Networking Research, Education, Mentoring and Service:
Ten Insights and a Look into the Future

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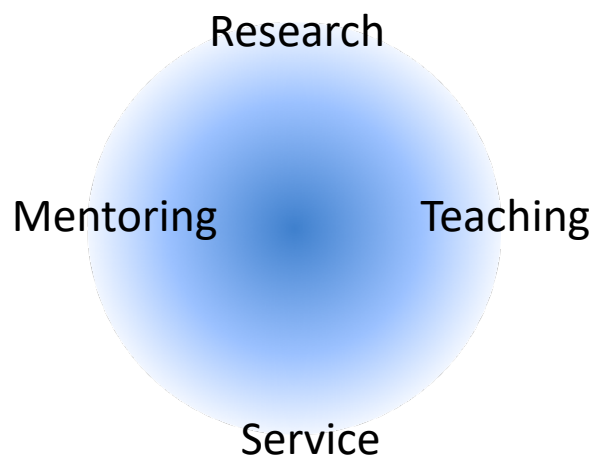
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2018 IEEE Infocom

Overview

Research

Mentoring

Teaching

Service

Top 10 lists: I *love* them

- "10 pieces of advice I wish my PhD advisor had given me", *CoNEXT, INFOCOM, N2Women student/workshops*
- "10 tips for writing a paper"
- "10 tips for writing a proposal," *CRA Career Mentoring workshop*
- "Networking Education and the hands-on experience: 10 observations, insights, and advice that I wish someone had told me"
- "10 Networking Papers: Recommended Reading," *ACM CCR* 2006
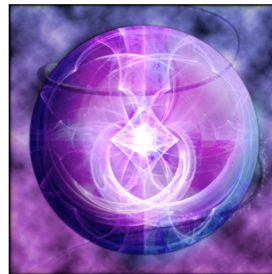
www.cs.umass.edu/~kurose

Observations about past, future: tough!

Future

Past

rose colored glasses   crystal ball
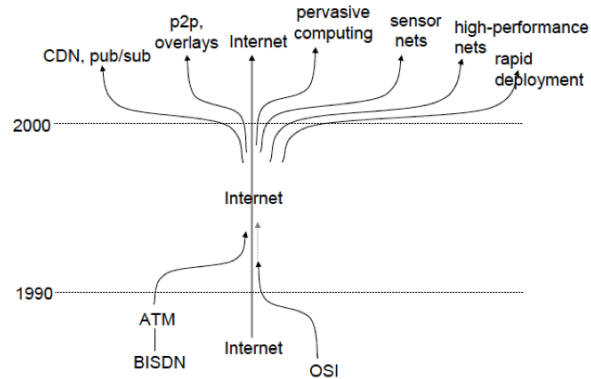
Observations about past, future: tough!

IEEE Infocom Keynote (Hong Kong 2004):
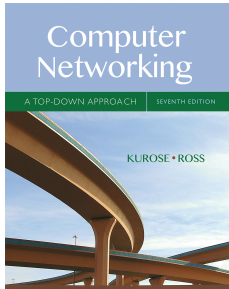

Observations about past, future: tough!

From 2006 Multimedia workshop (Paris)
(two days after Google acquired YouTube)

Observations about past, future: tough!

1995: Jim and Keith approach a publisher, with book idea

7th edition, 2016
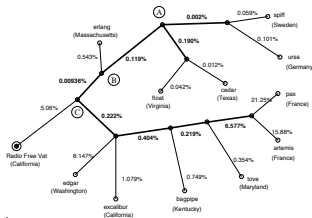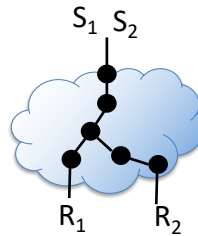
Overview
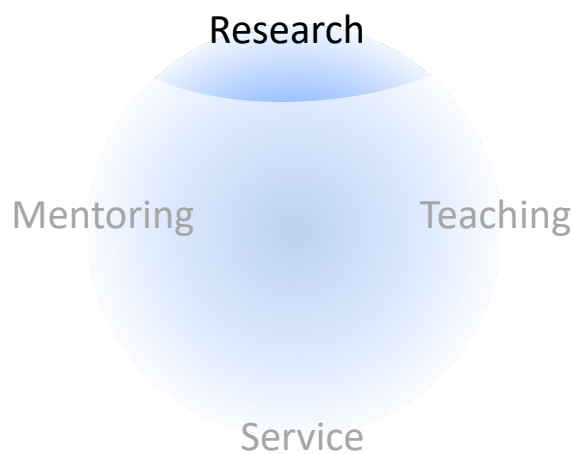
Research: what makes a problem interesting?

