

DETERMINING DATA AND SOME TECHNICAL REQUIREMENTS FOR
A MICRO-COMPUTER NETWORK WITHIN THE LOWER KABETE
CAMPUS, UNIVERSITY OF NAIROBI.

BY

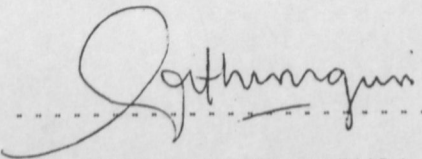
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A Management Research Project Submitted in Partial
Fulfillment of the Requirements for the Degree of
Masters of Business and Administration, Faculty of
Commerce, University of Nairobi.

June, 1990.

DECLARATION

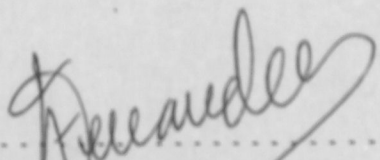
This Management Research Project is my original work and has not been presented for a degree in any other university.

Signed 

GILBERT GATHUNGURI KARUGA

Date 13th Sept. 1990

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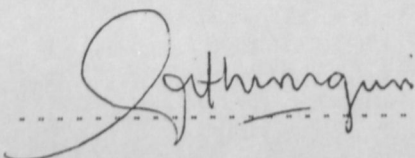
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MR. DANNY FERNANDES.

Date 17/9/90

DECLARATION

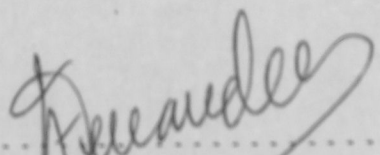
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TABLE OF CONTENTS

Acknowledgments
List of Tables
List of Abbreviations
Abstract

SECTION I INTRODUCTION
1.1 The Lower Kivu Basin: An Information
 Deficient
1.2 Objectives of the Study
1.3 Study Area

DEDICATION

SECTION II LITERATURE REVIEW
2.1 Development of Computer Networks
2.2 Characteristics of LAN's
2.3 Network Topologies
2.4 Data Base Systems and Management Products

SECTION III
3.1 TO My Parents

Simon Karuga and Margret Nyambura Karuga

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LIST OF TABLES

Table		Page
1.1	Lower Kabete Campus Population	4
1.2	Information Needs of the Campus	5
2.1	Characteristics of a LAN	12
2.2	Administrative Information Monitored by the Network	21
4.1(a)	Computer Hardware in the Faculty of Commerce..	33
4.1(b)	Computer Software in the Faculty of Commerce..	34

List of Figures

Figure		
2.1	Different Network Topologies	14
4.1 (a)	Data Flow Between the Deputy principal,s office And the Support Units.....	30
4.1 (b)	Data Flow within the campus	32

List of Abbreviations

DEC	Digital Equipment Corporation
DTR	Data Transfer Rates
IBM	International Business Administration
Kbps	Kilo bites Per Second
LAN	Local Area Network
Mbps	Mega Bits Per Second
MDBD	Maximum Distance Between Devices
MÓDEM	Modulation Demodulation
NSS	Number of Stations Supported
SNA	Standard Network Architecture
WAN	Wide Area Network

ABSTRACT

The evolution of civilization from material basis towards more complex forms has reached a stage of development where by information is a feature that can not be ignored. The task of putting together vital information has been greatly eased by the developments in technology. This developments in technology have been motivated by a desire to improve and ease the procedures of information processing.

This study set out to spell out the initial data and requirements necessary in the implementation of a Local Area Network within the Lower Kabete Campus of the University of Nairobi. The study also aimed at evaluating the currently available network systems that could be suitable for the requirements of the Lower Kabete Campus.

The required data was obtained from the various departments of the Lower Kabete Campus, the deputy principal's office and also the students welfare sections within the campus. The analyses of data was done by providing flow diagrams of the information flow within the college and also summary statistics in respect of the chosen variables or dimension. It was found that information requirements of the departments are very similar and common files on student related data could be created and shared between the departments, library, and the deputy principal's office.

There are various Local Area Network systems that could serve the Campus requirements. One system that was seen to be ideal for the campus was the Open Systems Local Area Network. It incorporates capabilities of future expansion and utilizes a variety of different vendors hardware and software.

SECTION 1

INTRODUCTION

Organizations in our society, both in the public and private sectors, are becoming larger and more complex. Information technology has the potential to foster more efficient and effective management over the internal workings of an organization. Being a relatively new concept in management information systems, organizations should strive to develop healthy synergies with information technology to ensure optimal utility of the technology. From an organizational point of view, this means that organizations may have fewer fillers and typists, for example, and more programmers and data base managers. In order that institutions providing any form of service progress, enormous and rapidly increasing stores of information must be gathered, organized, and distributed.

Resnikoff(1979) argues that great quantity and rapid growth of information collection are two irresistible forces which drive all activities before them. As organizations grow in size, special attention has to be given to the inherent complexity of information management. This is because most of the organizations preclude scaling or even trial and error methods as alternatives to maintaining complete information systems. This feature which is shared by all organizations calls for an effective way of collecting, processing, and disseminating the information needed.

Organizations have begun realizing the importance of information management and communication. This has been supported by the development of information processing tools. The computer has played a key role in the development of management information systems.

The need to improve on information processing and the utilization of computer resources has called for the interconnection of computers in the most profitable manner. The emergence of such inter-connected systems, called computer networks, has stimulated the design and development of supportive hardware, software, and management research in man-computer network interface (Mattison 1984).

