End-to-end Fault Tolerance for Grid-based Distributed Simulations

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The goal of this project is to take an end-to-end look at a grid application and to make it tolerant to fail-stop faults by using a number of tools and systems developed by our group.

In the ISS group, we have developed a number of techniques for adding checkpoint/restart to sequential and parallel applications ([MPIChkpt1], [MPIChkpt2], and [SHMEM]). We have also developed novel frameworks for deploying and using Web Services [O'SOAP] and have developed distributed simulation systems to solve multi-physics problems in a multi-institutional environment ([ICCS03], [HPDC04], [ICCS04]).

In this project, you will use these tools to demonstrate a complete solution for checkpoint/restart of a grid application that runs on geographically-distributed computers.

The first step is to choose a parallel application that will be the core computation of the system. We will help you with this selection.

The second step is to design a client/server system for distributed execution of the parallel application. This is done very easily with O'SOAP.

The third step is to use some combination of checkpoint/restart and message-logging to make the distributed simulation resilient to faults. Here are some things that you should think about:

- How can the client be made fault-tolerant? How can the client be moved easily from one machine to another?

- What happens if the server dies? How does the client find a new server that provides the same functionality? (Hint: [UDDI])

- Suppose that the compute nodes are separate from the server node (good idea for fault-tolerance!) If the compute nodes fail, how can the application be restarted on another set of compute nodes? The C3 precompiler may be very useful for this.

Once you have built and demonstrated your system, you will be expected to analyze it for remaining points of failure. In your write up, identify these points and suggest remedies. Think outside of the box, but be sure to make good use of the tools at your disposal!

References


