

Communication Protocol

Hartmut König

Communication Protocols Drago Hercog,2020-09-28 This book provides comprehensive coverage of the protocols of communication systems. The book is divided into four parts. Part I covers the basic concepts of system and protocol design and specification, overviews the models and languages for informal and formal specification of protocols, and describes the specification language SDL. In the second part, the basic notions and properties of communication protocols and protocol stacks are explained, including the treatment of the logical correctness and the performance of protocols. In the third part, many methods for message transfer, on which specific communication protocols are based, are explained and formally specified in the SDL language. The fourth part provides for short descriptions of some specific protocols, mainly used in IP networks, in order to acquaint a reader with the practical use of communication methods presented in the third part of the book. The book is relevant to researchers, academics, professionals and students in communications engineering. Provides comprehensive yet granular coverage of the protocols of communication systems Allows readers the ability to understand the formal specification of communication protocols Specifies communication methods and protocols in the specification language SDL, giving readers practical tools to venture on their own

Communication Protocol Specification and Verification Richard Lai,Ajin Jirachiefpattana,2012-12-06 Communication protocols are rules whereby meaningful communication can be exchanged between different communicating entities. In general, they are complex and difficult to design and implement. Specifications of communication protocols written in a natural language (e.g. English) can be unclear or ambiguous, and may be subject to different interpretations. As a result, independent implementations of the same protocol may be incompatible. In addition, the complexity of protocols make them very hard to analyze in an informal way. There is, therefore, a need for precise and unambiguous specification using some formal languages. Many protocol implementations used in the field have almost suffered from failures, such as deadlocks. When the conditions in which the protocols work correctly have been changed, there has been no general method available for determining how they will work under the new conditions. It is necessary for protocol designers to have techniques and tools to detect errors in the early phase of design, because the later in the process that a fault is discovered, the greater the cost of rectifying it. Protocol verification is a process of checking whether the interactions of protocol entities, according to the protocol specification, do indeed satisfy certain properties or conditions which may be either general (e.g., absence of deadlock) or specific to the particular protocol system directly derived from the specification. In the 80s, an ISO (International Organization for Standardization) working group began a programme of work to develop formal languages which were suitable for Open Systems Interconnection (OSI). This group called such languages Formal Description Techniques (FDTs). Some of the objectives of ISO in developing FDTs were: enabling unambiguous, clear and precise descriptions of OSI protocol standards to be written, and allowing such specifications to be verified for correctness. There are two FDTs standardized by ISO: LOTOS and Estelle. Communication Protocol Specification and Verification is written to address the two issues discussed above: the needs to specify a protocol using an FDT and to verify its correctness in order to uncover specification errors in the early stage of a protocol development process. The readership primarily consists of advanced undergraduate students, postgraduate students, communication software developers, telecommunication engineers, EDP managers, researchers and software engineers. It is intended as an advanced undergraduate or postgraduate textbook, and a reference for communication protocol professionals.

COMMUNICATION PROTOCOL ENGINEERING PALLAPA VENKATARAM,SUNILKUMAR S. MANVI,B. SATHISH BABU,2014-02-11 This well accepted book, now in its second edition, is a time-honoured revision and extension of the previous edition. With improved organization and enriched contents, the book primarily focuses on the concepts of design development of communication protocols or communication software. Beginning with an overview of protocol engineering, the text analyzes important topics such as • TCP/IP suite protocol structure. • Protocol specification. • Protocol specification

languages like SDL, SPIN, Estelle, E-LOTOS, CPN, UML, etc. • Protocol verification and validation techniques like semantic models and reachability analysis. • Generating conformance test suite and its application to a running protocol implementation. Audience Communication Protocol Engineering is purely a text dedicated to the undergraduate students of electronics and communication engineering and computer engineering. The text is also of immense use to the postgraduate students of communication systems. Highlights of Second Edition • Incorporates latest and up-to-date information on the topics covered. • Includes a large number of figures and examples for easy understanding of concepts. • Presents some new sections like wireless protocol challenges, TCP protocol, verification of TCP, test execution, test case derivation, etc. • Involves extension of protocol specification languages like SPIN, Estelle, Uppaal etc.

