

1. Record Nr.	UNINA9910627240903321
Autore	Callegati Franco
Titolo	Traffic engineering : a practical approach // Franco Callegati, Walter Cerroni, and Carla Raffaelli
Pubbl/distr/stampa	Cham, Switzerland : , : Springer, , [2022] ©2022
ISBN	3-031-09589-8
Descrizione fisica	1 online resource (232 pages)
Collana	Textbooks in Telecommunication Engineering
Disciplina	004.6
Soggetti	Queuing theory Network performance (Telecommunication) Telecommunication systems
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Nota di bibliografia	Includes bibliographical references and index.
Nota di contenuto	Intro -- Foreword -- Preface -- Contents -- 1 Introduction to Teletraffic Engineering -- 1.1 What Is Traffic Engineering? Some Basic Concepts and Definitions -- 1.1.1 The Definition of Traffic -- 1.2 An Important and Very General Rule of Teletraffic Systems: Little's Theorem -- 1.3 A More Detailed Model of the Teletraffic System: A Queuing System -- 1.3.1 Naming a Queuing System -- 1.3.2 Little's Theorem for Queuing Systems -- Exercises -- 2 An Introduction to Queuing System Modeling -- 2.1 Introduction -- 2.2 Modeling Service Requests -- 2.2.1 The Poisson Process -- 2.2.1.1 Average Arrival Rate -- 2.2.1.2 Inter-arrival Time -- 2.2.1.3 Merging and Splitting Poisson Arrival Processes -- 2.3 Modeling Service Time -- 2.3.1 Exponential Service Time -- 2.3.2 Deterministic Service Time -- 2.3.3 Uniform Service Time -- 2.3.4 Erlang Service Time -- 2.3.5 Pareto Service Time -- 2.4 Link the Time of Arrivals with the Service Time -- 2.5 Residual Service Time -- 2.5.1 The Residual Exponential Service Time and Its Memoryless Property -- 2.5.2 The Residual Deterministic Service Time -- 2.5.3 The Residual Uniform Service Time -- 2.6 Examples and Case Studies -- 2.6.1 Time Related Tariffs -- 2.6.1.1 Calculating the Average Cost of the Calls -- 2.6.2 Deriving the Poisson Formula from Exponential Inter-arrivals -- 2.6.3 Time to Complete Multiple Services -- 2.6.3.1 Case 1: Deterministic Service Time -- 2.6.3.2 Case 2:

Exponential Service Time -- Exercises -- 3 Formalizing the Queuing System: State Diagrams and Birth-Death Processes -- 3.1 Stateful and Time Dependent Systems -- 3.2 Defining Congestion as a Sample State -- 3.2.1 The PASTA Property -- 3.3 Birth-Death Processes -- 3.4 Queuing Systems, Memoryless Property, and BD Processes -- 3.5 Examples and Case Studies -- 3.5.1 The Poisson Process as a Birth-Only Process -- 3.5.2 Alarm Reporting.

3.5.3 Taxis at the Airport -- Exercises -- 4 Engineering Circuit-Switched Networks -- 4.1 Introduction -- 4.2 Modeling Circuit Switching Systems Without Waiting Space -- 4.2.1 Performance Metrics -- 4.2.2 An Ideal System with Infinite Circuits -- 4.2.2.1 Average Values -- 4.2.2.2 What About Congestion? -- 4.2.3 The Real System with a Finite Number of Circuits -- 4.2.3.1 Congestion: The Erlang B Formula -- 4.2.3.2 Average Values and Utilization -- 4.2.4 Utilization of Ordered Servers -- 4.2.5 Comparing the M/M and the M/M/m/0 Systems -- 4.2.6 Insensitivity to Service Time Distribution -- 4.2.7 How Good Is the Erlang B Model -- 4.2.8 Examples and Case Studies -- 4.2.8.1 Dimensioning the Number of Circuits in a PABX -- 4.2.8.2 Planning the Dimensioning of a Trunk Group Between Two Central Offices -- 4.2.8.3 Dimensioning Interconnections in a Private Telephone Network -- 4.2.8.4 Utilization of the Last Server and Network Cost Optimization -- 4.2.8.5 Coping with Traffic Increases -- 4.3 Modeling Circuit Switching Systems with Waiting Space -- 4.3.1 Performance Metrics -- 4.3.2 The M/M/m System -- 4.3.2.1 Congestion: The Erlang C Formula -- 4.3.2.2 Average Number of Customers -- 4.3.2.3 Average Waiting Time -- 4.3.3 Waiting Time Probability Distribution for a FIFO Queue -- 4.3.4 Examples and Case Studies -- 4.3.4.1 Dimensioning the Number of Operators in a Call Center -- 4.3.4.2 Adopting a Unique Emergency Telephone Number -- 4.3.4.3 Planning Lines and Operators in a Call Center -- 4.3.4.4 A Call Center with Impatient Customers -- 4.4 Multi-Dimensional BD Processes -- 4.4.1 The Multi-Service Link -- 4.4.2 Circuit-Switched Networks with Fixed Routing -- 4.4.3 Examples and Case Studies -- 4.4.3.1 QoS Comparison for Two Traffic Classes with Different Bandwidth Requirements.

