An Approach for Distributed Web-Based Simulation

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Abstract

In this paper, we introduce the concept of web-based simulation and some reviews on the distributed simulation on the world wide web (WWW) and suggest the structure of distributed web-based simulation which can reduce simulation run time and show how the callback mechanism works to enable the distributions of jobs to clients with push service in Remote Method Invocation (RMI). And finally we present a prototype of distributed web-based simulation.

Web-based simulation can be defined as the integration of Internet technology (web) with the field of computer simulation. Internet technology has advantages that can easily use various information such as general documents, pictures, voices and so on, through web browser. With some observations by Fishwick (1996) on the issue of web-based simulation, there are many potential impacts of web technologies on simulation, with particular attention given to three areas: (1) education and training, (2) publication, and (3) simulation programs. Page (1998) Extends Fishwick's categories to five areas of focuses: (1) Simulation as hypermedia (2) Simulation research methodology (3) Web-based access to simulation programs (4) Distributed modeling and simulation (5) Simulation of the WWW. The other review (Whitman, 1998) of literature shows three major types of web-based discrete-event simulation (DEV) tools: (1) Server Hosted Simulation (2) Client Executed Simulation (3) Hybrid Client/Server Simulation. Since distributed and parallel simulation is fairly complex and is difficult to specify a large and complicated model, most of researched architecture of distributed or parallel simulation is developed as Server hosted simulation approach which is mentioned above.

Related with all those above, there are many simulation tools which are developed to implement simulation process on the web. In recent, RMI technique in Java is introduced for the

distributed simulation over the web. CORBA and HLA(High Level Architecture) is also used for the distributed web-based simulation. On the whole, they can be divided into two major categories: To run the simulation on the stand-alone way and to run the simulation in the distributed way over the web. In this paper, these classifications are rearranged and extended with the focus on the distributed simulation environments. Those are, (1) Server Hosted distributed simulation and (2) Client/Server distributed simulation.

The proposed structure of web-based simulation enables followings: server notifies clients to participate in the simulation, and distribute simulation jobs to the clients, and run the simulation of multiple models simultaneously. This procedure can operate simulations more efficiently under the distributed environment. To perform this procedure, Push technique which is to be derived from callback mechanism in Java RMI is used for the hosted side which is realized as application. This paper also shows each step in which this proposed structure of distributed web-based simulation is performed.

The callback is a method which possibly perform asynchronous calls by constituting interfaces of clients into distributed objects and registering client's object references to server's distributed objects. In this method, it is not necessary for clients to wait for immediate response from the server, but they can do their own ongoing jobs. The purpose of using callback mechanism is to provide flexibility in the operations of simulation. Thus the following brief procedure is able to run the distributed simulation on the suggested structure under the real-world web.

Step 1. A client requests a simulation job.

Step 2. Simulation server responses and the client download modeling objects and submit simulation model.

Step 3. Server announces to the other connected client machine over the web and notify to participate in this simulation.

Step 4. Server pushes a simulation model to each clients and manages the distributed simulations, and then clients perform their own simulation jobs with RMI.

In this paper, we introduce the structure of distributed web-based simulation and the figures of some simulation objects on the client/server structure and also programming codes for a prototype which use the push technology realized by callback mechanism. We describe in detail how the callback mechanism can play a role for implementing the distributed or parallel simulation.