Qualcomm Research

Qualcomm Innovation Fellowship (USA): QInF 2013

These are draft slides and some details (e.g. dates) are approximate.
Official info available at www.qualcomm.com/innovationfellowship

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Summary of QInF

- Qualcomm Innovation Fellowship (QInF)
  - In tune w/ QC Research's culture of innovation, execution and teamwork
  - Initiated at Berkeley and Stanford in 2009 (46 participating teams)
  - Expanded to UCLA, UCSD and USC in 2010 (80 participating teams)
  - Expanded to 6 more schools in Eastern USA in 2011 (146 participating teams)
  - Expanded to Columbia, and internationally in 2012 (109 participating teams)

- Key structure of Fellowship
  - Fellowship to be awarded to a team of two PhD students
  - Application requires submitting an innovation proposal
  - Faculty to 'recommend' the innovation, rather than the student

- EIGHT to TEN teams to be awarded in 2013
  - Total prize money of $1M = 10 teams x 2 students x $50k each

- Schools participating in QInF 2013
  - CMU, MIT, Princeton, Rutgers, UIUC, Cornell, Michigan, Washington
  - Berkeley, Stanford, UCLA, UCSD, USC, UMCP, Columbia

QInF Winners

School	Students	Advisor	Topic 2009
Berkeley	Leo Mayerovich Seth Fowler	Ras Bodik	Parallel Web Browsing for Mobile Devices
Stanford	David Stavens Jesse Levinson	Sebastian Thrun	Precision Localization for Indoor Environments

School	Students	Advisor	Topic 2010
Berkeley	Maryam Tabesh Amin Arbabian	Ali Niknejad	Millimeter-wave Dual-Band Passive RFID using Antentronics
Berkeley	Bor-Yiing Su Bryan Catanzaro	Kurt Keutzer	Parallel Object Recognition on Mobile Platforms
USC	Viviane Ghaderi Sushmita Allam	Alice Parker Ted Berger	Modeling The Other Brain
UCLA	Taehee Lee Teresa Ko	Stefano Soatto Deborah Estrin	Object-Level Mapping, Localization, and Change Detection on Mobile Platforms
UCSD	Luke Barrington, Brian McFee	Gert Lanckriet, Lawrence Saul	Location-, Demographic-, Preference- and Content-Based Music Search and Recommendation
Stanford	John Brunhaver, Andrew Danowitz	Mark Horowitz	Understanding Inefficiencies in General Purpose Processors

Past QInF Winners

School	Students	Advisor	Topic 2011
UMD	Ching L Teo Yezhou Yang	Yiannis Aloimonos Hal Daumé III	Robots Need Language: A computational model for the integration of vision, language and action
Princeton	Mohammed Shoaib Kyong Ho Lee	Naveen Verma Niraj K. Jha	Algorithm-driven Platforms for Low-energy Intelligent Biomedical Systems
CMU	David Bromberg Daniel Morris	Lawrence Pileggi Jian-Gang Zhu	mLogic: Low-Power, Non-Volatile Magnetoelectronic Logic Circuits for Portable Applications
UIUC	Rajinder Sodhi Brett Jones	David Forsyth	Spatial Mobile Interaction using Depth Cameras
UCSD/ UCLA	Siarhei Vishniakou Paul Brochu	Deli Wang Qibing Pei	I-SENSE – Innovative Technology Enabling New Life-style
MIT	Ahmed Kirmani Andrea Colaco	Vivek K Goyal Franco Wong	Single Pixel Depth Sensing and 3D Camera
UCB	Mohit Bansal Taylor Berg-Kirkpatrick	Dan Klein John Blitzer	Automatic Summarization for Mobile Search
UCLA	Supriyo Chakraborty Zainul Charbiwala	Mani B. Srivastava	Balancing The Dichotomy Between Privacy and Utility in Mobile Empathic Systems: A Compressive Sensing Approach

