What is Computer Science?

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Introduction

- Name three software programs that you need to use everyday
- Name three software programs that make your life more fun
- Software is the driving force behind many (and soon to be almost all) of the systems that our world depends upon (including your social life :-))
- *Computer science is the art and science behind creating and running software*

What is Computer Science?

- Computer Science involves finding how to decompose problems into manageable parts and how to work on those parts
- Computer Scientists often use computer programming languages to write the steps for solving a problem, but *the crux of the work is spending time discovering the steps needed to solve a particular problem*
- A computer language is not just a way of getting a computer to perform certain operations but rather it is *a novel formal medium for expressing ideas about methodology.*
- The computer revolution is a revolution in the way we think and in the way we express what we think

What is Computer Science?

- Computer science, like Engineering, builds upon a foundation of Mathematics and Science
- Both computer science and physics are about how the world works at a rather fundamental level. The difference is that while in physics you're supposed to figure out how the world is made up, in computer science you create the world
- Engineering deals precisely with the notion of "*how to*." Science and Mathematics deal precisely with the notion of "*what is*." Computer Science deals with both...
- Computer Science in turn now drives the research and practice in Science, Technology, Engineering and Mathematics as well as other fields

Major Areas of Computer Science

- How to solve problems and how to organize data?
  - *Algorithms and Data Structures*
- How to express a solution in code?
  - *Programming Languages*
- How to design, maintain and manage systems to run the code?
  - *Systems:* Operating Systems, Computer Architecture, Databases, Distributed Systems (such as Cloud Computing), Networking etc.

Software engineering is the application of all three major areas

Software Engineering Example

- The Space Shuttle:
  - 2.5 million parts, 230 miles of wire, 4.5 million lbs, 18000 NASA employees
- The Linux Operating System kernel:
  - Version 3.6: 17 million lines of code, about 35,000 files, about 100,000 developers
- Lines of Code Visualization

Algorithm Example

- Problem: Compute 2^n (in as few multiplications as possible)
- Solution Approaches: Multiple ways of computing the result. Each is a different algorithm
- Performance: Naive approach versus recursive doubling can lead to a speedup of 100 or more!

Programming Language Example

```
// the naive algorithm in code
int powerOfTwo(n) {
    int result = 1;
    for (int i = 0; i < n; i = i + 1) {
         result = result * 2;
    }
    return result;
}
```

```
// the recursive doubling algorithm in code
// assumes n is a power of two
int powerOfTwo(n) {
    int result = 2;
    for (int i = 0; i < log(2,n); i = i + 1) {
         result = result * result;
    }
    return result;
}
```

Systems Examples

- *Facebook*: 1 billion users...how to manage the data and give real time access to it?
  (100+ Petabytes in one cluster of machines alone!)

