
Final Lecture: Futures

CSC 469H1F / CSC 2208H1F

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Plan for today

- Some directions things are headed
- New desires
 - ubiquitous computing
 - Internet-scale computing
 - Data-intensive supercomputing
- New technologies
 - Flash-based disk drives
 - Flash replacement: Phase change memory (PCM)
 - Multi-threaded multi-core processors
 - Better tools for handling complexity

Ubiquitous computing

- **IDEA: Computers all over the place**
 - but, they're just part of the environment, not really in your face
- **Lots of ongoing projects now**
 - Aura (CMU), Oxygen (MIT), Endeavor (UCB), etc...
- **Lots of interesting challenges**
 - low power and power management
 - wireless networking
 - real-time and on-time services
 - computation and data migration
 - addressing information overload
 - security and privacy!

Internet-wide computing

- Very wide-area computing and information sharing
 - Video conferencing and other forms of communication
 - Grid computing
 - Peer-to-peer distributed lookup and storage systems
 - PDA and other forms of remote information access
- Lots of projects
- Lots of interesting challenges
 - resource discovery and selection
 - person location
 - data and/or computation survival and migration
 - cost/benefit models
 - security, privacy, and fighting denial of service attacks

Data Intensive Supercomputing

- Large scale computer centred around data
 - Collecting, maintaining, indexing, computing
- Think google-style computing
 - Millions of processors in local-area clusters
 - Commodity parts, reliability depends on redundancy and sw management
 - Partitioned workload
- Lots of examples of problems that fit this model
- Big challenge is moving data
 - 1 TB is cheap to store, hard to move
 - E.g. seagate cheetah, 125 MB/s → 2.2 hours for 1 TB

New technologies

- Changing technology requires changes in system mgmt.
- Moore's Law
 - faster CPUs, more memory, more storage, more bandwidth
- Shared memory parallel computing becomes mainstream
 - Renewed interest in efficient synchronization, parallel scheduling, distributed shared memory
- Better wireless technologies, smaller devices
 - Ubiquitous computing vision becoming realistic
- Changes in storage technology
 - Cheap, fast non-volatile storage simplifies many file system problems

Better Tools

- Project AURA (CMU Ubicomp) catchphrase:
 - The most precious resource in a computer system is no longer its processor, memory, disk or network. Rather, it is a resource not subject to Moore's law: *User Attention*.
- Complexity of systems continues to grow, human ability to handle complexity does not
 - Need better languages to specify and check concurrent programs (HPCS languages: X10, FORTRESS, Chapel)
 - Automatic extraction of rules from code, and verification that rules are followed (Engler et al.: metacompilation)
 - Automatic diagnosis and recovery from errors (autonomous computing)
 - Reduction to less complex system (virtual machines)

What's next ...

- Wednesday:
 - Test 2, 4:10 pm - 6pm
 - Expect similar format to Test 1
- Final (unofficial) marks by next Friday
- After that: Have a great break!

Test Tips

- Non-programmable calculators will be allowed
- Covers Lecture 12 (Multiprocessor Scheduling II) - Lecture 21/22 (Security)
- Roughly same weight per lecture
- Expect mix of application, knowledge & thinking questions
 - Application: apply some topic / algorithm to a given scenario, e.g. Q3, Q4, Q5b from last year's test 2
 - Knowledge: demonstrate knowledge/understanding of a topic/problem, e.g. definitions, Q2, Q5a, Q6a, Q7, Q8
 - Thinking: take your knowledge of some topic and show how to use it in a new situation, e.g. Q6b,c
- Will have more thinking / less pure knowledge than last year