Past QInF Winners

School	Students	Advisor	Topic 2012
UCB	Asif Khan Chun Yeung	Sayeef Salahuddin Chenming Hu	Negative Capacitance FET with sub 60 mV/dec swing and high Ion for Ultra-low Power High Performance Mobile Computing
CMU	Chris Harrison Robert Xiao	Scott E Hudson	Synthetic Sensors and Interfaces
Columbia	Michael Lekas Sunwoo Lee	James Hone Ken Shepard	CMOS Compatible Graphene Nanoelectromechanical Systems for Next Generation RF Design
UCB	Sameer Agarwal Aurojit Panda	Ion Stoica Sam Madden	BlinkDB: Interactive Queries on Unbounded Data With Bounded Errors
UCLA	James Xu Yan Wang	Greg Pottie Bruce Dobkin	Multi-Context Driven Activity Classification through Three-dimensional Body Motion via Wearable Sensors
UIUC	Rakesh Komuravelli Matthew Sinclair	Sarita Adve Vikram Adve	Addressing the Hardware Challenges of Tightly Coupled Heterogeneous Architectures
Stanford	Alexander Neckar Sam Fok	Kwabena Boahen	Neuromorphics: Programmable Analog Computation Through Reconfigurable Digital Communication
UCLA	Xufeng Kou Murong Lang	Kang L. Wang	Topological Insulators Based Spin-Polarized FET

Timeline for QInF/US 2013

- Fellowship formally launched: Sep 12 (QInF Winners Day)
- Applications due: Nov 1, 2012
- Finalists announced: Dec 14, 2012
- Final presentations due: Feb 25, 2013
- Finals at QC Research locations: March 14, 18, & 20, 2013
- Winners announced: April 3, 2013
- QInF Winners Day (in San Diego): September
  - Winners from 2012 & 2013 to be invited
- Scholarships awarded in academic year 2013–14

QInF 2013 Submission: Nov 1st

- Team composition
  - Two PhD students
    - Need to be enrolled in PhD program in entire academic year 2013–14
- QInF website will provide exact details of application
  - www.qualcomm.com/innovationfellowship
- Each team will submit
  - Three page proposal summarizing the innovative idea
  - Letter from one or more faculty members, recommending the innovation proposal
  - CV of each student
  - QInF 2013 Official Rules statement
- Judging will be performed by researchers from QC Research

Proposals

- Three pages (approx)

- Need to include:
  - Introduction and problem definition
  - Innovation: proposal and relation to the state of the art
  - Execution: one year horizon of the project (even if the proposal is a multi-year project)
  - Teamwork: strength of the team for achieving the proposal milestones.

- Letter of recommendation from faculty for the proposal (guidelines)
  - Why the proposal is innovative
  - Why the proposal is important
  - Why the current team is likely to succeed in their proposal

- Note: Qualcomm does not publish the proposals, or provide templates, since we *want* to be surprised by your proposals
  - But, applicants are welcome to check out prior winners' web pages

QInF 2013 Focus Areas

1. Advances in Comm. Techniques and Theory
2. Cloud Computing
3. Internet of Things
4. Neuromorphic Computing
5. Mobile Imaging & Computational Photography
6. RF-Related Topics
7. Mobile Security and Privacy
8. Semiconductor Research
9. System Architecture & Programming Models
10. User Experience

Advances in Communication Techniques & Theory

- Interference Management among multiple base-stations
- Proximal Communication among peer nodes
- Multi-hop/Mesh networks
- Network coding for wireless networks
- Wide-area wireless networks using high-frequency spectrum
- Wireless systems for unlicensed/shared spectrum
- Dynamic wireless multicast

Cloud Computing

- Crowdsourcing
- System Software for mobile cloud
- Cloud assist for mobile computing
- Clouds and the internet of things
- Home/personal clouds: distributing content and computation across devices
- Real time resource allocation in cloud platform

Internet of Things

- Connected Home
- Personal Cloud
- Wireless Docking
- Wireless Health
- Low power wake-up receiver architectures
- Low power discovery & routing

Neuromorphic Computing

- Cortical signal processing
- Sensory encoding schemes
- Dendritic and analog processing
- Cerebellar processing and motor control
- Hardware implementation of neural elements

Computational Photography, Mobile Graphics & Imaging

- 3D object and scene reconstruction
- Scene understanding
- Image enhancement and super-resolution
- Image stabilization, rolling shutter removal
- Image editing, synthesis, retargeting and composition
- Real time rendering

