

**MASTER'S Thesis (FALL 2012)**

**TOPIC:** *Optimal Rejuvenation Scheduling for Cloud-Based Systems Using Extended Dynamic Fault Trees*

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**ABSTRACT**

Cloud-based systems are based on the composition of multiple service components to achieve specific functions. The nonfunctional characteristics of a cloud-based system, such as reliability and availability, play an important role in evaluating its system performance. Due to the promised high reliability and availability of physical facilities provided for cloud services, software faults become a major factor for system failures of cloud-based systems. In this thesis, we focus on the software aging phenomenon where system performance may be progressively degraded due to exhaustion of system resources, fragmentation and accumulation of errors. We adopt a proactive technique, namely software rejuvenation, to counteract the software aging problem. Based on the reliability analysis of the software components in an aging cloud-based system, we estimate its optimal software rejuvenation schedule. In order to formally model the software rejuvenation process, we extend the dynamic fault tree (DFT) formalism by introducing a new gate, called the Restart gate, which is triggered when the system reliability falls below a predefined safety reliability threshold. With the extended DFT model of a cloud-based system, we can convert the model into Markov Chains, calculate the system reliability over time, and estimate the optimal software rejuvenation schedule that maintains the reliability and availability of the cloud-based system at a reasonable level. Finally, we use a case study of a cloud-based system in e-commerce to illustrate the validity of our analytical approach.