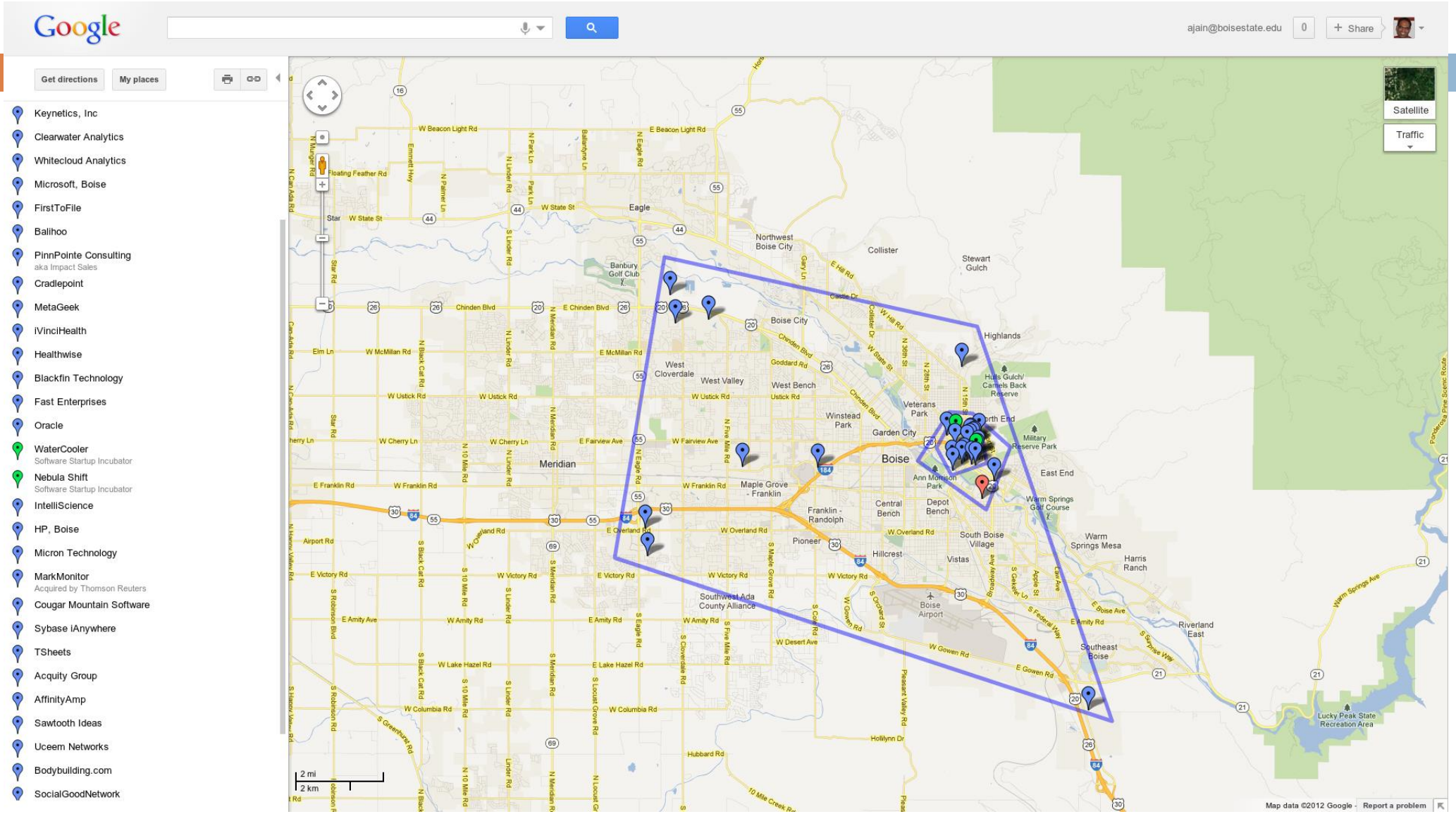
- *Google search*: Trillions of web pages, maps, satellite imagery, videos etc...how to store and manage real-time search?
  (Exabytes in 900,000+ servers!)

Computer Science Careers (1)

- The Computer Science major is the primary avenue into jobs with titles like Software Engineer, Software Developer, Systems Analyst, Systems Engineer
- Software developers have among the highest pay and highest job satisfaction

Computer Science Careers (2)