RF-Related Topics

- Low cost radio
- RF Mems
- RF Applications for Graphene
- Innovative PA Design
- Adaptive RF Matching

Mobile Security & Privacy

- Mobile Security
- Autonomic Computing
- Mobile Privacy (content control)

Semiconductor Research

- Carbon based electronics
- Monolayer semiconductor
- Spintronics (novel devices and circuit design)
- Ultra-low power technology (transistors, memory, circuits)
- Emerging memory technology (cell design, process, memory architecture)
- Flexible/printable electronics
- Next generation 3DIC technology, design and automation

System Architecture, Programming Models, & Mobile Apps

- Mobile Computing languages, compilers and tools
- Low power multi-processor/multi-core designs
- HW/SW co-design for heterogeneous systems
- Parallel and heterogeneous programming: models, frameworks, runtimes
- Mobile Web Technologies

User Experience

- HCI across multiple screens
- Touchless HCI
- Affecting Computing
- Shared Experiences on single and multiple devices
- Haptics/Vibrotactile Feedback
- Natural Interactions/NUIs on/with mobile devices
- Augmented Reality using HMDs
- Biometric Input
- Mobile Payment/Commerce

Finalist Presentations

- Proposals are assessed in a conference-like review system by Qualcomm Research researchers
  - For QInF 2010–2012, every proposal received 3+ reviews (4+ reviews for every finalist)

- Based on the review process, we will announce approximately 30 finalist teams across all the schools

- Finalist presentation will be part of judging
  - 13 min talk + 2 min for questions
  - No more than 12 slides
  - Presentation deck will be due approx. 2 weeks before
  - Tentative: Poster session for all the finalists
  - Finals attended by
    - QInF finalists and faculty from various schools
    - Qualcomm researchers

- Final Judges Panel consists of Qualcomm Research executives

QInF 2013 Finals Week

- Three finals – one each in Bridgewater (NJ), Santa Clara, and San Diego
- QC will support travel logistics
  - Provide buses to carry students from local schools
  - Arrange travel (air/ground) and stay for non-local students.

- Finals will be in mid-March

What will QC provide *in addition* to Fellowship

- Continuing relationship to QC
  - QC mentor to the winning team
  - Opportunities for regular collaboration with QC Researchers
  - Winners visit QC to present research update after 6 months, 1 yr
    - Also, invitation to the “QInF Day” in September, 2013
  - Expedited internship applications

- The fellowship concludes at the end of the first year
  - But the continuing research project may be proposed for funding through our university program
    - Funding not guaranteed, and may be at lower/higher level

- QC also keeps track of the other proposals, and may fund them
  - QInF proposals are an excellent way to initiate a research relationship with QC – 3 page proposals are widely distributed and accessed
  - And don’t forget internships, and full-time opportunities

Advice… from 2012 Winning Team (1/2)

- Rakesh Komuravelli & Matthew D. Sinclair from UIUC
- A word about proposals (in general):
  - Note: proposals aren't research statements
  - Grad students aren't typically exposed writing their own proposals
  - Think to the future (3-5 years from now)

- Propose a new project
  - Not something you've already been working on for years
  - Can be a branch of something you've already done
  - Qualcomm is especially interested in funding *new projects*

Proposal Writing Advice (2/2)

- Run your proposal by your advisor(s) several times
  - Improve several times before sending & before re-sending
- Make ideas as clear and concise as possible
  - Use details where necessary
  - 3 pages isn't a lot!
  - Qualcomm Research is a "general" PhD audience
  - Tie in team member's strengths

FAQ: Eligibility

- Citizenship restrictions: None
- Students from different advisors: Yes
- Students without advisors: Yes
- Any restrictions on receiving help from advisor, colleague: None
- Two applications with two teams: Yes
- Can existing Fellowship winners apply: Yes
  - The money will be disbursed through school/department
  - School will determine how to award the funds to the student's research
- Enrolment requirement
  - Need to be enrolled in full-time PhD program for entire academic year 2013–14
  - Students graduating in Fall 2013 are not eligible
- Following are not allowed
  - Team of one student
  - Member from any other school (team across two of the QInF schools is OK)
  - Visiting scholars, post-docs, MS students