network measurement, inference: hands-on, rigorous

Packet Loss Correlation in the MBone Multicast Network

Detecting Shared Congestion of Flows Via End-to-end Measurement
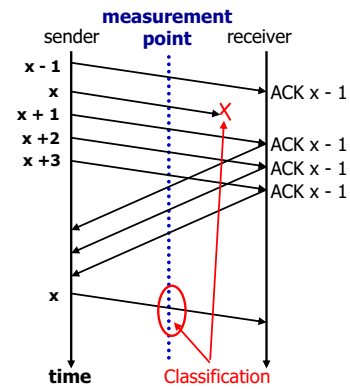
measurement in the middle

Research: what makes a problem interesting?

modeling: models provide and reflect insight

content-caching networks: bounding calculus, approximation algorithms

Packet-switching:
queueing networks
(Kleinrock, 1963)

more: multicast, video, network calculus, …

Research: what makes a problem interesting?

sensor networks: deployment, architecture, impact, interdisciplinary
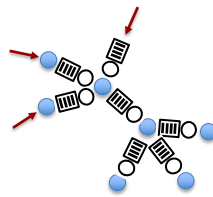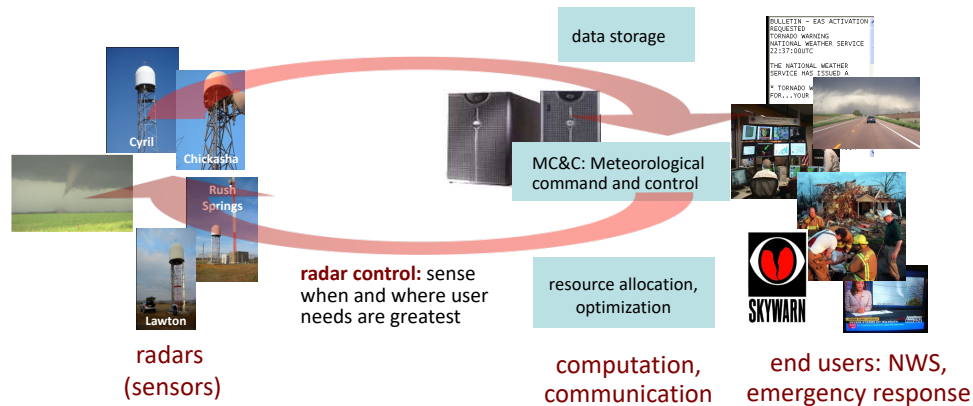

data storage

MC&C: Meteorological command and control

radar control: sense when and where user needs are greatest

resource allocation, optimization

radars (sensors)

computation, communication

end users: NWS, emergency response

CASA: Collaborative **A**daptive **S**ensing of the **A**tmosphere

Research: what makes a problem interesting?

network architecture: "big picture" challenges for large scale systems

- Signaling: hard state versus soft state
    - "robustness" (non-fragility)
    - complexity of control
    - maintainability
    - evolvability
    - adaptability
    - reconfigurability
    - security
    - manageability
- MobilityFirst: logically-centralized control plane element for generalized mappings (e.g., name, location)
    - context-sensitive (attribute specific) services

Picking Research Problems: carefully

A fool can ask more
questions in a minute
than a wise man/woman
(or a Yoda) can answer in a lifetime

- what's the fundamental issue you're solving?
- will the problem be of interest five, ten years from now?
- how "crowded" is the field?
  - lots of smart people!
  - what's your advantage?
- focus on fundamentals, solutions that cut across a solution space

