Welcome CAP Executive Board

Oct 2, 2008
CAP 2008 - 2009 Leadership

CAP Chairman:  
Rich Goldberg  
VP, Corporate Quality, Cisco

CAP Vice Chairman:  
Danny Brown  
VP, Technology Development, Cymer
Thanks to Dave Esbeck for the Spirit of Solar cruise Monday, September 8
Welcome Distinguished Students

Jacobs School Scholars and Fellows

**TESC President** Sara Richardson, BioEng ‘10

**DECaF Chairman** Katherine Lee, BioEng ‘10

**NSBE President** Chisolm Egbuonye, MAE ‘09

**2008 Summer Intern Program (TIP) representative**
Stephan Kemper, CSE ‘10
Distinguished Student

Jacobs School of Engineering
TESC President
Sara Richardson
Bioengineering ‘10
TESC strives to:

– Enrich the collegiate experience through engagement in the local community, Jacobs School traditions and culture, and engineering organizations

– Advance the reputation of the Jacobs School and promote academic integrity, excellence, and ingenuity

– Provide students with opportunities to improve their leadership skills, develop professionally, and interact with faculty, staff, alumni, and industry
TESC Events

• Dinner with the Deans (quarterly) November 20, 2008
• National Engineers Week: February 15-21, 2009
  – Tuesday: E-Games
  – Wednesday: Enspire – Introducing Engineering Futures to our Youth
  – Thursday: Research Expo / EUReKA
  – Friday: DECaF, Mixer, and Impulse
• Junkyard Derby: May 2009
Engage with Students

• Dinner with the Deans
  – Interact with student leaders and faculty from the Jacobs School and learn about student orgs

• Enspire
  – Sponsor TESC’s largest outreach event to help bring 400 middle school students to UCSD

• Junkyard Derby
  – Support engineering innovation and tradition

Sara Richardson,
serichardson@ucsd.edu
TESC President, tesc.ucsd.edu
Distinguished Student

Jacobs School of Engineering
DECaF Chairman
Katherine Lee
Bioengineering ‘10
Friday, February 20, 2009
9:30 am – 2:00 pm
UCSD Price Center Ballrooms

Registration is Open!
http://tesc.ucsd.edu/decaf

Katherine Lee, DECaF Chair, BioEng ‘10
Emily Almaraz, DECaF Business Relations, Mech Eng ‘10
Eunice Choi, DECaF Logistics Lead, Mech Eng ‘10
About DECaF

- Largest Student-Run Career Fair
  - Organized by TESC in conjunction with 18 engineering student organizations
- All proceeds fund engineering student organization projects and activities
- DECaF 2008
  - 90 Attending Companies
  - 1,500 Student Attendees
  - Recruiter/Volunteer Mixer
  - Industry Led Professional Workshops
DECaF 2009

● What’s New
  ● New DECaF Logo!
  ● Addition of New Price Center Ballroom to DECaF Event Space
  ● New Joint Sponsorship Packages with Research EXPO

● 2009 Sponsorship Packages
  ● DECaF Corporate/EXPO Luncheon Sponsorship - $15,000 New!
  ● DECaF/EXPO Joint Corporate Sponsorship - $7,500 New!
  ● DECaF Corporate Sponsorship - $2,500
  ● Standard Sponsorship - $700 before Oct. 31, $750 after Nov. 1
DECaF and CAP

- CAP Café
- CAP Resume Database
- 24 CAP Companies Attended DECaF 2008
- Corporate Sponsors
Distinguished Student

Jacobs School of Engineering
NSBE President
Chisom Egbuonye
Mechanical and Aerospace Engineering ‘09
NSBE UCSD

Mission is to increase the number of culturally responsible Black engineers who excel academically, succeed professionally and positively impact the community.

www.nsbe.ucsd.edu
Goals for 2008-2009

- Increase membership
- Collaborate with other organizations and companies
- Community service
- Night of Industry
- Corporate Guests
- National Convention
Night of Industry (NOI)

