2 Application Fields of Computer Systems

Chapter Objectives

The reader is expected to learn some cases of computer applications in engineering fields such as CAD/CAM and in business system fields such as POS systems and EOS. The objectives of this chapter are as follows:
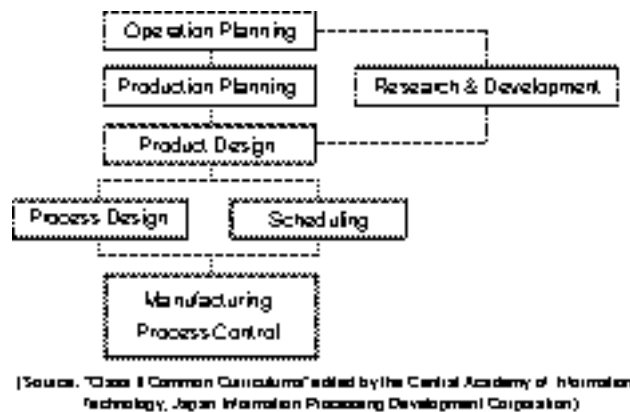
① Understanding the outlines of the mechanisms and functions of automatic production control, CAD/CAM/CAE, and factory automation (FA) systems.
② Acquiring knowledge about the computer applications in the business sector.
③ Acquiring knowledge about the computer applications in business-to-business commerce, such as EDI, CALS, and EC, and about business.

2.1   Engineering Applications

2.1.1   Automatic Control of Production

Human beings initially conducted production activities using their own power and simple tools. In the Industrial Revolution started in the late 18th century, tools dramatically evolved into machines, and human power into steam engines and electric power. Since the end of World War II, we have been seeing advances in computer and microelectronics technologies. Computers and microelectronic devices have automated production and complex control processes that used to be performed manually.
The production process flow is generally as shown below.

Figure 2-1-1
Production Process

(Source. "Class II Common Curriculum" edited by the Central Academy of Information Technology, Japan Information Processing Development Corporation)

The factors in the demand for production process automation include the following:
- Decreasing labor supply
- Mechanical substitution of dangerous and extreme human operations
- Cost reduction to deal with intensifying market competition
- Need to produce larger varieties of products in smaller quantities
- Advances in computer technology

Here are some examples of typical engineering systems:
- The direct numerical control (DNC) system in which a single computer controls multiple NC machine tools
- The automatic monitoring system that monitors machine tools and responds to any abnormality in real time
- The automatic warehousing system in which computers control a warehouse by operating robots, cranes, and so on
- The CAD (Computer Aided Design) system and the CAM (Computer Aided Manufacturing) system to design and manufacture products with computers
- The CAE system to help design and drafting on the computer display
- The office automation (OA) system to save labor in the clerical work
- The factory automation (FA) system to save labor in the manufacturing process in factories

2.1.2 CAD/CAM/CAE

(1) CAD

CAD is an acronym for Computer Aided Design.

The objective of CAD is to automate product design as much as possible by using computers. To achieve this objective, CAD generally uses graphic display devices, digitizers, and other tools. CAD is the process of designing a product through dialog on a computer (EWS: engineering workstation) display using the stored design information. CAD requires substantially less time than manual design.

As peripherals, CAD uses various input and output devices:
- Input devices: keyboard, digitizer, light pen, and mouse
- Output devices: printer and plotter

In addition, CAD requires graphic display devices and a database to store and retrieve design information. Graphic display devices are available in CRTs (Cathode Ray Tube) and in flat panel displays.

Figure 2-1-2

CAD Configuration
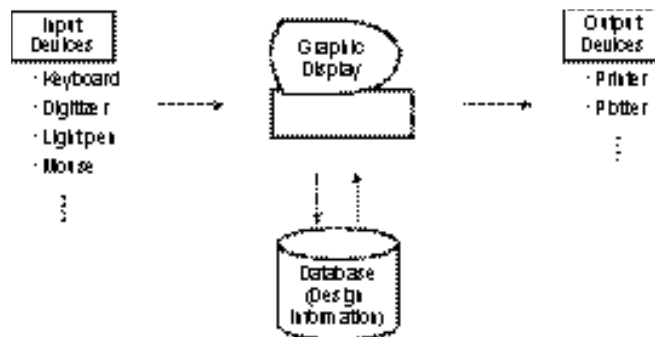
In CAD, actual assistance from the software is provided in the following steps:
- The computer provides accumulated design information and data and retrieves pertinent information and reference data.
- The computer provides geometric models to help to represent the object to be designed.
- The computer automatically creates part of a design proposal through a pre-arranged procedure.
- The computer examines and evaluates a design proposal by simulation and other procedures.

CAD is used for the design of electronic circuits, buildings, automobiles, and so forth. Combined with CAM, CAD is often referred to as CAD/CAM.

(2) CAM

CAM is an acronym for Computer Aided Manufacturing.

CAM means assisting the manufacturing products by using computers. It is the process of designing a manufacturing process based on the data in design drawings prepared in CAD and automatically controlling the assembly and processing of the product using numerically controlled (NC) machine tools and the like.

CAM makes it possible to automate machining and other operations with computers, thus saving labor.

CAM is based on the combination of several technologies, including the following:
- FMS (Flexible Manufacturing System)
- Computer aided process planning (process design)
- Computer aided scheduling
- Industrial robotics technology

(3) CAE

The objective of CAE (Computer Aided Engineering) is to reduce the time required for the development of a new industrial product with shorter prototyping and experimentation period. CAE helps to study characteristics of the product and its components through simulation and numerical analysis by such

methods as the finite element method (FEM) using a computer.

