General Informatics - Main Contents

Chapter 1. Informatics - system of disciplines for representing (coding), storing, processing and retrieving data and information

1.1. Introduction

- The distinction between *information* and *data* is essential to the informatics theory of informatic systems. Very briefly, *data are the materialization*, the representation of information, while *information is equivalent to knowledge* and has to do with the semantic aspect of the meaning of data.
- In order to explain these two concepts we realize a parallel between how these notions are manipulated in the human mind and how they are in a computer system.
- Figure 1.1. Summarizes a number of assumptions that are the basis of the following analysis.

Introduction

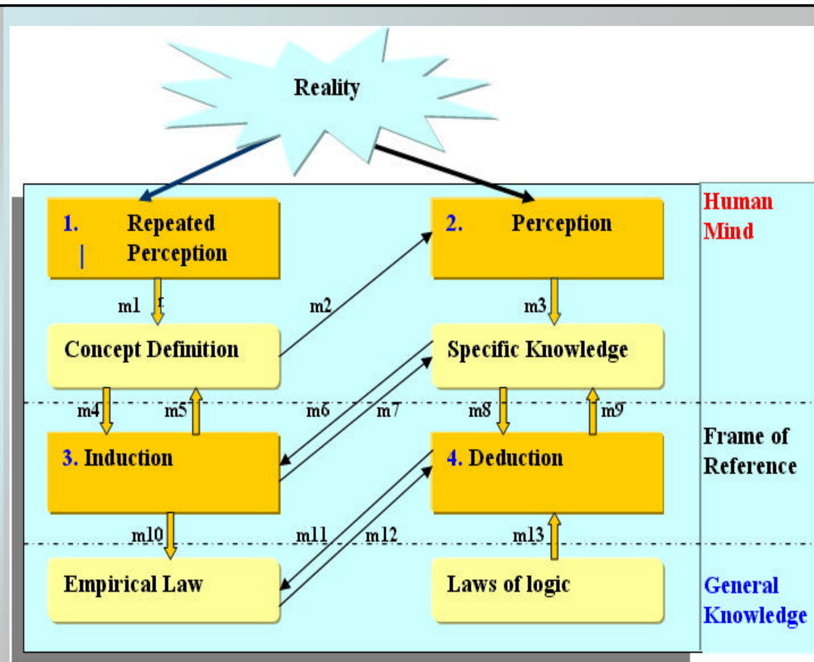


Figure 1.1. An informational and logic model of human mind

Introduction

Figure 1.1 - we can postulate the existence of an objective reality outside the mind of every beholder.

The mental processes are represented in figure1.1 by the numbered boxes (**1-4**):

1 - basic concepts formation by *repeated perception*;

the concepts are memorized (*stored*) and they can be transformed along the time (reformulated, remodeled, updated etc); the process is continuously going during one person's life (*m1*) and in the cycle (*m1,m2*) new concepts are formed (*created*) all the time, and old ones may be modified (*updated*), expelled or forgotten (*deleted*).

2 - transforming sense-organ perceptions (*inputs*) into *specific knowledge* (*m3*) about the reality (that is *information*), that is knowledge about particular situations and events.

3 - from his storage of specific knowledge (*m7, m6*), the human being may be able to *induce* the *empirical law* types of *general knowledge (m10)*.

The body of specific knowledge may also suggest the formation of new concepts (*m5*), possibly defined in terms of the existing ones (*m4*). The individual concepts may have a *feed-back* effect on the perception process (*m2*).

4 - In the *deduction* process, the human being uses, among other things, the *laws of logic* which are supposed to be *inherited and identical* for any human being (a person **-** P) at any moment in time t.

Let **P** denote a human being, a person.

Then by **P**'s *frame of reference*, denoted as **R_p(t)**, we mean the collection of concepts, definitions, laws (logical and empirical), perceived, deduced or deducible knowledge belonging to the mind of **P** at the time **t** (figure 1.2).

Introduction

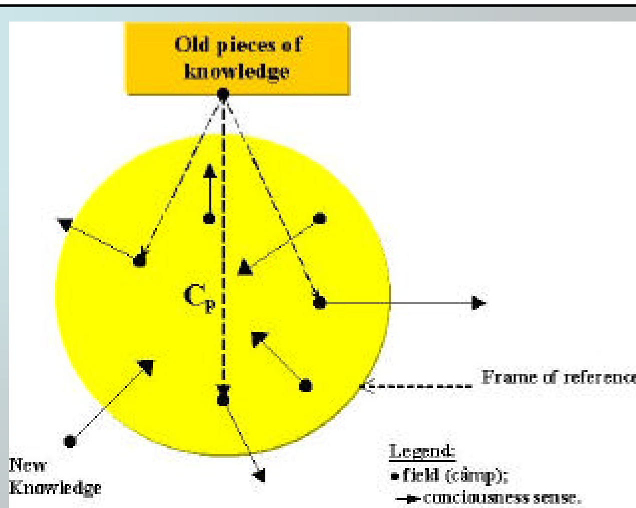


Figure 1.2. The frame of reference as a field of gravity

A person is more or less conscious of different parts of his frame of reference. New knowledge is added to the frame of reference and old pieces of knowledge are moved outward, away from the *center of consciousness* (**Cp**). The shortest distance between the field and the center of consciousness means a high degree of consciousness (figure 1.2).

Introduction

Consciousness function

We postulate the existence of a *consciousness function*, denoted as **C(k,P,t)**, where **k** means knowledge, which may take values between 0 and 1 and which tells the degree of consciousness of different pieces of knowledge for different persons at different times.

We define that:

-C(k,P,t)=0 if and only if **k** is not in $\mathbf{R_p(t)}$

and

-C(k,P,t)=1 if the person is immediately aware of **k** at the time **t**.

Introduction

A today's commercial Computer have no concept of 1 and 0

The computers have no concept of 0 and 1 even they work with.

The essence of the matter is that computers are devices that *simulate* the way that we handle things.

In order to illustrate that we take an example: let's consider a simple calculator that compute equations of the form X+Y=Z (figure 1.3).

Introduction

A today's commercial Computer have no concept of 1 and 0

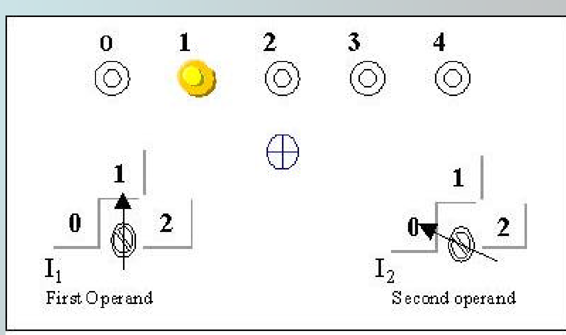


Figure 1.3. An example of a simple calculator

Any combination of positions of switches I_1 and I_2 will produced the right value and the device will be considered a simple calculator. In the figure 1.4 is represented a possible implementation of that device.

