Conditional Memory Ordering
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Presented in class by Renwei Yu                                                Critique : Srivatsan Chellappa

A Brief outline of the paper :
Memory ordering operations in multithreaded processors is not atomic and takes finite
time to execute. This paper aims at studying those memory ordering operations that are
superfluous and proposing methods to eliminate them ,thereby improving performance.
The paper studies the redundant memory operations such as

1) Thread confinement of lock variables: redundant memory ordering operations
when only one thread is using the memory variable.

2) Thread locality of locking : memory operations on variables in between accesses
by different threads is redundant i.e during the time no other thread needs the
memory, the same thread can avoid acquiring and releasing the variables.

3) Eager releases and repetitive acquires: A syncRelease operation could happen
eagerly than if subsequent syncRelease operation is separated in time.

For this the authors have proposed a new memory ordering algorithm called the CMO
model which reduces these unnecessary memory operations.

Strengths of the paper :

1) The ideas proposed in the paper aim at removing the redundant memory
operations and hence improve the throughput of the machine.

2) Their experimentation is conducted on both high cost and low cost memory
ordering implementations and it produces a speedup of upto 11% in high and 3%
in low MOI systems.

3) Simulations have been carried out over an extensive set of SPEC benchmarks and
multi threaded Java Benchmarks.

Weaknesses of the paper:

1) The paper to a great extent lacks clarity and the authors have not been able to
explain their proposal effectively.

2) The additional complexity involved in adding extra hardware ( to support the
syncConditional ) or implementing these schemes at in software at the kernel
level have not been assessed.

3) The paper quotes “Since the only architecturally visible aspect of CMO is the
addition of this single instruction (syncConditional), it should be obvious that
CMO is backwards compatible with respect to existing software ”. This the author
fails to illucidate this aspect.

4) The implementation details of the S-CMO have not been talked about to a great
extent.