The term CAE is used in the broad sense and the narrow sense. In its broad sense, CAE means the process of assisting in the stages from simulation to development, design, and drafting with the computer. In its narrow sense, CAE means only analytical work, leaving the subsequent work of design and drafting to CAD. In both cases, CAE does not include CAM in the manufacturing stage.
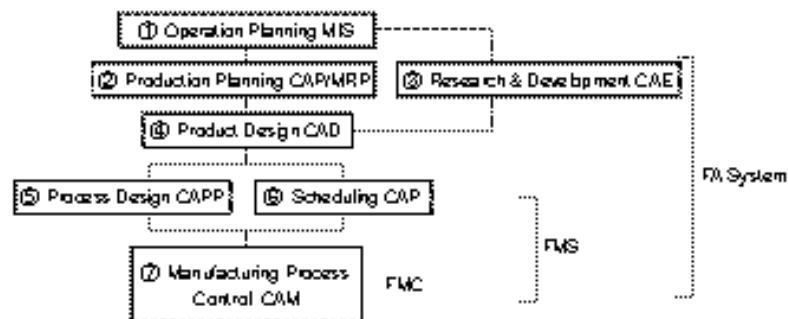
2.1.3   FA Systems and CIM

(1) FA Systems

The FA system is a system to perform work in a factory efficiently by automating the work as much as possible with the computer. It covers a very wide range of operations, from CAD/CAM to numerically controlled machine tools and robots.

The basic FA system configuration is shown in Figure 2-1-3.

Figure 2-1-3
FA System

(Source : "Class IICommon Curriculum" (with some subsequent additions) edited by the Central Academy of Information Technology, Japan Information Processing Development Corporation)

① Operation planning

Management Information System (MIS): A management decision making system

② Production planning

Material Requirement Planning (MRP): A system for controlling the flow of materials, from raw materials to finished products, over time

③ Research and development

Computer Aided Engineering (CAE): A system for outline design based on the simulation of the strength and mechanism analysis of products

④ Product design

Computer Aided Design (CAD): A system for detailed design, including the creation of geometric models of products

⑤ Process design

Computer Aided Process Planning (CAPP): A system for determining work procedures, working machines, work time, and so forth

⑥ Scheduling

Computer Aided Planning (CAP): A system for determining work schedules, machine assignment schedules, and so forth

⑦ Manufacturing process control

Computer Aided Manufacturing (CAM): A system for controlling working machines' manufacturing processes by computer

Of these systems, ② through ⑦ are collectively called an "FA system."
In addition, systems ⑤ through ⑦ are collectively referred to as "FMS" (Flexible Manufacturing System). The FMS links the automatic control of flexible manufacturing cells (FMCs), which are the units of processing and assembly in manufacturing, to an automated warehouse and automatic transport equipment for integrated control by computer. The FMS is drawing attention as an automatic production system to deal with the need to produce large varieties of products in small quantities.

(2) CIM

When an FA system is operated based on a management information system (MIS), the entire information system is called a CIM (Computer Integrated Manufacturing) system (Figure 2-1-4).
That is, CIM is built as an integrated corporate information system covering all stages from management strategies to production in order to improve the efficiency of all the operations of the enterprise.

Figure 2-1-4

CIM
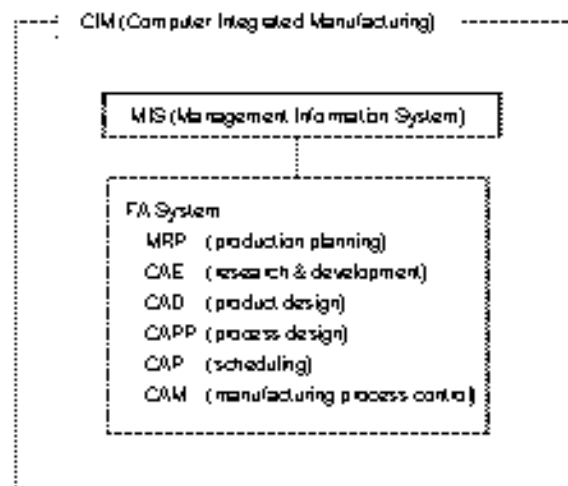
In this case, the FA system is a subsystem of CIM. Other subsystems of CIM include an OA system, a POS system, and an EOS (electronic ordering system).

2.2   Business Applications

2.2.1   Head Quarters Business Support Systems

Some typical business support systems are described below.

(1) Accounting Information System

As mentioned in Chapter 2, an accounting information system processes corporation accounting with the computer. It digitizes slip data entries, automates accounting calculation, and prepares financial statements. This system can not only ensure speedy accounting but also reduce processing errors and personnel expenses.

(2) OA System

The OA system is aimed at improving the efficiency of clerical processing by introducing office automation (OA) equipment into the office space.

The functions required of an OA system vary depending on the line of the business, operation, division, and user.

To serve a variety of purposes, several systems are available as shown below:

- A document processing system based on word processors
- An electronic filing system aimed at minimizing the use of paper
- A videoconferencing system that reduces travelling time by taking advantage of advances in communications bandwidth
- An electronic secretary system that assists in secretarial work
- A decision support system that assists in the decision makings in business operation

It is now becoming increasingly common to build an office system by combining such systems as mentioned above or to construct intelligent buildings in which OA systems are accessible everywhere.

(3) Groupware

① Outline of groupware

Groupware is designed to enable members of a group to collaborate to each other by linking the members' personal computers via a LAN (local-area network) or WAN (wide-area network). For example, when a project is to be carried out, it is a common practice to form a team to work on it. Groupware is used to manage the roles and schedules of the individual group members and to ensure smooth execution of the project.

② How to use groupware

Groupware is still an emerging field, and there aren't many items available for practical use. The functions usually provided by groupware at present are electronic mail, bulletin board, and videoconference. Other groupware capabilities include scheduling and work flow management, and online approval/dismissal of business trips and expense proposals.

a. Electronic mail

Electronic mail is a digital version of traditional postal mail that is transferred by personal computers, in-house LANs, and the Internet. A computer center has a mail box for each user, so that you can write messages to other users and read messages addressed to you. Email can be sent between users anywhere in the world, in seconds.