A today's commercial Computer have no concept of 1 and 0

Introduction

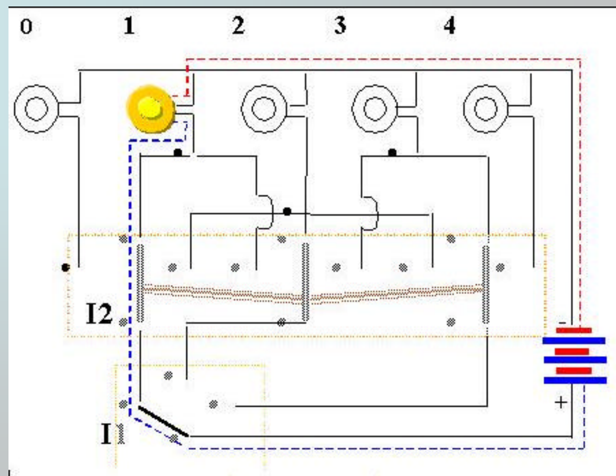


Figure 1.4. A possible implementation of the simple calculator from figure 1.3

A today's commercial Computer have no concept of 1 and 0

Introduction

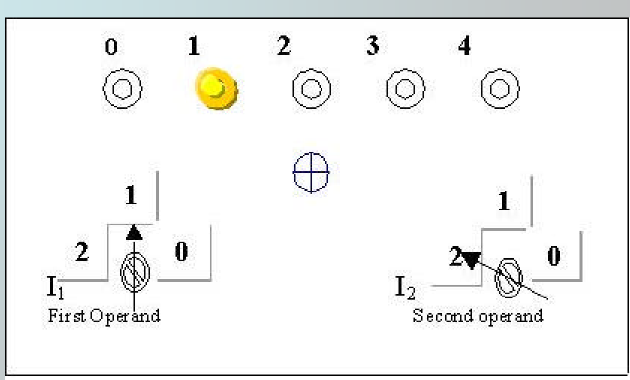


Figure 1.5. The effect of changing labels: computation error

Data

What is then data ?

Definition: "If a person intentionally arranges one piece of reality to represent another one, we short call the former arrangement *data*, and we shall say that the arranged pieces of reality is a medium which is used for storing the data." [*Bo Sundgren*, ref. BoS.1]

Data - example

For example, suppose you are asked to write down a shopping list with an estimate of the total cost. In that case, you use the symbols “0, 1, …,9” to represent the digits in our decimal system, and apply the mathematical operations for adding, and possibly also multiplying numbers in order to arrive at a total sum (The actual processing is realized in that case by a person).

Introduction

Data - example

In most of cases data represents primarily a person's knowledge about reality and only secondarily the piece of reality itself. The represented piece of reality has been observed by a human being and the data registration has been made on the basis of the observer's perceived knowledge.

Introduction

Data – alternative definitions

a) a series of non-redundant symbols, numbers, values or words;

b) a series of facts obtained by observation or research and recorded;

c) a collection of non-redundant facts;

d) the record of an event or fact.

Introduction

Information

What is information ? - Information is new knowledge.

The process of transforming data into information may be summarized as follows (figure 1.6):

⇒ ... the registration of facts ⇒ data ⇒ by corroborating data ⇒ information ... ⇒ (as a perpetual cycle).

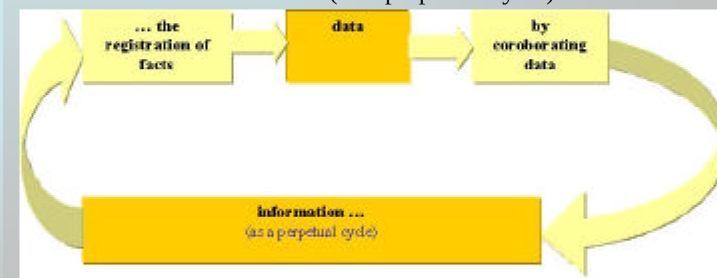


Figure 1.6. The process of transformation of data in information

Introduction

Information

In order to process information we need to make use of symbols that represent the data we have in our heads and we need to arrange the numbers in such a way that in the end our shopping list also includes an estimate of total costs (symbol manipulation).

An example of data would be a list of airline flights including departures and arrivals. When the data in the list are processed to produce a specific itinerary for a specific journey, or an organized airline guide, they have become information.

Introduction

Information - example

Tabela 1.1. **Orarul de zbor al curselor interne TAROM**

De la **FROM**	**La** **TO**	**Zile Operante** **FREQUENCY**	**Plecare** **DEPARTURE**	**Sosire** **ARRIVAL**	**Cursa Rot** **FLIGHT No.**
Satu Mare	**Arad**	J V	10	10^{15}	648
Arad	**Bucuresti**	J V	10^{20}	11^{15}	649
Bucuresti	**Iasi**	V	11	12	707
Bucuresti	**Iasi**	Mi J	15	16	708
Bucuresti	**Constanta**	V	12^{30}	13^{15}	765

Introduction

Information – other definitions

There are several definitions for information that are in common use :

a) Data that have been processed so that they are meaningful;

b) Data that have been processed for a purpose;

c) Data that have been interpreted and understood by recipient.

Information

The new knowledge (information) implies many important properties of information :

1. Being knowledge, information exists only in the mind of a human being as a part of a mental frame of reference.

2. Information is always related to one particular *existing* or *imagined* person, the *reference person*, that is, information is always somebody's information.

When we talk about storing information in a medium (tape-streamer, disk, CD, ...), we often assume that implicitly all users of the medium are identical with some average reference person.

Information

3. Information is always related to a set of old knowledge - the reference knowledge.

More precisely, the reference knowledge is the mental frame of reference of the reference person at a particular moment in time. For instance, when we talk of an information received by a person, we tacitly understand the reference knowledge to be the mental frame of reference of the same person at the time when she receives the message.

Information

Introduction

4. If we assume that new knowledge can't arise spontaneously in the human mind, the definition suggests the existence of an external source for every piece of information.

*If **i** is a new piece of information and **k** is the reference knowledge of **i**, then **i** would be at least an implicit knowledge of the reference person - that is **i** would not be new knowledge.*

Information

Introduction

INFORMATIONS in an work system can potentially take a variety of forms including numbers, text, sounds, pictures, video etc, and they can be created, modified or deleted with the system or other information can be simply received from other systems. The distinction between data, information, and knowledge is very important and as a helpful way to distinguish them in the figure 1.7 are represented the relationships between them.

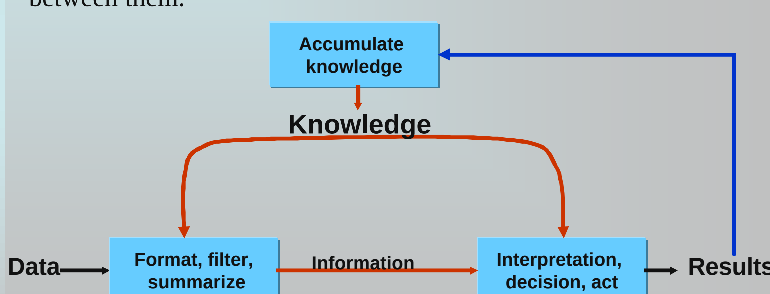


Figure 1.7. The relationships between data, information and knowledge

The transformation Data - Information

Data messages are transformed into information by a mental process. This process is a complicated combination of perception, deduction and inference process.

The DATA -INFORMATION transformation process may be executed in two steps (figure 1.8, adaptation from [BoS.1]):

1º. *interpretation*;

2º. *derivation*.

The transformation Data - Information

1º. *Interpretation* - The interpretation process yields as output conceptual messages. The conceptual message is the meaning or semantic content of the data message as interpreted by the receiver.