About NOI
- Career fair to recruit qualified students
- Student research/internship presentations
- Business casual environment to promote dialogue

Sponsorship
- To register your company contact Chisom Egbruonye @ 858-337-1084 or Cegbruony@ucsd.edu
- Registration deadline: Friday, October 17th
- More Information available on www.nsbe.ucsd.edu

Wednesday, November 19, 2008
5 - 8PM
Price Center Ballrooms AB
Distinguished Student

Jacobs School of Engineering
Stephan Kemper
Computer Science Engineering ’10
Summer 2008 TIP Experience
ViaSat Knowledge Database

UCSD Team Internship Project
Joshua Cerny, Virginia Tech
Greg Hart, UCLA
Stephan Kemper, UCSD
Project Description

• Data spread out all over corporate network
• Locating relevant project information difficult
  – Constantly growing infrastructure
  – Data in shares, CMS, wiki, SharePoint, etc.
• Surveys showed large amounts of wasted time

• Not an intern coding project
• Initial timeline was optimistic
The Solution

• Research search vendors
• Meet with representatives
• Run Proof of Concepts
• Gather employee feedback
  – Latest stage: beta testing, Aug 28 - 29
• Retrain software, repeat
• Pick a vendor, and install!
Benefits for ViaSat

• Engineers who are excited to be there
• Fresh, innovative talent
• Less supervision required
• Bigger projects possible
• Cost Efficient Labor
Benefits for Students

- Engineering is done in teams
- Experience the classroom can’t give
- Corporate work in your field
- Business and engineering sides of a project
- Paying summer job!
Welcome CAP Member

BD Biosciences

Bob Balderas, VP of R&D
Dean’s Report:

Jacobs School of Engineering
Dean Frieder Seible
Jacobs School of Engineering Dean Takes Flight
UC San Diego Moves Up to 6th in Federal Research Funding

• Almost $800 million for R&D

• UC San Diego moved to 6th place up from the 2007 ranking of 7th

* National Science Foundation
2008 New Faculty Hires

Yuri Bazilevs, SE  
Adam Engler, BE  
Ingolf Krueger, CSE

Jennifer Cha, NE  
Lelli van den Einde, SE  
Joe Wang, NE  
Liangfang Zhang, NE

Zhaowei Liu, ECE
Source: UCSD third week enrollment tables FA02-FA07 and FA08 accepts as of 9/29/08.
New Center and Research Initiative

December 12, 2008, Friday
Institute of Engineering in Medicine
Inaugural Ceremony
and Reception
3:00 p.m.

Synergize unique strengths and integrate engineering principles and novel technologies at UC San Diego with biomedical and translational research.

Shu Chien, M.D., Ph.D., is a professor of bioengineering and medicine, and founding director of the Institute of Engineering in Medicine at UC San Diego.
Structural and Materials Engineering Building (EBU IV)

- **Groundbreaking:** Oct 24, 2008
- **Building Open:** 2010
- **110,000 a.s.f.**
- **Structural Engineering, NanoEngineering, Visual Arts**
- **Architect:** Miller|Hull Partnership, LLP and Safdie Rabines Architects
SDSC New Building Dedication

Friday, October 14, 2008
San Diego Supercomputer Center
UC San Diego

80,000 square-foot addition

Agenda

7:00 – 7:30 AM Continental Breakfast / Networking

7:30 – 8:45 AM Program Begins

9:00 – 9:30 AM Tour of New Building & Data Center

*Formal dedication ceremony, starts at 10:45 AM.*

RSVP to: industrybreakfast@sdsc.edu

access the talent and technology...
Craig Mundie
Chief Research & Strategy Officer

Come meet Bill Gates’ successor!

