

# SDL—CCITT Specification and Description Language

ANDERS ROCKSTRÖM AND ROBERTO SARACCO

**Abstract**—The CCITT Specification and Description Language (SDL) became a CCITT recommendation in 1976, and a refined version was published by CCITT in 1980. This paper presents the background and history of SDL, and its relation to the other languages recommended by CCITT.

SDL is mainly a language to specify and describe the logic of functional processes in a fashion independent of implementation techniques, and is based on a finite-state machine approach. The concepts and representation forms of SDL are briefly explained. A survey is given of today's applications and tools, and the expected future developments are discussed.

## I. HISTORY

THE CCITT Specification and Description Language (SDL) has so far been under study within CCITT, Study Group XI, for three study periods (i.e.,  $3 \times 4 = 12$  years), and is presently being further refined upon and improved in the current study period. CCITT SG XI is a study group primarily dealing with producing recommendations in the area of telephony switching and signalling—therefore, it might need some explanation why the group undertook the study of SDL and the other CCITT languages.

### Why SDL

The study was initiated in the late 1960's when the experience of the first stored program control (SPC) applications in telephony was first felt. As SPC was a new technology there were a number of problems attached to the first exchanges. These problems were often identified as "software problems." Whether this was a correct identification may, of course, be discussed at length. This led, however, to a tendency of claiming that the solution to the problems should be to use "high-level languages" when programming the exchanges, in contrast to the "low-level" languages used at that time. Particularly for SPC telephony applications, a telephony-oriented language was urged. A proposal that this should be studied within CCITT was first raised at the CCITT Plenary Assembly in Madrid Plaza in 1968. The question raised was regarded as a switching problem, and the question was assigned to SG XI.

However, the results of the first discussions on this question were that the need of two different languages was recognized: one high-level and telephony-oriented programming language, and one language for specification and description of functions. This latter language, SDL, was not to be a programming

language but a language able to describe functions in a fashion independent of implementation techniques.

### Progress

The first period of study, 1968-1972, was mainly devoted to discussions about what should be studied. The main result of this study was that the "CCITT language family" was extended to also contain a "Man-Machine Language" (MML).

In the next Study Period the basic SDL was outlined, the language becoming not exactly defined but the general principles were agreed upon. The result of this was the Recommendations Z101-Z104 approved at the CCITT Plenary of 1976.

During the following Study Period, 1977-1980, these recommendations were refined upon. A number of semantic problems were resolved, and the language became extensively used within CCITT and by manufacturers and administrations. The new CCITT Recommendations on SDL, Z101-Z104, were approved in the Plenary of 1980.

The present work on SDL is presented in Section V of this paper.

### Relations to Other CCITT Languages

As briefly mentioned above, SDL has been developed in parallel with the other two CCITT languages; the high-level programming language CHILL and the man-machine language MML. During this development the desirability of a harmonized language family has been considered and recognized, i.e., the use of common concepts and terminology. This can be illustrated with the following quotation from the considerations to the study questions of 1972:

"... that there is an interrelation between the requirements of a command language and those of a high-level programming and methods of functional specification to be developed, and this relationship must be considered in their development. The establishment of a common standard terminology is of greatest importance. . . ."

This correlation between the languages has been obtained; for example, both CHILL and SDL contain a number of common concepts: process, signal, etc.

The relations between the languages and the actual system specified and described can be illustrated in the manner shown in Fig. 1.

Very briefly, Fig. 1 can be explained as follows. Both the specification and the description of a system can be made using SDL, and it is possible to make a "functional" comparison between these two descriptions. While SDL describes the functions of a system in a way independent of the implementation technique, CHILL can describe the same functions adding details depending on the implementation in software. The

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# An Introduction To The Ccitt Sdl

