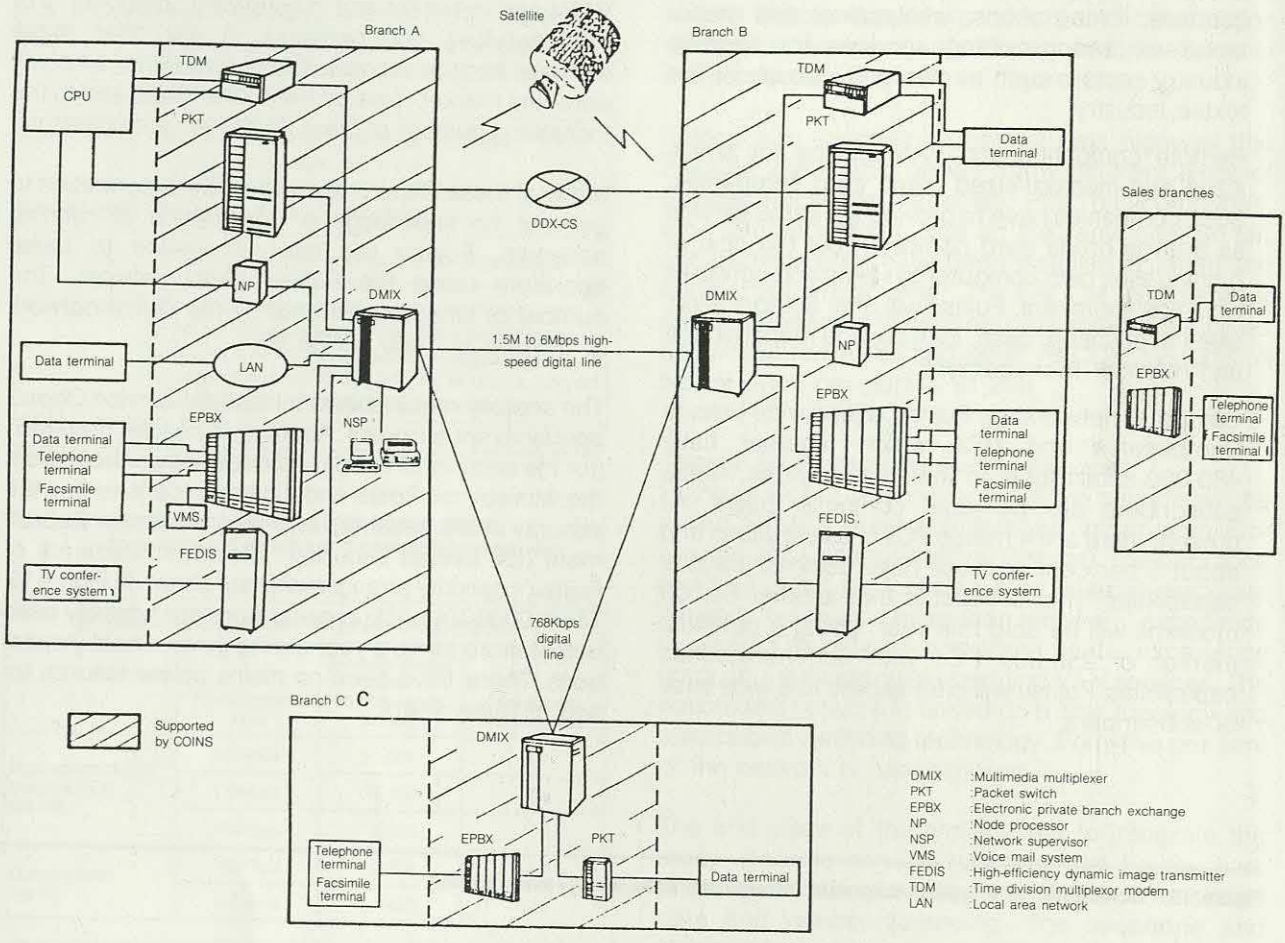


Figure 11 Products incorporated in a COINS network



Summary

The role of computer networks in business enterprises is summarised in Figure 17. Fujitsu expects to generate 80 billion yen ($500 million) in revenue from these services in five years time.

FUJITSU'S VECTOR PROCESSING SYSTEMS

Mr Mobuo Tahara described Fujitsu's vector processing systems (supercomputers). Worldwide, there are at present five vendors who market supercomputers. All these supercomputers are vector processors. The present status of supercomputer installations in the world, including orders, is shown in Figure 18.

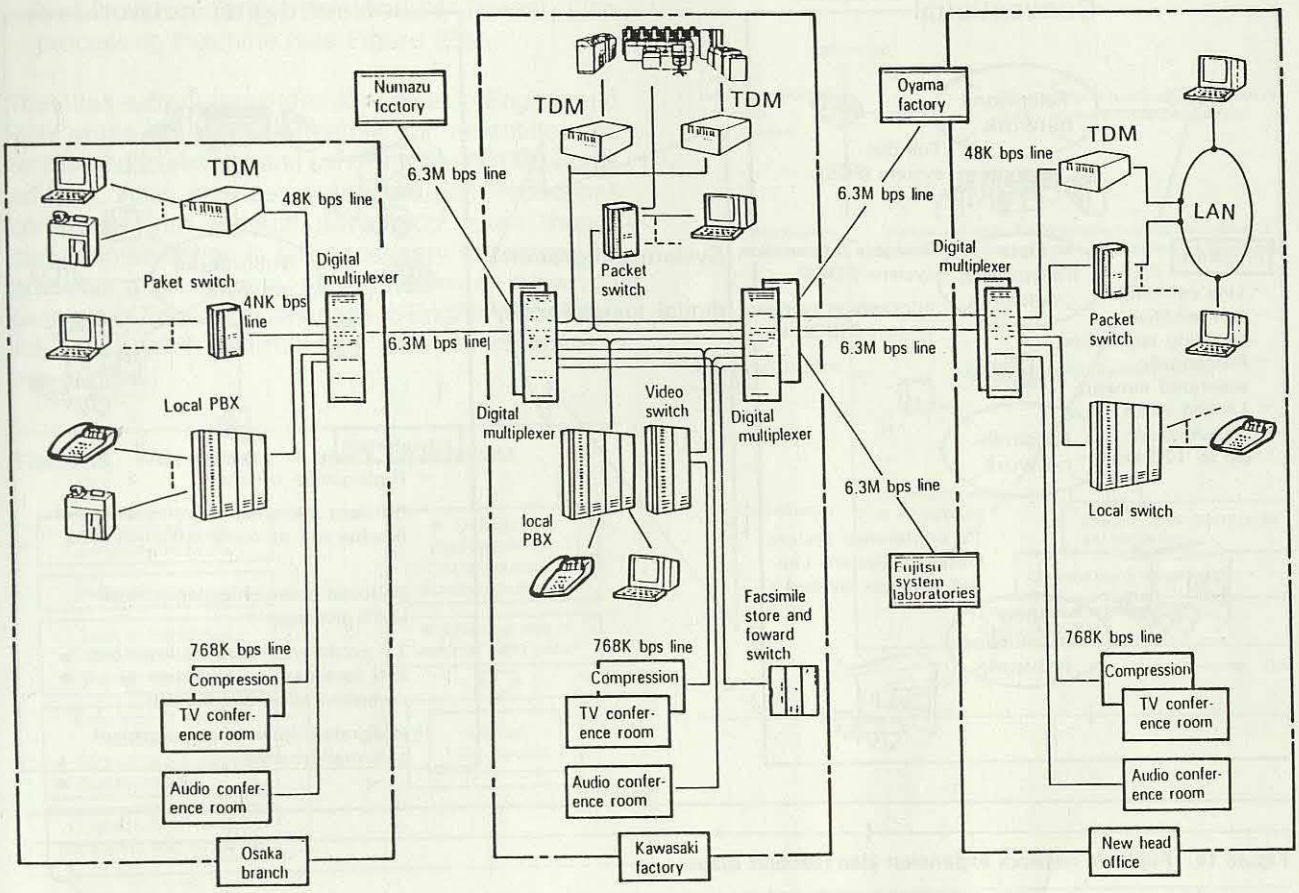
In Japan, as of March 1986 there were 41 supercomputers installed. Of these, 26 were Fujitsu machines. An analysis of the market sectors in which these 26 Fujitsu supercomputers were installed is shown in Figure 19.

Typical applications for supercomputers are as follows:

- National security: cryptography, surveillance.
- Energy development: R&D of fusion energy, R&D of advanced energy, analysis of petroleum and mineral deposits, maximisation of petroleum recovery.
- Scientific research: space science, atmospherics and ocean phenomena, theoretical physics, theoretical chemistry.
- Industrial: structural analysis, aircraft design, VLSI design, automobile design.
- Health and safety analysis: nuclear reactor safety analysis, weather forecasts, hazardous wastes elimination.

Supercomputers differ from conventional computers in that they operate on vector variables whereas conventional computers operate on scalar variables. A scalar is a single data item, or an element in an

Figure 12 Configuration of Fujitsu's digital network system (first stage)



array of data, whereas a vector is a complete array of data (a row or a column of a matrix for example). The relative advantages of scalar and vector processing are illustrated in Figure 20.

The main advantage of vector processing is high performance. Fujitsu's aims are to produce an easy programming environment, an easy-to-introduce system and high reliability. The easy programming environment includes:

- Use of the 'standard' Fortran 77 language.
- Advanced automatic optimisation features.
- Conversational tuning tools and library.

These features allow easy application program development and easy migration of existing user application programs.

The hardware specification of the Fujitsu supercomputer processors is shown in Figure 21, and a block diagram of the Fujitsu FACOM vector processor is shown in Figure 22.

KNOWLEDGE INFORMATION PROCESSING SYSTEMS

Fujitsu's research into knowledge information processing systems was outlined by Mr Tatsuya Hayushi, from Fijitsu Laboratories. Within the information processing division, Fujitsu is concentrating on four major areas:

- Fifth Generation Computer System (FGCS), sponsored by ICOT. This joint research project by Fujitsu and seven other major computer suppliers is aimed at building a parallel-inference machine with basic software (knowledge-base management, intelligent-interfacing and intelligent programming).
- Artificial intelligence (AI) – Fijitsu has already developed an AI machine called the Facom Alpha. Development of this machine and its software tools began eight years ago. One of the first applications is Atlas, an intelligent machine translation system. Within the artificial intelligence area, distributed knowledge base databases and software

