

System Analysis, Design and Development

An Introduction

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System Analysis, Design and Development

1. Introducing System:

- Systems Concept
- Development Approaches

2. System Development:

- Planning for System Development
- Data Modeling & Management

3. Information & Management

- Process Modeling
- Information Management

1. Introducing System

Why System Analysis?

- To solve a problem we need to analyze it
- Problems need to be defined first
- We are surrounded by real life problems, it take many shapes and forms, and we only see its effects and consequences.
- Organizational problems often handled by managers and problems comes from within the organization or from outside.

Why System Analysis?

- Managers should rely on information, as managers do not manage assets or people.
- Managers manage the information related to assets or people.
- Information, comes from data and used to build knowledge to make managers job easy.
- It also brings the wisdom to help managers predict problems before it happen.

Why System Analysis?

- Solving a problem results in business improvement.
- Also improving the business requires solving problems affecting its growth.
- Computer is only a powerful tool to process data and information, the rest still depends on how we formulate the problem and make progress in solving it.
- Managers need to think in a better way to solve organization problems

System Concept:

- System thinking: The way we formulate the problem in order to deal with the “whole”
- System practice: when system thinking is applied on real world problems.
- System approach: when we take a broad view which takes all aspect of the problem into account, with the interaction between parts.

System Concept:

- System is a way of thinking about organization and their problems. It also involve set of techniques that help in solving problems.
- A System is an orderly grouping of interdependent components linked together according to a plan to achieve a specific objectives. No one way to consider these components.

System Definition:

- System:
 - Must be designed to achieve a predetermined objectives.
 - Interrelationship and interdependent must exist among components.
 - Always, the objectives of the system as a whole have a higher priority that objectives of components. and their problems.

SYSTEM:

- System is an abstraction for dealing with problems
- It is a conceptualization and formulation for solutions and problems
- It is a way of thinking
- It is not limited or bounded by physical constraints, only limited by human mind
- Has its roots in the “General System Theory” originated in 1940 by Bertalanffy.

SYSTEM:

- To deal with system as a subject it is developed through its:
 - Definition
 - Characteristics
 - Elements
 - Classifications
 - Language
 - Methodologies

System Characteristics:

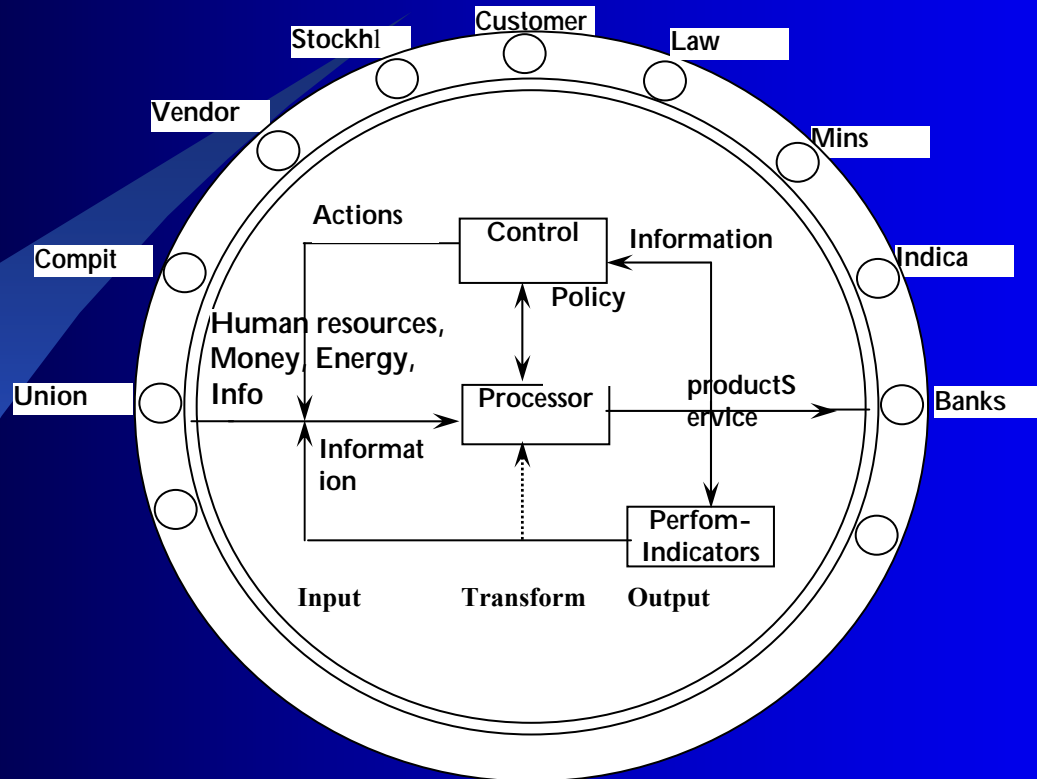
System with its definition definition has six main characteristics:

- Organization
- Interaction
- Interdependence
- Interaction
- Integration
- Central objectives

System Elements:

