

What is Computer Science?

Amit Jain

Department of Computer Science
College of Engineering
Boise State University

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 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 applies tools and techniques from all three areas above to practical problems

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 4.9.3 (2017): 20 million lines of code, about 41,000 files, around 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 naïve 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
int powerOfTwo(n) {
    int result = 1;
    for (int i = 0; i < n; i = i * 2) {
        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!)

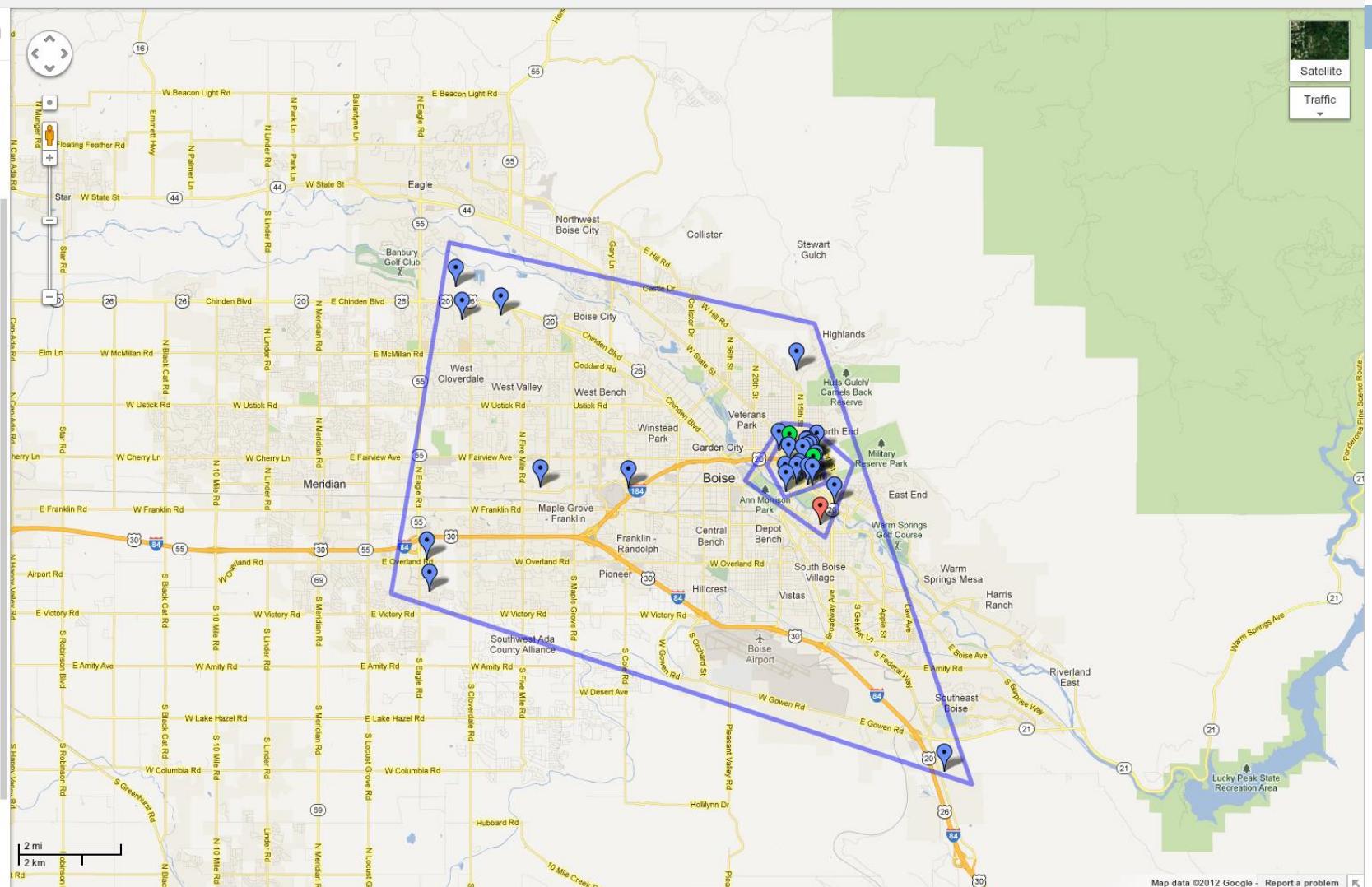
Computer Science Careers (1)

- 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)

