Computer Fundamentals

THE WORD 'COMPUTER' COMES FROM 'COMPUTE' WHICH MEANS TO CALCULATE.

NOW-A-DAYS, 80% OF WORK DONE BY COMPUTER IS OF NON-MATHEMATICAL NATURE.

A COMPUTER CAN STORE, PROCESS & RETRIEVE DATA AS AND WHEN DESIRED.

CHARACTERISTICS OF COMPUTERS

SPEED

A POWERFUL ONE CAN PERFORM MILLIONS OF ARITHMETIC OPERATIONS PER SECOND.

ACCURACY A 100% ACCURATE MACHINE INCAPABLE OF MAKING MISTAKES ON ITS OWN.

 DILIGENCE
FREE FROM MONOTONY, TIREDNESS, LACK OF CONCENTRATION etc.

VERSATILITY

CAPABLE TO PERFORM ALMOST ANY TASK BY CONVERTING INTO SERIES OF LOGICAL STEPS.

REMEMBERING POWER

HUMAN REMEMBERS IMPORTANT THINGS AND FORGETS UNIMPORTANT ONES, BUT COMPUTERS CAN KEEP ANY KIND OF INFORMATION AS LONG AS DESIRED BY USER.

UNINTELLIGENT

HAS NO I. Q. OF ITS OWN, HENCE CANNOT TAKE DECISIONS BY ITSELF.

COMPUTER ORGANIZATION

ALL COMPUTER SYSTEM PERFORM FIVE BASIC OPERATIONS –

INPUTTING

PROCESS OF ENTERING DATA AND INSTRUCTIONS INTO THE SYSTEM

STORING

SAVING DATA & INSTRUCTIONS SO THAT THEY ARE AVAILABLE FOR PROCESSING



PERFORMING ARITHMETIC AND LOGICAL OPERATIONS ON DATA TO GET INFORMATION

OUTPUTTING

PROCESS OF PRODUCING USEFUL INFORMATION FOR USER e.g. A PRINTED ACCOUNTS REPORT

CONTROLLING

DIRECTING THE MANNER & SEQUENCE IN WHICH ALL THE OPERATIONS ARE PERFORMED

ARITHMETIC LOGIC UNIT

PLACE WHERE ACTUAL EXECUTION OF INSTRUCTION TAKES PLACE

ALL CALCULATIONS ARE PERFORMED & ALL DECISIONS/COMPARISONS ARE MADE IN ALU

DATA & INSTRUCTION, STORED IN PRIMARY MEMORY PRIOR TO PROCESSING, ARE TRANSFERRED AS AND WHEN NEEDED TO ALUWHERE PROCESSING IS DONE INTERMEDIATE RESULTS ARE STORED IN PRIMARY MEMORY UNTIL NEEDED AGAIN

ALU IS DESIGNED TO PERFORM FOUR BASIC ARITHMETIC OPERATIONS NAMELY

ADD, SUBTRACT, MULTIPLY AND DIVIDE
& 2 LOGICAL OPERATIONS –

MOVE & COMPARE

CONTROL UNIT

HOW DOES THE INPUT DEVICE KNOW THAT IT IS TIME TO FEED DATA INTO MEMORY ?

HOW DOES THE ALU KNOW WHAT SHOULD BE DONE WITH DATA RECEIVED ?

HOW IS IT THAT ONLY THE FINAL RESULTS ARE SENT TO OUTPUT DEVICES ?

ALL THIS IS POSSIBLE BECAUSE OF THE CONTROL UNIT OF COMPUTER. BY SELECTING & INTERPRETING THE EXECUTION OF PROGRAM INSTRUCTIONS, IT IS ABLE TO MAINTAIN ORDER AND DIRECT THE OPERATION OF THE ENTIRE SYSTEM

IT ACTS AS A CENTRAL NERVOUS SYSTEM AND MANAGES THE ENTIRE SYSTEM

IT OBTAINS INSTRUCTIONS FROM THE PROGRAM STORED, INTERPRETS THEM AND ISSUES SIGNALS THAT CAUSE OTHER UNITS OF SYSTEM TO EXECUTE THEM

CENTRAL PROCESSING UNIT (CPU)

THE CONTROL UNIT AND ARITHMETIC LOGIC UNIT OF A SYSTEM ARE JOINTLY KNOWN AS CENTRAL PROCESSING UNIT OR CPU

THE CPU IS THE BRAIN OF THE SYSTEM.

ALL MAJOR CALCULATIONS & COMPARISONS ARE PERFORMED INSIDE THE CPU

THE SYSTEM CONCEPT

A SYSTEM IS A GROUP OF INTEGRATED PARTS THAT HAVE THE COMMON PURPOSE OF ACHIEVING SOME OBJECTIVES, 3 MAJOR CHARACTERISTICS OF A SYSTEM ARE –

A SYSTEM HAS MORE THAN ONE ELEMENT

ALL THE ELEMENTS ARE LOGICALLY RELATED

ALL ELEMENTS ARE CONTROLLED IN SUCH A WAY THAT THE SYSTEM GOAL IS ACHIEVED A COMPUTER IS A SYSTEM AS IT IS MADE UP OF INTEGRATED COMPONENTS (I/O DEVICES, MEMORY, CPU) THAT WORK TOGETHER TO PERFORM THE STEPS IN PROGRAM EXECUTION

RANDOM ACCESS MEMORY (RAM)

PRIMARY STORAGE IS ALSO REFERRED TO AS RANDOM ACCESS MEMORY (RAM)