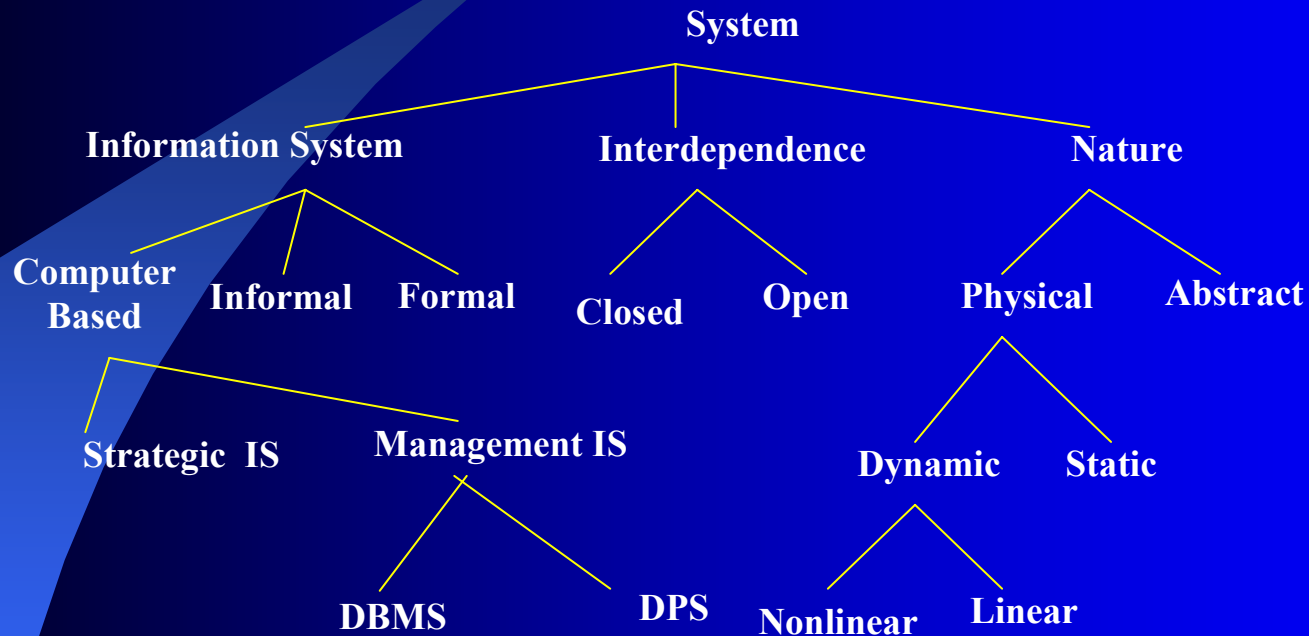
- Input / output
- Processor
- Control
- Feedback
- Environment
- Boundary and Interface
- Organization Culture (*at the heart of social systems*)

System Elements:

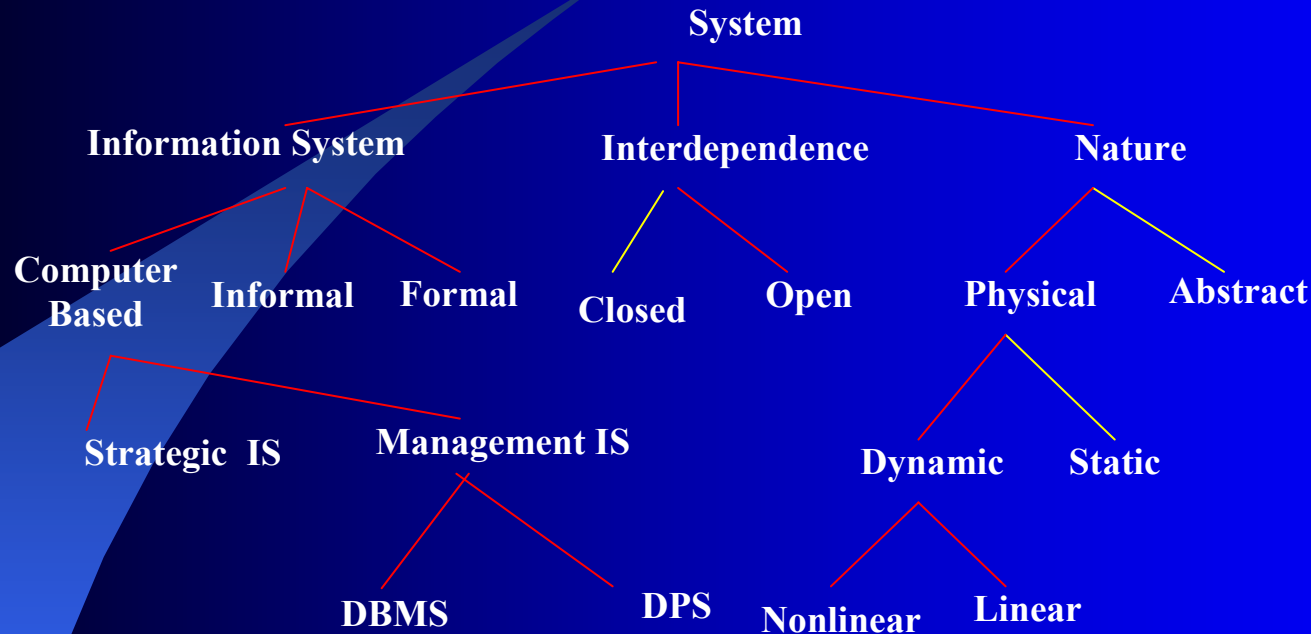


System Types and Classifications:

