

## Yutao He

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### RESEARCH INTERESTS

COTS-based fault tolerance, software fault tolerance and engineering, performability evaluation, embedded systems, wireless network systems, design and evaluation of component-based distributed high-confidence systems.

### EDUCATION

UNIVERSITY OF CALIFORNIA Los Angeles, CA  
**Ph.D. in Computer Science** (09/93-09/99)  
Dissertation: An Investigation of COTS-Based Fault Tolerance  
Advisor: Algirdas Avizienis

UNIVERSITY OF IOWA Iowa City, IA  
**M.S. Student in Electrical/Computer Engineering** (07/91-09/93)

TSINGHUA UNIVERSITY Beijing, P. R. China  
**B.E. in Electrical Engineering** (09/85-07/90)

### RESEARCH/WORKING EXPERIENCE

COMPUTER SCIENCE DEPT, UCLA Los Angeles, CA  
**Visiting Lecturer** (01/01-present)  
Teach the undergraduate class. Received excellent evaluations from students. (Overall ranking is 8.33 on a scale of 1-9).

COMPASS NETWORKS Van Nuys, CA  
**Senior Member of Technical Staff** (11/01-present)  
Serve as the system architect and developer for the software product line on the ATM network performance measurement and testing equipment platform.

Spirent Communications Calabasas, CA  
**Senior Member of Technical Staff** (03/01-10/01)

- Evaluating and optimizing performance of Linux TCP/IP network stack on custom hardware platforms. The Work includes: developing benchmarking methodology, implementing client-server benchmarking suite using C and PERL, measuring throughput & latency of Unix socket interfaces from Layers 2 to 7 (PHY, IP, TCP/UDP, SSL, FTP, HTTP), etc.
- Technically leading the PPP/PPPoE protocol firmware support on Linux-based hardware product line. The Work includes: talking with customers and marketing staff and writing up complete functional specification; designing the firmware architecture based on Linux sockets interfaces and POSIX Thread; evaluating, selecting, and integrating thirty-party software; implementing the system in C (8000+ lines); guiding QAs to develop test plans and suites, etc.
- Upgrading, maintaining custom Linux kernel and device drivers for specific I/O hardware, developing RPM-based firmware packaging environment with PERL.
- Consulting internal teams on technical issues in Linux kernel, network protocol stacks, system administration, and kernel-compatibility of company firmware and software products; writing technical documents and findings.

SOHAR, Inc. Beverly Hills, CA  
**Senior Research Engineer** (06/99-03/01)

- Principal Investigator as a DARPA ITO's SBIR project on the advanced assurance

technology for high-confidence real-time embedded software systems during its entire life-cycle. Developing the key technology, MOCHA (MOdel-based Certification for High Assurance), that specifies the base model of a software system using the UML-RT (UML for Real-Time), verifies various cross-cutting properties (reliability, safety, timeliness, etc.) via model-transformation, and manages model/evidence data with XML.

- Technical lead in a DoD Y2K testing project. Developed a systematic methodology, POMBA (Process-Oriented Metrics-Based Assessment), that intends to improve cost-effectiveness for high-assurance software testing and applied it to the analysis of eight data sets from the DoD's large-scale Y2K E2E (End-to-End) Testing effort.
- Technical lead for a DOE project that explores cost-effective high-performance computing for rejuvenating a legacy large-scale scientific computational software package (RETLAB). Responsible for designing and building the home-grown Beowulf-class PC cluster prototype that includes COTS hardware selection and construction, Red Hat GNU/Linux kernel configuration, MPI-based parallel computing environment setup, and performance tuning and evaluation.
- In charge of technical enhancement and maintenance of MEADEP, a failure data-based dependability analysis and modeling commercial tool on the Windows NT platform. Extended the tool with reward-based Markov analysis for performability evaluation. Designed and implemented the ELP (Event Log Processing) module, an automated data collection and processing tool based upon the client-server paradigm, Windows NT's Event Log facility using winsock, Access database engine and Visual C++.
- Research investigation on system-level dependability evaluation using the MEADEP modeling tool. Developed and applied the methodology for assessing Web-based e-commerce systems by combining Software Reliability Engineering (SRE) techniques.
- Technical lead in two large-scale Failure Modes, Effect, Criticality Analysis (FMECA) efforts for the U.S. Navy Standard Missile and the Fuze electronic control systems.
- Research investigation on intelligent agent-based network detection and recovery for wireless multimedia networks. Designed a sophisticated Modeling and Simulation (M&S) environment, called STAND (Simulation-based Toolkit for ANomaly Detection).
- Technical lead in designing and implementing the OFTT, a fault tolerance middleware toolkit for highly available Windows NT based monitoring and control applications. Developed the checkpointing technique that is able to save states of NT kernel objects created both statically and dynamically in multi-thread computation models, recovery algorithms, failure detection technique and implemented them in the Microsoft DCOM architecture.

