Summary
Multiscalar Processors

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January 31, 2005

1 To be completed before class

What are the problems solved by this paper? (50 words)
Most programs are written for sequential execution, with the assumption that instructions are executed strictly in the order they appear. Out-of-order processors suffer with increased instruction window size and issue logic. This paper tries to parallelize the execution with the help of the multiscalar paradigm and thereby improve the ILP. This is done while maintaining the sequential semantics assumed in the program.

What are the approaches attempted by this paper? (50 words)
The multiscalar processor has multiple processing units (PUs), each with its own fetching, executing and sequencing mechanism. Data is forwarded from one PU to the other in a cyclic ring fashion.
The CFG of the program is divided into tasks. The multiscalar processor uses branch prediction to speculatively execute the tasks on different PUs, while preserving inter-task data dependences through registers or memory. In case of a violation, i.e., a task uses wrong data values, the task is squashed.
The compiler breaks the CFG into tasks and creates masks which depict the inter-task dependences. The compiler directs the processor as to when to release a particular value. The processor uses synchronization to wait for register data from the previous PU. All memory dependences are tracked by means of a central Address Resolution Buffer (ARB). The ARB tracks all the memory dependences and detects violations.

What are the main conclusions of this paper? (50 words)
The authors simulated the multiscalar processor using a cycle-by-cycle simulator that is based on MIPS instructions. GCC 2.5.8 was extended to produce the code for the multiscalar processor. There is an average increase of 11 – 12% in the code size of the benchmarks tested.
The paper shows the IPC achievable using the multiscalar processor on in-order and out-of-order processors without explicit software support. The authors believe that with the help of increased software support and streamlined hardware, the multiscalar processor would be able to extract more ILP.

2 To be completed after class

Did this paper address an important issue? Explain. (100 words)

Are the proposed approaches valid? Describe its strength and weakness. (100 words)
Do the results support the conclusions? Explain. (100 words)

Describe the potential future works? (100 words)