INFORMATION STORED IN RAM GETS LOST AS SOON AS POWER IS OFF

IT IS POSSIBLE TO RANDOMLY SELECT & USE ANY LOCATION OF THIS MEMORY TO DIRECTLY STORE & RETRIEVE DATA & INSTRUCTIONS

ALSO REFERRED TO AS READ / WRITE MEMORY AS INFORMATION CAN BE 'READ' FROM A RAM CHIP & CAN ALSO BE 'WRITTEN' INTO IT

<u>READ ONLY MEMORY (ROM)</u>

CONSISTS OF PERMANENTLY STORED INFORMATION IN A PROGRAM KNOWN AS BOOTSTRAP LOADER PROGRAM

SUPPLIED BY SYSTEM MANUFACTURER AT THE TIME OF PURCHASING THE SYSTEM

INFORMATION ON ROM CAN ONLY BE READ & NOT POSSIBLE TO WRITE INFORMATION

CACHE MEMORY

ALSO TERMED AS HIGH-SPEED BUFFER

EMPLOY AN EXTREMELY FAST, SMALL MEMORY BETWEEN CPU & MAIN MEMORY

A HIDDEN MEMORY & NOT ADDRESSABLE BY THE USER

VERY EXPENSIVE AS COMPARED TO MAIN MEMORY, HENCE SIZE IS VERY SMALL

COMPUTER SOFTWARE

COMPUTER CANNOT DO ANYTHING ON ITS OWN

IT IS NECESSARY TO SPECIFY A SEQUENCE OF INSTRUCTIONS

SUCH A SEQUENCE WRITTEN IN ANY COMPUTER UNDERSTANDABLE LANGUAGE IS CALLED ' COMPUTER PROGRAM '

A PROGRAM CONTROLS THE ACTIVITY OF PROCESSING BY COMPUTER

TERM ' SOFTWARE ' REFERS TO THE SET OF COMPUTER PROGRAMS, PROCEDURES & ASSOCIATED DOCUMENTS (FLOWCHARTS, MANUALS etc.)

RELATIONSHIP WITH HARDWARE & SOFTWARE

HARDWARE & SOFTWARE MUST WORK TOGETHER TO PRODUCE RESULTS

BOTH ARE COMPLIMENTARY TO EACH OTHER

SOFTWARE SHOULD BE LOADED INTO HARDWARE BEFORE START OF PROCESSING

SOFTWARE PRODUCTION IS EXPENSIVE, DIFFICULT & A CONTINUING EXPENSE WHEREAS HARDWARE IS A ONE-TIME EXPENSE

DIFFERENT SOFTWARE CAN BE LOADED & EXECUTED ON SAME HARDWARE

SOFTWARE TYPES

APPLICATION SOFTWARE

ALSO KNOWN AS APPLICATION PACKAGE

A SET OF ONE OR MORE PROGRAMS DESIGNED TO CARRY OUT OPERATIONS FOR A SPECIFIED APPLICATION eg PAYROLL

PERSONS INVOLVED IN DEVELOPMENT OF SUCH PACKAGES ARE KNOWN AS APPLICATION PROGRAMMERS

SYSTEMS SOFTWARE

ALSO KNOWN AS SYSTEMS PACKAGE

SET OF ONE OR MORE PROGRAMS AIMED TO CONTROL THE OPERATIONS OF A SYSTEM

THESE DO NOT SOLVE SPECIFIC PROBLEMS

GENERAL PROGRAMS WRITTEN TO ASSIST USERS IN USE OF SYSTEM BY PERFORMING TASKS viz OPERATION CONTROL, DATA MOVEMENT & PROGRAM EXECUTION



ANY PROBLEM CAN BE SOLVED BY DEFINING THE LOGICAL SOLVING STEPS

SOLUTION HAS TO BE CONCEIVED INDIVIDUALLY

THERE COULD BE MANY POSSIBLE LOGICAL SOLUTIONS TO A PROBLEM

SAME PRINCIPLE APPLIES TO PROGRAMMING IN COMPUTER

PROGRAMMER SHOULD WRITE EACH & EVERY STEP CLEARLY & IN PROPER SEQUENCE

PROBLEM HAS TO BE UNDERSTOOD CLEARLY BEFORE PLANNING SOLUTION

ALGORITHM

ALGORITHM REPRESENTS LOGIC OF PROCESSING

SEQUENCE OF INSTRUCTIONS DESIGNED IN SUCH A WAY THAT IF THE INSTRUCTIONS ARE EXECUTED IN SPECIFIED SEQUENCE, SOLUTION OF DESIRED RESULT WILL BE OBTAINED

INSTRUCTIONS MUST BE PRECISE & UNAMBIGUOUS

RESULT SHOULD BE OBTAINED AFTER A FINITE NO. OF STEPS

ALGORITHM SHOULD TERMINATE AFTER RESULT IS OBTAINED

eg WRITE & POST A LETTER

STEP 1 - TAKE PAPER & WRITE DOWN THE LETTER

STEP 2 - PUT LETTER IN ENVELOPE & PASTE IT

STEP 3 - GO TO POST OFFICE & WEIGH LETTER

STEP 4 - IF WEIGHT MORE THAN 10 gm STICK Rs 5 TICKET IF NOT STICK Rs 3 TICKET

STEP 5 - POST THE ENVELOPE



AFTER PROGRAM ANALYSIS PHASE, NEXT STEP IS TO WRITE PROGRAMS

PROCESS OF WRITING PROGRAMS FOR AN ANALYSED PROBLEM IS CALLED 'CODING '

