

A Generic Fault-Tolerant Architecture for Real-Time Dependable Systems

**Edited by
David Powell**

Generic Fault Tolerant Architecture For Real Time Dependable Systems

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Generic Fault Tolerant Architecture For Real Time Dependable Systems:

A Generic Fault-Tolerant Architecture for Real-Time Dependable Systems David Powell, 2013-04-17 The design of computer systems to be embedded in critical real time applications is a complex task Such systems must not only guarantee to meet hard real time deadlines imposed by their physical environment they must guarantee to do so dependably despite both physical faults in hardware and design faults in hardware or software A fault tolerance approach is mandatory for these guarantees to be commensurate with the safety and reliability requirements of many life and mission critical applications This book explains the motivations and the results of a collaborative project whose objective was to significantly decrease the lifecycle costs of such fault tolerant systems The end user companies participating in this project already deploy fault tolerant systems in critical railway space and nuclear propulsion applications However these are proprietary systems whose architectures have been tailored to meet domain specific requirements This has led to very costly inflexible and often hardware intensive solutions that by the time they are developed validated and certified for use in the field can already be out of date in terms of their underlying hardware and software technology *Delta-4: A Generic Architecture for Dependable Distributed Computing* David Powell, 2012-12-06 Delta 4 is a 5 nation 13 partner project that has been investigating the achievement of dependability in open distributed systems including real time systems This book describes the design and validation of the distributed fault tolerant architecture developed within this project The key features of the Delta 4 architecture are a a distributed object oriented application support environment b built in support for user transparent fault tolerance c use of multicast or group communication protocols and d use of standard off the shelf processors and standard local area network technology with minimum specialized hardware The book is organized as follows The first 3 chapters give an overview of the architecture s objectives and of the architecture itself and compare the proposed solutions with other approaches Chapters 4 to 12 give a more detailed insight into the Delta 4 architectural concepts Chapters 4 and 5 are devoted to providing a firm set of general concepts and terminology regarding dependable and real time computing Chapter 6 is centred on fault tolerance techniques based on distribution The description of the architecture itself commences with a description of the Delta 4 application support environment Deltase in chapter 7 Two variants of the architecture the Delta 4 Open System Architecture OSA and the Delta 4 Extra Performance Architecture XPA are described respectively in chapters 8 and 9 Both variants of the architecture have a common underlying basis for dependable multicasting i e **Architecting Dependable Systems IV** Rogério de Lemos, 2007-08-15 As software systems become ubiquitous the issues of dependability become more and more crucial This state of the art survey contains 18 expanded and peer reviewed papers based on the carefully selected contributions to the Workshop on Architecting Dependable Systems WADS 2006 organized at the 2006 International Conference on Dependable Systems and Networks DSN 2006 held in Philadelphia PA USA in June 2006 *Reliable Software Technologies - Ada-Europe 2002* Johann Blieberger, Alfred

Strohmeier,2003-08-02 This book constitutes the refereed proceedings of the 7th International Conference on Reliable Software Technologies Ada Europe 2002 held in Vienna Austria in June 2002 The 24 revised full papers presented together with four invited papers were carefully reviewed and selected for inclusion in the proceedings The papers are organized in topical sections on embedded systems case studies real time systems high integrity systems Ada language issues program analysis tools distributed systems and libraries and APIs *Dependable Computing Systems* Hassan B. Diab,Albert Y. Zomaya,2005-10-05 A team of recognized experts leads the way to dependable computing systems With computers and networks pervading every aspect of daily life there is an ever growing demand for dependability In this unique resource researchers and organizations will find the tools needed to identify and engage state of the art approaches used for the specification design and assessment of dependable computer systems The first part of the book addresses models and paradigms of dependable computing and the second part deals with enabling technologies and applications Tough issues in creating dependable computing systems are also tackled including Verification techniques Model based evaluation Adjudication and data fusion Robust communications primitives Fault tolerance Middleware Grid security Dependability in IBM mainframes Embedded software Real time systems Each chapter of this contributed work has been authored by a recognized expert This is an excellent textbook for graduate and advanced undergraduate students in electrical engineering computer engineering and computer science as well as a must have reference that will help engineers programmers and technologists develop systems that are secure and reliable *Architecture and Design of Distributed Embedded Systems* Bernd Kleinjohann,2013-04-18 Due to the decreasing production costs of IT systems applications that had to be realised as expensive PCBs formerly can now be realised as a system on chip Furthermore low cost broadband communication media for wide area communication as well as for the realisation of local distributed systems are available Typically the market requires IT systems that realise a set of specific features for the end user in a given environment so called embedded systems Some examples for such embedded systems are control systems in cars airplanes houses or plants information and communication devices like digital TV mobile phones or autonomous systems like service or edutainment robots For the design of embedded systems the designer has to tackle three major aspects The application itself including the man machine interface The target architecture of the system including all functional and non functional constraints and the design methodology including modelling specification synthesis test and validation The last two points are a major focus of this book This book documents the high quality approaches and results that were presented at the International Workshop on Distributed and Parallel Embedded Systems DIPES 2000 which was sponsored by the International Federation for Information Processing IFIP and organised by IFIP working groups WG10 3 WG10 4 and WG10 5 The workshop took place on October 18 19 2000 in Schlo Eringerfeld near Paderborn Germany Architecture and Design of Distributed Embedded Systems is organised similar to the workshop Chapters 1 and 4 Methodology I and II deal with different modelling and

