Industry Partnerships;
Inter-Company Collaboration, Public Private Partnerships, Member Specific Research, and SRC support for all of the above.

Gilroy Vandentop
Dir. Intel Corporate University Research, SRC STARnet
CCC Symposium on Computing and Society
Partnerships Session, May 2016
Outline

• Intel partnerships and programs with universities
• SRC programs
• Intersection of Intel and SRC
• Benefits of SRC collaborations
• Summary
INTEL LABS TOP COLLABORATIVE PROJECTS
Focused collaborations on highest-priority needs for each Intel BU

- IOTG: REDEFINING "I" IN IOT
- NDG: SECURITY AUTHENTICATION
- DCG: BIG DATA AND DEEP LEARNING
- CCG: HOLOGRAPHIC DISPLAY
- TMG: ZERO POWER SYSTEMS ENERGY HARVESTING
- ISEC: MACHINE LEARNING FOR THREAT DETECTION
- SSG: HIGH PERFORMANCE SCRIPTING
- PEG: NEXT-GEN ARCHITECTURE 5G
CORPORATE UNIVERSITY RESEARCH

Very Large Centers – Solving Industry Scale Problems
Semiconductor Research Corp STARnet, NRI

Large Centers – Intel Labs’ Innovation Pipeline
Intel Science and Technology Centers (ISTCs) and Collaborative Research Institutes (ICRIs), Intel-NSF partnership

Small & Midsized Grants – Focused Problem-Solving
Intel Strategic Research Alliances (ISRAs)
CRC Strategic Research Sectors
Global Research Collaboration – Manage by SRC
Semiconductor Research Corporation: A Family of Distinct, Related Program Entities

Global Research Collaboration
Ensuring vitality of current industry

- Analog Devices
- AMD
- ARM, Inc.
- Freescale
- GLOBAL-FOUNDRIES
- IBM
- Intel
- Mentor Graphics
- Microsoft
- Mubadala Tech
- Research Triangle Institute
- TI
- Qualcomm

Gov’t Participants
State of Texas
State of NY
NIST
NSF

Other Participants
SEMI
SIA
MOSIS

Efficiency and Performance for Connectivity Constrained Computing (EP3C)

- GLOBALFOUNDRIES
- IBM
- Intel
- MICRON
- Raytheon
- TI
- United Technologies

Government Participant
DARPA

Other Participants
SEMI
SIA

Innovative and Intelligent Internet of Things (I3T)

- IBM
- Intel
- MICRON
- TI

Other Participants
SEMI
SIA

Trustworthy and Secure Semiconductors and Systems (T3S)

- GLOBALFOUNDRIES
- IBM
- Intel
- MICRON
- Raytheon
- TI
- United Technologies

Government Participant
DARPA

Other Participants
SEMI
SIA

Targeted Research Areas

- STARnet
- MARCO
- NERC

STARnet
Early research engagement of key long horizon semiconductor challenges

Gov’t Participants
NIST
NSF
State of Nebraska
State of NY
State of Texas

Other Participants
SEMI
SIA

Beyond CMOS – the next switch and associated architectures

Gov’t Participants
NIST
NSF
State of Nebraska
State of NY
State of Texas

Other Participants
SEMI
SIA

Nanoelectronics Research Initiative

- IBM
- Intel
- MICRON
- TI

Other Participants
SEMI
SIA

Education Alliance
Attracting and educating the next generation of innovators and technology leaders

- Texas Instruments
- Qualcomm
- Marvell
- National Instruments
- Texas Instruments Institute
- MOSIS
- SIA
- MARCO
- NERC
- SRC