The aim of information transfer is to support on a wide range of data processing applications. Sharing information conserves data-gathering resources and stimulates new ideas. Staff members have traditionally done most of their sharing of information in informal meetings, over telephones, through memos, or by carrying floppy disks between offices.

Two basic reasons for the need to interconnect computers into a network are 'load sharing' and 'resource sharing' (Adrian 1984). The former term, as the name suggests, means the ability to off-load work from one heavily loaded computer through the network onto another machine which is less loaded. This, at first sight, seems a highly attractive justification for computer net-

works but, in practice, there are many problems. One of the problems, and also the most significant is the compatibility of two computers.

The second justification for computer networks and the one which is perhaps more valid in most cases is known as resource sharing. The goal of computer networks is seen as to allow every computer in the network to make use of every local resource available in such a way that any program available to local users can be used remotely without degradation. The resources which can be shared in this way include, software, data, and hardware .

Computer networks are generally classified according to the extent the network covers. A network which is confined to a single factory, office building, or campus complex, and at the same time is completely controlled by the owner, is called a Local Area Network (LAN). On the other hand, when users of a network are widely dispersed and have little control over the network, then the network is termed as a Wide Area Network (WAN).

Computer networking has found applications both in the private and public organizations, including health and educational institutions.

1.1 The Lower Kabete Campus: An Information Perspective.

The Lower Kabete Campus of the University of Nairobi has now been in existence for almost two years. It houses the Faculty of Commerce and has a population of some 1313 persons as shown below in Table 1.1.

The Faculty of Commerce comprises of the departments of Business Administration, Accounting, and Management Science. In addition, the campus is serviced by the University of Nairobi Library and the Students Welfare Authority (SWA). The information needs on the campus may be categorized as shown in Table 1.2 below

Table 1.1. Lower Kabete Campus Population

CLASS	Population
i) Undergraduates: 1 st years	412
2 nd years	409
3 rd years	338
ii) Postgraduates: 1 st years	24
2 nd years	16
iii) Academic Staff	53
iv) Other Support staff	61
TOTAL.....	1,313

Table 1.2. Information needs of the Lower Kabete Campus

Information requirement	Examples
i) Educational	-Keeping track of academic performances -Information systems instruction
ii) Administrative	-Student Enrollment -Staffing position -Resident/NonResident students -Library Borrowers
iii) Research	-Inventory control -Carried out by staff -Carried out by students

Just to take an example, a database on basic information on each student (e.g Name, Registration Number, Resident/Non-resident Status) would be a common requirement in most of the above mentioned information areas. A computer network system which would allow for the efficient and effective sharing of such a data base could help enhance the management and administration of the Lower Kabete Campus.

1.2 Objectives of the Study

The origins of this study are based on informal conversations with the people directly dealing with information management on the campus. These include the vice-chairman of SWA, the Dean, the Librarian, the Chairmen of the various departments, and the members of the Faculty Computer Facility Committee.

Currently, the computer facility of the campus is mainly used for instructional purposes. Some administrative work (class lists, student exam results processing) is also handled.

From the conversations it became clear that many of the inherent problems of a fast growing campus population could be effectively tackled by a computerized, integrated information system.

The objectives of the study are:

- i) To carry out a system analysis of how common student related data is currently collected and used in the earlier mentioned departments in order to identify data files that could be shared.
- ii) Carry out a preliminary evaluation of some of the currently available LAN systems which could be suitable for the Lower Kabete Campus requirements.

SECTION 2

LITERATURE REVIEW

2.1 Development of Computer Network.

The Local Area Network (LAN) concept began with the development of distributive processing in the 1970's. The first step was to interconnect two identical computers in the same building, resulting in a point-to-point Network.¹ Once the advantages of distributive processing were realized, the growth of computer Networking increased at a rapid pace. Multipoint, star, and ring Network configurations soon began to revolutionize the data communication field.

One of the major early developments was the U.S. Department of Defense's Long Distance Private Packet-Switching Network, ARPANET, in the late 1960's. ARPANET was the first major application of the then new technology called "Packet Switching", in which data is segmented into blocks that are separately addressed and routed independently through the network.² The Packet Switch-

1. Fritz J.S. (et.al) Local Area Networks: Selection Guidelines, Prentice Hall inc. London

2. *ibid*

ing technology is used by some Networks today. Another major contribution of Packet Switching technology was the support for the concept of interconnecting dissimilar computers for data communication.

During the late 1970's through the 80's the use of versatile and relatively inexpensive mini-microcomputers became firmly established. Soon the need for application users to share files, programs, storage, and peripheral devices was recognized. The requirement for data exchange across departments, as well as over long distances, necessitated an increased use of data communication equipment.

The development of a commercial LAN can be traced back to Xerox's Alto Research Center in 1972 and was publicly announced as Ethernet in 1979.³ A cooperative effort involving Digital Equipment Corporation, Intel, and Xerox has produced an updated version of Ethernet. Since then, various other organizations have developed Ethernet "Look-alikes". Ethernet began a new trend in data communication by allowing devices of different manufacturers to communicate directly with one another. The Ethernet specification became a "defacto" Standard for more than 30 other companies

3. Cochrane J.I., (et.al), "Latest Network Trends", in, IEEE Communications, Vol. 23, No. 10 pp17-31, October 1985.

that have entered the LAN market. In recent years, more effort has been placed on increasing the data transfer rates and also the number of peripheral devices that the LAN's can support. The IBM developed system can transfer 4 megabits per second although a new version has the capacity of transferring 16 megabits per Second.⁴ The speed of both these LANs are low compared to a new system based on fiber optic cables (called FDDI Fiber Distributed Data Interface), which is becoming established as a new international standard. The advantage of FDDI is its speed, 100 megabits per second, roughly ten times as fast as its rivals.