#1

Picking Research Problems: carefully
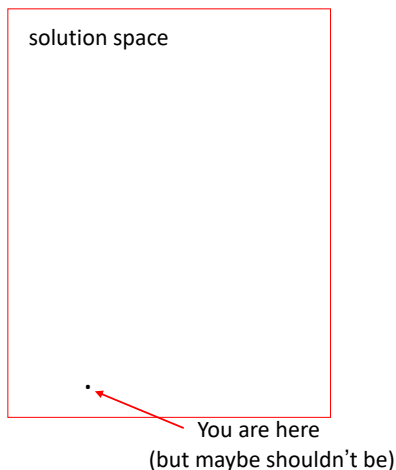
solution space

You are here
(but maybe shouldn't be)

- what's the fundamental issue you're solving?
- will the problem be of interest five, ten years from now?
- how "crowded" is the field?
  - lots of smart people!
  - what's your advantage?
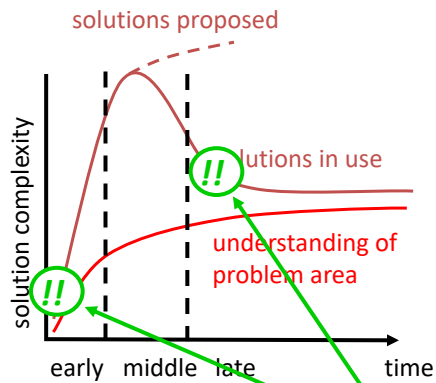- focus on fundamentals, solutions that cut across a solution space
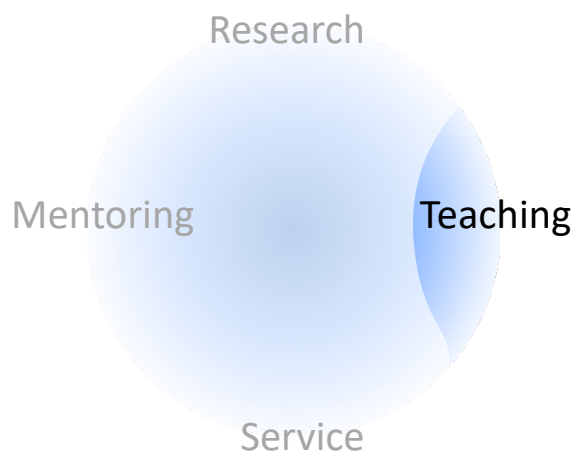
Choosing, defining a research problem

solutions proposed

solution complexity

lutions in use

understanding of
problem area

!!

!!

early   middle   late   time

[adapted from Hluchyj 2001]

maximum impact / mindshare

- complexity, sophistication are themselves not of interest
- simple is sometimes harder!

#2

Overview

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Teaching

- 50% an acquired art: *can be studied, and learned*
- 50% connecting with students, caring
- Question: what is the value of of "being there"
  - *active learning:* research shows: better learning outcomes
  - you can learn, try it!

#3

Teaching: a prediction

- tomorrow "textbooks": high quality, highly interactive, high production value
- interactive, with video, interactive animations, problems, reviews, question/answering
  - *teaching challenge:* what will be the "value added" by in-class participation?

As teachers, we will need to become increasingly aware of the value we add over technology-based education


#4

Computer Science for All (CS for All)

- Enable *all* students to have access to high-quality CS education in K-12:
    - knowledge base, capacity for rigorous, engaging CS education
    - foundation in NSF CS10K investments
    - professional development for educators
    - new Computer Science Principles AP exam
- Collaboration: NSF, Dept. Ed., industry, non-profits
- CISE, EHR: $120 million over five years

"In the new economy, computer science isn't an optional skill – it's a basic skill…"

President's Weekly Address 1/30/2016

CS Education

CS UG programs

Booming CS enrollments

Newly declared undergrad CS/CE majors
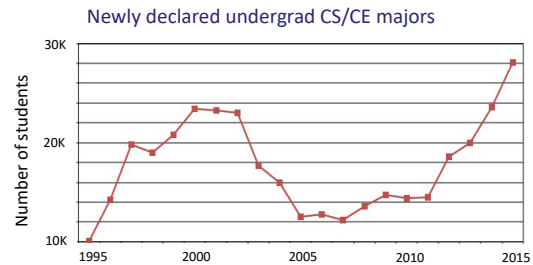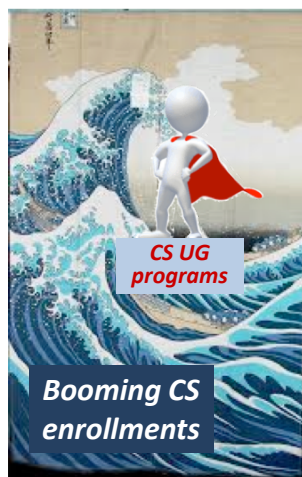
Explosion of interest seems different this time around
- broader interests
- minors, other disciplines

