

Performance Evaluation of Connectionless Service for ATM Networks

Duke P. Hong and Tatsuya Suda *

*Department of Information and Computer Science,
University of California, Irvine, CA 92717-3425*

GLOBECOM '95 Paper 26.6

Abstract

This paper investigates the performance of the *direct* approach to connectionless service over ATM. The direct approach utilizes connectionless servers, attached to or incorporated in a subset of the ATM switches, to provide a packet switching service. The number of connectionless servers and ATM connections utilized by the direct approach is found analytically and compared to alternative approaches. Furthermore, the effects of two architectural options that significantly impact the performance of connectionless servers, the packet forwarding scheme (packet-based and cell-based) and the flow control scheme (static rate control and a dynamic proportional rate control) are also evaluated.

1 Introduction

While emerging Asynchronous Transfer Mode (ATM) networks must be capable of supporting future applications such as digital voice and video, many of the design choices made to optimize ATM for voice and video render the transport of traditional connectionless data traffic difficult. If ATM is to be widely accepted, it must efficiently support diverse data applications. However, there are substantial differences between ATM and existing data networks. Two major differences are the connection-oriented service of ATM versus the connectionless nature of many existing LANs and the small fixed cell size employed by ATM versus larger variable sized datagrams.

There are two main approaches to providing connectionless data service in ATM networks. One approach is to use the connection-oriented service of ATM to provide trunks between each pair of communicating ATM end systems. An example in Figure 1(a) illustrates ATM end systems, the ATM-to-LAN interworking units, maintaining ATM connections to other interworking units. Note that a separate connection is required for each destination ES. This approach is called the *indirect* or *connection based* approach since the network only indirectly achieves connectionless service through the use of connections provided by ATM.

A second approach is based on the deployment of connectionless servers (CLS) throughout the network, interconnected to form a virtual connectionless network [1]. Unlike ATM switches, which operate at the cell level, connectionless servers operate at the packet level offering a

datagram routing service. By attaching connectionless servers to a subset of the ATM switches and using ATM connections between the CLS's, various topologies may be formed [2]. An example configuration is shown in Figure 1(b). With this approach, an end system needs only one open connection to send packets to any number of destinations. This method is called the *direct* or *server based* approach because the ATM network provides connectionless service directly to the end systems using connectionless servers.

The direct and indirect approaches require different sets of resources. The direct approach may require significantly fewer connections than the indirect approach but requires connectionless servers to be deployed. The number of connections may become a significant factor in large networks where the number of VPI/VCI's a switch can process may be limited. It may also require significantly fewer connection set-ups. These issues are explored in Section 2.

The effectiveness of the direct approach also depends on the performance of the connectionless servers themselves. Two factors that significantly affect CLS performance, the packet forwarding method and the flow control method, are explored in Section 3.

Concluding remarks are presented in section 4.

2 Comparison of Direct and Indirect Approaches

This section presents a quantitative comparison of the direct and indirect approaches utilizing a simple analytical model. As one of the major advantages of the direct approach is the fewer number of ATM connections required, this issue will be explored below.

It is assumed that the indirect approach sets up an ATM connection when a conversation¹ begins between a pair of ATM end systems for which no connection is currently open. A single connection may carry more than one conversation between a pair of end systems. The connection is torn down when there are no longer any active conversations to use it.

For the direct approach, it is assumed that a single ATM connection is opened between an end system and a connectionless server whenever the end system has any active conversations. The connectionless servers are assumed to maintain permanent connections between each other.

The conversations are independently generated at each end system according to a Poisson process with mean rate λ . Conversation durations are assumed to be exponentially distributed with mean β . The probability, c_i , that

*This research is supported in part by grants from the University of California MICRO program, the Pacific Bell CalREN program, Hughes Aircraft, Nippon Steel Information and Communication Systems Inc. (ENICOM), Hitachi Ltd., Hitachi America, Tokyo Electric Power Company, Nippon Telegraph and Telephone Corporation (NTT), Hewlett Packard (HP), and SUN micro systems.

¹A conversation is a series of packets between two hosts, such as during a file transfer or telnet session.

