Impact of Database Scaling on DSS Workload Characteristics on SMP Systems

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Motivation

• Question: How to profile and evaluate realistic commercial workloads?

• Are the workload characteristics independent of database scaling?
Workload Evaluation Options

• **Simulation** with scaled down workloads.

• Realistic workloads with **hardware emulation**.
Setup Environment

System Under Test

MemorIES

L3 PC Console

6XX Bus

PCI
Tools

• MemorIES -I.

• pmcount.

• Standard UNIX (AIX) tools.
Experimental Platform

- 12-way IBM S7A SMP
  - MemorIES board replaces 4 processors.
  - 262 MHz Northstar processors.
  - 8MB L2 caches.
  - 24GB main memory.
  - More than 1TB disk space.
  - L2 size/associativity can be varied from 8MB 4-way to 1MB direct-mapped.
Preliminary Results

• Impact of DSS workload on L3 behavior.

• Effect of DB size on L3 cache miss characteristics.

• Impact of DB size on L2 miss characteristics.
Impact of DSS Workload on L3 Miss Behavior
Impact of DSS Workload on L3 Miss Behavior (Contd.)

Load Avg. for 30GB TPC-H Power Run

Load Avg. for 30GB TPC-H Throughput Run
Effect of DB Size on L3 Miss Characteristics

L3 Miss Ratio vs. DB Size

Effect of DB Size on L3 Miss Characteristics
Effect of DB Size on L3 Miss Characteristics (Contd.)

L3 Miss Rate vs. DB Size

L3 Cache Size

128MB 256MB 512MB

L3 Miss Rate

10GB 30GB 100GB

Thousands
Impact of DB Size on L2 Miss Characteristics

Increased working set => More misses.

Increase in miss rate is significant for 100GB => L3 will be useful.
Impact of DB Size on L2 Miss Characteristics (Contd.)

L2 Miss Breakup (128MB/L3)

L2 Miss Breakup (256MB/L3)
Impact of DB Size on L2 Miss Characteristics (Contd.)

As dataset size increases, misses increase => DClaims decrease.

Because of Database distribution on multiple disks, increased throughput (useful work) translates to increased cache traffic.
Concluding Remarks

- DSS workload characteristics vary significantly with DB size.
- Misses per instruction can vary three fold between a 10GB and 100GB database.
- Invalidation requests and modified interventions on the memory bus decreases moderately with increase in database size.
- Due to the large variations in workload characteristics, it is important that realistic DB sizes are used for system evaluations.