CS Education

- *second sea change (tsunami):* broadening interest in computing among incoming students
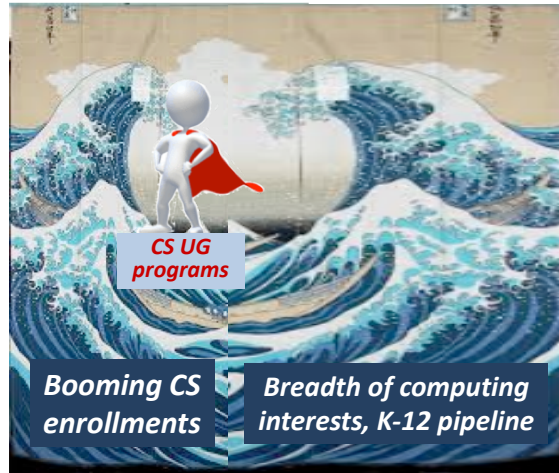- success of CS10K, CS4All
- CS+X

#6

Overview

Research

Mentoring   Teaching
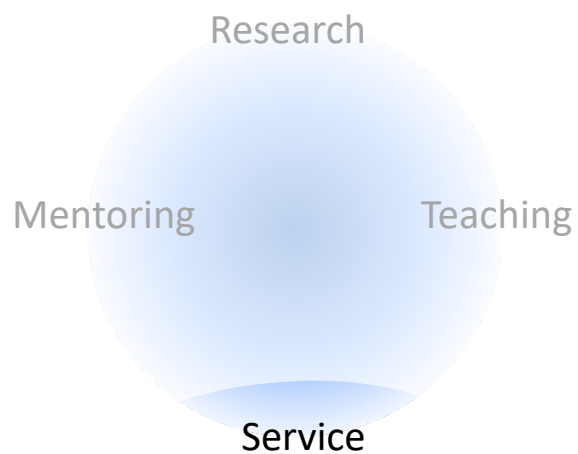
Service

Service

- do it because you love it, and you think it needs to be done
  - 1st Infocom student workshop (2005) (with Edmundo de Sousa e Silva)
  - Sigcomm education workshops (2002,2003,20011)
  - journal EIC positions, PC positions
- service to larger community: your institution, CS community, government (NSF!):
  - good leaders are needed from (and for) our community
- if you do it, do a *jrex* (a.k.a. amazing) job

Overview

Research

Mentoring
- colleagues
- grad students

Teaching

Service
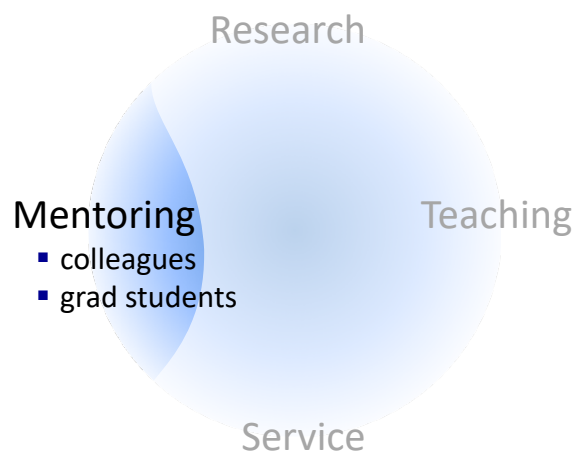
Mentoring: the *process* of doing research

apprenticeship

- research is still a guild
  - grad student = apprentice
  - early career faculty need mentoring also!
- what my former students tell me 1-25 years later:
  - learn research process, how to define/frame problems
  - communication: writing, speaking
- early career faculty, researchers: learning the "ropes"