Performance Evaluation And Applications Of Atm Networks

**Mohammad S. Obaidat, Georgios I.
Papadimitriou**



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Application and Theory of Petri Nets 1998 Jörg Desel, Manuel Silva, 2003-06-26 This volume contains the proceedings of the 19th annual International Conference on Application and Theory of Petri Nets The aim of the Petri net conference is to create a forum for the dissemination of the latest results in the application and theory of Petri nets It always takes place in the last week of June Typically there are 150 200 participants About one third of these come from industry while the rest are from universities and research institutions The conferences and a number of other activities are coordinated by a steering committee with the following members G Balbo Italy J Billington Australia G DeMichelis Italy C Girault France K Jensen Denmark S Kumagai Japan T Murata USA C A Petri Germany honorary member W Reisig Germany G Roucairol France G Rozenberg The Netherlands chairman M Silva Spain The 19th conference has been organized for the rst time in Portugal by the Department of Electrical Engineering of the Faculty of Sciences and Technology of the New University of Lisbon together with the Center for Intelligent Robotics of UNINOVA It takes place in Lisbon at the same time as EXPO 98 the last world exhibition of the 20th century **Applied System Simulation** Mohammad S. Obaidat, Georgios I. Papadimitriou, 2012-12-06

Simulation and modeling are efficient techniques that can aid the city and regional planners and engineers in optimizing the operation of urban systems such as traffic light control highway toll automation consensus building public safety and environmental protection When modeling transportation systems such as freeway systems arterial or downtown grid systems the city planner and engineer is concerned with capturing the varied interactions between drivers automobiles and the infrastructure Modeling and simulation are used to effectively optimize the design and operation of all of these urban systems It is possible that in an urban simulation community workshop citizens can work interactively in front of computers and be able using the click of the mouse to walk up to their own front porch looking at the proposed shopping mall alternatives across the street from virtually any angle and proposed bridge or tunnel and see how it can reduce traffic congestion Buildings can be scaled down or taken out their orientation can be changed in order to check the view and orientation in order to have better site with efficient energy conservation The stone or brick material on a building can be replaced by colored concrete or more trees and lampposts can be placed on the site Such flexibility in simulation and animation allows creative ideas in the design and orientation of urban sites to be demonstrated to citizens and decision makers before final realization

High-Speed Networking for Multimedia Applications Wolfgang Effelsberg, Otto Spaniol, André Danthine, Domenico Ferrari, 2012-12-06 High Speed Networking for Multimedia Applications presents the latest research on the architecture and protocols for high speed networks focusing on communication support for distributed multimedia applications This includes the two major issues of ATM Networking and quality of service for multimedia applications It is to be expected that most of the bandwidth in future high speed networks will be taken up by multimedia applications transmitting digital audio and video Traditional networking protocols are not suitable for this as they do not provide guaranteed bandwidth end to end delay or delay jitter nor do they have addressing schemes or routing algorithms for multicast connections High Speed Networking for Multimedia Applications is a collection of high quality research papers which address these issues providing interesting and innovative solutions It is an essential reference for engineers and computer scientists working in this area It is also a comprehensive text for graduate students of high speed networking and multimedia applications

The Fundamental Role of Teletraffic in the Evolution of Telecommunications Networks J. Labetoulle, J.W. Roberts, 2013-10-22 The International Teletraffic Congress ITC is a recognized international organization taking part in the work of the International Telecommunications Union The congress traditionally deals with the development of teletraffic theory and its applications to the design planning and operation of telecommunication systems networks and services The contents of ITC 14 illustrate the important role of teletraffic in the current period of rapid evolution of telecommunication networks A large number of papers address the teletraffic issues behind developments in broadband communications and ATM technology The extension of possibilities for user mobility and personal communications together with the generalization of common channel signalling and the provision of new intelligent network services are further

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Proceedings of the International Workshop on Applications of Neural Networks to Telecommunications Joshua Alspector, Rodney Goodman, Timothy X.

Brown, 2013-06-17 The world is witnessing the rapid evolution of its own nervous system by an unparalleled growth in communication technology Like the evolution of the nervous systems in animals this growth is being driven by a survival of the fittest mechanism In telecommunications the entities that fuel this growth are companies and nations who compete with each other Companies with superior information systems can outrun and outsmart others because they serve their customers better On the threshold of an explosion in the variety speed and usefulness of telecommunication networks neural network researchers can make important contributions to this emerging new telecommunications infrastructure The first International Workshop on Applications of Neural Networks to Telecommunications IWANNT was planned in response to the telecommunications industry's needs for new adaptive technologies This workshop featured 50 talks and posters that were selected by an organizing committee of experts in both telecommunications and neural networks These proceedings will also be available on line in an electronic format providing multimedia figures cross referencing and annotation

Recent Advances in Statistics and Probability J. P. Vilaplana, M. N. Puri, 2020-05-18 No detailed description available for Recent Advances in Statistics and Probability