- There are many classifications as:



System Types and Classifications:

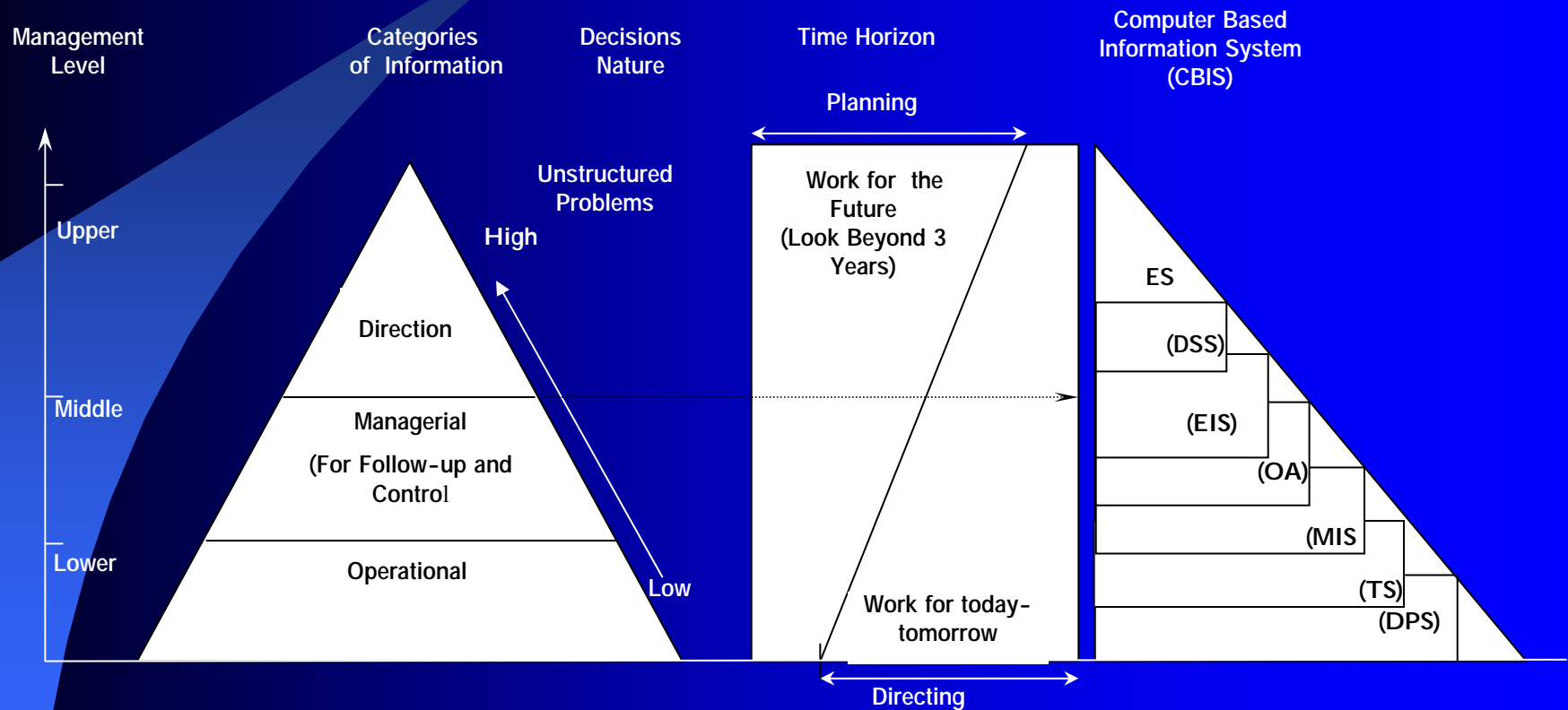


- Organization is an open dynamic system, with number of interacting subsystems.

Information System:

- System deals with three categories of information
 - Strategic: long term for planning and policy
 - Managerial: for implementation and control
 - Operational: short term daily control.
- It also develops informal information which is an employee-based system formed to meet personnel and vocational needs, and to help solve work related problems.

Management levels and information:



System Language:

- With the system movement number of methods were used to describe systems. This brought the system language through which models are used now.
- The model is a way to express and describe the system, but it needs tools. Tools may cover mathematical relationship, drawings, and rules.
- System analysis uses models extensively to express the system components with its interactions, and behavior.
- Models become more effective when they are used methodologically.

Why Do We Need A Methodology?