Figure 13 Effects of corporate digital network

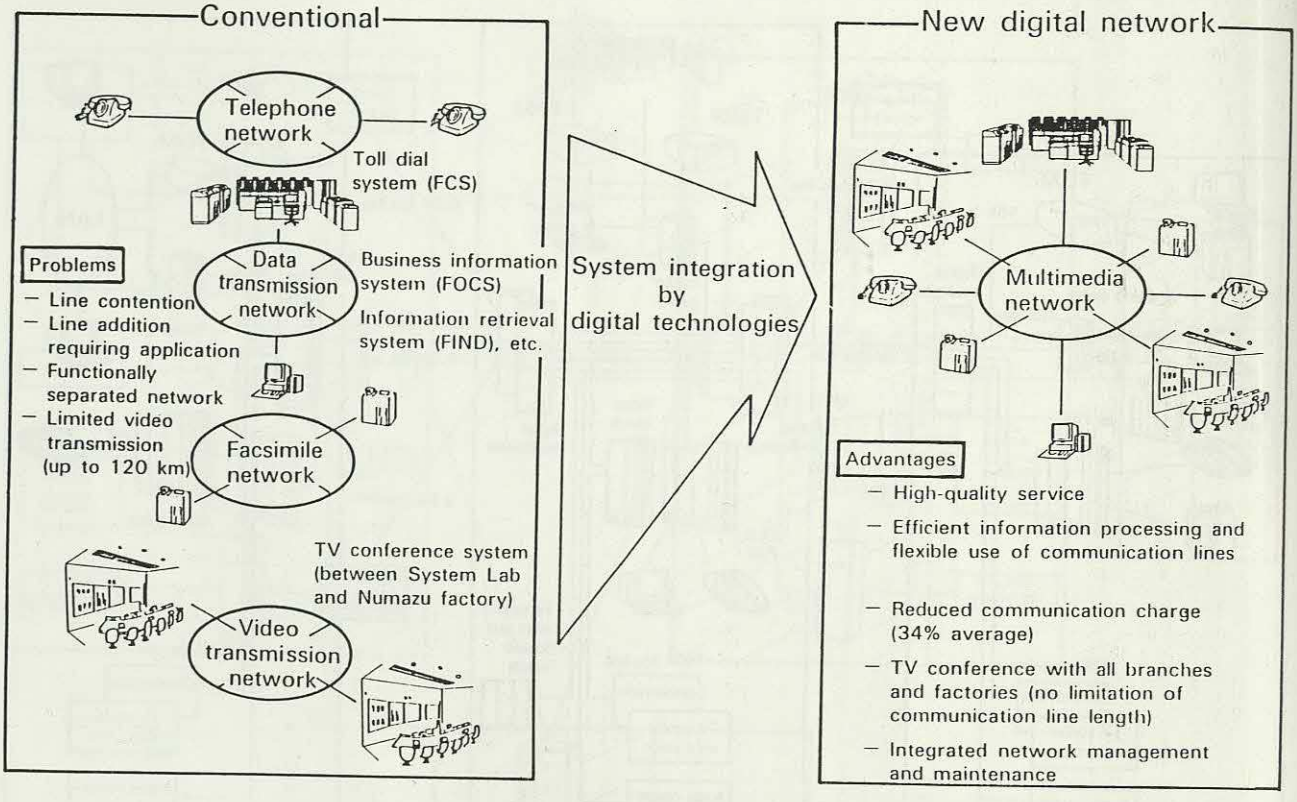
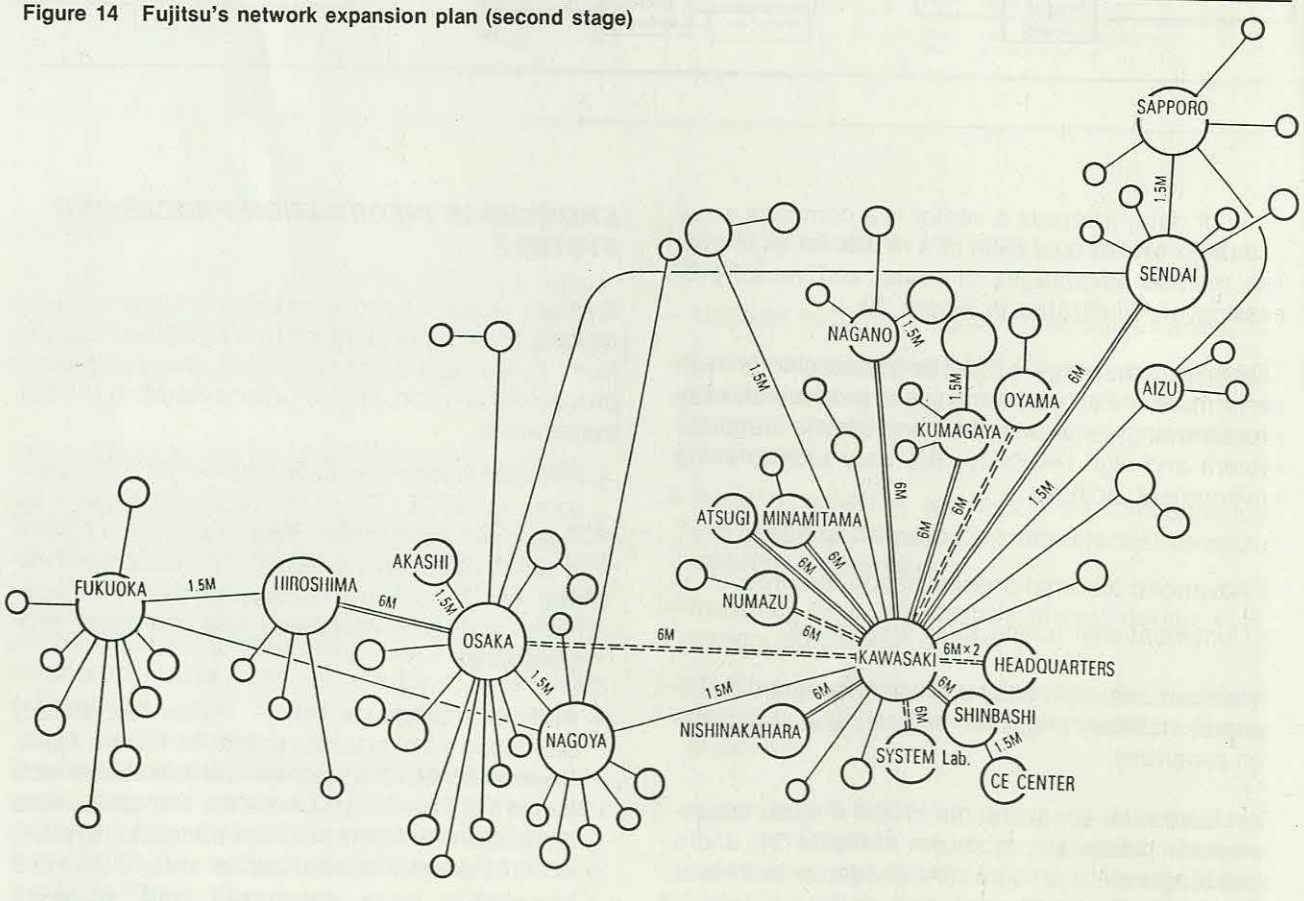


Figure 14 Fujitsu's network expansion plan (second stage)



engineering techniques are being developed. The Facom Alpha became available in March 1985, and it is currently the world's fastest Lisp processing machine (see Figure 23).

The Altas system translates Japanese to English and vice versa. It is used mainly for scientific and technical documents, and can translate 60,000 words an hour. Atlas provides significant cost reductions compared with manual translation, even though human intervention is still necessary to correct the grammar and meaning. (Delegates were shown an example of English-to-Japanese-to-English translation; the final English text had very little resemblance to the original.)

Figure 15 VAN services — user's expectations

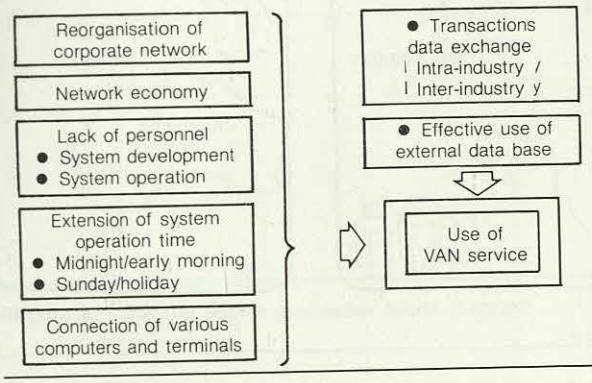


Figure 17 Role of computer networks in business enterprises

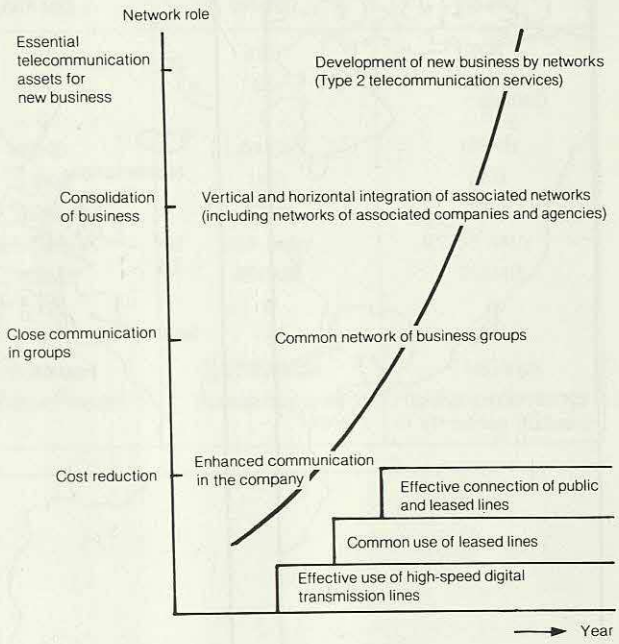


Figure 16 Fujitsu's security plan for VAN services

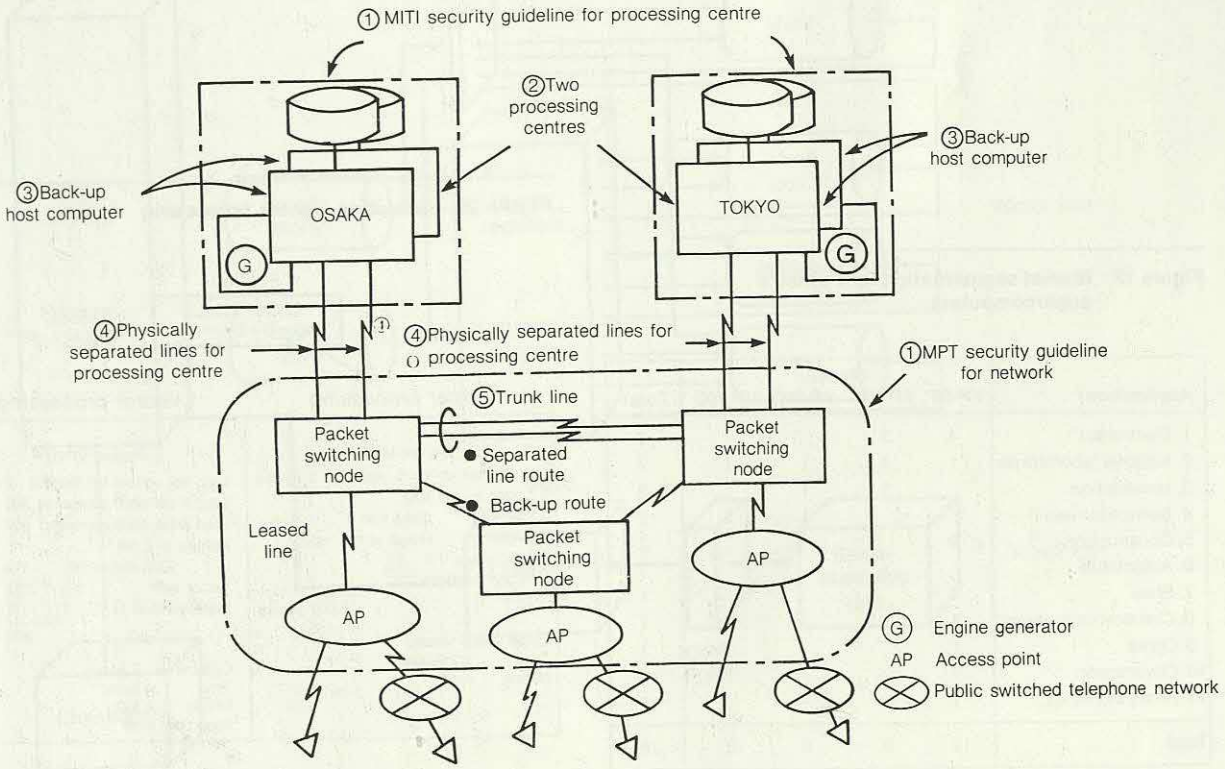


Figure 18 Supercomputer installations in the world (including orders) as of November, 1985 — all manufacturers

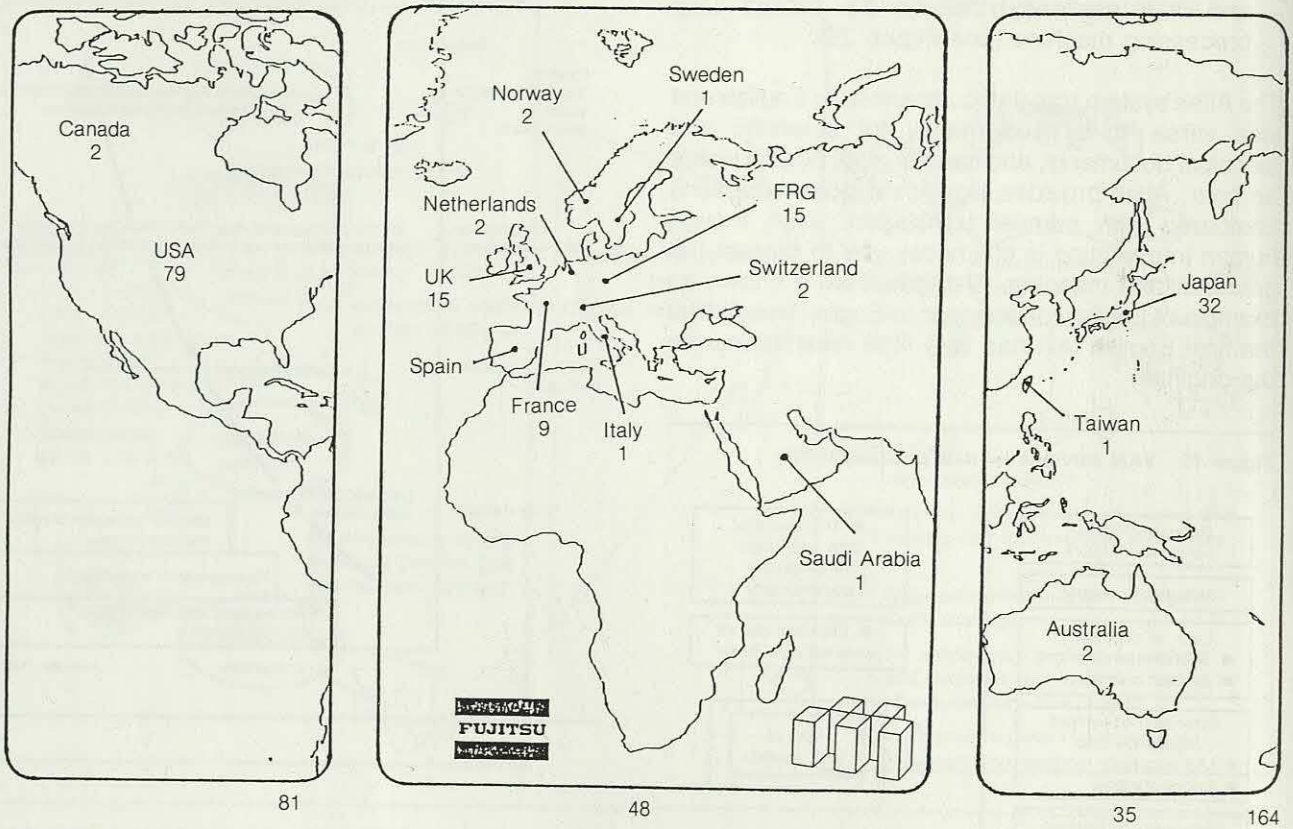


Figure 19 Market segmentation for Fujitsu's supercomputers

Applications	*Models* VP-50	VP-100	VP-200	VP-400	*Total*
1. Electronics	4	3			7
2. National laboratories	1	4	1	1	7
3. Universities		1	1		2
4. Service bureau			1	1	2
5. Construction	2				2
6. Automobile		1			1
7. Steel	1				1
8. Chemical engineering	1				1
9. Optics	1				1
10. Government	1				1
11. Heavy industries	1				1
Total	12	9	3	2	26