VARIOUS LANGUAGES ARE USED TO WRITE COMPUTER PROGRAMS



A LANGUAGE IS A SYSTEM OF COMMUNICATION TO EXCHANGE IDEAS

SIMILARLY, COMPUTER LANGUAGE IS A MEAN TO COMMUNICATE BETWEEN PEOPLE & COMPUTER

A PROGRAMMER TELLS A COMPUTER WHAT TO DO WITH HELP OF A LANGUAGE

CLASSIFICATION

PROGRAMMING LANGUAGES HAVE PROGRESSED THROUGHOUT THE YEARS, FOR USING BINARY DIGITS TO ENGLISH LIKE WORDS

HOWEVER, ALL COMPUTER LANGUAGES CAN BE CLASSIFIED INTO 3 BROAD CATEGORIES

MACHINE

ASSEMBLY

HIGH-LEVEL

MACHINE LANGUAGE

ONLY LANGUAGE A COMPUTER CAN UNDERSTAND DIRECTLY

COMPRISES OF BINARY DIGITS 0 & 1

COMPUTER RECOGNIZES IT & CONVERTS IT INTO EQUIVALENT ELECTRICAL SIGNALS

TYPICAL OPERATIONS INVOLVE READING, ADDING, SUBTRACTING, WRITING ETC

ADVANTAGES

PROGRAMS WRITTEN IN MACHINE CODE ARE EXECUTED VERY FAST

INSTRUCTIONS ARE DIRECTLY UNDERSTOOD BY CPU

DISADVANTAGES

MACHINE DEPENDENCY AS INTERNAL DESIGN OF EVERY COMPUTER IS DIFFERENT

ASSEMBLY LANGUAGE

OPERATION CODES WERE REPLACED BY SYMBOLS – MNEMONICS

MNEMONICS OR MEMORY AID IS A MENTAL TRICK USED TO HELP REMEMBER

MNEMONICS COMES IN VARIOUS SHAPES & SIZES

EG - SUBTRACT IS 1111 IN BINARY OR 15 IN DECIMAL BUT WORD 'SUB 'IS EASY TO REMEMBER

ALL COMPUTERS CAN HANDLE LETTERS & NUMBERS

THEY CAN BE TAUGHT TO RECOGNIZE COMBINATIONS OF THEM

EG - SUBSTITUTE ' 14 ' EVERY TIME SEE THE SYMBOL ' ADD ' ETC

NOW A PROGRAM CAN BE WRITTEN USING SUCH SYMBOLS

TRANSLATION OF SYMBOLS IS REQUIRED TO CONVERT THE SYMBOLS INTO MACHINE LANGUAGE

TRANSLATOR PROGRAM IS CALLED AN 'ASSEMBLER'

IT IS A SYSTEM PROGRAM SUPPLIED BY MANUFACTURER

PROGRAM WRITTEN IN ASSEMBLY IS CALLED 'SOURCE PROGRAM' & ONCE IT IS TRANSLATED INTO MACHINE IT IS KNOWN AS 'OBJECT PROGRAM'

ASSEMBLY LANGUAGE PROGRAM	INPUT	ASSEMBLER	OUTPUT	MACHINE LANGUAGE PROGRAM	
(SOURCE PROGRAM)		ONE - TO - ONE	(OBJECT PROGRAM)		
CORRESPONDENCE					

EXAMPLE

MNEMONIC	OP CODE	MEANING
ADD	14	ADD TO CONTENTS OF A REGISTER
SUB	15	SUBTRACT FROM CONTENTS OF A REGISTER
STA	30	STORE A REGISTER

ADDRESSES OF SYMBOLS ARE STORED FOR CONVENIENCE

MEMORY LOCATION	CONTENTS		
	MNEMONICS	ADDRESS	
0000	ADD	1000	
0001	SUB	1001	
0002	STA	1002	



EASIER TO UNDERSTAND & USE THE MACHINE EASY TO LOCATE & CORRECT ERRORS EASY TO MODIFY

NO NEED TO REMEMBER ADDRESSES

AS THERE IS ONE-TO-ONE CORRESPONDENCE, THE EFFICIENCY OF MACHINE LANGUAGE IS ALSO THERE

LIMITATIONS

MACHINE DEPENDENT

HARDWARE KNOWLEDGE REQUIRED

MACHINE LEVEL CODING AS ASSEMBLER INSTRUCTIONS REQUIRED

BEING MACHINE DEPENDENT, BOTH MACHINE & ASSEMBLY LANGUAGES ARE REFERRED AS 'LOW - LEVEL LANGUAGES'

<u>HIGH – LEVEL LANGUAGE</u>

MACHINE & ASSEMBLY LANGUAGE REQUIRES A DEEP KNOWLEDGE OF INTERNAL MACHINE STRUCTURE

HIGH-LEVEL LANGUAGES ARE PROBLEM ORIENTED RATHER THAN MACHINE

THEY USE ENGLISH LIKE WORDS & MATHEMATICAL SYMBOLS

HENCE PROGRAMMER CAN CONCENTRATE ON PROGRAM LOGIC BETTER
AN HLL IS A SYMBOLIC LANGUAGE WITH MACRO INSTRUCTIONS

EVERY INSTRUCTION IN HLL IS TRANSLATED IN MACHINE CODE

DEPENDING ON THEIR SPECIFIC DEALING WITH PARTICULAR PROBLEM LIKE BUSINESS, MATHEMATICAL, HLL ARE KNOWN BY THAT NAME

HLL INSTRUCTIONS ARE TRANSLATED IN MACHINE CODE BY A TRANSLATOR PROGRAM CALLED 'COMPILER'



A PROGRAM WRITTEN IN HIGH LEVEL LANGUAGE IS A SOURCE PROGRAM

COMPILER CONVERTS IT INTO MACHINE CODE AS OBJECT PROGRAM

COMPILERS ARE LANGUAGE SPECIFIC & NOT GENERAL

COMPILERS ARE LARGE PROGRAMS WHICH RESIDE PERMANENTLY ON SECONDARY STORAGE

INTERPRETER

 ANOTHER TYPE OF TRANSLATOR WHICH CONVERTS ONE INSTRUCTION AT A TIME & IMMEDIATELY EXECUTES IT

NO OBJECT CODE IS PREPARED & HENCE EVERY TIME TRANSLATION IS REQUIRED TO EXECUTE THE PROGRAM

RESPONSE IS FAST TO CHANGES IN SOURCE PROGRAM

INTERPRETERS ARE EASY TO WRITE & REQUIRE LESS MEMORY

TIME CONSUMING AS EACH INSTRUCTION MUST BE TRANSLATED EVERY TIME

ASSEMBLERS, COMPILERS & INTERPRETERS ARE SYSTEM SOFTWARE, ALSO REFERRED AS 'LANGUAGE PROCESSORS' AS THEY PROCESS A LANGUAGE

