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Design Document

Benchmarking is an act of measuring and evaluating performance of a system under reference conditions, relative to a reference evaluation. In this assignment we will be evaluating 4 aspects of computers: Processor, Memory, Disk and Network.

Overall Program Design

All the benchmarks are written C programming language, a makefile is created to execute the program.

Concurrency is achieved using POSIX threads.

A strong scaling is implemented ie a fixed size problem is divide between available no of threads.

The evaluate multiple combinations of inputs we are using SLURM scheduler.
A slurm job script is written for every input file and submitted for execution on hyperion node using sbatch command. When the job finishes execution a output file is generated containing benchmarking results.

CPU Benchmark

A CPU benchmark calculates speed of the processor in terms of Giga Operations executed per second.

The workload consists of quarter precision operations (1-byte char data), half precision operations (2-byte short data), single precision operations (4-byte integers data) and double precision operations (8-byte double data)

Concurrency of 1,2 and 4 threads is used to evaluate the strong scaling performance.

Benchmark is evaluated by comparing calculated values against theoretical peak throughput.

Memory Benchmark

A memory benchmark calculates speed of the memory ie no of bytes accessed per second.

The workload consists of 1GB of data operated over of 100 times (total 100GB). memcpy operation is used as operation of evaluation. Data is accessed with sequential and random access patterns for better evaluation with various block sizes.

Concurrency of 1,2 and 4 threads is used to evaluate the strong scaling performance.

Benchmark is evaluated by comparing calculated values against theoretical peak throughput and latency.

Disk Benchmark

A disk benchmark calculates speed of the disk i.e. no of byes read/written to/from the disk from/to buffer in main memory.

Workload consists of 10GB of data accessed with random and sequential read-write operations.

Concurrency of 1,2 and 4 threads is used to evaluate throughput and concurrency of 1,2,4,8,16,32,64,128 threads is used to evaluate latency output.

Benchmark is evaluated by comparing calculated values against theoretical peak throughput and latency.

Network Benchmark

A network benchmark evaluated TCP and UDP protocol for speed of data transfer from client to server and back.

Workload consists of 1GB data operated over 100 times with various block sizes.

Concurrency of 1,2 and 4 threads is used to evaluate the strong scaling performance.

Benchmark is evaluated by comparing calculated values against theoretical peak throughput and latency.

Design tradeoff:
Compiler optimizations are turned using gcc flags
AVX instructions are not used

Improvements and extensions:
More complex operations could have been used to have more accurate results.
A user interface representing comparative results would be a nice addition.
Cache was not disabled for memory and disk.