Figure 20 Scalar vs. vector processing

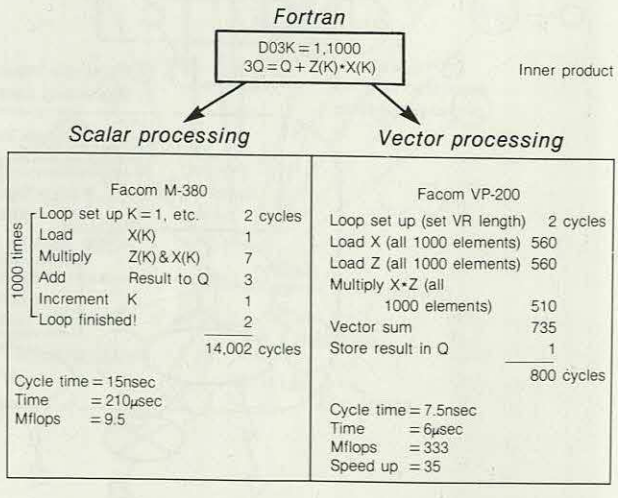


Figure 21 Hardware specification for Fujitsu's supercomputer (VP) processors

Item		*VP-50*	*VP-100*	*VP-200*	*VP-400*
Scalar instruction		195	195	195	195
Vector instruction		83	83	83	83
Floating point register	(S)	8	8	8	8
Vector register	(V)	32KB	32KB	64KB	128KB
Mask register	(V)	0.5KB	0.5KB	1KB	2KB
Vector control register	(V)	32bit	32bit	32bit	32bit
Address translation register	(V)	256 entry	256 entry	256 entry	256 entry
Main storage	(Max)	128MB	128MB	256MB	256MB
Execution pipeline		5	6	6	5
Parallel pipeline execution		3	5	5	4
Maximum (peak) performance		140Mflops	285Mflops	570Mflops	1.14Gflops
Characteristics		Low price, easy to introduce	Standard model	Standard model	Highest performance in VP series (IGflops)

Figure 22 Facom vector processor block diagram

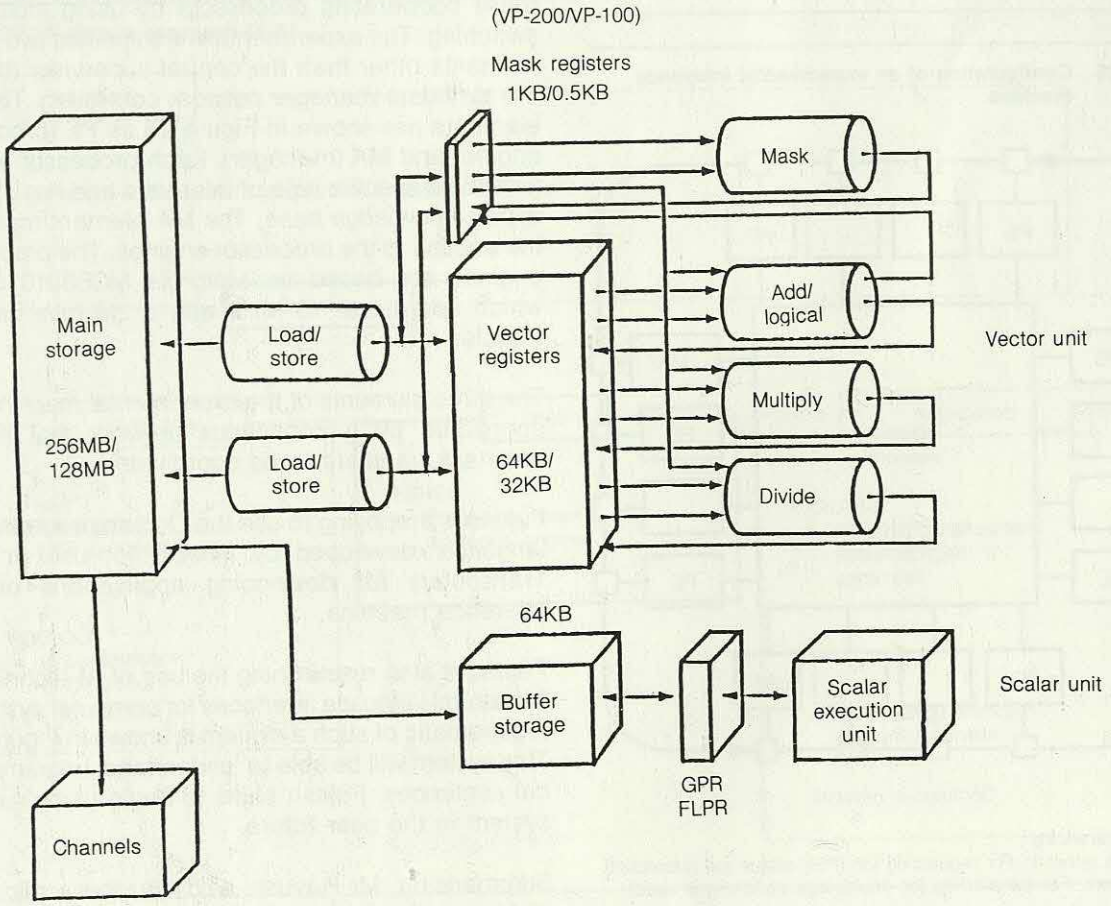


Figure 23 Relative LISP processing performance

Machine	*Language*	*Interpreter*	*Compiler*
FACOM α	UTILISP	16	40
DEC 2060	MACLISP	2.6	16
Symbolics 36XX	ZETALISP	1	12
Xerox 1121	INTERLISP-D	0.3	3.5
VAX 11/780	FRANZLISP	0.7	1.9

● Test program used: TPU-6

Figure 24 Fujitsu's participation in Fifth Generation research

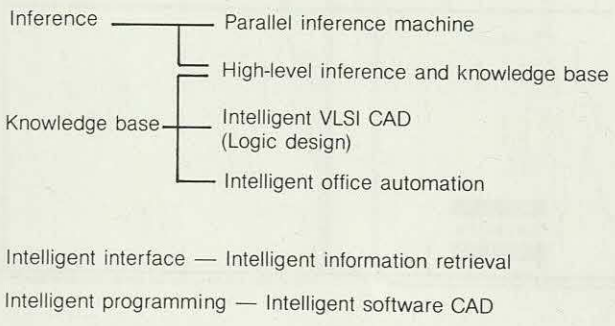
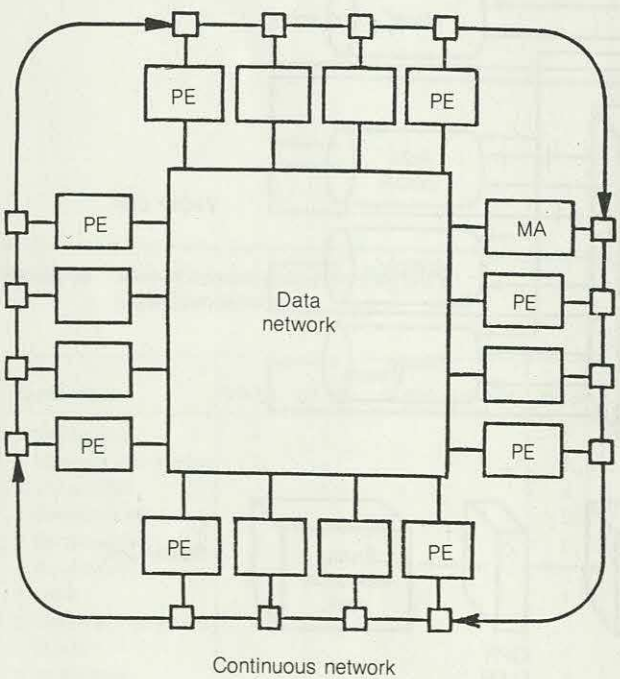


Figure 25 Configuration of an experimental inference machine



PE: For inferencing
Continuous network: For requesting job (PEs' status are circulated)
Data network: For transferring job (multistage switching is used)

Other automatic translation projects are underway for the Korean, German and French languages.

- Pattern recognition – research in this area includes speech and image recognition, process recognition, understanding of speech, and control of systems by spoken word rather than terminal input.
- Intelligent computer-aided design systems – the aim is to remove a lot of the effort from logical package design, particularly in printed circuit manufacture.

Figure 24 lists the Fifth Generation research areas that Fijitsu is concentrating on. One area of particular interest is inference machines based on parallel-inference, where the speed of the processor is greatly enhanced. So far the inference research within Fijitsu has concentrated mostly on the hardware aspects.

The proposed configuration for an experimental inference machine is shown in Figure 25. At the centre is a data or task network controller that transfers the job between the different components of the machine.

The experimental machine is a combination of co-operating machines, rather than a single processor. The data/task network transfers the job between these cooperating processors by using multistage switching. The experimental machine has two major elements other than the central supervisor (that is, the task/data manager network controller). The two elements are shown in Figure 25 as PE (processor engine) and MA (manager). Each processor engine handles a specific type of inference and has its own expert knowledge base. The MA element manages the access to the processor engines. The processor engines are based on Motorola MC68010 chips, which operate at 10 MHz with a 2M bit/s internal transfer rate.

The three elements of the experimental machine are connected by a continuous network that allows data/task transfers to be coordinated.

Fujitsu is proposing to use the Occam programming language (developed by INMOS for use with its Transputer) for developing applications on its inference machine.

Fujitsu is also researching the use of AI techniques for natural-language interfaces for computer systems. A schematic of such a system is shown in Figure 26. This system will be able to 'understand' ungrammatical sentences. Fujitsu plans to begin using such a system in the near future.

Summarising, Mr Hayushi said that the application of AI techniques is still at an early stage of develop-

Figure 26 Natural-language interfaces

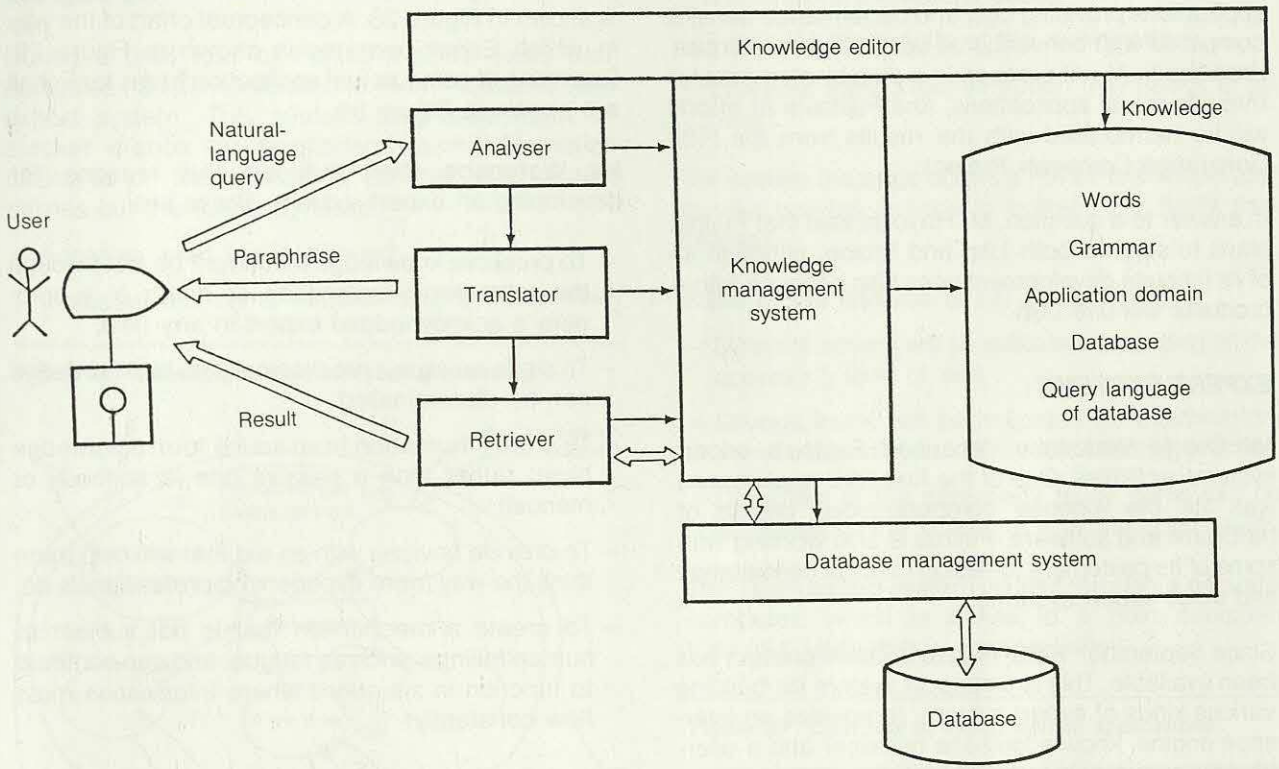
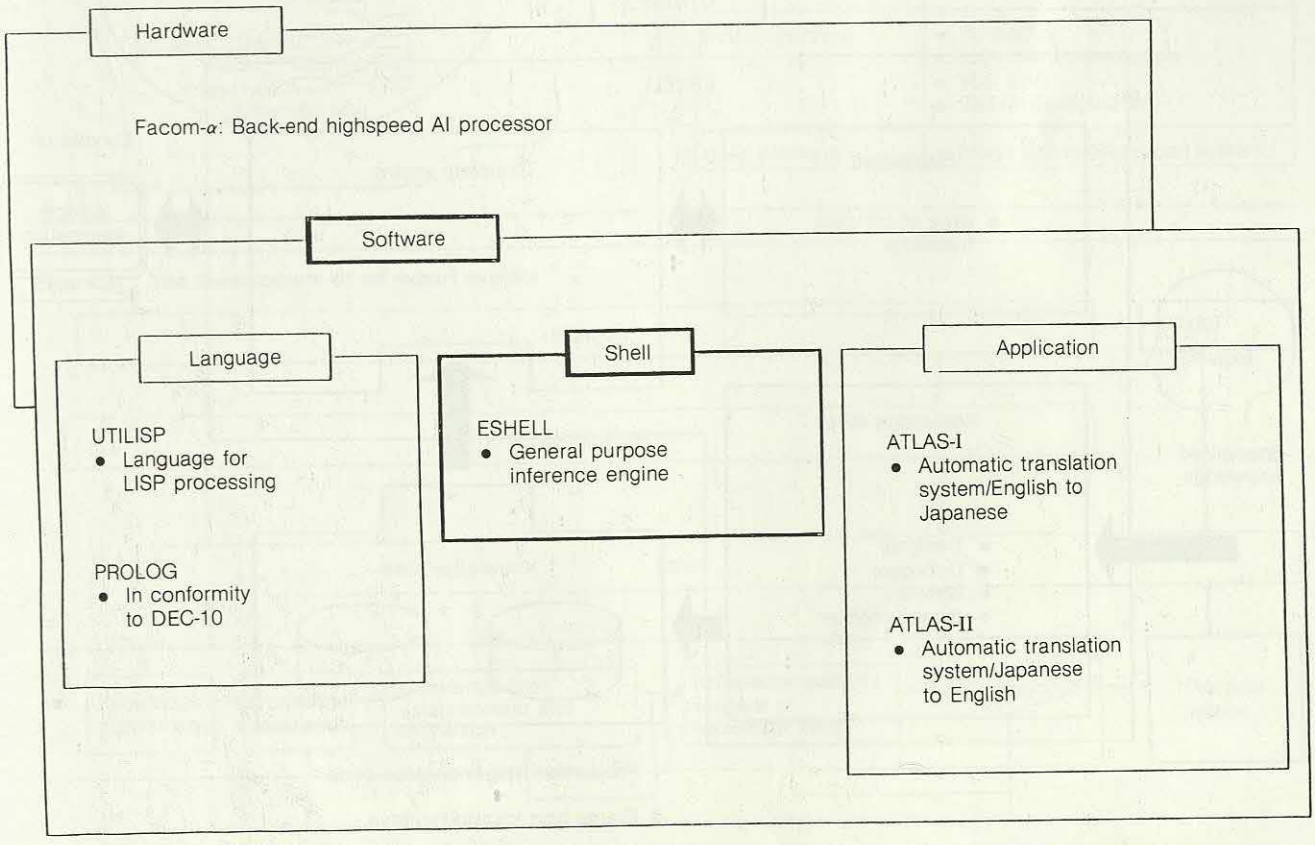