CONCLUSION

AN HLL SHOULD POSSESS BASIC CHARACTERISTICS –

RELATIVELY INDEPENDENT OF A GIVEN COMPUTER SYSTEM

EACH STATEMENT SHOULD BE MACRO INSTRUCTION

SHOULD USE NATURAL WORDS & SYMBOLS TO WRITE PROGRAMS

LANGUAGE SHOULD BE INDEPENDENT OF MACHINE LANGUAGE INSTRUCTIONS

SHOULD NOT BE EXPERIMENTAL IN NATURE & EXIST ON MORE THAN ONE COMPUTER SYSTEM

ADVANTAGES

MACHINE INDEPENDENCE

EASY TO LEARN & USE

FEW ERRORS POSSIBLE

LOWER PROGRAM PREPARATION COST

BETTER DOCUMENTATION

EASILY MAINTAINABLE

LIMITATIONS

LOWER EFFICIENCY

TAKES MORE TIME TO EXECUTE

LACK OF FLEXIBILITY

AUTOMATIC, HENCE NOT UNDER PROGRAMMERS CONTROL

SOME HIGH LEVEL LANGUAGUES

- FORTRAN FORmula TRANslation DEVELOPED BY IBM
- COBOL COmmon Business Oriented Language DEVELOPED BY CODASYL & ANSI
- BASIC Beginners All purpose Symbolic Instruction Code DEVELOPED BY PROF JOHN KEMENY & THOMAS KURTZ, USA
- PASCAL NAMED AFTER FRENCH MATHEMATICIAN BLAISE PASCAL, DEVELOPED AT SWITZERLAND FOR STRUCTURED PROGRAMMING CONCEPTS
- PL / 1 PROGRAMMING LANGUAGE ONE BY IBM, A GENERAL PURPOSE LANGUAGE

OPERATING SYSTEMS

AN OS IS AN INTEGRATED SET OF PROGRAMS USED TO MANAGE VARIOUS RESOURCES & OVERALL OPERATIONS OF A SYSTEM

PRIME AIM IS TO IMPROVE PERFORMANCE & EFFICIENCY OF A SYSTEM & FACILITY & EASE WITH WHICH IT CAN BE USED

IT MAKE THE SYSTEM USER FRIENDLY WITH NECESSARY INTERFACE THE OS HAS TO BE PRESENT IN THE MEMORY OF SYSTEM

OUT OF COMPLETE OS, ONE CONTROL PROGRAM RESIDE IN MAIN MEMORY OF SYSTEM KNOWN AS RESIDENT PROGRAM / ROUTINE

OTHER PROGRAMS ARE STORED ON DISK & CALLED TRANSIENT PROGRAM / ROUTINES

THESE INCLUDE UTILITY PROGRAMS, COMPILERS, ASSEMBLERS ETC CONTROL PROGRAM TRANSFER THESE PROGRAMS INTO MAIN MEMORY WHEN NEEDED

EFFICIENCY OF A OPERATING SYSTEM IS JUDGED BY TWO MAIN FACTORS -

> THROUGHPUT - TOTAL VOLUME OF WORK PERFORMED BY SYSTEM OVER A PERIOD

> TURN AROUND TIME - RESPONSE TIME WITH USER REQUEST & RESULT OBTAINED

EVOLUTION OF OS

FIRST OS WAS DEVELOPED IN EARLY 50's FOR IBM 701 SYSTEMS, WAS ELEMENTARY IN NATURE & NOT MUCH POWERFUL

JOB-TO -JOB TRANSITION WAS NOT AUTOMATIC & SYSTEM TIME WAS WASTED

BATCH PROCESSING

ALSO KNOWN AS SERIAL, SEQUENTIAL, OFF LINE OR STACKED JOB PROCESSING

EACH USER PREPARES HIS PROGRAM OFF LINE
& SUBMIT TO CENTRE

 BATCH OF MANY USER PROGRAMS IS LOADED & EXECUTED SERIALLY, USEFUL FOR APPLICATION LIKE PAYROLL, RESULTS ETC

DISADVANTAGES

 REDUCES TIMELINESS IN SOME CASES WHERE TIME REQUIRED TO COLLECT DATA INTO BATCHES DESTROYS VALUE OF DATA

MAKES EACH JOB WAIT IN LINE AT EACH STEP
& INCREASES TURNAROUND TIME

 DIFFICULT TO PROVIDE DESIRED PRIORITY SCHEDULE

MULTIPROGRAMMING

IN BATCH PROCESSING, BATCHED PROGRAMS ARE LOADED ONE AFTER ANOTHER INTO MAIN MEMORY FOR PROCESSING

 A LOADED PROGRAM WILL REMAIN IN MEMORY UNTIL IT COMPLETE EXECUTION & WILL BE SOLE OCCUPANT OF MEMORY

 THE CPU WILL BE EXCLUSIVELY AVAILABLE TO IT

TWO OF SYSTEM'S MOST POWERFUL RESOURCES, CPU & MEMORY WILL BE UNDER – UTILIZED

- ALL PROGRAMS ARE NOT LARGE ENOUGH TO OCCUPY FULL USER AREA OR COMPLEX ENOUGH TO HAVE FULL CPU TIME
- TO OVERCOME THE PROBLEM OF UNDER -UTILIZATION OF CPU & MEMORY CONCEPT OF MULTIPROGRAMMING WAS INTRODUCED IN OS