- Systems becomes more complex.
- The integrated nature of information shows itself with the emerging technologies.
- Information adds value to the products, so it needs to be accurately represented.
- Information becomes one of the corporate resources and needs to be managed.

Why Do We Need A Methodology?

- High interest rate, and changing environment put more pressure on developers.
- Maintenance cost becomes a major factor and should not be ignored.
- development is not an art any more, it is a science (or the art of science!).

Why Do We Need A Methodology?

- The cost of software becomes very high, and system life cycle becomes a major factor of concern.
- In 1993 canceled projects represented a waste of 14.3 billion and over 285000 effort year in USA.
- We can see many development approaches with many methodologies emerging during the last 30 years.

2. Systems Development Approaches:

- More than one thousand methodologies exist in the literature (in the last 20-30 years)
- They can be divided among the following number of broad approaches:
 - Systems
 - Participative
 - Structured
 - Object-Oriented
 - Strategic
 - Prototyping
 - Data
 - Multi-view

What is Methodology?

- Methodology is a collection of techniques stemmed from a vision and philosophy, which cuts through a set of methods covers different fields of knowledge in order to select the best fit to solve a problem or set of problems and to achieve predetermined objectives.
- It is also the practical implementation of System Development Life Cycle (SDLC)
- Systems analyst is the person who applies, uses, and develops methodology suitable for the circumstances.

What is Methodology?

- Visit Methodology.org to view methodologies
- Some of these methodologies are:
- Methodology development stemmed always from our thinking methods for approaching problems
- The table gives some of these methodologies

SSM	IEM	YSM
SSADM	MERISE	JSD
SDM	DAFNE	OOAD
V-MODEL	MEIN	HOOD

Systems Engineering and Analysis

- Building physical systems generated a great needs to deal with its engineering which led to the systems engineering discipline.
- These engineering projects required some level of analysis to justify its cost and economical feasibility, which led to systems analysis discipline.
- We should remember that organization has physical and social subsystems

Hard System thinking: Engineering Methodology

- Systems engineering comprises set of activities which lead to the creation of a complex man-machine entity and/or procedures with its information flow.
- Systems analysis is the systematic appraisal of the costs and other implications of meeting a defined requirement in various ways.
- Both are research strategy rather than methods or techniques, and both require art from practitioner when using scientific methods.

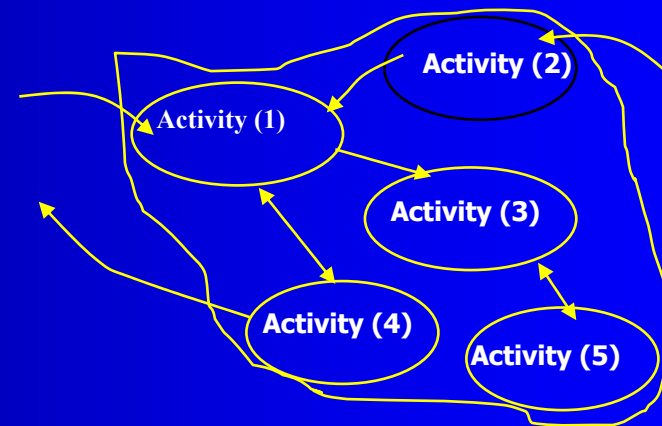
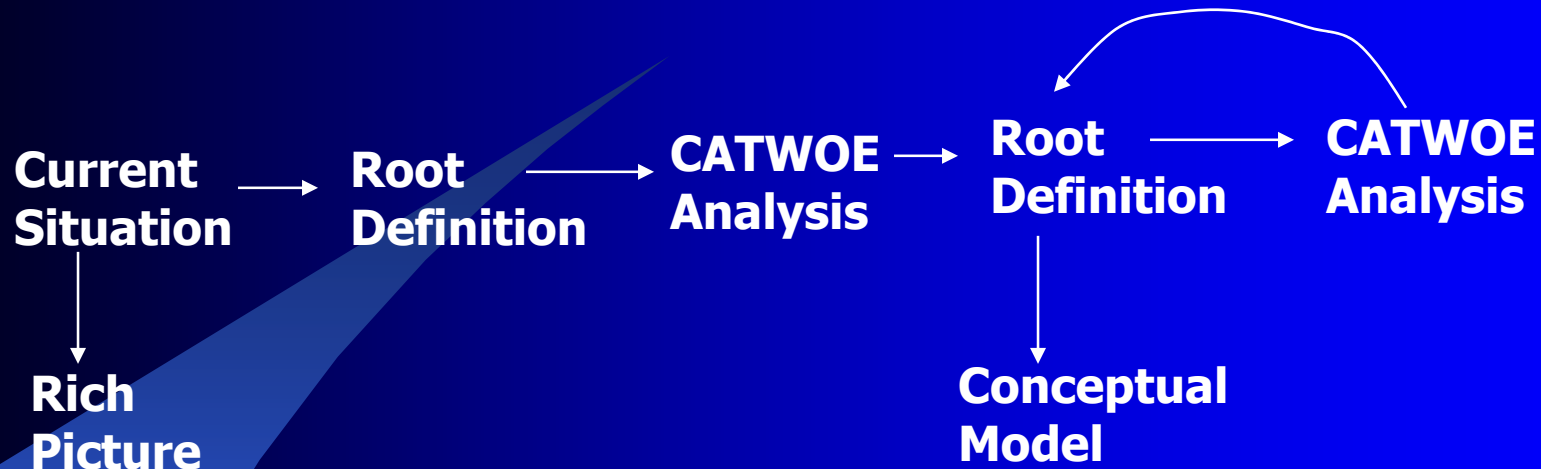
Soft System thinking: Soft Methodology

