

# Milestones in Software Evolution

*Edited by Paul W. Oman and Ted G. Lewis*



IEEE Computer Society Press  
Los Alamitos, California

Washington • Brussels • Tokyo

# Table of Contents

<b>Preface</b> . . . . .	v
<b>Section 1: The First Guiding Lights</b> . . . . .	1
Flow Diagrams, Turing Machines and Languages with Only Two Formation Rules . . . . .	3
<i>C. Böhm and G. Jacopini (Communications of the ACM, Vol. 9, No. 5, May 1966, pp. 366-371)</i>	
GO TO Statement Considered Harmful . . . . .	9
<i>E.W. Dijkstra (Communications of the ACM, Vol. 11, No. 3, Mar. 1968, pp. 147-148.</i>	
The Art of Computer Programming . . . . .	11
<i>D. Knuth (Fundamental Algorithms, Vol. 1, 1968, pp. 1-9)</i>	
Program Development by Stepwise Refinement . . . . .	20
<i>N. Wirth (Communications of the ACM, Vol. 14, No. 4, April 1971, pp. 221-227)</i>	
On the Criteria To Be Used in Decomposing Systems into Modules . . . . .	27
<i>D.L. Parnas (Communications of the ACM, Vol. 15, No. 12, Dec. 1972, pp. 1053-1058)</i>	
<b>Section 2: The Awakening--Towards Science and Engineering</b> . . . . .	33
The Mythical Man-Month . . . . .	35
<i>F.P. Brooks (Datamation, Vol. 20, No. 12, Dec. 1974, pp. 35-42)</i>	
A Genealogy of Control Structures . . . . .	43
<i>H.F. Ledgard and M. Marcotty (Communications of the ACM, Vol. 18, No. 11, Nov. 1975, pp. 629-639)</i>	
Software Engineering . . . . .	54
<i>B.W. Boehm, IEEE Transactions on Computers, Vol. C-25, No. 12, Dec. 1976, pp. 1226-1241)</i>	
A Survey of Programming Design and Specification Techniques . . . . .	70
<i>C. Jones (Proceedings, Specifications of Reliable Software, 1979, pp. 91-103)</i>	
Why Use Logic? Why Prove Programs Correct? . . . . .	83
<i>D. Gries (The Science of Programming, pp. 1-5, Part 0)</i>	
<b>Section 3: Recognizing the "Big" Picture--Stages of Software Development</b> . . . . .	89
A Taxonomy of Current Issues in Requirements Engineering . . . . .	91
<i>G. Roman (Computer, Vol. 18, No. 4, Apr. 1985, pp. 14-22)</i>	
A Guided Tour of Program Design Methodologies . . . . .	100
<i>G.D. Bergland (Computer, October 1981, pp. 18-37)</i>	
Verifying and Validating Software Requirements and Design Specifications . . . . .	125
<i>B.W. Boehm (IEEE Software, Vol. 1, No. 1, Jan. 1984, pp. 75-88)</i>	
Abstraction Techniques in Modern Programming Languages . . . . .	140
<i>M. Shaw (IEEE Software, Vol. 1, No. 4, Oct. 1984, pp. 10-26)</i>	
Toward a Theory of Test Data Selection . . . . .	156
<i>J.B. Goodenough and S.L. Gerhart (IEEE Transactions on Software Engineering, Vol. SE-1, No. 2, June 1975, pp. 156-173)</i>	
The State of Software Maintenance . . . . .	174
<i>N.F. Schneidewind (IEEE Transactions on Software Engineering, Vol. SE-13, No. 3, Mar. 1987, pp. 303-310)</i>	

<b>Section 4: Looking for Improvements -- Towards Quality and Productivity . . . . .</b>	<b>183</b>
Assessing Software Maintainability . . . . .	185
<i>G.M. Berns (Communications of the ACM, Vol. 27, No. 1, Jan. 1984, pp. 14-23)</i>	
Automated Software Quality Assurance . . . . .	195
<i>H.M. Sneed and A. Meroy (IEEE Transactions on Software Engineering, Vol. SE-11, No. 9, Sept. 1985, pp. 909-916)</i>	
Classifying Software for Reusability . . . . .	204
<i>R. Prieto-Diaz and P. Freeman (IEEE Software, Vol. 4, No. 1, Jan. 1987, pp. 6-16)</i>	
Cleanroom Software Engineering . . . . .	215
<i>H.D. Mills, M. Dyer, and R.C. Linger (IEEE Software, Vol. 4, No. 5, Sept. 1987, pp. 19-24)</i>	
Tools for Measuring Software Reliability . . . . .	221
<i>J. D. Musa (IEEE Spectrum, Vol. 26, No. 2, Feb. 1989, pp. 39-42)</i>	
<b>Section 5: A Renaissance of Paradigms -- Challenging the Norms . . . . .</b>	<b>225</b>
Message/Object Programming: An Evolutionary Change in Programming Technology . . . . .	226
<i>B.J. Cox (IEEE Software, Vol. 1, No. 1, Jan. 1984, pp. 50-61)</i>	
Visual Languages: A Tutorial and Survey . . . . .	238
<i>S. Chang (IEEE Software, Vol. 4, No. 1, Jan. 1987, pp. 29-39)</i>	
A Spiral Model of Software Development and Enhancement . . . . .	249
<i>B.W. Boehm (Computer, Vol. 21, No. 5, May 1988, pp. 61-72)</i>	
User-Interface Tools: Introduction and Survey . . . . .	261
<i>B. Myers (IEEE Software, Vol. 6, No. 1, Jan. 1989, pp. 15-24)</i>	
<b>Section 6: Looking Back, Looking Forward . . . . .</b>	<b>271</b>
Programming: Sorcery or Science? . . . . .	273
<i>C.A.R. Hoare (IEEE Software, Vol. 1, No. 2, April 1984, pp. 5-16)</i>	
Structured Programming: Retrospect and Prospect . . . . .	284
<i>H. Mills (IEEE Software, Vol. 3, No. 6, Nov. 1986, pp. 58-66)</i>	
No Silver Bullet: Essence and Accidents of Software Engineering . . . . .	293
<i>F.P. Brooks (Information Processing 86, edited by H.J. Kugler 1986, pp. 1069-1076)</i>	
Characterizing the Software Process: A Maturity Framework . . . . .	301
<i>W. Humphrey (IEEE Software, Vol. 5, No. 2, Mar. 1988, pp. 73-79)</i>	
<b>Section 7: Bibliography of recommended readings . . . . .</b>	<b>309</b>
Index . . . . .	311
About the Authors . . . . .	318