For businesses, however, electronic mail is more than a substitute for letters and facsimiles. That is, since even field workers can send electronic mails directly to top management, it becomes possible for people at all levels to share information. Electronic mail thus ensures more efficient execution of collaborative work.

b. Bulletin board

While electronic mail is a means of communication between individuals, the electronic bulletin board is a broadcast system that enables multiple people to read and write freely. Some bulletin boards functions as the circulation of information and the reservation of conference rooms. The bulletin board system should be used effectively to ensure better communication among the members working on the same project.

c. Videoconferencing

Videoconferencing enables participants to have discussions and exchange opinions over the network. Videoconferencing is similar to the bulletin board but enables the registered members only. Unlike ordinary conferences, videoconference does not require participants to exchange opinions at the same time. This is one of the major advantages of videoconferencing.

d. Schedule management software

It is important but often difficult to manage schedules. When a large number of people are involved, it is quite a job to coordinate their schedules.

Schedule management software is used to manage schedules by shared calendars.

This software coordinates the work schedules of the members of a project team by recording their schedules and negotiating and reflecting changes over the network.

e. Bottom-up decision-making system

This is a system to perform "ringi," the unique Japanese method of decision making, by computer. In the conventional ringi system, a document stating a proposal and seeking approval is routed by the author to the section head, the department head, the director in charge, and the president. In the bottom-up decision-making system, similar document data is transmitted in this order and the managers signify their approval by using their electronic seals. Since the system makes it unnecessary for the author to physically take a proposal to the managers, it improves work efficiency and helps reduce the use of paper.

③ Orientation of groupware

Groupware is not an operational system such as accounting or sales processing but to conversational and informational systems.

That is, the productivity of intellectual work would be more effectively improved by utilizing groupware in the EUC (End-User Computing) environment. It will be interesting to see what new groupware items will be developed in the future.

2.2.2 Retail Business Support Systems

It is vital for information processing engineers to properly understand what systems are required in particular situations of business activity. To this end, it is necessary for them to be able to build systems by accurately grasping the flow of information in various lines of business, detecting problems, and studying solutions. Such systems required in various situations of business activity are called business support systems in the broad sense.

The retail industries are also seeing the building of systems to ensure efficient operations. Such systems are called "retail information systems."

Typical retail information systems include the following:

- POS (point-of-sale) system
- EOS (electronic ordering system)
- Inventory management system

Since inventory management has already been learned in Chapter 3, this section describes the POS system and the EOS.

(1) POS System

① What is the POS system?

The POS system is a system to manage information at the point of sale. POS is an acronym for Point Of Sale.

In the retail business, in which goods are purchased and sold, merchandise management is an important job. The POS system makes it always possible to grasp the number of goods sold in order level of not to run out of stock and to avoid storing excessive inventory. The system helps accurately grasp the level of inventory and the time to place orders.

In the POS system, a bar code reader linked to a cash register determines product names and prices by identifying the bar codes on the products customers are buying.

In addition to bar code readers, auxiliary computing and storage devices to indicate product prices and inventory levels are installed in convenience stores and supermarkets. These devices send data to computers located for the headquarters.

Figure 2-2-1
POS System
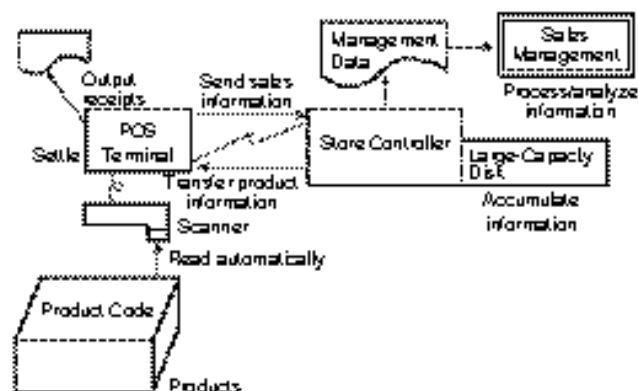
(Source: "Class II Common Curriculums" edited by the Central Academy of Information Technology, Japan Information Processing Development Corporation)

The POS system will provide the following benefits:
- Simpler and more accurate checkout by cashiers
- Automatic accumulation of sales data
- Proper merchandise offerings
- Less time required for sales staff training

② Bar codes

A bar code represents characters with a combination of parallel vertical lines and spaces of varying thickness. A bar code can be optically scanned.

Today bar codes are attached to most foodstuffs and daily necessities and are playing an important role as point-of-sale input information. Bar codes are also used in libraries for the management of books.

A patent on bar codes was obtained in 1949 but bar codes were not widely used until around 1970 because devices to read these codes were astronomically expensive. Today bar code readers are inexpensive, and bar codes are in wide use.

a. Structure of bar codes

As noted, the bar code represents information by a combination of wide and narrow vertical bars.

In the case of the 2 of 5 system, each of five bars corresponds to one binary, a narrow bar representing a "0" and a wide bar a "1." One character is coded by five bars, on which two are always wide (Figure 4-2-2). Therefore, even if a wide bar is mistakenly printed or read as a narrow bar or vice versa, the resulting absence of two wide bars makes it possible to detect the data error. And yet, if in a set of five bars, one wide bar is mistakenly read as a narrow one and one narrow bar as a wide bar, then the data error cannot be detected.

Figure 2-2-2
Bar Codes

b. Bar code reader

Bar code readers are of:
- the pen type,
- the touch type, or
- the laser type.

The pen type bar code reader reads bar codes by scanning them with an LED (light emitting diode). The touch type reader can read bar codes by simply applying an LED to them. The laser type reader can read bar codes at some distance.

(2)   EOS

EOS is an acronym for Electronic Ordering System.
In any line of business, accepting orders and placing orders are essential parts of business activity. These jobs require a great deal of time and manpower, and errors tend to occur. These jobs are important, since they are directly related to inventory management.
These jobs often involve the following problems:
- It takes time to receive deliveries after placing orders.
- It takes time to check inventory levels.
- It is possible to miss ordering necessary goods.
- It is necessary to have some knowledge about product inspection.
The EOS solves these problems by automatically managing these ordering tasks by computer.
The EOS receives such data as the product codes of the merchandise to be ordered, their quantities, suppliers or business partners through terminals and sends the data to the pertinent departments at headquarters, or suppliers or shippers in order to handle ordering tasks.