Modern network developments are utilizing digital technology and digital services in network intelligence and control.⁵ Software controlled digital switching and cross-connected equipment provided in service nodes, lay the foundation for sophisticated control of the Network, both for internal operations and direct user control.

4. Breeze Paul, "LAN's, WAN's and other Link-ups"

5. *op.cit* Cochrane

2.2 Characteristics of LANS

LAN's are one of the most promising developments in today's hi-tech communications field. Although no two persons define a LAN in the same way, there are several characteristics that distinguish a LAN from other networks. These are given in table 2.1.below. The table gives the upper and the lower bounds of the variables that distinguish LANS from WANS. Some LANS meet these specifications more efficiently than others, and the evaluation of a LAN is based on the ratings on these variables.

There is a wide choice of technologies, capabilities, degrees of vendor support, and price ranges on LANs. With vendors claiming they have the ideal network configuration, many potential users exercise caution before they commit large capital expenditure for a LAN.

A variety of alternative LAN designs are commercially available. Generally, one LAN is distinguished from another on the basis of the following variables⁶

- (1) Intended application and offered services
- (2) Network topologies
- (3) Protocol architecture, and
- (4) Transmission medium

6. (p.Cit Lefkon

Table 2.1 Characteristics of a local Area Network⁷

-
- . High data rate (typically 1 to 10 Mbps)
 - . Limited geographical scope - typically spanning 1 kilometer
 - . Support of full connectivity - all devices should have the potential to communicate with each other
 - . Equal access by all user devices.
 - . Ease of reconfiguration and maintenance
 - . Good reliability and characteristics
 - . Stability under high load
 - . Compatibility to the greatest extent possible to a variety of equipment.
 - . Relatively low costs.
-

2.3 Network Topologies

The geometrical arrangement of computer resources, remote devices, and communication facilities is known as network topology. Computer networks comprise of nodes and links. A node is an end point of any branch in a computer network and can take the form of a computer, a terminal device, a work station, or an interconnecting equipment facility. A link is a communication path between two nodes.

Most local Area networks have a specified topology with which they are designed to operate. With standard networks, there are two basic network types : the point - to - point connection

7. Lefkon G. Richard, Selecting a Local Area Network AMA Management Briefing, New York, 1986. pp 8-18

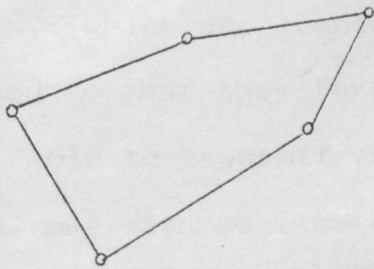
and the multipoint connection. In a point - to - point, two nodes are connected through a single communication link, so that one communication channel exists for that link. In a multipoint connection, several nodes share the same communication link, but only one node can transmit at a time. Most LAN's utilize the point-to-point and multipoint concepts⁸. All messages are physically transmitted to every network station, but each station only acts upon those messages addressed to itself.

There are basically two types of network technology, the broadcast networks and the non-broadcast networks. The distinction between the two technologies is in the way data travels across the communication media. In the non-broadcast or baseband, data is pulsed directly onto the communication media in a digital format at a rate corresponding to the specified data transfer rate of the network. The Broadcast uses a radio frequency modulator/demodulator (MODEM) to send data in radio frequency format. This format allows multiple channels and makes it suitable for different applications.⁹ The most common LAN topologies are the ring, the star, the bus, and the mesh which are represented in Figure 2.1.

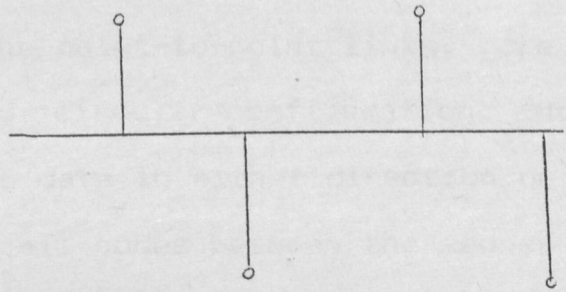
8. Fritz op.Cit

9. Lefkon, R.G. Selecting a Local Area Network, AMA Management briefings, 1986, pp26-27

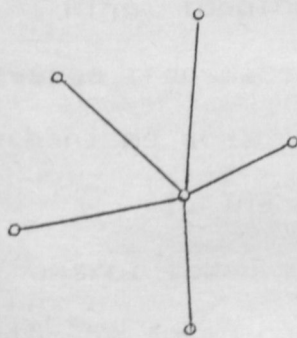
Figure 2.1 Different Network Topologies



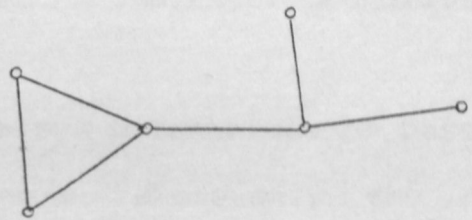
a. Ring Topology



b. Bus Topology



c. Star Topology



d. Mesh Topology

Source: Frintz, J.S. (et.al), Local Area Networks: Selection Guidelines, Prentice-Hall, Inc, New Jersey, p.8.

2.3.1 Ring Topologies

The distinguishing features of ring topologies is that the nodes, which are connected by the point-to-point links, are arranged so that they form a closed, circular configuration. Nodes are able to transmit and receive data in either direction on the ring, but data must pass through all nodes between the sender and the receiver with the possibility of shorter path in one direction or the other.