Figure 27 Fujitsu's approach to AI



ment. Much more long-range R&D still has to be carried out. However, there are already many AI applications providing cost and performance benefits compared with conventional computing techniques. Progress in AI will proceed in a step-by-step manner through actual applications, and Fujitsu's AI efforts will be harmonised with the results from the Fifth Generation Computer Project.

In answer to a question, Mr Hayushi said that Fujitsu plans to support both Lisp and Prolog, although all of its inhouse development uses Lisp because future products will use Lisp.

EXPERT SYSTEMS

Mr Shoriki Watonabe described Fujitsu's expert systems activities. One of the first R&D applications was for the inhouse computer-aided design of hardware and software. Fujitsu is also working with some of its customers to design medical consultation and other expert systems.

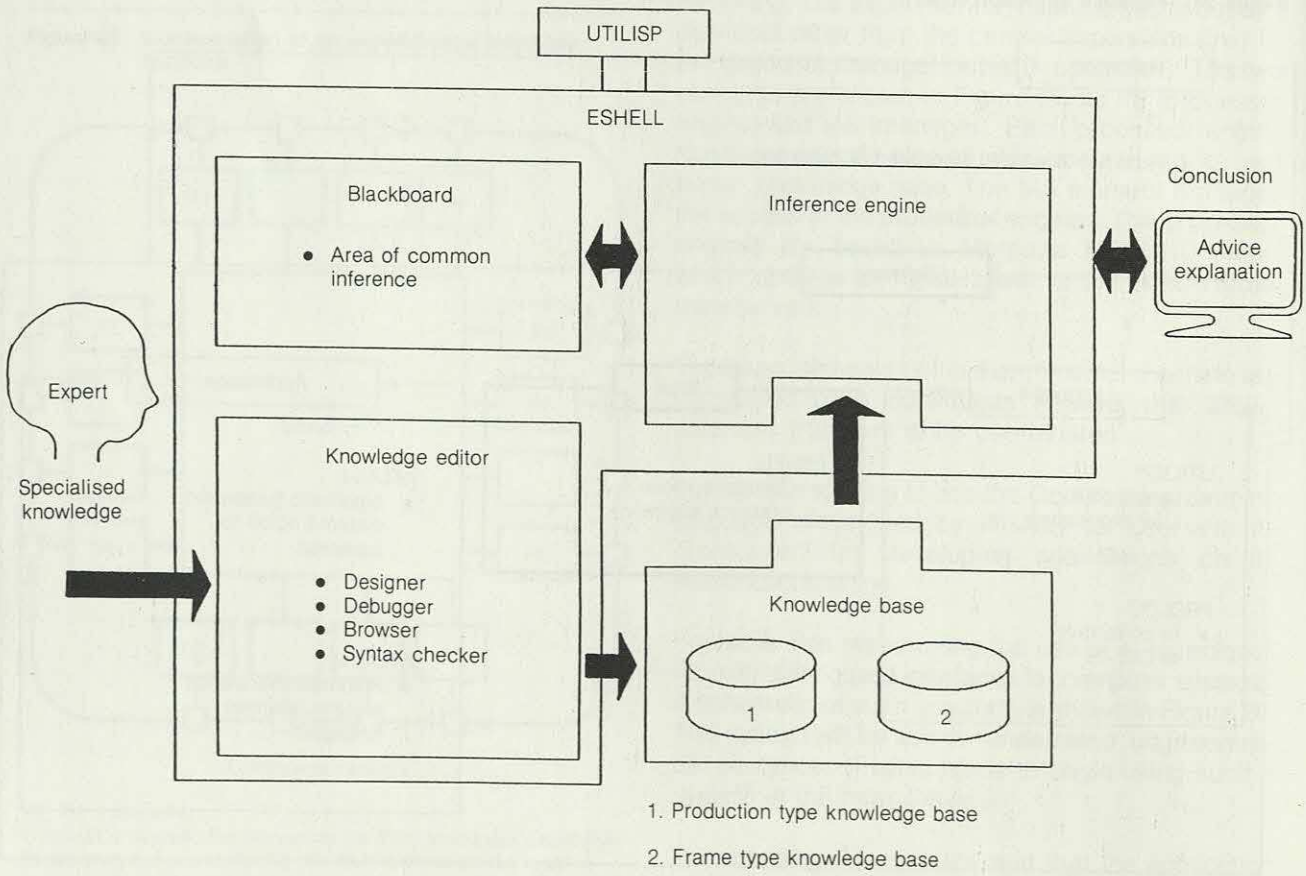
Since September 1985, Fujitsu's Eshell product has been available. This is a support system for building various kinds of expert system. It provides an inference engine, knowledge-base manager and a user-friendly man-machine interface. The way in which Eshell fits into Fujitsu's overall approach to AI is shown in Figure 27, and a schematic of the system is shown in Figure 28. A conceptual chart of the way in which Eshell operates is shown in Figure 29. Examples of some actual application areas for Eshell are shown in Figure 30.

Mr Watonabe then outlined the reasons for developing an expert system. These are:

- To preserve knowledge that might be lost through the retirement, resignation or death of a company's acknowledged expert in any field.
- To clone an expert mechanically so his knowledge can be disseminated.
- To store information in an active form (knowledge base) rather than a passive one (a textbook or manual).
- To provide novices with an aid that will help them think the way more experienced professionals do.
- To create a mechanism that is not subject to human failings, such as fatigue, and can continue to function in situations where information must flow constantly.

The relationships of the individuals and the processes

Figure 28 Eshell, Fujitsu's expert shell



involved in developing an expert system are shown in Figure 31.

During a brief tour of Fujitsu's plant, study tour delegates had demonstrated to them Fujitsu's Team expert system. This system diagnoses faults in stacker cranes by monitoring alarm information displayed on the operator's console. The system carries out the following tasks:

- Analyses what has happened.
- Indicates the items that need to be examined, based on the experience of the expert knowledge stored in its knowledge base.
- Evaluates the results of the examinations.
- Indicates the corrective action that needs to be taken.

The system therefore allows a novice crane operator to take precise actions to correct any faults that develop.

Some of the features of the system include:

- Different actions will be indicated depending on the operator's level of skill.
- Several items will be indicated for examination, thereby speeding up the trouble-shooting process.
- Diagrams of the potentially faulty items can be displayed on the screen of a personal computer.

The Team expert system is used through a personal computer, which is online to a host computer (OSIV/F4 MSP) that is running Eshell.

Figure 29 Conceptual chart of Eshell processing

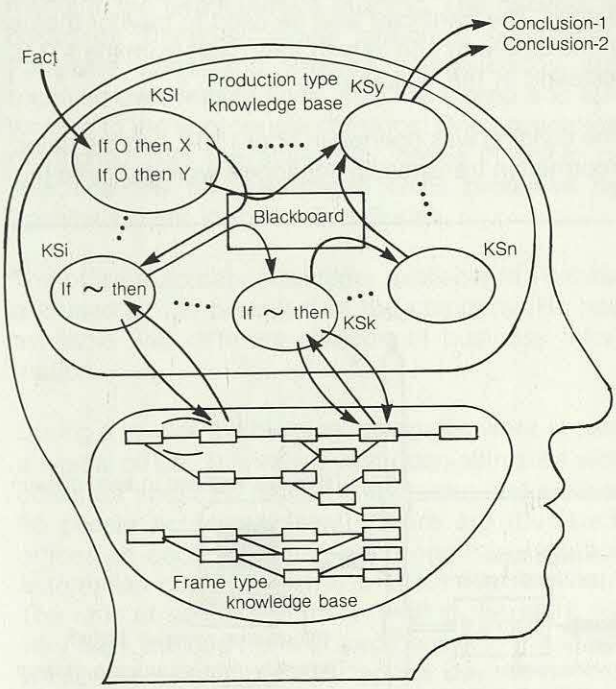
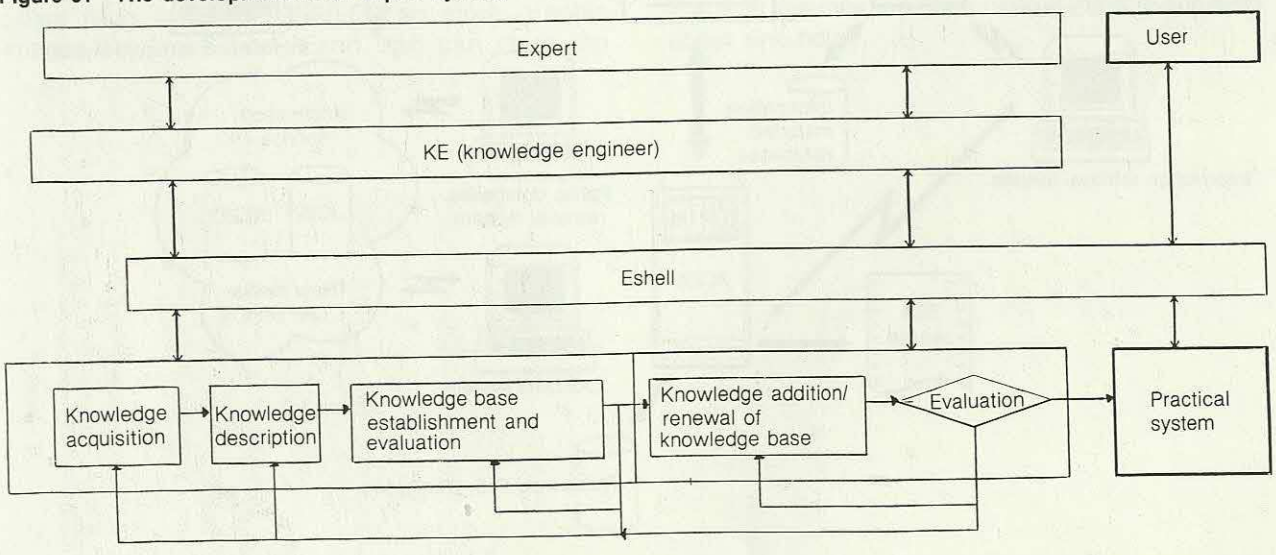


Figure 30 Examples of expert system applications

Domain	*Examples*
Diagnosis analysis	• Plant diagnosis • Medical diagnosis • Insurance assessment
Design planning	• Scheduling • Investment consultation • VLSI CAD • System configuration
User interface	• Image processing expert system