MULTIPROGRAMMING

MULTIPROGRAMMING IS INTERLEAVED
EXECUTION OF TWO OR MORE DIFFERENT &
INDEPENDENT PROGRAMS BY SAME
COMPUTER "

ACHIEVED BY PLACING TWO OR MORE PROGRAMS INTO MEMORY & EXECUTING THEM CONCURRENTLY

CPU SWITCHES FROM ONE PROGRAM TO ANOTHER ALMOST INSTANTANEOUSLY

BECAUSE OF ITS FAST SPEED, CPU CAN ALLOCATE TIME TO SEVERAL PROGRAMS INSTEAD OF REMAINING IDLE

WHEN ONE PROGRAM IS WAITING FOR I/O TRANSFER, ANOTHER CAN UTILIZE CPU TIME

THUS, IT IS POSSIBLE SEVERAL USERS TO SHARE A CPU

CPU WILL BE ABLE TO EXECUTE ONLY ONE INSTRUCTION AT A TIME, SIMULTANEOUS EXECUTION OF MORE THAN ONE PROGRAM WITH A SINGLE CPU IS IMPOSSIBLE **REQUIREMENTS OF MULTIPROGRAMMING SYSTEMS**

 MULTIPROGRAMMING HAS TWO MAIN
ADVANTAGES - INCREASED THROUGHPUT & LOWERED RESPONSE TIME

THROUGHPUT IS INCREASED BY UTILIZING THE IDLE TIME OF CPU FOR MANY RUNNING OTHER PROGRAMS ALREADY RESIDING IN MAIN MEMORY

RESPONSE TIME IS LOWERED BY RECOGNIZING THE JOB PRIORITY & PROCESSING IT

BUT INCORPORATION OF MULTIPROGRAMMING IN OS COMPLICATES MATTERS FOLLOWING HARDWARE & SOFTWARE FEATURES ARE REQUIRED -

LARGE MEMORY - 128 K OR MORE WITH HARD DISK & FAST CPU

MEMORY PROTECTION - TO SECURE PROGRAMS FROM EACH OTHER

PROGRAM STATUS PREVENTION - WHEN ONE PROGRAM IS SUSPENDED & OTHER TAKES OVER

PROPER JOB MIX OF I/O-BOUND & CPU-BOUND JOBS

MULTIPROCESSING

INTERCONNECTED COMPUTERS WITH TWO OR MORE INDEPENDENT CPUs THAT HAVE ABILITY TO SIMULTANEOUSLY EXECUTE SEVERAL PROGRAMS

 INSTRUCTIONS FROM DIFFERENT & INDEPENDENT PROGRAMS CAN BE PROCESSED AT SAME TIME BY DIFFERENT CPUs

ALTERNATIVELY CPUS MAY EXECUTE DIFFERENT INSTRUCTIONS FROM SAME PROGRAM SIMULTANEOUSLY

THERE ARE INFINITE NO. OF POSSIBLE MULTIPROCESSING SYSTEMS

 SEVERAL SMALL CPUs CAN BE LINKED TOGETHER TO PERFORM MAJOR PROCESSING

IF ONE OF THE CPU BREAKS DOWN, OTHER CPUs WILL TAKE OVER ITS JOB

CPUs CAN ALSO BE CONNECTED INTO ELABORATE COMPUTER NETWORKS

IN SOME SYSTEMS, EACH CPU MAY PERFORM ONLY SPECIFIC APPLICATIONS eg - ONE PROCESS ONLY ON-LINE JOBS WHILE OTHER ONLY BATCH JOBS



IMPROVES THE PERFORMANCE BY ALLOWING PARALLEL PROCESSING

FACILITATES EFFECTIVE UTILIZATION OF ALL DEVICES OF SYSTEM

PROVIDES A BUILT-IN BACKUP & AVERTS A COMPLETE BREAKDOWN

LIMITATIONS

A VERY SOPHISTICATED O.S. IS REQUIRED TO SCHEDULE, BALANCE & COORDINATE THE INPUT, OUTPUT & PROCESSING ACTIVITIES OF MULTIPLE CPUs

A LARGE MAIN MEMORY IS REQUIRED FOR ACCOMMODATING OS & PROGRAMS

EXPENSIVE, IN ADDITION TO INITIAL HIGH CHARGES, REGULAR OPERATION & MAINTENANCE IS ALSO A COSTLY AFFAIR

TIME SHARING

A PROCESSING SYSTEM WITH A NO. OF INDEPENDENT, RELATIVELY LOW SPEED, ON-LINE, SIMULTANEOUSLY USABLE STATIONS, EACH PROVIDING DIRECT ACCESS TO CPU

ALLOCATION OF COMPUTER RESOURCES IN A TIME - DEPENDENT FASHION TO SEVERAL PROGRAMS SIMULTANEOUSLY

PROVIDE A LARGE NUMBER OF USERS DIRECT ACCESS TO CPU

ACCOMPLISHED BY PROVIDING A SEPARATE TERMINAL TO USERS

ALL THESE TERMINALS ARE CONNECTED TO MAIN SYSTEM

TIME IS DIVIDED AMONG USERS ON SCHEDULE BASIS & NOT ON PRIORITY BASIS

 ALL USERS ALLOTTED A BRIEF SHARE OF CPU TIME IN TURN

THIS SHORT PERIOD OF TIME IS KNOWN AS ' TIME SLICE ', ' TIME SLOT ' OR ' QUANTUM '

