

# FIAS PROTOCOL SPECIFICATION

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PROTOCOLS  
CONTRIBUTIONS TO THE INTERNATIONAL CONFERENCE ON COMPUTER COMMUNICATION  
RICHARD LAI R.J. LINN STAN BUDKOWSKI KATIE TARNAY ED  
BRINKSMA CONCORDIA UNIVERSITY CARL A. SUNSHINE SUDHIR AGGARWAL YECHIAM YEMINI AMERICAN NATIONAL STANDARDS INSTITUTE RICHARD LAI FRIEDRICH H.  
VOGT S.M. DEEN NATIONAL INFORMATION STANDARDS ORGANIZATION (U.S.) KATALIN TARNAY NARAIN GEHANI CARL A. SUNSHINE RICHARD J. LINN INTERNATIONAL  
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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

FOR MORE THAN A DECADE RESEARCHERS AND ENGINEERS HAVE BEEN ADDRESSING THE PROBLEM OF THE APPLICATION OF FORMAL DESCRIPTION TECHNIQUES TO PROTOCOL SPECIFICATION IMPLEMENTATION TESTING AND VERIFICATION THIS BOOK IDENTIFIES THE MANY SUCCESSES THAT HAVE BEEN ACHIEVED WITHIN THE INDUSTRIAL FRAMEWORK AND THE DIFFICULTIES ENCOUNTERED IN APPLYING THEORETICAL METHODS TO PRACTICAL SITUATIONS ISSUES DISCUSSED INCLUDE TESTING AND CERTIFICATION VERIFICATION VALIDATION ENVIRONMENTS AND AUTOMATED TOOLS FORMAL SPECIFICATIONS PROTOCOL CONVERSION IMPLEMENTATION SPECIFICATION LANGUAGES AND MODELS CONSIDERATION IS ALSO GIVEN TO THE CONCERNs SURROUNDING EDUCATION AVAILABLE TO STUDENTS AND THE NEED TO UPGRADE AND DEVELOP THIS THROUGH SPONSORSHIP OF A STUDY OF AN APPROPRIATE CURRICULUM AT BOTH UNDERGRADUATE AND GRADUATE LEVELS IT IS HOPED THIS PUBLICATION WILL STIMULATE SUCH SUPPORT AND INSPIRE FURTHER RESEARCH IN THIS IMPORTANT AREA

FORMAL DESCRIPTION TECHNIQUES AND PROTOCOL SPECIFICATION TESTING AND VERIFICATION ADDRESSES FORMAL DESCRIPTION TECHNIQUES FDTs APPLICABLE TO DISTRIBUTED SYSTEMS AND COMMUNICATION PROTOCOLS IT AIMS TO PRESENT THE STATE OF THE ART IN THEORY APPLICATION TOOLS AND INDUSTRIALIZATION OF FDTs AMONG THE IMPORTANT FEATURES PRESENTED ARE FDT BASED SYSTEM AND PROTOCOL ENGINEERING FDT APPLICATION TO DISTRIBUTED SYSTEMS PROTOCOL ENGINEERING PRACTICAL EXPERIENCE AND CASE STUDIES FORMAL DESCRIPTION TECHNIQUES AND PROTOCOL SPECIFICATION TESTING AND VERIFICATION COMPRISSES THE PROCEEDINGS OF THE JOINT INTERNATIONAL CONFERENCE ON FORMAL DESCRIPTION TECHNIQUES FOR DISTRIBUTED SYSTEMS AND COMMUNICATION PROTOCOLS AND PROTOCOL SPECIFICATION TESTING AND VERIFICATION SPONSORED BY THE INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING HELD IN NOVEMBER 1998 PARIS FRANCE FORMAL DESCRIPTION TECHNIQUES AND PROTOCOL SPECIFICATION TESTING AND VERIFICATION IS SUITABLE AS A SECONDARY TEXT FOR A GRADUATE LEVEL COURSE ON DISTRIBUTED SYSTEMS OR COMMUNICATIONS AND AS A REFERENCE FOR RESEARCHERS AND PRACTITIONERS IN INDUSTRY

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 OS 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

RESEARCHERS AND PRACTITIONERS CONCERNED WITH THE APPLICATION OF FORMAL METHODS TO THE DESIGN DESCRIPTION ANALYSIS IMPLEMENTATION AND TESTING OF OPEN SYSTEMS CONTRIBUTED TO THIS BOOK IT IS THE NINTH IN A SUCCESSFUL SERIES OF ANNUAL VOLUMES