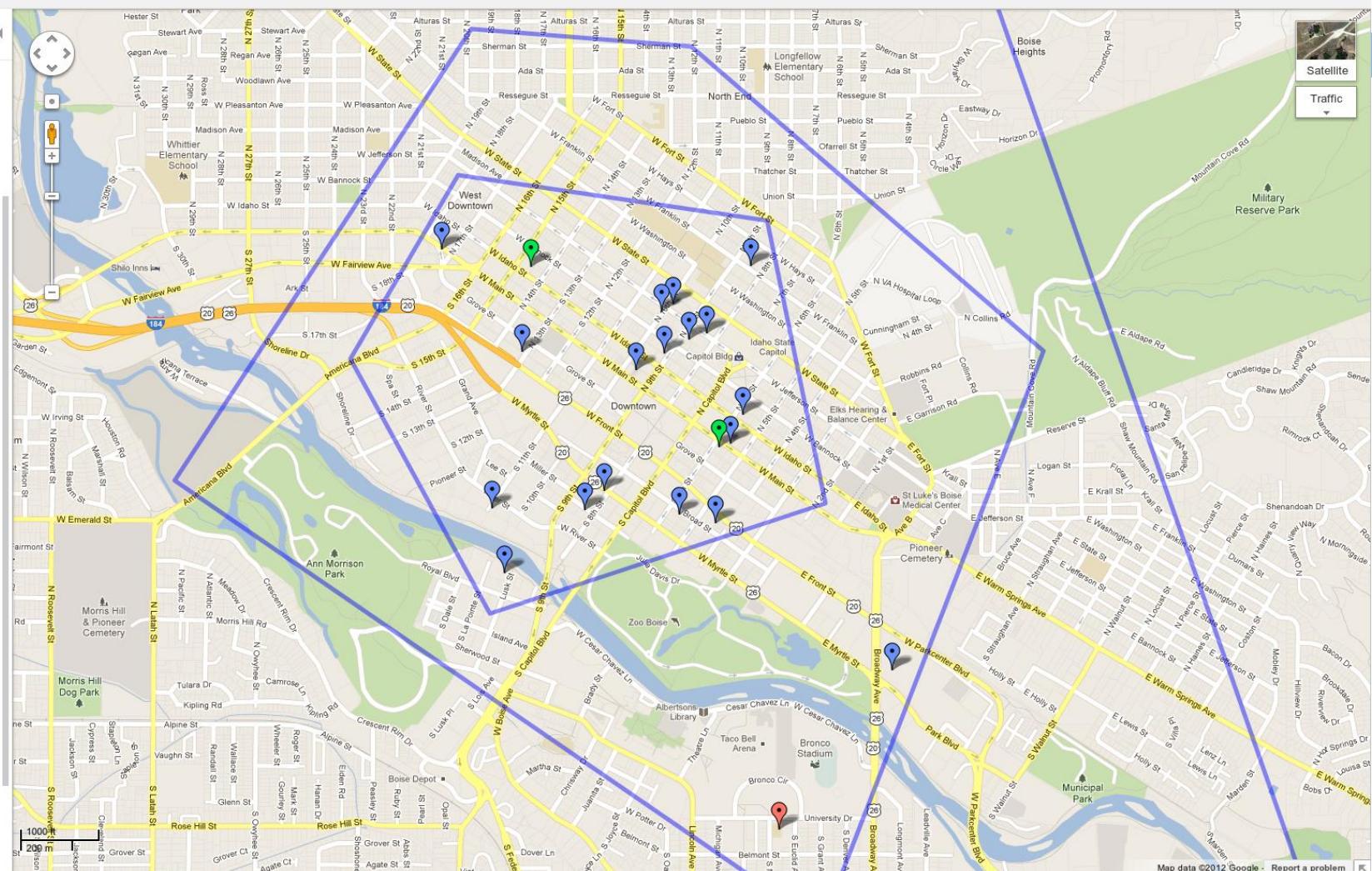
- Wide variety of careers: Software companies, Engineering companies, Biomedical companies, Investment companies etc.
- Google, Amazon, Facebook, Twitter, NSA, Wall Street, Biotech Firms, Intel, Microsoft and many other national and international firms.
- *Boise Metro Area*: Hundreds of software companies! HP, Micron, Clearwater Analytics, Keynetics, MarkMonitor (Reuters), MetaGeek, Balihoo, WhiteCloud Analytics, Healthwise and many more

- Keynetics, Inc
- Clearwater Analytics
- Whitecloud Analytics
- Microsoft, Boise
- FirstToFile
- Ballhoo
- PinnPointe Consulting aka Impact Sales
- 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
- Acuity Group
- AffinityAmp
- Sawtooth Ideas
- Uceem Networks
- Bodybuilding.com
- SocialGoodNetwork





- [Get directions](#)
 - [My places](#)
 - [Print](#)
 - [GO](#)
- Keynetics, Inc
- Clearwater Analytics
- Whitecloud Analytics
- Microsoft, Boise
- FirstToFile
- Balihoo
- PinnPointe Consulting
aka Impact Sales
- 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
- Acuity Group
- AffinityAmp
- Sawtooth Ideas
- Uceen Networks
- Bodybuilding.com
- SocialGoodNetwork



Computer Science@Boise State

- Nationally accredited program; commended for the depth and breadth of the coursework and projects
- The department has more than **tripled** in number of faculty and budget in the last four years. **Eleven** new faculty have been hired last 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

Acknowledgements and Sponsors

- *IDoCode: Towards a Sustainable Model of Computer Science in Idaho High Schools.* National Science Foundation Award# 1339403

