

Analysis, Design and Implementation of Information Systems

**A
Transition to Objects**

Ashok Kumar Sharma



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Distributors:

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Distributors for Western India:

PREFACE BOOKS

223, Cama Industrial Estate, 2nd Floor,

Sun Mill Compound, Lower Parel (W), **Mumbai**-400 013

ISBN 81-259-0938-9

Reprint 2003

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The book was developed, edited and produced at:

Consultant Publisher: P K Madhavan

Project Coordinator: Anula Lydia

Editorial Team:

Pradeep Kumar, G Thiraviyam, C Sarita



Vijay Nicole Imprints

A-25, 4th Floor, Nelson Chambers,

115, Nelson Manickam Road,

Aminjikarai, Chennai - 600 029

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Printed at Vishal Printers, Delhi - 110032

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A Transition to Objects

Preface

The book covers information systems analysis, design and implementation and a transition to objects. The structure of the book follows a logical sequence to ensure comprehensive treatment of the subject at hand. At the end of each chapter, a brief transition to object-oriented approach is included. This way you will get to know how to use object-oriented concepts throughout the entire software life cycles. The book was developed mainly from lecture notes. The primary objective of the book is to promote systems thinking which has been enhanced by object modelling. The book is not about object-oriented language or coding. Instead there is an emphasis on creating a better design, and implementation details are deferred until the later stages which is the inherent characteristic of the object-oriented model. Object-oriented technology is a way of thinking abstractly about a problem using real world concepts and constructs. Objects, introduced a few years back, is a new paradigm in system development. Till now mainly four paradigms existed i.e. Classical, Spiral, Prototype, and Generic (that which combines the above three). The new paradigm stresses to combine Data and Flows into a modelling paradigm thus allowing objects to be modelled as independent entities which can be combined to form an integrated system. It also emphasises using the same in analysis and design thus removing the need for conversion from analysis to implementation model. An easy method to adopt object oriented approach is to start with the E-R model where each entity is an object. The attributes of entities and relationship becomes the object properties.

This book is written mainly for the purpose of imparting practical knowledge to students of computer science who wish to choose their career in the field of Information System Design. Its users can also be those who intend to be in the application development field. The concepts of this text enable an analyst or designer to operate successfully in the twentieth century. Students of MCA (Master of Computer Applications) or MBA (Master of Business Administration) with specialisation in systems can be very much benefitted by this book.

Instead of becoming a specialist in certain areas, it is better to adapt yourself to the information society whose main resource is knowledge and the study of systems is a good tool to make yourself flexible for other areas. The knowledge of analysis and design can be incorporated into several carriers. The object-oriented approach can be used in almost any kind of application.

I wish to thank my reviewers especially Dr. Anil Kr. Saini, faculty at Management Studies, Delhi who gave excellent suggestions for quality, flexibility and readability. I also recognise the constructive feedback and contribution made by the MCA students at Shri Guru Ram Rai Institute of Technology and Science, Dehradun in various portions of the manuscript.

I feel that this edition will provide you with a solid understanding of the fundamentals of Information Systems Analysis, Design and Implementation.

A K Sharma

Acknowledgements

A number of people deserve thanks for helping with this book. I would first of all like to thank my editors, Mr. P K Madhavan, Ms. Anula Lydia, the team at Vijay Nicole Imprints, an affiliate publishing unit of Vikas Publishing House Pvt Ltd, New Delhi. Acting on all the comments I received was painful, although this has made it a better book. A number of individuals shared my ideas on Object-oriented Development for all their contributions, I thank Prof. Harold Spraker, Prof. Hutchinson, Prof. Lee, Prof. Wilcox and Prof. Beers of Middle Tennessee State University, USA.

The major part of the pragmatics of the book was developed and derived from my involvement with complex application software systems that are being developed at companies and consultancy services such as Church of God Publishing House, Cleveland, Tennessee, USA; Barroughs Corporation at Chattanooga, TN (USA); Continental Foundation Joint Venture, 28, Nehru Place, New Delhi (India); En Dee Wollen and Silk Mills, Faridabad (India); India Casting Co. Agra (India); Agra Beverages Corp. India; Centre for Entrepreneurship Development and Management, New Delhi (India). I had the opportunity of interacting with hundreds of software engineers and their managers on my routine placement visits and I thank them all for making this book relevant to real-world problems. I also want to thank my brother Chetan, his wife, Lalitha and their kids, Rakesh and Shoba for their encouraging phone calls and e-mails from USA, for such academic activities.