- If a desired state S_1 and a present state S_0 systems engineering (SE) defines the needs or objectives as (S_1-S_0) , and systems analysis (SA) provides an ordered way to select the best among alternative systems.
- The belief that real-world problems can be formulated in this way characterizes all 'hard' systems thinking whether it comes from SE or SA.
- Social system cannot be defined as a goal oriented system, and requirements cannot be taken as given without providing a structure for a debate about change.

Soft / Hard System thinking the Unified Methodology

- The author presents a unified methodology to handle the overall system development life cycle, Total Unified Methodology (TUM).
- At the start we utilize the SSM with the system thinking approach where the root definition and the conceptual model are utilized.
- Structured approach is adopted to define the logical model
- Reengineering is the key to develop the new logical and physical model with the information mapping
- Once the process and data model established with system and process quality matrices, software engineering is utilized for computerized solution.

Root definition



3. System development

- System development starts with strategic planning to ensure that system objectives are congruent with corporate and business objectives.
- It includes strategic plan, master plan, long term plan, medium term plan.
- The aim of system planning is to produce an integrated system, not separate and isolated subsystems.

Planning for system development:

- Strategic planning: is an on going process of defining (changing) corporate objectives for information management, with strategies and policies of allocating the resources to achieve these objectives.
- Planning here concerns with business requirements not technology or departments requirements.

Planning for system development:

- Long term planning: concerns with the future requirements of information system departments. It concentrates on changing concepts and skills of users with the changing objectives of the corporate.
- Medium range planning is used to define corporate needs from information processing functions by adopting specific projects to be completed within 3-5 years.

Planning for system development:

Through planning, corporate should answer the following questions:

- What are objectives of information management?
- What are strategies to achieve these objectives?
- What is the optimum method to structure and coordinate efforts to achieve these objectives?
- How can we estimate the cost and assess risks in implementing these efforts?

Planning for system development:

- How should processing functions be distributed among corporate subsystems?
- How can business process be transformed (using IT potentials)?
- How can IT support business process?
- How much integration is required?
- What are direct and indirect impacts between information management and business efficiency?
- How can we evaluate the success of information management projects in terms of profitability and quality?

Planning for system development:

- Answering these questions will provide a strong guidance for management team through the implementation phases of information management projects.
- It touches all aspects of corporate management as its objectives, policies, structure, as well as management procedures.
- It is clear that early stages of planning is not, and should not, driven by technical factors, or technology.

Planning for system development:

- One set of deliverables of strategic planning is corporate model or architecture model, business model with corporate main information elements including the present information resources.
- Business model includes business process model and business data model with process/entity matrix.
- The model should reflect the present situation with the projected new improvement and changes on the corporate or subsystems levels.

4. Business model and IS models

Business model depicts:

- Business process: interlinked activities that deliver specific outputs to identified customers.
- Activity: elements of the BP that the organization undertakes to the benefits of its business.
- Entities: those “things” which carry data or information required for activity implementation.

Through business process model and entity data model.

Business model and IS models

- On the subsequent levels of modeling and decomposition the entities become the focus of IS database models.

IS model includes the following models/diagrams:

- process flow
- hierarchy activity
- data flow
- entity relation
- entity life history

with its supporting documentation.

Automated Tools:

There are wide varieties of (automated) tools available to help in developing all models such as:

- RAD tools
- DD tools
- CASE tools
- DBMS tools

Some can automatically generate computer codes (see tool links at: analyst_corner/analyst.html).

Their benefits include:

