

## ABSTRACT

### Replica Accessing Techniques for Improved Availability in Distributed Transaction Processing Systems

Michael Anthony Hosein

As network and computer hardware continue to improve at tremendous rates, the effectiveness of many distributed services tends to be limited by availability rather than performance [Hennessy 1999]. This means that once a service is available it can be delivered at high speed because of high performance network and computing equipment. The bottleneck on service provision would therefore tend to occur when the service is unreachable (i.e. not available). As a result, over the last few years, many researchers have started focusing on architectures that improve overall availability rather than performance.

This dissertation looks at a technique that was designed to improve availability in distributed systems that use replicas. It employs mechanisms that increase the amount of concurrency possible. The approach combines the use of optimistic and pessimistic concurrency control measures. While increasing concurrency, a bound is kept on the deviation of replicas from what their true values should be. The approach used involves the processing of transactions locally at nodes based on a value called the cost bound, which approximately measures the level of availability of the system. The user gets a response after a transaction is processed optimistically based on the cost bound. However, transactions are also processed pessimistically later on, and if necessary a revised response may be published.

The amount of message passing in the system was investigated and modified in order to improve performance; the cost bound is adjusted dynamically based on feedback on a node's behavior; the application of the cost bound to wireless networks, and the effect of failure modes and Internet traffic on the performance of the system are discussed.

**Keywords:** Availability, distributed service, concurrency control, optimistic, pessimistic.