ABSTRACT

Scalability Analysis of the COPAR Service using Opnet Modeler

Rhea Loni Seegobin

The COPAR Service, also known as Combining Optimism and Pessimism in Accessing Replicas, previously ran on a collection of eight computing nodes connected by the Internet. The COPAR Service designed as a distributed system, maintained a high level of scalability and availability when tested with eight nodes, parallel processing techniques and cost bound optimization methods.

This thesis explores how scalability and availability in the COPAR Service is affected when the system is expanded to 100 nodes. This is achieved by implementing the COPAR Service in a network simulation package called Opnet Modeler. Opnet provides the means for increasing the size of the COPAR Service from eight to 100 nodes, without having to incur the actual expense of acquiring and maintaining 100 physical nodes worldwide.

The COPAR Service has been re-designed and re-implemented using Opnet's editors and the C/C++ programming language. Many challenges were encountered during the translation of COPAR from a Java based system into an Opnet Modeler Simulation. Some challenges included the synchronization of external C++ objects amongst thread processes, the implementation of parallel

processing in Opnet's sequential environment and the integration of externally defined C++ objects into Opnet.

Graphical and tabular results were collected for three types of processing techniques which can be used by COPAR. The techniques used were: local and remote optimistic processing, local optimistic processing and pessimistic processing. These results provided a way to measure availability and scalability in the system. Careful analysis of the results showed that a high level of availability was maintained and the system proved to be scalable.

Keywords: Distributed Systems; Parallel Processing; Optimization; Mutual Exclusion; C++ Threads; COPAR Service; Opnet Modeler.