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Broadband Communications Paul J. Kühn, Roya Ulrich, 2013-06-29 New Services such as for Internet data and multimedia applications have caused a fast growing demand for broadband communications The fundamental technologies for the integration of these services have

been developed in the last decade optical communications photonic switching high speed local area networks Asynchronous Transfer Mode ATM ISDN and B ISDN Internet packet networks and mobile communications The development was possible through the dynamic progress in communication and computer technologies and through worldwide standardization activities within ITU T the ATM Forum the IETF IEEE ANSI ETSI and other bodies These developments have been supported by research and field trial programmes Past developments such as about LAN Internet or ISDN networking technologies have shown that it needs a time span of 10 years for a new technology from its research stage to its full application Broadband Communications is just at its onset for full deployment It will have a dramatic effect not only on the networking situation but on the whole development of information technology throughout our social and economic life which is expressed by the conference theme The Future of Telecommunications The Broadband Communications conference series of IFIP WG 6.2 addresses the fundamental technical and theoretical problems related with these technologies BC 98 is the fourth meeting in a series on conferences being held in Stuttgart Germany The previous conferences were held in Estoril Portugal in 1992 in Paris France in 1994 and in Montreal Canada in 1996

European Optical Communications and Networks: Papers on networks Conference on European Fibre Optic Communications and Networks (11, 1993, 's-Gravenhage),1993 Database and Data Communication Network Systems, Three-Volume Set Cornelius T. Leondes,2002-07-09 Database and Data Communication Network Systems examines the utilization of the Internet and Local Area Wide Area Networks in all areas of human endeavor This three volume set covers among other topics database systems data compression database architecture data acquisition asynchronous transfer mode ATM and the practical application of these technologies The international collection of contributors was culled from exhaustive research of over 100 000 related archival and technical journals This reference will be indispensable to engineering and computer science libraries research libraries and telecommunications networking and computer companies It covers a diverse array of topics including Techniques in emerging database system architectures Techniques and applications in data mining Object oriented database systems Data acquisition on the WWW during heavy client server traffic periods Information exploration on the WWW Education and training in multimedia database systems Data structure techniques in rapid prototyping and manufacturing Wireless ATM in data networks for mobile systems Applications in corporate finance Scientific data visualization Data compression and information retrieval Techniques in medical systems intensive care units

Queueing Modelling Fundamentals Professor Chee-Hock Ng,Professor Soong Boon-Hee,2008-04-30 Queueing analysis is a vital tool used in the evaluation of system performance Applications of queueing analysis cover a wide spectrum from bank automated teller machines to transportation and communications data networks Fully revised this second edition of a popular book contains the significant addition of a new chapter on Flow Congestion Control and a section on Network Calculus among other new sections that have been added to remaining chapters An introductory text Queueing Modelling Fundamentals focuses on queueing modelling techniques and

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Information Highways for a Smaller World and Better Living Seon Jong Chung,1996 This work discusses the issues among people creating computer communication technology the people using computer communication the people impacted by it and the regulators responsible for balancing the interest of these multiple groups

Multimedia Networking: Technology, Management and Applications Syed, Mahbubur Rahman,2001-07-01 In recent years rapid Internet growth has pushed the development of new multimedia applications in all aspects of life such as entertainment communication collaborative work and electronic commerce Future applications will make use of different technologies like voice data and video but in order to make such a wide variety of multimedia applications successful a number of technology and management issues must be addressed Multimedia Networking Technology Management and Applications addresses the dynamic and efficient uses of resources a fundamental aspect of multimedia networks Geared toward professionals educators and students alike this exciting new book will detail current research and the future direction of multimedia networking

Core Networks and Network Management D. W. Faulkner,Alan Harmer,1999 WDM Networks and Systems Network Planning and Management The demand for ever more capacity over the lucrative long haul routes coupled with the need for higher reliability is pushing optical technology towards its limits WDM systems allow upgrading of existing core networks and offer new opportunities for long haul systems design towards ultimate terrabit systems The prospect of an all optical layer offers new possibilities for dynamic management of capacity and protection switching Papers published in these proceedings Explore business opportunities for WDM systems Highlight recent advances in key technologies such as add drop multiplexers arrayed planar waveguides and broadband EDFAs Present new bandwidth management techniques Push the transmission limits to the technology by minimising dispersion non linearities and intermodulation effects and charts the way to soliton systems

Networked Data Acquisition Systems (Daq 96) - Proceedings Of The Second International Data Acquisition