Figure 2-2-3

EOS
(Electronic
Ordering System)
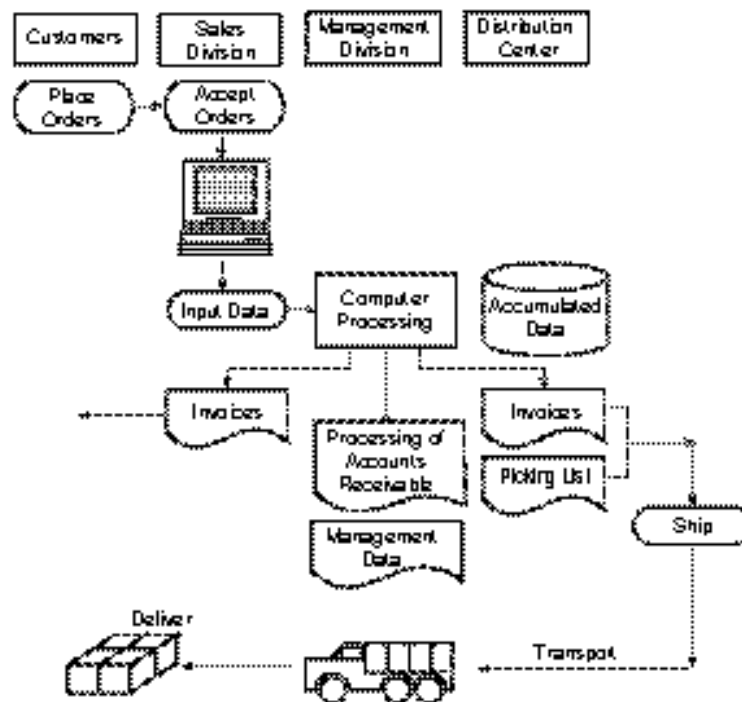
[Source : "Class II Common Curriculum" edited by the Central Academy of Information Technology,
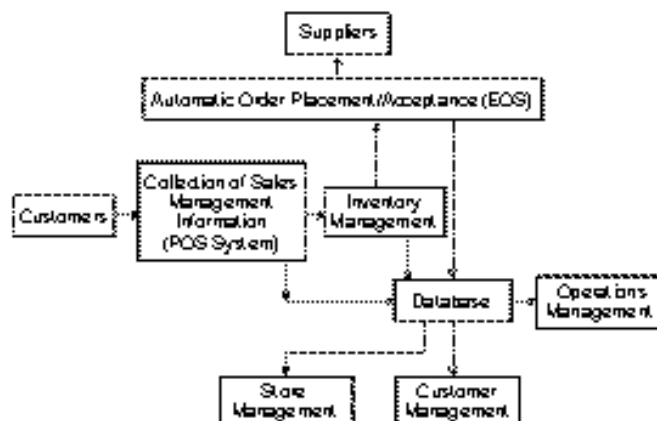Japan Information Processing Development Corporation]

The EOS would bring the following benefits:
- Simpler inventory management
- Labor saving in product inspection
- Cost reduction in distribution
- Accurate merchandise management

When linked to the POS system, the EOS can be more effective from the viewpoint of merchandise management (Figure 2-2-4).

Figure 2-2-4

Sales and Distribution
Information System

(Source: "Class II Common Curriculums" edited by the Central Academy of Information Technology,
Japan Information Processing Development Corporation)

To implement EOS, the following matters need to be agreed by business partners:
- Standardization of order acceptance and placement procedures
- Systematization of codes, including merchandise and supplier codes
- Protocol compatibility

2.2.3   Financial Systems

(1)   What Are Financial Systems?

The first online system implemented in Japan is the score keeping system used in the Tokyo Olympics in 1964. The system was taken over by the banking industry the next year. The financial industry thus became the first user of a commercial online system in Japan.
Since then, the financial system has gone through the first-, second-, and third-generation online projects. Today it is providing a variety of services as a social system indispensable for people's lives.

(2)   Banking Systems

A typical banking system consists of operational, clerical, and informational subsystems. Furthermore, the subsystems have the following subsystems:
- Operational subsystems: Accounting
                                 Fund and securities
                                 International exchange
                                 External connection, etc.
- Clerical subsystem: Retail banking
                                 Call and customer support center
- Informational subsystem: Management information

These functions have evolved through the processes described below.

① First online project

Banks began to use computers for their operations in the 1960s. The systems they worked on were called the first online systems. To improve clerical processing efficiency and save labor, these systems made use of online storage of ledgers and the centrally controlled automatic fund transfers.

② Second online project

In the 1970s, banks began to work on the second online project in order to strengthen the system's functionalities. This project realized the interbank linkage of online cash dispensers, the linked processing of major accounts, and so forth. Furthermore, in 1973, banks put into operation the "Zengin Data Telecommunication System," a data telecommunication system of all banks in Japan. The Zengin System has Zengin centers in Tokyo and Osaka, which are linked to each financial institution's computer center through a Zengin terminal using leased lines. This system is functioning as the core of a domestic settlement system by performing such functions as sending and receiving messages on domestic exchange transactions and calculating exchange settlement amounts.

