CHAPTER I

INTRODUCTION

Networking technologies play important role in our lives. It is undisputed that Internet has become an integral part of Education, Business, Industry, Economy as well as residential world of our society. Performance based network infrastructure and bounded end-to-end delays is the need of ever growing Internet and distributed real-time applications. Asynchronous Transfer Mode (ATM) is described as the future computer networking paradigm [10] [25] [28]. It is a high speed, connection-oriented switching and multiplexing technology that uses short, fixed-length packets called cells to transmit all types of traffic concurrently, viz Voice, Video and Data. ATM technology has an enormous impact on future distributed systems because of its attractive features.

ATM is extremely reliable network service which is becoming increasingly essential for present day Internet. The core features of ATM technology are:

i) Enables high bandwidth distributed applications by providing data transmission speeds potentially up to 2.5 Gbps for both local area and wide area networks and services.

ii) Supports both fundamental approaches to switching viz circuit switching and packet switching, within a single integrated switching mechanism, called cell switching.

iii) Uses virtual networking for point-to-point communication and as well supports multicasting.

iv) Enables transport of a wide range of multimedia data such as Text, Voice and Video efficiently over a single network.

v) It is a Scalable technology.

vi) Has a fairly solid base of standards. Adopted by International Telecommunications Union (ITU) and Broadband Integrated Services Digital Network (B-ISDN).
1.1 BACKGROUND

Networking requirements are primarily classified into two broad categories, voice communication and data communication. Voice communication requires fixed bandwidth, low delay and is tolerant to occasional information loss. Data communication is bursty in nature. Though data is tolerant to higher transit delays, it is susceptible to information loss. In times of yore, the networking fraternity was divided into two groups viz the telecommunication world and data communication world. Telecommunication world is supervised by International Telecommunications Union-Telecommunication (ITU-T) and deals with voice conversation services. The basic services offered include telephony and facsimile. The data communication world is supervised by the organizations like Internet Engineering Task Force (IETF), the Institute of Electrical and Electronic Engineers (IEEE) and the International Standards Organization (ISO). The services offered include data transfer in LAN and WAN environment.

Till recently, voice was carried using circuit-switched networks. Packet based networks were considered unsuitable for voice because of unpredictable and high delay characteristics. Specialized software packages, compression, silence suppression schemes and echo cancellation techniques have improved the voice quality over Internet. The quality of voice over Internet is inferior, but the price differential makes Internet telephony highly attractive [31].

The telecommunication body ITU-T developed Integrated Services Digital Network (ISDN) with a motivation to provide digital pipe for integrated services like Voice, Video and Data. The development of Narrowband ISDN (N-ISDN) provides unified network for different applications. Inherent limitations of N-ISDN forced ITU-T to look at alternatives that would satisfy the increased bandwidth demand without sacrificing efficiency. ATM technology is developed to fulfill the requirements for Broadband ISDN (B-ISDN) services. B-ISDN aims to provide integrated services, albeit higher data rates. ATM is developed to expedite the process of convergence and provide a synergy between the telecommunication and data communication sectors.

Internet does not provide any inherent mechanism for Quality of Service (QoS); a protocol is desired that would allow IP real-time applications to specify
delay bounds. As a result, the Resource reSerVation Protocol (RSVP) is defined by IETF, with the purpose of allowing applications to set up reservations for network resources. Pervasiveness of ATM lies in the fact that it seamlessly integrates LAN and WAN. ATM provides a single platform, thereby leveraging the process of network convergence apart from inherent QoS [2] [10] [25] [27] [28].

1.2 PROBLEM FORMULATION

The purpose of present work is to build and simulate a distributed real-time system that utilizes the strength of the ATM technology and compare its performance with existing IP technologies such as Ethernet, LAN and TCP/IP inter-networking and also to study QoS provisions of the system.

1.3 PRESENT WORK

The real-time distributed system defined for this study is a model of Network for Technical University (NTU). The structure of Technical University has at layer 1 the University, at layer 2 number of regions distributed geographically, at layer 3 a number of colleges in the geographical location and at layer 4 a number of departments within the college campus. The different regions of Technical University and the different colleges under a region are knit by Public Networks. The departments of a college use a Private Network. Each department is facilitated with bidirectional multimedia communication over a single network.

OPNET IT Guru Academic Edition 9.1, 2003, simulation tool is used for NTU system. The tool provides a virtual environment for modeling, analyzing and predicting the performance of IT infrastructures including applications, servers and networking technologies. The tool has Graphical User Interface (GUI) environment that “directly mirrors actual networks, devices, protocol and applications” [11] and allows network analysis that are integrated within.
1.4 ORGANIZATION OF THE THESIS

Chapter 1 deals with introduction, background, problem formulation, present work and organization of the thesis.

Chapter 2 provides an overview of ATM. This chapter discusses basics of ATM, Traffic Management and QoS, Traffic Descriptors, Service Categories, Connection Admission Control and Congestion Control.

Chapter 3 provides detailed information on QoS in ATM and IP networks. It discusses QoS and traffic management in the internet and reserving the resources of the network using RSVP. The inherent features of QoS and traffic management in ATM networks are discussed. Finally, signaling and QoS negotiation in ATM are discussed.

Chapter 4 deals with design features of NTU system. The architecture and hierarchical layers of NTU system for implementation and evaluation is discussed. It also provides the methodology followed to design and build the NTU simulation model. In particular, it explains the implementation of each layer of the NTU system, as well as the methodology that is followed for the specification of QoS in OPNET IT Guru Academic Simulation tool.

Finally, Chapter 5 discusses the results obtained by simulating each scenario. The conclusions are drawn based on the system study. In addition, some suggestions for potential work in the area are specified.