Updated September 2015
SRC Research Programs

<table>
<thead>
<tr>
<th>Contracting Entity</th>
<th>SRC</th>
<th>MARCO</th>
<th>NERC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Programs</td>
<td>Global Research Collaboration (GRC)</td>
<td>Semiconductor Technology Advanced Research Network (STARnet)</td>
<td>Nanoelectronics Research Initiative (NRI)</td>
</tr>
<tr>
<td>Nature of Research</td>
<td>Narrowing options</td>
<td>Creating options</td>
<td>Discover next logic switch</td>
</tr>
<tr>
<td>Main Sponsorship</td>
<td>Industry (Global)</td>
<td>Industry + DARPA (U.S. only)</td>
<td>Industry + NSF + NIST (U.S. only)</td>
</tr>
<tr>
<td>Operational Model</td>
<td>Individual researchers and centers, 3 year contracts</td>
<td>Multi-university collaborative centers, 5 year contracts</td>
<td>Individual researchers (at NSF centers) and multi-university centers, 5 year contracts</td>
</tr>
<tr>
<td>Technology Spectrum</td>
<td>CMOS and beyond – 10+ yrs. horizon</td>
<td>Radically new solutions to broad spectrum of information and communication technologies – 20+ yrs. horizon</td>
<td>Next logic switch beyond CMOS – 20+ yrs. horizon</td>
</tr>
<tr>
<td>Industry Involvement</td>
<td>Strategic direction (BoD) and execution (TABs)</td>
<td>Strategic direction (GC) and arms-length technical guidance (SAB)</td>
<td>Guidance from TPG and on-site industry assignees</td>
</tr>
<tr>
<td>Government Involvement</td>
<td>Limited direct funding; leveraged contribution</td>
<td>Significant funding (~40%) and program direction from DARPA</td>
<td>Major funding from state and federal (NSF and NIST)</td>
</tr>
<tr>
<td>University Autonomy</td>
<td>Independent researchers guided by industry</td>
<td>Autonomous centers with high collaboration among and within</td>
<td>Collaborative researchers guided by industry members and assignees</td>
</tr>
<tr>
<td>Technology Transfer</td>
<td>Industry-driven processes (industrial liaisons, annual reviews, and e-workshops)</td>
<td>Primarily faculty-driven processes (associates, annual reviews, and e-seminars, etc.)</td>
<td>Combination of industry &amp; faculty-driven processes (e.g., industrial assignees, reviews, e-workshops, etc.)</td>
</tr>
</tbody>
</table>
Intersection of Intel and SRC

- Large collaborative centers are enabled by SRC
- Optimal IP terms are enabled by SRC
  - Most important for process and hardware research
- Software and security research
  - Historically mostly handled in house
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Benefits of SRC model

- **Intangible benefits of collaboration**
  - Senior technologists as fellow travelers
  - Neutral ‘3rd’ party trusted environment

- **Student programs and visibility**

- **Attractive IP terms and growing portfolio**

- **Funding leverage**

- **Public Private Partnership expertise**

- **Cost effective university program support**
Large Centers – Feeding Intel Labs’ Innovation Pipeline

Semiconductor Research Corp STARnet, NRI

Intel Science and Technology Centers (ISTCs) and Collaborative Research Institutes (ICRIs), Intel-NSF partnership

Very Large Centers – Solving Industry Scale Problems

Small & Midsized Grants – Focused Problem-Solving

Corporate Research Council Oversight

~$60M/year in academic research investments with broad reach

- Top-down
- Large-scale
- Systems scope
- Interdisciplinary
- Multi-BU
- New markets
- Long-range

- Bottom-up
- Single PI
- Technologies scope
- Unidisciplinary
- Single-BU
- Existing markets
- Product-focused

Intel Strategic Research Alliances (ISRAs)
CRC Strategic Research Sectors
Global Research Collaboration

SSG
IOTq
IT
Other BU
Other BU
Other BU
Other BU
How do I engage with Intel’s university research needs?

