

# Communication and Computer Networks: Modelling with Discrete-time Queues

Woodward, M E

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# Communication And Computer Networks Modelling With Discrete Time Queues

**Richard J. Linn, M. Ümit Uyar**



## **Communication And Computer Networks Modelling With Discrete Time Queues:**

*Communication and Computer Networks* Michael E. Woodward, 1994 This book is concerned exclusively with discrete time queues and their applications to the performance modeling of communication and computer networks Since most modern networks operate on the basis of time slotting and transmit information in fixed length packets or cells it thus becomes natural to model such networks in discrete time by associating a time slot in a physical network with the unit time in the corresponding discrete time model The book shows how in this way very accurate models that faithfully reproduce the stochastic behaviour of a communication or computer network can be constructed The treatment is self contained and progresses from basic probability theory and discrete time queueing networks These latter are applied to model the performance of numerous wide area satellite networks and local area networks ranging in complexity from simple Aloha schemes to the timed token protocol of the FDDI network The main objective of this book is to present a unified method for modeling any network access protocol as a discrete time queueing network and to develop efficient solution techniques for these models A significant number of the models and their solutions which are included have not previously appeared in the open literature The text should prove useful to practitioners and researchers concerned with communication and computer network performance modeling or anyone wanting a sound understanding of the application of discrete time technique to this subject area

**Communication and Computer Networks** Woodward, 1993-12-01 **Queueing Networks and Markov Chains** Gunter Bolch, Stefan Greiner, Hermann de Meer, Kishor S. Trivedi, 2006-04-14 Critically acclaimed text for computer performance analysis now in its second edition The Second Edition of this now classic text provides a current and thorough treatment of queueing systems queueing networks continuous and discrete time Markov chains and simulation Thoroughly updated with new content as well as new problems and worked examples the text offers readers both the theory and practical guidance needed to conduct performance and reliability evaluations of computer communication and manufacturing systems Starting with basic probability theory the text sets the foundation for the more complicated topics of queueing networks and Markov chains using applications and examples to illustrate key points Designed to engage the reader and build practical performance analysis skills the text features a wealth of problems that mirror actual industry challenges New features of the Second Edition include Chapter examining simulation methods and applications Performance analysis applications for wireless Internet J2EE and Kanban systems Latest material on non Markovian and fluid stochastic Petri nets as well as solution techniques for Markov regenerative processes Updated discussions of new and popular performance analysis tools including ns 2 and OPNET New and current real world examples including DiffServ routers in the Internet and cellular mobile networks With the rapidly growing complexity of computer and communication systems the need for this text which expertly mixes theory and practice is tremendous Graduate and advanced undergraduate students in computer science will find the extensive use of examples and problems to be vital in mastering both the basics and the fine points of the field

while industry professionals will find the text essential for developing systems that comply with industry standards and regulations

*Queueing Networks with Discrete Time Scale* Hans Daduna, 2003-05-15 Building on classical queueing theory mainly dealing with single node queueing systems networks of queues or stochastic networks has been a field of intensive research over the last three decades Whereas the first breakthrough in queueing network theory was initiated by problems and work in operations research the second breakthrough as well as subsequent major work in the area was closely related to computer science particularly to performance analysis of complex systems in computer and communication science The text reports on recent research and development in the area It is centered around explicit expressions for the steady behavior of discrete time queueing networks and gives a moderately positive answer to the question of whether there can be a product form calculus in discrete time Originating from a course given by the author at Hamburg University this book is ideally suited as a text for courses on discrete time stochastic networks

*Queueing Networks with Discrete Time Scale* Hans Daduna, 2001-07-18 Building on classical queueing theory mainly dealing with single node queueing systems networks of queues or stochastic networks has been a field of intensive research over the last three decades Whereas the first breakthrough in queueing network theory was initiated by problems and work in operations research the second breakthrough as well as subsequent major work in the area was closely related to computer science particularly to performance analysis of complex systems in computer and communication science The text reports on recent research and development in the area It is centered around explicit expressions for the steady behavior of discrete time queueing networks and gives a moderately positive answer to the question of whether there can be a product form calculus in discrete time Originating from a course given by the author at Hamburg University this book is ideally suited as a text for courses on discrete time stochastic networks

