Dependable Computing and Fault-Tolerant Systems

Edited by
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William C. Carter
A. Avižienis, H. Kopetz, J. C. Laprie (eds.)

The Evolution of Fault-Tolerant Computing

In the Honor of William C. Carter

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Foreword

For the editors of this book, as well as for many other researchers in the area of fault-tolerant computing, Dr. William Caswell Carter is one of the key figures in the formation and development of this important field. We felt that the IFIP Working Group 10.4 at Baden, Austria, in June 1986, which coincided with an important step in Bill's career, was an appropriate occasion to honor Bill's contributions and achievements by organizing a one-day "Symposium on the Evolution of Fault-Tolerant Computing" in the honor of William C. Carter.

The Symposium, held on June 30, 1986, brought together a group of eminent scientists from all over the world to discuss the evolution, the state of the art, and the future perspectives of the field of fault-tolerant computing. Historic developments in academia and industry were presented by individuals who themselves have actively been involved in bringing them about. The Symposium proved to be a unique historic event and these Proceedings, which contain the final versions of the papers presented at Baden, are an authentic reference document.

Vienna, May 1987

Algirdas Avižienis
Hermann Kopetz
Jean-Claude Laprie
The Working Group WG 10.4 of IFIP, the International Federation for Information Processing, was established by the IFIP General Assembly in October 1980, and operates under IFIP Technical Committee TC-10, "Digital Systems Design". The charter of WG 10.4 states the aim and the scope of this Working Group as follows:

**Aim:** Correct design and reliable operation are basic goals for all classes of information processing systems (data processing, process control, telecommunications, etc.). The Aim of the Working Group is to promote and integrate the many diverse specialities of reliable computing (fault tolerance and fault avoidance) into a cohesive field of scientific and technical knowledge.

**Scope:** Specifically, the Working Group is concerned with progress in:

- understanding of faults (design faults, physical faults, human interaction faults, etc.) and their effects;
- development of specification and design methods for reliability, availability, maintainability, testability and verifiability;
- development of methods for fault detection and treatment;
- development of validation methods (testing, verification, evaluation);
The concept of WG 10.4 was formulated during the IFIP Working Conference on Reliable Computing and Fault Tolerance on September 27-29, 1979 in London, England, held in conjunction with the Euro-IFIP 79 Conference. Professor A. Avizienis of UCLA, Los Angeles, USA and Professor A. Costes of LAAS, Toulouse, France, who organized the London Conference and proposed the formation of the Working Group were appointed as Chairman and Vice Chairman, respectively, of the new WG 10.4 in 1980 and served until 1986, when Dr. J. C. Laprie (LAAS, Toulouse, France) succeeded to serve as Chairman, and Profs. J. Meyer (University of Michigan, USA), and Y. Tohma (Tokyo Institute of Technology, Japan) became Vice Chairmen of the Working Group.

The first meeting of the new WG 10.4 took place in Portland, Maine, USA, on June 22-23, 1981. In attendance were 29 founding members of the Working Group. Since then, the membership has grown to 50 members from 15 countries. Ten WG 10.4 meetings have been held from 1981 through 1986 in various locations, including USA (4 meetings), France (2), and Italy, Australia, Canada, Austria (1 each).

The main goal of WG 10.4 meetings is to conduct in-depth discussions of important technical topics. The principal theme since the first meeting has been the understanding and exposition of the fundamental concepts of fault-tolerant computing. Other major topics have been: distributed computing, real-time systems, certification of dependable systems, specification methods, and design diversity. Beside the key themes, research reports by members and guests are presented at every meeting, and business meetings are held to plan future activities.

In addition to group meetings, beginning in 1982 the WG 10.4 has served as a cooperating sponsor of the annual International Symposium on Fault-Tolerant Computing that is organized by the TC on Fault-Tolerant Computing of the IEEE Computer Society. Since 1983, the WG 10.4 also cooperates with the "Safety, Security, and Reliability" technical committee (TC 7) of EWICS, the European Workshop on Industrial Computer Systems, and other groups in sponsorship of the IFAC SAFECOMP Workshops.

This volume is first of a series of technical books that represent the efforts of the members of IFIP WG 10.4 and of their colleagues who cooperate with them or are guests at WG 10.4 meetings.
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