QUALCOMM: Company Overview and Opportunities for Students and Collaboration

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Outline

1. General background on Qualcomm
2. Research and Development
3. Opportunities for Students and Faculty
Qualcomm Overview

• Founded in 1985
• *FORTUNE* 500® Company
• NASDAQ Symbol: QCOM
• Member of the S&P 500 Index
• Approximately 6,100 U.S. patents and patent applications
• "100 Best Managed Companies" — *Industry Week*
• "100 Best Companies to Work for in America" — *FORTUNE*
The Key Role of Research at Qualcomm

Source: www.qualcomm.com
Qualcomm R&D Activities

• Core Research
• Risk Reduction/Mitigation
• Prototyping
• Standards
• IP Generation
• Field Validation

• Technology Proof
• Evaluate external technologies for partnership/investment
• Development and Productization
• Market Strategy
Qualcomm R&D Resources

• **Who we are**
  – Mostly engineering:
    • Systems, Software, Hardware, Standards, Test engineering
    – Business Development, Economic Analysis, Ventures, Program Management

• **Complete Development Labs**
  – State of the art prototype development facility
  – Large CPU simulation cluster
  – Audio and Multimedia Lab
  – WiFi test lab
  – Antenna ranges to develop and test new designs

• **Outdoor Field Systems**
  – Over-the-air systems for current and next generation networks
  – Evaluation of enhancements to air-interfaces, terminals, basestations
Examples of Some R&D Projects

• Teams focused on evolving the systems design and enabling advanced implementations to improve the wireless wide area networks including:

  – CDMA2000 / EVDO (Evolution Data Optimized)
  – WCDMA / HSPA (High-Speed Packet Access)
  – UMB: 3GPP2 OFDM system (Ultra-Mobile Broadband)
  – LTE: 3GPP OFDM system (Long-Term Evolution)
  – MediaFLO: Broadcast (Forward-Link Only) system.
Examples of Some R&D Projects (cont’d)

- Also have a significant and growing number of R&D projects focused on innovation within the broad area of wireless communications. Some examples are:
  - Research into advanced RF, antenna, and digital HW technologies
  - Development of advanced platforms for wireless system prototyping
  - Design of seamless inter-working between 3G WAN and 802.11 LAN
  - Design of access-independent mobile-centric core network architectures
  - Dynamic Interference Management in an Ad-Hoc Deployment
  - Peer-to-peer system architecture
  - Cognitive radio
Examples of Product Solutions

• QUALCOMM CDMA Technologies (QCT) is the largest provider of 3G chipset and software technology in the world.
  – Chipsets shipped to more than 50 customers and powering the majority of all 3G devices commercially available.

• QCT partners with nearly 60 3G network operators around the globe
  – Largest CDMA engineering team in the wireless industry.

• Wide range of products covering
  – Mobile-Station-Modem (MSM) processors
  – RF Processors
  – Cell-Site-Modem (CSM) processors
  – Power Management IC’s
  – Qualcomm Single Chip (QSC) solutions for RF, MSM, PMIC
Introduction of QFT (Qualcom Flarion Technologies)

• Brief history
  – 1998 Flash-OFDM concept developed in Lucent Bell-Labs
  – 2000 Flarion Technologies founded to commercialize Flash-OFDM technology
  – 2006 Flarion acquired by QUALCOMM

• Flash-OFDM development
  – 1998 – 2000 Concept & Proto Development
  – 2005 – 2007 Commercial Deployments

• More recent technology/product development
  – Leverage Flash-OFDM expertise into UMB and LTE
What Make QFT Unique?

- **Academic culture + real-world attitude**
  - New innovations to address real-world challenges
    - Example 1: notion of self-noise and impact on superposition coding design
    - Example 2: single-carrier FDM for OFDM peak-to-average ratio reduction
  - Applying cutting-edge academic research directly to product and making real impact
    - Example 1: LDPC coding
    - Example 2: multi-user diversity scheduling

- **Start-up mindset + big company resource**
  - Broad system view
  - Cross-functional collaboration

- **Vision about future wireless communications**
  - Flarion pioneered mobile broadband wireless OFDMA when most of the world just started 3G WCDMA
  - QFT will continue to innovate
Opportunities for Graduate Students

• Internships
  – Internship program for PhD and MS students
  – Can be 3-6 months
  – Don’t need to be in the summer

• Full-time Hiring
  – CR&D
  – QCT
  – QFT
What kinds of people we are looking for?

“Smart, motivated and gets things done”
What areas of engineering expertise do we want?

• Very broad: systems, software, hardware, standards, testing

• Systems: digital communications, digital signal processing, information theory, control theory, etc.

• Software: C/C++, DSP, embedded RTOS/device drivers, networking protocols, applications, etc.

• Hardware: FPGA, ASIC, RF, etc.
How do you get hired?

• **Resume Review**
  – Use a spell checker. Please
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• **Phone interview**
  – Questions on experience and general knowledge, may involve simple problem solving

• **On site interview**
  – About 6 technical interviewers
  – Each interviewer has 45 minutes
    • It’s not what you say you can do – it’s what you can prove you can do. This is a final exam. Act like it. Study.
    • New grad questions: simple design questions
    • Questions will often be designed so the interviewer can adjust the difficulty on the fly
  – Prepare to defend your resume
    • Padding your resume is risky
Why QUALCOMM?

• Run by Engineers
  – Everyone from the CEO to an R&D individual contributor is an engineer
    • CEO and COO are both PhDs
• No bean counting
  – Order desk copies of any book at your discretion
• Individual offices, no cubes in R&D
• Fully equipped labs
  – $100k+ scopes and logic analyzers are commonplace
• Stock options are nice
Opportunities for Faculty Collaboration

• **Collaboration can take many forms**
  – Informal research discussions
  – Providing feedback on problems of interest
  – Visiting faculty appointment at Qualcomm for 6-12 months
  – Funded research with shared IPR
  – Cost sharing of a grad student or postdoc
  – Sharing of data and discussion of results under NDA
Things to Remember

• Qualcomm Careers WebSite
  www.qualcomm.com/careers
• Qualcomm University Relations and Recruiting
  – Adam Ward award@qualcomm.com
  – John Smee jsmee@qualcomm.com