Figure 2-2-5
Zengin System
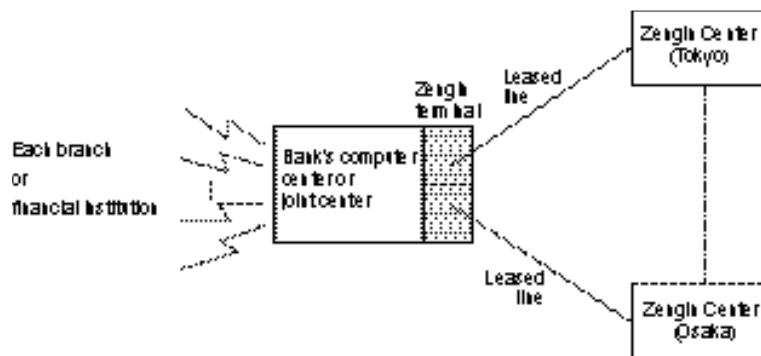
Internationally, SWIFT (Society for Worldwide Interbank Financial Telecommunication) was founded in 1973. SWIFT II is now in operation. This system is an international network of financial institutions. It handles communications on interbank transfers, customer remittances, and so forth concerning international financial transactions. Unlike the Zengin System, SWIFT II does not process interbank fund settlement.

③ Third online project

In the 1980s, in order to strengthen their information management functions, and customer networks to deal with financial deregulation, banks reconstructed their account systems and enhanced their information, international, securities, exchange and external connectivity.
In 1988 the Bank of Japan Financial Network System (BOJ-Net) went into operation. Handling foreign exchange settlements by yen, government bond operations, and other business, this system is contributing to efficient, speedy clerical processing in the entire banking industry.
In addition, the MICS nationwide cash dispensing service that started in 1990 made it possible for depositors to get cash through dispensers installed at any type of financial institutions. Previously, depositors had been able to get cash only through dispensers installed at financial institutions belonging to particular syndication of banks such as city banks, regional banks, and local credit unions.

(3) Electronic Banking

Electronic banking uses systems that electronically exchange data over the network connecting financial institutions' computers with corporate and individual customers' computers and terminals.
By the objects to be networked, electronic banking systems can be divided into:
- firm banking, which uses a system networking financial institutions and businesses, and
- home banking, which uses a system networking financial institutions and individuals.

Major types of processing performed in electronic banking include deposit balance inquiries, depositing

and withdrawal operations through cash dispensers and automatic teller machines (CDs and ATMs), and account transfer transactions. Recently, electronic banking has been able to handle such operations as providing foreign exchange rates, payroll calculations, account transfer reservations, settlement of accounts payable, and so forth. Advising and inquiry services using touch-tone telephones began in 1981. After firm banking, banks kicked off home banking in which consumers can deal with their banks through personal computers, word processors, and game machines.

① Firm banking

Firm banking is a system that enables businesses to perform real-time transactions with their banks, such as inquiring about deposit balances, making deposits, and performing account transfers.
Firm banking also allows businesses to send such data as account transfers and salary payments directly to their financial institutions. Some city banks have realized firm banking utilizing personal computers.

② Home banking

Home banking is a social system that enables consumers to perform such transactions as checking the balances of their bank accounts and transferring funds from their accounts to others' through personal computers or game machines at home.
Banks are considering realizing general home shopping in the future by connecting homes, department stores, and banks so that consumers can do catalog shopping through home terminals and pay for the purchases through home banking.

2.2.4   Intelligent Transport System

(1)   What Is the Intelligent Transport System?

Japan's first road traffic system is the regional traffic control center developed by the National Police Agency in 1958.
Since then, various government ministries and agencies have separately developed various systems. These systems were built and operated as stand-alone systems with no links among them. In January 1994, the Vehicle Road and Traffic Intelligence Society (VERTIS) was founded under the support of government ministries and agencies for the purpose of standardizing these systems and linking them organically.
An intelligent transport system is a system designed to ensure smooth traffic flows, prevent accidents and congestion, and reduce pollution by installing information systems in roads and vehicles for bi-directional exchange of information.
Major intelligent transportation systems now in operation are the Vehicle Information & Communication System (VICS) and the Advanced Traffic Information Service (ATIS).

(2)   Vehicle Information & Communication System (VICS)

In July 1995, the Vehicle Information & Communication System (VICS) Center was founded by the Ministry of Posts and Telecommunications (now incorporated into the Ministry of Public Management, Home Affairs, Post and Telecommunications), the Ministry of Construction (now incorporated into the Ministry of Land, Infrastructure and Transport), the National Police Agency, and private businesses and organizations.
VICS is a system to transmit road traffic information to the navigation equipment installed in vehicles via information transmitters (optical and radio beacons) installed on road walls and elsewhere or through FM multiplex broadcasting.

Figure 2-2-6
Vehicle Information
& Communication
System (VICS)
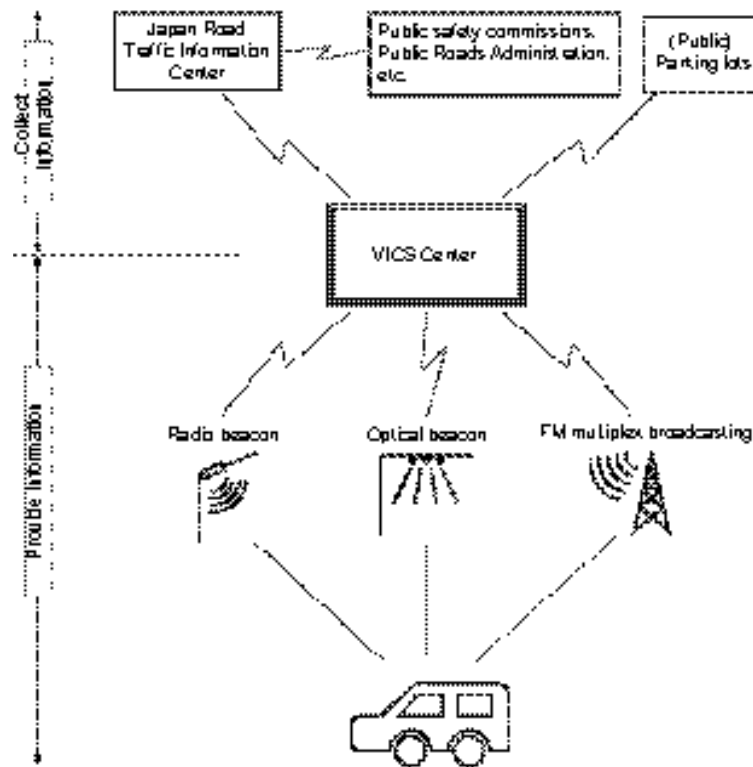
Unlike conventional road information services based on radio waves, VICS allows not only voice transmission of information but also the display of information using characters, graphics, and maps.
VICS information is available at levels 1 to 3, and users can see congestion and regulatory information on the navigation screen.
- Level 1: Information on congestion displayed in characters
- Level 2: Information on congestion displayed in pictures
- Level 3: Information on congestion displayed on a navigation map
There are three types of VICS information:

