Chapter 1

INTRODUCTION

Introduction to Network Architecture

Since telephone networks have been successfully adapted for data transmission, there has a rapid growth in data processing system using telecommunication facilities. Today's computer networks range from a small processor that supports a few terminals to a complicated system connecting many processing units and thousands of terminals. Computer and communication can be combined into an integrated system in order to utilize resources more effectively. Communications have provided users an access to computers at various locations. On-line real time systems such as airline and railway reservation system and banking system are these examples. The nature and usage of these systems are varied. However,there are many common parts of the systems involved, which can be mutual utilized of computer systems economically and effectively. Since the main purpose of a network architecture is to standardize structure of a system model, communication protocols and formats, it facilitates to distribute function. Therefore a network architecture is an effective way to realize computer network systems.

Each computer manufacturer has announced its own network architecture, such as DCA (UNIVAC), DECNET (Digital Equipment Corporation), DINA (NEC) , HNA (Hitachi), FNA (Fujitsu), SNA (IBM). Standardization of of network architecture meet the International Organization of Standardization (ISO)[3] document ISO/ TC97 / SC16 / XC16 / N117. Layer structure is common among different network architecture but the number of layer and functions of each layer are not the same.

Purpose of Research

The purpose of this thesis is to study and make use of IBM's System Network Architecture (SNA) in order to improve computer network systems in Thailand. Thai Airways International's computer system will be discussed and design for test case in SNA environment.

Scope of design

A design of computer network for Thai Airways International's computer system using System Network Architecture is based on the current application and future growth. First, present hardware configuration, software configuration, and application programs are studied. Then, design the system using SNA concept, choose appropriate software and hardware and also do any modification that is the prerequisite of SNA . Since the advancement of hardware and software grown rapidly , the design will give the overall picture idea of the system implementation in SNA, not the full detail of each boxes. As a result of this thesis, the design will be helpful for effectively planning and choosing appropriate hardware and software direction.

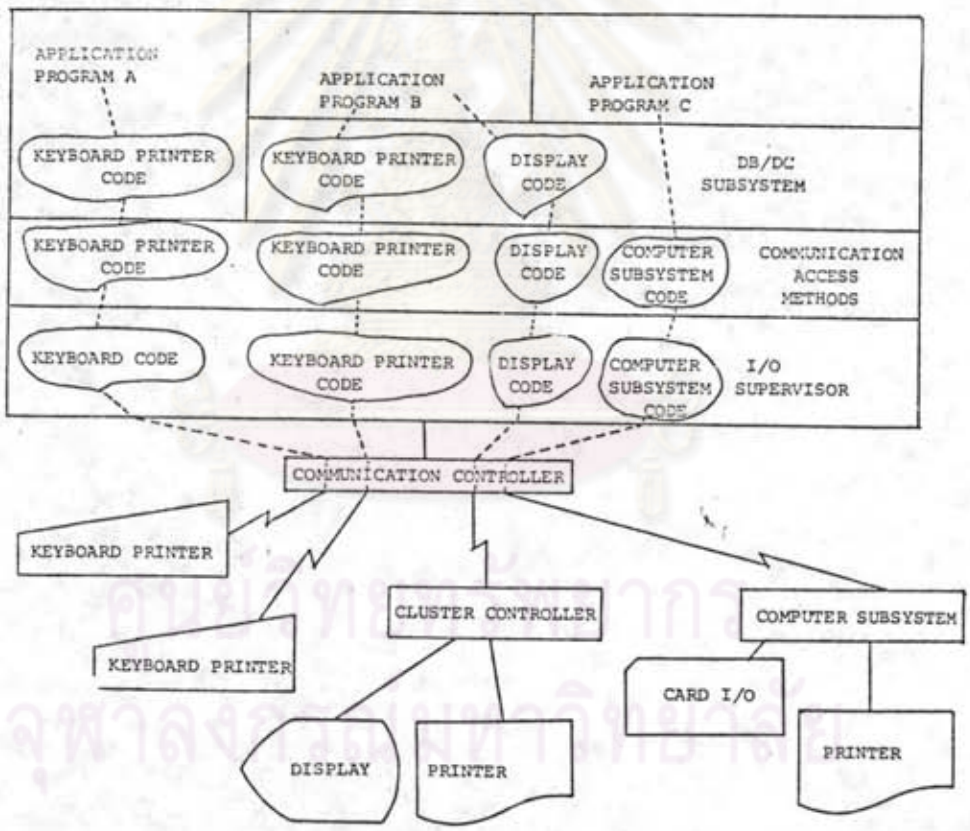

Figure 1-1 Distribution of terminal specific code in an early teleprocessing system

History of Computer Communication

Early computer communication between remote user and central processing unit using slow speed data rate because terminals were operated in start-stop mode. Application program had to provide start-stop line control characters and polling sequences. Each application program had to support every type of terminal. System modifications both hardware and software were costly and consumed a lot of time. When new terminals were added or changed, application program need to be changed. SNA was developed to provide a unified structure for contemporary teleprocessing environment.