Finally, thanks to my wife, Rita and my kids, Rohit and Shivani, for constantly encouraging me to bring out the best in me for the book and for keeping me company during many late nights of writing.

A K Sharma

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AN OVERVIEW OF MANAGEMENT INFORMATION SYSTEM

ROLE OF MIS

Management Information System (MIS) refers to the organisational information system which is implemented to support the managerial and operational functions. Presently most of the information systems are computerised to make the decisional and operational controls efficient and effective. This system can be developed for top, middle or lower level of management to provide information and controls for day-to-day working of an organisation. Once it is developed and put into productive use, it improves the day-to-day work and both long-term and short-term decisions. The benefits derived out of such systems are both tangible and intangible. It can be developed for one functional area or for all the functions of an organisation.

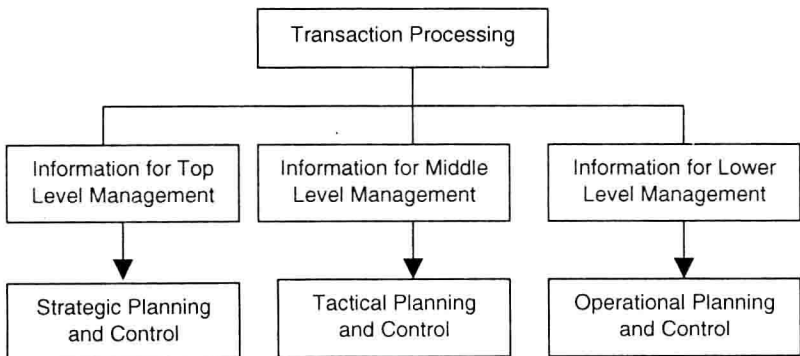


Fig 1.1 MIS description

Therefore, we can summarise the role of MIS or computer department as an organised effort to achieve the organisation objectives efficiently and effectively. The computers make the organisation's information system possible and feasible. The strategic and tactical decisions can also be programmed into the computerised system and this gives an organisation an opportunity to progress fast in this competing world. Hence, MIS is a formal system which provides reports to the various organisational levels for decision making.

In the beginning when computerisation was gaining popularity, the MIS or the computer department which was supporting the operations of an organisation, used to be in the accounting department or close to the controller of the organisation because it is an extension of the concepts of financial and managerial accounting, taking into consideration the techniques of operations management. Financial accounting can be considered as an information system with rules, procedures and processes designed for providing data and information suited for the organisation and its clients. Managerial accounting is concerned with cost behaviour and other analysis useful for management decisions.

These days the concepts of distributed processing, on-line, real-time, centralisation of all information, resources, centralisation of computing, decentralisation of information resources etc., have enhanced the capabilities of organised effort. Since MIS is an evolving concept and an orientation towards the information systems designed, it is more important to see how much a system adopts the MIS orientation.

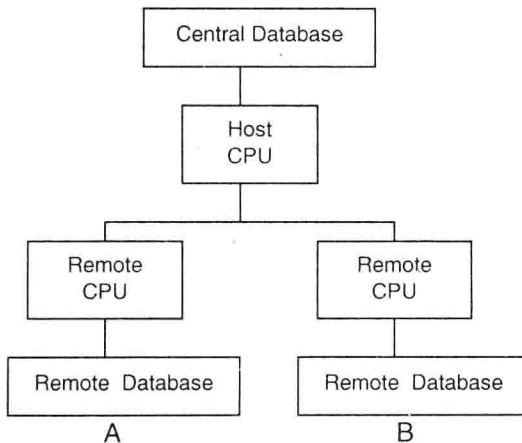


Fig 1.2 *Distributed database*

The organisational function subsystems are different i.e. marketing, personnel, logistics, production etc. and hence we can either have an MIS for each or an MIS that can be integrated into various activities performed in each of these subsystem can be common from operations management to strategic and tactical planning. Therefore, we can have a common repository of data, providing access to one or several MIS of an organisation to perform various activities, i.e. processing of orders, scheduling of

events, formulation of budgets and other objectives and plans, control of purchasing, inventory control, salary administration and a number of other activities.

