

Introduction

JIANGJIANG (JANE) LIU

Department of Computer Science
Lamar University, TX, U.S.A.

Computing Markets

F Characterized by applications, requirements, and computing technologies

F Three different markets

- o Servers
 - w Tremendous growth in demand
 - For Web servers
- o Desktops
- o Embedded computers

Shifting



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Desktop

F A few years ago

- o Focus on **clock rate** as direct measure of performance

- o **Pentium 4**

F Recently

- o **Chip multiprocessor**
- o Intel
- o AMD

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Servers

F Provide large scale, reliable file, and computing services

F High performance computing

- o Single compute-intensive workloads applications
 - o Weather forecasting: Earthquake, Hurricane, etc.
 - o Oil exploration
 - o Bioinformatics: Protein structure determination.
 - o Backbone of large-scale enterprise computing

F Web servers

- o Emergence of World Wide Web
 - w Document server
 - w Transaction-processing server

F SUN Niagara processor

- o Data center

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Server – Key Features

F Availability

- o Reliably and effectively provide a service
- o Different from “reliability”
 - o Reliability: system never fails – unavoidable
 - o Availability: maintain reliability in case of system failure
- o Why crucial?
 - o Brokerage operations
 - w Cost of downtime per hour: \$6450
 - w Credit card authorization: \$2600
- o Maintain availability:
 - o Redundancy

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Server – Key Features

F Scalability

- o Growing demand for services
- o Scale up
 - o Computing capacity
 - o Memory
 - o Storage
 - o I/O bandwidth

F Efficient throughput

- o Individual request response
- o Overall performance
 - o How many requests can be handled in a unit time?
 - w Transaction per minute
 - w Web pages served per second

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Embedded Computer

F Minimize memory and power

- o Substantial portion of system cost and power consumption
- o Code size
 - o Application fits in on-chip memory/ small off-chip memory

F Processor cores and application-specific circuitry

- o Customized hardware/software solution running on standardized embedded processor core

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Computer Design

F High performance, low power consumption, low cost, security, etc.

F Task

- o Instruction set design
- o Functional organization
- o Logic design
- o Implementation
 - o Integrated circuit design
 - o Packaging
 - o Power
 - o Cooling

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Computer Design

F Design for next technology

F Must be aware of current implementation technologies

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Current Implementation Technologies

F Integrated circuit logic technology

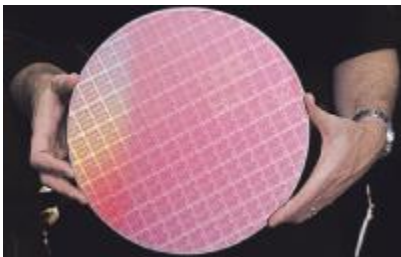
- o Transistor density increases dramatically – 35%/yr.
- o Die size – 10%-20%/yr.
- o ÷ On-chip transistor count – 55%/yr.

F Semiconductor

- o Dynamic random-access memory (DRAM)
 - o Density - 40%-60%/yr.
 - o Cycle time – one-third/10 years

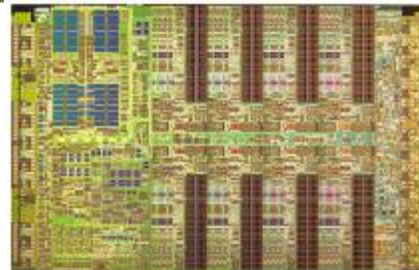
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Wafer



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Microprocessor

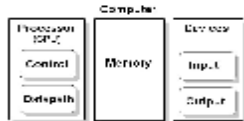


CELL CITY MAP: The Colloquial name for the cell phone's PolySiP2000 processor has a die processor core. The core is made up of the chip in itself or the processor in Apple computers. The other eight cores, outside the core, are made of silicon (silicon) and designed to do the same tasks.

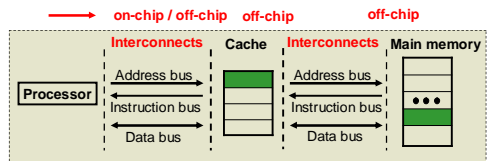
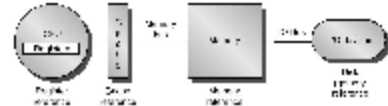
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Computer System Components

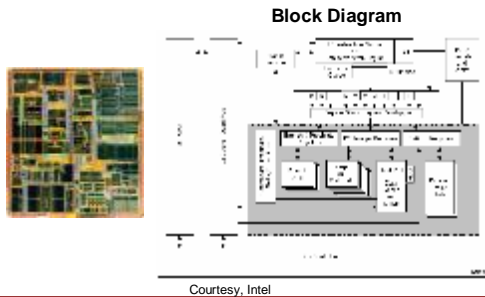
- F Computation system: Processor core
- F Memory system
 - o Storage components: Store information
 - o Registers; TLB; Caches; Main memory
 - o Communication components: Communicate information
 - o I/O buffers and signaling/driving circuitry; I/O pads; Pins
 - o On- and off-chip buses
- F I/O system: Secondary and tertiary storage I/O, network I/O



Computer System Components



Intel Itanium Processor

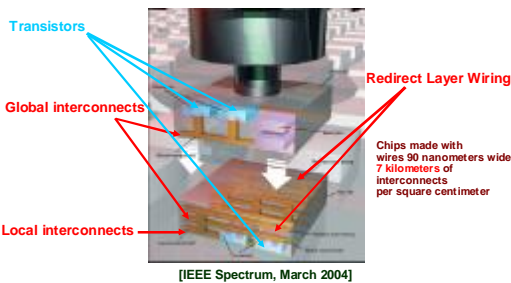


Courtesy, Intel

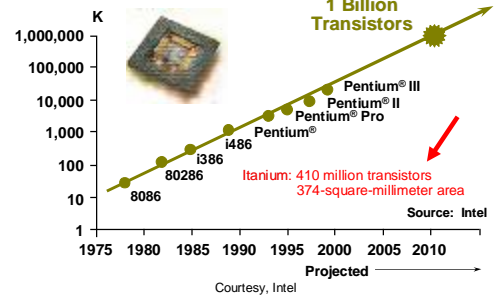
Key Features

- F Performance
- F Power consumption
- F Cost
- F Reliability
- F Scalability
- F Security
- F Current implementation technologies?

Chips Go Vertical



Transistor Counts



Courtesy, Intel