Ring topologies are categorized according to the type of message transmission mechanism employed. Examples of transmission mechanisms are:

1. The round-robin which employs a technique of passing a control token from one node to the next, where only the node with the token can transmit an arbitrary length message.
2. The slotted ring in which fixed-sized slots are cycled around the ring with a bit indicating whether the slot is full or empty, the node can fill a slot as required or can be assigned a specific slot or set of slots.

Performance of a ring network is dependent upon the message transmission mechanism. A simplistic mechanism requires each node to take messages into buffers as they are passed from node to node in order to interrogate the address field and verify the destination of the message.

Expansion of the ring topology is usually simple. It requires the insertion (electrical) of the new node's interface into the ring. It also involves identifying the new address to the neighboring nodes. Rings provide the best performances for networks with a small number of nodes operating at high speeds over short distances.¹⁰

2.3.2 Star Topologies

The only non-broadcast topology currently available in the commercial LAN market is the star¹¹. The star topology consists of a central node to which every other node is linked via point-to-point connection. The central node controls and routes all network traffic e.g,when messages are sent between the network nodes, the transmitting node makes the request to the central node, which in turn establishes a path to the receiving node. Star topology networks are of two types, circuit switched or message switched.

10. Slonim J.et.al "Considerations for Determining the Degree of Decentralization or Centralization in the Computing Environment", Information and Management, Vol.2, No.1., pp 15-29.

11. Fritz op.cit

With circuit switching, the link between the transmitting and receiving nodes is established on demand for exclusive use of the circuit until the connection is released.

With message switching, the entire message is transmitted to an intermediate point, stored for a short period, and then transmitted again toward its destination. The destination of each message is indicated by an address field in the message.

A single star configuration may be expanded up to the limitations of the central switch. Configurations grow in terms of switching capacity, number of concurrent circuits that may be maintained, and total number of nodes that may be serviced. Switching capacity depends upon the message rates, throughput, and the processing time required for each message. Throughput in a star topology network is the time required for the central switch to process and route a message.

2.3.3 Bus Topologies

The bus network has its nodes connect to a linear length of cable to which user stations are connected by the network interface units. Each network interface unit has a unique identifier address for receipt of transmitted messages. Because of the passive role the nodes play in transmission on the bus, generally a node can fail without affecting the operations of the entire network.

The reliability of a bus network depends on the topology and the control strategy. When using various types of contention control, almost all failures have the same effect as a collision which usually are handled automatically depending on network configuration and management. Network performance is determined by bus band-width, number of nodes, access protocols and the type, average, and peak user data traffic. Bus structure expandability primarily depends on the transmission medium, and the expansion may require the addition of amplifiers or repeaters accordingly. Hardware and software characteristics must also be considered, but generally bus structures are easily re-configured and expanded.

A variation of the bus is the tree topology which splits the bus into different segments. Bridging devices are used to connect the segments. Reliability and performance characteristics are similar to the bus.

2.3.4 Mesh Topologies

Mesh topologies, also called unconstrained or hybrid topologies, are non specific network configurations. The actual connections make up the geometric shape and can vary from one implementation to another, the resulting configuration usually being the most economical one. Mesh topology can be made up of

point-to-point and multipoint data links creating redundant data paths. Nodes can be routing or monitoring depending on the topology.

Performance characteristics of the mesh network utilizing adaptive routing techniques are difficult to predict and often involve complex simulation models. Expandability is relatively easy as long as the connecting nodes can handle the additional traffic.

2.4 Network and Systems Management Products

Network management products are a set of sophisticated tools for the observation and control of complex networks. The tools respond to English like commands and present displays that make use of color graphics to show the condition of the network. The tools also work with a database of configuration information and network parameters. Information in this database can be readily accessed and analyzed.

2.4.1 Network Administration

Network management and control mechanisms are required for configuration control, maintenance, security and accounting purposes. Some of the administrative information to be monitored and collected by the network may include the ones give in Table 2.2 below. Many of these statistics will be used in developing and defining the network traffic workload characterization.

While the knowledge of the technical aspects of Networking is needed to understand its operations, equally important is a study of the organizational, management, and administrative issues that will emerge as a result of implementing a network. Mattison argues that:

"...as managers try to 'forge' hybrids of computers into homogeneous, integrated systems, they are discovering that integration means more than simply the physical compatibility of component parts

... standardized protocols, gateways, machines, and translational strategies can help, but after all the physical incompatibilities have been resolved, a much larger problem, the problem of informational and organizational integration becomes apparent..."¹²

2.4.2 Network Control

Network control can be very sophisticated and is bound to become even more so with continued vendor competition for new products. Most network control functions are desirable rather than mandatory requirements. Some of these are:

- Network interface user assignment
- A user can select his or her own call number, have it
* verified by the controller and inserted into a
look-up table or the controller can assign a call

12. Mattison, M. Robert., "The Organizational and Informational Context of Large Business Systems Integration Projects., SIGNAL RECORD, Vol. 16, No. 2, September 1987, pp 20-35.

number to a new user

- Configuration

The most basic use of network management is to maintain configuration control. Tables and libraries are maintained concerning node addresses, data rates, and other pertinent information.

