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Model-Driven Dependability Assessment of Software Systems

Digest of Papers

Dependable Computing for Critical Applications

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.

Dependable Computing EDCC-4

Fundamentals of Dependable Computing for Software Engineers

Dependability: Basic Concepts and Terminology

This book analyzes the causes of failures in computing systems, their consequences, as well as the existing solutions to manage them. The domain is tackled in a progressive and educational manner with two objectives: 1. The mastering of the basics of dependability domain at system level, that is to say independently of the technology used (hardware or software) and of the domain of application. 2. The understanding of the fundamental techniques available to prevent, to remove, to tolerate, and to forecast faults in hardware and software technologies. The first objective leads to the presentation of the general problem, the fault models and degradation mechanisms which are at the origin of the failures, and finally the methods and techniques which permit the faults to be prevented, removed or tolerated. This study concerns logical systems in general, independently of the hardware and software technologies put in place. This knowledge is indispensable for two reasons: • A large part of a product's development is independent of the technological means (expression of requirements, specification and most of the design stage). Very often, the development team does not possess this basic knowledge; hence, the dependability requirements are considered uniquely during the technological implementation. Such an approach is expensive and inefficient. Indeed, the removal of a preliminary design fault can be very difficult (if possible) if this fault is

detected during the product's final testing.

Advances in Computers

It was with great pleasure that, on behalf of the entire organizing committee, I welcomed participants to EDCC-4, the Fourth European Dependable Computing Conference, held for the first time in France. The fourth issue of EDCC carried on the traditions established by the previous conferences in this series: EDCC-1 was held in Berlin (Germany) in October 1994, EDCC-2 in Taormina (Italy) in October 1996, and EDCC-3 in Prague (Czech Republic) in September 1999. EDCC evolved from a merger of two other conference series at the moment when the Iron Curtain fell. One of these, known as the "International Conference on Fault-Tolerant Computing Systems", was organized during the period 1982-1991, by the German Technical Interest Group "Fault-Tolerant Computing Systems". The other series, known as the "International Conference on Fault-Tolerant Systems and Diagnostics", was organized during the period 1975-1990 in the former Czechoslovakia, Poland, Bulgaria, and the former GDR. The composition of the EDCC steering committee and the organizing committees of the successive issues of the conference have mirrored the East-West unification character of the conference series. The EDCC conference is becoming a unique meeting point for researchers and practitioners from all over the world in the field of Dependable Systems. It is organized by the SEE Working Group "Dependable Computing" in France, the

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GI/ITG/GMA Technical Committee on Dependability and Fault Tolerance in Germany, and the AICA Working Group "Dependability of Computer Systems" in Italy. Furthermore, committees of several global professional organizations, such as IEEE and IFIP, support the conference.

International Conference on Dependable Systems and Networks

Safety and Reliability of Software Based Systems

This volume contains the conference proceedings of the 2001 6th IEEE International Symposium on High Assurance Systems Engineering.

Computer Security, Dependability, and Assurance

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

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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.

1999 Pacific Rim International Symposium on Dependable Computing

This book presents papers on various problems of dependability in computer systems and networks that were discussed at the 14th DepCoS-RELCOMEX conference, in Brunów, Poland, from 1st to 5th July 2019. Discussing new ideas, research results and developments in the design, implementation, maintenance and analysis of complex computer systems, it is of interest to researchers and practitioners who are dealing with dependability issues in such systems.

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Dependability analysis came as a response to new challenges in the evaluation of contemporary complex systems, which should be considered as systems of people – with their needs and behaviours – interacting with technical communication channels (such as mobile activities, iCloud, Internet of Everything) and online applications, often operating in hostile environments. The diversity of topics covered, illustrates the variety of methods used in this area, often with the help of the latest results in artificial and computational intelligence.

International Symposium on Fault-Tolerant Computing

Systems engineers are increasingly having to deal with the problem of how to make the process of designing and constructing dependable computing systems much more predictable and cost-effective. The great challenge about dependability is that it is a systems issue, since virtually all aspects of a computing system, and of the means by which it was specified, designed and constructed, can affect the system's overall dependability. This book explores links, and gaps, between topics that are often investigated separately, but whose interactions can be of considerable relevance to issues of overall system dependability. It contains material on all four of the main topics that are crucial to the successful production of dependable computing systems namely: fault prevention, fault tolerance, fault removal, and fault forecasting. Particular emphasis is placed on the problems of real-time and distributed computing systems. This book provides up to date

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information about the latest research on these topics from a team made up of many of Europe's leading researchers - it is based on the work of two successive major ESPRIT Basic Research Projects on Predictably Dependable Computing Systems. These projects lasted over six years in total, and each involved approximately forty researchers at any one time. The book contains a carefully edited selection from among the over two hundred published papers produced by the PDCS projects and provides a good general overview of the work of the two projects, as well as coverage of most of the projects' major research achievements.