2º. *Derivation* - In order to be able to interpret the data message, a person must posses a compatible frame of reference $\mathbf{R_p(t)}$ at the time **t** when she interprets the data. The frame of reference must contain interpretation rules. These rules make the person associate the data with a piece of reality supposed by that person **P** to be represented by the data. If a person possess a frame of reference that is compatible with the data message, we'll say that the data are meaningful to the person **P**. Data that are not meaningful do not convey information. On the other hand, meaningful data may, but need not, convey information.

Introduction

The transformation Data - Information

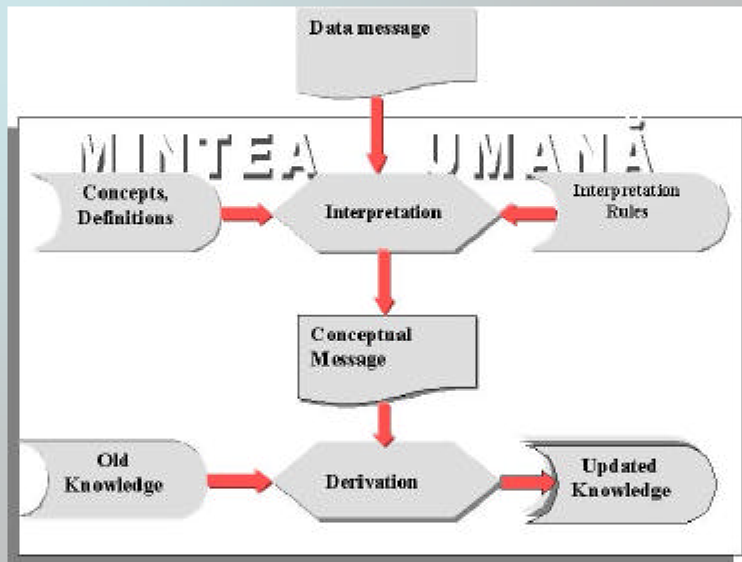


Figure 1.8. The transformation of data in information

Introduction

The transformation Data - Information

A process used to transform data into information is called "data process". Data processes are sometimes known as "transformation processes".

Some examples of data processes include the following:

-***Classification* –** this involves placing data into categories**;**

-***Rearranging/Sorting* –** this involves organizing data so that items are grouped together or placed into a particular order**;**

-***Aggregating* –** this involves summarizing data**;**

-***Performing calculations* –** this involves applying different computation formula (<> of +);

-***Selection* –** this involves choosing or discarding items of data based on a set of selection criteria;

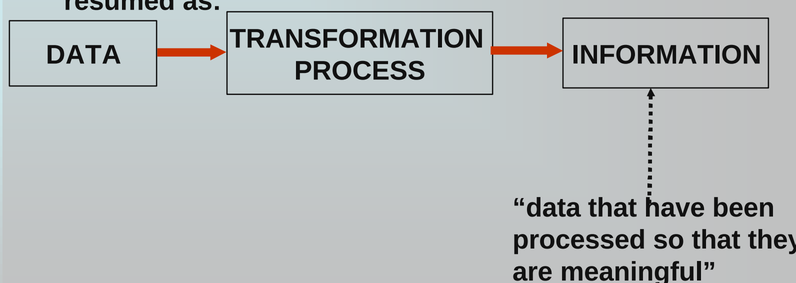
……

Introduction

A process can be considered valid only if his action serves to place data into meaningful context (valid process).

Several processes can be used in combination to produce information.

The transformation of data into information can be resumed as:



2.1. Information systems

The system concept simplifies phenomena that appear to be complex and unrelated. Systems are combinations of elements including all or some of the sources: objectives, inputs, outputs, processes, and other internal relationships, and a boundary with the rest of the universe (figure 1.9, 1.10, 1.11 [Summers, ref. Summ.1]). The system achieves its objective ('s) by the process of converting transactions data into decision and control information ([SACS.89], [RTC.89], [BoS.1], [Summ.1], [SgAv.94]).

Information Systems

System

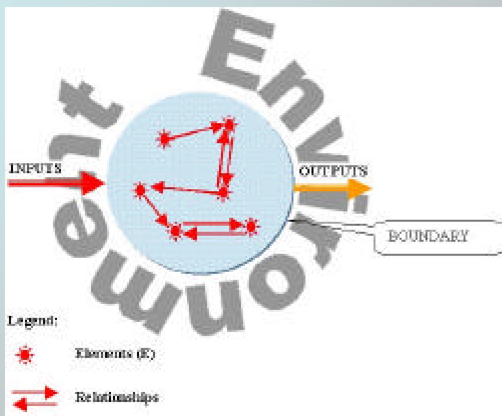
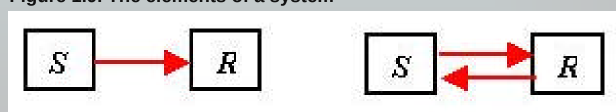


Figure 1.9. The elements of a system



dominating *feed-back*

Figure 1.10. The relationships between the elements of a system

Information Systems

System

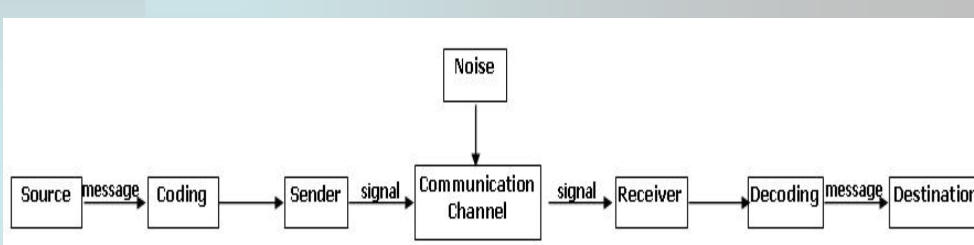


Figure 1.xx. The elements of a communication system

Information Systems

System

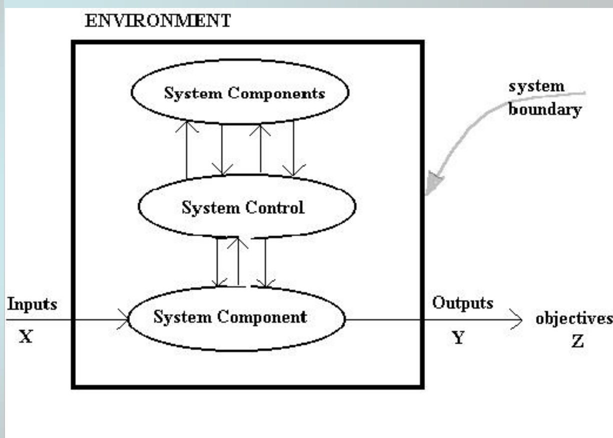


Figure 1.11. The elements of a system (details)

Information Systems

Cybernetic System

In a cybernetic context (figure 1.12) the inputs X are transformed by a process P inside of the system S in order to obtain the results (outputs) Y: Y=P(X).

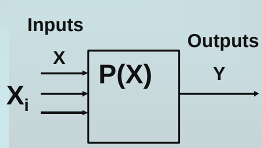


Figure 1.12. The system as processing applied to inputs

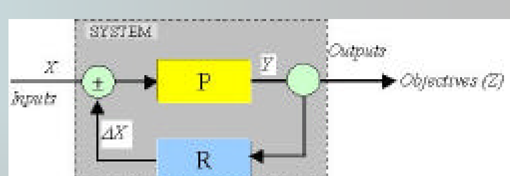


Figure 1.13. The system as a cybernetic system

Most of the time between the outputs and objectives we have some differences that can be expressed as Z#Y. For that reason, it is necessary to correct this differences by intermediate of a regulator R that corrects the inputs by an average value ΔX (figure 1.13):

Y=P(X+ΔX).