FAQ: Other

- Intellectual property
  - IP developed by the students is owned by student/university, and is governed by university rules
- Are proposals for projects that are aligned with Qualcomm's business interests favored ?
  - We are hoping that the fellowship applications will introduce us to new areas of research. As such, we explicitly encourage proposals in new areas that are not yet aligned with Qualcomm's business interests.
- Is proposal = thesis ?
  - Not necessarily. We welcome a different idea that you have, and this will allow you to develop it
- Should we include a business plan / path to commercialization
  - No. This is a fellowship intended to encourage research.

Conclusions

- Points to Remember
  - Application deadline: Nov 1, 2012
  - Eight to ten team awards of $100,000 each
- Please check back regularly at the QInF web page
  - www.qualcomm.com/innovationfellowship
- We have a mailing list for general notifications
  - Send request to add from school email account to
  - innovation.fellowship@qualcomm.com
- Also available on the web page
  - FAQs (compilation of all queries we receive)
  - Application submission procedure
- Questions, comments
  - innovation.fellowship@qualcomm.com

Prior year QInF Winners

QInF 2009: Meyerovich and Fowler (Berkeley)

- Title: Parallel Web Browsing for Mobile Devices
- Advisor: Prof. Ras Bodik

- Web browsing is becoming a vital task for mobile devices. And mobile browsers are much slower than PC browsers
- Browsing requires the performing of many tasks: CSS, kernel, layout, rendering, Javascript, network etc. – none of which dominates the latency
- Hence need to look at parallelizing ALL of the above steps for a multi-core mobile device

QInF 2010: Ghaderi and Allam (USC)

- Title: Modeling the “Other” Brain
- Advisors: Prof. Alice Parker and Prof. Theodore Berger

  - Modeling GLIAL CELLS - an important evolutionary process that has long been neglected
  - First transistor-level model of tripartite synapse
  - Unique research model based on experiments, computational models, and hardware emulations
  - Inter-disciplinary efforts in combination with our resources will enhance the success of this project
    - Students from EE and Med School
  - Open new avenues in neuromorphic engineering e.g. efficient neural prostheses, ‘brain-like’ control of robots, autonomous vehicles

QInF 2011: Sodhi and Jones (UIUC)

- Topic: Spatial Mobile Interaction using Depth Cameras
- Advisor: Prof. David Forsyth

- Currently, interaction with a mobile device is limited to the screen, hence limited by size of screen
- Use a depth sensor and camera on the phone to enhance the interaction zone of a device to the 3-dimensional space in front/rear of the device
- What types of interaction (e.g. gestures) are feasible, effective and optimal for such 3D interfacing with devices

QInF 2011: David Bromberg, Daniel Morris (CMU)

- Topic: mLogic and Chainlink: Low-Energy, Nonvolatile Spintronic Circuits and Memory
- Advisors: Jimmy Zhu, Larry Pileggi

- All magnetic logic and memory
  - State is magnetization; signals are currents
  - Minimal connections to CMOS for 3D integration
- Capabilities augment CMOS
  - Nonvolatile
  - Noisy and intermittent <100 mV supply

QInF 2012: James Xu, Yan Wang (UCLA)

- Topic: Multi-Context Driven Activity Classification through Three-dimensional Body Motion via Wearable Sensors
- Advisors: William J Kaiser and Greg J Pottie

- Develop an end-to-end system to classify subject's activities
- Incorporate both physiological context and ambient context

About Qualcomm

QUALCOMM®

Fortune 500 Company

Leader in developing and delivering innovative digital wireless communications products and services based on CDMA and other advanced technologies

World's largest fabless semiconductor company, #1 in wireless

Broadly licensed patent portfolio: ~11,600 U.S. and ~54,100 international patents and patent applications