Friday 10.10.08

11:15

Shaping the Future with Technology

Ballroom East

Price Center

Microsoft

UCSD Jacobs School of Engineering
This Year’s TIP Sponsors: 2008 Global Footprint

access the talent and technology...
Team Internship Program: International Team Projects 2008

HILTI
Liechtenstein and Germany

- Project #1: Create a more intuitive User Interface for HILTI's Anchor Design Software and test with clients
- Project #2: Define a design concept for an electrical plug system feasible for handheld electrical equipment in underground mining applications

ResMed
Australia

- Optimize a nocturnal blood pressure monitoring device to monitor effects of blood pressure on sleep-disordered breathing

Qualcomm Incorporated
Israel

- Project #1: Enhance Universal Broadcast (Mobile TV) Module Performance Tools
- Project #2: Study and enhance various data streams over USB and SD/SDIO interfaces of the mobile phone / cellular modem
- Project #3: Re-architecture of Data Networking API for the Qualcomm Component Model

Project #1: Identify new product lines for Zeiss in the Personal Health market
- Project #2: Evaluate market opportunities for Zeiss in the Nanoparticles market

Zeiss
Germany

Team Internship Program: access the talent and technology...
COSMOS

- Pipeline to STEM
- 150 HS Students, 4-week residential summer school
- Inquiry-based, hands-on experience
- Summer internships at Cisco and Qualcomm and scholarships for COSMOS alumni

“COSMOS was awesome. I loved being able to learn more about science with students who shared a common interest.”

“COSMOS was a life-altering experience. I learned so much and created so many memories.”
How Will US Elections Change US-China Cooperation?

• UC San Diego, in partnership with Tsinghua University, will host a symposium focused on how the US Elections will change the agenda for US-China cooperation.
• Monday, November 10, 2008 in Beijing at the School of Management at Tsinghua University.
• Speakers include:
  • Peter Cowhey, Dean, Graduate School of International Relations and Pacific Studies, UCSD
  • Frieder Seible, Dean, Jacobs School of Engineering, UCSD
  • Jim Fallows, prominent American journalist
  • Leaders from Tsinghua University

http://www.jacobsschool.ucsd.edu/events/china-symposium/
Faculty Presentation

James Buckwalter, Ph.D.
Assistant Professor,
Department of Electrical & Computer Engineering
The I/O Revolution and Prospects of Traveling Wave Integrated Circuits

James Buckwalter
Assistant Professor
Department of Electrical and Computer Engineering
University of California- San Diego
La Jolla, CA 92093
Broadband Communication: Wrapped Up in Knots?

1900s: Telephone Line

1950s: Computer

1990s: Telephone Line

2000s: Server

2008: Microprocessor
Electrical Interconnects

The societal impact:

- High-speed serial I/O is a power hog.
  - 65nm multicore processor: 30W for on-chip/off-chip interconnects.
  - 32bit memory bus operating at 6.4Gb/s (PCI) burns roughly 4W.
  - 200M computers + 20M servers = 880MW/yr.
  - Energy costs $44,000/hr or $385M/yr.
  - Data centers in the US expect to require 25 power plants by 2011; More greenhouse gases than jet travel by 2020.

- Real dollars, real pollution.
- Fractional improvements can save millions.
Reach

Where are broadband communication links important?

<table>
<thead>
<tr>
<th>Distance</th>
<th>Applications</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1cm</td>
<td>Chip/module scale</td>
<td>Undefined</td>
</tr>
<tr>
<td>&lt;10cm</td>
<td>Chip-to-chip</td>
<td>RapidIO, PCIexpress</td>
</tr>
<tr>
<td>&lt;10m-100m</td>
<td>Card-to-card, SAN</td>
<td>Infiniband, GbE, FibreChannel,</td>
</tr>
<tr>
<td>~1km</td>
<td>Last mile, LAN</td>
<td>GbE</td>
</tr>
</tbody>
</table>