4.4.3.2 Strategies for QoS Management: Bandwidth Sharing, Bandwidth Partitioning and Trunk Reservation -- 4.4.3.3 A Simple Circuit Switching Network -- 4.4.3.4 Dimensioning a Small Private Telephone Network -- Exercises -- 5 Engineering Packet-Switched Networks -- 5.1 Introduction -- 5.2 Single Server Queuing -- 5.2.1 Performance Metrics -- 5.2.2 A General Result for Single Server Systems with Infinite Waiting Space -- 5.3 Memoryless Single Server Queuing Systems -- 5.3.1 Infinite Queuing Space: The M/M/1 System -- 5.3.1.1 Congestion: The Probability of Being Queued -- 5.3.1.2 Delay: The Time Spent Waiting in the Queue -- 5.3.1.3 The Output Traffic Process: Burke's Theorem -- 5.3.2 Finite Queuing Space, the M/M/1/L System -- 5.3.2.1 Blocking Probability -- 5.3.2.2 Average Performance Metrics -- 5.3.3 Examples and Case Studies -- 5.3.3.1 LAN Interconnection with a VPN -- 5.3.3.2 IoT Data Collection -- 5.3.3.3 Load Balancing Between Two Output Links -- 5.3.3.4 A Voice over IP Interconnection -- 5.3.3.5 Multiplexing Multi-Service Traffic -- 5.3.3.6 Queue Length Measured in Number of Bits -- 5.4 A Look at Some More General Cases -- 5.4.1 Poisson Arrivals May Be Fine, But What About Service Time? The M/G/1 Queue -- 5.4.1.1 The Average Waiting Time with FIFO Scheduling -- 5.4.1.2 Some Relevant Cases of the M/G/1 Queue -- 5.4.2 Packet Switching and Quality of Service: When One Pipe Does Not Fit All -- 5.4.2.1 Priority Queuing -- 5.4.2.2 Shortest Job Next (SJN) Scheduling -- 5.4.2.3 Kleinrock's Conservation Law -- 5.4.3 Examples

and Case Studies -- 5.4.3.1 Stop-and-Wait with Errors -- 5.4.3.2  
Packet Payload Padding -- 5.4.3.3 Non-preemptive Priority Scheduling  
with Two Classes -- 5.4.3.4 Priority Scheduling for Multimedia Traffic  
-- 5.4.3.5 Data, Voice, and Video Traffic with Priority -- 5.4.3.6 Token  
Bucket Scheduling -- Exercises.  
A Brief Introduction to Markov Chains -- A.1 Discrete Time Markov  
Chains -- A.1.1 Transition and Steady State Probabilities -- A.1.2  
Irreducible Markov Chains -- A.1.3 The Chapman-Kolmogorov  
Equations -- A.1.4 The Markov Chain Behavior as a Function of Time --  
A.1.5 Time Spent in a Given State -- A.2 Continuous Time Markov  
Chain -- A.2.1 The Time Spent in a State -- -- B The Embedded  
Markov Chain for the M/G/1 System -- B.1 Steady State Probabilities of  
the Number of Customers in the System at Departure Times -- B.2  
Steady State Probabilities at Generic Time Instants -- Index.

---