Table 2.2. Administrative Information Monitored by the Network¹³

-
- Distributions
 - Packet size
 - Packet type
 - Packet arrival times
 - Source of delay
 - Channel acquisition
 - Communication(LAN) delay
 - Successful and unsuccessful transmissions
 - Collision counts
 - Retry counts
 - Communications matrices
 - Terminal-to-host
 - Host-to-Host
 - Terminal- to-Gateway
 - Host-to-Gateway
 - Throughput and utilization
 - Error reporting
 - Equipment status
 - Frequency of use
 - Operational status
 - Line status
-

13. Fritz (p. Cit.)

2.4.3 Maintenance

The individual hardware and software components of the network must be maintained. For hardware, this generally means preventive and corrective maintenance to ensure a working system. With time, most components of the hardware like printers, communications links and work stations will require servicing, or replacement due to malfunctioning or to keep them running efficiently. This means that periodic checks should be made to maintain the system in order.

Software maintenance generally implies change to the software to enhance or modify a network function. Manufacturers of network software are continuously improving on the current network software. With time, it becomes necessary to incorporate this new changes in the existing network due to the changes that will have taken place in the organization. An example here would be a modification of the software to increase data transfer rates or the addition of an application software the users find useful.

SECTION 3

STUDY DESIGN

3.1 Population

This study addresses itself to the immediate system requirements that will be needed in the process of implementing a computer network as an improvement to information management within the campus. The population is made up of the different administrative sections of the campus dealing with student data. These include:

- i) The three departments within the Faculty, these are:
 - Department of Business and Administration
 - Department of Accounting
 - Department of Management Science
- ii) The Deputy Principal's office
- iii) The Library
- iv) The Students Welfare Authority
- v) The Records office

3.2 Research instrument

The data was collected using a non-structured interview guidelines as indicated in sub-section 3.2.1. Open ended type of questions were used. These type of questions were suitable because of the exploratory nature of the study. The interviews were self administered. Secondary data was also collected from the distributors of computer network software and hardware. These comprised of existing network systems and their specifications.

3.2.1 Interview Guideline

1. Name of department or section of the Lower Kabete Campus
.....
2. How many employees are there within your department/section?
?.....
3. How large is the volume of data generated by the following data variables within your department/section ?
 - a) Administrative Purposes
 - b) Financial purposes
 - c) Admissions
 - d) Instructional
4. Where is the data stored ?.....
5. Do you use any machines to assist you in the data collection?
?.....
6. If the answer to (5) is yes, Could you please name all the machines that you use.
 - 1.....
 - 2.....
 - 3.....
 - 4.....
 - 5.....

7. Have you developed any data standards ?.....
8. Do you have any experts involved in the data gathering ?
.....
9. Have you noted any growth in data requirements in your department ?.....
10. Can you list the growth of the most well specified data item within your department/section for the last four years ?
Data item
1986/87
1987/88
1988/89
1989/90
11. How many other departments require data from your section ?
.....
12. Could you please name the departments that need data from your section in the order of increasing needs ?
a)
b)
c)
d)
e)
f)
13. Does Your Department require any information from the other departments ?.....
14. Could you list these departments in the order of importance to your department.
a.
b.
c.
d.
e.
f.
15. How do you communicate with the departments that require data from your department ?.....
.....
.....
.....
16. Where do transactions to update your data occur ?
.....
.....
.....

-
17. How is updating performed ?

18. Does the data within your department become redundant with time ?

19. How are the users of data from your department distributed ?

-
20. Do you encounter any difficulties in data management within your department/section ?

21. Can you list the difficulties that you encounter in data management ?

-
22. Do you encounter any difficulties in data/information communication within your department/section ?

23. Can you list the communication difficulties you encounter ?

-
24. Do you require the services provided by computers at any stage of your information processing ?

25. How do you get access of the services ?

-

3.3 Data Analyses

The data collected was analyzed using tables and figures. Data flow diagrams were also used to analyze the information flow between the various departments and sections of the Lower Kabete Campus.

SECTION 4

RESULTS

4.1 Introduction

The demand on operational capabilities within the three departments of the Lower Kabete Campus follows a very similar trend over the academic year. However, the demand on the same by other support services is not very predictable. The results are divided along these two lines.

The main aim of the interviews was to establish the software and hardware required by each of the sections within the campus. One aspect that was generally observed was the fact that any work that required the use of micro-computers was delayed until there was sufficient time for a member of staff to be sent over to the faculty computer facility. This of course increases the inefficiency of operation within the section.

As indicated in Table 1., the campus population has more than doubled over the last three years. The trend is expected to continue as years go by. Currently, the peak demand on most resources appear to be higher than the operational capabilities of most resources. A thorough analysis of each of the departments operations give a clearer insight into the cause of operation problems especially during peak periods.

4.2 The Deputy Principal's Office.

This office deals with all non-academic affairs of the campus. Its answerable to the Principal of the College of Humanities and Social Sciences of the University of Nairobi. Within the campus, the deputy principal's office is charged with the co-ordination of the recently established Students Welfare Authority. A substantial amount of information flows from the sections of the Students Welfare Authority in the campus to this office. These sections include the the halls of residence, catering services and the health services. Although not directly involved with academic affairs, occasionally, meetings are held between the chairmen of the various departments and the deputy principal to improve on the running of the college.

Most of the information is stored in the form of letters which are filed in cabinets. No data standards have been developed and most filing is done in alphabetical order to ease retrieval. Currently, retrieval is not difficult but any further processing of the stored information is a tiresome process as the only aiding machines are typewriters, calculators and telephones, all which work independently and call for demanding effort in putting the information that each machine produces together. Other sections of the campus do call upon the office for certain information that the office holds which can only be obtained after some delay due to information processing difficulties. The delay

in communication between the office and the sections that require information from the office is also observed during peak demand periods. The mode of communication is through telephone lines, messengers and mail.

Most of the users of data from the office are located locally within the campus apart from the principal's office which is at the main campus a few kilometers away.