Multicore Processor  
Memory Card  
Blade card  
Server
## Rate Demands

<table>
<thead>
<tr>
<th>Distance</th>
<th>Parallel Links</th>
<th>Serial Rate</th>
<th>Aggregate Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1cm (Multicore)</td>
<td>64</td>
<td>4Gb/s</td>
<td>256Gb/s</td>
</tr>
<tr>
<td>&lt;10cm (XDR2)</td>
<td>32</td>
<td>12.4Gb/s</td>
<td>409Gb/s</td>
</tr>
<tr>
<td>&lt;10m-100m (GbE)</td>
<td>1</td>
<td>10Gb/s</td>
<td>10Gb/s</td>
</tr>
<tr>
<td>~1km</td>
<td>1</td>
<td>1-40Gb/s</td>
<td>1-40Gb/s</td>
</tr>
</tbody>
</table>

At every level of physical scale, higher capacities are being demanded.

<table>
<thead>
<tr>
<th>Distance</th>
<th>Aggregate Rate</th>
<th>Power</th>
<th>Energy/bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1cm (multicore)</td>
<td>256Gb/s</td>
<td>30W</td>
<td>1.46pJ</td>
</tr>
<tr>
<td>&lt;10cm (XDR2)</td>
<td>409Gb/s</td>
<td>17W</td>
<td>41pJ</td>
</tr>
<tr>
<td>&lt;10m-100m (GbE)</td>
<td>10Gb/s</td>
<td>6W</td>
<td>600pJ</td>
</tr>
<tr>
<td>~1km</td>
<td>1-40Gb/s</td>
<td>???</td>
<td>&gt; 1000pJ</td>
</tr>
</tbody>
</table>

Power is basically fixed at each scale, energy efficiency is closely tracking distance.

Sources: Intel/Rambus XDR2/SolarFlare
Trend Summary

- Energy efficiency is required.
- Higher speeds are required.
- Power consumption cannot change.

What are the options?
- Replace electrical interconnects? Optics/Wireless
- Can we do better with current approaches?
An Historic Convergence

**Economics:**
Costs of Hardware, Installation, Operation.

**Physics:**
Channels, Propagation

**Communication Theory:**
Coding, Signal Processing

**Devices/Circuits:**
Silicon/III-V, RF/Analog/Mixed Signal
**Broadband Optics**

**Source:** IBM

<table>
<thead>
<tr>
<th>MAN/WAN</th>
<th>Cables–long</th>
<th>Cables–short</th>
<th>Card-to-card</th>
<th>Intra-card</th>
<th>Intra-module</th>
<th>Intra-chip</th>
</tr>
</thead>
<tbody>
<tr>
<td>![Image](36x36 to 576x756)</td>
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<td>![Image](36x36 to 576x756)</td>
</tr>
</tbody>
</table>

- **Length:**
  - Multi-km
  - 10–300 m
  - 1–10 m
  - 0.3–1 m
  - 0.1–0.3 m
  - 5–100 mm
  - 0–20 mm

- **No. of lines per link:**
  - One
  - One to tens
  - One to hundreds
  - One to hundreds
  - One to hundreds
  - One to hundreds

- **No. of lines per system:**
  - Tens
  - Tens to thousands
  - Tens to thousands
  - Tens to thousands
  - Thousands
  - Approximately ten thousand
  - Hundreds of thousands

- **Standards:**
  - Internet Protocol, SONET, ATM
  - LAN/SAN (Ethernet, InfiniBand, Fibre Channel)
  - Design-specific, LAN/SAN (Ethernet, InfiniBand)
  - Design-specific and standards (PCI, backplane InfiniBand and Ethernet)
  - Design-specific, generally
  - Design-specific
  - Design-specific

- **Use of optics:**
  - Since the 1980s
  - Since the 1990s
  - Present time, or very soon
  - 2005–2010 with effort
  - 2010–2015
  - Probably after 2015
  - Later

- Optics is well established for >100m distances.
- Expensive (>200 per 10Gb/s module), Silicon Photonics?
- Extremely promising at chip scales.
Broadband Wireless

- Allocated bands
  - 57-64GHz
  - 71-76 GHz
  - 81-86 GHz
  - 92-95 GHz

- 60GHz for short range video links.