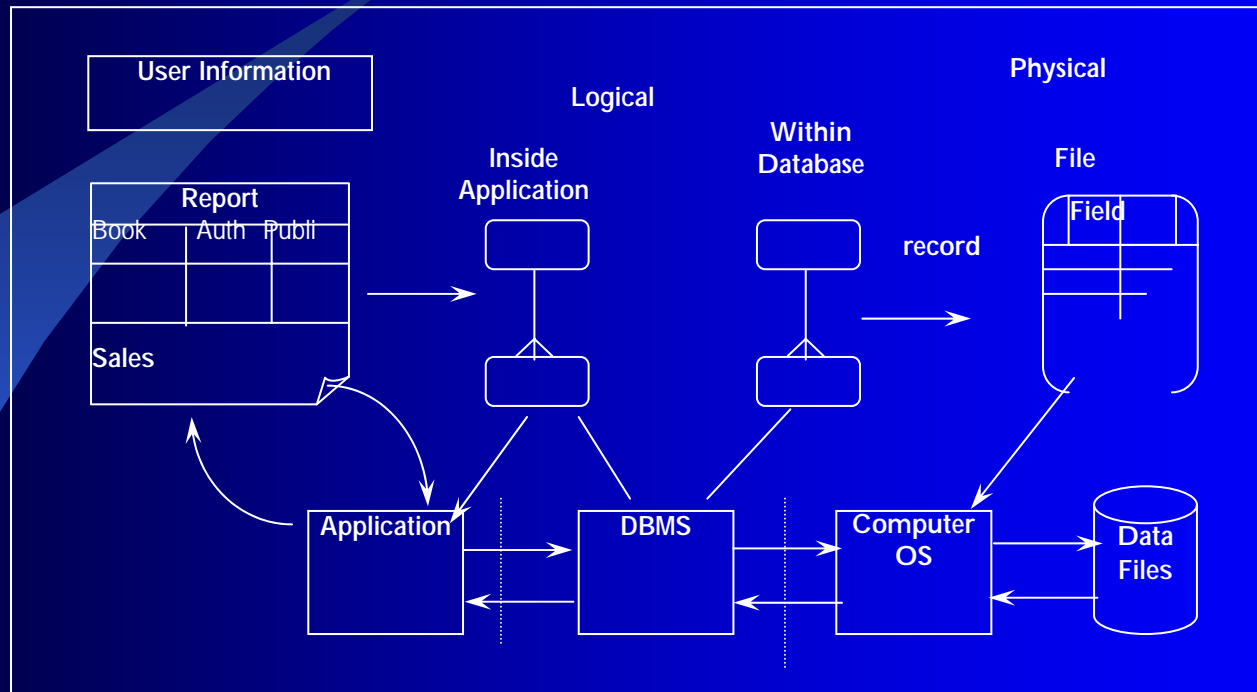
- Increased productivity in development process,
- Produce high quality of software,
- Reduced maintenance cost.

IS modeling: Database approach:

- One of the main reasons to use a database is to share corporate information resources among users and producers of data and information.
- DBMS is used to help users to build database and to manage its retrieval and manipulation by its users.
- DBMS are built to handle “data/entities” through predetermined sets of relations between its elements and with different manipulation capabilities.

IS modeling: Database approach:

Database conceptual model:



Development phases of Database:

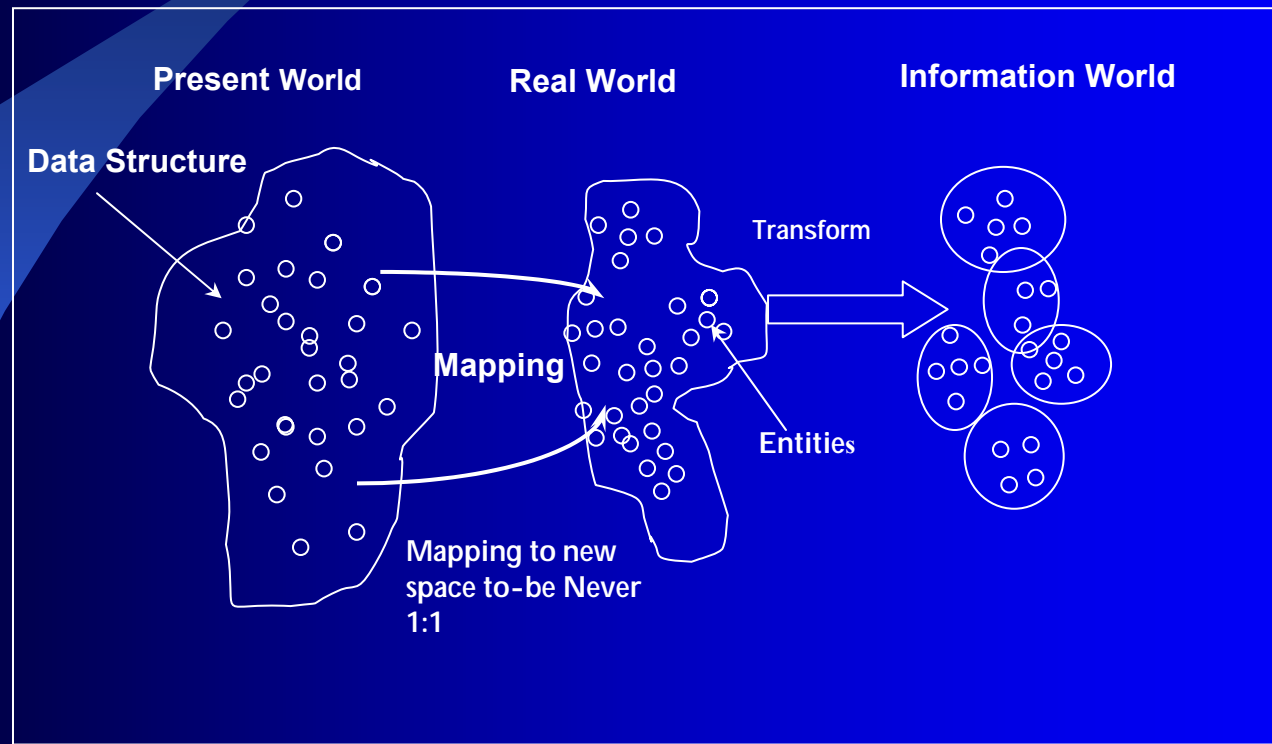
- Corporate database is one of the products of its development efforts. It is produced through number of development phases of SDLC.
- Major development phases include:
 - Analysis and logical model development
 - Logical design of database
 - Physical design of database
- The purpose of data analysis is to identify data required by business model in order to be rationalized and streamlined between users.

