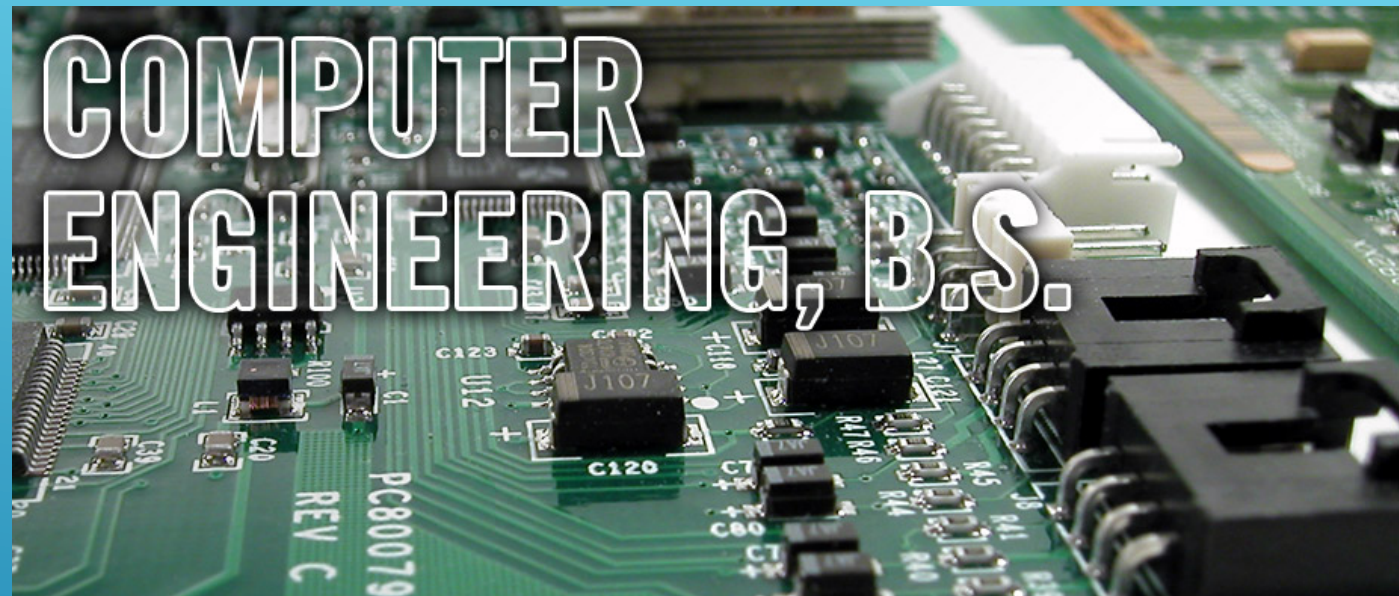


COMPUTER ENGINEERING PROGRAM

DR. YAN LINDSAY SUN

Department of Electrical, Computer
and Biomedical Engineering

**Computer
Engineering
Program**



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Computer and
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Engineering

<https://www.youtube.com/watch?v=BIOONzSike0>

- ▶ You are probably aware that an amazing computer revolution has rapidly changed the way much of the world works.
- ▶ Developments in radio, television, radar, transistors, computers, robotics, and Internet have fundamentally altered human life.

Computer Engineering Program

Then...

“When smartphones and tablets

*light up the sky,
load up the clouds.”*

Now...

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Engineering

Source - <http://www.alternet.org/speakeasy/alyssa-figueroa/recording-memories-why-must-we-capture-our-every-moment>



Era of Internet and Cloud

What Happens in an Internet Minute?



And Future Growth is Staggering



Computer Engineering Program

The field of **Computer Engineering** is at the epicenter of this development.