COMPUTER SCIENCE DEPARTMENT, UCLA

Los Angeles, CA

**Ph.D. Student**

(09/93-09/99)

The primary focus of my dissertation was on cost-effective COTS-based fault tolerance for high-confidence computing systems. The work included:

- Assessed built-in fault tolerance features in high-performance COTS microprocessors via the concept of confidence assurance architecture (CAA).
- Developed the framework of design fault taxonomy (DFT) to characterize residue design faults in high-performance COTS microprocessors and their effects on high-confidence computing. Explored application of Software Reliability Engineering techniques in studying hardware design faults.
- Investigated the co-processor fault tolerance technique for large-scale COTS-based high-confidence systems.

COMPUTER SCIENCE DEPARTMENT, UCLA Los Angeles, CA  
**Graduate Teaching Assistant** (01/97-03/99)  
Led weekly discussions and designed quizzes, exams and lab projects for the undergraduate course: *CS M51A Logic Design of Digital Systems*. Received consistently excellent student evaluations.

RADIOLOGICAL SCIENCES DEPARTMENT, UCLA Los Angeles, CA  
**Graduate Student Researcher** (10/94-12/96)

- Developed and implemented COTS-based fault tolerance techniques to assure data integrity in the distributed high-volume medical image archiving system.
- Explored the object-oriented Fragmentation-Redundancy-Scattering (FRS) technique in designing secure, reliable, distributed medical image archives.
- Designed and implemented the prototype of a web-based clinical information system, EPIC Med, that provides integrated access to distributed medical information for diagnosis and treatment. The front-end was written in Java AWT, the database back-end was written in MySQL database engine, and the integration logic was written in Tcl.
- Developed the performability model and evaluated the cost-effectiveness of *Certification Trail* software fault tolerance technique via the UltraSAN tool.
- Requirement analysis and system design of the patient image archiving software system using the Booch-based OOAD methodology and CORBA component architecture.
- Developed and maintained the distributed patient image archiving system using SyBase as the back-end database engine and BSD sockets as the network communication mechanism.

TISSUE TYPING LABTORARY, UCLA Los Angeles, CA  
**Software Developer and DBA** (05/94-09/94)  
Designed, implemented and maintained an in-house database application with Oracle SQL product family tools. Administrated the Oracle database engine and trained the personnel.

CENTER FOR CAD, UNIV. OF IOWA Iowa City, IA  
**Graduate Research Assistant** (11/92-9/93)  
As a key member of a DARPA project, played a leading role in design, implementation and maintenance of one distributed CAD software system. The work included: GUI front-end with X-window Motif toolkit; Network programming with NCS; Database back-end with the ROSE Library; System-level integration in C++, Perl, csh, and; Configuration management with CVS.

PRISMA SOFTWARE COMPANY Cedar Falls, IA  
**QA Manager** (05/92-08/92)  
Worked as the testing manager in charge of quality control for the company's Windows database software products. The work included: developed a testing strategy for software life-cycle quality assurance; prepared test plans; managed test activities, evaluated test results, interviewed and trained testing staffs, and recommended better development practices to programmers. The developed methodologies helped to increase effectiveness, shorten schedules, and reduce costs of the testing effort and still remained active after my departure.

DEPT ELECTRICAL&COMPUTER ENG. UNIV. OF IOWA Iowa City, IA  
**Graduate Research Assistant** (08/91-11/92)

- Conducted a fault-tolerant flight control software experiment for studying and improving the N-Version Programming (NVP) technique for tolerating software

design faults. The work included: Complete specification, design, implementation, testing of the software under a rigorous design paradigm; Extraction of software metrics from 10 software versions; Assessment of the software reliability through design review and a suite of testing techniques. The software was written in C while data collection and testing were automated by csh script and RCS.

- Investigated efficient data structures and algorithms for VLSI circuit transient fault testing and developed in C a simulator based on the diagnosis-oriented parallel-pattern single-fault propagation technique.

BUREAU OF BROADCASTING & TELEVISION

Lanzhou, P. R. China

**Electrical Engineer**

(09/90-04/91)

- Development of MCS 8300 microcontroller-based automatic monitoring and management systems for television transmission stations.
- Maintenance and troubleshooting for TV/Radio transmitters, receivers and their peripherals.

