

Lecture 6: Microprocessor Overview

- Embedded Systems
- Technology Trends
- Why study MCU

Classes of Computers

- Desktop computers
 - General purpose, variety of software
 - Subject to cost/performance tradeoff
- Server computers
 - Network based
 - High capacity, performance, reliability
 - Range from small servers to building sized
- Embedded computers
 - Hidden as components of systems
 - Stringent power/performance/cost constraints

Embedded System Overview

- Embedded Systems
 - Computing systems embedded within electronic devices.
 - Repeatedly carry out a particular function or a set of functions.
 - Contain both hardware and software
 - Billions of units produced yearly, versus millions of desktop units



What distinguishes embedded systems?

- Application-specific
- Resource-constrained
- Real-time operations
- Physically-embodied
- Software runs "forever"

A "short list" of embedded systems

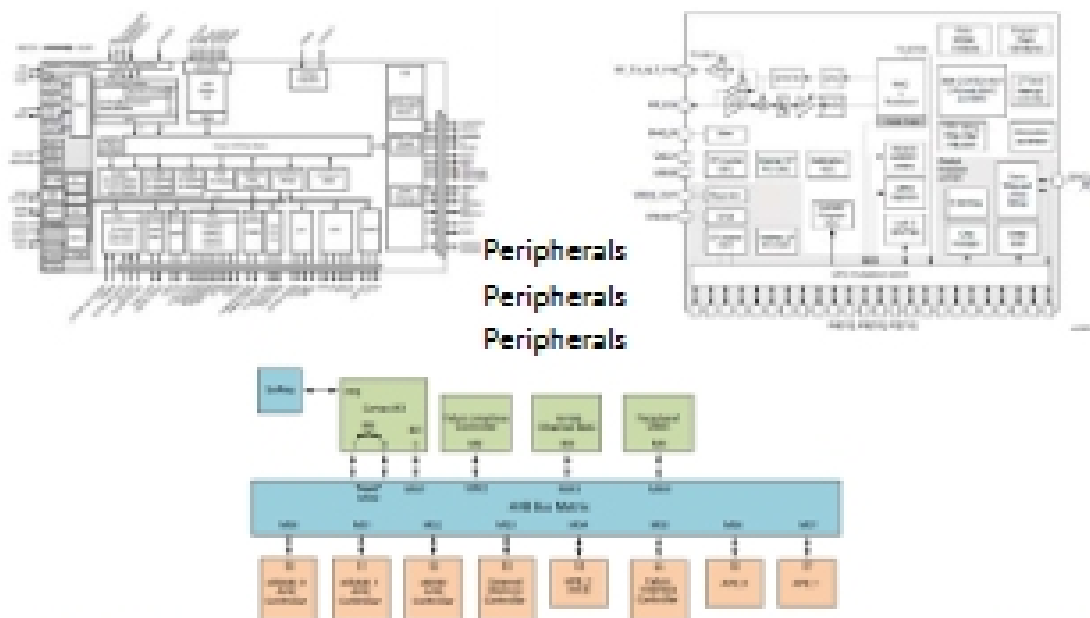
- Anti-lock brakes
- Auto-focus cameras
- Automatic teller machines
- Automatic toll systems
- Automatic transmission
- Airline systems
- Battery chargers
- Camcorders
- Cell phones
- Cell-phones base stations
- Cordless phones
- Cruise control
- Carbide check-in systems
- Digital cameras
- Disk drives
- Electronic card readers
- Electronic instruments
- Electronic toys/games
- Factory control
- Fax machines
- Fingerprint identifiers
- Home security systems
- Life-support systems
- Medical testing systems
- Modems
- MPEG decoders
- Network cards
- Network switches/routers
- On-board navigation
- Pagers
- Photocopiers
- Point-of-sale systems
- Portable video games
- Printers
- Satellite phones
- Scanners
- Smart ovens/dishwashers
- Speech recognition
- Stereo systems
- Teleconferencing systems
- Televisions
- Temperature controllers
- Theft tracking systems
- TV set-top boxes
- VCR's, DVD players
- Video game consoles
- Video phones
- Washers and dryers



• The list grows longer each year.

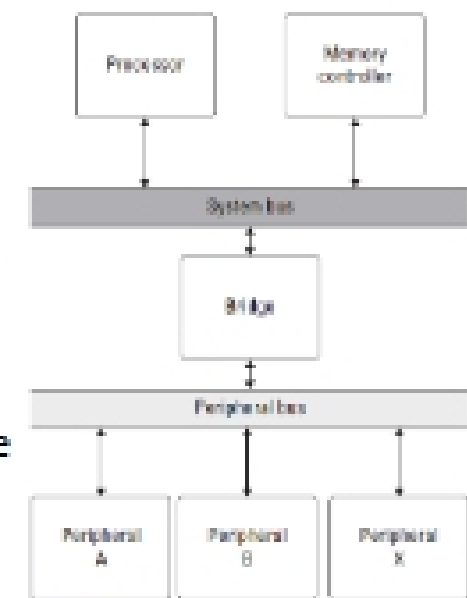
What differentiates these products from one another?

The difference is...