Design Guidelines for a Monitoring Environment Concerning Distributed Real-time Systems

The only recent book on dependability/fault-tolerance that covers both software and hardware aspects of dependability, Dependable Computing Design and Assessment addresses the new reality of dependability. After a discussion of reliability, availability, and hardware and software fault models, the authors explore hardware redundancy, coding techniques, processor-level error detection and recovery, checkpoint and recovery, software fault tolerance techniques, and network-specific issues. Ideal for both students and practitioners, the capabilities and applicability of all techniques are illustrated with examples of actual applications and systems.

Dependable Computing

Annotation These proceedings from a June 2002 conference present new results from research and experiences in areas including hardware architecture and design, distributed computing, security and intrusion tolerance, software techniques, dependability modeling and evaluation, and networking. Other themes include failure detectors, Internet performance and dependability, and measurement and analysis of distributed systems. Specific topics include an adaptive decomposition approach for the analysis of stochastic Petri nets, self-organizing systems with self-diagnosability, process modeling to support dependability arguments, and secure intrusion-tolerant replication on the Internet. Work from the conference reflects an increased emphasis in the field on systems design and implementation. There is no subject index. Annotation copyrighted by Book News, Inc., Portland, OR.

Dependable Computing

Fundamentals of Dependable Computing for Software Engineers presents the essential elements of computer system dependability. The book describes a comprehensive dependability-engineering process and explains the roles of software and software engineers in computer system dependability. Readers will

learn:Why dependability mattersWhat it means for a

Dependable Computing

Dependability analysis is the recent approach to performance evaluation of contemporary systems which tries to cope with new challenges that are brought with their unprecedented complexity, size and diversity. Especially in case of computer systems and networks such evaluation must be based on multidisciplinary approach to theory, technology, and maintenance of systems which operate in real (and very often unfriendly) environments. As opposed to “classic” reliability which focuses mainly on technical aspects of system functioning, dependability studies investigate the systems as multifaceted and sophisticated amalgamations of technical, information and also human resources. This monograph presents selected new developments in such areas of dependability research as mathematical models, evaluation of software, probabilistic assessment, methodologies, tools, and technologies. Intelligent and soft computing methods help to resolve fundamental problems of dependability analysis which are caused by the fact that in contemporary computer systems it is often difficult to find a relation between system elements and system events (the relation between reasons and results) and it is even more difficult to define strict mathematical models with “analytical” relationships between such phenomena.

Delta-4: A Generic Architecture for Dependable Distributed Computing

The International Working Conference on Dependable Computing for Critical Applications was the first conference organized by IFIP Working Group 10.4 "Dependable Computing and Fault Tolerance", in cooperation with the Technical Committee on Fault-Tolerant Computing of the IEEE Computer Society, and the Technical Committee 7 on Systems Reliability, Safety and Security of EWICS. The rationale for the Working Conference is best expressed by the aims of WG 10.4: "Increasingly, individuals and organizations are developing or procuring sophisticated computing systems on whose services they need to place great reliance. In differing circumstances, the focus will be on differing properties of such services - e. g. continuity, performance, real-time response, ability to avoid catastrophic failures, prevention of deliberate privacy intrusions. The notion of dependability, defined as that property of a computing system which allows reliance to be justifiably placed on the service it delivers, enables these various concerns to be subsumed within a single conceptual framework. Dependability thus includes as special cases such attributes as reliability, availability, safety, security. The Working Group is aimed at identifying and integrating approaches, methods and techniques for specifying, designing, building, assessing, validating, operating and maintaining computer systems which should exhibit some or all of

these attributes. " 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 Europ-IFIP 79 Conference. Profs A. Avi~ienis (UCLA, Los Angeles, USA) and A.