Figure 31 The development of an expert system



FRIDAY 18 APRIL

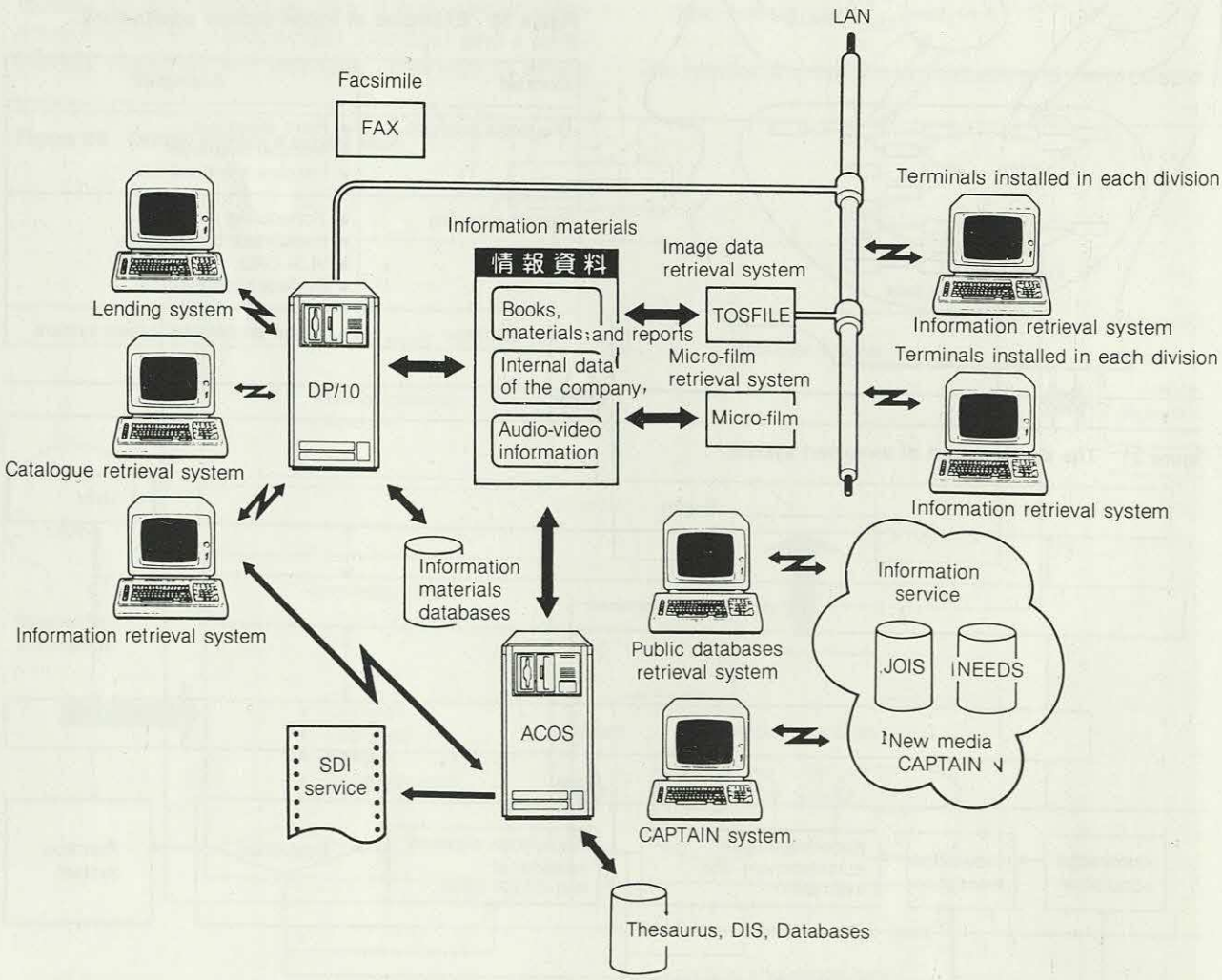
TOSHIBA

Study tour delegates spent the morning at Toshiba's headquarters – the so-called intelligent building. We were greeted by Mr Shida, manager of administration. At 169 metres tall, Toshiba's building is the eighth tallest in Japan – although it has the largest floor area.

All of the equipment and systems installed in the building are manufactured by Toshiba. There are 1,000 electronic office automation machines in the building, and 7,000 staff. Ordinary staff 'clock on' by wiping their identity cards through an electronic device. The card can also be used to pay for meals in the cafeteria and to withdraw cash from the ATMs installed in the building.

The building was opened in April 1984, and the basic information transmission channels were built into the

Figure 1 Outline of Toshiba's information service system



building's infrastructure. These are based on an optical fibres ring-type LAN that interlinks each floor, with a coaxal cable bus-type LAN for each floor. The ring operates at 100M bit/s and the buses operate at 10M bit/s. Distributed computers (TOSBAC DP series) and various office automation devices can be connected to the buses. Each department has its own distributed processor and office automation devices, which are used for departmental computing and for exchanging information between floors and departments.

Toshiba has a worldwide network that is used to collect information from its offices throughout the world, and make it available to the relevant departments in the headquarters building. The network is based on Toshiba's digital switching equipment. Facsimile, data and teletype transmissions are received over leased lines, and are stored and forwarded to the appropriate divisions. One application mentioned was the availability online in Tokyo of specifications for customised chips produced by Toshiba's plant in the United States.

The office automation systems available in Toshiba are used by the president of the company. He has available 340 different choices of business information.

During a tour of the building, delegates were shown a typical office. This was a vast open-plan area with desks for about 80 people (there were about 50 to 60 people actually present). There are four such offices on each floor, and each one has an office automation corner, which has about five terminals. The ratio of screens to office staff is therefore not very high, although one or two people in the office we saw were using portable 'lap-top' devices on their desks.

We were also shown TOSFILE, Toshiba's laser-disc office filing system. TOSFILE can store graphic images only (not data). Each disc can store the equivalent of 10,000 A4 pages, and 25 discs can be loaded into an autochanger. Four autochanger devices can be connected to each system, giving a total capacity of 6 million pages. Documents are scanned and digitised before being loaded into the system, and they can be retrieved and manipulated on a black-and-white screen (controlled via a mouse and icons) before being printed on a laser printer. Key information (document title, author and date) has to be input manually. The cost of a basic TOSFILE system is 15 million yen. Ten systems are in use in Toshiba's headquarters, mainly in the business information centre. These systems are available for use by any of Toshiba's staff.

The business information centre coordinates the books and other printed material in Toshiba's library, and makes information available via the TOSFILE system. It also provides access to corporate and external databases. Figure 1 shows an outline of the information service system.

Delegates also visited the Decision Room at the top of the building. This executive decision room is a 'computer presentation room' that provides sophisticated audio-visual and conferencing facilities. The room can seat about 60 people around an elliptical table that has built-in microphones and speakers. At one end of the room there are two 100-inch display screens that can be used to display television pictures, and graphic images. The graphics can be projected from within the room or generated on a departmental computer. The room is controlled from a console containing two workstations, two personal computers and a display unit. Any data residing in Toshiba's systems can be retrieved and displayed instantly on the screens.

The Decision Room is used regularly by Toshiba's managers, and is often booked up weeks in advance. The average meeting comprises 40 people and lasts about one hour.

FRIDAY 18 APRIL

PROFESSOR OHNO

Dr Yutaka Ohno is Professor of the Department of Information Science in the Faculty of Engineering at Kyoto University. He briefed study tour delegates on the aims of the Sigma (software industrialised generator and maintenance aids) project. Professor Ohno is Chairman of the Sigma system development committee, and was one of the founders of the project. The motivation for the project came from Japan's recognition that its software technology was inferior to that of the United States and Europe. MITI therefore asked Professor Ohno and his team to undertake a large-scale software project. The five-year project has only just begun, and Professor Ohno was therefore not able to report on any concrete results – only on the aims of the project.

Many organisations in Japan involved in producing software are small concerns that do not have the resources to produce the software they need. Sigma is attempting to produce a software development environment that is suitable for this type of organisation. The project is not concerned so much with the software development effort of the large computer suppliers. The aims of the Sigma project are:

- To improve software quality and productivity.
- To prevent duplicate development of software.
- To provide a means for sharing information about software development facilities, software know-how, and software technology.
- To provide for the efficient training of software engineers.

The approach being adopted has two distinct elements:

- The establishment of a standard for software development that is independent of the hardware on which the programs will be executed.
- The establishment of a network system for operating programs and for retrieving and transferring technical information.

The ultimate aim of the project is to automate 80 per cent of the process by which programs are written. (In subsequent discussions with Professor Ohno it became clear that Sigma is not aiming to automate the system specification stage of system development.)

Sigma was planned by MITI and is promoted by the IPA (Information Processing Agency), a non-profit organisation representing user organisations. The organisation of the project is shown in Figure 1. The project team consists of 40 full-time staff drawn from the IPA, information services companies, mainframe suppliers and NTT. Plans are formulated by the head office of system development and are approved by the 50-person system development committee. The committee members are drawn from senior executives (presidents, board members) of leading information companies.

The configuration of the proposed Sigma network system is shown in Figure 2. The purpose of the network is to allow a software developer sitting at a workstation to have access to a range of facilities that will aid the system development process. Thus, Sigma provides a means for sharing knowledge and experience amongst software developers. The network is based on a large central processor that maintains databases about Sigma users, software directories, development methods, etc. The Sigma operating system will be based on an enhanced, extended version of Unix.

Users of Sigma will contract with IPA in order to use the system. Any software developed may be deposited in the databases for use by other organisations (on a royalty payment basis).

Figure 1 Organisation of Sigma system project

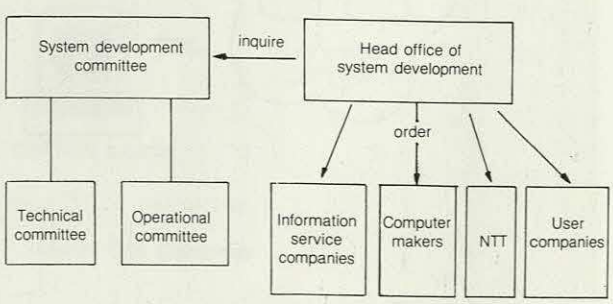
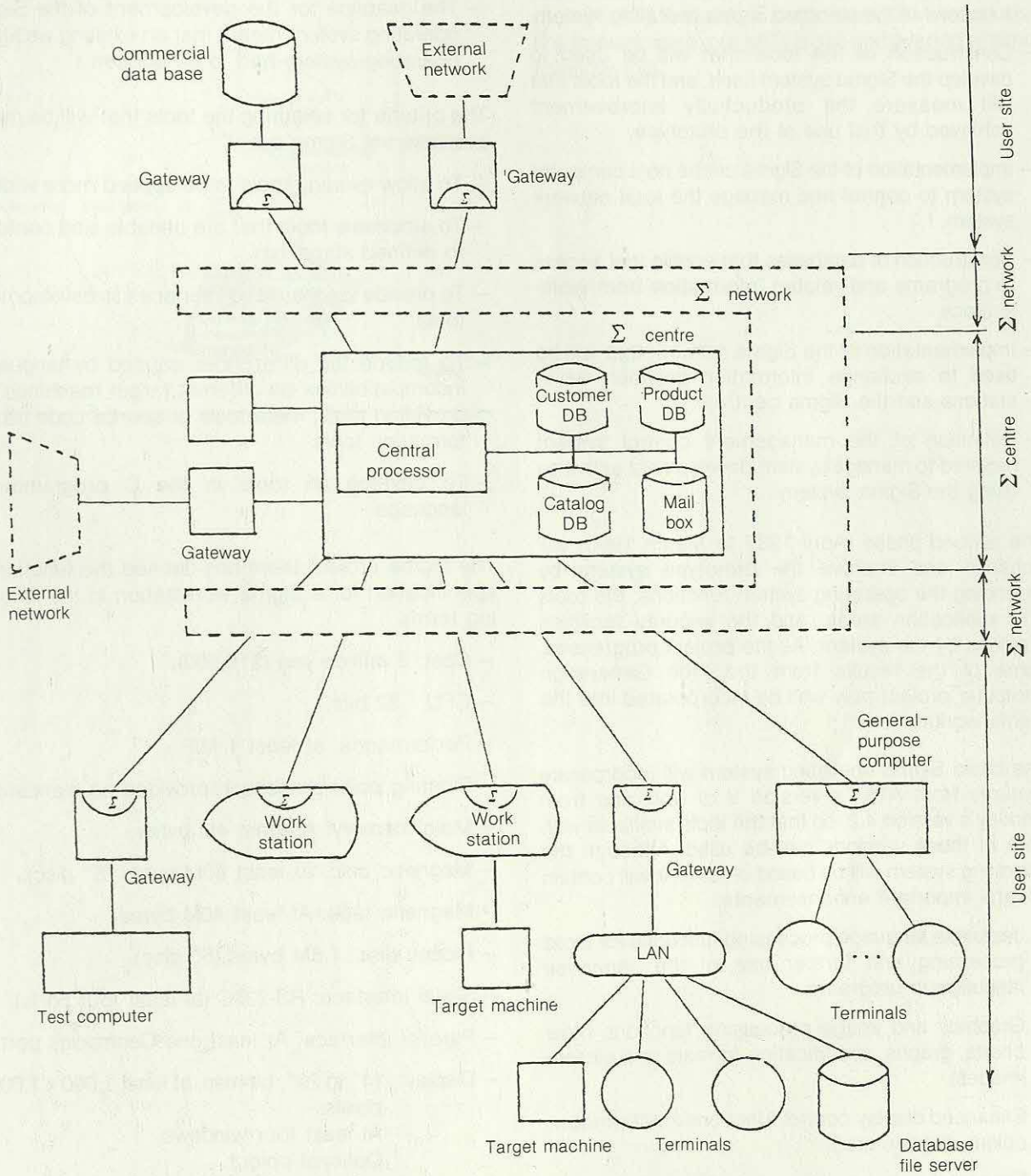


Figure 2 Sigma network system centre configuration



To use the Sigma system, the software developer will need a development computer or workstation equipped with the Sigma operating system. He will be able to retrieve software tools from the central database, and will be able to exchange tools with other users through Sigma's electronic mail facilities. In this way, a user will be able to construct his own specific development environment that provides the tools suitable for his own level of expertise.

Total funds for the five-year project are 25 billion yen ($140 million). The funding is provided equally by the government and the ten participants in the project (mainframe suppliers, software companies, NTT, etc.).

The first phase of the project runs from October 1985 to March 1987 and will develop and begin trial use of the prototype Sigma system. The activities in this phase are:

- Construction of the first version of the Sigma operating system, which will provide the basic functions of the standard Sigma operating system.
- Construction of the tools that will be used to develop the Sigma system itself, and the tools that will measure the productivity improvement achieved by trial use of the prototype.
- Implementation of the Sigma centre host computer system to control and manage the total network system.
- Construction of databases that enable trial access to programs and related information from workstations.
- Implementation of the Sigma network that will be used to exchange information between workstations and the Sigma centre.
- Definition of the management control system required to manage system development activities using the Sigma system.

The second phase (April 1987 to March 1990) will enhance and improve the prototype system by extending the operating system functions, the tools and application areas, and the security facilities provided by the system. As the project progresses, some of the results from the Fifth Generation computer project may well be incorporated into the Sigma workstation.

