Chapter II

Distributed Simulation in Industry

Roberto Revetria, Università degli Studi di Genova, Italy

Roberto Mosca, Università degli Studi di Genova, Italy

Abstract

This chapter introduces the basic concepts of distributed simulation applied to real life industrial cases with particular reference to IEEE 1516 High Level Architecture (HLA): one of de facto standards for distributed simulation. Starting from a concise introduction HLA, the chapter proposes a simple hands-on with a complete implementation example of HLA. Successfully achieved the ability to create small federations, the reader is guided by two real life application of distributed simulation: the first is related to a supply chain modeling for the aerospace industry while the second one is focused on logistic platforms modeling. The authors have edited this chapter keeping in mind usual difficulties that can be encountered in real life projects: for such purpose a reference implementation and full code examples are provided in order to ensure a smooth but effective learning curve. The reader will also find suggestions for proper management of HLA-based simulation projects.
Introduction

Originally, modeling was divided into discrete simulations and continuous simulations. Then, some other simulation models appeared, such as Monte Carlo simulations (time-independent) and continuous/discrete mixed simulations. Also the architecture of the simulations has been developing during these years, especially parallel and distributed simulation, in order to speed up simulation time (the first) and to improve the interoperability among different systems (the latter). One of the latest steps was to introduce the concept of human interactivity in simulation (“human-in-the-loop”), from which sprung real-time and scaled real-time simulations. Finally, with the development of HLA, dissimilar simulation components could interoperate in the same framework.

HLA: Introduction

In 2000, HLA became an IEEE standard for distributed simulation. It consists of several federates (members of the simulation), that make up a federation (distributed simulation), work together and use a common runtime infrastructure (RTI).

The RTI interface specification, together with the HLA object model template (OMT) and the HLA rules, are the key defining elements of the whole architecture.

Figure 1. Continuous and discrete simulations

<table>
<thead>
<tr>
<th>Continuous vs. Discrete Simulations</th>
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<tbody>
<tr>
<td><strong>Continuous</strong></td>
</tr>
<tr>
<td>Continuously advances time and</td>
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<tr>
<td>system state.</td>
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<tr>
<td>Time advances in increments small</td>
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<tr>
<td>enough to ensure accuracy.</td>
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<tr>
<td>State variables updated at each</td>
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<tr>
<td>time step.</td>
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