Development phases of Database:

- Logical data model development should be linked and synchronized with BPR, ISO certification, TQM, and any other improvement program.
- Based on the new and modified business/data models we develop a logical design of database.
- Logical database design goes into the details of the logical model through:
 - Entity relation diagram E-R
 - Class- Object relation diagram
- Physical design is concerned with the physical representation of database on corporate network.

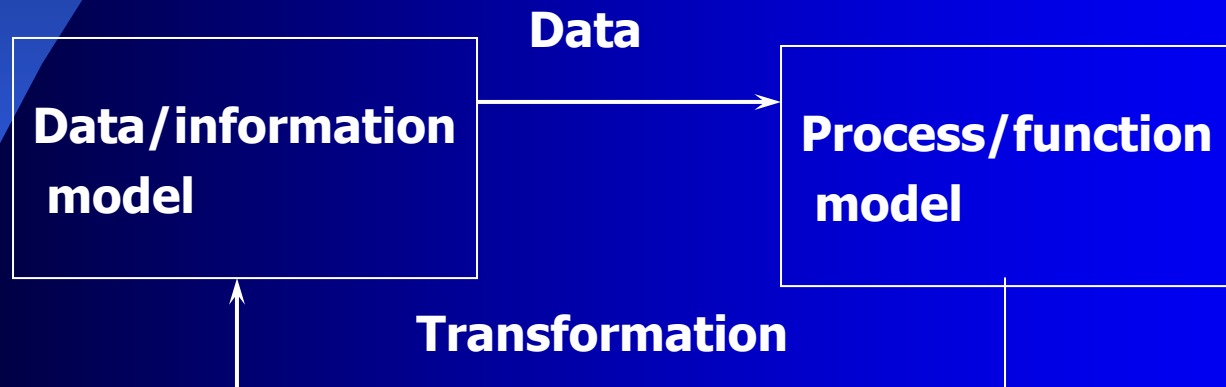
5. Information & Management

- IT potential helps to change organization world. We cannot transfer the old data to this new world with 1:1 mapping.



New data model:

- Processing of corporate database is designed to take into consideration the business needs and the corporate decision analysis rationale.
- Both are handled by data and process flow analysis.

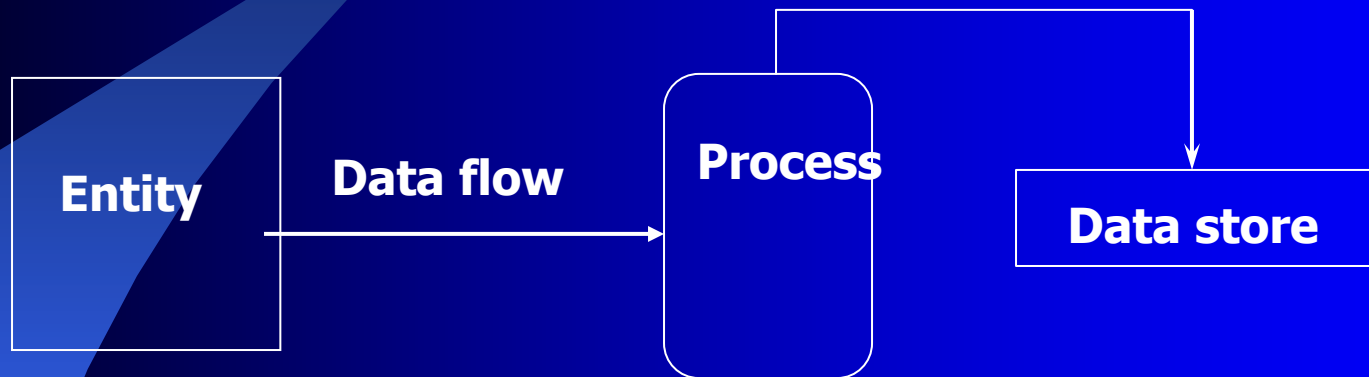


Function model:

- Information system can be viewed at any instant of time through two main axes:
 - Data: with its relation and structure
 - Activities: with its procedures and logic
- Database approach documents and delivers data models with its relation.
- Changes of data is triggered by the business process and completed by IS functions.
- Business process and IS functions should be modeled and structured to satisfy management needs.

Structured approach:

- DFD is used to model any processing system. It is built around system functions by using the following 4 symbols:



- Each data store is identified by its data contents, data flow, which are used to develop LDS.

