Algebraic Specification of Communication Protocols

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Algebraic Specification Of Communication Protocols

Michael Alexander,William Gardner

Algebraic Specification Of Communication Protocols:

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   *Algebraic Specification of Communication Protocols* Bernard Berthomieu,1981 This report is concerned with specifying communication protocols and proving their behavior correct Many different approaches have been taken for modeling communication protocols the approach taken here is algebraic Communication protocols are seen as complex data types and are defined using the algebraic method The modeling techniques devised are applied to the specification and verification of a complex data transfer protocol Properties proven include system invariants and those of an operational nature These experiments have been carried out using the Affirm system for designing abstract data types algebraically and proving their properties Author

Algebraic Specification-based Performance Analysis of Communication Protocols Columbia University. Department of Computer Science,N. Nounou,Y. Yemini,1984   **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 aretwo 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 **Algebraic Methods: Theory, Tools and Applications** Martin Wirsing,Jan A. Bergstra,1989-09-20 Algebraic Methodology and Software Technology Martin Wirsing,Maurice Nivat,1996-06-19 Content Description Includes bibliographical references and index

Algebra of Communicating Processes Alban Ponse,Christiaan Verhoef,Sebastiaan F.M.van Vlijmen,2012-12-06 ACP the Algebra of Communicating Processes is an algebraic approach to the study of concurrent processes initiated by Jan Bergstra and Jan Will em Klop in the early eighties These proceedings comprise the contributions to ACP94 the first workshop devoted to ACP The work shop was held at Utrecht University 16 17 May 1994 These proceedings are meant to provide an overview of current research in the area of ACP They contain fifteen contributions The first one is a classical paper on ACP by J A Bergstra and J W Klop The Algebra of Recursively Defined Processes and the Algebra of Regular Processes Report IW 235 83 Mathematical Centre Amsterdam 1983 It serves as an introduction to the remainder of the proceedings and indeed as a general introduction to ACP An extended abstract of this paper is published under the same title in the ICALP 84 proceedings Of the re maining contributions three were submitted by the invited speakers and the others were selected by the programme committee As for the presentations Jos Baeten Rob van Glabbeek Jan Friso Groote and Frits Vaandrager were each invited to deliver a lecture A paper relating to Frits Vaandrager s lecture has already been submitted for publication elsewhere and is not therefore included in these pro ceedings Gabriel Ciobanu one of our guests gave an impression of his work in an extra lecture Furthermore ten presentations were given on the basis of selected papers

Introduction to Process Algebra Wan Fokkink,2013-03-09 Automated and semi automated manipulation of so called labelled transition systems has become an important means in discovering flaws in software and hardware systems Process algebra has been developed to express such labelled transition systems algebraically which enhances the ways of manipulation by means of equational logic and term rewriting The theory of process algebra has developed rapidly over the last twenty years and verification tools have been developed on the basis of process algebra often in cooperation with techniques related to model checking This textbook gives a thorough introduction into the basics of process algebra and its applications Process Algebra: Equational Theories of Communicating Processes J. C. M. Baeten,M. A. Reniers,2010

Presents a unified overview of the various process algebras currently in use and sets the standard for the field **Process Algebra for Parallel and Distributed Processing** Michael Alexander,William Gardner,2008-12-22 Collects the Latest Research Involving the Application of Process Algebra to ComputingExploring state of the art applications Process Algebra for Parallel and Distributed Processing shows how one formal method of reasoning process algebra has become a powerful tool for solving design and implementation challenges of concurrent systems Parallel Pr **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 **Handbook of Process Algebra** J.A. Bergstra,A. Ponse,S.A. Smolka,2001-03-16 Process Algebra is a formal description technique for complex computer systems especially those involving communicating concurrently executing components It is a subject that concurrently touches many topic areas of computer science and discrete math including system design notations logic concurrency theory specification and verification operational semantics algorithms complexity theory and of course algebra This Handbook documents the fate of process algebra since its inception in the late 1970 s to the present It is intended to serve as a reference source for researchers students and system designers and engineers interested in either the theory of process algebra or in learning what process algebra brings to the table as a formal system description and verification technique The Handbook is divided into six parts spanning a total of 19 self contained Chapters The organization is as follows Part 1 consisting of four chapters covers a broad swath of the basic theory of process algebra Part 2 contains two chapters devoted to the sub specialization of process algebra known as finite state processes while the three chapters of Part 3 look at infinite state processes value passing processes and mobile processes in particular Part 4 also three chapters in length explores several extensions to process algebra including real time probability and priority The four chapters of Part 5 examine non interleaving process algebras while Part 6 s three chapters address process algebra tools and applications **Specification, Algebra, and Software** Shusaku Iida,José Meseguer,Kazuhiro

