

## **DISTRIBUTED SIMULATION MODELING: A COMPARISON OF HLA, CORBA, AND RMI**

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### **ABSTRACT**

The execution of distributed simulations has become increasingly important to the Department of Defense (DOD). This paper compares three architectures for supporting distributed computing, HLA, CORBA, and RMI. While the fundamental structure of each is similar, there are differences that can profoundly impact an application developer or the administrator of a distributed simulation exercise.

### **1 INTRODUCTION**

The design and execution of distributed simulation models has become increasingly important to the Department of Defense (DOD). In recent years, the DOD has invested considerable resources in infrastructures for distributed simulation modeling. The current focus is the High Level Architecture (HLA) spearheaded by the Defense Modeling and Simulation Office (DMSO) (US Department of Defense, 1998). The HLA benefits greatly from two earlier DOD efforts: the Distributed Interactive Simulation (DIS) protocol standards, and the Aggregate Level Simulation Protocol (ALSP). There have been several efforts in the commercial sector to enable distributed computing. Two of the most viable recent efforts are the Common Object Request Broker (CORBA), by the Object Management Group (OMG), and Remote Method Invocation (RMI), from Sunsoft's Java Development Kit (JDK).

There are many reasons why DOD has an interest in a common framework for performing distributed simulation. Declining defense budgets have increased the necessity for cost containment. Increased use of simulation for training, acquisition, and analysis promises to substantially reduce costs. A common architecture for distributed simulation enhances interoperability and reuse in various DOD simulation modeling efforts.

Each of these three architectures for distributed computing offers much to the problem of executing a distributed simulation model. Each has a fundamental world view that affects the structure of its architecture.

This paper will compare the features of these three important technologies with particular focus on their impact on distributed simulation. Naturally, it is impossible to cover all aspects of the architectures, so this paper will only touch briefly on the salient features of each, emphasizing those aspects impacting the simulator.

In the following section we will discuss the core elements of distributed architectures. Sections 3 through 5 will touch on the important features of HLA, CORBA, and RMI, respectively, followed by a brief discussion and comparison in Section 6. Section 7 will present conclusions and recommendations.

### **2 BASIC ELEMENTS OF DISTRIBUTED ARCHITECTURES**

We will focus our attention on three of the basic elements of distributed architectures: an object interface language, an object manager, and a naming service. In addition, we will consider issues such as the programming languages supported, the hardware and operating systems, and the network protocols used.

An object interface language is important for supporting distributed applications because they require a more abstract level of communications than ordinary applications. An object must make only minimal assumptions about the implementation of another object's method since that method could involve objects on another machine. In contrast to a class's definitions of methods, an interface is a contract for implementing objects and contains only a list of methods. Interfaces are therefore the ideal vehicle for providing interoperability between distributed objects. HLA and CORBA take a multilingual approach to distributed objects so they define their own separate interface specifications that are distinct from the implementing languages. RMI, on the other hand, is a language specific approach and thus uses the Java language interface for its interface specification. This considerably simplifies many design issues but limits the extent to which RMI can deal with distributed objects in other languages. Using interfaces is a critical factor for implementing

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