TYPICALLY IS ORDER OF 10 - 20 MILLISECONDS

BECAUSE OF HIGH CPU SPEED EACH USER HAS ILLUSION THAT CPU IS DEDICATED TO HIM/HER

- AT ANY INSTANT ALL USERS USING A TIMESHARING SYSTEM WILL FALL IN ONE OF THE FOLLOWING THREE STATUS GROUP
- ACTIVE USERS PROGRAM CURRENTLY HAS CONTROL OF CPU
- READY USERS PROGRAM IS READY BUT WAITING FOR ITS TURN OF CPU TIME
- WAIT USER HAS MADE NO REQUEST FOR EXECUTION OR WAITING FOR SAME I/O OPERATION

ADVANTAGES

REDUCES IDLE CPU TIME

OFFERS COMPUTING FACILITY TO SMALL USERS

PROVIDES ADVANTAGES OF QUICK RESPONSE

REDUCE THE OUTPUT OF PAPER REPORTS

AVOIDS DUPLICATION OF SOFTWARE

DISADVANTAGES

SECURITY

SINCE HUNDREDS OF USER USING SYSTEM SIMULTANEOUSLY

■ RELIABILITY

SHOULD BE HIGHLY RELIABLE AS SEVERAL USERS ACCESS IT

DATA COMMUNICATION

USER INTERACT WITH MAIN SYSTEM THROUGH A REMOTE TERMINAL WITH DATA COMMUNICATION FACILITIES

OVERHEADS

SWITCHING FROM USER TO USER & SWAPPING PROGRAMS IN & OUT TAKES UP GOOD

AMOUNT OF CPU TIME & IT SHOULD BE MINIMIZED TO REDUCE RESPONSE TIME

ON - LINE PROCESSING

PERMITS TRANSACTION DATA TO BE FED UNDER CPU CONTROL DIRECTLY

DATA IS NOT STORED FIRST & THEN SORT AS IN CASE OF SEQUENTIAL PROCESSING

DATA CAN BE KEYED IN THRU KEYBOARD OR ANY OTHER DATA COLLECTION METHOD ACCESS TO DATA BY CPU IS QUICK & DIRECT

INQUIRING BY A USER CAN BE RESPONDED WITHOUT A SEQUENTIAL SEARCH

 A TIMESHARING SYSTEM IS A TYPICAL EXAMPLE OF ON-LINE PROCESSING

REAL TIME PROCESSING

 MANY APPLICATIONS REQUIRES AN IMMEDIATE RESPONSE FROM SYSTEM

THEORETICALLY, THERE SHOULD BE NO TIME
- GAP WITH REQUEST & RESPONSE

PRACTICALLY THIS MEANS THE RESPONSE TIME SHOULD BE AS MINIMUM AS POSSIBLE USED IN WEATHER FORECASTING, NUCLEAR PLANTS, CHEMICAL PROCESSING ETC

REQUIRE IMMEDIATE INPUT TRANSACTION FROM ALL STATIONS

ONE EARLY & SOPHISTICATED COMMERCIAL REAL TIME SYSTEM WAS

THE AMERICAN AIRLINES' SABRE RESERVATION SYSTEM

VIRTUAL STORAGE

A HIERARCHY OF TWO MEMORY SYSTEMS - ONE LOW COST, LOW SPEED & LARGE CAPACITY & OTHER HIGH COST, SMALL CAPACITY & HIGH SPEED

THE OS MANAGES THE TWO IN SUCH A WAY THAT USER FEELS HE HAS ACCESS TO A SINGLE, LARGE, DIRECTLY ACCESSIBLE & FAST MAIN MEMORY

IT ALLOWS USER NOT TO WORRY ABOUT MEMORY SIZE LIMITATION

 IT ALSO PERMITS SHARING OF MEMORY AMONG SEVERAL USERS IN CASE OF MULTIPROCESSING & MULTIPROGRAMMING TO IMPLEMENT VIRTUAL MEMORY SYSTEM, MAIN MEMORY IS DIVIDED INTO FIXED SIZE CONTIGOUS AREAS CALLED 'PAGE FRAMES '

ALL USER PROGRAMS RESIDING ON ON-LINK DISK ARE ALSO DIVIDED INTO PIECES OF SAME SIZE CALLED ' PAGES' OR ' SEGMENTS'

NOW ONLY THOSE SEGMENTS WILL BE IN PRIMARY MEMORY THOSE ARE REQUIRED FOR CURRENT PROCESSING

REMAINING PAGES WILL BE IN 'VIRTUAL' MEMORY
<u>OS - CONTROLLED SOFTWARE</u>

MANY TASKS ARE OF A ROUTINE NATURE

OS - CONTROLLED SOFTWARE FOR THESE TASKS REDUCE TIME & EXPENSE OF PREPARING APPLICATION PROGRAMS FOR THEM

■ GROUPED INTO 3 CATEGORIES NAMELY -

1. TRANSLATION PROGRAMS

LANGUAGE PROCESS, TRANSLATES SOURCE PROGRAMS TO OBJECT PROGRAMS

> eg ASSEMBLER, COMPILER ETC

2. LIBRARY PROGRAMS

CONSISTS FREQUENTLY USED SUBROUTINES

> eg MATHEMATICAL FUNCTIONS, STATISTICAL ANALYSIS ETC

3. UTILITY PROGRAMS

SERVICE PROGRAMS ARE ROUTINES THAT PERFORM NEEDED SERVICES

> EG EDITING TEXTS, DEBUGGING, SORT RECORDS, DATA TRANSFER etc

TEXT EDITORS

DEBUGGING TOOLS

SORT & MERGE

BUSINESS DATA PROCESSING CONCEPTS

DATA PROCESSING

DATA IS A COLLECTION OF RAW FACTS -UNORGANIZED BUT ORGANIZABLE

ORGANIZED DATA IS NORMALLY TERMED AS INFORMATION

PROCESSING IS A SERIES OF OPERATIONS THAT CONVERT DATA INTO INFORMATION

DATA PROCESSING SYSTEMS INCLUDE RESOURCES AS PEOPLE, PROCEDURES & DEVICES

DATA STORAGE HIERARCHY

BASIC BUILDING BLOCK OF DATA IS A CHARACTER (A-Z, 0-1 etc)

