Young Architect Workshop

Srilatha (Bobbie) Manne
AI and Advanced Architectures
Microsoft
Road to Success

“The Road to Success is Always Under Construction.”

Lily Tomlin
My Background

- PhD
- Alpha Team
- Intel Team
- Kid #1
- Kid #2
- AMD Research
- Home Office
- Cavium
- Microsoft

Year Timeline:
- 1999
- 2001
- 2003
- 2007
- 2014
- 2018
To Boldly Go Where No One Has Gone Before

• Parts
• Process
• Potential
The Parts

- Find the right professor/area
- Take background classes
- Have a good tool belt
- Have an elevator pitch
- Read, Read, Read…
Finding the right research group

- Is this the area you are interested in?
- Large groups or small?
- Structured group or flexible?
- New professor or established faculty?
Computer Architecture Tool Belt

- Simulators (gem5, Pin, QEMU, DynamoRio, GPGPU-Sim, McPat)
- Scripting languages (Python, Perl, or something else)
- Data analysis tools (Pandas, R, etc)
- Performance analysis (perf, vtune, CodeAnalyst, power measurement tools)
The pitch

To cite Susan Eggers (Eckert-Mauchly Award Winner, 2018), have an elevator pitch ready
1.) This is what I’m working on
2.) This is why it’s important
3.) This is my solution, and why it’s different from what others are doing
Reading Papers

- Average of ~60 papers/conference
  - 240 papers from HPCA/ASPLOS/ISCA/MICRO
  - 4 hours/paper

- Reading notes:
  - Note the negatives
  - Note at least one thing positive
  - Start listing ‘what-if’ questions
Some suggestions on how to read papers

- From: “How To Read A Paper”, by S. Keshav
  - Bird’s eye
  - More detailed analysis
  - Think about how you would address the same problems
The Process

- Survey papers: Not just in your field, but in related fields
- The big problems
- Cross pollinate
- Go back in time
- Network, network, network (internships are great)
Go for the Big Problems... but be prepared to deviate

- Ubiquitous security
- Memory wall
- Reconfigurable accelerators
- Agile computing
- Biological computing
- Reverse engineering the brain
Look around you...

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**ML Papers (ISCA)**

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What’s next?
Step Back in Time

- Virtualization
  - Burroughs, IBM (1970s)
- Out-of-order Execution
  - Tomosulo’s algorithm: 1960s
- Confidence Estimation
  - Branch Prediction: 1981
- Transactional Memory
  - PL and Databases: 1986
- Cloud Computing
  - Utility Computing: 1960s
Network

- Find out what others are doing within and outside your field
  - Conferences
  - Grad student get togethers
  - Keynote talks
- Leverage internships
  - Attend intern talks
  - Schedule meetings with people ... ask them what they find interesting
The Potential

- Learn to ask questions
- Ignorance is bliss
- Violate rules and premises
- Failure is a part of the process
- Lean on someone... (friend and critic)
- Know and value your strengths
- Find and follow your passion
Questions are more important than answers

*Ignorance: How it Drives Science* by Stuart Firestein

- “...don’t talk about what is known; ... talk about what you’d like to figure out...”
- “… no surer way to screw up an experiment than to be sure of its outcome”
Sometimes it’s better to not be encumbered by “established beliefs”

Present Bias
- Makes us discount the past
- Forces us to take fewer risks

Myopic judgement
- If you have a hammer, everything looks like a nail)

Theory Induced Blindness
- Once you have accepted a theory, it’s extraordinarily difficult to notice its flaws.
Violate Rules and Premises

Beliefs/premises that are no longer true

► Pipelines built for CISC are fundamentally different than RISC
► Custom design is always better performing than design automation tools
► Speculation is ‘safe’
Failure is part of the process

- The research idea does not produce the expected results.
- Your paper gets rejected (again, and again, and again...).
- Your product gets cancelled.
Lean on someone

- A friend who will help you through the tough times
- A critic who will make your work stronger
Know and Value Your Strengths

Everyone has strengths and weaknesses

- Deep knowledge base
- Big idea person
- Data analyst
- Detailed organizer
- Intuitive thinker
- Experienced engineer
- Great presenter/networker
Find and Follow Your Passion

“Science is not only a discipline of reason, but, also, one of romance and passion.” Stephen Hawking

- Grad school is a long process
- Lots of frustration interspersed with occasional clarity and, if you’re lucky, an epiphany
- Love what you do...
“If we knew what we were doing, it would not be called research, would it? “
Albert Einstein