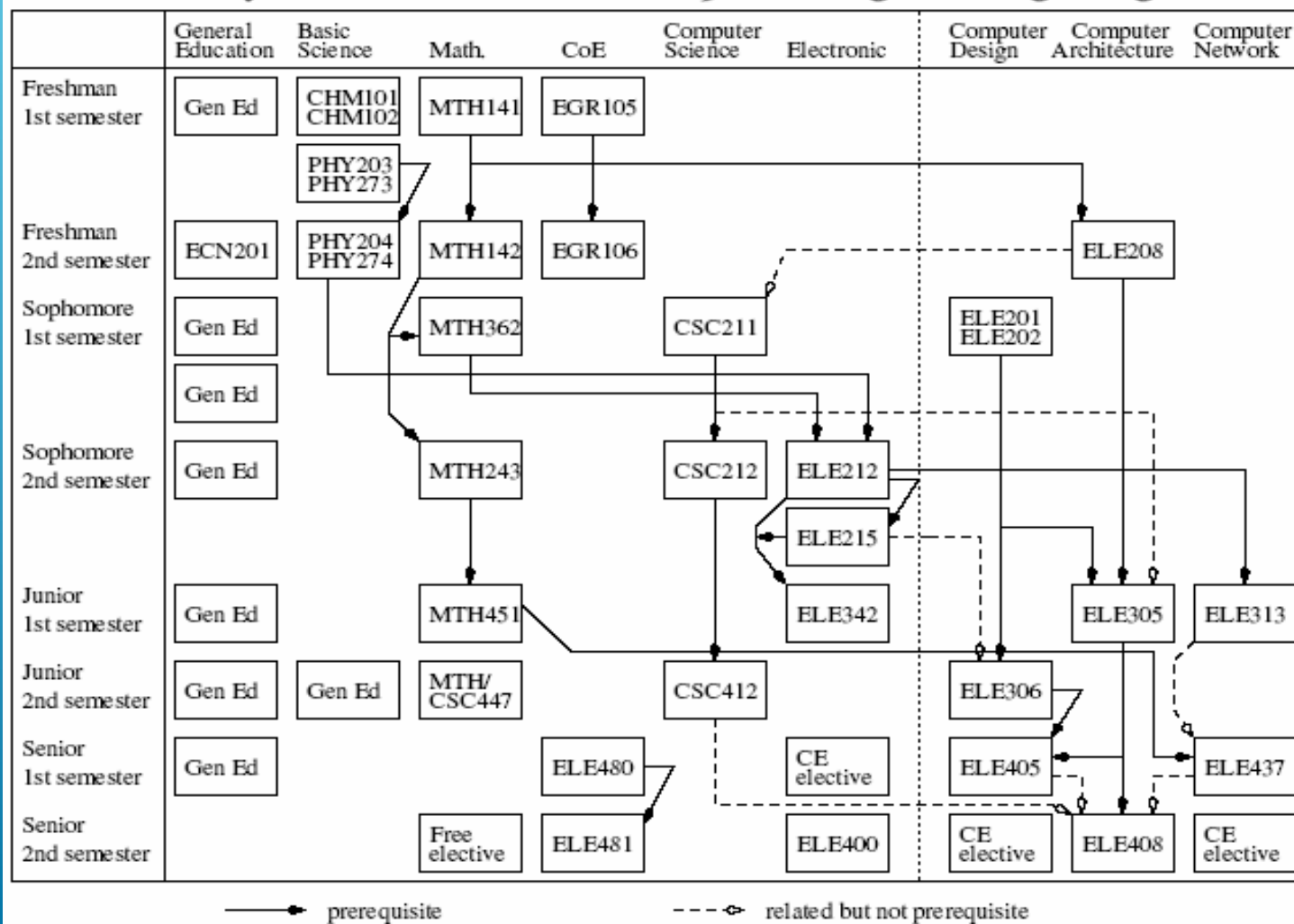
CE is a discipline that **integrates** several fields of electrical engineering and computer science.

CE majors usually have training in **electronic engineering, software design and hardware-software integration**. (instead of only software engineering or electronic engineering).

Computer Engineering Program

CE CURRICULUM

University of Rhode Island Computer Engineering Program



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IT IS A MAJOR IN DEMAND.

Software engineering companies,

Telecommunications firms

Designers of digital hardware

Network companies

Security, Digital forensics firms ...

