Developing Software When it Matters
What Does it Mean to Engineer Software?

Jim Vallino
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What do these have in common?

- They all need a lot of software to operate.
- 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 design at different levels–from a line of code up to the entire system.
An engineer’s favorite calculation tool is the back of an envelope.

This calculation shows that one software engineer writing 1 line of code per minute for a year, can produce \(120,000\) lines per year.

2 million lines for a top-level game will take more than 17 software engineers a year to produce.
One large website. Complex.

One small software upgrade. Easy.

One 90 minute outage. Priceless?

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 without taking down the system.
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 structured 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 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
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 learn
  - Algorithms and theory
  - How the basic technologies work
  - Where technology needs to be improved

- Software engineers want to learn
  - Design principles
  - Best practices for developing software
  - Characteristics of technology to use the most appropriate for their software systems requirements

A software engineer needs a skill set that is a balance of all 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.

April 28, 2011

Software Engineer Ranked Best Job for 2011

Top 10 best jobs
MONEY Magazine and Salary.com rate careers on stock market growth, pay, stress-levels and perks.
1. Software Engineer
2. College professor
3. Financial adviser

Best Jobs in America
CNNMoney/PayScale's top 100 careers with big growth, great pay and satisfying work.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Job title</th>
<th>Median pay</th>
<th>10-year job growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Software Architect</td>
<td>$124,000</td>
<td>23%</td>
</tr>
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</table>

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Why Choose Software Engineering @ RIT
Today, you will see the multiple aspects that contribute to the quality of RIT’s software engineering program.

The quality of our program is in our

Staff & Advisors

Faculty

… and Students!
Our students and graduates are finding jobs in a broad array of companies across many domain areas.
RIT’s software engineers earn great salaries for both co-op and full-time employment.

<table>
<thead>
<tr>
<th>Program</th>
<th>Co-op Average</th>
<th>Full-time Range</th>
<th>Full-time Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Engineering</td>
<td>$21.03</td>
<td>$55,000</td>
<td>$75,000</td>
</tr>
<tr>
<td>Computer Science</td>
<td>21.65</td>
<td>40,000</td>
<td>72,000</td>
</tr>
<tr>
<td>Management Information Systems</td>
<td>16.98</td>
<td>30,000</td>
<td>67,000</td>
</tr>
<tr>
<td>New Media Interactive Development</td>
<td>17.50</td>
<td>40,000</td>
<td>64,300</td>
</tr>
<tr>
<td>Computing Security</td>
<td>21.03</td>
<td>42,000</td>
<td>64,250</td>
</tr>
<tr>
<td>Computer Engineering</td>
<td>20.71</td>
<td>50,000</td>
<td>63,000</td>
</tr>
<tr>
<td>Networking &amp; Systems Admin.</td>
<td>17.20</td>
<td>38,000</td>
<td>63,000</td>
</tr>
<tr>
<td>Information Technology</td>
<td>16.47</td>
<td>24,000</td>
<td>60,000</td>
</tr>
<tr>
<td>Game Design and Development</td>
<td>17.05</td>
<td>33,600</td>
<td>57,500</td>
</tr>
</tbody>
</table>

Source: RIT Office of Cooperative Education and Career Services website, Spring 2016 (partials)

Placement rate in full-time positions or graduate school is > 90%.
Our program is based on the four elements of a software engineer’s daily practice discussed earlier.

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

By 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.
We have a curriculum designed from the ground up as a software engineering program.

<table>
<thead>
<tr>
<th>Content area</th>
<th>#credits/%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software Engineering</td>
<td>37/30%</td>
</tr>
<tr>
<td>CS and Comp. Eng.</td>
<td>15/12%</td>
</tr>
<tr>
<td>Eng. Electives</td>
<td>9/7%</td>
</tr>
<tr>
<td>Math/science</td>
<td>28/22%</td>
</tr>
<tr>
<td>General Education</td>
<td>27/22%</td>
</tr>
<tr>
<td>Free Electives</td>
<td>9/7%</td>
</tr>
</tbody>
</table>

Key:
- Red: Software Engineering Courses
- Blue: Computer Science Courses
- Green: Computer Engineering Courses
- Orange: Engineering Electives
- Yellow: Professional Elective
- Purple: Math and Science Courses
- Black: General Education
- Green: Free Electives

This is a recommended course sequence. Individual schedules may vary. You are responsible for verifying course offerings and prerequisites. Please seek the guidance of your academic advisor as necessary. For additional information refer to the department's website (www.se.rit.edu).

You are encouraged to meet with your advisor at least once per term. Your advisor can guide your course planning, and help solve scheduling problems.

General Education Framework
This curriculum satisfies RIT's General Education Framework requirements. See the RIT website for more details.

Wellness Education Requirement
Complete two different wellness activity courses.

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

Senior Project Sponsors
(previous examples)

Datto
Harris RF Communications
Lockheed Martin
MITRE Corporation
RIT COLA English
RIT COS School of Chemistry and Material Sciences
RIT ITS
RIT ITS & Office of Co-op and Career Services
RIT weather.rit.edu
Spectracom
Trillium Health
Two Sigma Investments, LLC
US Department of Veterans Affairs
Wegmans Food Markets Inc.

http://www.se.rit.edu/senior-project
We have a combined undergraduate and graduate program.

- Get a BS and MS in software engineering in six years
  - 4 years undergraduate
  - 1 year of co-op
  - 1 year of graduate work
When choosing a career, you need to consider three elements.

- **Market**
  - $45K - $70K - $100K

- **Skill**
  - SE is the 'go to' group when we want talented students to make a software platform sing and dance.
  - Dr. Jeremy Haefner, RIT Provost

- **Passion**
  - Do you have a passion to develop quality software that
    - Helps people live
    - Makes people more productive at work and at home
    - Provides entertainment to people
    - Keeps people connected to family and friends

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

- **Ask our students**
  - Society of Software Engineers [http://sse.se.rit.edu/](http://sse.se.rit.edu/)
  - What is the student experience?

- **Ask our faculty**

- **Visit our website at** [www.se.rit.edu](http://www.se.rit.edu)

- **Give us a call** – 585-475-5461

- **Get in touch via e-mail or join our Facebook page**

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  - [http://twitter.com/RITGolisanoCCIS](http://twitter.com/RITGolisanoCCIS)