Title of the PhD thesis: Cloning Mechanisms for High Level Architecture Based Distributed Simulation

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Part I: To the candidate

Summary of the thesis

The thesis investigates the development of methods and mechanisms for cloning in HLA based simulation. Cloning and replication have been used in distributed systems, distributed data bases and distributed simulation, among others, to improve performance, scalability and fault-tolerance.

The thesis contains a comprehensive review of the related work; shows a solid understanding of the basic concepts in distributed simulation, and presents novel mechanisms for cloning in HLA based simulations, some scenarios for cloning-enabled distributed simulations and a number of interesting performance results.

HLA is an IEEE standard that is widely used in defence and to some extend in civil applications. Performance, scalability and fault-tolerance are among the most critical aspects of HLA based distributed simulation. Hence the thesis focus is of vital interest to the simulation community.

Suggested modifications

The thesis is well structured, well written and combines theoretical work with development and experimental research. The following issues do not suggest any radical changes to the thesis work, but can improve its readability:

- Page 4: A single run is not sufficient to understand behavior od stochastic simulations. Cloning can be used to initiate several runs of a simulation, but with different values of the random variables.
- Page 16: Here you should clarify the difference between cloning and replication and not defer it to page 27.
- Page 22: In distributed simulation literature, LP stands for logical process. Thus physical PL would be read as physical logical process which sounds strange! You may use LP (instead of physical LP) and virtual LP.
• Page 36: reading chapter 3, I didn't find out whether execution of a federate is stopped during cloning or not. Please clarify it somewhere, preferably at the beginning of this chapter.

• Page 86: Does the last paragraph indicates that the simulation execution is stopped during initialization of the generated clones, but it doesn’t say what happens during creation of new clones.

• Page 121 second paragraph: It is claimed that the HLA specification does not support fault tolerance. Though the claim is true for 1615, the latests version of HLA (HLA evolve) includes some support for fault tolerance.

• Section 9.1.2: The thesis is well written and in general contains adequate level of details. However, this is not true in section 9.1.2, where several details are missing. In particular, it is not clear how the management module restores a crashed federate:
  (a) Is the simulation execution stopped after a failure discovery until the failed federate is restored or does the execution continue during the recovery process.
  (b) The state manipulator (Figure 9.1) saves all RTI states before passing RTI calls to the federates, but how about the internal changes in a federate, i.e., those that are not passed to RTI?
  (c) How can you generate a new physical federate based on the RTI saved info without knowing the local changes made in a federate?

• Typing and formulation: I have marked several typing and formulations amendments in the manuscript.