Fault-tolerance in HLA-based distributed simulations

MARTIN EKLÖF

Academic Dissertation which, with due permission of the KTH Royal Institute of Technology, is submitted for public defence for the degree of Licentiate of Technology on Tuesday the 13th June 2006, at 2:15 p.m. in Sal D, KTH-Forum, Isafjordsgatan 39, plan 4, Kista.
Abstract

Successful integration of simulations within the Network-Based Defence (NBD), specifically use of simulations within Command and Control (C2) environments, enforces a number of requirements. Simulations must be reliable and be able to respond in a timely manner. Otherwise the commander will have no confidence in using simulation as a tool. An important aspect of these requirements is the provision of fault-tolerant simulations in which failures are detected and resolved in a consistent manner. Given the distributed nature of many military simulations systems, services for fault-tolerance in distributed simulations are desirable. The main architecture for distributed simulations within the military domain, the High Level Architecture (HLA), does not provide support for development of fault-tolerant simulations.

A common approach for fault-tolerance in distributed systems is checkpointing. In this approach, states of the system are persistently stored throughout its operation. In case a failure occurs, the system is restored using a previously saved state. Given the abovementioned shortcomings of the HLA standard this thesis explores development of fault-tolerant mechanisms in the context of the HLA. More specifically, the design, implementation and evaluation of fault-tolerance mechanisms, based on checkpointing, are described and discussed.

Key Words
HLA, fault-tolerance, distributed simulations, federate, federation