**Stochastic Models in Reliability, Network Security and System Safety** Quan-Lin Li, Jinting Wang, Hai-Bo Yu, 2019-10-21 This book is dedicated to Jinhua Cao on the occasion of his 80th birthday Jinhua Cao is one of the most famous reliability theorists His main contributions include published over 100 influential scientific papers published an interesting reliability book in Chinese in 1986 which has greatly influenced the reliability of education academic research and engineering applications in China initiated and organized Reliability Professional Society of China the first part of Operations Research Society of China since 1981 The high admiration that Professor Cao enjoys in the reliability community all over the world was witnessed by the enthusiastic response of each contributor in this book The contributors are leading researchers with diverse research perspectives The research areas of the book include a broad range of topics related to reliability models queueing theory manufacturing systems supply chain finance risk management Markov decision processes blockchain and so forth The book consists of a brief Preface describing the main achievements of Professor Cao followed by congratulations from Professors Way Kuo and Wei Wayne Li and by Operations Research Society of China and Reliability Professional Society of China and further followed by 25 articles roughly grouped together Most of the articles are

written in a style understandable to a wide audience This book is useful to anyone interested in recent developments in reliability network security system safety and their stochastic modeling and analysis Discrete-Time Models for Communication Systems Including ATM Herwig Bruneel,Byung G. Kim,2012-12-06 Most queueing analyses performed in the literature are based on characterization of queueing phenomena in continuous time items Recently in the telecommunication industries BISDN broadband integrated services digital network has received considerable attention since it can provide a common interface for future communication needs including video data and speech Since information in BISDN is transported by means of discrete units of 53 octet ATM asynchronous transfer mode cells interests in discrete time systems have increased Discrete Time Models for Communication Systems Including ATM provides a general framework for queueing analyses of discrete time systems After a brief look at past studies of discrete time systems a detailed description and analysis are presented for a generic discrete time model with a single server arbitrary service times and independent arrivals The book then follows a less stringent approach and focuses more on the average statistics and on different queueing disciplines Conventional first in out and last in first out disciplines are discussed in terms of the average statistics Systems with multiple classes of messages without class dependent priorities are considered to establish a discrete time conservation law Multiple classes with priorities are also considered to derive performance measures of priority scheduling disciplines Finally a multi queue system with cyclic service is analyzed in the context of round robin service ordering This is followed by analyses of discrete time queueing systems with more complicated input and output processes Specifically single server systems are investigated whereby either the arrivals or the server is subject to random interruptions Results are mainly obtained in terms of generating functions and mean values of the principal performance measures The influence of the nature of the arrival correlation and the server interruptions on the queueing behavior is discussed Finally the book explores queueing models directly associated with ATM switches and multiplexers This book is a valuable reference and may be used as a text for an advanced course on the subject

**Queueing Networks** Xiuli Chao,Masakiyo Miyazawa,Michael Pinedo,1999-08-03 Wiley Interscience Series in Systems and Optimization Queueing Networks Customers Signals and Product Form Solutions Xiuli Chao New Jersey Institute of Technology USA Masakiyo Miyazawa Science University of Tokyo Japan Michael Pinedo New York University USA Mathematically beautiful and elegant yet has much practical application Professor Richard Weber The first mathematical analysis of a queueing problem concerned the use of early telephone switches Since then emerging technologies such as those in telecommunications and the manufacturing industry have prompted considerable interest and activity in the field Much of the current research has been enabled by recent rapid advances in computer technology making large scale simulations and complex approximations possible Today queueing systems play an integral role in the performance evaluation and optimization of computer communication manufacturing and transportation systems Includes Discussion on the fundamental structures of queueing network models The latest developments in the field Thorough

examination of numerous applications Exercises at the end of each chapter Coverage of queueing networks with signals Discussion of future research developments With the advances in information technology many networks have in addition to conventional jobs signals and messages circulating throughout the system A signal carries information and instructions and may trigger complex simultaneous events The objective of this book is to present in a unified framework the latest developments in queueing networks with signals After introducing the foundations in the first four chapters Chapters 5 through to 8 cover a number of different queueing network models with various features Chapters 9 to 11 focus on more fundamental structures of queueing networks and Chapter 12 presents a framework for discrete time queueing network models The text is illustrated throughout with numerous examples Graduate students in operations research computer science electrical engineering and applied mathematics will find this text accessible and invaluable An essential reference for operation researchers and computer scientists working on queueing problems in computing manufacturing and communications networks

