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Reactive Shared Objects for Interprocess Synchronization

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hall ES51, ED-building, Rännvägen 6B,
on **October 18th, 2004** at **10:00**.

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Reactive Shared Objects for Interprocess Synchronization.

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Abstract

In parallel processing environments such as multiprocessor systems, processes are synchronized using concurrent objects, which allow many concurrent processes to access them at the same time. The performance of these concurrent objects heavily relies on the load conditions of the surrounding environment (e.g. OS, other applications, interconnection network, etc.), which are variant and unpredictable due to indeterministic interferences among processes. Therefore, in order to minimize synchronization cost, a major overhead in parallel applications, we need to construct efficient concurrent objects that can react to the environment variations in order to achieve good performance under all possible system conditions. This thesis presents two new reactive shared objects: the *reactive multi-word compare-and-swap object* and the *self-tuning reactive tree*.

The *multi-word* compare-and-swap objects are powerful constructs, which make the design of concurrent data objects much more effective and easier. The *reactive* multi-word compare-and-swap objects are advanced objects that dynamically measure the level of contention as well as the memory conflicts of the multi-word compare-and-swap operations, and in response, they react accordingly in order to guarantee good performance in a wide range of system conditions. We present two algorithms that are non-blocking (lock-free), allowing in this way a fast and dynamical behavior.

The self-tuning reactive trees distribute a set of processes to smaller groups accessing different parts of the memory in a coordinated manner, and moreover reactively adjust their size in order to attain efficient performance across different levels of contention. We present a data structure that in an on-line manner balances the trade-off between the tree traversal latency and the latency due to contention at the tree leaves.

The experiments on the SGI Origin2000, a well-known commercial cc-NUMA multiprocessor, showed that the new reactive objects achieve significant improvements compared to previous results.