## COMPUTER SKILLS

**Programming Languages:** C, C++, JAVA, FORTRAN, PASCAL, JAVASCRIPT, Tcl/Tk, PERL, Unix Shell scripts, SQL, x86/MIPS assembly languages, VHDL, UML, HTML, Access, Visual Basic, DCOM, CORBA, Masie, UC.

**Platforms:** Linux, Solaris and other UNIX variants, Windows 95/98/NT/2000. VxWorks and Nucleus RTOS

**Software Tools:** The GNU development tools, MS Visual Studio, Java SDK, MS Front-Page, MS MFC, X Motif, network programming using Berkeley Sockets and winsock, multi-thread programming with POSIX Threads, Matlab, UltraSan and ARIES.

## SELECTED PUBLICATIONS

**Yutao He**, Herbert Hecht, and Raymond Paul, "Measuring and Assessing Software Test Process Using Test Data", *Proc. 5<sup>th</sup> IEEE High Assurance Systems Engineering Symposium*. (HASE 2000), pp. 259-264, Nov., 2000, Albuquerque, NM.

Myron Hecht, **Yutao He**, Herbert Hecht, and Xuegao An, "Integration of System Dependability and Software Reliability Growth Models for E-Commerce Systems", *Proc. 5<sup>th</sup> IEEE High Assurance Systems Engineering Symposium*. (HASE 2000), pp. 35-42, Nov., 2000, Albuquerque, NM.

**Yutao He** and Algirdas Avizienis, "Assessment of the Applicability of COTS Microprocessors in High-Confidence Computing Systems: a Case Study", *Proc. International Conf. on Dependable Systems and Networks (DSN 2000)*, pp.81-86, New York City, NY, June, 2000.

Myron Hecht, **Yutao He**, Xuegao An, and Bing Zhang, "OFTT: A Fault Tolerant Middleware Toolkit for Process Monitoring and Control Windows NT Applications", *Proc. International Conf. on Dependable Systems and Networks (DSN 2000)*, pp. 225-230, New York City, NY, June, 2000.

Myron Hecht, **Yutao He**, and Xuegao An, "Dependability Analysis for E-Commerce Site Business Decisions", *Proc. of FastAbs of International Conf. on Dependable Systems and Networks (DSN 2000)*, pp.B48-B49, New York City, NY, June, 2000.

**Yutao He**, "An Investigation of Commercial Off-The-Shelf (COTS) Based Fault Tolerance", PhD thesis, Computer Science Department, University of California, Los Angeles, September 1999.

Algirdas Avizienis and **Yutao He**, "Microprocessor Entomology: An Taxonomy of Design Faults in COTS Microprocessors". In J. Rushby and C. B. Weinstock, editors.

*Dependable Computing for Critical Applications 7*. IEEE Computer Society Press, 1999.

Algirdas Avizienis and **Yutao He**, "The Taxonomy of Design Faults in COTS Microprocessors", *FastAbs of 28th Int'l Symposium on Fault Tolerance Computing*, June 1998.

**Yutao He**, Ann T. Tai and Algirdas Avizienis, "Performability Evaluation of the Certification Trail Method Using UltraSAN", *Proc. of Int'l Workshop on Computer-Aided Design, Test, and Evaluation for Dependability*, pp. 139 – 144, June 1996, Beijing, P. R. China.

**Yutao He**, Lu J. Huang, Daniel J. Valentino, and Algirdas Avizienis, "Fault tolerance techniques to assure data integrity in high-volume PACS image archives", *Proc. of SPIE Medical Imaging 1995: PACS Design & Evaluation 2435:378-386*.

Algirdas Avizienis, Lu J. Huang, D.A. Rennels, **Yutao He** and Daniel J. Valentino, "System and software engineering for a large-scale PACS", *Proc. of SPIE Medical Imaging: PACS Design & Evaluation 1995*.

Michael R. Lyu and **Yutao He**, "Improving the N-Version Programming Process Through the Evolution of a Design Paradigm", *IEEE Trans. On Reliability*, vol. 42, No. 2, June, 1993, pp 179-189.

**AWARDS**

FELLOWSHIP Computer Science Department, UCLA (1993-1994)

**RESEARCH FUNDING**

Principal Investigator for DARPA ITO (SB011-007-00) SBIR Phase I grant, "Assurance Technology for High Confidence Software and Systems", \$100,000, 2001.

**PROFESSIONAL ACTIVITIES**

- Members of the IEEE Computer Society and ACM.
- Referees for IEEE Trans. On Reliability, HASE since 1997, DSN 2001.
- Invited panelist on Engineering Career Workshop organized by UCLA Regents Scholar Society (1998, 1999).
- Co-founder of Buddy Mentoring Program of UCLA Computer Science Department (April, 1998 – Sept., 1999)

**REFERENCES**

To be furnished upon request.