- Wide variety of careers: Software companies, Engineering companies, Biomedical companies, Investment companies etc.
- Google, Amazon, Facebook, Twitter, NASA, Wall Street, Biotech Firms, Intel, Microsoft and many other national and international firms.
- *Boise Metro Area*: Hundreds of software companies! HP, Micron, Clearwater Analytics, Keynetics, MarkMonitor (Reuters), MetaGeek, Balihoo, WhiteCloud Analytics, Healthwise and many more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Satellite
Traffic
Eagle
Star
Meridian
Boise
Boise City
Garden City
West Cloverdale
West Valley
West Bench
Northwest Boise City
Collister
Stewart Gulch
Highlands
Hulls Gulch/ Cartels Back Reserve
Veterans Park
Winstead Park
Military Reserve Park
East End
Ann Morrison Park
Warm Springs Golf Course
Central Bench
Depot Bench
Franklin - Randolph
Maple Grove - Franklin
Pioneer
Hillcrest
South Boise Village
Vistas
Warm Springs Mesa
Harris Ranch
Riverland East
Southeast Boise
Boise Airport
Southwest Ada County Alliance
Banbury Golf Club
Lucky Peak State Recreation Area
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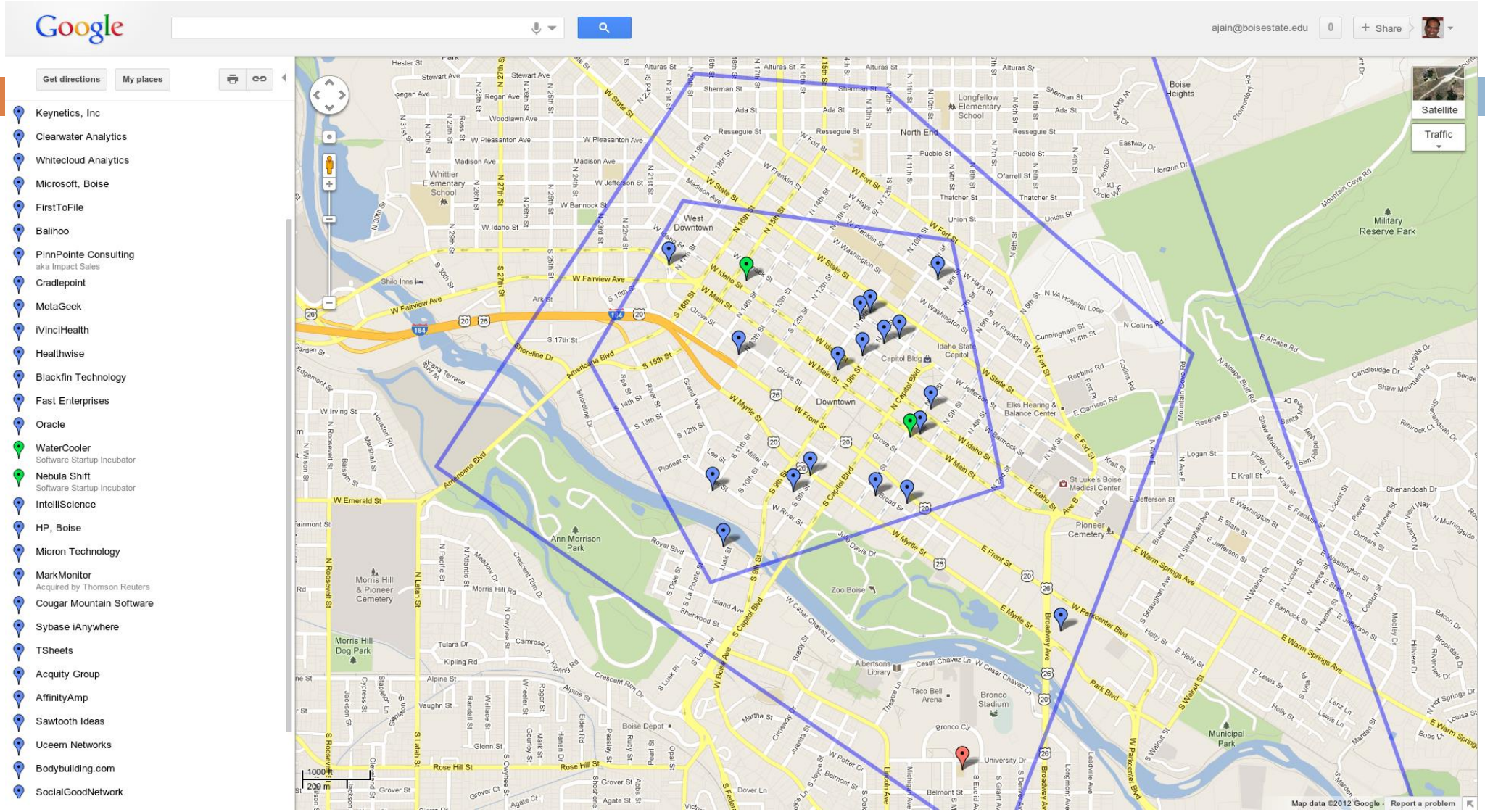
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Cradlepoint
MetaGeek
iVinciHealth
Healthwise
Blackfin Technology
Fast Enterprises
Oracle
WaterCooler
Software Startup Incubator
Nebula Shift
Software Startup Incubator
IntelliScience
HP, Boise
Micron Technology
MarkMonitor
Acquired by Thomson Reuters
Cougar Mountain Software
Sybase iAnywhere
TSheets
Acquity Group
AffinityAmp
Sawtooth Ideas
Uceem Networks
Bodybuilding.com
SocialGoodNetwork
Satellite
Traffic
Boise Heights
Longfellow Elementary School
North End
Military Reserve Park
West Downtown
Downtown
Capitol Bldg
Idaho State Capitol
Ann Morrison Park
Zoo Boise
Pioneer Cemetery
Morris Hill & Pioneer Cemetery
Morris Hill Dog Park
Albertsons Library
Taco Bell Arena
Bronco Stadium
Municipal Park
Boise Depot
Whittier Elementary School
Shilo Inns
St Luke's Boise Medical Center
Elks Hearing & Balance Center
1000 ft
200 m
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Computer Science@Boise State

- Nationally accredited program; commended for the depth and breadth of the coursework and projects
- The department has more than doubled in number of faculty and budget in the last three years. Ten new faculty are being hired in the coming year!!
- Students scored over 90th percentile in the national Major Field Test in computer science, averaged over the last six years compared to around 175 other schools
- Strong feedback from employers: HP, Micron, Microsoft, Google, Intel, Amazon, MetaGeek, Balihoo, Clearwater, Keynetics, MarkMonitor, Cradlepoint and others