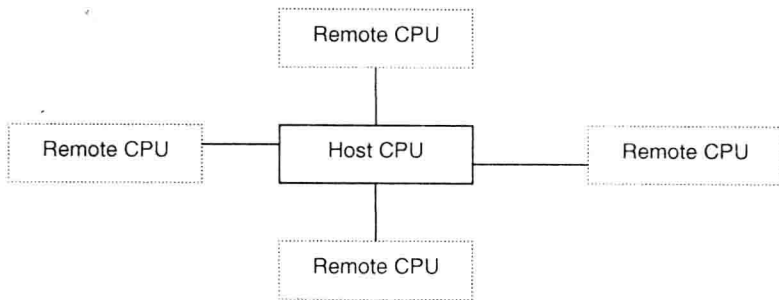


Fig 1.3 Distributed data processing

While analysing or designing a Management Information System, we must remember that it is a human being who will be using the computerised system and so the capabilities of humans may impose certain limitations on information system. Human behaviour is one of the important factors that should be kept in mind while analysing, designing and implementing an information system.

The MIS Subsystem is shown below the MIS Umbrella :—

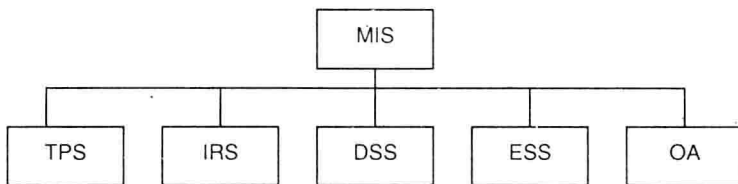


Fig 1.4 MIS umbrella

The various MIS functions are shown above in the MIS organisation chart. Sometimes a system that can provide output fast enough to satisfy any users' requirements and which makes the output available quick enough to control real life activity is desirable. The concept is related to the speed of processing so that the time between input and output is minimised (Real Time). Time sharing is a technique that allows several users of an on-line real time system to use that system simultaneously. The speed, at which the system's hardware and software operate, allows the system to switch from one active user to other, doing a part of each job till all the work is completed. Real Time operations can be defined as Data Processing in parallel with a physical process so that the results of the data processing are immediately useful to the physical operations.

Real Time systems have three characteristics, which are :

1. Data maintained on-line
2. The computer can be interrogated from remote terminals
3. The data is updated as events occur

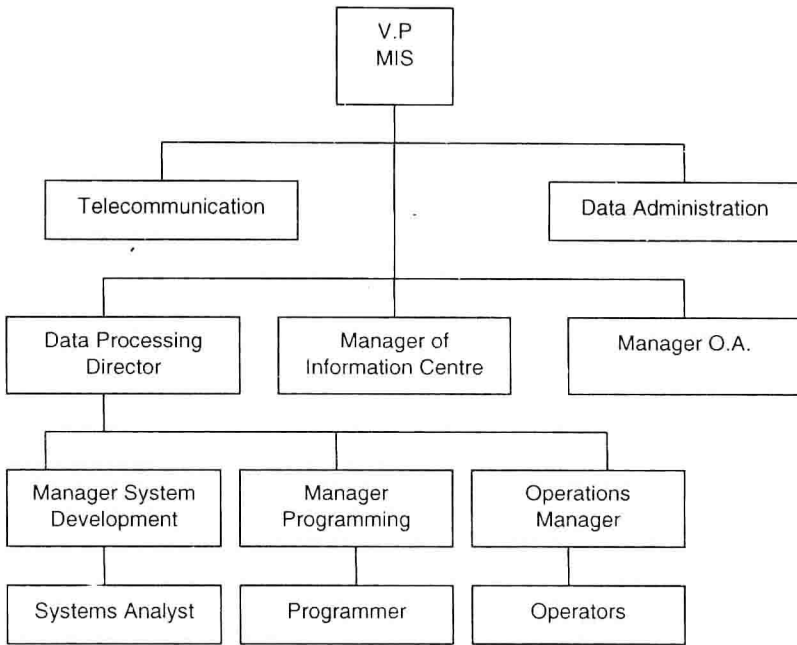


Fig 1.5 MIS subsystem

MIS CONCEPTS

Definition of MIS

Management Information System refers to a class of systems which provide support to the different levels of management i.e. the Top Management, the Middle Management, and the Lower Management. It supports the Management in planning, organising, staffing, directing and controlling. Such a system is physical in nature and not abstract. The level of abstraction is very very low. Management Information System (MIS) provides operational support to Management in day to day activities or weekly or monthly or yearly activities.