① Information by FM multiplex broadcasting

- Information is provided by NHK's (Japan Broadcasting Corporation's) FM multiplex broadcasting. Users need receiver equipment.
- Information is wide in scope but not very detailed.
- Information on alternative routes to avoid congestion (DRGS) is unavailable in principle.

② Information by optical beacons

- Information is provided by optical beacons installed on major public roads.
- Information is narrow in scope but detailed.
- Information on alternative routes to avoid congestion (DRGS) is available.

③ Information by radio beacons

- Information is provided by radio beacons installed on expressways.

All types of information are updated every five minutes. Information by optical beacons and radio beacons is provided around the clock.
Sources of information are road administrators (such as prefectural police headquarters and the Public Roads Administration), public parking lots, and so forth.

(3)   Advanced Traffic Information Service (ATIS)

In July 1993, the Tokyo Metropolitan Government and private businesses and organizations jointly established the Traffic Information Service Co., Ltd., which started services in 1995.

Advanced Traffic Information Service (ATIS) is a system for conveying road traffic information to the navigation equipment installed in automobiles via telephone lines and mobile communications (Figure 2-2-7).

Figure 2-2-7

Advanced Traffic Information Service (ATIS)
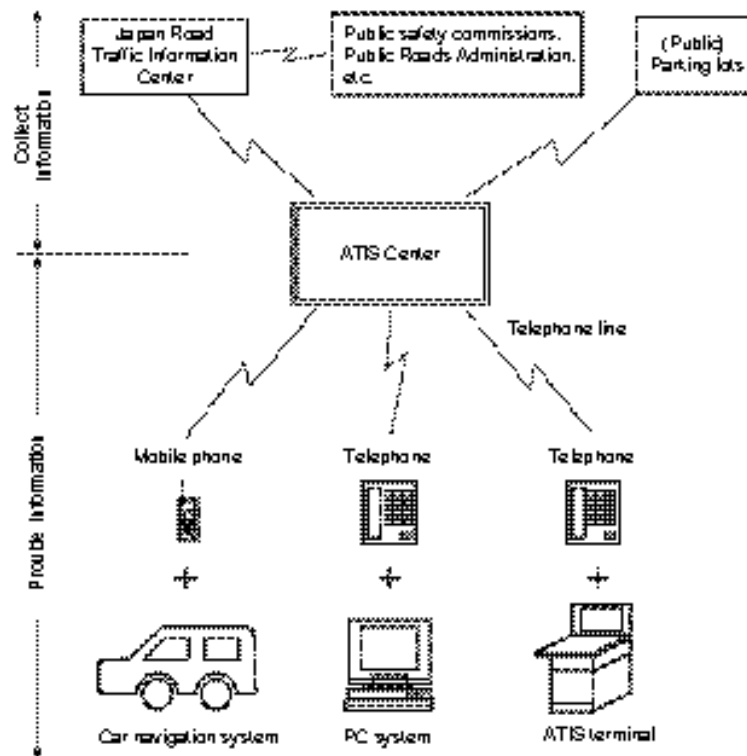
In addition to the navigation equipment, information such as time distance and accident information are accessible at office through PCs or ATIS dedicated terminals. Therefore, it can be used at transportation and taxi companies.

2.2.5   Government Administrative Information System

(1)   Government Agency's Information Systems

Since fiscal 1995, the Government has been computerizing administrative activities under the Basic Plan to Promote Administrative Computerization. Specific efforts under this plan include providing each official with a personal computer, installing a LAN in each government ministry and agency, establishing a WAN covering all government ministries and agencies in the Kasumigaseki district, and enhancing other infrastructure. In particular, the Kasumigaseki WAN, which went into operation in January 1998, is designed to achieve the following results by interconnecting the LANs of the individual ministries and agencies:

- Establishing advanced infrastructure for the processing and distribution of information among ministries and agencies
- Promoting the information sharing among ministries and agencies through online databases
- Establishing and expanding shared databases

The Kasumigaseki WAN employs star network topology centering around a network operation center to which the LANs of individual ministries and agencies are connected. The network uses leased lines and the TCP/IP protocol (Figure 2-2-8).

Figure 2-2-8
Kasumigaseki WAN
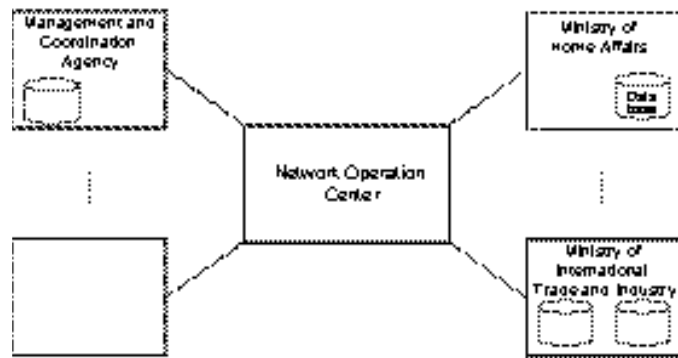
The government is now endeavoring to establish closer connections with local public entities. At the same time, the government is promoting the following plans to provide better administrative services to the people:

- Providing administrative information (such as public relations materials, white papers, and statistics) through electronic media
- Establishing a single-window system for information delivery
- Extending service hours
- Accepting applications, notices, reports, consulting, and so forth online
- Collecting opinions online

The computerization of the operations of government ministries and agencies can have a big impact on all other administrative institutions and social activities. Therefore, the promotion of the information technology should include efforts to address such tasks as establishing a law on the disclosure of administrative information and reviewing and improving current systems, regulations, procedures, and practices.

