CS 100: Parallel Computing

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Week 11-2

Logistics

Upcoming

- HW 6: Up tomorrow
- Thursday Mini-exam 3

Reading

- Zyante Ch 6 Security
- Pattern Ch 7 Speed: Parallel Computers

Goals Today

- HW 6 and the Term Paper
- Parallel computing wrap-up
- Mini-exam 3

HW 6 and The Term Paper

HW 6

- Problem 1: Upgraded your computing security or privacy in two ways
- Problems 2-5: Prep for the term paper
- Due Tue 11/24, day before Thanksgiving Break

Term Paper

- 4+ pages single spaced
- Computing topic of your choice
- Include technical, historical, social perspectives
- 2 High-quality references
- Buffer credit available via completing an early draft

Recall Histograms

DADCBDCCACCDFCDBDBF BBADBA 0: F BBFFC ΑF BAD F F 1: D F В С В A C С Α ABC В Α C В ACD D С F ΑD CD С F 2: R D D В D Α D D F F А В CAF 3: D F D С Α D Α D Α В D СА С В В С BC 4: С F D CF Α С D Α F D F С F D В С D D В В Α С D F 5. Δ D D Α Α D D C D D В В Α AF F Α D D В CAA F А F А ΒF DΒ F 6: B B D Α Α Α D AAD Α D F F Α B Α 7: D C F F В F С F С D F D D В D С D D CCCB AAD 8: F D CF AACACCB D AAF F D С D A C R F D Α A A B D A D D A C D D B C A B B A F C A A B D A 9:

Moore's Law

- Smaller transistors \rightarrow closer together
- Smaller transistors can "flip" faster
- More faster transistors on a chip \rightarrow more speed
- Processor speed doubles every 18 months



Microprocessor Transistor Counts 1971-2011 & Moore's Law

How Small are Transistors?

- Intel Core i7 uses a 32 nanometer process
- Distance between memory units in the processor is about 64 nanometers
- A hard sphere radius of a hydrogen Atom is about 0.11 nanometers
- About 591 atoms apart
- 22 nanometer processor is close

However...



Source: Danowitz et al

- CPU speed isn't getting faster these days
- Fastest Dell Speed I found was 4.0 GhZ

The Allure of Parallel Programming

- Having multiple CPUs is helpful for some problems just like having multiple people is helpful
- Amdahl's Law: Almost every problem has a serial component: a spot where only one proc/person can work
- Hillis: Parallel programming is faster than people believe
- Trade-offs: More CPUs cost money, is it worth it?



Source

In a call center each, person can work independently but if there are no calls to take, they get paid to watch cat videos.

Why The Slow Down

- Changing bits faster requires energy
- Faster processors suck down more power
- Consider the data center: lots of CPUS stacked together get hot



Google Me This

- How much of a data center's energy is used by CPU/servers?
- How much energy does a typical datacenter consume?
- How many homes could you power with that amount of energy?
- Hint: try looking for an article on Facebook data centers circa 2012

Answers

The first phase of Facebook's data center in Prineville, Ore. will have a capacity for 28 MW of power, points out Data Center Knowledge. That's about the same amount of power used by all the homes and businesses in the rest of the Oregon county where the data center is located (20,815 people).

Data centers are increasingly requiring energy capacity of close to 100 MW of power, which is the equivalent power for about 80,000 U.S. homes, says Greenpeace.

https://gigaom.com/2012/01/31/

the-era-of-the-100-mw-data-center/

Average home in 2014: 911 kilowatthours (kWh) per month. http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3

Mini-Exam 3

Now