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

HARDBOUND THIS BOOK COVERS RESEARCH IN PROTOCOL THEORY AND ANALYSIS SPECIFICATION AND FORMAL MODELS OF PROTOCOLS PROTOCOL VALIDATION AND VERIFICATION PERFORMANCE ANALYSIS OF PROTOCOLS AND PROTOCOL DESIGN IMPLEMENTATION AND TESTING MAIN FEATURES 1 BROAD COVERAGE OF THE RESEARCH IN THE AREA OF COMPUTER COMMUNICATION PROTOCOLS 2 A COMBINATION OF THEORETICAL AND EXPERIMENTAL RESEARCH ON PROTOCOL MODELLING DESIGN ANALYSIS SYNTHESIS VERIFICATION AND TESTING 3 A DESCRIPTION OF INTERNATIONAL RESEARCH ACTIVITIES CONDUCTED BY LEADING RESEARCHERS IN THE FIELD FROM OVER 13 COUNTRIES

THIS STANDARD SPECIFIES AN OPEN SYSTEMS INTERCONNECTION APPLICATION LAYER SERVICE DEFINITION AND PROTOCOL SPECIFICATION FOR INFORMATION RETRIEVAL

THIS VOLUME CONTAINS THE PROCEEDINGS OF CONCURRENCY 88 AN INTERNATIONAL CONFERENCE ON FORMAL METHODS FOR DISTRIBUTED SYSTEMS HELD OCTOBER 18 19 1988 IN HAMBURG CONCURRENCY 88 RESPONDED TO GREAT INTEREST IN THE FIELD OF FORMAL METHODS AS A MEANS OF MASTERING THE COMPLEXITY OF DISTRIBUTED SYSTEMS IN ADDITION THE IMPULSE WAS DETERMINED BY THE FACT THAT THE VARIOUS METHODOLOGICAL APPROACHES SUCH AS CONSTRUCTIVE OR PROPERTY ORIENTED METHODS HAVE NOT HAD AN EXTENSIVE COMPARATIVE ANALYSIS NOR HAVE THEY BEEN INVESTIGATED WITH RESPECT TO THEIR POSSIBLE INTEGRATION AND THEIR PRACTICAL IMPLICATIONS THE FOLLOWING TOPICS WERE ADDRESSED SPECIFICATION LANGUAGES MODELS FOR DISTRIBUTED SYSTEMS

VERIFICATION AND VALIDATION KNOWLEDGE BASED PROTOCOL MODELING FAULT TOLERANCE DISTRIBUTED DATABASES THE VOLUME CONTAINS 12 INVITED PAPERS AND 14 CONTRIBUTIONS SELECTED BY THE PROGRAM COMMITTEE THEY WERE PRESENTED BY AUTHORS FROM AUSTRIA THE FEDERAL REPUBLIC OF GERMANY FRANCE ISRAEL ITALY THE NETHERLANDS THE UNITED KINGDOM AND THE UNITED STATES

LOW VOLUME HIGH VARIETY PRODUCTS LIKE PERSONALIZED CARS OR CUSTOMIZED ENGINES WILL BE THE KEY ISSUES FOR MANUFACTURING IN THE 21ST CENTURY THE NECESSARY CONTROL TECHNOLOGY IS BASED ON THE CONCEPT OF HOLONS WHICH ARE THE UNITS OF PRODUCTION AND BEHAVE AS AUTONOMOUS AND COOPERATIVE AGENTS PROVIDING FLEXIBILITY ADAPTABILITY AGILITY AND DYNAMIC RECONFIGURABILITY THIS BOOK PRESENTS THE LATEST RESEARCH RESULTS IN AGENT BASED MANUFACTURING AS CARRIED OUT BY RESEARCHERS IN ACADEMIA AND INDUSTRY WITHIN THE INTERNATIONAL HOLONIC MANUFACTURING SYSTEMS PROJECT AS THIS PROJECT WAS DRIVEN BY INDUSTRY THE RESULTS PRESENTED HERE ARE OF VITAL INTEREST NOT JUST TO RESEARCHERS IN AGENT TECHNOLOGIES OR DISTRIBUTED ARTIFICIAL INTELLIGENCE BUT ALSO TO ENGINEERS AND PROFESSIONALS IN INDUSTRY WHO HAVE TO RESPOND TO RAPID CHANGES AND NEW DEMANDS IN PRODUCTION

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 OS 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

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

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IN THE GRAND TAPESTRY OF DIGITAL LITERATURE, NEWS.XYNO.ONLINE STANDS AS A DYNAMIC THREAD

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