Lack of calculation power and manual tabulation of data stand out as two problems that have led to increased communication difficulties. Such services are sought from the Faculty computer facility. The data flow diagram on Figure 4.1(a) illustrates the overall relationship of the various units that seek information from the deputy principal's office.

4.3 The Faculty Departments.

Data on the three departments was collected independently but the analyses revealed very similar operational trends. Demand on the operational capabilities reached a peak at the same time and subsided at a very similar rate. All the departments had minimum activities going on during university vacations and activities were high at the beginning of the semesters and during the examinations period.

All the departments utilize the same communication modes which are, memos, letters, and telephones. Apart from the department of Management Science which utilizes the faculty computer

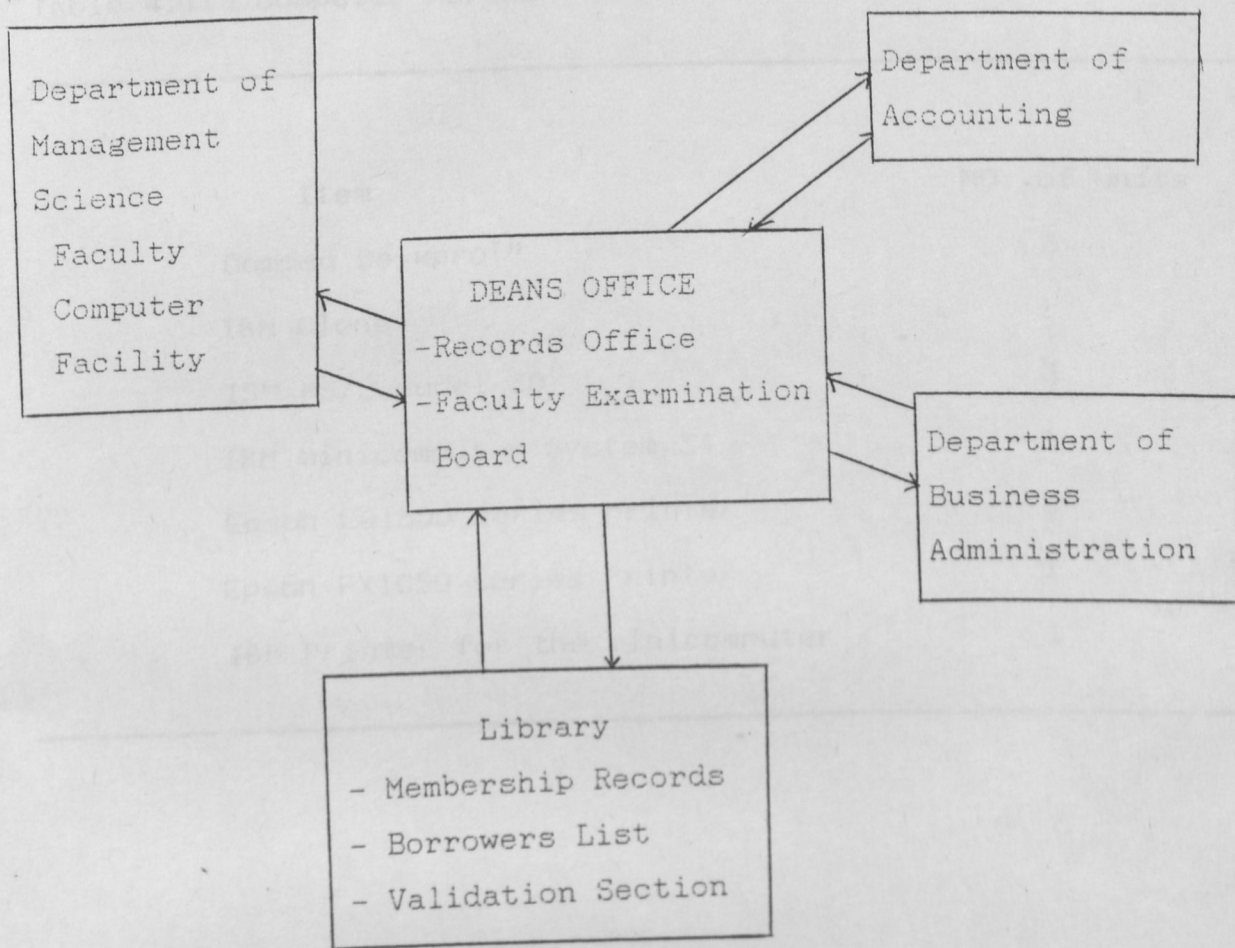
facility to a great extent, other departments make very little use of the facility. For most of their data processing, the Department of Accounting and the Department of Business and Administration request the assistance of the Management Science department personnel. Figure 4.1 (b) shows the information flow within the Faculty.

4.4 The Faculty Computer Facility.

The Faculty of commerce has an assorted collection of different Hardware and Software. However, relatively little use is made of them as compared to their capabilities. Table 4.1(a) and 4.1(b) below gives a list of the hardware and software maintained by the Faculty Computer Facility.

Figure 4.1 (b)

Information Flow Within the Lower Kabete Campus.



See notes in Appendix 3.

Table 4.1(a) Computer Hardware in the Faculty Facility

Item	NO. of Units
Compaq Deskpro™	3
IBM Clone	1
IBM PS/2 model 30	3
IBM minicomputer System 34	1
Epson LQ1500 series printer	2
Epson FX1050 series Printer	1
IBM Printer for the minicomputer	1

Table 4.1(b) Computer Software in the Faculty Computer Facility

Word Processing Software

Word star 2000

Word Perfect

Chiwrite

Spread Sheets

LOTUS

Supercalc

Data Analyses Packages

Statgraphics

SPSS

Data Base Packages

dBASE III plus

Programming Languages

BASIC

RPG II

A major factor which results in under utilization of the facility is lack of computing skills.