The basic Sigma operating system will incorporate features from AT&T's version V of Unix and from Berkley's version 4.2, so that the tools available with both of these versions can be used. Although the operating system will be based on Unix, it will contain several important enhancements:

- Japanese language processing functions for word processing and further use of the Japanese language in programs.
- Graphics and image processing functions (flow charts, graphs, specification formats and picture images).
- Enhanced display control functions (multiwindow, colour display, etc.).
- Enhanced communications functions (interfaces to analogue public networks, to digital X.25 packet exchange networks, and IEEE 802.3 LANs; Unix file transfer protocols; LAN protocols; TCP/IP protocols; Sigma centre and gateway functions).

The overall configuration of the Sigma operating system is shown in Figure 3. Unix was chosen as the basis for Sigma because:

- There is practical experience of existing software resources that have been developed for the various Unix versions.
- It is likely that Unix will continue to be enhanced.
- The deadline for the development of the Sigma operating system meant that an existing well-tried operating system had to be chosen.

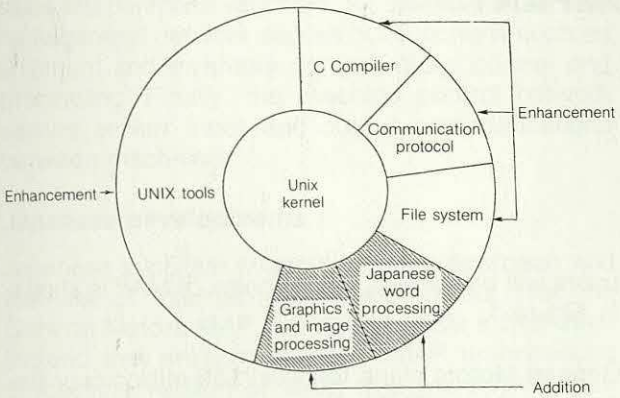
The criteria for selecting the tools that will be made available via Sigma are:

- To allow existing tools to be applied more widely.
- To emphasis tools that are useable and conform to defined standards.
- To provide standardised interfaces to development tools.
- To reduce the differences caused by language incompatibilities on different target machines by providing tools, meta tools or source code transformation tools.
- To develop all tools in the C programming language.

The Sigma project team has defined the functional specification for a Sigma workstation in the following terms:

- Cost: 3 million yen ($16,500).
- CPU : 32 bits.
- Performance: at least 1 MIP.
- Floating point processor: provided as standard.
- Main memory: At least 4M bytes.
- Magnetic disc: At least 80M bytes (5″ disc).
- Magnetic tape: At least 40M bytes.
- Floppy disc: 1.6M bytes (5″ disc).
- Serial interface: RS-232C (at least four ports).
- Parallel interface: At least one Centronics port.
- Display: 14″ to 20″, bit-map, at least 1,000 x 1,000 pixels.
  At least four windows.
  Optional colour.
- Pointing device: mouse with at least two buttons.
- Keyboard: JIS revised.
- Communications interface:
  IEEE 802.3 LAN
  GLOBAL X.25
  GP-IB
  RS-422 serial interface.
- Laser printer: At least 300 dots per inch, A4, at least ten pages per minute.

Figure 3 Configuration of the Sigma operating system



Professor Ohno closed by saying that all the major Japanese computer suppliers are involved with the project. AT&T is also a participant. IBM would also like to participate, but MITI is still considering whether to allow this.

MONDAY 21 APRII

OMRON TATEISHI ELECTRONIC COMPANY

Omron was established in 1933 and has its headquarters in Kyoto. It is the leading electronic component manufacturer in Japan and one of its important product specialities is the factory automation industry. It has 11,500 employees (plus 1,500 overseas). Sales in 1985 were 260 billion yen ($1.5 billion).

The company manufactures a wide range of factory automation components, including: power relays, micro relays, sensors of all types, photoelectric switches, microswitches, timers, proximity switches, etc. In addition, it makes a programmable controller (SYSMAC). It also assembles its components into a wide range of products. These include electronic cash registers, auto-teller machines for banks, auto-vending machines, ticket-vending machines, traffic control systems, and healthcare products (bloodcell analysers, for example). It also manufactures consumer products such as digital thermometers and home-use blood pressure measures. In the office equipment field it manufactures the Rolm CBX (under licence) and a local area network for linking personal computers together with many other products.

Factory automation

During the last two years the Japanese economy has had a high rate of growth. However, a lower growth rate is foreseen for the future, together with the need to shift from high-volume mass-production to customised low-volume runs. To cope with this, CIM (computer integrated manufacture) has been developed in the United States, and JIT (just in time) manufacturing has been developed in Japan. These developments should permit computer power to be used in the new customised environment.

The leading company in this field in the United States is General Motors. Three years ago General Motors sponsored the MAP project, because it had realised that communications costs accounted for 50 per cent of its investment in factory automation. (In Japan a figure of 15 to 20 per cent is more usual.)

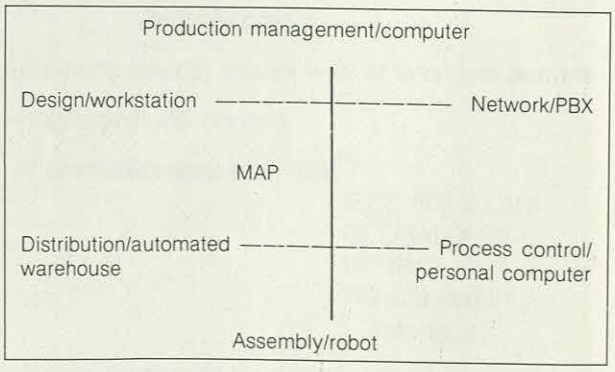
A key feature of General Motors' plan is to establish standards independently of vendors, and General Motors will purchase only standardised products. It is intended that an international group of MAP users will be formed. An overview of MAP is shown in Figure 1.

General Motors plans to invest $50 million over the next five years. This will include 40,000 robot units and 20,000 process-control, numerical-control and conveyor units. General Motors has a technical centre with 700 staff, and 27 divisions of General Motors are involved with MAP.

A demonstration of the MAP concepts was given at the Autofact '85 exhibition held in Detroit in November 1985. The products of 23 different suppliers were linked together and the factory automation system (sponsored by General Motors) was also linked to an office automation system sponsored by Boeing (see Figure 2).

MAP communications technology will be based on LANs. Of the three possible standard LAN systems, the specifications for a multichannel broadband LAN (IEEE 802.4) have been adopted. For factory use, the token bus system is better than the LAN systems that are typically used for office automation because it is expandable and can handle realtime operations. The bus system makes it possible to add nodes without adversely affecting performance, and it is better for realtime operations because it gives priority to information transmission.

Figure 1 An overview of MAP



Source: AUTOFACTO '85

The three basic networks required in a factory are shown in Figure 3. The management control network is principally for office automation (processing of sales and purchase vouchers, for example). A factory management network carries out functions such as shipment and inventory control, order control and processing. Finally, the machine control network carries sensor input and output communications between machines.

Japanese developments

Japanese suppliers support an open approach and the use of international standards, but feel the General Motors MAP approach is only a first step. Instead, they are promoting EPA MAP, an enhanced processing version of MAP, and will submit their proposals to the IEEE 802 Committee in July/August this year. Basically, they feel a need for three changes:

- A need to change the language (or internationalise it). For example, an 'emergency display' signal should not be in English because a Japanese operator will not understand it.
- A realtime system must be introduced; the current MAP system is applicable to discrete units only and is not suitable for realtime operations.
- CATV (coax) networks are not popular in Japan. Optical fibre is the most frequently used media because it is very much faster and costs about one-third as much as a CATV network.

The current grouping of MAP products is shown in Figure 4.

Figure 2 Autofact '85 topology

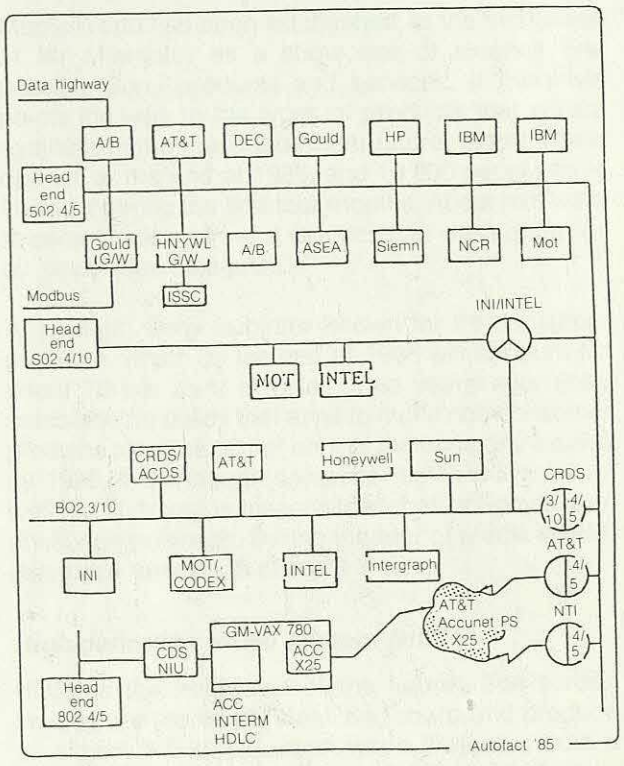


Figure 3 Local area networks required in a factory

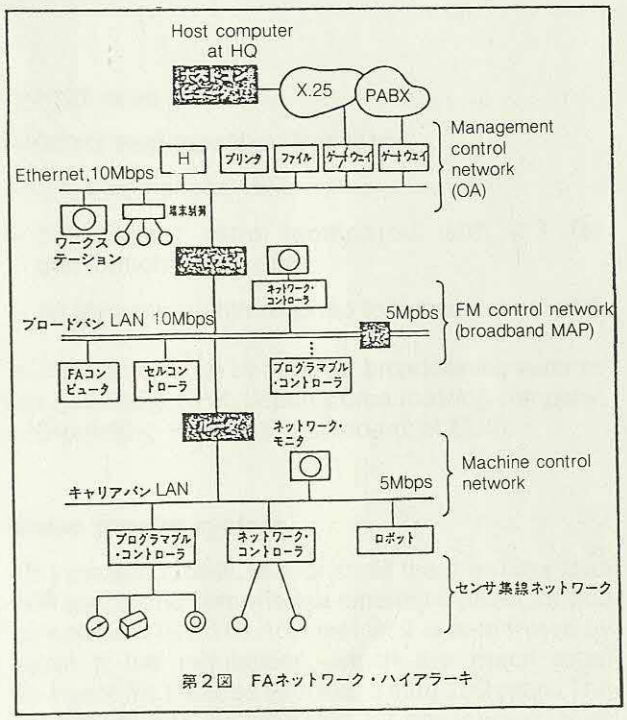


Figure 4 Grouping of MAP products

1.	Network products (Intel, Motorola, Concard and INI) a) Standard chips b) Standard cards (for multi bus, VME bus and PC bus) c) Standard specification box (RF-MODEM + Token processing + RS-232C)
2.	Intelligent equipment (Gould and AB) a) Intelligent PC b) MAP interfacer (bridge, router and gateway) c) Network management (fault detection and addressing)
3.	Plant engineering (ITI, SDI, etc.) * MAP testing * ITI is authorised to approve MAP products.
4.	Products for system development * Network analyser
5.	Unbundling software (SDI) * Development of high-grade software for MAP (SESSION, case, MMFS and network management) *UNIX, ZENIX, MS-DDS/3B Series and NCR Tower PC
6.	Cables

Answers to questions

1. At present, broadband modems and communications interfaces are not incorporated into Omron's programmable controllers. These units are separate, which makes it easier and cheaper for customers to introduce new products. However, in the longer term, Omron would like to see such equipment incorporated into products because the combined equipment would be cheaper.
2. EPA MAP in Japan is at the R&D stage.

SONY

Study tour delegates spent the afternoon at Sony's marketing headquarters in Tokyo, and visited 'Media World' – an advanced technical demonstration centre containing 13 zones that feature various types of systems and products based on pictures and graphics. Delegates were greeted by Mr T Miamoto, Managing Director. He pointed out that in the world of data processing, IBM and other suppliers had concentrated on systems for communication in the form of data. Sony believes that pictures are a vital element of any human communications system; conventional computer systems cannot handle pictures.

Sony is therefore specialising in the area of picture communications and believes that this area will have a major role to play in the next decade for business communications. Picture communications requires expertise in video, displays, lasers, mass-storage media and semiconductors – and Sony has expertise in each of these fields.

Media World has been established, at the instigation of Mr Miamoto, as a showcase of existing and possible Sony products and services. It therefore points the way to the types of products that will be available in the reasonably near future. Media World opened at the end of 1985, and 15,000 people have visited it during the first four months. About half want to come back again – a reaction that was confirmed by study tour delegates.

At present, Sony is better known for its consumer products, which by the end of 1986 will account for about 70 per cent of sales. Two years ago, Sony established a policy that aims to make non-consumer products produce 50 per cent of the company's sales by 1990, even though consumer sales will grow as well. Mr Miamoto is responsible for all of Sony's non-consumer business. During the tour of Media World, delegates saw each of the 13 zones.

High-definition video system (HDTV)

HDTV is the 'television of the future'. The screen images are incredibly clear and sharp and produce an almost 3-D effect, even when projected onto a 150″ screen. The specification of the system is:

- 1125 scan lines.
- 60 Hz field-repetition frequency.
- 2:1 line-interlace ratio.
- 5:3 aspect ratio (compared with 4:3 for conventional television).
- 30 MHz bandwidth required to transmit the signal.

HDTV will be in use by 1990 for broadcasting systems (via satellites). NHK, Japan's broadcasting company, is promoting HDTV as a standard at CCIR.