Types of systems

A system can be:

- *open*, if it exchanges inputs and outputs with its environment;

- *closed*, if it does not exchange inputs and outputs with its environment .

Information Systems

System: Element

An ***element*** is the smallest part of a system that can be used in a system description or design.
An element belongs to a system if and only if it contributes to the system's activity.
The description of a system must begin with the description of its elements.
Not all systems contain every type of elements. Inputs and Outputs are sometimes absent (closed systems).

Information Systems

System: objectives

The system's ***objectives*** are the reasons for being (they can be one or more). Each of them consists of an effect (its desired end result) and a time frame. Different systems with the same objectives may arrange their elements differently.

Example:

An optimal (economic information) system is that one that best achieves the following objectives:

1. To process the information efficiently - that is at a lower cost;
2. To obtain reports quickly;
3. To ensure a high degree of accuracy;
4. To minimize the possibility theft and fraud.

System: Input

An ***input*** is a phenomenon that is produced by *environment* and that has a measurable effect on the system. An input crosses the boundary to became an element of the system.

I n f o r m a t i o n S y s t e m s

System: Output

An ***output*** is a measurable phenomenon produced by the system and that has an observable effect on the environment. The output crosses the boundary to became a part of the environment.

I n f o r m a t i o n S y s t e m s

System: Process

A **process** is a planned sequence of operations, with a beginning and an end, intended to produce a result. This process may be realized by a *person* or by a *computer*.

A **computer** is simply a device that processes raw data into useful information.

A computer can be programmed and is capable of performing as sequences of subtasks.

A **program** is a sequence of instructions that are to be executed.

Figure 1.14 shows the principle of a programmable device. Suppose that the program must add two numbers X and Y and do determine a result Z (we simulate the simple calculator from figure 1.3).

System: Programmable Device

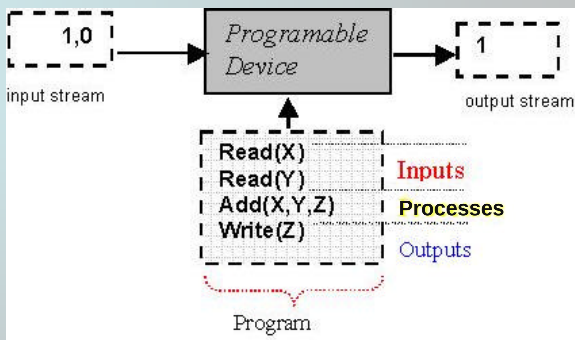


Figure 1.14. The principle of a programmable device

-*input stream* - *a series of numbers* ;

- a *program* – *instructions to be executed*.

- *output stream* – *the computation results*.

Information Systems

System: Programmable Device

We can distinguish here between three types of instructions:

1)[*Input*] The instruction Read(X) by which the *next* input value is read from the input stream and *internally* stored as variable X (and Y);

2)[*Output*] The instruction Write (X) of which execution takes the value of the internally stored variable X and write that value to the output stream;

3)[*Process*] A collection of simple arithmetic operations that generally require three internally stored variables. For example the instruction Add(X,Y,Z) assigns the value of the operation X+Y to Z.

What it means is that we need a powerful *central processing unit* (**CPU**) that is connected to a *main memory* (*main store*).

System: Programmable Device

The computing cycle will be simple (figure 1.15): the microprocessor receives data from input devices, processes is, and sends the data to output devices for display, printing or communication. Along the way the CPU stores data temporarily in memory or permanently on storage medium such as magnetic disk, tape, or optical disk.

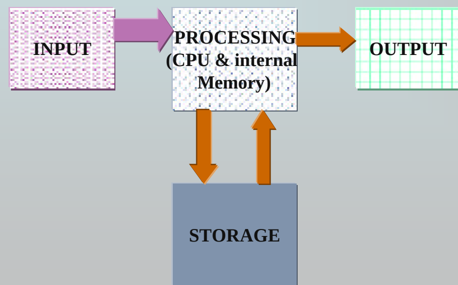


Figure 1.15. The computing cycle

INPUT - is the process of entering data into a computer;

PROCESSING - all needed processing necessary to transform data into meaningful information;

OUTPUT - getting processed data output to the computer is the job of output devices;

STORAGE - if we want to keep data for later retrieval we use storage devices.

System: Programmable Device

The CPU, or processor as it called (microprocessor for PC's), essentially has two operations built into it:

-an operation **FETCH** that reads the next instruction from the main store and stores it locally in a special variable **INSTRUCTION**;

- an operation **EXECUTE** that does precisely what its name suggests: it executes the instruction currently stored as the variable **INSTRUCTION**, and in turn internally stores the result in a special variable **RESULT**.

Information Systems

System: Programmable Device

With this two instructions the design of the computer is simple: we need to implement a device that continuously executes the alternating sequence of only two operations FETCH and EXECUTE.

The EXECUTE operation is capable of handling only a restricted number of instructions (called the processor instruction set). In this context programming a computer then consists of telling it what to do by constructing valid sequences of instructions taken from instruction set.

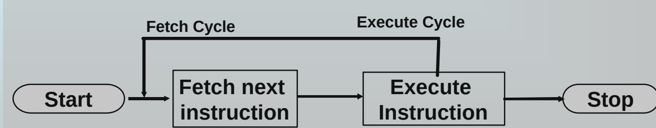


Figure 1.15-1 ***Basic Instruction Cycle***

Information Systems

System: Programmable Device

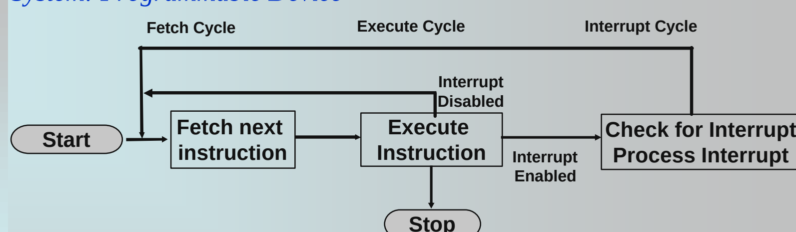


Figure 1.15-2 ***Instruction Cycle with Interrupts***

Fetch:

-The processor fetches the instruction frm memory (loaded into IR);

-Program counter (PC) holds address of the instruction to be fetchrd next;

-Program counter is incremented after each fetch.

Execute:

- The processor interprets the instruction and performs the required action.

Information System

An **INFORMATION SYSTEM** transforms *data* into *information*.

It has rules that determine what data will accept, how it will process those data to transform them into information, and what information will be reported and what form the reports will take.

Information Systems

Information System

If the process (or a part of it) of transforming data into information is accomplished by using **application software** we have an **informatic system** included into an information system.

The related notions to define application software follows:

- A **program** is a set of instructions designed to control the computer;
- **Software** can be a single program or a group of programs that work together;
- An **application program** is a job that a computer can perform such as creating text documents, creating graphic images, communicating with other computers etc;
- **Application software** is the term used to describe programs that tell the computer how to perform a such jobs (word processing, graphics, desktop publishing, spreadsheet software etc).

Information Systems

Information Systems

Information System

Data concept form the basic premise of informatic systems.