Communication Protocol Engineering Miroslav Popovic, 2018-10-03 As embedded systems become more and more complex, so does the challenge of enabling fast and efficient communication between the various subsystems that make up a modern embedded system. Facing this challenge from a practical standpoint, Communication Protocol Engineering outlines a hands-on methodology for developing effective communication protocols for large-scale systems. A Complete Roadmap This book brings together the leading methods and techniques developed from state-of-the-art methodologies for protocol engineering, from specification and description methods to cleanroom engineering and agile methods. Popovic leads you from conceptualization of requirements to analysis, design, implementation, testing, and verification. He covers the four main design languages: specifications and description language (SDL); message sequence charts (MSCs); tree and tabular combined notation (TTCN); and unified modeling language (UML). Practical Tools for Real Skills Fully illustrated with more than 150 figures, this guide also serves as a finite state machine (FSM) library programmer's reference manual. The author demonstrates how to build an FSM library, explains the components of such a library, and applies the principles to FSM library-based examples. Nowhere else are the fundamental principles of communication protocols so clearly and effectively applied to real systems development than in Communication Protocol Engineering. No matter in what stage of the process you find yourself, this is the ideal tool to make your systems successful.

Understanding and Using the Controller Area Network Communication Protocol Marco Di Natale, Haibo Zeng, Paolo Giusto, Arkadeb Ghosal, 2012-01-19 This book offers a hands-on guide to designing, analyzing and debugging a communication infrastructure based on the Controller Area Network (CAN) bus. Although the CAN bus standard is well established and currently used in most automotive systems, as well as avionics, medical systems and other devices, its features are not fully understood by most developers, who tend to misuse the network. This results in lost opportunities for better efficiency and performance. These authors offer a comprehensive range of architectural solutions and domains of analysis. It also provides formal models and analytical results, with thorough discussion of their applicability, so that it serves as an invaluable reference for researchers and students, as well as practicing engineers.

Serial Communication Protocols and Standards Dawoud Shenouda Dawoud, Peter Dawoud, 2022-09-01 Data communication standards are comprised of two components: The “protocol” and “Signal/data/port specifications for the devices involved”. The protocol describes the format of the message and the meaning of each part of the message. To connect any device to the bus, an external device must be used as an interface which will put the message in a form which fulfills all the electrical specifications of the port. These specifications are called the “Standard”. The most famous such serial communication standard is the RS-232. In IT technology, Communication can be serial or parallel. Serial communication is used for transmitting data over long distances. It is much cheaper to run the single core cable needed for serial communication over a long distance than the multicore cables that would be needed for parallel communication. It is the same in wireless communication: Serial communication needs one channel while parallel needs multichannel. Serial Communication can also be classified in many other ways, for example synchronous and asynchronous; it can

also be classified as simplex, duplex and half duplex. Because of the wide spread of serial communication from home automation to sensor and controller networks, there is a need for a very large number of serial communication standards and protocols. These have been developed over recent decades and range from the simple to the highly complicated. This large number of protocols was necessary to guarantee the optimum performance for the targeted applications. It is important for communication engineers to have enough knowledge to match the right protocol and standard with the right application. The main aim of this book is to provide the reader with that knowledge. The book also provides the reader with detailed information about:- Serial Communication- Universal Asynchronous Receiver Transmitter (UART)- Universal Synchronous/Asynchronous Receiver Transmitter (USART - Serial Peripheral Interface (SPI) - eSPI- Universal Serial Bus (USB)- Wi-Fi- WiMax- Insteon. The details of each technology including specification, operation, security related matters, and many other topics are covered. The book allocates three chapters to the main communication standards. These chapters cover everything related to the most famous standard RS-232 and all its variants. Other protocols such as: I2C, CAN, ZigBee, Z-Wave, Bluetooth, and others, are the subject of the authors separate book "Microcontroller and Smart Home Networks".

Principles of Protocol Design Robin Sharp, 2008-02-13 This book introduces the reader to the principles used in the construction of a large range of modern data communication protocols. The approach we take is rather a formal one, primarily based on descriptions of protocols in the notation of CSP. This not only enables us to describe protocols in a concise manner, but also to reason about many of their interesting properties and formally to prove certain aspects of their correctness with respect to appropriate specifications. Only after considering the main principles do we go on to consider actual protocols where these principles are exploited. This is a completely new edition of a book which was first published in 1994, where the main focus of many international efforts to develop data communication systems was on OSI - Open Systems Interconnection - the standardised architecture for communication systems developed within the International Organisation for Standardization, ISO. In the intervening 13 years, many of the specific protocols - developed as part of the OSI initiative have fallen into disuse. However, the terms and concepts introduced in the OSI Reference Model are still essential for a systematic and consistent analysis of data communication systems, and OSI terms are therefore used throughout. There are three significant changes in this second edition of the book which particularly reflect recent developments in computer networks and distributed systems.