(2) Local-Government Information Delivery Systems

Local-government information delivery systems are operated by local public entities to provide useful information for local residents.

Here are some typical local-government information delivery systems:

- Local information network: A network easily accessible to local residents in general, providing information on the availability of public facilities, accepting reservations, giving information on the books and magazines in libraries, and so on
- Local satellite communication network: A network designed for regional promotion by exchanging multiple local public entities' event and administrative information via communication satellites
- Personal computer communication: A personal computer communication network system operated by a public entity for such purposes as the exchange of information among residents

Local-government information delivery systems are being operated for such objectives as providing better services for residents, promoting residents' participation in administration, and enhancing local public entities' activities. Matters requiring attention include the protection of privacy, risk management to deal with system failures, and system development and operation costs.

One typical local-government information delivery system is K-NET, which the Kanagawa Prefectural Government and private businesses are jointly running in order to build local information and communication infrastructure.

2.2.6 Inter-Enterprise Transaction Data Interchange

(1) EDI (Electronic Data Interchange)

EDI (Electronic Data Interchange) means the process of digitizing order forms, quotations, and other information on business-to-business transactions and exchanging the digital data over a network. Electronic business-to-business transactions are realized by standardizing data exchange protocols and data formats. In

Japan, EDI has progressed in the form of regional VAN and industry VAN.

| Figure 2-2-9 | Data Format Standardization
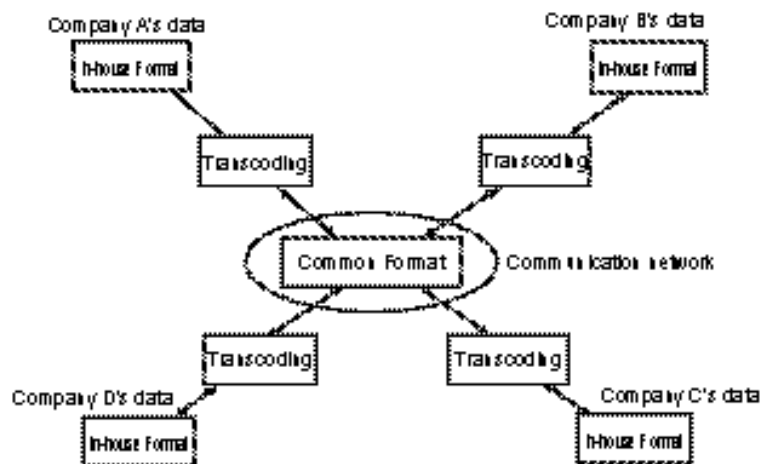
(Prepared from "Electronic Data Interchange Subcommittee Report," Computer Interoperation Environment Establishment Committee, the Ministry of Economy, Trade and Industry [former Ministry of International Trade and Industry])

| Figure 2-2-10 | Data Exchange Protocol Standardization
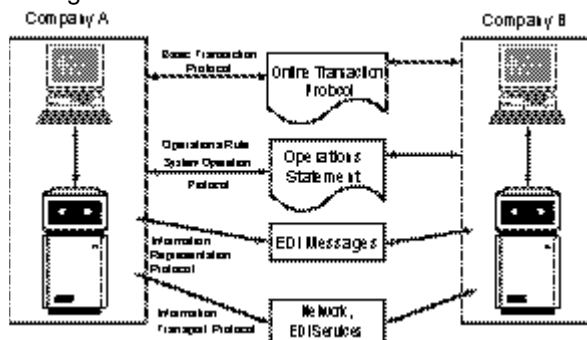
(Prepared from "Electronic Data Interchange Subcommittee Report," Computer Interoperation Environment Establishment Committee, the Ministry of Economy, Trade and Industry [former Ministry of International Trade and Industry])

The standard EDI protocol adopted by the United States and Europe in 1988 is called UN/EDIFACT (United Nations/Electronic Data Interchange For Administration, Commerce and Transport).
Web-EDI over the Internet has recently been widely in use.

① Benefits

EDI has the following benefits:
- Transaction cost reduction
- Manufacturing and sales cost reductions
- Relaxing time and physical restrictions on transactions

② Challenging issues

The wide acceptance of EDI may cause the following problems:
- Widening difference of information processing ability among businesses
- Decline in the competitive position of non-EDI companies in the industry
- Heavy burden on weak companies
- Data format confusion

(2) CALS (Commerce At Light Speed)

CALS is a system in which information on the product life cycle ranging from procurement through design, development, production, operation management to maintenance is managed digitally in an integrated manner to support the individual processes.

The origin of CALS is the concept "Computer aided Acquisition and Logistics Support" developed by the U.S. Department of Defense for materials procurement support systems.

While EDI primarily handles the interchange of transaction-related document data, CALS is a system to share information mostly concerning products.

① Benefits

CALS provides the following benefits:

- Sharing all information on the product life cycles in digital data
- Improving the quality of operations and products, and raising productivity
- Reducing costs in the entire life cycle

② Relations with EDI

The differences between CALS and EDI mentioned above include the following:

- CALS extends EDI to operations other than order acceptance and placement.
- CALS reduces costs throughout the life cycle of whole activity.

(3) EC (Electronic Commerce)

EC (Electronic Commerce) is defined by the Electronic Commerce Promotion Council of Japan (ECOM) as any commercial transaction part or all of which is performed over a network.

EC provides a mechanism in which individuals, businesses, governments, or organizations perform a series of activities such as selling, distribution, advertising, settlement, and various services.

EC is subdivided into:

- commerce between businesses (business to business: B-to-B)
- commerce between businesses and consumers (business to consumer: B-to-C)

① B to B (business to business)

B-to-B commerce can be further subdivided into commerce between specific businesses and commerce between any to any businesses.