- 80GHz for last mile links.

- Other applications?
  - High-speed I/O
    - Low power
    - Highly directive

<table>
<thead>
<tr>
<th>Band</th>
<th>Technology</th>
<th>Energy</th>
</tr>
</thead>
<tbody>
<tr>
<td>60GHz</td>
<td>SiBeam (4Gb/s)</td>
<td>500pJ/b</td>
</tr>
<tr>
<td>60GHz</td>
<td>Panasonic (OOK,1Gb/S)</td>
<td>30pJ/b</td>
</tr>
<tr>
<td>3-10GHz</td>
<td>UWB (480Mb/s)</td>
<td>200pJ/b</td>
</tr>
</tbody>
</table>
Broadband Circuits Research @ UCSD

- Energy efficient mixed-signal circuits
  - Optimal Coding/Signal Processing for
    - Channel (Bandwidth-limited)
    - Deep-submicron CMOS (Dynamic Range-limited)
- Broadband (10-40Gb/s) traveling wave circuits for optical and electrical links
  - High-bandwidth / Multiband
  - Impedance matching/ Low noise
  - Getting the most out of modern silicon devices.
High-Speed Silicon Devices

- Fast Devices >200GHz
  - 65nm CMOS
    - $f_T = 220\text{GHz}$
    - $V_{ds} = 1\text{V}$
  - 120nm SiGe BiCMOS
    - $f_T = 210\text{GHz}$
    - $V_{ce} = 2.5\text{V}$

Amplifiers

W-band wideband amplifiers for silicon transceivers
Classic Amplifier Topologies

- **Cascaded Amplifiers**
  - Lumped Element Circuit
  - Gain [dB] \( \sim N \)
  - Bandwidth falls off with N!

\[
BW = f_T \frac{\sqrt{2^{1/N} - 1}}{\sqrt[4]{A_v}}
\]

- **Distributed Amplifiers**
  - Traveling Wave Circuit
  - Gain [dB] \( \sim \log N \)
  - Bandwidth \( \sim \) constant
    (fixed at Bragg Frequency)
Our goal: How do we get the most gain-bandwidth out of modern silicon devices?

- Distribute device capacitances along gate and drain into a transmission line.
- Traveling waves along input and output.

Overall Gain

Voltage Gain:
\[ A_v = \sum A_{v,\text{stage}} = N \frac{g_m Z_{o,d}}{2} \]

Gain Bandwidth:
\[ GBW = \frac{A_v}{2\pi\sqrt{LC}} \propto N f_T \]
A 100GHz Cascaded Constructive Wave Amplifier

- Millimeter-wave Wideband Amplifier
- 120nm Silicon Germanium BiCMOS
- Chip area: 330μm by 1mm = 0.330 mm²

100GHz Measurement

- Agilent E8361 with N5260A (10MHz – 110GHz)
- Cascade ACP-110-LW 100um Probes
- Calibration (On-wafer and CS-5)
**S-parameter Measurements**

- **S21**: 26dB @ 99GHz
- **BW**: 14GHz
- **S12**: -24dB @ 99GHz
- **Input Return Loss**: <-15dB,
- **Output Return Loss**: <-12dB
- **GBW**: = 300GHz
- **Pdc**: = 76mW

*These are records for performance in silicon!*
Summary

- Broadband communication is entering an era of revolution;
  - Driven by energy efficiency, rate demands
  - Electrical, optical, wireless channels

- High $f_T (>200\text{GHz})$ silicon devices offer
  - High-speed signal processing
  - Optimized source/channel coding
  - Millimeter-wave Performance: Traveling wave circuits for broadbands/high-frequencies.