- ▶ Many other business enterprises hire Computer Engineering majors right out of college and pay them well.
- ▶ Computer Engineering also makes great preparation for medical school, business school, and law school (particularly if you want to specialize in patent law).

OVERVIEW

All about designing and building computers, computing, and communication systems

- ▶ Silicon chip design
- ▶ Combining chips into systems
- ▶ Combining systems into networks
- ▶ Helping systems recover from failure
- ▶ Software design to help computers run faster and more efficiently
- ▶ Security mechanisms to protect the systems/networks/applications against malicious attacks.

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SNAPSHOT 1 - INTEGRATED CIRCUIT DESIGN



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SNAPSHOT 2 – ARCHITECTURE

► <https://www.youtube.com/watch?v=fy-BcAU1W9Y>

The screenshot shows a web browser window displaying the University of Rhode Island College of Engineering website. The browser's address bar shows the URL `egr.uri.edu/velobit/`. The website has a yellow navigation bar with links: ABOUT URI, ADMISSION, ACADEMICS, CAMPUS LIFE, ATHLETICS, RESEARCH & OUTREACH, and SUPPORT URI. Below this is a dark blue header with the University of Rhode Island logo, a search bar, and links for Webmail, eCampus, and Sakai. The main content area features a large video player titled "FROM INNOVATION TO SUCCESSFUL COMPANY" with a play button icon. To the left of the video is a sidebar with navigation links under "Prospective Students", "Academics", and "The College". Below the video player, there is a section titled "Primary Storage" and "Cache" with a diagram showing a database cylinder and a play button icon. The article text describes the VeloBit startup, its founder Professor Qing Yang, and its success in securing grants and starting a company. The website footer includes a Windows taskbar with various application icons and a system clock showing 10:17 AM on 9/21/2015.

ABOUT URI | ADMISSION | ACADEMICS | CAMPUS LIFE | ATHLETICS | RESEARCH & OUTREACH | SUPPORT URI

THE UNIVERSITY OF RHODE ISLAND

Search The University of Rhode Island

Webmail | eCampus | Sakai

COLLEGE OF ENGINEERING

102 Bliss Hall, Kingston, RI 02881 USA
- 401.874.5985

URI Homepage

Prospective Students

- Why We're Unique
- Visit Us!

Academics

- Undergraduate Programs
- Graduate Programs
- International Engineering Program

The College

- About the College
- People
- Departments
- Diversity
- Research
- Facilities
- Giving
- For Students, Faculty & Staff

Engineering Webmail

FROM INNOVATION TO SUCCESSFUL COMPANY

Qing "Ken" Yang is a serial entrepreneur, having started four companies in the last 15 years. The University of Rhode Island computer engineering professor has a winning formula: secure grants, conduct research at the school, start company, hire employees, repeat.

"It's a positive loop," Yang says.

His latest startup, VeloBit, Inc., has attracted more than \$5 million in venture capital, employs 15 and counts more than 500 customers around the globe. In July 2013, it was acquired by computer hardware giant Western Digital.

The firm sells patented software based on a new algorithm developed by Yang to speed up servers that process data such as customer information, financial records, inventory and other data that keeps Corporate America humming.

VeloBit's software squeezes more speed from solid-state "flash" disk drives that are becoming standard in servers. The software - installed in under a minute - identifies frequently accessed files and places them in cache closer to the central processor. The software saves companies money by minimizing the need to buy pricey new hardware.

The roots of VeloBit - a play on "velocity" and "bit" or "fast information" - reach to 2010 when Yang met former venture capitalist Duncan McCallum, who would become the startup's co-founder and CEO.

McCallum, an even-keeled executive with a Harvard MBA, says Yang demonstrated the essential ability to articulate his research, prove its mettle and sell it.

"I took the red pill and committed to VeloBit when Qing in his lab proved he could build his solution in an all-software package," McCallum says. "There would not be a company without Qing Yang."