4.5 The Library.

Routine work is predominant in the library. This includes the procedures followed in processing borrowers cards, updating catalogues, and following up defaulters. Although currently a definite solution exists to each problem that arises, some of the solutions are only obtained after a lot of routine manual work.

The main media used for communication are telephones, memos, letters, and messengers. Communication between the library and the other sections of the campus are presently convenient. Most of the routine work could very well be computer based.

Current communication channels are sufficient to serve the library and campus information needs but due to the increase in population as indicated in Table 1.1, it will be inevitable to seek for a better communication system. A continuous communication process between the Library and the Dean's office could greatly enhance and improve on the information system management. The relationship between the library and the Dean's office is illustrated in figure 4.1(b).

A software application for the library to keep borrowing records, catalogs, and control circulations would be necessary.

This will make it easy to identify reference materials or books that are available to teach a certain level of syllabus by author, publisher, or subject. It would also improve the control and circulation of library material held by borrowers.

4.6 Suitable Local Area Networks For the Campus

Currently, the demands on the information system within the Lower Kabete Campus are well within the specifications of most available Local Area Networks (see Appendix 3 for network specifications). These include the distances between any two offices which is less than two hundred meters for offices within the campus. Data transfer rate is also not an currently because any system that is found suitable for the campus is able to transfer data at a much faster rate then can be currently achieved.

The magnitude of data that is currently maintained or circulating within the campus is very much below the capacity of most networks which have data transfer rates between 19 KBPS and 10 MBPS as shown in Appendix 3. Also the storage capacity of the computers in the network is very large and occupies very little physical space. In the evaluation of the networks suitable for the campus, the most important aspect to look into is the future expansion in both the hardware as well as software requirements.

In Appendix 2, two networks have been evaluated and in Appendix 3, further network specifications have been given. The OSLAN system has the potential of serving the campus needs for information management and at the same time incorporating future expansion needs. The OSLAN system can utilize the existing micro-computers.

This system also has the ability of interacting with a mainframe and one of the future expansion phase would be to link up the network with the minicomputer in the campus as well as the mainframe computer at the Institute of Computer Science. The software requirements of the campus can all be supported by the the OSLAN system.

Another system considered was the ETHERNET. This system has very similar characteristics to the OSLAN system and can also be of value to the Lower Kabete Campus.

Ethernet is a system for local communication among computing stations. Ethernet uses coaxial cables to carry variable length digital data packets among, for example, personal micro-computers, printing facilities, large file storage devices or even large central computers.

In its current state, the network consist of five Ethernet segments connected together with gateway machines. The network software has the basic motions of file transfer, remote execution, network mail and remote logging.

SECTION 5

CONCLUSIONS

5.1 System Strategy

As per the observations made in the data analyses stage, the Faculty of Commerce should ensure the establishment of an efficient system for information collection, storage, manipulation, and retrieval that will provide planners, staff members, and administrators with up-to-date and accurate data.

The above objective is achievable, by among other things, using an integrated computerized system. The different hardware and software that exist within the campus should be incorporated in the network to reduce cost and also to avoid redundancy of the equipment that already exists. Little use is made of the current equipment as stand alone units. This is due to lack of skills and appropriate support staff, and non-portable software. The campus has plans for future acquisition of computer systems. An information processing strategy would be necessary so as to integrate any computers acquired into a system that will be well utilized by all college members.

The Faculty of Commerce has invested in a number of micro-computers and is also currently equipped with an IBM mini computer. These micro-computers are used by members of the department of Management Science and a few other staff members who have the skill of operating the computers. With appropriate planning,

data interchange between various computer systems located within different office would be possible. The mode of inter-change would be through magnetic media and communication lines networking.

The analyses of the data collected indicate that the enhancement and acquisition of computer systems by most departments within the campus appears to be an inevitable step in improving information management within the campus. The resulting integration will create a total information processing system. The total system will therefore have the capacity to interchange data within the various departments and this will greatly increase information flow within the campus. Common files could be maintained and exchanged over the system whenever need arises.

5.2 System Requirements

5.2.1 Student Statistics.

The Faculty needs a computer based data base on all student related data, and also additional statistical software to support the wide range of research that goes on within the Campus.

Due to limited resources allocated to the faculty, it has become necessary to efficiently utilize them. To achieve this, reliable and timely statistics on expenditure and other student related issues are necessary. Provision of most student related

information to the sections and individuals needing it has been slow, mainly because it takes long to process and analyze the data manually.

The foregoing means that a basic requirement in implementing a network is an information analysis exercise. This will help organize and summarize data that is generated by the day-to-day operations of the campus, making it available to as many users as possible. This will facilitate:

- (a) Maintenance of historical data: This is the data that is collected by the Campus administration over time . A number of research projects are based on student related historical data and also many forward planners base their projections on historical data.

- (b) Up dating: The eventual result of the academic course of a student is an effort of different members of staff. Putting together the course information provided by each staff member becomes quite an easy process when different information sources 'pour' their bits of data into one data base as events occur.

(c) Analyses: It is only from the analyses of data that the campus can have dependable information for decision and policy making. With the continuously changing administration and educational environment, quicker solutions to problems that arise can only be achieved through the use of computer based analytical tools.

5.2.2 Loans Recovery

Within the Ministry of Education there is a section responsible for tracing and managing loan repayments from University graduates. This section is currently trying to compile information on all the loanees, so as to recover outstanding amounts.

