

# Jean-Claude Laprie Award in Dependable Computing

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*Dr. Jean-Claude Laprie was Directeur de Recherche at LAAS-CNRS, Toulouse, France. He devoted his entire career to research on the dependability of computing systems. His unique capability of abstraction and formalization, and his contributions to the formulation of the concepts and methodologies of dependability, rapidly led to national and international recognition. He received the IFIP Silver Core in 1992, the Silver Medal of French Scientific Research in 1993, and the Grand Prize in Informatics of the French Academy of Science in 2009. He was made Chevalier de l'Ordre National du Mérite in 2002.*

The IFIP 10.4 working group on Dependable Computing created the award in his honor in 2011. It recognizes outstanding papers that have significantly influenced the theory and/or practice of Dependable Computing. For 2014, the award committee decided to recognize three seminal papers in the award's impact categories:

- B. Randell, "[System Structure for Software Fault Tolerance](#)", IEEE Transactions on Software Engineering, vol.SE-1, no.1, **1975**, pp 220-232.
- J.H. Wensley, L. Lamport, J. Goldberg, M.W. Green, K.N. Levitt, P.M. Melliar-Smith, R.E. Shostak, C.B. Weinstock, "[SIFT: The Design and Analysis of a Fault-Tolerant Computer for Aircraft Control](#)", Proceedings of the IEEE, vol.66, no.10, **1978**, pp.1240-1255.
- H. Kopetz, G. Bauer, "[The Time-Triggered Architecture](#)", Proceedings of the IEEE, vol.91, no.1, **2003**, pp. 112-126.

Randell's **System Structure for Software Fault Tolerance** paper laid the foundations for several decades of research into computing systems capable of tolerating residual design faults in software. Until then, fault-tolerant computing had only been concerned with physical faults affecting computer hardware. This paper introduced the concept of redundancy of design (which we now call design diversity or design dissimilarity) in which multiple software components of independent design operate as a redundant set, in a way analogous to standby sparing in hardware. The concepts of recovery blocks, of checkpointing and recovery, and the domino effect, all of which became commonplace terms in decades of research on fault-tolerance, were introduced in this paper.

Wensley, Lamport, Goldberg, Green, Levitt, Melliar-Smith, Shostak and Weinstock pioneered the notion of Software-Implemented Fault Tolerance in their famous paper **SIFT: The Design and Analysis of a Fault-Tolerant Computer for Aircraft Control**. The SIFT system made breakthroughs in fundamental theory and algorithms for achieving reliable distributed system operation in the presence of Byzantine failure modes, specifically focusing on the key problems of clock synchronization and consensus. The team developed and demonstrated the first software-based implementation of a fault-tolerant computer using these algorithms, and were among the first to create extensive analytical proofs of correctness of their algorithms. The impact of this work goes far beyond this implementation in that its groundbreaking conceptual framework spawned an entire new area of distributed systems theory and underlies many existing fault-tolerant computer designs.

Kopetz and Bauer's paper on the **Time Triggered Architecture** described a design pattern for dependable real-time computing that has had an outstanding impact on industry. Research prototypes developed at the Vienna University of Technology were refined into commercial products by a spin-off company that now supplies hardware and software products to major actors in the aerospace, automotive, railway, robotics and electrical energy industries. Indeed, time-triggered systems are the most commonly-used fault-tolerance approach in current critical real-time system architectures. Instantiations of the approach are notably deployed in the Airbus A380 and the Boeing 787.