ARE PUT TOGETHER TO FORM A DATA ITEM / ELEMENT OR FIELD

A FIELD IS A MEANINGFUL COLLECTION OF RELATED CHARACTERS

IT IS THE SMALLEST LOGICAL ENTITY TREATED AS A SINGLE UNIT

A RECORD IS A LOGICAL COLLECTION OF RELATED FIELDS

A FILE IS A LOGICAL COLLECTION OF RELATED RECORDS

IT IS CUSTOMARY TO SETUP A MASTER FILE OF PERMANENT DATA & TRANSACTION FILES OF TEMPORARY DATA

A DATABASE IS A COLLECTION OF LOGICALLY RELATED MASTER FILES

FILE ORGANIZATIONS

RECORDS ARE ARRANGED IN FILES IN VARIOUS WAYS

ACCESS OF THEM DEPENDS ON THE WAY THEY ARE STORED

THREE COMMONLY USED FILE ORGANIZATIONS ARE

SEQUENTIAL, INDEXED & DIRECT/RANDOM

SELECTION OF A PARTICULAR FILE ORGANIZATION DEPEND ON THE TYPE OF APPLICATION

FILE UTILITIES

CONSISTS OF ROUTINES WHICH PERFORM VARIETY OF GENERALISED OPERATIONS ON DATA FILES & NORMALLY ARE DATA INDEPENDENT

SORTING - USE PRIMARY & SECONDARY KEY TO ARRANGE RECORDS

SEARCHING - SCANNING THE FILE TO FIND A PARTICULAR RECORD

MERGING - COMBINING RECORDS FROM TWO OR MORE FILES

DATA BASE SYSTEMS

IN CONVENTIONAL DATA PROCESSING SYSTEMS, EACH APPLICATION HAS ITS OWN MASTER FILE ORGANIZED IN SEQUENTIAL, DIRECT OR INDEXED

EACH FILE WAS PROCESSED VIRTUALLY INDEPENDENTLY OF OTHER FILES

EACH FILE WOULD NEED ITS SEPARATE PROGRAMS FOR PROCESSING

THE DATA BASE CONCEPT

A CENTRALIZED & INTEGRATED SHARED DATA FILE CONSISTS OF COMPANY DATA

ORGANIZED & STRUCTURED IN A DIFFERENT MANNER THAN SEQUENTIAL FILE

PERMITS ACCESS TO ANY OR ALL DATA BY ALL APPLICATIONS WITH EASE

DUPLICATION OF DATA IS MINIMIZED

SEPARATES DATA FROM APPLICATION PROGRAM & EMPHASIZE THEIR INDEPENDENCE

PROVIDES DEFINITION OF LOGICAL RELATIONSHIP WITH DATABASE RECORDS

STORED ON DASD

DATA BASE SYSTEMS ARE INSTALLED & COORDINATED BY AN INDIVIDUAL CALLED Data Base Administrator (DBA) WITH OVERALL AUTHORITY TO CONTROL DATA DEFINITIONS & STANDARDS

DBA LOOKS FOR SECURITY, TRAINING & MAINTENANCE OF DATABASE

DATA BASE MANAGEMENT SYSTEMS

- COLLECTION OF PROGRAMS REQUIRED TO STORE & MANIPULATE DATA FROM A DATABASE IS CALLED A DBMS
- PRINCIPAL COMPONENTS ARE DATA DESCRIPTION & MANIPULATION MODULES
- DATA DESCRIPTION MODULE ANALYZE DATA REQUIREMENTS OF APPLICATION PROGRAMS & TRANSFER CONTROL TO DATA MANIPULATION MODULE
- DATA MANIPULATION MODULE RETRIEVES THE NEEDED DATA ELEMENTS FROM DATA BASE

A DBMS CAN ORGANIZE, PROCESS & PRESENT SELECTED DATA ELEMENTS

THIS ENABLES USERS TO SEARCH, PROBE & QUERY DATA BASE

FREE THE PROGRAMMER TO WORRY ABOUT ORGANIZATION & LOCATION OF DATA

MOST DBMS ARE DESIGNED TO INTERACT WITH LANGUAGES AS COBOL

MANY DBMS INCLUDE SPECIAL, USER-FRIENDLY 'QUERY LANGUAGES '

NETWORKING AND DATA COMMUNICATION

COMMUNICATION IS THE PROCESS OF DATA TRANSFER FROM ONE POINT TO ANOTHER

BASIC ELEMENTS OF A COMMUNICATION PROCESS

SENDER OR SOURCE - WHICH CREATES MESSAGE

MEDIUM - WHICH CARRIES THE MESSAGE

SINK OR RECEIVER - WHICH RECEIVES MESSAGE

TRANSMISSION MODES

THREE WAYS OR MODES TO TRANSMIT DATA -

SIMPLEX

- COMMUNICATION CAN TAKE PLACE IN ONLY ONE DIRECTION eg PRINTER
- DEVICE CONNECTED ARE EITHER SEND-ONLY OR RECEIVE-ONLY
- SUITABLE FOR APPLICATIONS WHERE DATA FLOW IS UNIDIRECTIONAL
- NORMALLY IN MOST DATA PROCESSING APPLICATIONS, COMMUNICATION IN BOTH DIRECTION IS REQUIRED TO AT LEAST CROSS-CHECK THE DATA TRANSFER

