UMass Dartmouth
COLLEGE OF ENGINEERING

Computer and
Information Science
Department

Ph.D. THESIS PROPOSAL (SPRING 2017)

TOPIC: ***Software Reliability Models for Cloud-Based Software Rejuvenation Using Dynamic Fault Trees***

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ABSTRACT

Due to the promised high reliability of physical facilities provided for cloud services, software faults have become one of the major factors of cloud system failures. The software aging phenomenon indicates that system performance of a cloud-based system may be progressively degraded due to exhaustion of system resources, memory leaks, and accumulation of round-off errors. To maintain the high reliability of cloud-based software systems, it becomes critical to find a feasible solution to counteract the software aging problem. In this proposal, we adopt a proactive technique, called software rejuvenation, to enhance the fault tolerance of cloud-based systems using software standby spares. Dynamic Fault Tree (DFT) formalism is adopted to model the system reliability before and during a software rejuvenation process in an aging cloud-based system, as well as to generate a software rejuvenation schedule. A novel analytical approach is presented to derive the reliability functions of a software Hot SPare (HSP) gate employing either one or two hot standby spares. The reliability functions have been verified using Continuous Time Markov Chain (CTMC) for the cases of constant failure rates. Preliminary results have been given for reliability models with non-constant failure rates. We use case studies to show how system reliability of cloud-based software systems can be calculated, and how cost-effective software rejuvenation schedules can be generated to keep the system reliability consistently above a predefined critical reliability level. Finally, we address our future plans for developing suitable software reliability models of cloud services, and computing the reliability of cloud-based software components with non-constant failure rates.