Proceedings of the IEEE Workshop on Real-Time Applications, Washington, DC, July 21-22, 1994

The 46 papers include discussions of algorithm-based fault tolerance, operating systems, checkpointing, designing fault-tolerant systems, networking issues, using COTS to design dependable networked systems, diagnosis and reconfiguration, CORBA and group communication, coding and on-line testing, evaluating dependability, and detecting intrusion. Sections also include software demonstrations and practical experience reports, but the student papers, fast abstracts, and posters are not printed. A sampling of individual papers turns up an algorithm-based error detection scheme for the multigrid algorithm, multiprocessor architecture using an audit trail for fault tolerance, two-step algorithms for the maximal diagnosis of wiring interconnects, and the automatic design of optimal concurrent fault detectors for linear analog systems. Only authors are indexed. Annotation copyrighted by Book News, Inc., Portland, OR.

Resilience Assessment and Evaluation of Computing Systems

This volume of Advances in Computers is number 66 in the series that began back in 1960. This series presents the ever changing landscape in the continuing evolution of the development of the computer and the field of information processing. Each year three volumes are produced presenting approximately 20 chapters that describe the latest technology in the use of computers today. Volume 66, subtitled "Quality software development," is concerned about the current need to create quality software. It describes the current emphasis in techniques for creating such software and in methods to demonstrate that the software indeed meets the expectations of the designers and purchasers of that software. In-depth surveys and tutorials on software development approaches Well-known authors and researchers in the field Extensive bibliographies with most chapters All chapters focus on software development issues Discussion of high end computing applications, a topic generally not understood by most software professionals

Theory and Applications of Dependable Computer Systems

This book presents selected papers from the Fifteenth International Conference on Dependability of Computer Systems (DepCoS-RELCOMEX), which illustrate the

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diversity of theoretical problems in analysis of performability, reliability and security of contemporary computer systems. Covering also methodologies and practical tools involved in this field, it is a valuable reference resource for scientists, researchers, practitioners and students who are dealing with these subjects. Established in 2006, DepCoS-RELCOMEX is an annual conference series organised by Wrocław University of Science and Technology. It focuses on the dependability and performability of contemporary computer systems – topics that can provide solutions to new challenges in evaluation of their reliability and efficiency. Since they are probably the most complex technical systems ever engineered by humans, the organization of modern computer systems cannot be modelled and analysed solely as structures (however complex and distributed) built only on the basis of technical resources. Instead they should be considered as a unique blend of interacting people (their needs and behaviours), networks (together with mobile properties, iCloud organisation, Internet of Everything) and a large number of users dispersed geographically and producing an unimaginable number of applications. This new, interdisciplinary approach is developing a continually increasing range of methods which apply also the latest findings in artificial intelligence (AI) and computational intelligence (CI).

Dependable Computer Systems

"This book addresses the complex issues associated with software engineering

environment capabilities for designing real-time embedded software systems"--Provided by publisher.

Dependable Computing for Critical Applications 5

Risk Assessment and Management in Pervasive Computing: Operational, Legal, Ethical, and Financial Perspectives

Safety and Reliability of Software Based Systems contains papers, presented at the twelfth annual workshop organised by the Centre for Software Reliability. Contributions come from different industries in many countries, and provide discussion and cross-fertilisation of ideas relevant to systems whose safety and/or reliability are of paramount concern. This book discusses safety cases and their varying roles in different industries; using measurement to improve reliability and safety of software-based systems; latest developments in managing, developing and assessing software intensive systems where reliability and/or safety are important considerations; and practical experiences of others in industry.

Software for Dependable Systems

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The book deduces a framework to reveal, define, quantify, measure, analyze, design, implement, test, monitor and enhance dependability (functional and non-functional) requirements of a distributed system with real-time constraints. It is presented how the framework can be applied throughout all life-cycle stages, under varying constraints and with maximized cost effectiveness. An overview of the tools and methodologies applicable has been given and an integrated and generalized architecture for ensuring continuous fulfillment of system requirements, proposed. The intended audience is broad: real time and distributed systems scientists and developers, software engineers, students, quality assurance managers, contractors, users, service providers and all those searching for an alternative approach to handling and ensuring automated control of fulfillment of system requirements. Moreover, those needing a handbook on contract negotiations and a method of tracing operational results back into system requirements of long lived projects with high dependability and integrity demands.

Dependable Computing Systems

Computer Safety, Reliability and Security

Contains 32 papers presented at the December 1999 symposium. The session

headings are dependability in mobile environments, hardware fault-tolerance, error detection and correction, dependable systems, dependability evaluation, software dependability, checkpointing, fault-injection based dependability, dependability in parallel systems, and dependability in computer networks. Paper topics include parity sensitive comparators, the effect of interconnect schemes on the dependability of a modular multi-processor system with shared resources, a fuzzy-based approach for the design and evaluation of dependable systems using the Markov model, and the cost of ensuring safety in distributed database management systems. Four remaining papers from the symposium are published in IEEE Transactions on Reliability, vol. 48, no. 4, December 1999. No subject index. Annotation copyrighted by Book News, Inc., Portland, OR.