#7

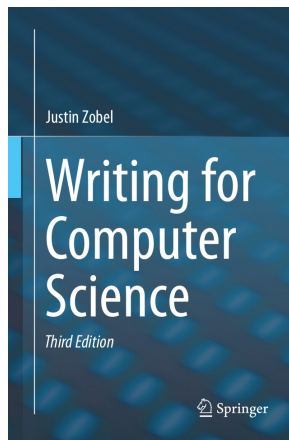# Learn how to write *really* well

"No tale is so good that it can't be spoiled in the telling" Proverb

- can *not* overstress importance of good writing
  - the most important course?
- "unfair advantage" in paper selection, proposal
- best investment of your time
- study role models

http://www-net.cs.umass.edu/kurose/writing/

#8

Recommended reading:

Writing for Computer Science
by Justin Zobel
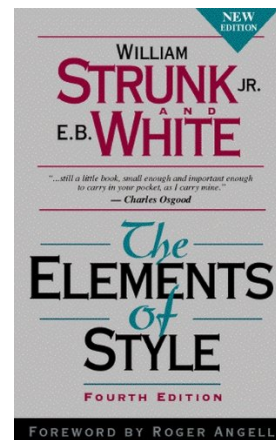
The Elements of Style
by William Strunk E. B. White
(50 years old – and still a classic!)

Learn how to speak *really* well

- Can't overstress importance of good speaking
  - important course to teach/take?
- "unfair advantage" in mindshare
- convey exciting story/message
  - thoughtful
  - engaging
  - clear, concise
- practice, practice practice
  - videotape, critique yourself
  - study role models

#9

Identify role models

- who does something you care about *really* well?
  - how do they do it?
- many role models:
  - no one does everything
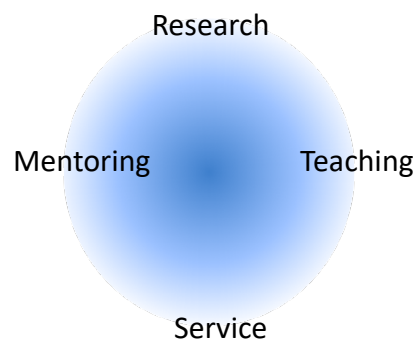 - find your balance
- get a mentor
- be a mentor

#10

Overview

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… a few final observations….

Final observations

Networking research community: vibrant!
- SDN, NFV: solving management and control plane challenges; bringing computation to the edge
- Mobility, wireless
- cybersecurity
- data
- cyberphysical systems, IoT
- ….

More generally: evolving human-technology frontier
- networking's key role when computing is embedded on, around, and in us

Final observations

- constant need to "prove" yourself
  - being out of your comfort zone can be hard but …
  - the need to keep learning
- privileged to be doing what we do
  - working in a discipline that has, and will continue to, profoundly change the world
  - meaningful work, well paid
  - our roles as teachers and mentors are *impactful*
- work we do is great; people matter

THANKS!

… to the *amazing* PhD students and postdocs I've worked with at UMass:

Supratik Bhattacharyya	Sharad Jaiswal	Sambit Sahu
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Vasanta Chaganti	Ramin Khalili	Shubho Sen
Yu-CHih Chen	Benyuan Liu	Jonathan Shapiro
Shenze Chen	Yong Liu	Rahul Simha
Mostafa Dehghan	Victoria Manfredi	Suresh Singh
Jayanta Dey	Daniel Menasche	Jennie Steshenko
Daniel Figueiredo	Sue Moon	Kyoungwon Suh
Victor Firoiu	Ramesh Nagarajan	Suddu Vasudevan
Timur Friedman	Erich Nahum	Bing Wang
Zihui Ge	Giovanni Neglia	Wei Wei
Majid Ghaderi	Jitu Padhye	Maya Yajnik
Kurt Gordon	Jim Partan	David Yates
Yu Gu	Sridhar Pingali	Ellen Zhang
Yang Guo	Ram Ramjee	Chun Zhang
Dan Gyllstrom	Bruno Ribeiro	ZhiLi Zhang
Simon Heimlicher	Elisha Rosensweig	Mike Zink
Ren Hung Hwang	Dan Rubenstein	

THANKS!

… to all of my research collaborators over the years

THANKS!