specification paradigms and the corresponding design methodologies Generic system architectures for different classes of embedded systems are presented in Chapter 2 In Chapter 3 several design environments for the support of specific design methodologies are presented Problems concerning test and validation are discussed in Chapter 5 The last two chapters include distribution and communication aspects Chapter 6 and synthesis techniques for embedded systems Chapter 7 This book is essential reading for computer science researchers and application developers

Architecting Dependable Systems II Rogério de Lemos, Cristina Gacek, Alexander Romanovsky, 2004-10-22 As software systems become ubiquitous the issues of dependability become more and more critical Given that solutions to these issues must be taken into account from the very beginning of the design process it is appropriate that dependability is addressed at the architectural level This book results from an effort to bring together the research communities of software architectures and dependability Inspired by the ICSE 2003 Workshop on Software Architectures for Dependable Systems the book focuses on topics relevant to improving the state of the art in architecting dependable systems The 15 thoroughly reviewed papers originate partly from the workshop others were solicited in order to achieve complete coverage of all relevant aspects The papers are organized into topical sections on architectures for dependability fault tolerance in software architectures dependability analysis in software architectures and industrial experience

Distributed, Parallel and Biologically Inspired Systems Mike Hinchey, Bernd Kleinjohann, Lisa Kleinjohann, Peter Lindsay, Franz J. Rammig, Jon Timmis, Marilyn Wolf, 2010-08-06 This volume contains the proceedings of two conferences held as part of the 21 IFIP World Computer Congress in Brisbane Australia 20-23 September 2010 The first part of the book presents the proceedings of DIPES 2010 the 7 IFIP Conference on Distributed and Parallel Embedded Systems The conference introduced in a separate preface by the Chairs covers a range of topics from specification and design of embedded systems through to dependability and fault tolerance The second part of the book contains the proceedings of BICC 2010 the 3 IFIP Conference on Biologically Inspired Collaborative Computing The conference is concerned with emerging techniques from research areas such as organic computing autonomic computing and self adaptive systems where inspiration for techniques derives from exhibited behaviour in nature and biology Such techniques require the use of research developed by the DIPES community in supporting collaboration over multiple systems We hope that the combination of the two proceedings will add value for the reader and advance our related work

Building the Information Society Rene Jacquot, 2008-04-08 In the context of the 18th IFIP World Computer Congress WCC 04 and beside the traditional organization of conferences workshops tutorials and student forum it was decided to identify a range of topics of dramatic interest for the building of the Information Society This has been featured as the Topical day session track of the WCC 04 Topical Sessions have been selected in order to present syntheses latest developments and or challenges in different business and technical areas Building the Information Society provides a deep perspective on domains including the semantic integration of heterogeneous data virtual realities and new entertainment fault tolerance for trustworthy and dependable

information infrastructures abstract interpretation and its use for verification of program properties multimodal interaction computer aided inventing emerging tools and techniques for avionics certification bio nano and information technologies E learning perspectives on ambient intelligence the grand challenge of building a theory of the Railway domain open source software in dependable systems interdependencies of critical infrastructure social robots as a challenge for machine intelligence Building the Information Society comprises the articles produced in support of the Topical Sessions during the IFIP 18th World Computer Congress which was held in August 2004 in Toulouse France and sponsored by the International Federation for Information Processing IFIP *On the Move to Meaningful Internet Systems 2004: OTM 2004 Workshops* Zahir Tari, Angelo Corsaro, 2004-10-14 A special mention for 2004 is in order for the new Doctoral Symposium Workshop where three young postdoc researchers organized an original setup and formula to bring PhD students together and allow them to submit their research proposals for selection A limited number of the submissions and their approaches were independently evaluated by a panel of senior experts at the conference and presented by the students in front of a wider audience These students also got free access to all other parts of the OTM program and only paid a heavily discounted fee for the Doctoral Symposium itself In fact their attendance was largely sponsored by the other participants If evaluated as successful it is the intention of the General Chairs to expand this model in future editions of the OTM conferences and so draw in an audience of young researchers to the OnTheMove forum All three main conferences and the associated workshops share the distributed aspects of modern computing systems and the resulting application created by the Internet and the so called Semantic Web For DOA 2004 the primary emphasis stayed on the distributed object infrastructure for ODBASE 2004 it was the knowledge bases and methods required for enabling the use of formal semantics and for CoopIS 2004 the main topic was the interaction of such technologies and methods with management issues such as occurs in networked organizations These subject areas naturally overlap and many submissions in