- **Very Large Centers – Solving Industry Scale Problems**
  - Semiconductor Research Corp STARnet, NRI

- **Large Centers – Feeding Intel Labs’ Innovation Pipeline**
  - Intel Science and Technology Centers (ISTCs) and Collaborative Research Institutes (ICRIs), Intel-NSF partnership

- **Small & Midsized Grants – Focused Problem-Solving**
  - Intel Strategic Research Alliances (ISRAs)
  - CRC Strategic Research Sectors
  - Global Research Collaboration

**Corporate Research Council Oversight**

- Work with SRC to respond to calls for proposals =
- Foster individual relationships with Intel engineers =
- Do great research and be invited to compete =

**Intel Strategic Research Alliances (ISRAs)**

- **Top-down**
- **Large-scale**
- **Systems scope**
- **Interdisciplinary**
- **Multi-BU**
- **New markets**
- **Long-range**

- **Bottom-up**
- **Single PI**
- **Technologies scope**
- **Unidisciplinary**
- **Single-BU**
- **Existing markets**
- **Product-focused**
Risk Factors

The above statements and any others in this document that refer to plans and expectations for the fourth quarter, the year and the future are forward-looking statements that involve a number of risks and uncertainties. Words such as “anticipates,” “expects,” “intends,” “plans,” “believes,” “seeks,” “estimates,” “may,” “will,” “should” and their variations identify forward-looking statements. Statements that refer to or are based on projections, uncertain events or assumptions also identify forward-looking statements. Many factors could affect Intel’s actual results, and variances from Intel’s current expectations regarding such factors could cause actual results to differ materially from those expressed in these forward-looking statements. Intel presently considers the following to be the important factors that could cause actual results to differ materially from the company’s expectations. Demand could be different from Intel’s expectations due to factors including changes in business and economic conditions; customer acceptance of Intel’s and competitors’ products; supply constraints and other disruptions affecting customers; changes in customer order patterns including order cancellations; and changes in the level of inventory at customers. Uncertainty in global economic and financial conditions poses a risk that consumers and businesses may defer purchases in response to negative financial events, which could negatively affect product demand and other related matters. Intel’s results, including revenue, gross margin, expenses and interest and other, would likely be adversely affected in the event of widespread financial and business disruption on account of a default by the U.S. on U.S. government obligations and/or a prolonged failure to maintain significant U.S. government operations. Intel operates in intensely competitive industries that are characterized by a high percentage of costs that are fixed or difficult to reduce in the short term and product demand that is highly variable and difficult to forecast. Revenue and the gross margin percentage are affected by the timing of Intel product introductions and the demand for and market acceptance of Intel’s products; actions taken by Intel’s competitors, including product offerings and introductions, marketing programs and pricing pressures and Intel’s response to such actions; and Intel’s ability to respond quickly to technological developments and to incorporate new features into its products. The gross margin percentage could vary significantly from expectations based on capacity utilization; variations in inventory valuation, including variations related to the timing of qualifying products for sale; changes in revenue levels; segment product mix; the timing and execution of the manufacturing ramp and associated costs; start-up costs; excess or obsolete inventory; changes in unit costs; defects or disruptions in the supply of materials or resources; product manufacturing quality/yields; and impairments of long-lived assets, including manufacturing, assembly/test and intangible assets. Intel’s results could be affected by adverse economic, social, political and physical/infrastructure conditions in countries where Intel, its customers or its suppliers operate, including military conflict and other security risks, natural disasters, infrastructure disruptions, health concerns and fluctuations in currency exchange rates. Expenses, particularly certain marketing and compensation expenses, as well as restructuring and asset impairment charges, vary depending on the level of demand for Intel’s products and the level of revenue and profits. Intel’s results could be affected by the timing of closing of acquisitions and divestitures. Intel’s results could be affected by adverse effects associated with product defects and errata (deviations from published specifications), and by litigation or regulatory matters involving intellectual property, stockholder, consumer, antitrust, disclosure and other issues, such as the litigation and regulatory matters described in Intel’s SEC reports. An unfavorable ruling could include monetary damages or an injunction prohibiting Intel from manufacturing or selling one or more products, precluding particular business practices, impacting Intel’s ability to design its products, or requiring other remedies such as compulsory licensing of intellectual property. A detailed discussion of these and other factors that could affect Intel’s results is included in Intel’s SEC filings, including the company’s most recent reports on Form 10-Q, Form 10-K and earnings release.