Ogata,2014-03-01 This Festschrift volume published in honor of Kokichi Futatsugi contains 31 invited contributions from internationally leading researchers in formal methods and software engineering Prof Futatsugi is one of the founding fathers of the field of algebraic specification and verification and is a leading researcher in formal methods and software engineering He has pioneered and advanced novel algebraic methods and languages supporting them such as OBJ and CafeOBJ and has worked tirelessly over the years to bring such methods and tools in contact with software engineering practice This volume contains contributions from internationally leading researchers in formal methods and software engineering *Modeling and Analysis of Communicating Systems* Jan Friso Groote,Mohammad Reza Mousavi,2023-05-09 Rigorous theory and real world applications for modeling and analysis of the behavior of complex communicating computer systems Complex communicating computer systems computers connected by data networks and in constant communication with their environments do not always behave as expected This book introduces behavioral modeling a rigorous approach to behavioral specification and verification of concurrent and distributed systems It is among the very few techniques capable of modeling systems interaction at a level of abstraction sufficient for the interaction to be understood and analyzed Offering both a mathematically grounded theory and real world applications the book is suitable for classroom use and as a reference for system architects The book covers the foundation of behavioral modeling using process algebra transition systems abstract data types and modal logics Exercises and examples augment the theoretical discussion The book introduces a modeling language mCRL2 that enables concise descriptions of even the most intricate distributed algorithms and protocols Using behavioral axioms and such proof methods as confluence cones and foci readers will learn how to prove such algorithms equal to their specifications Specifications in mCRL2 can be simulated visualized or verified against their requirements An extensive mCRL2 toolset for mechanically verifying the requirements is freely available online this toolset has been successfully used to design and analyze industrial software that ranges from healthcare applications to particle accelerators at CERN Appendixes offer material on equations and notation as well as exercise solutions **Introduction to Coalgebra** Bart Jacobs,2017 An accessible introduction to coalgebra with clear mathematical explanations and numerous examples and exercises **Integrated Formal Methods** Jim Davies,Jeremy Gibbons,2007-09-14 This book constitutes the refereed proceedings of the 6th International Conference on Integrated Formal Methods IFM 2007 held in Oxford UK It addresses all aspects of formal methods integration including of a process of analysis or design application of formal methods to analysis or design extension of one method based upon the inclusion of ideas or concepts from others and semantic integration or practical application Current Trends in Theoretical Computer Science Gheorghe P?un,Arto Salomaa,2001 The scientific developments at the end of the past millennium were dominated by the huge increase and diversity of disciplines with the common label computer science The theoretical foundations of such disciplines have become known as theoretical computer science This book highlights some key issues of theoretical computer science as they seem to us now at the beginning of the

new millennium The text is based on columns and tutorials published in the Bulletin of the European Association for Theoretical Computer Science in the period 1995 2000 The columnists themselves selected the material they wanted for the book and the editors had a chance to update their work Indeed much of the material presented here appears in a form quite different from the original Since the presentation of most of the articles is reader friendly and does not presuppose much knowledge of the area the book constitutes suitable supplementary reading material for various courses in computer science

Protocol Engineering Hartmut König,2012-10-08 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 **Software Science and Engineering** Ikuo Nakata,1991 12 selected papres from those presented at a series of symposia held at Kyoto University and ASTEM RI Kyoto during the years 1986 through 1990 under the title Software Science and Engineering **Cafeobj Report: The Language, Proof Techniques, And Methodologies For Object-oriented Algebraic Specification** Razvan Diaconescu,Kokichi Futatsugi,1998-06-30 CafeOBJ is an industrial strength modern

algebraic specification language a successor of the famous OBJ language and directly incorporating new paradigms such as behavioural concurrent specification and rewriting logic CafeOBJ is the core of an environment supporting the systems mainly software but not only development process at several levels including prototyping specification and formal verification This book presents not only the formal definition of the language and its semantics but also methodologies for specification and verification in CafeOBJ with emphasis on concurrent object composition and modularity The presentation of the CafeOBJ concepts is supported by many examples and an appendix illustrates the power of the language and its methodologies by a larger CASE study including specification testing and verification The book may be used both by software engineers interested in algebraic methodologies and by students and researchers in software engineering and or theoretical computing science as a fast introduction to state of art algebraic specification

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