MIS also supports decision making functions in an organisation. The decisions can be tactical or strategic. Such a system existed decades back and is not a new concept, except that it was manual and no computing devices were utilised to make it more fast, efficient and effective. By the introduction of computer in late 40s it became feasible in the sense that now information can be retrieved quickly from the computer's memory where transactions are stored. The processing of transactions has now become fast by the power of computers. Actually it is the power of computers that MIS is now feasible. The productivity of the individuals have also increased with the aid of computers. Productivity is the output-input ratio within a time period with due consideration to quality. It can be improved by (1) increasing outputs with same inputs (2) by

decreasing inputs for same outputs (3) by increasing outputs and decreasing inputs to change the productivity ratio favourably.

$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

Hence we can say that MIS is a Man-Machine integrated system providing support in decision making and controlling operations of an organisation. A better definition of MIS can be that of a computerised man-machine integrated system providing support in decision making and day-to-day activities of an organisation.

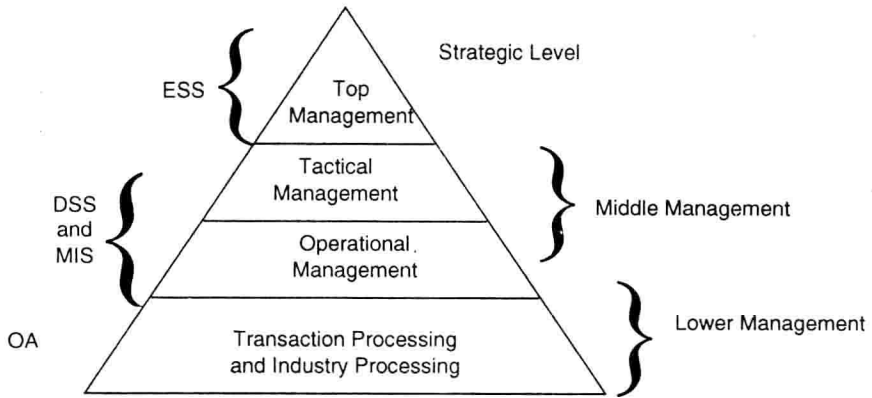


Fig 1.6 MIS—Pyramid structure

ESS: Executive Support System DSS: Decision Support System OA: Office Automation.

The above pyramid structure is used to define information systems supporting various levels of management and various activities in each of the functional subsystems of an organisation. The functional subsystems are marketing, production, personnel, logistics, accounting, top management etc.

By Integrated System we mean integration of data and integration of processing. The reason we have used the word integrated system instead of system is that in an organisation, there are a number of activities that are interrelated and interdependent and are done in a sequence rather than in a haphazard manner. To attain this sequence in computer programs, the computer programs are linked to each other in the same sequence as the manual processing activities. For example, we have to enter a customer order first, then produce a challan or shipping document and then invoices and finally the customer account will be updated. Hence each of the above mentioned activity constitutes a program and the programs for all these activities have to be run in a sequence so that the output of one program becomes the input of next program, and the output of this becomes input to the third and so on. Hence, there is a link between the activities (programs). This link is an interconnection or interaction between various programs. Therefore these set of programs are integrated and not

differentiated or distributed. These set of programs can be called an application. Such an application as described above can be given a name i.e. Order Processing Application.

The concept of integrated data is achieved by a database where we keep all our data at a central place. It is a repository of data. It is a data bank. We do not keep the data in any other place. This is how we achieve integration in data. All programs access data from the same place. A data item that is updated by one user is updated for all uses and users. Hence it cannot be different for different users. This reduces data redundancy and integrity problems.

