## What Does it Mean to Engineer Software?

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## What do these have in common?

• They all need a *lot* of software to operate. How much?

○ The Boeing 777 files with over 4,000,000 lines of code on-board.

 $\odot$  A typical top-level game has between 1 and 2 M SLOC (source lines of code)

• These are **huge** software systems that can not be thought of one line or class at a time. The software engineer needs to think about the design at different levels—from a line of code up to the entire system.



Software engineering design

1 SLOC/min/SE \* 60 min/hr \* 40 hrs/wk = 2,400 SLOC/wk/SE

2,400 SLOC/wk/SE \* 50 wk/year = 120,000 SLOC/year/SE

2 \* 10^6 SLOC / 1.2 \* 10^5 SLOC/yr/SE = ~17 SEs for the year





Teamwork



No! It was estimated to cost **\$2.8M** in lost revenue.

This is not safety-critical, but it is financial-critical.

This team needed a better understanding of the process for developing a critical system, and how to bring an upgrade on-line where the state of the process for the pro

Software development process

The software engineer's daily job is to answer questions about the software system.

- How can I help the customer? What is required to solve the customer's problem?
- How will the user interact with the system?
- What operating system, language, hardware is going to be used?
- What is the overall software system structure and how do different components interact with each other?
- What code do I have to write?
- How do I organize my team so we are effective?
- Can we finish the game in time to have it on the shelves for Christmas shopping?

# To answer those questions, the software engineer must interact with many people.

- Customers asking for the system
- People who will use the system
- Domain experts: banking, avionics, security, medical, scientists, ...
- Engineers from other engineering disciplines
- Most closely with the other software engineers on the project

Communication

## Yes, software engineers get their hands dirty writing programs using the latest technologies and techniques.



of Software Engineering

## The difference between computer science and software engineering is the difference between science and engineering.

- Scientists build things to learn something new.
- Engineers learn things to design and build quality products.
- Scientists want to achieve scientific breakthroughs.
- Engineers want to avoid engineering failures.
- Computer scientists want to understand the algorithms, and the foundations of computing theory.
- Software engineers want to learn the design principles and best practices for building quality software systems.

• Computer scientists want to know how the basic technology works and where to improve it.

• Software engineers want to know the characteristics of the technologies so they can design the most appropriate technology into their software systems.

## The ACM, AIS, IEEE-CS Computing Curricula 2005 Overview used diagrams to explain the range of computing disciplines.









of Software Engineering

## A software engineering program should be a balance of all of these areas in the computing realm.



You can have the title on your degree match the title on your business card and the best job to have.

INFOTECH FEATURE



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#### April 28, 2011

### Software Engineer Ranked Best Job for 2011



### **BEST JOBS IN AMERIC**

MONEY Magazine and Salary.com rate careers on sa By Tara Kalwarski, Daphne Mosher, Janet Paskin and Donna



#### Top 10 best jobs

MONEY Magazine and Salar growth, pay, stress-levels and 1. Software Engineer

Software Engineer
College professor
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#### The 10 Best Jobs of 2011





Keywords



The geeks strike back: despite enduring an industry bubble and the threat of outsourcing, Software Engineer ranks as the Best Job of 2011.

## Why Choose Software Engineering @ RIT

Our software engineering program is based on those four elements of an engineer's daily practice.

- Software engineering design
- Software development process
- Teamwork
- Communication

Learning these four skills, you will be able to deliver software products that meet the customer's needs, arrive on time, within budget, and operate without bugs.

Our students and graduates are finding jobs in a broad array of companies across many domain areas.



# RIT's software engineers earn a very competitive salary for both co-op and full-time employment.

Program	Co-op Average	Full-time Range		Full-time Median
Software Engineering	\$18.15	<b>\$42,000</b>	\$ 100,000	<mark>\$ 64,476</mark>
Computer Science	17.00	40,000	85,000	62,400
Computer Engineering	17.70	52,000	70,000	60,000
Applied Networking & Sys. Admin.	15.25	49,700	103,000	58,000
Management Information Systems	14.51	40,000	60,000	55,000
New Media Interactive Development	12.50	40,000	65,000	52,500
Information Technology	14.85	30,000	110,000	51,250
Game Design and Development	14.21	45,000	50,000	48,250

Source: RIT Office of Cooperative Education and Career Services website, July 2011

Placement rate in full-time positions or graduate school is > 90%.

# If you think we have a quality program now, it will be as good or better under semesters!

The quality of the program is in the



### ... and the students!



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# Our semester program is very similar to our current quarter program.

Content area	% of credits quarters	% of credits semesters	
Software Engineering (Req. and elective)	29%	29%	
Computer Science and Computer Engineering	10%	12%	
Engineering Electives (SE, CS, KGCOE)	6%	5%	
Application Domain	6%	7%	
Math/science	21%	20%	
General Education	22%	22%	
Free Electives	6%	5%	

## **Every student will receive an individual advising plan** based on a nominal flowchart for each cohort group.





# You don't need to worry about semester conversion because we're figuring it out for you.

### Quarter Courses in 1<sup>st</sup> Year

- Three quarters of 1<sup>st</sup> year CS ——>
- Three quarters of Calculus
- Two quarters of Discrete Math
- Personal SE
- First-year Writing
- General Education elective ——>•
- General Education Perspective --->•

### Mapped to Semester Courses

- Two semesters of 1<sup>st</sup> year CS
- Two semesters of Calculus
- Discrete Math
- Math/Science elective
- SE Freshman Seminar
- Personal SE
- First-year Writing
- First-year Seminar
- General Education Perspective

# The software engineering program culminates with a year-long senior project.



http://www.se.rit.edu/senior-project

Our academic advisors are the best people to ask for information regarding details of the curriculum.

- Can I minor in another field?
- How long does it take to graduate?
- Can I transfer AP credits?
- What is required for general education?

If you have any questions, get them answered today, next week, or next month.

- Ask our students
  - Society of Software Engineers <a href="http://sse.se.rit.edu/">http://sse.se.rit.edu/</a>
- Ask our faculty or academic advisors
- Visit our website at <u>www.se.rit.edu</u>
- Give us a call
- Get in touch via e-mail
- Join our Facebook page