With Thanks

The Networking Research Group, MSR
  • Esp. Victor Bahl, Srikanth Kandula, Jitu Padhye, Ming Zhang

Advisors and mentors
  • David Wetherall, Tom Anderson
  • Sally Floyd, Miguel Castro, Ant Rowstron

Collaborators
  • Aruna Balasubramanian, Lili Qiu, Charles Reis, Maya Rodrig, Neil Spring, Arun Venkataramani, John Zahorjan, Yin Zhang, ..........
How to build research network systems in your spare time

Ratul Mahajan
This talk

Goal:
• Articulate a research method for building network systems

Non-goal:
• Building consensus
Common concerns for research network systems

Do we need another paper on ...?
Is this problem important?
Does this solution work?
What is new here?
Why not solve the problem this other (simpler) way?

Do these represent flaws in the research process or communication?
A method for building research network systems

0. Pick the domain carefully
1. Know the problem well before you build
2. Debate several solution ideas
   • Have a core idea to what you build
3. When building, start small and then embellish
4. Make it real
Picking a domain

Be wary of the hot trends
Observe the world for changes
• Workload, technology trends, concerns
• New technologies
• Government regulations

Prefer underexplored domains
Serendipitous matches

Large enterprises → Small enterprises
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1. Knowing the problem

Papers alone are rarely a good source

Scrubintize (e.g., measure, survey)

• verb, to look over closely

• Use imagination to guide what and how to scrubintize

• Do not imagine the problem!
Some scrutiny how-to's

Client-BS connectivity pattern in a realistic setting did not match observations in controlled environments
Output of well-done scrutiny

Primary:
- Identification of real issues and non-issues
- An estimate of the benefit before you commit fully
- Detailed insight
  - E.g., domain characteristics that you can leverage

Secondary:
- Sets up evaluation for later
- Risk reduction in publishing
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Fishing for solution ideas

Filter your problem to its crux

Bradley.chattablogs.com
Idea triage

Set up an idea racetrack

• Compare relative strengths
• Focus on the essence
• Give others’ ideas a fair shake
  • “Not invented here” is not a disqualifying criterion

Helps to have an “adversary”

Answer new measurement questions that arise
Output of the triage exercise

A promising solution idea (or two)
- Core of the system that you are about to build
- Simple to express

Clarity on the design space
- Reframing of the problem
- Classification of your own terms
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Building the system

Start small

- Quickly check if the idea works at all
- Consider using controlled experimental platforms first
- Hardcode certain factors

Then embellish as needed to make it work

If it does not work as expected:

- Figure out why
- Return to idea generation with the newfound knowledge
Evaluating your system

Does it work?

• How does it compare to the state of art?

Why/when does it work?

• Do its assumptions hold in practice?

What are the benefits (or costs) of its complexity (or simplifications)?
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Making it real

Identify the impediments to making your work go beyond the paper

- Release data, code
- Deploy (e.g., on PlanetLab)
- Talk to practitioners, technology transfer
- More research, perhaps in other areas

Often takes you outside your traditional researcher role, but well worth it.
How does this method help address those common concerns?

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Debate several solution ideas
When building, start small and then embellish
Make it real

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Summary

Good research processes help avoid common mistakes and improve efficiency

• As a community, we should openly share what works well and what doesn’t

One process:

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