Protocol Engineering Hartmut König, 2012-10-09 Communication protocols form the operational basis of computer networks and telecommunication systems. They are behavior conventions that describe how communication systems interact with each other, defining the temporal order of the interactions and the formats of the data units exchanged - essentially they determine the efficiency and reliability of computer networks. Protocol Engineering is an important discipline covering the design, validation, and implementation of communication protocols. Part I of this book is devoted to the fundamentals of communication protocols, describing their working principles and implicitly also those of computer networks. The author introduces the concepts of service, protocol, layer, and layered architecture, and introduces the main elements required in the description of protocols using a model language. He then presents the most important protocol functions. Part II deals with the description of communication protocols, offering an overview of the various formal methods, the essence of Protocol Engineering. The author introduces the fundamental description methods, such as finite state machines, Petri nets, process calculi, and temporal logics, that are in part used as semantic models for formal description techniques. He then introduces one representative technique for each of the main description approaches, among others SDL and LOTOS, and surveys the use of UML for describing protocols. Part III covers the protocol life cycle and the most important development stages, presenting the reader with approaches for systematic protocol design, with various verification methods, with the main implementation techniques, and with strategies for their testing, in particular with conformance and interoperability tests, and the test description language TTCN. The author uses the simple data transfer example protocol XDT (eXample Data Transfer) throughout the book as a reference protocol to exemplify the various description techniques and to demonstrate

important validation and implementation approaches. The book is an introduction to communication protocols and their development for undergraduate and graduate students of computer science and communication technology, and it is also a suitable reference for engineers and programmers. Most chapters contain exercises, and the author's accompanying website provides further online material including a complete formal description of the XDT protocol and an animated simulation visualizing its behavior.

Communication-Protocol-Based Filtering and Control of Networked Systems Lei Zou,Zidong Wang,Jinling Liang,2022-05-03

Communication-Protocol-Based Filtering and Control of Networked Systems is a self-contained treatment of the state of the art in communication-protocol-based filtering and control; recent advances in networked systems; and the potential for application in sensor networks. This book provides new concepts, new models and new methodologies with practical significance in control engineering and signal processing. The book first establishes signal-transmission models subject to different communication protocols and then develops new filter design techniques based on those models and preset requirements for filtering performance. The authors then extend this work to finite-horizon H-infinity control, ultimately bounded control and finite-horizon consensus control. The focus throughout is on three typical communications protocols: the round-robin, random-access and try-once-and-discard protocols, and the systems studied are drawn from a variety of classes, among them nonlinear systems, time-delayed and time-varying systems, multi-agent systems and complex networks. Readers are shown the latest techniques—recursive linear matrix inequalities, backward recursive difference equations, stochastic analysis and mapping methods. The unified framework for communication-protocol-based filtering and control for different networked systems established in the book will be of interest to academic researchers and practicing engineers working with communications and other signal-processing systems. Senior undergraduate and graduate students looking to increase their knowledge of current methods in control and signal processing of networked systems will also find this book valuable.

Protocol Specification and Testing Katalin Tarnay,2012-12-06 The increasing number of computer networks has aroused users' interest in many and various fields of applications, in how a computer network can be built, and in how it may be used. The fundamental rules of computer networks are the protocols. A protocol is a set of rules that governs the operation of functional units to achieve communication [STA-86}. The book follows a practical approach to protocol specification and testing, but at the same time it introduces clearly and precisely the relevant theoretical fundamentals. The principal objectives of this work are: to familiarize readers with communication protocols, to present the main, formal description techniques, to apply various formal description techniques to protocol specification and testing. It is considered that the readership will primarily consist of protocol developers, protocol users, and all who utilize protocol testers. Secondly the book is suggested for postgraduate courses or other university courses dealing with communication networks and data communication. A large part of the book provides a comprehensive overview for managers; some parts are of especial interest to postal organizations. The book consists of three parts: the first part introduces the OSI Reference Model, it provides an overview of the most frequently used protocols and explains the fundamentals of protocol testing. The second part familiarizes readers with the methods used for protocol specification, generation, and testing. Finite-state machines, formal grammars, Petri nets and some specification languages (SDL, ESTELLE, LOTOS) are discussed in a pragmatic style. The third part deals with applications.