SNA devides network functions into discreate layers and defines protocols and formats of communication between equivalent layers. New hardware products and programming need to be developed on this architecture.

Advantages of System Network Architecture (SNA)[22] are

- Improved response times
- Decreased communication lines costs
- Decrease main processor load
- Improved availability

Feature of SNA

- Distributed function
- Attachment independence
- Device dependence
- Configuration flexibility

Basic concept of SNA

A key concept of SNA is the division of the communication system function into a set of logical layers. In the earlier product support programs, these functions are separated into several logical function, but not formalized. SNA defines and formalizes each function layers because of two basic reasons.

1. To permit changes to be made in one layer without effecting other layers

2. To allow interactions between functionally paired layers in different units.

The major functional layers defined by SNA are.

1. Application layer
2. Function Management Layer
3. Transmission Subsystem Layer

Transmission Subsystem Layer

The Transmission Subsystem concerned with routing and movement of data units between origins and destinations. The Transmission Subsystem does not examine , use, or change the contents of these data units. Method of transmission between nodes requires no change in the data units. Application programs and terminal operators can obtain data processing services without involved in transmission details. The Transmission Subsystem may utilize a variety of physical connections and protocols between the nodes of SNA network . A basic design concept of the Transmission Subsystem is the intrigity of data unit exchanged between Function Management Layer.

Function Management Layer

The Function Management Layer is concerned with the preparation of information from one application layer to another application layer. Function Management components convert data into a form convenient for the user. For example, application data originally formatted for a line printer can be converted to a display screen format . The conversion can be done in either central processing unit or in the control unit supporting the display terminal. New programmable control unit is a part of a Function Management Layer because it can be prompt the inexperienced terminal operator by indicator light or informational messages, thus, decreasing the application processing load on the central processing unit (CPU). Separation of Function Management Layer from Application Layer and from Transmission Subsystem Layer allow main processor free from processing any device-specific transformation, and implementation of new products are simple since they effect only function Management Layer.

Application Layer

The Application Layer is concerned only with application functions. This layer performs the user's application processing and need not be involved in the protocol or procedure for controlling a communication line

or routing data units through the networks. In the computer, the application layer consists of the application programs. At the terminal, the application layer is represented by the terminal operator or an application program in a programmable control unit. SNA refers the sources and destinations of information as 'end user'.

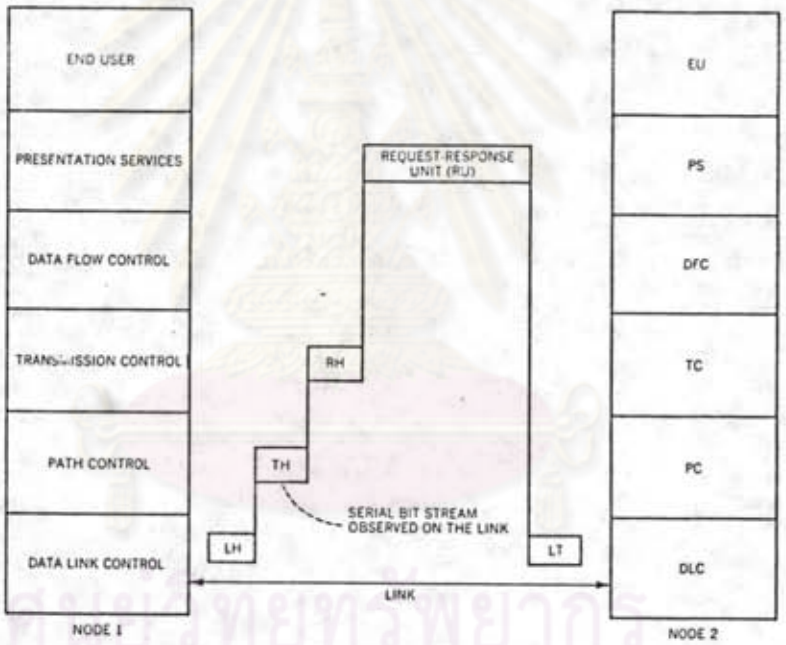

Figure 1-2 Layer Structure of SNA

Network Access Path [2]

The basic function to be performed by computer network is to provide the access paths for and end user at one geographical location to access other end user at another geographical location. There are many ways to characterize networks, for example:

1 According to particular application (banking, time sharing).
2 According to geography (in plant, out plant).
3 According to ownership (public, private).

Another way of characterizing networks is to examine topological character of transmission lines that connect together the nodes at which the different end user are located. Some examples of network topologies are.

