NetBench: A Benchmarking Suite for Network Processors

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Applications

- Different “levels” of applications:
  - **Micro-level:**
    - “Close” to link, components of higher levels
    - Apps: CRC checksum, RTR table lookup
  - **IP-level:**
    - IP packet processing
    - Apps: IPv4 Routing, DRR scheduling, NAT, firewall
  - **Application-level:**
    - More complex processing
    - Apps: URL-based switching, Diffie-Hellman, MD5
NetBench Characteristics

- Instruction-level parallelism:
  - IPC of 1.38 to 1.97

- Instruction mix:
  - Add ~40-50%
  - Load ~20-30%
  - Arithmetic ~10%
  - Others < 10%

- Cache miss rates:
  - Only one measurement: 4kB i-cache, 4kB d-cache, 128kB L2
  - i-cache miss rate < 0.3%
  - d-cache miss rate < 2.3%
IXP1200 Implementation

- Implementation on IXP1200:
  - IPv4 routing, MD5, CRC checksum
- Throughput:
  - IPv4: 2.2 Gbps on IXP, 1.2 on Pentium
  - MD5: 0.3 Gbps on IXP, 0.2 on Pentium
  - CRC: 0.3 Gbps on IXP, 0.2 on Pentium
- What conclusions can be drawn from this result?
Other NP Benchmarks

- NP Forum
  - Consortium of NP vendors
  - Has recently standardized IP forwarding
  - MPLS etc. next

- EEMBC
  - Embedded processor consortium
  - Has a few networking-related micro-benchmarks

- Question:
  - What are good benchmarking metrics?
  - How to incorporate networking and processing aspects?
NP Benchmark Summary

• Difficult to define good benchmark
  – Many levels to processing
  – Many application domains
  – Has to be general enough to be “standard”

• Many measurements
  – What do they mean?
  – How can those numbers be used for NP design?
Topics for Remaining Classes

- Performance modeling for design space exploration
- Simulation of network processors
- Scheduling of processing tasks
- Look at more commercial products
- What should we focus on?