Advanced Communication Protocol Technologies Katalin Tarnay,Gusztáv Adamis,Tibor Dulai,2011 This book explores the complications and solutions created by communication required between ever-expanding technologies, covering the fundamentals of protocol functions and protocol operations, the controlling protocols of ISDN and mobile networks, the evolution of IP-based protocols, and advanced solutions for routing, mobility and multimedia transmission--

Advanced Communication Protocol Technologies ,2011 This book explores the complications and solutions created by communication required

between ever-expanding technologies, covering the fundamentals of protocol functions and protocol operations, the controlling protocols of ISDN and mobile networks, the evolution of IP-based protocols, and advanced solutions for routing, mobility and multimedia transmission--

Communication Protocol Modeling Carl A. Sunshine,1981

Communicating Systems with UML 2 David Garduno Barrera, Michel Diaz,2013-02-07 This book gives a practical approach to modeling and analyzing communication protocols using UML 2. Network protocols are always presented with a point of view focusing on partial mechanisms and starting models. This book aims at giving the basis needed for anybody to model and validate their own protocols. It follows a practical approach and gives many examples for the description and analysis of well known basic network mechanisms for protocols. The book firstly shows how to describe and validate the main protocol issues (such as synchronization problems, client-server interactions, layer organization and behavior, etc.) in an easy and understandable way. To do so, the book considers and presents the main traditional network examples (e.g. unidirectional flows, full-duplex communication, error recovering, alternating bit). Finally, it presents the outputs resulting from a few simulations of these UML models. Other books usually only focus either on teaching UML or on analyzing network protocols, however this book will allow readers to model network protocols using a new perspective and integrating these two views, so facilitating their comprehension and development. Any university student studying in the field of computing science, or those working in telecommunications, embedded systems or networking will find this book a very useful addition.

Multimedia Communications Franklin F. Kuo, Wolfgang Effelsberg, J. J. Garcia-Luna-Aceves, 1998 Here is the network specialist's complete guide to planning and deploying multimedia on the Internet, Intranets, and any networked environment. The title covers everything LAN and WAN professionals need to know to prepare for--and deploy--networked multimedia.

Mobile Telecommunications Protocols for Data Networks Anna Hac, 2003-02-21 Mobile users are demanding fast and efficient ubiquitous connectivity supporting data applications. This connectivity has to be provided by various different networks and protocols which guarantee that mobile networks function efficiently, performing routing and handoff for mobile users. Hac proposes a comprehensive design for mobile communications including mobile agents, access networks, application protocols, ubiquitous connectivity, routing, and handoff. It covers the entire spectrum of lower and upper layer protocols to evaluate and design modern mobile telecommunications systems. Furthermore, the aspects of modern mobile telecommunications for applications, networking, and transmission are described. For mobile users and data applications these are new networking and communications solutions, particularly for the local area network environment. * Describes the recent advances in mobile telecommunications, their protocols and management * Covers hot topics such as mobile agents, access networks, wireless applications protocols, wireless LANs, architecture, routing and handoff * Introduces and analyses architecture and design issues in mobile communications and networks * Includes a section of questions/problems/answers after each chapter The book is written as a practical, easily accessible tutorial with many figures and examples of existing protocols and architectures making it essential reading for engineers, system engineers, researchers, managers, senior & graduate students.

Design and Analysis of Security Protocol for Communication Dinesh Goyal, S. Balamurugan, Sheng-Lung Peng, O. P. Verma, 2020-03-17 The purpose of designing this book is to discuss and analyze security protocols available for communication. Objective is to discuss protocols across all layers of TCP/IP stack and also to discuss protocols independent to the stack. Authors will be aiming to identify the best set of security protocols for the similar applications and will also be identifying the drawbacks of existing protocols. The authors will be also suggesting new protocols if any.

Algebraic Specification of Communication Protocols S. Mauw, G. J. Veltink, 1993 Modern computer networks now circle the world, but the transmission of information between them depends on the many different protocols that define the behaviour of the sender and receiver. It is clear

therefore, that the accurate description of these protocols is important if harmonious communication is to be maintained. In this book the authors use the formal specification language PSF to provide an unambiguous description of several communication protocols of varying levels of complexity, ranging from the alternating bit protocol to the token ring protocol. Beginners, as well as professionals in the field of communication protocols, will benefit from both the methods of specification described and the protocols discussed in this book.

Formal Methods for Communication Protocol Specification and Verification Carl A. Sunshine, Rand Corporation, 1979 Increasingly numerous and complex communication protocols are being employed in distributed systems and computer networks of all types. This Note describes some of the more formal techniques that are being developed to facilitate design of correct protocols. Our major conclusion is that it is vital to specify the services provided by a protocol layer in addition to specifying the cooperating protocol entities which make up the layer. We develop service specifications of several representative protocols by using formal techniques from software engineering such as abstract machines and buffer histories. A survey of protocol verification methods and a bibliography indexed by key phrases are also provided. (Author).

Communication Control in Computer Networks Josef Pužman, Radoslav Porizek, 1980

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