A Star

B Multidrop

C loop

D Tree

E Mesh

F Mesh of trees

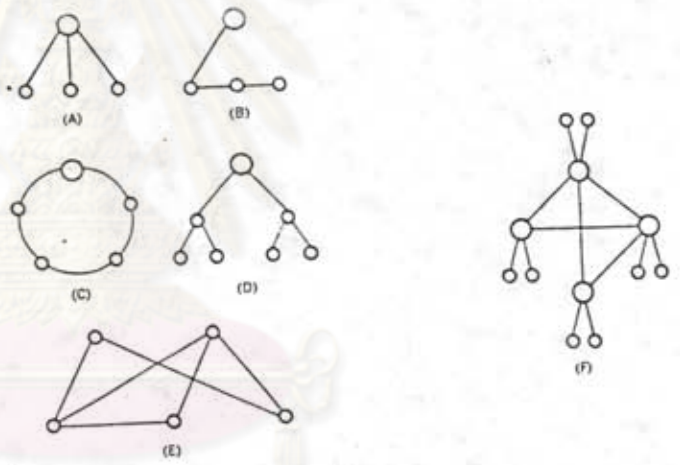

Figure 1-3 Network topologies

Access path requirement

In order to give a user access to processor-based resource, several components are implemented.

1 Common carrier, is a set of physical transmission lines from the origin node to the destination node. In out - plant situation, this is done by common carrier provided links, either physical wires or satellite.

2 Modem (modulator-demodulator units) , provide the function of changing the energy in voice frequency range in the lines to data bits at both end.

3 Data link control, provide a capability for making sure that the bit stream received is an error free from bit stream transmitted. The simple data link control is asynchronous (start-stop) mode, which we still use in slow speed terminal such as teletype. Synchronous character oriented data link control (such as Binary Synchronous Control ,BSC) provide better line control compare to asynchronous data link control, but retain several disadvantages . The same set of chracter (for example ASCII or EBCDIC) and the same position in data frame are used for line control character, text chracter, and device control character. Therefor, text chracter could be converted by noise to control character

The other disadvantage is the line control characters are taken from the same alphabet as device control and text character. So everytime the new choice of alphabet is made for particular needs of some users, the line control need to be changed.

The new bit oriented data link controls such as High Level Data Link control (HDLC) , Advanced Data Communication Control Protocol (ADCCP) and Synchronous Data Link Control (SDLC) are the new concept with proof much better performance than the old DLC. In these protocols, line control information always occurs at its own same place in a frame. The line control commands are specified as bit pattern that have nothing to do with any alphabet set. HDLC is the standard being developed by the International Standard Organization (ISO), ADCCP is the standard of American National Standard Institute , and SDLC protocol is the IBM version.

4 Addressing, routing, packetizing provide the capacity of sharing one line to many users. Address fields and control characters are added to the Data Link Control for multiple nodes per leased line. Packetizing is the method of segmenting the long messages to frame by frame basis in order to match the available buffer size.

5 Dialogue management provide the control of data flow between end user and decide when and end user should listen or when it should talk.

Once the listed elements are provided , the access path can be considered complete. This is shown in fig 1-4 . The elements occur in pairs and the two members of each pair talk to each other. For example, one modem talks to the other , ignoring both details of the transmission link and meaning of bits. As another example, a Data Link Control ignores what its modem is doing about modulation and demodulation and also what information with in a frame contains.

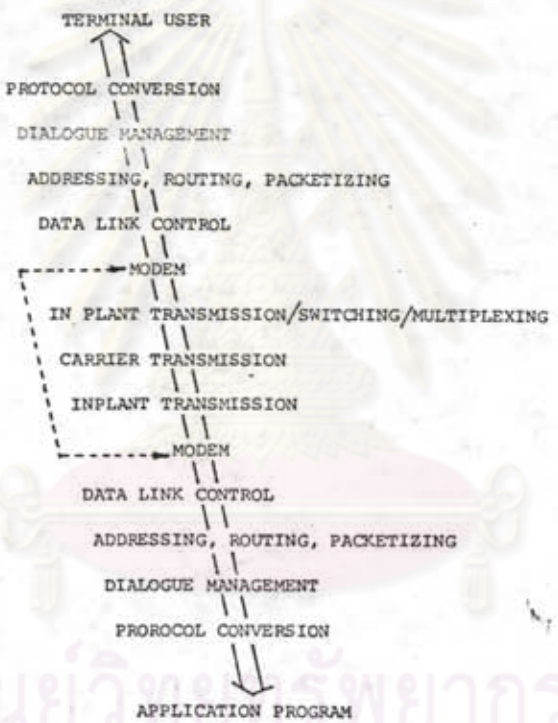

Figure 1-4 Access path elements