Video theatre system

This system is designed for small theatres (less than 100 seats) and comprises a cinematic projector and cinematic VTRs. The 100-seat limit is determined by Japan's fire regulations, which are much more stringent for theatres with more than 100 seats. The equipment can be operated by one person. High quality audio and video projection is obtained by using U-matic equipment.

Sony has installed 30 video theatre systems in Japan, some of them in supermarkets, so that children (and fathers) can relax whilst the shopping is done. The equipment costs about $70,000. The theatre at Media World has a 'body sonic' feature, where the seats and floor vibrate at predetermined points in the video sequence.

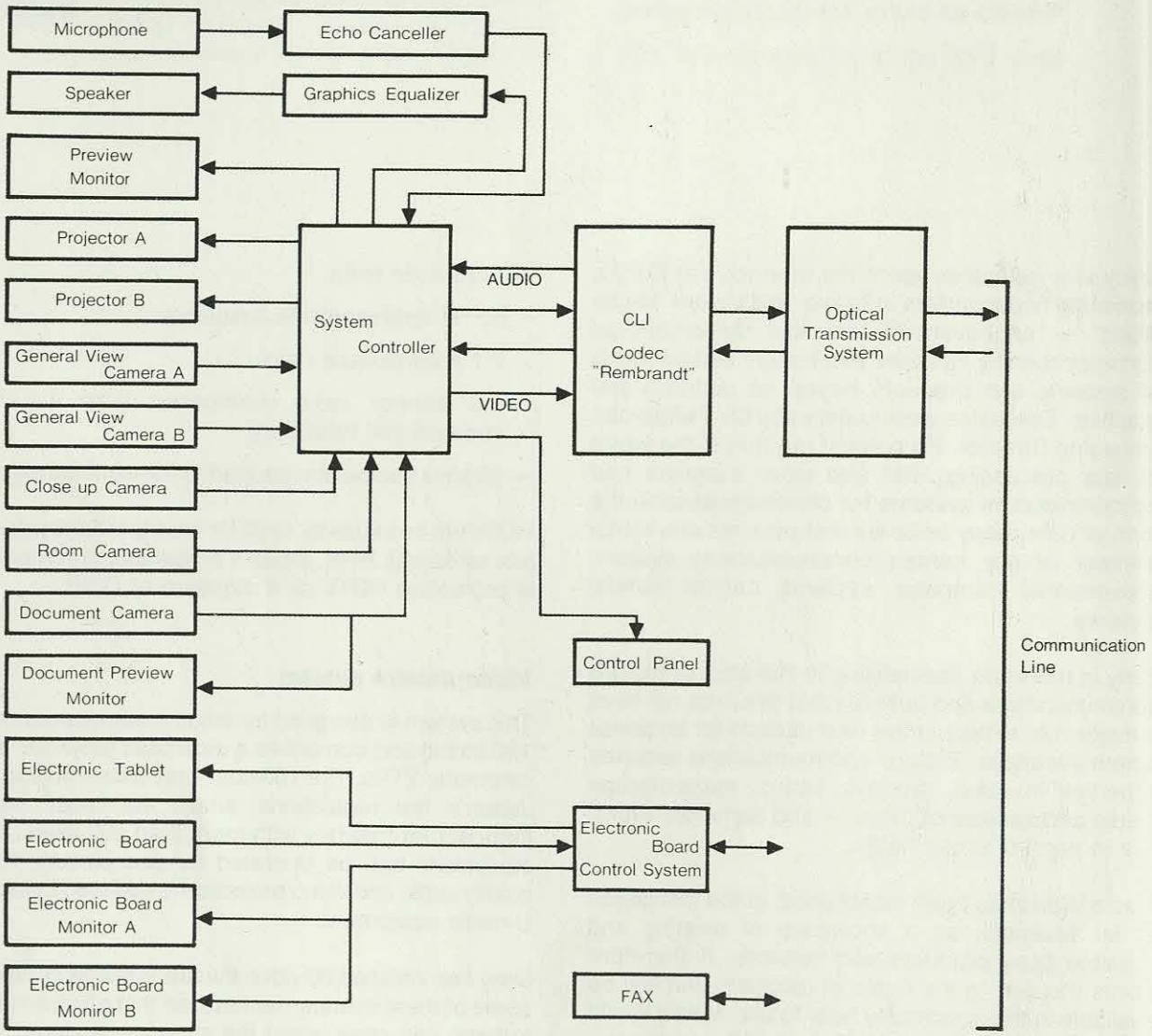
Teleconference room

Sony's video teleconferencing system is based on CLI's (Compression Labs, Inc) codex. (1984 study tour delegates visited CLI in San Jose.) The system allows the signal to be transmitted at rates ranging from 384k bit/s to 1.5M bit/s. A video showed the different performances achieved by different transmission rates. The picture quality at 384k bit/s was still very acceptable.

A block diagram of the system at Media World is shown in Figure 1. The main features of the system are:

- High-resolution full-colour motion picture, with

Figure 1 Block diagram of teleconference system (at Sony Media World)



capability to display face and document/graphics images simultaneously.

- The system is equipped with capabilities for two face-to-face cameras, one close-up camera, one document/graphics camera, and one camera for the presenter/MC, two video projectors, electronic writing board and tablet.
- The split-screen feature can accommodate a large meeting consisting of six to ten participants at one end of the link.
- The close-up camera can be controlled from either side of the conference, enabling selection and zoom-up display of any object or person.
- The CLI codex achieves highly efficient compression, enabling transmission of a close-to-natural picture, even with quick movements.
- Conversion between NTSC, PAL and RGB video makes the system suitable for international conferences.
- Video, audio, graphics, and data are transmitted over a single channel.

Sony has three conference rooms – at Media World, at corporate headquarters (2 kms from Media World) and at the Atsugi plant (50 kms from corporate headquarters). The systems at headquarters are linked by a 20M bit/s optical fibre, and the Atsugi line (1.5M bit/s) costs 1 million yen a month, and has been in use for three months. Sony has found that video teleconferencing is efficient for 'repeat' meetings. For an initial meeting, people still prefer to meet face-to-face.

Sony is developing a new type of TV camera, based on CCD technology. This camera will be less obtrusive than the cameras presently used, and will require less light. (The lighting in the teleconference room was very bright and hot.) The system is designed on a modular concept, which means that it can be used to configure systems ranging from a full-scale studio (as at Media World) to a 'rollabout' package.

At present, the system is only in use in Sony, but the product will be marketed as from August 1986. One possible application area being promoted in universities by Sony is 'telelectures'.

Multi-purpose conference room

This room is equipped with a video projection system, special filing system and videotex terminals that allow a variety of information to be retrieved as it is required. Information can be generated via microcomputers, and live television can also be displayed.

Multi-learning laboratory

This zone contains a variety of systems (mainly videodisc and PC-based) that can be used for computer-aided instruction and learning.

Information systems

High-quality optical-disc-based systems are displayed in this zone. These PC-controlled systems would typically be installed in a department store to promote and display products. 'Jumbo-tron' – Sony's exhibition-size display system – was also displayed, as was a computerised video library, where video cassettes were loaded into and unloaded from a bank of videotape players by robots.

Man-machine interface

This zone demonstrates various interactive information systems that have been designed to explore different aspects of the man-machine interface. One device on display was CD-ROM (compact-disc read-only memory). One CD-ROM disc can store up to 275,000 pages of text, or it can be used to store graphics, still pictures and sound. Each disc can store 540M bytes of data (eleven times that of a conventional floppy disc), and has a data transfer rate of 150k bytes per second. CD-ROM is a low-cost medium for mass and offline data distribution. Sony now has extensive experience of producing large volumes of compact discs (for the audio market); 2 million discs a month are produced in Japan and the United States.

Potential applications for CD-ROM include historical databases, electronic publishing, information services, reference material and graphics applications. Delegates were shown an encyclopaedia application, where all of the textual information (but not graphics or pictures) were stored on one CD-ROM disc.

The Sony VIEW (Visual Information Enhanced Workstation) was also on display. This is a microcomputer-controlled optical disc system that provides random access to still frames of information. Up to 20,000 frames can be stored on each disc.

New media

One product on display in this area was Mavigraph, a high-quality video printer, which can produce a colour image from a video signal in three minutes. A full system costs 2.84 million yen.

Various videotex systems from around the world were on display, together with an ultra-high-resolution video camera.

Office automation

The equipment of most interest to delegates on show in this zone was SIOS (Sony Integrated Office System). SIOS is an electronic filing system based on write-once, and read-many-times 12″ optical discs and a high-resolution full-page black-and-white display that uses a keyboard and a mouse and pointer. Documents can be captured by an image scanner, and can then be manipulated using the display and keyboard. Text can be added to documents, but the screen image (not data or text) is stored on the disc. Once an image has been retrieved it can be printed via a laser printer. Each disc contains 3.2 gigabytes, and four discs can be loaded in one unit. Up to four units can be online to the system. The average access time is 800 milliseconds. The cost of a stand-alone unit is 15 million yen. The software controlling the SIOS system is based on Unix. At present, 50 SIOSs have been installed within Sony.

In a short presentation after the tour of Media World, Sony explained the rationale for believing that there is a market for electronic filing systems. A survey by the Japan Productivity Association had shown that each office worker generated 13,000 pages of incoming and outgoing mail a year, and that this amount was increasing by 7 to 8 per cent a year. Sony's answer to the problem of storing all of this information is optical disc filing.

SIOS uses a hierarchical storage system analogous to conventional filing. One surface of a disc represents a filing cabinet that can be subdivided into binders, documents and pages. A document can consist of just one page or several hundred. A maximum of 21,000 pages can be held on one disc surface.

As documents are registered in the system, they need to have keywords (up to 30) appended to them. The

system software provides facilities for rearranging the keywords and for revising documents. Old versions of documents remain in the system, and can be retrieved if necessary.

Documents can be retrieved by keyword, by document name or by a 'bookmarker', which will present a predefined page of a document.

The editing features of SIOS allow a document to be moved about on the screen and to be rotated and zoomed up or down. Customised editing functions and editing languages can also be created.

Open studio and audio-mixing room

These two zones of Media World showed Sony's products aimed at the professional broadcasting and audio markets.

TUESDAY 22 APRIL

MITSUBISHI CORPORATION

Delegates were welcomed by Mr Kuwahara, General Manager – Office Information Systems Department. Mitsubishi is Japan's largest *sogo sasha* and, as such, it is very difficult to explain precisely what the corporation's business is. Sogo sasha literally means global (or general) trading concern, and sogo sashas have five major functions: trading, information services, financing, investment, and organising. Sogo sashas do not manufacture products themselves. Instead they skilfully combine the five functions in order to motivate and generate business. The success of a sogo sasha depends very much on making effective use of information.

The nine largest sogo sashas transact more than half of Japan's foreign trade. They also handle large volumes of trade entirely outside of Japan. For example, 9 per cent of the United States' exports to South East Asia, and 5 per cent of its imports from that region are handled by Mitsubishi companies.

Mitsubishi trades 25,000 products through 200 offices throughout the world. Its information services have to handle vast quantities of daily messages flowing into and out of its 62 Japanese offices and 161 overseas offices. For example, the head office receives 60,000 telexes and 40,000 letters a day. Major statistics about Mitsubishi Corporation are:

- Capital: 70.2 billion yen ($351 million).
- Annual sales: 16.4 trillion yen ($82 billion).
- Employees: 9,000

There are two office systems departments in Mitsubishi Corporation. Department A develops corporate level systems, and Department B develops dispersed, distributed systems for use by individual groups or departments.

Mr Suzuki, Manager of the database team, Department A, then described some of Mitsubishi's corporate information systems activities. All systems activities are coordinated by an OA committee that reports to the executive committee, comprising the chairman and senior vice-presidents. Department A has 73 staff and Department B has 57 staff. These numbers exclude programmers, however. All programming work is put out to specialist software houses.

The first mainframe and online systems (IBM 360 and GE respectively) were installed in 1971. The major development effort today is in implementing MINTS (Mitsubishi's integrated information system), a total online system that enables employees to extract data from aggregated corporate databases.

The overall structure of Mitsubishi's systems is shown in Figure 1. Data from the operational systems (TRADS, KEEPS, PEARL, COINS, etc.) is aggregated once a month into the four management information system databases (business, customers, accounting, and personnel). These databases are based on IMS and are accessed via programs written in Focus. The executive-LAN shown in the figure is a concept, not a physical local area network. It is at the pilot development stage with four executive vice-presidents using terminals to access monthly closing data, ten-year historical data, and data about other sogo sashas. The divisional systems shown on the right of Figure 1 are a new area, and are the responsibility of Department B.

Mitsubishi's hardware configuration is shown in Figure 2. The IBM 3090 in Tokyo was installed in January 1986; the 3083 is used as a global JES III machine; and the 3081 in Osaka is used to support

Figure 1 System network and OA in Mitsubishi

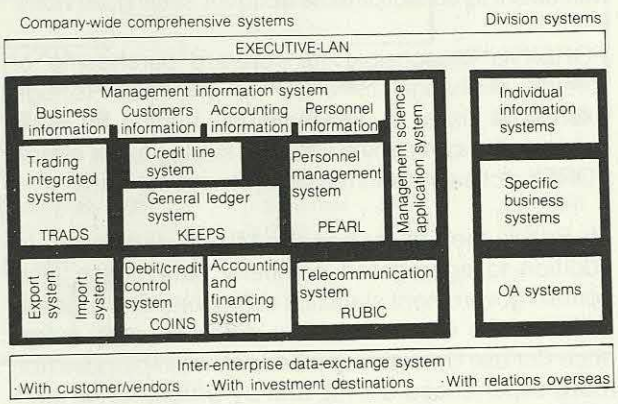
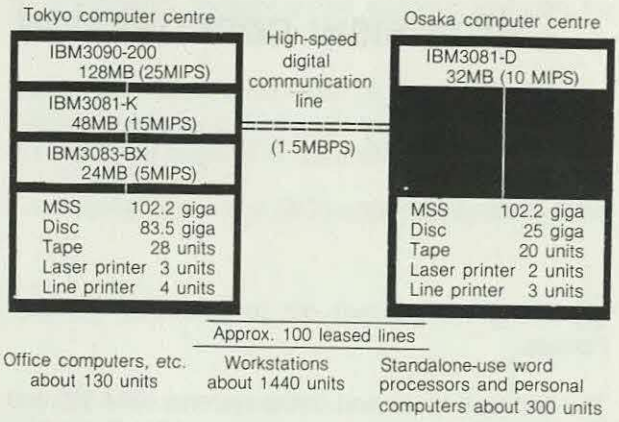


Figure 2 Mitsubishi's system hardware configuration



distributed systems, although the main purpose of the Osaka centre is to act as a backup to the Tokyo centre. The office computers are mainly IBM, Fujitsu, Mitsubishi Electric and Datapoint. IBM 5550 workstations (special Kanji versions) are used, although there are about 200 3270s as well. The SNA architecture is used. A total of 55 mips is installed, supporting 1,400 terminals and 430 PCs and word processors. The ratio of terminals and PCs to staff is about 1:6. This ratio is expected to change to 1:2 within about five years.

