ATM Networks
Concepts and Protocols

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Dedication

To my mother, Sneha Lata Kasera for making me what I am
— Sumit

To my parents, and brothers
— Pankaj

Preface

It goes without saying that we are now living in a networked world; a world where networking technologies play a very important role in our lives. Be it the railway booking counter, or automated banking, be it the ubiquitous Internet or the global wireless telephony systems, a life without networks is inconceivable.

Among the plethora of networking technologies that have emerged over the last decade, ATM is considered to be a breakthrough one. The popularity and pervasiveness of ATM lies in the fact that it seamlessly integrates local area network and wide area network—a concept also referred to as *single network for desktop-to-the-core*. Moreover, ATM provides a single platform for voice, video and data, thereby leveraging the process of *network convergence*. Apart from this, ATM also provides quality of service. All these factors are considered unique selling points of ATM technology.

When we first laid our hands on ATM technology and wanted to know more on the subject, we found to our surprise that there was hardly any book that provided a conceptual treatment to ATM. This was despite the fact that ATM technology had attracted widespread interest. Majority of the books were a shadow of ATM standards, derived from ITU-T and ATM Forum publications. Moreover, these books had too many underlying assumptions and were hopefully inadequate in giving an insight into the topic. The concepts got hidden in too many abbreviations and too many jargons. The result was that people were more concerned with whether ATM was a 'telecommunication network' or a 'datacommunication network', rather than trying to understand what either of them meant. We also observed that authors of technical books wrote with the assumption that technical stuff ought to be complicated because it is technical. Contrary to the above viewpoint, we believed that everything is more or less simple unless made otherwise.

Given this, we felt a need to write a book on the subject that was simple, and easy to understand; a book that could solve the problems that we were facing when we were studying; a book that provided a comprehensive overview of ATM, and a book that offered fewer assumptions. This thought provided us the motivation to write a book.

Around the same time, we got an opportunity to work on the development of ATM signaling software. This project provided us in-depth knowledge of ATM because signaling

covers almost every aspect of ATM. Since then, we have worked on a number of projects on ATM, as well as on related technologies like Frame Relay (FR) and Internet Protocol (IP). These projects have provided us the requisite technical know-how to write this book.

This book was written in nearly 2 years time. During the first half of the activity, Pankaj was actively involved in writing the manuscript, after which he left for the US to pursue MS at the Ohio State University. Since then he has contributed by reviewing the manuscript and providing miscellaneous support.

The Book

The organization of this book is novel and unprecedented. We have tried to ensure that the concepts and the protocols are treated separately. To achieve this, we have divided some of the chapters into two parts (as is the case in Chapters 5, 6, 7, 8, and 9). In these chapters, the first part elucidates the general concepts and principles, while the second part explains how the concepts and principles apply to ATM. For other chapters, we have provided enough background information so that the reader can comprehend complicated topics. The underlying idea is to do away with most of the assumptions and to make this book as self-sufficient and simple as possible.

- **Chapter 1** talks about the factors that have a significant influence on shaping the current technologies. This is useful in the sense that it provides the perspective as to *why ATM is what it is*.
- **Chapter 2** refreshes the basic topics on networking. The key concepts discussed in this chapter include *types of network services* (connection-oriented versus connection less), *protocol layering* (layered abstraction and OSI model) and *switching* (circuit-switching versus packet switching). Chapter 2 provides the background knowledge for Chapter 3.
- **Chapter 3** essentially provides an overview to ATM, which includes a number of aspects of ATM like its *definition, genesis, basic principles, virtual-circuit concepts,* and *ATM protocol stack*. A preview of some of the precursor technologies like X.25, frame relay, and ISDN is also provided in this chapter. Then, this chapter looks at the *relationship between ATM and B-ISDN*, which people find quite confusing.
- **Chapter 4** expands upon the ATM protocol stack discussed in the previous chapter and provides detailed information. The protocol stack essentially comprises *physical layer*, *ATM layer*, and *ATM Adaptation Layer (AAL)*. This chapter covers all these layers. In

particular, it discusses a number of physical layer options for ATM, the functions of ATM layer, and provides a detailed description of various AALs.

The next five chapters (i.e. Chapters 5 to 9) are where the beauty of this book lies. As briefly stated earlier, each chapter has two parts. Part one discusses basic concepts, while part two talks about how the concepts apply to ATM.

- **Chapter 5** is titled "Traffic Management" and talks about *traffic management concepts, tools* and *techniques*. The important topics covered in this chapter include *connection admission control, congestion control,* and *flow control*. Apart from these topics, the concept of *traffic-descriptors* and *service-descriptors* is also elucidated. It is in this chapter that the concept of *Quality of Service (QoS)*, which forms the strength of ATM, is explained.
- **Chapter 6** talks about *switch design*. Following the style of Chapter 5, the first part of this chapter talks about buffering techniques including *input buffering*, *output buffering*, and *shared buffering*. This part also discusses important switching architectures like *shared-memory architecture*, *shared-medium architecture* and *space-division architecture*. In part two, a number of ATM switch architectures including Prelude, PARIS, Knockout, Starlite, and Moonshine are discussed.
- **Chapter 7** is probably one of the most well-written chapters. The reason being that we had implemented the complete ATM signaling software. The implementation provided us with the first hand knowledge about ATM signaling. The first part of this chapter talks about signaling concepts like *signaling channels*, *signaling models* and *signaling-protocol-design*. The second part talks about various *ATM signaling standards* (like Q.2931, Q.2971, and UNI 4.0).
- **Chapter 8** is titled "Addressing and Routing". The first part is very comprehensive and provides a very good understanding of *addressing* and *routing*. The second part is a detailed description of *Private Network-Node Interface* (PNNI), which is a routing and signaling protocol for ATM. Note that PNNI is a signaling as well as routing protocol, but is discussed only in Chapter 8, and not in Chapter 7.
- **Chapter 9** discusses network management. The first part explains three important network management models, *OSI* model, *Simple Network Management Protocol* (SNMP) model and *Telecommunication Management Network* (TMN) model. The second part explains how these models apply to ATM. In particular, Chapter 9 is a discussion of essential ATM network management standards, as provided by various governing bodies.
- **Chapter 10** is the chapter on interworking. Unlike the previous chapters, it has only one part. Nonetheless, all topics mentioned in this chapter are briefly introduced (provided

the topic has not been covered earlier). The key topics covered are LAN Emulation (LANE), IP over ATM (IPOA), and Multiprotocol over ATM (MPOA).

Since this book provides comprehensive coverage of the basic concepts of ATM, avoids complicated mathematical formulae, and makes minimal assumptions, it will benefit a wide spectrum of audience. This includes students studying ATM for the first time or doing research on ATM; engineers engaged in switch design, protocol stack development and technical research; and marketing people. All will find this book extremely readable and very informative.

The authors would also like to add that the views expressed in the book are entirely their own and does not reflect the views of their company.

Suggestions

- Your comments are valuable to us. So, please send your comments and suggestions for improvement at s.kasera@mailcity.com. We would be glad to incorporate your comments in the next edition of the book.
- Since standardization is an ongoing activity, some of the standards quoted in this book have been superseded by newer specifications. Some of these have been explicitly mentioned in the reference section. For others, the reader is advised to cross-check from the appropriate governing body. For ATM Forum specifications, the reader could browse www.atmforum.com. For ITUT recommendations, could go to www.itu.ch. For Internet RFCs, the reader could browse http://www.ietf.org/rfc.html.

Sumit Kasera
Pankaj Sethi

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