An Assessment of the Computer Science Activities of the Office of Naval Research

This book presents the proceedings of the First European Dependable Computing Conference (EDCC-1), held in Berlin, Germany, in October 1994. EDCC is the merger of two former European events on dependable computing. The volume comprises 34 refereed full papers selected from 106 submissions. The contributions address all current aspects of dependable computing and reflect the state of the art in dependable systems research and advanced applications; among

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the topics covered are hardware and software reliability, safety-critical and secure systems, fault-tolerance and detection, verification and validation, formal methods, hardware and software testing, and parallel and distributed systems.

Nuclear Engineering International

The papers in this book address the international concern for computer system dependability. The individual aspects of system dependability, reliability, availability, safety, and security, are discussed along with concepts for designing, analyzing, implementing, and operating dependable systems.

Design of Dependable Computing Systems

The resilience of computing systems includes their dependability as well as their fault tolerance and security. It defines the ability of a computing system to perform properly in the presence of various kinds of disturbances and to recover from any service degradation. These properties are immensely important in a world where many aspects of our daily life depend on the correct, reliable and secure operation of often large-scale distributed computing systems. Wolter and her co-editors grouped the 20 chapters from leading researchers into seven parts: an introduction and motivating examples, modeling techniques, model-driven prediction,

measurement and metrics, testing techniques, case studies, and conclusions. The core is formed by 12 technical papers, which are framed by motivating real-world examples and case studies, thus illustrating the necessity and the application of the presented methods. While the technical chapters are independent of each other and can be read in any order, the reader will benefit more from the case studies if he or she reads them together with the related techniques. The papers combine topics like modeling, benchmarking, testing, performance evaluation, and dependability, and aim at academic and industrial researchers in these areas as well as graduate students and lecturers in related fields. In this volume, they will find a comprehensive overview of the state of the art in a field of continuously growing practical importance.

Sixth IEEE International Symposium on High Assurance Systems Engineering

The focus of Software for Dependable Systems is a set of fundamental principles that underlie software system dependability and that suggest a different approach to the development and assessment of dependable software. Unfortunately, it is difficult to assess the dependability of software. The field of software engineering suffers from a pervasive lack of evidence about the incidence and severity of software failures; about the dependability of existing software systems; about the

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efficacy of existing and proposed development methods; about the benefits of certification schemes; and so on. There are many anecdotal reports, which—although often useful for indicating areas of concern or highlighting promising avenues of research—do little to establish a sound and complete basis for making policy decisions regarding dependability. The committee regards claims of extraordinary dependability that are sometimes made on this basis for the most critical of systems as unsubstantiated, and perhaps irresponsible. This difficulty regarding the lack of evidence for system dependability leads to two conclusions: (1) that better evidence is needed, so that approaches aimed at improving the dependability of software can be objectively assessed, and (2) that, for now, the pursuit of dependability in software systems should focus on the construction and evaluation of evidence. The committee also recognized the importance of adopting the practices that are already known and used by the best developers; this report gives a sample of such practices. Some of these (such as systematic configuration management and automated regression testing) are relatively easy to adopt; others (such as constructing hazard analyses and threat models, exploiting formal notations when appropriate, and applying static analysis to code) will require new training for many developers. However valuable, though, these practices are in themselves no silver bullet, and new techniques and methods will be required in order to build future software systems to the level of dependability that will be required.

Proceedings ACM SIGSAC New Security Paradigms Workshop

Proceedings of Words ..

Annotation The Office of Naval Research and the National Science Foundation established these workshops to determine the state of the art and to set the course for future research in three scientific communities: computer security, fault tolerance, and software assurance. Although these areas may differ in their emphasis, this workshop established a unifying theme to help coordinate research efforts. This book includes a proposed research agenda, which provides a brief distillation of notes from the workshop, as well as 14 articles covering topics such as error recovery in critical infrastructure systems, practical techniques for damage confinement in software, and diversity against accidental and deliberate faults. No subject index. Annotation copyrighted by Book News, Inc., Portland, OR.

