Machine-Level Programming I: Introduction
Jan 27, 2004

Topics

- Assembly Programmer's Execution Model
- Accessing Information
  - Registers
  - Memory
- Arithmetic operations

X86 Evolution: Programmer's View

Name	Date	Transistors
Pentium III	1999	8.2M

- Added "streaming SIMD" instructions for operating on 128-bit vectors of 1, 2, or 4 byte integer or floating point data
- Our fish machines

Pentium 4	2001	42M

- Added 8-byte formats and 144 new instructions for streaming SIMD mode

X86 Evolution: Clones

Advanced Micro Devices (AMD)

- Historically
  - AMD has followed just behind Intel
  - A little bit slower, a lot cheaper
- Recently
  - Recruited top circuit designers from Digital Equipment Corp.
  - Exploited fact that Intel distracted by IA64
  - Now are close competitors to Intel
- Developing own extension to 64 bits

X86 Evolution: Clones

Transmeta

- Recent start-up
  - Employer of Linus Torvalds
- Radically different approach to implementation
  - Translates x86 code into "Very Long Instruction Word" (VLIW) code
  - High degree of parallelism
- Shooting for low-power market

New Species: IA64

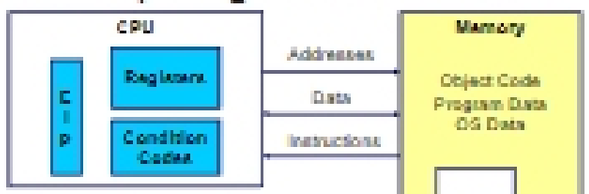
Name	Date	Transistors
Itanium	2001	10M

- Extends to IA64, a 64-bit architecture
- Radically new instruction set designed for high performance
- Will be able to run existing IA32 programs
  - On-board "x86 engine"
- Joint project with Hewlett-Packard

Itanium 2	2002	221M

- Big performance boost

Assembly Programmer's View



Programmer-Visible State

- EIP Program Counter
  - Address of next instruction
- Register File
  - Heavily used program data
- Condition Codes
  - Store status information about most recent arithmetic operation
  - Used for conditional branching

- Memory
  - Byte addressable array
  - Code, user data, (some) OS data
  - [redacted] procedures