The applicaton base comprises more than 28,000 programs representing nearly 10 million lines of code. Most programs are written in Cobol, although about 10 per cent are in PL/1, and there is a very small amount of Assembler programs. The cost per instruction is about 1,500 to 2,000 yen.

Two company-wide applications are COINS, Mitsubishi's debit/credit control systems, and FOREX (forward foreign exchange series). COINS covers all domestic transactions and processes data and office work resulting from accounts receivable and payable. The staff displaced by the COINS systems have been reallocated to sales activities. COINS has enabled Mitsubishi to consolidate its account settling services.

FOREX is responsible for forward purchasing of foreign exchange in order to minimise foreign exchange risks in international trading. It also supports the company's financial strategies. In effect, FOREX acts as an inhouse international bank.

Mr Suzuki then described the MINTS databases. In addition to aggregated company data, these also contain government statistics on imports and exports. Data can be retrieved in four different ways: reference (for use by novices), standard, multi-purpose (for more experienced users), and by programs (written in FOCUS by users). About 900 staff are registered as users of the MINTS database, although only about 20 per cent of these are active users. Fourteen databases are available, representing a total of about eight million records.

Reference retrieval displays the output on a screen, although hard copy is also available. Standard retrieval also uses a screen and printer so that standard tables can be prepared for each user department. With multi-purpose retrieval, the user selects from a menu of alternatives. Regular training sessions are held once or twice a month to educate users in how to access the MINTS databases.

The number of database enquiries per month is low (between 6,000 and 7,000 at the end of 1985). About half of the accesses are generated by 'program' retrieval, although this represents the smallest class of users. Response times are very slow due to the inefficiency of FOCUS. The use of the system had been even lower before the introduction of a Kanji version of FOCUS in April 1985. Users are not charged for accessing the MINTS databases.

The plan is to refine the MINTS databases further so they can be accessed by top management. For this purpose, the databases will be transferred to a Mitsubishi Electric minicomputer (to provide better response times). All access software will be written in Basic, including graphic display procedures. The access procedures will be kept as simple as possible (menu-based), and will use a touch-sensitive keyboard.

Answering questions from delegates, Mr Suzuki said that Mitsubishi's systems were probably more advanced than those of the other sogo sashas. He also said that IBM was chosen as the main supplier because of Mitsubishi's need for worldwide compatability.

Mr Hashimoto, Applications System Manager with Department B, then described some of Mitsubishi's business strategy support systems. He began by describing the foodstuff POS information system – an experimental project jointly developed by Crown Sangyo Stores, Mitsubishi, Dentsu (agents for GE's MK III) and IBM Japan. This system channels data collected by POS terminals in Crown's stores through Crown's headquarters to Mitsubishi's system, which creates weekly databases relating to products, sales, etc. The aim is to create a useful data resource that can be used as a decision aid for foodstuff sales and merchandising strategies.

Another business strategy support system is the foodstuff distribution information system. This is a value-added network service that exchanges day-to-day transaction and marketing information between Mitsubishi, foodstuff manufacturers, warehouse and

trucking firms, wholesalers and retail stores and supermarkets. The system processes transaction information (order details, delivery, payment particulars, etc.) and sales details, and feeds the relevant information through to Mitsubishi's own system.

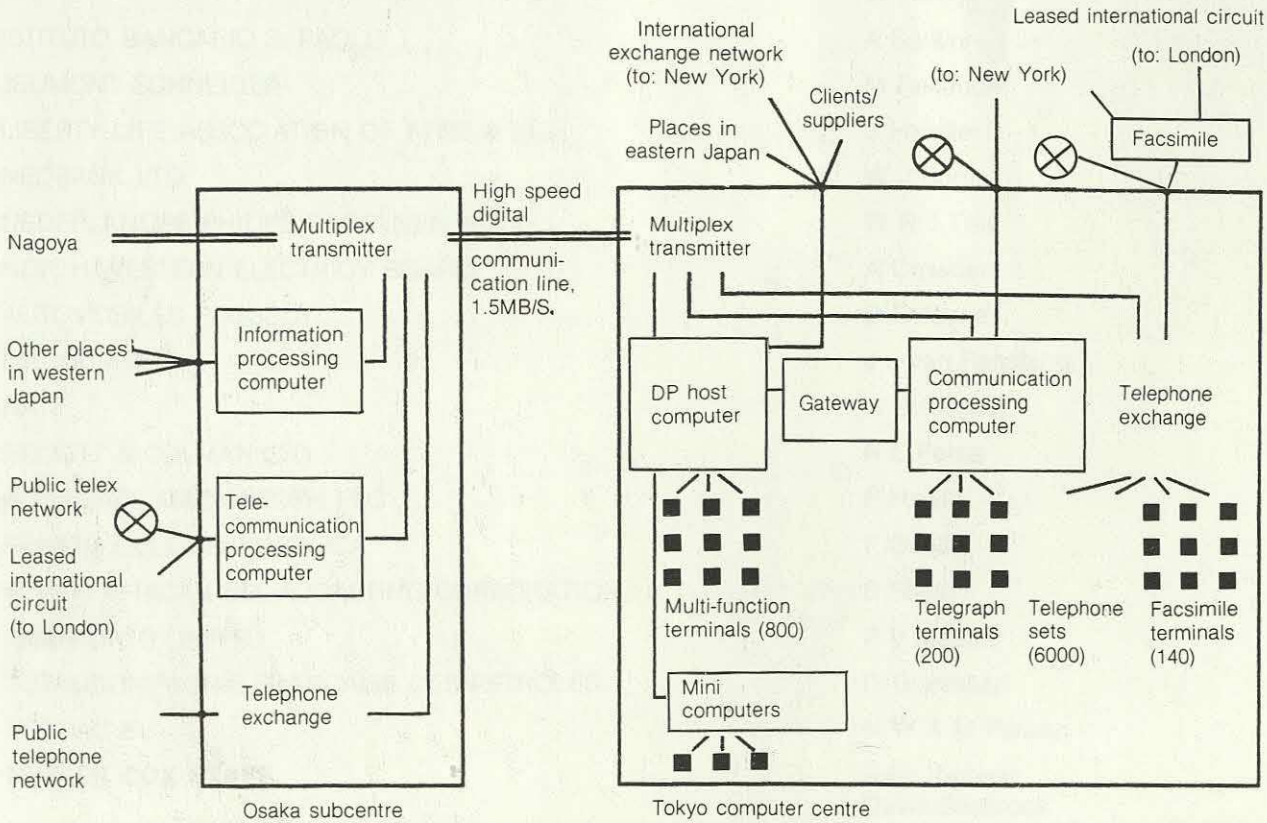
Mr Hashimoto also described AUTEX (international order processing system for automobile export). This system provides an international relay system that processes car orders from overseas distributors. AUTEX provides overseas distributors with rapid confirmation of orders, and automatically places the order with the manufacturer (Mitsubishi Motor Corporation). It also provides an ideal stock/order simulation function that is used to advise overseas distributors about stock levels.

Mr Hashimoto then described Mitsubishi's national and worldwide telecommunications network, which provides data, facsimile and telex facilities (see Figure 3 for a summary). In total, about 1,400 terminals, 300 telex machines and 250 facsimile machines are linked to networks. KDD's high-speed digitised packet network is used to communicate with 16 minicomputers (IBM S/36 and S/38) in overseas offices. The facsimile exchange network handles 8,000 sheets of paper a day (increasing by 20 per cent a year). Mitsubishi is the first company in the world to use the new CCITT MHS (message handling system) architecture. Mr Hashimoto, when questioned, did not know if this is the same as the CCITT X.400 standard.

The session at Mitsubishi continued with Mr Hashimoto outlining some of the 'new media' business activities that Mitsubishi is involved in.

- Ground communications: Mitsubishi is involved with all of the four organisations planning to provide competitive common-carrier facilities following on from the deregulation of telecommunications in Japan. These services will commence in the autumn of 1986.
- Satellite communications: Mitsubishi has a majority interest in a group planning to launch a Ford Aerospace Satellite in February 1988.
- Value-added networks: Mitsubishi has a joint venture in Japan with IBM.
- Information services: one example of Mitsubishi's activities in this area are the bi-directional medical services provided (via videotex) to hospitals and pharmacies.
- Videotex: Mitsubishi has participated in many

Figure 3 Mitsubishi's telecommunications networks



videotex projects, both as an information provider and as a system operator.

- CATV: Mitsubishi is providing capital for several CATV projects.

The session at Mitsubishi concluded with a description of the way in which OA (that is, systems) is promoted in the company. The emphasis is on moving as much of the systems analysis activities to the users, and preparing for the time when each employee has a terminal. The training and general education of 'systems engineers' (analysts) was described. The focus here is on business analysis skills, not programming skills. Programs are treated as 'black boxes' that are written and maintained by external contractors. The cost of using a contract programer is approximately 650,000 yen a month (excluding computer time). Contract programmers do not work on site, but have access to Mitsubishi's computer hardware.

1986 STUDY TOUR OF JAPAN

LIST OF DELEGATES

AHOLD NV	M van Marion
BARLOW RAND COMPUTER SERVICES (PTY) LTD	E Groeneweg
BURMAH-CASTROL (UK) LTD	J Saunders
CASTROL LTD	S R Petchy
CITIBANK NA	Hi Sun Wung
DUTCH PTT	F A M Franse
ELF AQUITAINE	L Nardon
FRANCE CABLES ET RADIO	M Montagnon
GENCOR GROUP INFORMATION SERVICES	B R Shaw
IMPERIAL BREWING & LEISURE LTD	P Sole
ISTEL LIMITED	J A Sansom W Henry
ISTITUTO BANCARIO S. PAOLO	A Santini
JEUMONT SCHNEIDER	M Renaudie
LIBERTY LIFE ASSOCIATION OF AFRICA LTD	S Handler
NEDBANK LTD	W J Burns
NEDERLANDSE PHILIPS BEDRIJVEN BV	W R J Tillie
NORTH WESTERN ELECTRICY BOARD	A Crowder
AUTOMOBILES PEUGEOT	D Lafaurie
PSC BUREAU	J J van Rensburg
RATP	H Schwebel
RECKITT & COLMAN LTD	R E Ferris
ROWNTREE MACKINTOSH PLC	P Hewitt
SENATO DELLA REPUBBLICA	F Guelfi
SOUTH AFRICAN BROADCASTING CORPORATION	S Shear
TIGER OATS LIMITED	P V Slattery
TOTAL-COMPAGNIE FRANCAISE DES PETROLES	D Gianinazzi
VOLMAC BV	N W A M Panken
BUTLER COX STAFF	John Kinnear David Seabrook

THE BUTLER COX FOUNDATION

Butler Cox & Partners

Butler Cox is an independent management consultancy and research organisation, specialising in the application of information technology within commerce, government and industry. The company offers a wide range of services both to suppliers and users of this technology. The Butler Cox Foundation is a service operated by Butler Cox on behalf of subscribing members.

Objectives of the Foundation

The Butler Cox Foundation sets out to study on behalf of subscribing members the opportunities and possible threats arising from developments in the field of information systems.

New developments in technology offer exciting opportunities — and also pose certain threats — for all organisations, whether in industry, commerce or government. New types of systems, combining computers, telecommunications and automated office equipment, are becoming not only possible, but also economically feasible.

As a result, any manager who is responsible for introducing new systems is confronted with the crucial question of how best to fit these elements together in ways that are effective, practical and economic.

While the equipment is becoming cheaper, the reverse is true of people — and this applies both to the people who design systems and those who make use of them. At the same time, human considerations become even more important as people's attitudes towards their working environment change.

These developments raise new questions for the manager of the information systems function as he seeks to determine and achieve the best economic mix from this technology.

Membership of the Foundation

The majority of organisations participating in the Butler Cox Foundation are large organisations seeking to exploit to the full the most recent developments in information systems technology. An important minority of the membership is formed by suppliers of the technology. The membership is international with participants from Australia, Belgium, France, Italy, the Netherlands, Sweden, Switzerland, the United Kingdom and elsewhere.

The Foundation Research Programme

The research programme is planned jointly by Butler Cox and by the member organisations. Each year Butler Cox draws up a short-list of topics that reflects the Foundation's view of the important issues in information systems technology and its application. Member organisations rank the topics according to their own requirements and as a result of this process members' preferences are determined.

Before each research project starts there is a further opportunity for members to influence the direction of the research. A detailed description of the project defining its scope and the issues to be addressed is sent to all members for comment.

The Report Series

The Foundation publishes six reports each year. The reports are intended to be read primarily by senior and middle managers who are concerned with the planning of information systems. They are, however, written in a style that makes them suitable to be read both by line managers and functional managers. The reports concentrate on defining key management issues and on offering advice and guidance on how and when to address those issues.

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