ISSCC Evening Panel 2000

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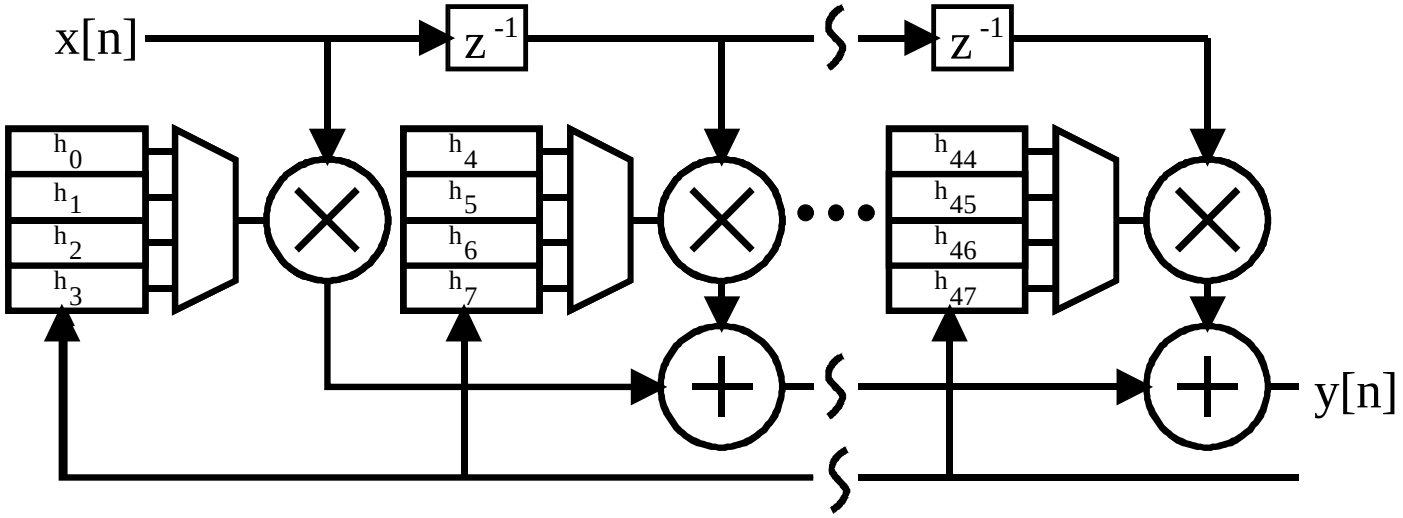
More parallelism, less overhead

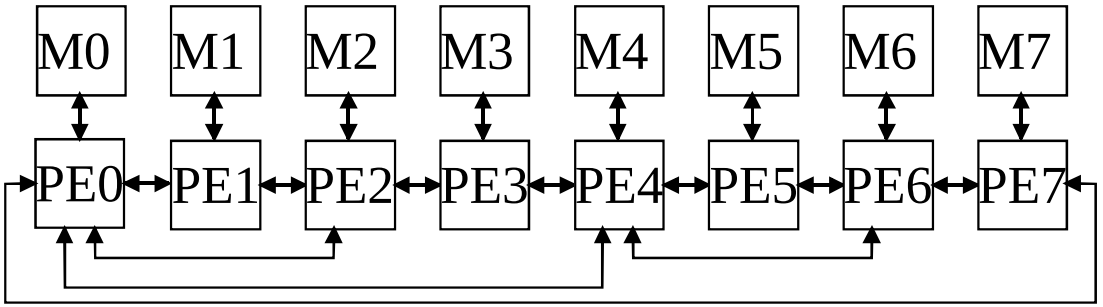
- Mainstream microarchitectures are currently designed to minimize compiler's impact
  - most of the power and chip area spent in buffering and scheduling
  - less than 20% of the power is for actual execution
  - even less of the chip area is for actual execution
- In the next decade, new applications will demand
  - much better performance, power and cost
  - VDSL, software radio, pervasive networking, high-speed switches
- Compiler-enabled architectures for DSP and embedded:
  - long-term competitiveness though reprogrammability
  - performance scalability though partitioning
  - power savings through more locality and slower clocks
  - design-time reduction by reusing general hardware

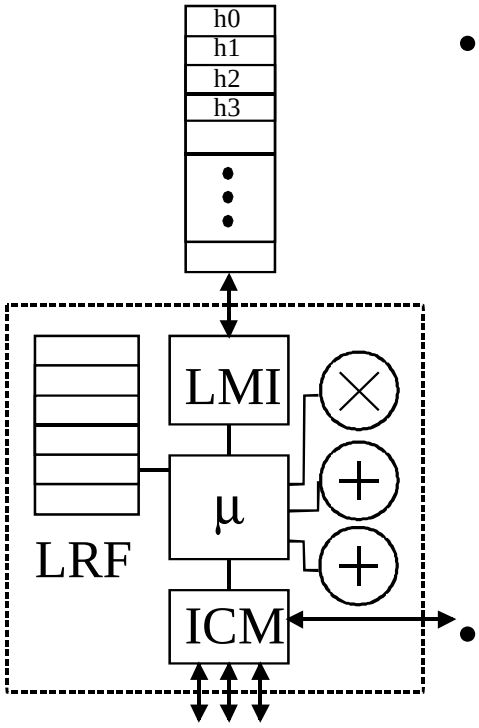
Example: VDSL CAP Receiver



- VDSL not viable on today's DSP
  - Execution units
  - Memory bandwidth
- Future:
  - Exploit algorithmic locality in a scalable architecture
  - Use compiler to partition memory access and computation

VDSL in a scalable-interface VLIW DSP





- Statically scheduled VLIW architecture
  - Compiler partitions computation and associated memory reference and storage
  - Centralized control with shift interconnect designed to hot-path common merges
  - Compiler managed multi-threading/streaming with real-time guarantees
  - seamless interface to special function blocks
- 2000 MACs sustained with 16 units at lower power than current VLIW DSPs

Enabling compiler technology

- Deep program analysis
  - High-resolution data flow
  - Pointer / alias / array/ structure reference analysis
  - Advanced control flow manipulation techniques
  - Software / architecture power modeling
  - Safe execution time analysis
  - Identify opportunities for parallel execution and partition data set
- Parallelization and optimization
  - Computation and memory reference partitioning
  - Localization of memory and instruction references
  - Efficient, low-overhead multithreading with real-time guarantees
  - Managing specialized and/or non-uniform architectures

Most Important Microprocessor of 2010

- No single most important microprocessor
- Where will be the most exciting growth be?
- Domain Specific Processors that drastically
  - reduce needs for ASIC's
  - increase performance per watt
  - increase performance per mm^2
  - improve real-time characteristics