Inside the Processor (CPU)

- Datapath: performs operations on data
- Control: sequences datapath, memory, ...
- Cache memory
 - Small fast SRAM memory for immediate access to data

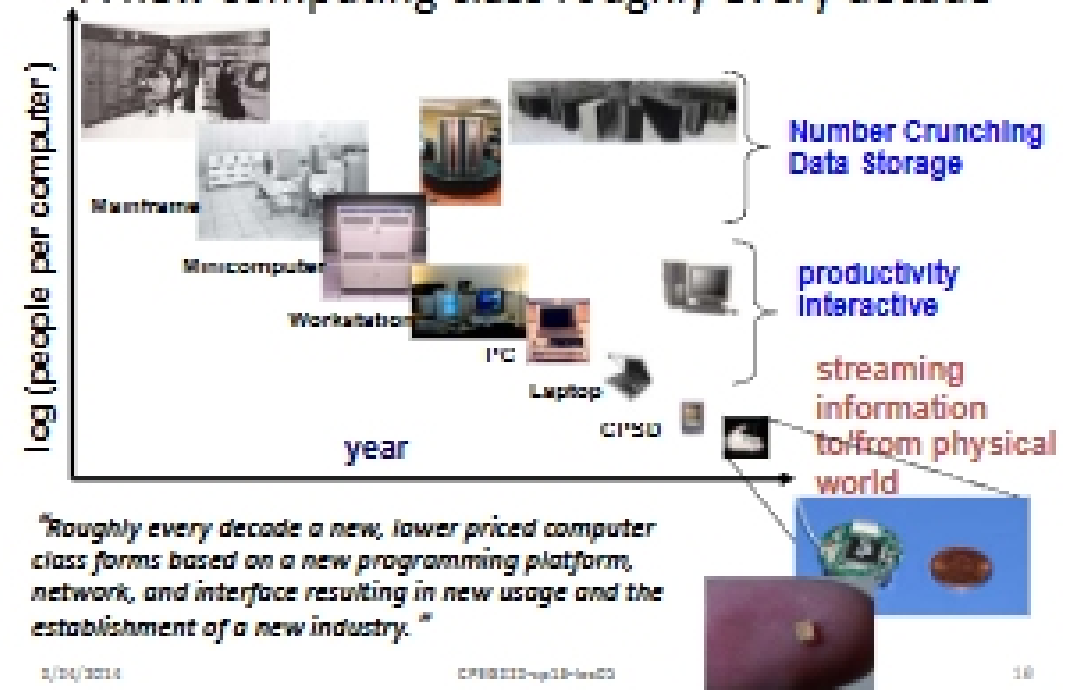


Q: What is driving the embedded everywhere explosion?

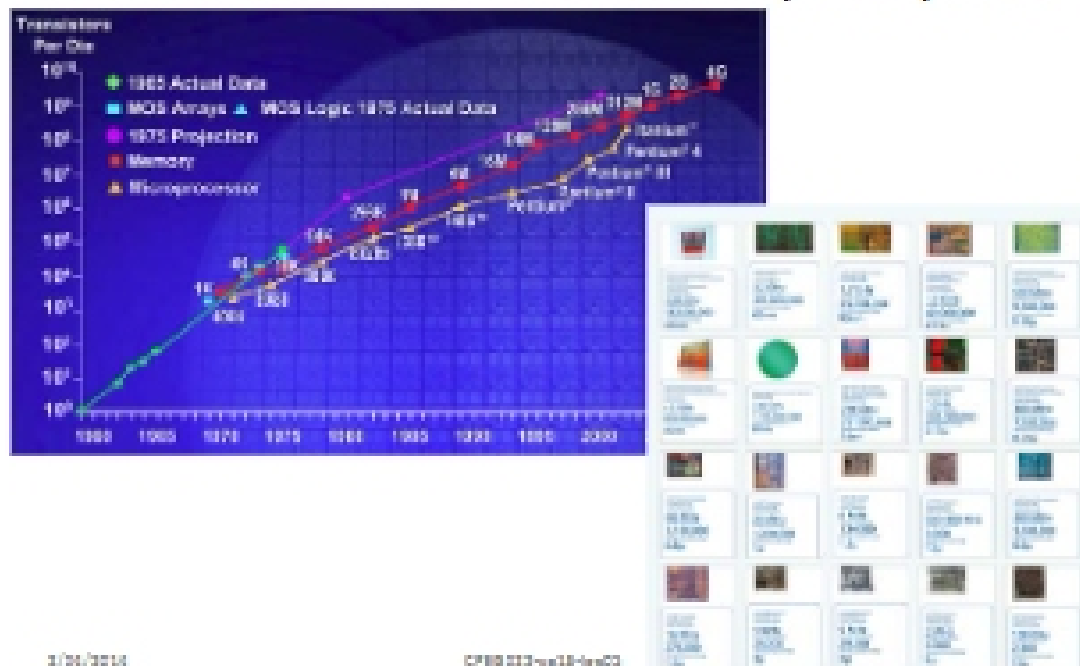
A: Technology Trends

- Microprocessors
- Memory (RAM and Flash)
- Imagers (i.e. camera) and MEMS sensors (e.g. accelerometer)
- Energy storage/generation

Bell's Law of Computer Classes:
A new computing class roughly every decade



Moore's Law:
IC transistor count doubles every two years



Flash memory scaling:
Rise of density & volumes; Fall (and rise) of prices