HALF - DUPLEX

CAN TRANSMIT DATA IN BOTH DIRECTIONS, BUT ONE AT A TIME

CAN ALTERNATIVELY RECEIVE & TRANSMIT DATA

REQUIRE TWO SET OF WIRE FOR COMMUNICATION

MOST COMMON IS VOICE COMMUNICATION

ALSO USED TO CONNECT A TERMINAL WITH A COMPUTER

FULL - DUPLEX

 HALF - DUPLEX REQUIRES A 'TURN AROUND' TIME & SPECIAL SWITCHING CIRCUIT FOR REVERSAL OF DIRECTION & TIME IS WASTED

FULL - DUPLEX ALLOWS FLOW OF INFORMATION IN BOTH DIRECTIONS SIMULTANEOUSLY ON THE TRANSMISSION PATH

NETWORK TOPOLOGIES

NETWORK IS A LOGICAL EXTENSION OF DATA COMMUNICATION SYSTEM

TWO OR MORE COMPUTERS ARE LINKED TOGETHER TO STORE DATA & RESOURCES

`TOPOLOGY` REFERS TO WAYS IN WAY THEY CAN BE LINKED

IT DETERMINES THE DATA PATHS TO BE USED WITH NETWORK STATIONS

MAJOR NETWORK CONFIGURATIONS ARE –

STAR

A HOST COMPUTER ATTACHED TO LOCAL ONES THRU MULTIPLE COMMUNICATION LINES

LOCAL COMPUTERS ARE NOT LINKED TOGETHER CAN ONLY COMMUNICATE VIA HOST

ROUTING FUNCTION IS PERFORMED BY HOST BY ESTABLISHING A LOGICAL PATH



A NO HOST CONFIGURATION OR EQUAL COMMUNICATION

NO CENTRAL HOST COMPUTER

EACH NODE HAS SIMPLE COMMUNICATION CAPABILITIES

NODES RECEIVES DATA, USES IF RELEVANT, ELSE PASS IT ON

LAN AND WAN

A LOCAL AREA NETWORK IS A DIGITAL COMMUNICATION SYSTEM CAPABLE OF INTERCONNECTING LARGE NO. OF COMPUTERS, PERIPHERAL & TERMINALS WITHIN A LIMITED AREA OF AROUND 1 KM

NORMALLY OPERATES IN A COMPACT AREA LIKE OFFICES OR CAMPUS

CONFIGURATION CAN BE STAR, RING OR HYBRID

CHANNELS GENERALLY ARE COAXIAL OR FIBRE OPTIC CABLES

DIFFERENCES

LAN IS RESTRICTED TO LIMITED AREA WHILE WAN SPANS GREAT DISTANCES

- COST OF DATA TRANSMISSION IS NEGLIGIBLE IN LAN & VERY HIGH IN WAN
- LAN CONNECTS SYSTEMS, TERMINALS etc PHYSICALLY WHILE WAN DO NOT
- DATA TRANSMISSION SPEED HIGHER IN LAN THAN IN WAN
- FEW DATA TRANSMISSION ERRORS IN LAN VIS-A-VIS WAN

Information Technology in Functional Areas of Management - Basic Information Systems

Financial IS

These systems involve large amount of data concerned with internal & historical information about finances

In some areas of financial planning, they provide futuristics look associated with planning eg budgeting is wholly futuristic

Supports financial managers in financing of a business by allocation & control of financial resources eg cash and security management, capital control budgeting, financial forecasting and financial planning Financial control data systems provides different supervisory information on financial status, status change information to management, investors, auditors & govt agencies

Major problems

Determine standards of control

Determine when action is required & what

Obtaining up-to-date information rapidly on variances

Solution

Automation speeds up reporting eg Invoices Billing/Preparation **Production / Operations Systems**

- Concerned about physical flow of goods or production of goods or services
- Covers Production Planning & Control, Inventory Control & Management, Purchasing, Distribution & Transportation
- Timing of information is important hence Automation necessary e.g. Scheduling of Purchasing, Materials Planning & Operations
- Purchasing → Order economic order quantity, Monitor buyer performance, Late delivery
- Materials Planning → Plan & Control Parts, Forecast Future Material needs / changes

Marketing Information System

- Most overlooked but important information system
- Marketing executives rely on intuition rather than analysis for decision
- Primarily maintains information about sales, orders, shipments
- What is required is a system that gives information about pricing, advertisement, product promotion policy, sales force effort to make better decisions
- Feedback from market is a major factor
- Hence major features required from Marketing Info System is to assist in product planning, pricing decisions, advertising, sales promotion strategies, forecasting etc

Specific subsystems of Marketing Information System -

Sales Management System – To report sales, categorized by product line, sales region, marketing force, promotional classification

Forecasting System - Marketing Information System use market research information on present sales to determine sales trends

Product Management System – It gathers and analyze data as most important items of organisation based on the notion that 80% of profit comes from 20% of items eg Maruti car model 800 among company's entire fleet Information is used to access growth potential of these products

Identify service problems

Forecast future sales

Determine promotional expenditure

Target future market

 Advertising and Promotion System – Advertisement in print, tv, radio, sponsoring events, dealer incentives, exhibition of products. The system assists in maintenance of cost budgets Customer Support System – Documents sales & installation activities, tracking follow-up calls, scheduling training sessions, remind sales executives to revisit important customers

Eg Inventory Management with Marketing Information System

Too little inventory means lost sales & costly rush orders

Too much inventory means carrying costs, interest costs, warehousing costs & chances of obsolescence

Personnel Information System

 Deals with flow of information about people working in organisation plus future personnel needs

Five basic functions / subsystems of personnel are -

- Recruitment
- Placement
- Training
- Compensation
- Maintenance

A Human Resource Management System is required to achieve all the requirements. **Personnel Administrative Data System (PADS)**

Provides data to carry out the administrative responsibility of an employee eg

Personnel status reporting system – Work required by management

Personnel action system – Hiring, Transfer, Job Change

 Fringe Benefits Administration System – Insurance claims, Accident reporting