Member of the S&P 100 & 500 Indexes

Hewitt Best Employers in Korea 2009

EDN INNOVATION Honoring Excellence in Electronics WINNER 2008

THE INFOTECH 100 BusinessWeek

COMPUTERWORLD 100 BEST PLACES TO WORK IN IT 2009

Forbes 2009 GLOBAL 2000 WORLD'S BIGGEST COMPANIES

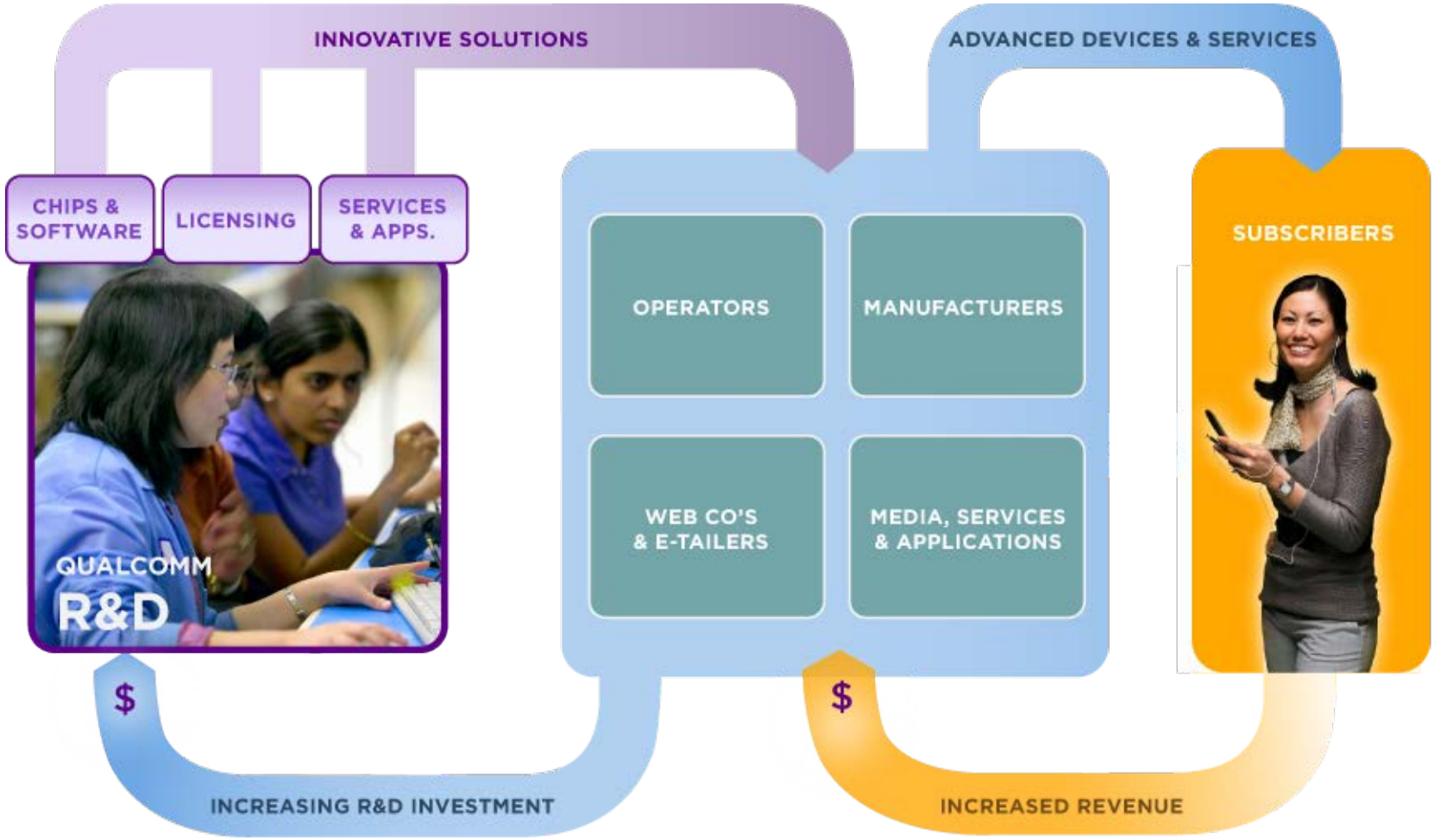
ANDREWSEYBOLD Choice Awards 2009 WINNER

2009 TECHNOLOGY INNOVATION AWARDS

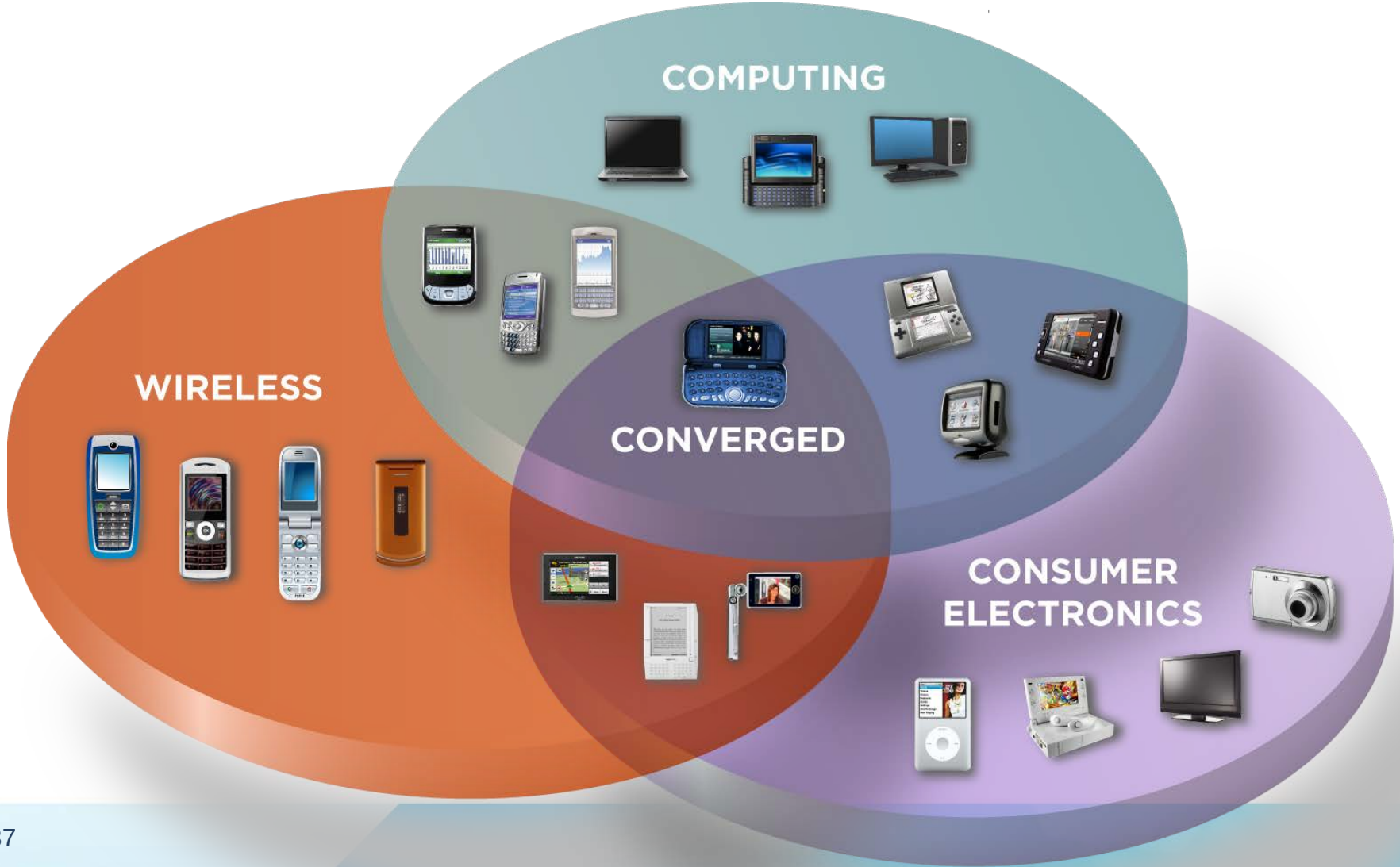
GREAT PLACE TO WORK INSTITUTE INDIA BEST companies to work for 2009