→ Traveling wave mm-Wave/Analog/Digital on one-chip
CAP Business:
Anne O’Donnell
*Director, Corporate Affiliates Program (CAP)*
Senior Design Projects

Nate Delson, Ph.D.
Director, Mechanical Engineering Design Center
We Are Looking For a Few Good Mechanical Engineering Capstone Design Projects

Nathan Delson, Ph.D.
Director, Mechanical Engineering Design Center
Dept. of Mechanical and Aerospace Engineering
Teams of Mechanical Engineering Seniors Work on Developing Working Prototypes

- Mechanical
- Electro-mechanical
- Fluids
- Heat transfer
- Control
What Course Provides

- Teams of 3-6 students
- 15 week duration projects
- Support from full machine shop and electronics shop
- CAD and simulation software
- Instructor guidance on a weekly basis
Sponsor Responsibility

- Project Description
- Weekly meetings
- Budget
  - Parts and Materials
  - $1500 shared machine shop expensive
Project Descriptions Due Dates

October 15 for Fall-Winter projects
- project kickoff at beginning of November
- project completion in mid March

January 15th for Winter-Spring projects
- project kickoff in mid February
- project completion in mid June

www.maelabs.ucsd.edu/mae156/student_projects.htm
New Initiatives with your employees and our alumni

Tatis Cervantes
Assistant Director of Alumni Affairs
Jacob School of Engineering
New CAP Benefits

Building a Community Between CAP/Alumni/Students/Faculty
Building a Community and Touching Base
Building Relationships & Families with the Jacobs School

Jacobs Scholars Wedding
Engineering Courtyard
Ed Wu ’04 & Simone McCloskey ’07
Be Part of Jacobs School Legacy Walk
You Pick the Tech-Topic. We’ll Pick the Faculty!

- Provide alumni and your employees an update of cutting-edge research at the Jacobs School of Engineering
- Create a Jacobs School community within your company
- Build a Bridge between your employees/Jacobs alumni to engage with the Jacobs School faculty and students
Adopt a Future Engineer - a Jacobs School Student for a Day

- **One:One** opportunity to guide and inspire students with their career goals and aspirations

- **Job Shadowing** - Students witness firsthand
  - your company culture
  - technical skills in practice
  - career options

- Two-way Informational Interviews
Yahoo! Hack Week

JOIN US FOR THESE HACK EVENTS:

October 13th  
BBQ & Hack Kickoff Featuring Rasmus Lerdorf

October 14th  
Mobile Widget & SearchMonkey Brain Jam

October 15th  
Future Open Technology Tech Talk

October 16th  
24-Hour Hack Competition Begins

October 17th  
Demos, Judging, Awards, After Party

For more details, developer tools and examples of past university hacks visit:
http://developer.yahoo.com/hacku

Questions? Email us at: hacku@yahoo-inc.com
Please join us to celebrate women in science & engineering!

SPAWAR Systems Center San Diego (SSC SD)
And
UCSD Jacobs School of Engineering

Girl’s Night Out!

This fun filled evening will feature:

- Presentations by distinguished women already in the field
- The path from middle school to college pursuing science & engineering-related disciplines
- Engaging experiments led by UCSD students, SSC-SD professionals, & industry partners
- Summer opportunities to study science and engineering

Inspiring young girls to become educated women
2008 results:

- **ViaSat** hosted lunch with faculty
- Keynote speaker on innovation from Northrop Grumman Space Technology
- **Yahoo!** and **Northrop Grumman** Sponsorship
- You can sponsor the 2009 event!
Reception following Board Meeting in CALIT2

SPECFLIC 2.6 INSIDE GALLERY
INSTALLATION BY ADRIENE JENIK
AUGUST 6-OCTOBER 3, 2008

PARTICLES OF INTEREST
INSTALLATION BY *PARTICLE GROUP*
IN FRONT OF GALLERY
AUGUST 6-OCTOBER 3, 2008