fact also treat envisaged mutual impacts among them **On the Move to Meaningful Internet Systems 2004: OTM 2004 Workshops** R. Meersman, 2004-10-14 This book constitutes the joint refereed proceedings of seven international workshops held as part of OTM 2004 in Agia Napa Cyprus in October 2004 The 73 revised papers presented together with 31 abstracts of posters from the OTM main conferences were carefully reviewed and selected from more than 150 submissions In accordance with the 7 workshops the papers are organized in topical sections on grid computing and its applications to data analysis Java technologies for real time and embedded systems modeling inter organizational systems regulatory ontologies ontologies semantics and e learning PhD symposium and interoperability Distributed Systems for System Architects Paulo Veríssimo, Luís Rodrigues, 2012-12-06 The primary audience for this book are advanced undergraduate students and graduate students Computer architecture as it happened in other fields such as electronics evolved from the small to the large that is it left the realm of low level hardware constructs and gained new dimensions as distributed systems became the

keyword for system implementation As such the system architect today assembles pieces of hardware that are at least as large as a computer or a network router or a LAN hub and assigns pieces of software that are self contained such as client or server programs Java applets or protocol modules to those hardware components The freedom she he now has is tremendously challenging The problems alas have increased too What was before mastered and tested carefully before a fully fledged mainframe or a closely coupled computer cluster came out on the market is today left to the responsibility of computer engineers and scientists invested in the role of system architects who fulfil this role on behalf of software vendors and integrators add value system developers R D institutes and final users As system complexity size and diversity grow so increases the probability of inconsistency unreliability non responsiveness and insecurity not to mention the management overhead

What System Architects Need to Know The insight such an architect must have includes but goes well beyond the functional properties of distributed systems *Advances in Distributed Systems* Sacha Krakowiak, Santosh Shrivastava, 2003-06-26 In 1992 we initiated a research project on large scale distributed computing systems LSDCS It was a collaborative project involving research institutes and universities in Bologna Grenoble Lausanne Lisbon Rennes Rocquencourt Newcastle and Twente The World Wide Web had recently been developed at CERN but its use was not yet as common place as it is today and graphical browsers had yet to be developed It was clear to us and to just about everyone else that LSDCS comprising several thousands to millions of individual computer systems nodes would be coming into existence as a consequence both of technological advances and the demands placed by applications We were excited about the problems of building large distributed systems and felt that serious rethinking of many of the existing computational paradigms algorithms and structuring principles for distributed computing was called for In our research proposal we summarized the problem domain as follows We expect LSDCS to exhibit great diversity of node and communications capability Nodes will range from mobile laptop computers workstations to supercomputers Whereas mobile computers may well have unreliable low bandwidth communications to the rest of the system other parts of the system may well possess high bandwidth communications capability To appreciate the problems posed by the sheer scale of a system comprising thousands of nodes we observe that such systems will be rarely functioning in their entirety *Distributed Computer Control Systems* 1995 A.E.K. Sahraoui, J.A. de la Puente, 2014-05-23 The series of IFAC Workshops on distributed computer control systems DCCS provide the opportunity for leading researchers and practitioners in the field to discuss and evaluate recent advances and current issues in theory applications and technology of DCCS DCCS 95 the 13th IFAC workshop in the series was held in Toulouse Blagnac France The topics covered at this meeting included the role of real time in DCCS specifications scheduling methods for DCCS real time distributed operating systems and databases and industrial applications and experience with DCCS

Resource Management in Real-time Systems and Networks C. Siva Ram Murthy, G. Manimaran, 2001 This book introduces the concepts and state of the art research developments of resource management in real time systems and

networks Real time systems and networks are of increasing importance in many applications including automated factories telecommunication systems defense systems and space systems This book introduces the concepts and state of the art research developments of resource management in real time systems and networks Unlike other texts in the field it covers the entire spectrum of issues in resource management including task scheduling in uniprocessor real time systems task scheduling fault tolerant task scheduling and resource reclaiming in multiprocessor real time systems conventional task scheduling and object based task scheduling in distributed real time systems message scheduling QoS routing dependable communication multicast communication and medium access protocols in real time networks It provides algorithmic treatments for all of the issues addressed highlighting the intuition behind each algorithm and giving examples The book also includes two chapters of case studies