Data are stored and maintained by processes that create, modify and delete the data. All data in an enterprise (organization) should be captured and recorded with central controls to information system development because data may be used in several systems concurrently, stored in different ways, distributed and often updated and modified by way of network links and nodes.

Information Systems

The information system may be represented as a (sub)system of the observed (analyzed) organization (enterprise) system, as depicted in the figure 1.16.

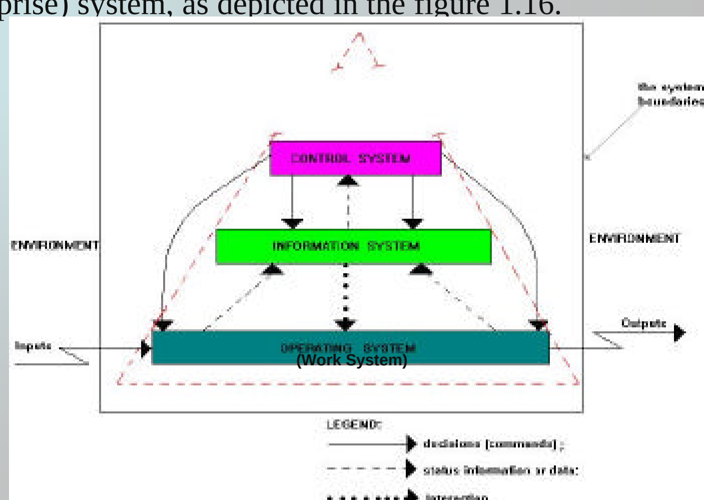


Figure 1.16. The information system as part of the organization system

Information Systems

For a given system the information can be of different types.

For example if we reference to accounting information we ca distinguish three categories (figure 1.17):

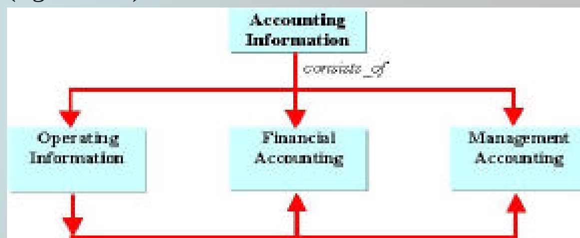


Figure 1.17. The categories of accounting information

1. Operating information is a considerable amount required to conduct an organization's day-to-day activities;

2. Financial accounting is intended both for managers and for the use of parties external to the organization;

3. Management accounting is the accounting information specifically prepared to aid managers.

Information Systems

This management accounting information is used in three management functions:

1. planning (what actions will be taken in the future) performed by managers at all levels;

2. implementation of the plans (detailed and specific plans);

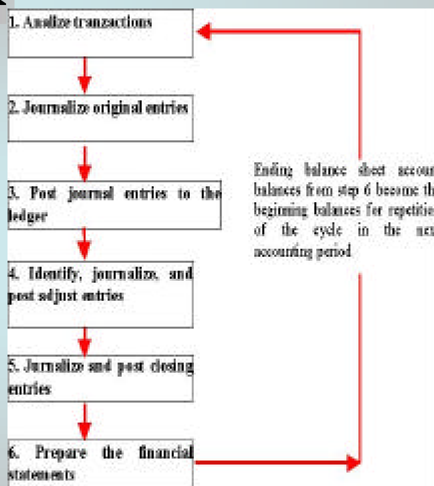
3. control is the accounting information specifically prepared to aid managers.

The relationships among the management functions of planning, implementation and control is shown in figure 1.18.

Figure 1.18. Relationship of management functions

Information Systems

The accounting cycle can be summarized as depicted in figure 1.19.



1. Deciding which account or accounts should be debited, which should be credited and in what amounts in order to reflect events in the accounting records;

2. Is a purely mechanical step of journalizing original entries - recording the result of the transaction analysis in the journal;

3. Posting is the process of recording changes in the ledger accounts exactly as specified by the journal entries. This is another purely mechanical step.

4. At the end of accounting period, judgment is involved in deciding on the adjusting entries.

5. The closing entries are journalized and posted (a step that can be done mechanically).

6. Financial statements are prepared.

Figure 1.19. The accounting cycle

Information Systems

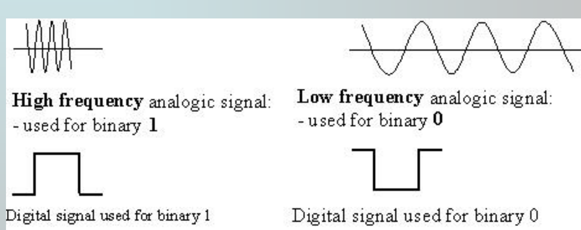


Figure 1.21. The analog and digital data

Figure 1.20 shows a parallel between the manual processing and the automatic processing.

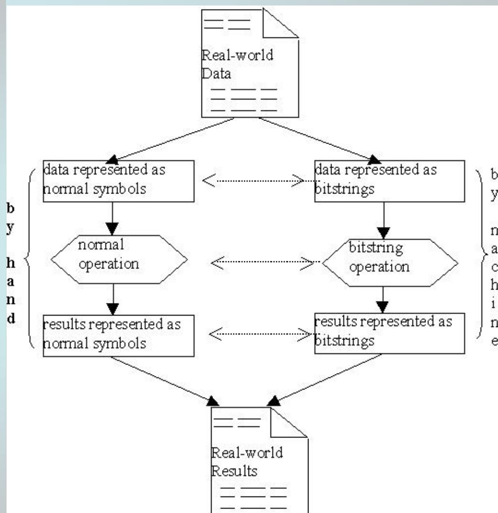


Figure 1.20. The parallel between manual and automatic processing

- **bit;**
- **nibble;**
- **byte;**
- **word etc**

Information Systems

Primary Intel Memory Storage Unit Designations

Unit	Bits
Bit	1
Nibble	4
Byte	8
Word	16
Double-word	32
Quad-word	64
Line (486)	128

1.3. Computer System

A computer system is composed by two fundamental elements (figure 1.21):

- **hardware**, that refers to the physical parts of the computer as processors, internal memory, clock, terminals, disks, network interfaces, and other input/output devices;

- **software** that make the computer able to store, process and retrieve information, to find out spelling errors in documents, to play games etc.

Computer Systems

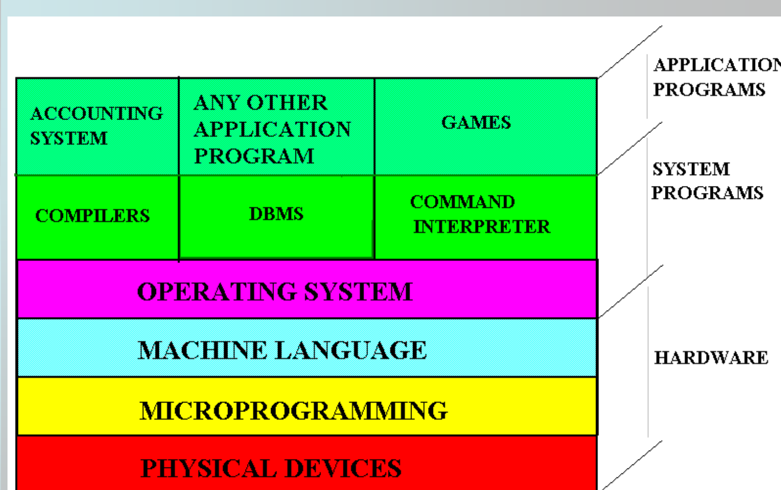


Figure 1.21. The computer system - hardware, system programs and application programs

The Software can be classified in two types:

- **system software (or programs)** that manages and control the functionality of the computer itself;

- **application programs (or user software)** that solves problems for users.