Structured approach:

- Originally concerned with the functional processing (of business) and the identification of the data required for its activities.
- DeMarco structured analysis starts at the logical level with DFD to express data flow, process, data store and external entities (outside system boundary). The model defines data flow with its data elements as it is processed though and stored within the system.
- Each data store is identified by its data contents data flow and used to define LDS.

Structured approach:

- Tools of structured analysis are:
 - Data flow diagram DFD
 - Data dictionary DD
 - Decision table / Decision tree
 - Structured English
- Logical analysis starts by modeling the existing system using DFD. DD is used to identify and document all DFD elements with its data contents (data elements), with no consideration of its method of implementation.

6. Modern structured approach:

- From DFD we reconstruct as-is business model, which help to identify problems and difficulties to be revised by those defined in the requirements catalogue.
- With business problem defined, business area analysis gives us new requirements for reengineering which analyzed further and used to build new and modified model.
- Based on the new business model detailed analysis and evaluation of the new modified (system) solution should be carried out.

Modern Structured approach:

- Examination of the feasibility of solution should take place continuously as the project grows.
- Selecting a system solution requires building physical DFD with its corresponding database logical model and processing functions.
- DFD are decomposed to give more functions and process details with its corresponding data.
- Now for each sub-process we split the DFD into:
 - Data model
 - Functional / process model

Modern Structured approach:

- Process logic is defined from the corporate policies and procedures which should be available with the employees.
- Process logic is expressed by using Structured English, to facilitate the programming and coding of the system functions.
- All previous information with its corresponding documentation and models represents system requirements specifications or simply system specifications, which triggers system design phase.

Modern Structured approach:

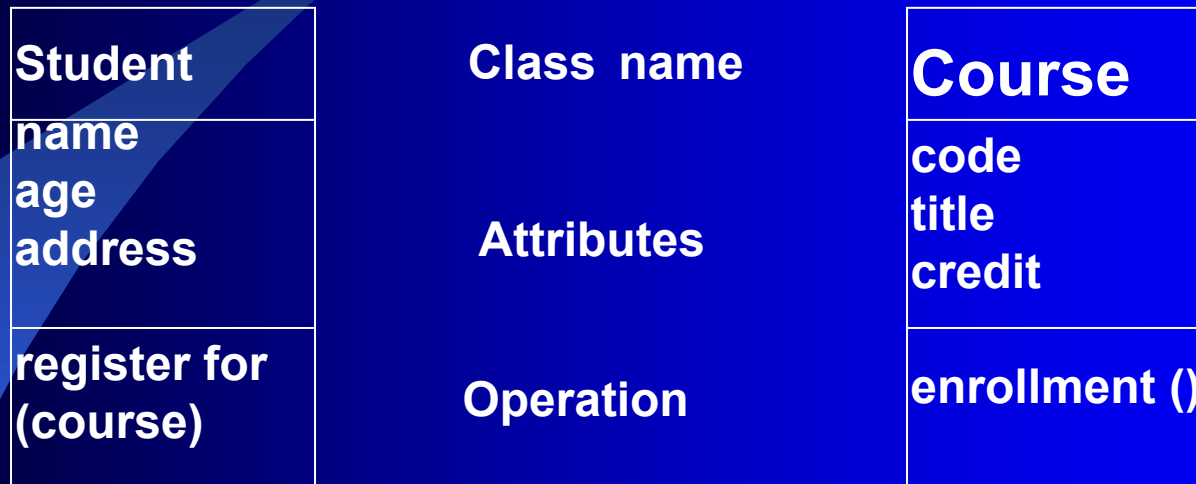
- Tools of design include:
 - Structure chart
 - IPO, HIPO
 - Event-driven structure
- Design ends up with program structure, hardware specifications and software system specifications with testing plan with its procedures, training and implementation plan.
- Modern structured approach also accommodates new trends of software engineering and programming as Object-Oriented programming

Object-Oriented approach:

- With object orientation we combine data and function approach by building business classes and objects. System is viewed as interacting objects.
- Objects is defined by its data (entity) with a specific behavior (method) as it reacts to other objects in the system.
- Objects with the same characteristics belong to a class of objects or simply a class.
- Different modeling notations are used with OOAD, Unified Modeling Language (UML) is widely used.

Object-Oriented approach:

- OOAD methodologies still use data and process modeling notation with new additions.



- With this modern software development methodology the emphasis is shifted to standardized business process.

Manage by Information (MBI):

- With these standardized business processes, called core business processes, we can generate or configure new business objects.
- Repeated business objects will have a pattern.
- Software industry is moving now to process pattern and software factory.
- The collection of methods and hardware and software development tools may be considered as production systems and plant of the system factory.

Manage by Information (MBI):

- System factory is managed, planned and scheduled, on the basis of decision criteria that indicate the most appropriate production route to take.
- System factory is expected to be distributed among the organization as most of its production work will be carried out by the users.
- Information production, with its continuous evaluation, and maintenance of IS need new managers with concepts of information management.

References:

For complete list of references see:

<http://www.analysthome.com>