Munin: Distributed Shared Memory Using Multi-Protocol Release Consistency

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Abstract

Munin is a distributed shared memory system that allows parallel programs written for shared memory multiprocessors to be executed efficiently on distributed memory multiprocessors.

Unlike existing DSM systems, which provide only a single memory consistency mechanism, Munin provides a suite of consistency protocols. The consistency protocol to be used with a particular shared object is specified by annotating the declaration of the object in the source program. Munin is furthermore the first DSM system to implement release consistency, a relaxed form of memory consistency. Release consistency allows network latency to be masked, and significantly reduces the number of messages required to keep memory consistent. Munin's multi-protocol release consistency is implemented entirely in software. At the heart of the implementation is a delayed update queue, that buffers and merges pending remote writes.

A prototype implementation on an Ethernet network of 16 SUN-3 processors indicates good performance, without having to make major modifications to the shared memory programs.

Further work will include implementation of a second prototype on a high-performance architecture, investigation of hardware support, a port to Mach, and porting new applications and languages to Munin.

List of Papers

1. J.K. Bennett, J.B. Carter, and W. Zwaenepoel, "Munin: Distributed Shared Memory Based on Type-Specific Memory Coherence", *Proceedings of the Second Symposium on Principles and Practice of Parallel Programming*, pp. 168-176, March 1990. Also available as Technical Report RICE COMP TR90-108.

2. J.K. Bennett, J.B. Carter, and W. Zwaenepoel, "Adaptive Software Cache Management for Distributed Shared Memory Architectures" *Proceedings of the Seventeenth International Symposium on Computer Architecture*, pp. 125-134, May 1990. Also available as Technical Report RICE COMP TR90-109.

3. J.B. Carter, J.K. Bennett, and W. Zwaenepoel, "Implementation and Performance of Munin", accepted for publication *Thirteenth Symposium on Operating System Principles*, October 1991. Preliminary version available as Technical Report RICE COMP TR90-150.

Papers can be otained by anonymous ftp from titan.rice.edu [128.42.1.30] under public/munin.