Computer Systems

The most fundamental of all the system programs is the **operating system**, which controls all the computer's resources and provides the base upon the application programs can be written.

A modern computer consists of one or more processors, some main memory, clocks, terminals, disks, network interfaces, and other input/output devices.

The operating system must hide to the user (application programmer, application user a.s.o.) the complexity of the hardware and give the programmer a more convenient set of instructions to work with.

The operating system can be defined as a collection of generalized service programs designated to control the computer and his peripheral devices. The hardware together with the operating system form a **virtual computer** (figure 1.22).

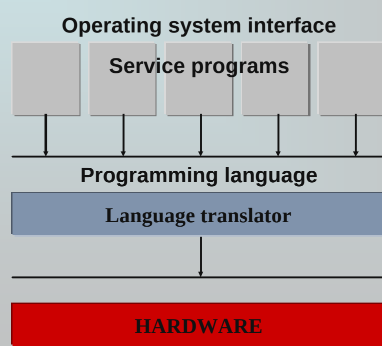


Figure 1.22. The principle of a virtual computer architecture

A computer is a digital electronic machine capable of storing data and/or information and acting instructions.

Functionally the machine has three main hardware components:

A) - **memory** (e.g. the high speed memory that is capable of storing data and instructions) ;

B) - **processor** (it is capable of interpreting instructions taken from the memory) ;

C) - **peripherals** (or I/O devices take information from agent external to the machine and provide information to those agents.

The peripherals can be:

- *input units* that allow us to send information to the computer;

- *output units* that allow us to receive information from the computer;

- *input/output* units.

The PC family of computers links all internal control circuitry (figure 1.23) together by a circuitry design known as bus. A bus is simply a shared path on the main circuit board (called motherboard) all the controlling parts of the computer are attached. When data is passed from one component to another it travels along the common path to reach its destination.

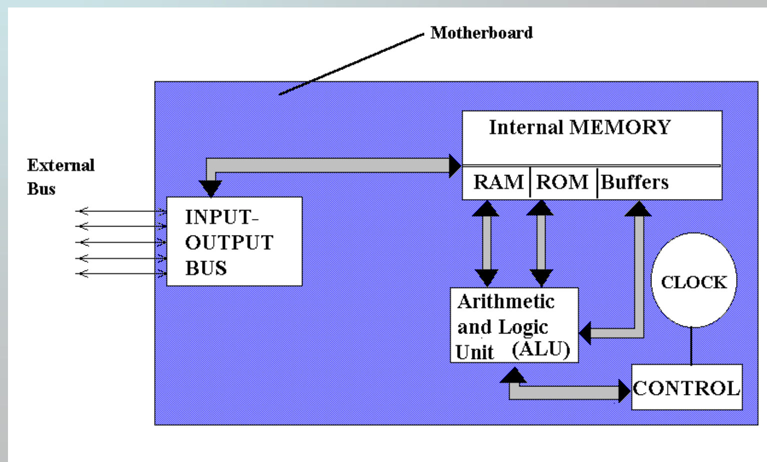


Figure 1.23. A simple CPU

The data provided by the external agents is converted into a specific combination of electrical signals in a binary format. After data are converted into a binary form, they are available for processing. The central processing unit (CPU) perform this activity in conjunction with the memory and storage (figure 1.23).

The **CPU** (figure 1.24), the "brain" of the computer system, consists of a control unit and an arithmetic and logic unit (ALU):

- the **CONTROL** unit manages the computer system, acting like a traffic cop directing the flow of data throughout the system;

- the **ALU** performs all mathematical and logical functions.

Computer Systems

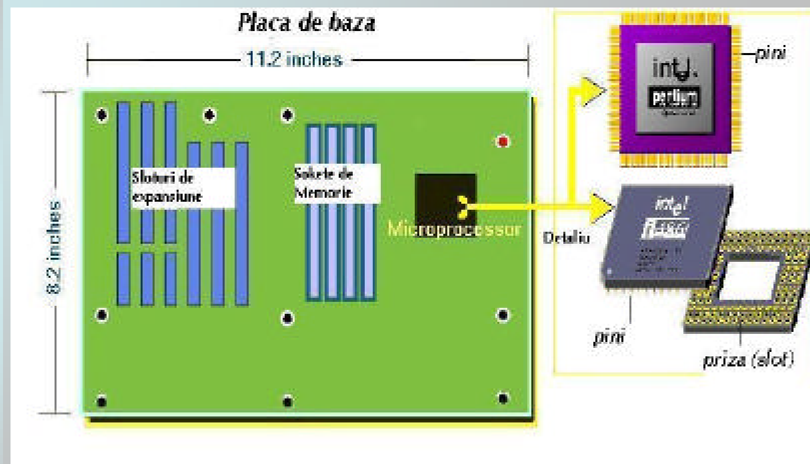


Figure 1.24. An example of CPU (external view)

Computer Systems

A. The memory is the computer's work area that allow it to "remember" numbers, words and paragraphs as well as a list of commands we wish the computer to perform. Memory comes in two forms:

- **RAM -** random access memory (figure 1.25) **-** that temporarily stores data needed for the current processing task. When the power is down his content is lost and the memory is said to be volatile;

- **ROM -** read only memory **-** is permanent memory that provides the basic se of instructions for starting the computer.

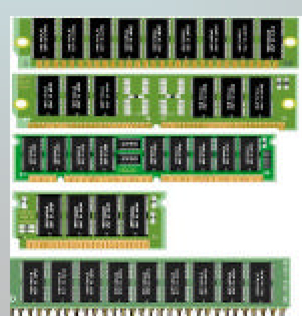


Figure 1.25. RAM memory chips

Computer Systems

B. The central processing unit has three components

- a **control unit** for controlling the computer;

- an **arithmetic and logic unit** for performing arithmetic and logical operations;

- a set of general purpose or dedicated **registers** (figure 1.26) used for storing data immediately prior to or following an operation.

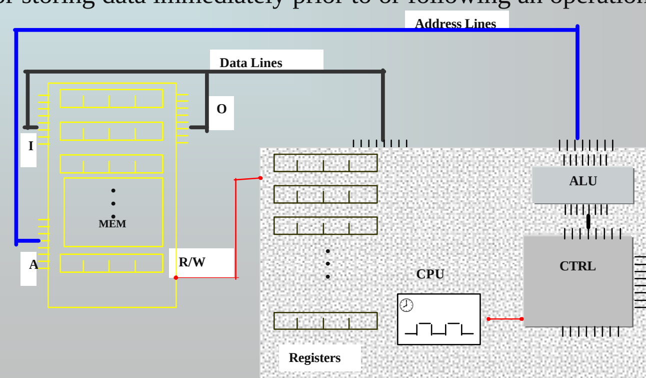


Figure 1.26. The general architecture of a computer (von Neumann)