Yang spent nearly three years developing algorithms to speed up solid-state hard drives. To refine the work, Yang relied on computer facilities at the University of Rhode Island, a grant from the National Science Foundation and a team of graduate students poring over lines of computer code. (One graduate student, Jin

University of Rhode Island Engineering Innovation

Primary Storage

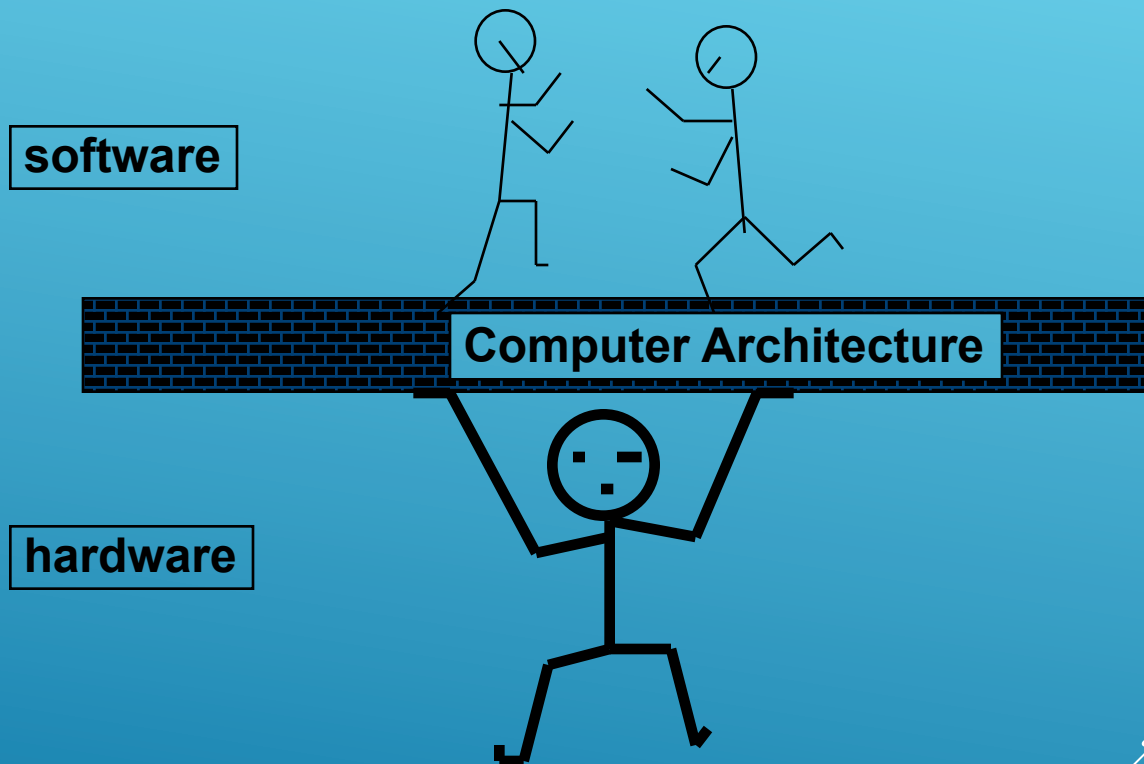
Cache

Professor Qing Yang

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COMPUTER ARCHITECTURE: A CRITICAL INTERFACE



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SNAPSHOT 3 – ROBOTICS

<https://www.youtube.com/watch?v=7c1MSgvoqr4>

The screenshot shows a web browser window displaying the University of Rhode Island website. The browser's address bar shows the URL ww2.uri.edu/big-stories/race-on-the-world-track. The website's navigation bar includes links for ABOUT URI, ADMISSION, ACADEMICS, CAMPUS LIFE, ATHLETICS, RESEARCH & OUTREACH, and GLOBAL. Below the navigation bar is a search bar and a section titled "THE BIG STORY" with a sub-link "See other big stories...". The main content area features a sidebar on the left with links such as "Experience Cuba. Now.", "Honors Colloquium 2015", "Behold the bug.", "Warm welcome.", "Grow for the Greater Good.", "Summer like a Scientist.", "Oversee our oceans.", "Jazz it up.", and "View all big stories". The main article is titled "RACE ON THE WORLD TRACK." and features a photo of three students holding a small robot car. The article text describes the students' achievement in building an autonomous model race car that won first place in a national competition and is representing the United States at the world championships. It mentions the annual Freescale Cup in Rochester, N.Y. in April, where the car completed a 100-foot track in 17.7 seconds. The article also includes a quote from Professor Qing Yang: "This is a good opportunity to inspire students to do real design. The best way to learn is by doing." and mentions that the students programmed a 32-bit microprocessor to interface with a camera, motor, battery, wheels and sensors.