Predictably Dependable Computing Systems

Dependable Computing - EDCC-1

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This book constitutes the refereed proceedings of the Second Latin-American Symposium on Dependable Computing, LADC 2005, held in Salvador, Brazil, in October 2005. The 16 revised full papers presented together with 3 invited talks, and outlines of 2 workshops and 3 tutorials, were carefully reviewed and selected from 39 submissions. The papers are organized in topical sections on evaluation, certification, modelling, embedded systems, time, and distributed systems algorithms.

Designing Software-Intensive Systems: Methods and Principles

This book constitutes the refereed proceedings of the Third Latin-American Symposium on Dependable Computing, LADC 2007, held in Morelia, Mexico, in September 2007. The 14 revised full papers presented together with 2 invited talks, and outlines of 3 tutorials and 2 panel sessions, were carefully reviewed and selected from 37 submissions. The papers are organized in topical sections on fault-tolerant algorithms, software engineering of dependable systems, networking and mobile computing, experimental dependability evaluation, as well as intrusion tolerance and security.

Choice

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Over the last two decades, a major challenge for researchers working on modeling and evaluation of computer-based systems has been the assessment of system Non Functional Properties (NFP) such as performance, scalability, dependability and security. In this book, the authors present cutting-edge model-driven techniques for modeling and analysis of software dependability. Most of them are based on the use of UML as software specification language. From the software system specification point of view, such techniques exploit the standard extension mechanisms of UML (i.e., UML profiling). UML profiles enable software engineers to add non-functional properties to the software model, in addition to the functional ones. The authors detail the state of the art on UML profile proposals for dependability specification and rigorously describe the trade-off they accomplish. The focus is mainly on RAMS (reliability, availability, maintainability and safety) properties. Among the existing profiles, they emphasize the DAM (Dependability Analysis and Modeling) profile, which attempts to unify, under a common umbrella, the previous UML profiles from literature, providing capabilities for dependability specification and analysis. In addition, they describe two prominent model-to-model transformation techniques, which support the generation of the analysis model and allow for further assessment of different RAMS properties. Case studies from different domains are also presented, in order to provide practitioners with examples of how to apply the aforementioned techniques. Researchers and students will learn basic dependability concepts and how to model them using UML and its extensions. They will also gain insights into dependability analysis

techniques through the use of appropriate modeling formalisms as well as of model-to-model transformation techniques for deriving dependability analysis models from UML specifications. Moreover, software practitioners will find a unified framework for the specification of dependability requirements and properties of UML, and will benefit from the detailed case studies.

Proceedings

The European Commission emphasizes, in its Fifth Research Framework, the “. . . emerging generic dependability requirements in the information society, stemming both from the ubiquity and volume of embedded and networked systems and services as well as from the global and complex nature of large scale information and communication infrastructures, from citizens, administrations and business in terms of technologies, tools, systems, applications and services". The series of Conference on Computer Safety, Reliability, and Security (Safecomp) contributes to satisfy these requirements by reviewing the state of the art, experiences, and new trends in the relevant scientific and industrial areas. Safecomp is intended to be a platform for technology transfer among academia, industry, and research institutions, providing the opportunity for exchange of ideas, opinions, and visions among experts. This year Safecomp celebrates the 20th anniversary, its first Conference having been organized in Stuttgart by EWICS (European Workshop on Industrial Computer Systems) in 1979, and we hope these Proceedings will

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contribute to the celebration by supporting Safecomp aims. The Proceedings include the 25 papers that have been presented orally at the Conference and the full version of the 14 papers that have been presented as posters, all of which were selected from 76 submissions. Papers almost uniformly take up Safecomp topics, dealing with the issues of Safety Assessment and Human Factors, Verification and Validation, Design for Safety, Formal Methods, and Security.

Dependable Computing for Critical Applications

Annotation Presenting all 20 of the conferences talks, covers assessing and coping with commercial off-the-shelf components, formal methods, distributed systems, time-triggered architecture, fault tolerance and safety, models of partitioning for integrated modular avionics, dependability evaluation, and probabilistic guarantees. A summary is also provided for a panel on certifying and assessing critical systems. Among the specific topics are building fault-tolerant hardware clocks from commercial components, improving the performance of atomic broadcast protocols using the newsmonger technique, the experimentally validating high-speed systems using physical fault injection, and evaluating dependability using a multi-criteria decision analysis procedure. No mention is made of where or when the conference was held. There is no subject index. Annotation copyrighted by Book News, Inc., Portland, OR.

Dependable Computing for Critical Applications 7

Provides extensive information about pervasive computing and its implications from various perspectives so that current and future pervasive service providers can make responsible decisions about where, when and how to use this technology.

Engineering in Dependability of Computer Systems and Networks

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