**Queueing Networks** Richard J. Boucherie, Nico M. van Dijk, 2010-11-25 This handbook aims to highlight fundamental methodological and computational aspects of networks of queues to provide insights and to unify results that can be applied in a more general manner The handbook is organized into five parts Part 1 considers exact analytical results such as of product form type Topics include characterization of product forms by physical balance concepts and simple traffic flow equations classes of service and queue disciplines that allow a product form a unified description of product forms for discrete time queueing networks insights for insensitivity and aggregation and decomposition results that allow sub networks to be aggregated into single nodes to reduce computational burden Part 2 looks at monotonicity and comparison results such as for computational simplification by either of two approaches stochastic monotonicity and ordering results based on the ordering of the process generators and comparison results and explicit error bounds based on an underlying Markov reward structure leading to ordering of expectations of performance measures Part 3 presents diffusion and fluid results It specifically looks at the fluid regime and the diffusion regime Both of these are illustrated through fluid limits for the analysis of system stability diffusion approximations for multi server systems and a system fed by Gaussian traffic Part 4 illustrates computational and approximate results through the classical MVA mean value analysis and QNA queueing network analyzer for computing mean and variance of performance measures such as queue lengths and sojourn times numerical approximation of response time distributions and approximate decomposition results for large open queueing networks span Part 5 enlightens selected applications as spanloss networks originating from circuit switched telecommunications applications capacity sharing originating from packet switching in data networks and a hospital application that is of growing present day interest span The book shows that span the intertwined progress of theory and practicespan will remain to be most intriguing and will continue to be the basis of further developments in queueing networks

**Simulation in Computer Network Design and Modeling: Use and Analysis** Al-Bahadili,

Hussein,2012-02-29 This book reviews methodologies in computer network simulation and modeling illustrates the benefits of simulation in computer networks design modeling and analysis and identifies the main issues that face efficient and effective computer network simulation Provided by publisher *Distributed Computing and Internet Technology* Tomasz Janowski,Hrushikesh Mohanty,2010-02-08 LNCS 5966 Fuzzy Engineering and Operations Research Bing-Yuan Cao,Xiang-Jun Xie,2012-06-30 Fuzzy Engineering and Operations Research is the edited outcome of the 5th International Conference on Fuzzy Information and Engineering ICFIE2011 held during Oct 15 17 2011 in Chengdu China and by the 1st academic conference in establishment of Guangdong Province Operations Research Society GDORSC held on Oct 20 2011 in Guangzhou China The 5th ICFIE2011 built on the success of previous conferences and the GDORC first held are major Symposiums respectively for scientists engineers practitioners and Operation Research OR researchers presenting their updated results developments and applications in all areas of fuzzy information and engineering and OR It aims to strengthen relations between industry research laboratories and universities and to create a primary symposium for world scientists in Fuzziology and OR fields The book contains 62 papers and is divided into five main parts Fuzzy Optimization Logic and Information The mathematical Theory of Fuzzy Systems Fuzzy Engineering Applications and Soft Computing Methods OR and Fuzziology and Guess and Review **Proceedings of the Eleventh International Conference on Management Science and Engineering Management** Jiuping Xu,Mitsuo Gen,Asaf Hajiyev,Fang Lee Cooke,2017-06-27 This book is organized in 2 volumes and 6 parts Part I is Big Data Analytics which is about new advances of analysis statistics coordination and data mining of big data Part II is Information Systems Management which is about the development of big data information system or cloud platform Part III is Computing Methodology with Big Data which is about the improvements of traditional computation technologies in the background of big data Part IV is Uncertainty Decision Making which is about the decision making methods with various uncertain information such as fuzzy random rough gray unascertained Part V is Intelligence Algorithm Part VI is Data Security which is a particularly important aspect in the modern management environment Foundations of Computer Science Wilfried Brauer,1997-10-24 Content Description Dedicated to Wilfried Brauer Includes bibliographical references and index 1994 ACM SIGSAC New Security Paradigms Workshop ,1994 Presents papers from the August 1994 workshop on computer security Topics include policy and value models architectures e mail security infrastructure fuzzy systems semantics in multilevel logic databases security system development and cryptography and access controls Lacks an index Annota **Discrete-Time Models for Communication Systems Including ATM** Herwig Bruneel,Byung G. Kim,1992-12-31 Most queuing analyses performed in the literature are based on characterization of queueing phenomena in continuous time items Recently in the telecommunication industries BISO broadband integrated services digital network has received considerable attention since it can provide a common interface for future communication needs including video data and speech Since information in BISO is transported by means of