Institutional Investor 2009: Best CEO & Best CFO Telecom Equipment/Wireless

Qualcomm Business Model: Technology and Value Chain Enabler

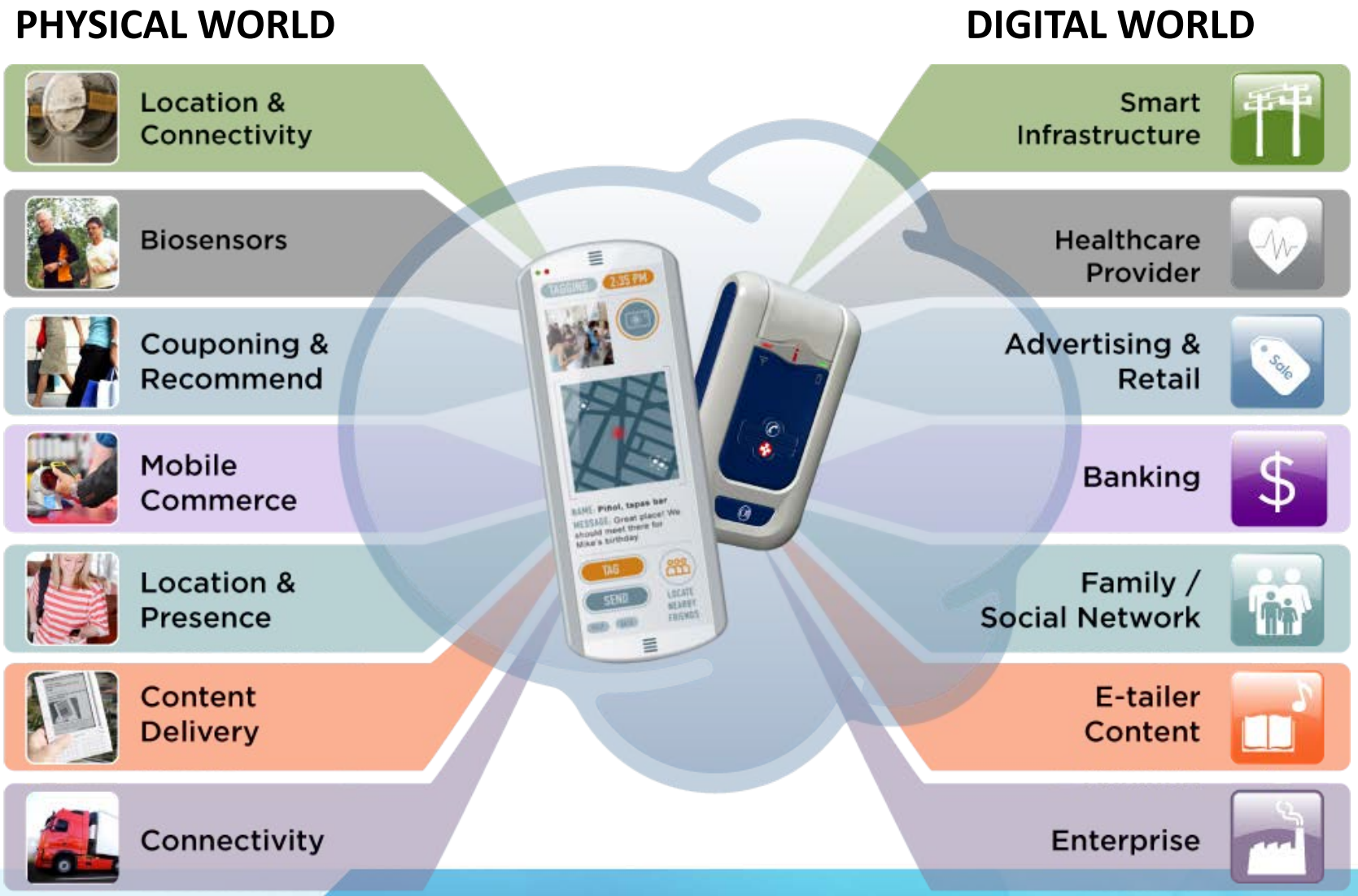


Creating New Mobile, Computing and CE Device Categories



Expanding the Wireless Ecosystem

Wireless: Bridging Physical to Digital



The Internet Goes Mobile in Many Forms