Workshop Shuhei Ajimura, Masaharu Nomachi, 1997-07-15 This workshop followed the First International Conference which was hosted by Fermilab on 26-28 October 1994. That conference discussed the switch type event builder. Much intensive R D work ensued from it showing the importance of 1 data flow control and 2 high speed memory access on network adapters/drivers. Those two themes are involved in many networked data acquisition systems. Therefore Networked Data Acquisition Systems was selected as the theme of DAQ 96. It includes a wide variety of data acquisition system presentations from present and near future experiments at high energy and nuclear physics laboratories. *Multimedia Communications* Francesco De Natale, Silvano Pupolin, 2012-12-06 Multimedia Communications is at the core of the advanced interactive services that make up today's Information Society. Videoconferencing, teleworking, teleshopping and video on demand will benefit from developments in broadband and mobile telecommunication systems, intelligent multimedia terminals and digital signal processing. The latest research findings from these fields are presented here in the proceedings of the 10th Tyrrhenian Workshop on Digital Communications held in Ischia, Italy, September 19-1998. Focus is placed on the following four areas: Signal Processing for Multimedia Communications, Modeling, Analysis and Simulation of Multimedia Traffic Sources, Access Techniques, Multimode Multimedia Terminals. In particular, multimedia services and applications are presented. This comprehensive collection of papers will enable the reader to keep pace with the rapid changes that are taking place in this field. Experts have co-operated with top research centers worldwide on an academic and industrial level to make this an up-to-date reference volume for all those who are concerned with technological advances in Multimedia Distributed Systems.

Advances in Databases and Information Systems Johann Eder, Ivan Rozman, Tatjana Welzer, 1999-09 This book constitutes the refereed proceedings of the Third East European Conference on Advances in Databases and Information Systems ADBIS 99 held in Maribor, Slovenia, in September 1999. The 26 revised full papers presented together with two invited papers were carefully reviewed and selected from a total of 94 submissions. The papers are organized in topical sections on information retrieval and multimedia integration, transactions, index structures, agent technology, data mining, data modeling, incomplete data queries, database theory and performance issues. *Networks: The Next Millennium - Proceedings Of Singapore International Conference On Networks 1997* Hung Keng Pung, Jit Biswas, Lek Heng Ngoh, 1997-06-16 SICON 97 is the fifth conference since the first SICON organized in 1989. It aims to provide a forum for the presentation and dissemination of results in computer communications and networking research. SICON 97 has a single track technical programme comprising less than half of the total number of full papers that were submitted to the International Programme Committee of well known and respected experts for review. The technical programme covers original research and development in the following areas: high speed networks, ATM, optical networks, wireless and mobile networks, performance measurement and modeling, network security, resource sharing and quality of service, internetworking, network architecture and protocols and distributed computing.

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Table of Contents Performance Evaluation And Applications Of Atm Networks

1. Understanding the eBook Performance Evaluation And Applications Of Atm Networks
 - The Rise of Digital Reading Performance Evaluation And Applications Of Atm Networks
 - Advantages of eBooks Over Traditional Books
2. Identifying Performance Evaluation And Applications Of Atm Networks
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Performance Evaluation And Applications Of Atm Networks
 - User-Friendly Interface
4. Exploring eBook Recommendations from Performance Evaluation And Applications Of Atm Networks
 - Personalized Recommendations
 - Performance Evaluation And Applications Of Atm Networks User Reviews and Ratings
 - Performance Evaluation And Applications Of Atm Networks and Bestseller Lists

5. Accessing Performance Evaluation And Applications Of Atm Networks Free and Paid eBooks
 - Performance Evaluation And Applications Of Atm Networks Public Domain eBooks
 - Performance Evaluation And Applications Of Atm Networks eBook Subscription Services
 - Performance Evaluation And Applications Of Atm Networks Budget-Friendly Options
6. Navigating Performance Evaluation And Applications Of Atm Networks eBook Formats
 - ePub, PDF, MOBI, and More
 - Performance Evaluation And Applications Of Atm Networks Compatibility with Devices
 - Performance Evaluation And Applications Of Atm Networks Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Performance Evaluation And Applications Of Atm Networks
 - Highlighting and Note-Taking Performance Evaluation And Applications Of Atm Networks
 - Interactive Elements Performance Evaluation And Applications Of Atm Networks
8. Staying Engaged with Performance Evaluation And Applications Of Atm Networks
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Performance Evaluation And Applications Of Atm Networks
9. Balancing eBooks and Physical Books Performance Evaluation And Applications Of Atm Networks
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Performance Evaluation And Applications Of Atm Networks
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Performance Evaluation And Applications Of Atm Networks
 - Setting Reading Goals Performance Evaluation And Applications Of Atm Networks
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Performance Evaluation And Applications Of Atm Networks
 - Fact-Checking eBook Content of Performance Evaluation And Applications Of Atm Networks
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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