discrete units of 53 octet ATM asynchronous transfer mode cells interests in discrete time systems have increased Discrete Time Models for Communication Systems Including ATM provides a general framework for queueing analyses of discrete time systems After a brief look at past studies of discrete time systems a detailed description and analysis are presented for a generic discrete time model with a single server arbitrary service times and independent arrivals The book then follows a less stringent approach and focuses more on the average statistics and on different queueing disciplines Conventional first in out and last in first out disciplines are discussed in terms of the average statistics Systems with multiple classes of messages without class dependent priorities are considered to establish a discrete time conservation law Multiple classes with priorities are also considered to derive performance measures of priority scheduling disciplines Finally a multi queue system with cyclic service is analyzed in the context of round robin service ordering This is followed by analyses of discrete time queueing systems with more complicated input and output processes Specifically single server systems are investigated whereby either the arrivals or the server is subject to random interruptions Results are mainly obtained in terms of generating functions and mean values of the principal performance measures The influence of the nature of the arrival correlation and the server interruptions on the queueing behavior is discussed Finally the book explores queueing models directly associated with ATM switches and multiplexers This book is a valuable reference and may be used as a text for an advanced course on the subject

**Applied Discrete-Time Queues** Attahiru Alfa, 2015-12-26 This book introduces the theoretical fundamentals for modeling queues in discrete time and the basic procedures for developing queueing models in discrete time There is a focus on applications in modern telecommunication systems It presents how most queueing models in discrete time can be set up as discrete time Markov chains Techniques such as matrix analytic methods MAM that can be used to analyze the resulting Markov chains are included This book covers single node systems tandem system and queueing networks It shows how queues with time varying parameters can be analyzed and illustrates numerical issues associated with computations for the discrete time queueing systems Optimal control of queues is also covered Applied Discrete Time Queues targets researchers advanced level students and analysts in the field of telecommunication networks It is suitable as a reference book and can also be used as a secondary text book in computer engineering and computer science Examples and exercises are included

**Queueing Theory for Telecommunications** Attahiru Sule Alfa, 2010-07-28 Queueing theory applications can be discovered in many walks of life including transportation manufacturing telecommunications computer systems and more However the most prevalent applications of queueing theory are in the telecommunications field Queueing Theory for Telecommunications Discrete Time Modelling of a Single Node System focuses on discrete time modeling and illustrates that most queueing systems encountered in real life can be set up as a Markov chain This feature is very unique because the models are set in such a way that matrix analytic methods are used to analyze them Queueing Theory for Telecommunications Discrete Time Modelling of a Single Node System is the most relevant book available on queueing

models designed for applications to telecommunications This book presents clear concise theories behind how to model and analyze key single node queues in discrete time using special tools that were presented in the second chapter The text also delves into the types of single node queues that are very frequently encountered in telecommunication systems modeling and provides simple methods for analyzing them Where appropriate alternative analysis methods are also presented This book is for advanced level students and researchers concentrating on engineering computer science and mathematics as a secondary text or reference book Professionals who work in the related industries of telecommunications industrial engineering and communications engineering will find this book useful as well

Fourth International Workshop on Research Issues in Data Engineering Jennifer Widom, Sharma Chakravarthy, 1994 Proceedings of a workshop held in Houston Texas in February 1994 Papers centering around active databases are divided into six sections implementation and optimization language design and applications integrity constraints and derived data rule processing I and II and design and debugging T

*Conformance Testing Methodologies and Architectures for OSI Protocols* Richard J. Linn, M. Ümit Uyar, 1994 A tutorial in the form of a collection of previously published papers and original material that cover current research and development in data communications protocol testing including test suite generation and practice and present essential practical experience in harnessing theory for protocol testing Includes a glossary of terms Annotation copyright by Book News Inc Portland OR

## Unveiling the Power of Verbal Beauty: An Mental Sojourn through **Communication And Computer Networks Modelling With Discrete Time Queues**

In some sort of inundated with screens and the cacophony of immediate interaction, the profound power and mental resonance of verbal beauty frequently disappear into obscurity, eclipsed by the constant barrage of noise and distractions. However, nestled within the lyrical pages of **Communication And Computer Networks Modelling With Discrete Time Queues**, a interesting work of literary splendor that impulses with natural thoughts, lies an remarkable trip waiting to be embarked upon. Published with a virtuoso wordsmith, this mesmerizing opus guides visitors on an emotional odyssey, softly revealing the latent possible and profound influence stuck within the intricate internet of language. Within the heart-wrenching expanse of this evocative evaluation, we shall embark upon an introspective exploration of the book is main subjects, dissect its captivating publishing model, and immerse ourselves in the indelible effect it leaves upon the depths of readers souls.

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