In old and traditional systems, the database management concepts were missing and that is why work was performed using flat files. There were problems of data mismatch, integrity and data being updated by one user in a file, while the same data used by another user in his file is aged or non-updated. Also there was no way to link the programs. There were batch jobs. The processing Management System (DBMS) brought about tremendous changes in the way the work used to be carried out. Hence the system (a set of programs to do daily work) integration made MIS practical, in the sense that the information provided was up-to-date, accurate, valid and on time with efficiency (achievement of an objective with the least amount of resources). Therefore, there must be an organised plan for integrated processing. Planning needs to be done before hand to decide what all needs to be computerised and how each activity will be done and in which sequence and what will be the procedures to carry out a set of activities and which all resources will be required to do those activities. Therefore a system is not merely a set of programs or variables. The parts of a vacuum cleaner together with a human being constitutes the vacuum cleaning system. The variables or the parts must interact with each other to achieve a desired goal. Therefore, a system is an organised, inter-related and integrated set of variables or components interacting to achieve a desired goal. Physical systems are all around you. Abstract systems are based on ideas and constructs, which are also interdependent. For example, the system of theology is an abstract system.

Physical systems can be open, closed, relatively closed, deterministic, probabilistic, static, dynamic, etc.

Hence we can say that MIS is a concept and an orientation towards which an information system design moves rather being in an absolute state.

In this definition we have used the term system design. Actually the people who develop the processing logic/programs are the designers. Analysts simply handover the system specification to designers to generate the program code. Specifications refers to the exact way to carry out a particular activity or the exact procedure to tackle a situation. Just like we have specifications for a machine part which has to have exact given dimensions so that it can be fitted properly with other parts to make the machine work efficiently and effectively. So it is the description about something. When management requires an order entry program to be written, the analysts and designers

work together to develop a set of programs to perform a particular activity. So the design may constantly or periodically change because of the changing conditions or needs of the users of the system. So the design constantly moves towards MIS requirements to fulfill them or to achieve them 100 per cent or in a better way.

Information technologies are today not only impacting the processing of data but also influencing the way the people work at their jobs, the products that many businesses turn out and the manner in which various business groups compete. The predominant business applications of computers in the 1950s were transaction processing systems such as payroll and billing. The early MISs [called the information reporting systems] consisted of periodic printed reports with the primary purpose to help managers in decision making. In the late 1970s with the advent of Microcomputers, came the decision support systems (DSS). Usually it is a subsystem of MIS, as shown:

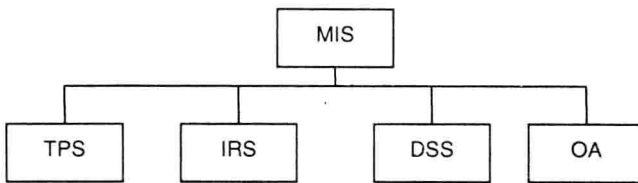


Fig 1.7 Introduction on DSS

INFORMATION SYSTEMS HIERARCHY

A better understanding of MIS can be developed from the following diagram.

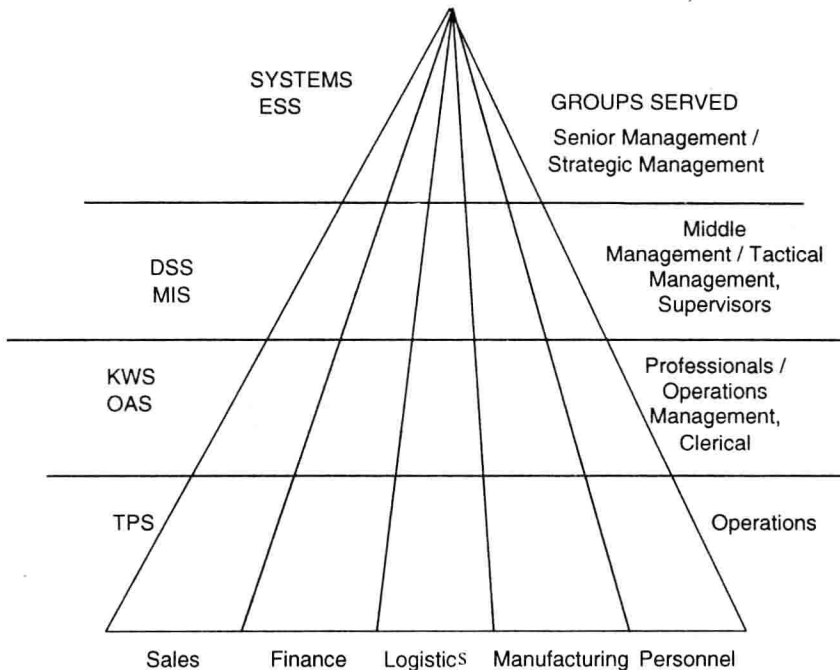


Fig 1.8 Pyramid structure