EC between specific businesses is performed through an industry-specific system using CALS and EDI mentioned above. On the other hand, EC between any to any businesses is performed as EDI in an open network environment.

More specifically, B-to-B commerce is largely performed as inter-business transactions in such industries as manufacturing and wholesale. In these industries, B-to-B commerce is often aimed at cultivating new sales channels, increasing revenue, carrying out effective marketing, or improving customer relationship.

② B to C (business to consumer)

B-to-C commerce is the form of transactions in which businesses in the retail and service industries directly provide products and services for consumers. By eliminating an intermediate stage (middlemen) in the complex process of product distribution, B-to-C commerce enables substantial reductions in costs and time.

In addition, B-to-C commerce allows transactions without having actual inventory, thus enabling businesses to reduce inventory burden. Furthermore, businesses can conduct operations 24 hours on 365 days a year, with an adequate customer support.

③ C to C (consumer to consumer)

C-to-C commerce is a special form of transactions in which products are bought and sold between consumers. In C-to-C commerce, consumers perform transactions and settle the prices between themselves, and the company providing the arena receives commissions from sellers. A typical example of C-to-C commerce is Internet auctions.

Meanwhile, B to B, B to C, and C to C may sometimes be written as B2B, B2C, and C2C, respectively.

Exercises

Q1. **Which is the correct statement about FA (Factory Automation) systems?**

A. An FA system performs geometric modeling of products using CAD.
B. CAM is an acronym for Computer Aided Modeling.
C. FA systems have nothing to do with CIM.
D. FMS is a subsystem of FMC.
E. The system to calculate the quantities of resources required for production is called MAP.

Q2 **For designing industrial products and building construction and for making industrial designs, which of the following technologies improves drawing and designing efficiency by using computers?**

A. CAD   B. CAI   C. CAM   D. CIM   E. GUI

Q3 **Which of the following systems displays objects using wire-frame models, surface models, and the like for efficient design work?**

A. CAD   B. FA   C. FMS   D. MAP   E. POP

Q4 **Which of the following systems constitutes part of an FA system and performs design and drafting interactively and automatically by using computers, graphic displays, computer aided drafting machines, and so on?**

A. CAD   B. CAE   C. CAM   D. CAT

Q5 **Which of the following systems calculates necessary quantities of materials from basic production plans or manages manufacturing schedules by using parts configuration, inventory, and other files?**

A. CAD   B. FA   C. MRP   D. Order entry   E. Order picking

Q6 **Which provides overall support to a series of production activities by using computers?**

A. CIM   B. EOS   C. OA   D. POS

Q7 **Which of the following systems is designed to enable the sharing of transaction, technology, and other information between purchasers and suppliers by creating an integrated data environment for the information to be used throughout the entire life cycle of products, ranging from planning, development, and design through purchasing, manufacturing, operation, to maintenance, in manufacturing industries?**

A. CAD   B. CAE   C. CALS   D. CAM

Q8 **Which is the correct statement about groupware?**

A. Groupware is the technology to represent, store, and process graphics with computers.
B. Groupware is the technology to use microprograms instead of hardware to realize computer functionalities and instructions.
C. Groupware is a system to support collaborative work in an organization with computers.
D. Groupware is the use of software functionalities to provide an operating or running environment in which the user need not be conscious of hardware.

Q9 **Which of the systems collects and analyzes sales information on individual products separately in retail stores and is considered effective in tracking best-selling goods and preventing stock shortages?**

A. CAD   B. CAM   C. DSS   E. OA   D. POS

Q10 **Which is the correct statement about bank-POS systems?**

A. A bank-POS system analyzes day-by-day and temporal changes in a bank's over-the-counter business in order to improve operating efficiency.
B. A bank-POS system provides analysis of best-selling products and other services by connecting bank computers with POS terminals.
C. A bank-POS system performs online settlement of sales charges through POS terminals connected to bank computers.
D. A bank-POS system is a system that upon insertion of IC card issued by a bank into a POS terminal, subtracts a sales charge from the amount stored on the card and transfers it to the POS terminal.

Q11 **Which is the correct statement about the settlement methods under different card systems?**

A. Bank-POS cards, credit cards, prepaid cards, and loyalty cards all employ ID verification because they have a settlement function.
B. The settlement method with bank-POS cards is immediate payment.
C. The settlement method with credit cards is installment payments without interest.
D. The settlement method with prepaid cards is deferred payment.
E. The settlement method with loyalty cards is deferred payment.

Q12 **Following the evolution of computers, various cards have come to be used. Which of the following is the card whose main function is checking a limit amount and credit standing and allowing settlement at a later date?**

A. ID card   B. Bank-POS card   C. Credit card
D. Prepaid card   E. Loyalty card

Q13 **Which is the <u>inappropriate</u> statement about EDI?**

A. For EDI, order placement and acceptance information formats are standardized in Japan.
B. EDI enables accurate, real-time transactions and settlements over a wide area.
C. It is expected that EDI-based placement and acceptance of orders will make large amounts of paperwork unnecessary.
D. EDI is the process of exchanging data on commercial transactions between different businesses via communication network.
E. The so-called FB (firm banking) is a kind of EDI.

Q14 **Which is the <u>inappropriate</u> statement about information systems for businesses?**

A. The DSS is an applications system that performs accounting, payroll work, and so on by computer. It is a support system designed to improve the efficiency of routine work.
B. The EOS is an automatic ordering system in which the codes and quantities of goods to be ordered are entered via data entry terminals and transmitted online.
C. The MRP system plans and manages the procurement of parts and materials based on bills of materials and the manufacturing of parts and products.
D. The POP is a system that integrates on a real-time basis the information (such as product names, quality, facilities conditions, and workers) required at the worksite to give appropriate instructions.
E. The SIS is a system that works out and executes strategies in order that the enterprise can expand its activities and strengthen its competitive position.