**Jørgen Staunstrup, Wayne Wolf**



## **An Introduction To The Ccitt Sdl:**

*An Introduction to the CCITT SDL.* Anders Rockström, 1985      **CCITT SDL** Roberto Saracco, Paul A. J. Tilanus, International Telegraph and Telephone Consultative Committee, SDL Forum, 1987      Telecommunications Systems Engineering Using SDL Roberto Saracco, Jared R. W. Smith, Rick Reed, 1989 SDL the Specification and Description Language for Telecommunication Systems has evolved into a fully fledged tool for the specification of telecommunication sub systems and is proving its fitness for major applications The current 1988 version the subject of this book is used in the specification of the Functional Reference Model for Integrated Broadband Communication being studied in RACE the European Community R D programme in Telecommunications For the many potential users of SDL whether in industry or in the operating companies this book should be of great practical value By using worked examples from actual telecommunications engineering practice and by explaining conceptual choices as they are made it will enable students to learn the many features of the language in coherent combinations and thus inspire correct usage from an engineering point of view I congratulate the authors on their initiative and wish their readers success in mastering this invaluable addition to the tools of the trade From the preface by Rudolf W Meijer Commission of the European Communities Directorate General Telecommunications Information Industries and Innovation      Hardware/Software Co-Design Jørgen Staunstrup, Wayne Wolf, 2013-04-17 Introduction to Hardware Software Co Design presents a number of issues of fundamental importance for the design of integrated hardware software products such as embedded communication and multimedia systems This book is a comprehensive introduction to the fundamentals of hardware software co design Co design is still a new field but one which has substantially matured over the past few years This book written by leading international experts covers all the major topics including fundamental issues in co design hardware software co synthesis algorithms prototyping and emulation target architectures compiler techniques specification and verification system level specification Special chapters describe in detail several leading edge co design systems including Cosyma LYCOS and Cosmos Introduction to Hardware Software Co Design contains sufficient material for use by teachers and students in an advanced course of hardware software co design It also contains extensive explanation of the fundamental concepts of the subject and the necessary background to bring practitioners up to date on this increasingly important topic      **100 Years of Telephone Switching** Robert J. Chapuis, Amos E. Joel Jr., Amos E. Joel, 2003 Explores both the technology and marketing decision making in a world wide industry where product purchasers represent long term decisions This book deals with the mainstream switching systems required for the public network It is about the history of core switching systems and signaling      *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

*Formal Description Techniques and Protocol Specification, Testing and Verification* Atsushi Togashi, Tadanori Mizuno, Norio Shiratori, Teruo Higashino, 2013-06-05 FORTE PSTV 97 addresses Formal Description Techniques FDTs applicable to Distributed Systems and Communication Protocols such as Estelle LOTOS SDL ASN 1 TTCN Z Automata Process Algebra Logic The conference is a forum for presentation of the state of the art in theory application tools and industrialization of FDTs and provides an excellent orientation for newcomers **A Practical Approach to Real-time Systems** Phillip A. Laplante, 2000 Under the same cover this volume offers both modern and classic papers focusing on real time systems design and analysis Rather than focusing in theoretical observations of real time systems it is intended for the practical professional who is building real real time systems The editor himself the author of a course on real time systems has selected articles to provide a deep exploration of issues raised in his other works In particular emphasis is placed on applying practical but theoretically sound approaches in software engineering rate monotonic design and analysis testing and architecting systems for real time applications Protocol Specification, Testing, and Verification, VIII Sudhir

Aggarwal, Krishan Sabnani, 1988 *Software for Computer Control* 1986 D. Florian, V. Haase, 2014-05-23 This volume studies the advances of software for computers their development applications and management Topics covered include software project management real time languages and their uses and computer aided design techniques The book also discusses how far artificial intelligence is integrated with business and industry to give a complete overview of the role of computer systems today

**Protocol Test Systems** Tadanori Mizuno, Teruo Higashino, Norio Shiratori, 2013-03-09 This book presents the latest research results in protocol testing It contains the complete proceedings of the seventh IFIP WG6 1 International Workshop on Protocol Test Systems IWPTS 94 organized by the International Federation for Information Processing and held in Tokyo Japan in November 1994 The book presents an alliance between research and industry and between the theory and practice of testing of data communication systems

**ICCC Symposium '89 on Computer Communication**, 1989 **Object-oriented Environments** Jørgen Lindskov Knudsen, Jørgen Lindskov Knudsen, 1994 This volume presents the results of extensive research into object orientation including object oriented design implementation languages and environments The focus of the book has been to develop and promote object oriented techniques into industry leading to prototype evaluations product development and the commercial development of OSDL tools

**Information Processing**, 1986 **Formal Description Techniques** Kenneth J. Turner, 1989 Software tools papers Software tools demonstrations Object oriented design with FDTs Language issues arising practical use Theoretical aspects of analysis Experience in writing formal descriptions Practical aspects of analysis

*Automatic Control and Computer Sciences*, 1990 *Elektronikk*, 1993 Keys to Successful Software Development Phillip A. Laplante, 1999 In this compendium readers should find current and classical articles and papers on software project management Useful for new software project managers seeking to come up to speed quickly experienced software project managers looking for new approaches and software project team members looking for insights this collection presents practical techniques and a scientific framework for managing the software enterprise Areas covered include managing projects and people software life cycle processes requirements engineering reuse and reengineering reliability risk mitigation and avoidance using metrics and process measurement and tools

**Annex F.1 to Recommendation Z.100, SDL Formal Definition** Comité Consultivo Internacional Telegráfico y Telefónico. Asamblea Plenaria (, 1989 Elektronisches W hlsystem Telefonie Signal bertragung Signalisierung Telefonie Organisationstheorie Ablauforganisation Software Programmiersprache Betriebssystem EDV

**Protocol Specification, Testing, and Verification, IX** Ed Brinksma, Giuseppe Scollo, Chris A. Vissers, 1990 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

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