Experience Cuba. Now.
Honors Colloquium 2015
Behold the bug.
Warm welcome.
Grow for the Greater Good.
Summer like a Scientist.
Oversee our oceans.
Jazz it up.
View all big stories

Admissions/Request Information
URI Alumni Association
Give Online

RACE ON THE WORLD TRACK.



A car with a mind of its own may sound like science fiction, but at URI, computer engineering students are proving that it's already a reality. And they'll soon be proving it to the world. Three URI students designed and built an autonomous model race car that took first place in a national competition, and they're representing the United States this summer at the world championships.

Competing at the annual **Freescale Cup** in Rochester, N.Y. in April, the foot-tall car relied on a camera and software programmed by the students to zip along a curvy and hilly racetrack without human intervention. It completed the course in 17.7 seconds, faster than 27 other teams. The URI students now head to South Korea in August to compete against 19 teams from around the globe.

"It was amazing," said team member **Geoffrey Mcelroy '14**. "It's one of those once-in-a-lifetime opportunities."

Geoff and teammates **Cory Jalbert '14** and **David Cipoletta '14** were classmates in a senior computer engineering course. **Professor Qing Yang** offered his students a choice for grading: take a series of traditional exams or design a robotic car and take one exam. Six students opted for the latter, fielding two teams that competed in Rochester. "This is a good opportunity to inspire students to do real design," Professor Yang said. "The best way to learn is by doing."

The students programmed a 32-bit microprocessor to interface with a camera, motor, battery, wheels and sensors. They added intelligence by creating algorithms that learned from previous mistakes and kept the car on the 100-foot track.

"This is a good opportunity to inspire students to do real design. The best way to learn is by doing. ~Professor Qing Yang"

EN 9:59 AM 9/21/2015

SNAPSHOT 4 – COMPUTER NETWORKS

Samples of student projects

- Remote Camera
- Whiteboard Sharing Application
- Real Time Streaming Video
- Active Flood Response Firewall
- Chat Application which uses Blue Tooth Technology
- Wireless Temperature Sensor Using ZigBee

SNAPSHOT 5- INFORMATION & NETWORK SECURITY

Samples of Project Topics

- ▶ Security mechanisms at EBay
- ▶ On-line shopping security
- ▶ Video scrambling in Cable TV
- ▶ Jamming and anti-Jamming techniques for wireless networks
- ▶ Digital rights management solutions
- ▶ Virus, worm and spyware

Computer Engineering Program

SNAPSHOT 6 - CYBER SECURITY

The screenshot shows a web browser window with the URL web.uri.edu/hc/archives/2014hc/. The page features a yellow navigation bar with links to ACADEMICS, CAMPUS LIFE, ATHLETICS, RESEARCH & OUTREACH, and GLOBAL. Below the navigation bar is a search bar and a header for the URI HONORS COLLOQUIUM, sponsored by the University of Rhode Island Honors Program.

The main content area is titled "2014 HONORS COLLOQUIUM JAMES BAMFORD CYBERSECURITY". It includes a large image of James Bamford, a man with a mustache, in front of a bookshelf. To the right of the image is a yellow diamond-shaped warning sign with a computer monitor icon and the text "CYBERSECURITY & PRIVACY".

Below the image and sign, the text reads:

FALL 2014 HONORS COLLOQUIUM
Tuesday Evenings, 7:30 p.m.
September – December 2014
Edwards Auditorium, URI Kingston Campus

Our dependence on modern technology is not without its downsides. Cyber threats pose serious economic and national security challenges. Moreover, corporations and government agencies track our online activities, purchases, and even our location.

Join us! The public is invited to attend this series of free events in person or online.