The above work has been performed by the ministry manually resulting in approximately 80% default rate.¹⁴ Most of the constraints spelt by the ministry stem back to the management of student information within the university. These constraints are:

- No immediate access to past information on loanees.
- Manual calculation of interest and balances .
- Not easy to determine how the loans were administered.

14. Source: Ministry of Education ,Students Loan Scheme Section.

Here a specific strategy would be to improve on the student loan management within colleges and subsequently passing over the information to the ministry in an easily digestible format. This means that the college would require an application package that tracks student receivables at all campus levels.

5.3 Hardware Requirements

The proposed strategy is based on a package solution. The solution encompasses industry-compatible hardware and is also functionally modular. The total system will then be networked using Open System Local Area Network (OSLAN). This means that the resultant system will not be vulnerable to partial failures of either hardware or software within the network. At the same time, the network will include the current configurations investment in the Faculty Computer Facility.

5.4 Staffing and Training

An information processing strategy utilizing micro-computers and package software is recommended because the environment demands relatively low level technical computer staff. This strategy would reduce the need to train or recruit additional

staff to assist in the daily operations of an information processing system as compared to if, for example, a strategy based on a main frame system was used.

With the growth in the campus population as shown in Table 1.1, information processing and communication modes need to be improved to keep up with the resultant increase in demand on the computer facility and the current communication modes.

5.5 Limitations of the Study

The findings of this study are subject to some limitations. First, the conclusions are not based on quantitative statistics but rather on general observations. This was due to the nature of the study. Secondly, most of the respondents had very little computer knowledge and this resulted in a number of vague answers in the interviews conducted.

5.6 Suggestions for Future Research

Much of the research that has been done on information systems has not really dealt with effects of changes on organizations that are necessary to cope with the technological change. Future research can include:

1. Investigation of the kinds of organizational climate required to cope with future technological innovations.
2. To extend the scope of this study to cover the entire university .
3. Replicate the study in another campus or organization.
4. An appraisal of the network if it is implemented.

APPENDIX 1.

Brief outline of some LAN's

1. OPEN SYSTEMS LOCAL AREA NETWORK COMMUNICATIONS (OSLAN)

OSLAN is a high speed, high integrity Local Area Network. OSLAN will allow communications between different types of computers. An OSLAN network may be enlarged to cope with expanding needs. A small number of servers and work stations may be progressively enlarged to a final system serving the entire University.

Such a system may also interact with the mainframe supported data processing system at Chiromo via communication gateway and external transmission lines.

2. The Standard Ethernet

Ethernet is the digital local Area Network. Ethernet networks provide rapid access to data in remote locations and high data rate supported by Digital DECNET software makes file transfer practical. Following seven years of development, Ethernet was brought to market as a standard in 1980. This was the Ethernet version 1.0 and was submitted for consideration as a standard to the institute of Electrical and Electronics Engineers (IEEE)

In June 1982 most of the companies developing computer networks were required to conform to the standards of IEEE.

Ethernet was then updated to its final 2.0 DIX version and was officially approved by the European computer manufactures Association's (ECMAS) technical committee on communications protocols in 1982. On June 1983, the IEEE and the American National standards institute (ANSI) officially adapted Ethernet as a standard.

Ethernet is a system for local communication among computing stations. Ethernet also uses coaxial cables to carry variable length digital data packets among, for example, personal microcomputers, printing facilities, large file storage devices or even large central computers.

In its current state, the network consist of five Ethernet segments connected together with gateway machines. There is one segment per office building. The network software has the basic motions of file transfer, remote execution, network mail and remote logging. An extended file-system syntax has been added that allows file path names to be specified.¹⁵

Ethernet provides an effective solution to the problem of microcomputer interconnections.

15. The overview of the Ethernet Network were obtained from pamphlets and interviews conducted with the staff of Resources Interlink company, Nairobi.

Standard Ethernet cable is recommend for communications between floors and building. Thin cable is recommended for communications between work stations, personal computers, and low-end systems in local work areas. Ethernet is suitable for customers who must distribute multiple information services to a large user population over an extensive local area.

APPENDIX 2

Some Network Specifications

NETWORK	TRANSMISSION MEDIUM	DATA TYPE	TOPOLOGY	DTR	NSS	MDBD
OMINET	Twisted wire	Digital	Bus	1 Mbps	64	4000ft
IBX/40	Twisted wire	Digital	Star	56.7 Kbps	4,096	29000ft
CCM-200	Coaxial cable	Digital	Bus	19.2Kbps	1,000	10 miles
XODIAC	Twisted wire	Digital	Bus	2Mbps	32 PCs	1Km
LOCALNET	Twisted wire	Audio/Video	Tree	19.2Kbps	20,000	50 Km
AST-STAR	Fiber Optical	Digital	Bus,Star	1 Mbps	16 PCs	8000 ft
10-NET	Coaxial cable	Digital	Bus	1 Mbps	32 PCs	10000ft
10 MEG-FIBER	Twisted wire	Digital	Star	10 Mbps		3Km
10 NET LAN	Twisted wire	Digital	Star	10 Mbps		500m
AST-NET	Coaxial Cable	Digital	Star	5 Mbps	100	1500ft

Source: Obtained From Different LAN Vendors

Appendix 3

Notes on Figures 4.1(a) & 4.1(b)

1. The distance between any two offices is less than two hundred meters. Most of the offices are less than two meters apart. All the Networks that have been appraised have a capacity which is much larger than this distance.
2. The data transfer rates currently is not an issue worth considering because the current data transfer rates can be met by any Network configuration.
3. The arrows indicate the data flow without attaching any magnitude.

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