Architecting Dependable Systems Rogério de Lemos,Cristina Gacek,Alexander Romanovsky,2007-08-01 As software systems become more and more ubiquitous the issues of dependability become more and more critical Given that solutions to these issues must be planned at the beginning of the design process it is appropriate that these issues be addressed at the architectural level This book is inspired by the ICSE 2002 Workshop on Architecting Dependable Systems it is devoted to current topics relevant for improving the state of the art for architecting dependability Some of the 13 peer reviewed papers presented were initially presented at the workshop others were invited in order to achieve competent and complete coverage of all relevant aspects The papers are organized in topical sections on architectures for dependability fault tolerance in software architectures dependability analysis in software architectures industrial experience

First International Symposium on Object-Oriented Real-Time Distributed Computing (ISORC '98) ,1998 Aimed at researchers professors practitioners students and other professionals this work looks at object oriented real time distributed computing

Model-Based Engineering of Embedded Real-Time Systems Holger Giese,Gabor Karsai,Edward A. Lee,Bernhard Rumpe,Bernhard Schätz,2010-10-06 The topic of Model Based Engineering of Real Time Embedded Systems brings together a challenging problem domain real time embedded systems and a solution domain model based engineering It is also at the forefront of integrated software and systems engineering as software in this problem domain is an essential tool for system implementation and integration Today real time embedded software plays a crucial role in most advanced technical systems such as airplanes mobile phones and cars and has become the main driver and catalyst for innovation Development evolution verification configuration and maintenance of embedded and distributed software nowadays are often serious challenges as drastic increases in complexity can be observed in practice Model based engineering in general and model based software development in particular advocates the notion of using models throughout the development and life cycle of an engineered system Model based software engineering reinforces this notion by promoting models not only as the tool of abstraction but also as the tool for verification implementation testing and maintenance The application of such model based engineering techniques to embedded real time systems appears to be a good candidate to

tackle some of the problems arising in the problem domain

Enterprise Information Systems VII Chin-Sheng

Chen, Joaquim Filipe, Isabel Seruca, José Cordeiro, 2007-09-20 The purpose of the 7th International Conference on Enterprise Information Systems ICEIS was to bring together researchers engineers and practitioners interested in the advances and business applications of information systems ICEIS focuses on real world applications therefore authors were asked to highlight the benefits of Information Technology for industry and services Papers included in the book are the best papers presented at the conference

Software Architecture and Design for Reliability Predictability Assefa D. Semegn, 2011-09-22

Reliability prediction of a software product is complex due to interdependence and interactions among components and the difficulty of representing this behavior with tractable models Models developed by making simplifying assumptions about the software structure may be easy to use but their result may be far from what happens in reality Making assumptions closer to the reality which allows complex interactions and interdependences among components results in models that are too complex to use Their results may also be too difficult to interpret The reliability prediction problem is worsened by the lack of precise information on the behavior of components and their interactions information that is relevant for reliability modeling Usually the interactions are not known precisely because of subtle undocumented side effects Without accurate precise information even mathematically correct models will not yield accurate reliability predictions Deriving the necessary information from program code is not practical if not impossible This is because the code contains too much implementation detail to be useful in creating a tractable model It is also difficult to analyze system reliability completely based on the program code This book documents the resulting novel approach of designing specifying and describing the behavior of software systems in a way that helps to predict their reliability from the reliability of the components and their interactions The design approach is named design for reliability predictability DRP It integrates design for change precise behavioral documentation and structure based reliability prediction to achieve improved reliability prediction of software systems The specification and documentation approach builds upon precise behavioral specification of interfaces using the trace function method TFM It also introduces a number of structure functions or connection documents These functions capture both the static and dynamic behaviors of component based software systems They are used as a basis for a novel document driven structure based reliability prediction model System reliability assessment is studied in at least three levels component reliability which is assumed to be known interaction reliability a novel approach to studying software reliability and service reliability whose estimation is the primary objective of reliability assessment System reliability can be expressed as a function of service reliability A mobile streaming system designed and developed by the author as an industrial product is used as a case study to demonstrate the application of the approach

Generic Fault Tolerant Architecture For Real Time Dependable Systems Book Review: Unveiling the Magic of Language

In an electronic era where connections and knowledge reign supreme, the enchanting power of language has become more apparent than ever. Its ability to stir emotions, provoke thought, and instigate transformation is really remarkable. This extraordinary book, aptly titled "**Generic Fault Tolerant Architecture For Real Time Dependable Systems**," published by a very acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound affect our existence. Throughout this critique, we will delve into the book is central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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