Free iPad Mini to be raffled each week in Edwards Auditorium. Must be present at the drawing to win.

UPCOMING EVENT

Below the "UPCOMING EVENT" heading is a small portrait of a man with a beard and glasses.

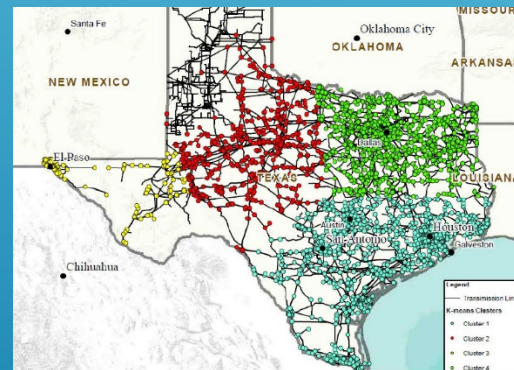
At the bottom of the page, there is a yellow diamond-shaped warning sign with a computer monitor icon and the text "THINK BIG WE DO".

WORKING WITH OTHER ENGINEERS

- ▶ Building neural controlled artificial leg

https://youtu.be/CKyvBUvI_B0

- ▶ Securing US Power Grid



CASE STUDY II

- ▶ Securing online reputation systems

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SO WHAT'S IN IT FOR ME?



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A Computer Controlled Car Using
Wireless Remote: It works!

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DESIGNING NETWORK ROUTERS AND BRIDGES



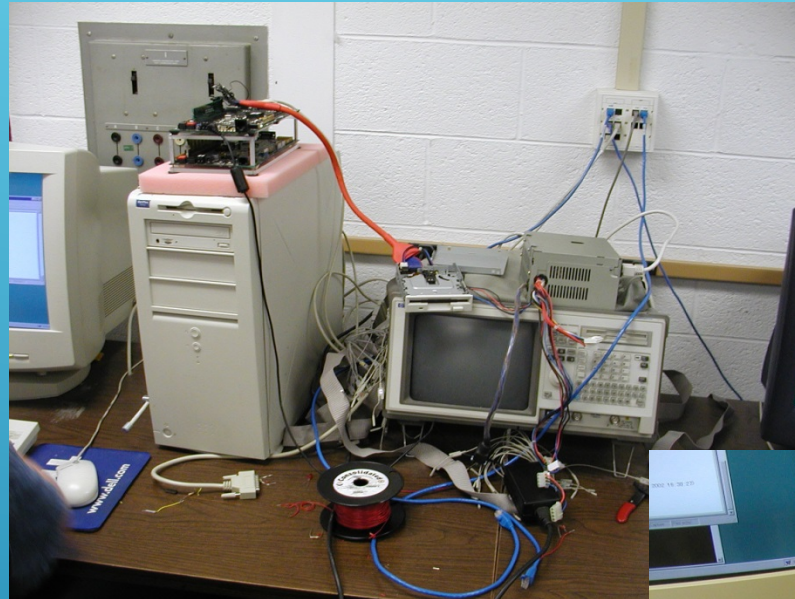
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IMPLEMENTING DISK CONTROLLER AND NETWORK INTERFACE



JOB OPPORTUNITIES

- ▶ Our graduates have the necessary background and technical skills to work professionally in one or more of the following areas:
 - ▶ Computer hardware and software design
 - ▶ Computer-based systems
 - ▶ Computer network design
 - ▶ System integration
 - ▶ Electronic design automation

DOWN THE ROAD.....

The following materials are borrowed from Dr. Bruce Jacob's talk "career path in computer engineering".

The Scene

OPEN CURTAIN: *Engineer* -- talented, motivated, hard-working, comfortable with the college thing, is accosted by *Parents, D and M*

D: Hey — we know it's only Junior Year, but have you got the rest of your life planned out yet?

M: By the way, we're very proud of the grades and all, but — again — about your life ...

Engineer: Aaaaaaaaaaaaaaaaaaaaaaaaaaagh!

Careers in Engineering

YOUR OPTIONS:

College => **Industry**

=> Grad School => **Industry**
 => **Research**
 => **Academics**