Computer Systems

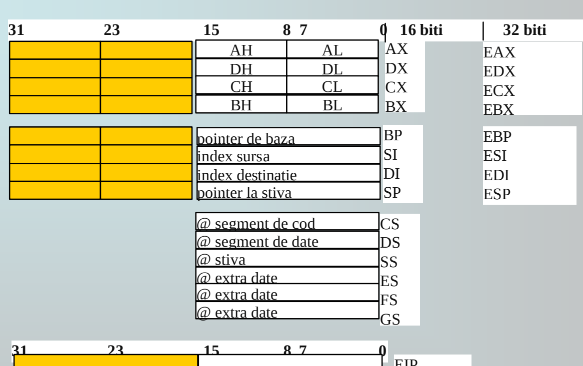


Figure 1.27. The register set for Pentium microprocessor

Computer Systems

The computing cycle consisting of input, processing, output and storage involves several steps in the flow of data. Data typically flow through the system in the following manner:

1. The control unit of the CPU directs the transfer of data from an input device to memory or storage. For example the text data that appears on the screen as you type goes into the random access memory (RAM);

2. Data in storage remain in storage until needed for next processing task. Then the control unit transfers data from storage to memory. For example, when you select a spreadsheet program and a balance-sheet report they are loaded from storage into memory;

3. The control unit sends the required data from memory to the arithmetic and logic unit. For example, the formula and data you need to calculate the Profit & Loss are placed in the ALU;

Computer Systems

4. The ALU makes the necessary mathematical and logical computations as you enter data and formula;

5. When all calculations are completed, the control unit sends the result to memory (RAM);

6. The control unit sends the output from memory (RAM) to a monitor and/or printer;

7. The control unit can also send all or part of the contents of memory to storage (disk) for future use. The control unit can also erase data from memory when instructed to do or when power to the computer is turned off.

Computer Systems

The control unit manages the computer in a four-step process (called Fetch, Decode, Execute and Storage):

1. **Fetch** an instruction from memory and store it in an register;

2. **Decode** the instruction into a form usable by the ALU;

3. Send a command to the ALU to **Execute** the decoded instruction;

4. [**Store**]

    4.1 Send the result of the executed command into a register;

    4.2 Move the result to memory;

Repeat the process for the next instruction.

Computer Systems

The basic instruction set that the microprocessor can perform is called machine language. From that basic set we can enumerate the four basic arithmetic operations, a variety of logic operations (tests, conditional branches, loops).

Generally this machine language is accessible for the programmers by intermediate of assembly languages. The general format of an instruction in that language take the form

instruction_code $\quad$ *operand*$_1$, *operand*$_2$ *[,result]*

In order to build applications we need a variety of instructions to:
- load data in general purpose registers (LOAD);
- add binary numbers (ADD);
- logical operations on bitstrings (AND, OR, NOT, XOR, NOR, NAND, …);
- store data etc.

A computer instruction is represented generally on one memory word and to instruction component certain bits are reserved.

To each instruction is associated an unique code (or number) code tat will be later used to be interpreted and executed by the microprocessor. If the code of an instruction is misspelled then the operation will be rejected and followed by an error message of the type "*illegal instruction*".

The next table shows examples of assembly instructions for the 8086 microprocessors family.

Instruction	**Efect**
Mov *dest, src*	Moves/Copies data from/in register to/from memory *dest ? src*
in *port8*	Loads register AL (or AX) from the I/O port byte: AL ? [port] word: AL ? [port]; AH ? [port + 1]
out *port8*	Transfers from AL in I/O port byte: [port] ? AL word: [port] ? AL; [port +1] ? AH
Pop *dest*	Transfers from stack in dest (reg16, r/m16 or segreg)
Push *src*	Transfers reg16 or r/m16 in stack
Add *dest,src*	Add two operands and places the result in dest dest ? (src + dest)
inc *dest*	aduna 1 la dest (reg or r/m) dest ? (dest+1)

The next sequence is the source code of a bug in Word'97:

```
3080ECB6   mov         eax,dword ptr [ebp-4]
3080ECB9   and         eax,0B9000000h
3080ECBE   cmp         eax,10000000h
3080ECC3   je          3080EC15
3080ECC9   lea         eax,[ebp-0Ch]
3080ECCC   push        eax
3080ECCD   push        180h
3080ECD2   mov         ecx,esi
3080ECD4   call        30821842
3080ECD9   lea         eax,[ebp+0Ch]
3080ECDC   push        eax
3080ECDD   mov         edi,19Ch
3080ECE2   push        edi
3080ECE3   mov         ecx,esi
```

Computer Systems

The microprocessor interacts with the circuitry world around it in three ways:

1st. Via **direct** (DMA) and **indirect** (registers) memory access;
2nd. Via **Ports** that are used by the microprocessor to communicate with and controls of all other parts of the computer (except HDD). The I/O ports are doorways to which information passes as it travels to or from an I/O device. Each port is identified by a 16-bit port number;
3rd. By using **interrupts**. The interrupts are the means by which the circuitry outside of the microprocessor reports that something has happened and requests that some action to be taken;

Interrupts are managed by interrupt handler and can be grouped in the following categories:
- interrupts generated by the computer circuitry as response to some event;
- interrupts generated by the CPU as a result of some unusual program result;
- interrupts deliberately generated by programs as a way of invoking distant subroutines stored in either RAM or ROM. (NMI – nonmascable interrupt).

IT Role

If we accept as a common definition of IT concept as "data processing together with the communication systems used to transmit those data" then the role of IT in business can be boiled to six data processing functions (as described in table 1): capturing, transmitting, storing, manipulating, and displaying data.

Table 1. The data processing functions performed by IT

Function	Role	Example of devices or technologies used to perform th function
Capture	To obtain a digital representation of information in a form allowing to be transmitted or stored.	Keyboard, bar code scanner, document scanner, optica character recognition, video camera, sound recorde video TV, voice recognition, and automatic generation.
Transmit	To move/copy data from one place to another	Broadcast radio, broadcast television, cable TV, satellit broadcasts, telephone networks, data transmissior networks, fiber optic cable, fax-modems, e-mail, voic mail, Internet, intranet, extranet, mobile phones etc
Store	To store data to a specific place and a specific device for later retrieval	Paper, magnetic tape, floppy disk, hard disk, optical disk CD-ROM, DVD, Zip, Jazz, flash memory etc.
Retrieve	To find the specific data and/or information that is currently needed for the task to be done	Paper, magnetic tape, floppy disk, hard disk, optical disk CD-ROM, DVD, Zip, Jazz, flash memory etc.
Manipulate	Create new information from existing data through summarizing, sorting, rearranging, reformatting or other simple or complex types of calculations or representation	Computers (and/or networks) and general or specifi software
Display	To show information to a person	Printers, computer screen, TV, digital data projector mobile phone screen etc.

I
T

R
o
l
e

The major directions of the improvements in IT include:

1st **a greater miniaturization, computing and transmitting speed, and portability**;

2nd **a greater connectivity and continuing convergence of computing and communications**;

3rd **a greater use of digitized information and multimedia**;

4th **a better software techniques and interfaces with peoples**.

I
T

R
o
l
e

The miniaturization, speed and software generalizations make possible to realize a large variety of hardware circuitry that implement this generalizations and that are delivered with each new computer generation as parts of his basic architecture.

The database management systems and other tools have separated the technical aspects of data handling from the logic of the application. All this evolutionary directions involve permitting programmers (and users) to specify what they want the computer to accomplish rather than specifying every detail of how the computer should store, retrieve, and manipulate the data.

IT Role

The object-oriented analysis, design and programming make possible to use, in different applications, the same object that have same interface, functionality and behavior for all users.

The user interfaces use the same guidelines and interacting objects and that object have a common general behavior. The usage of wizards allows people to automate generation of applications or parts of the applications from templates or patterns.

The CAD (computer aided design) software have helped change the nature of design processes and the experience in using them has a direct influence in applying the same concepts in software design and realization.

IT Role

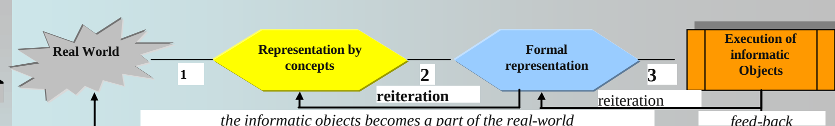
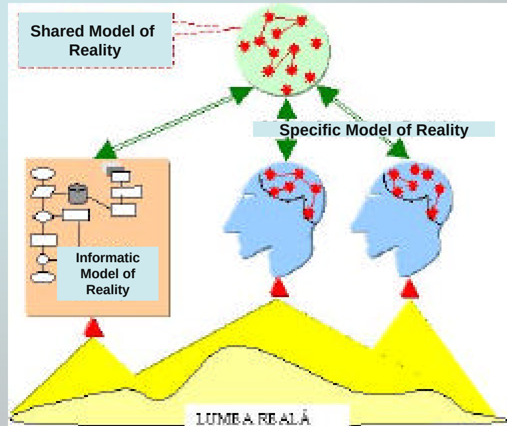


Figure 1.22. The transitions from real world to an informatic representation

I
T

R
o
l
e

Figure 1.23. Formal and concept modeling of reality



The Internal Architecture of Information Systems – An Abstract View

The internal architecture of an information system is built around three elements ([Dat.86], [RHC.89], [SgAv.94], [AvDg.97], [SgAv.98], [RR.99], [RR.00], [Av.01/2]):

1. the data model - a set of formal and consistent rules specifying how to represent data, and a set of operators used to manipulate this data;

2. the information base (database or traditional files or both)-a computerized record-keeping system, which is a system whose overall purpose is to maintain data (or information) and to make it available on demand;

3. the information processing (data processing)-achieved by application programs activated by end users' requests or by other programs.

The Internal Architecture of Information Systems – An Abstract View

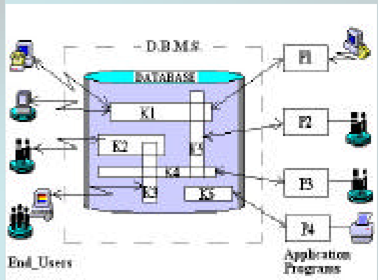


Figure 1.24. The usage of an informatic system

End_Users:

Beginner - need to know *what* your system does before they start to learn *how* to use it ;

Intermediate - know *what* the system does, but they often forget the details of *how* (is the group that must be supported directly in the user interface);

Expert - know what to do and how to do it and are primarily interested in doing things *quickly*.

The Internal Architecture of Information Systems – An Abstract View

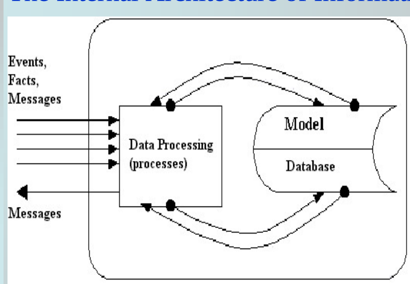


Figure 1.25. The simplified architecture of an information system

The operations on files and/or databases are performed by using elementary actions such as:

- insert/add - add a new record/row or sentence to a file/database (*Insert, Append, Add*);

- delete - delete a record or suppress a sentence from a file/database (*Delete, Remove, Erase*);

- modify - (called also updating) modify (sometimes using constraints) existing records (*Modify, Update*).

- searching (finding) a deductible or existing sentence (query) (*Search, Find, Select, Fetch*). A sentence is derived from the sentences in your files/system database and others are deduced from these.

The Internal Architecture of Information Systems – An Abstract View

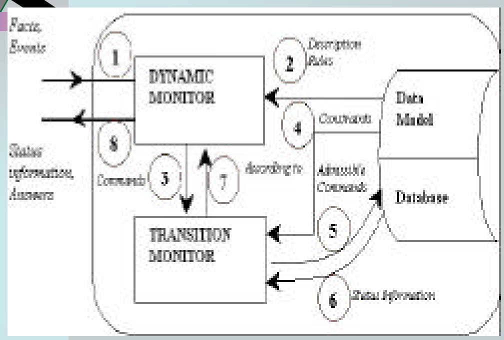


Figure 1.26. Information System Architecture – processing detail

Denoted (labeled) channels mean:
1. receive a message (fact or event from external agents, typically a query);
2. search an action into the model, while waiting for the synchronization, if this appears;
3. command is transmitted to the transition monitor;
4. search into the model for restrictions associated to the requested find_out transition, consult the files/database in order to determine if the transition is possible, if not send a message about that ;
5. execution of the command by processing each elementary associated action;
6. turn changes to be effective (the real taking place) and transmit the database/file content if we have any searching query;
7. transmit a message to dynamic monitor (status and other information) if execution is OK !;
8. send the messages to the environment answer)

GENERAL INFORMATICS
Main Contents

SUBJECT: General Informatics, first year
Professor: Vasile AVRAM, Professor, Ph. D.
Number of hours: - Course: 28
- Seminar and lab: 14
- Credits: 4

OBJECTIVES OF THE COURSE:
- **introducing into the system of notions and concepts of informatics with distinguishing between the theoretical informatics and the economy applied one;**
- **the knowledge of the hardware and software characteristics of personal computers, and their usage;**
- **programming basics in a programming language (Visual Basic).**

GENERAL INFORMATICS
Main Contents

BASIC CONTENT:

- **Chapter 1: Informatics - system of disciplines for representing (coding), processing, storing and retrieving data and information;**
- **Chapter 2: Boolean algebra and numbering systems;**
- **Chapter 3: The representation of processing algorithms;**
- **Chapter 4: The Architecture and functionality of PC's. PC networks;**
- **Chapter 5: Operating systems for PC's and LAN's (Local Area Network);**
- **Chapter 6: The steps in computer solving problems process;**
- **Chapter 7: Programming Basics in Visual Basic (VB).**

GENERAL INFORMATICS
Main Contents

EVALUATION SYSTEM:

a) Student's obligations throughout the year (essay, supplemental bibliographies etc)

- seminar attendance 10%;
- project: realization of an object-oriented application program (30%);
- tests (1 or 2 written) (10%);

(50% final mark)

b) Exam requirements:

- project presentation; - tests passed;
- 50 % activity during the semester + 50 % final exam = 100%

c) Type of examination: written

GENERAL INFORMATICS
Main Contents

BASIC BIBLIOGRAPHY:

- **V.Avram, Gh. Dodescu – Informatics-Computer Hardware and Programming in Visual Basic, Ed. Economica, Bucuresti 2003**
- **Gh. Dodescu, V.Avram – Informatics-Operating Systems and Application Software, Ed. Economica, Bucuresti 2005**
- **Halvorson, Michael –** ***Microsoft Visual Basic 6.0: step by step*****, Ed. Microsoft Press, Redmond, SUA, 1998**
- **Winn L. Rosch, Totul despre hardware, Teora, 1998**
- **Microsoft Visual Basic - Programmer's Guide, Version 6.0 Microsoft Press or E-book on Server in MSDN**