

# The Last Word

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# What we learned



- **The classics:** how the networks work
- **The problems:** how networks fail to work
  - a large and growing category!
- **The latest:** how networks *could* work
- so you now can go out and do research
- ...but why would you want to?

Why I'm excited  
about networking

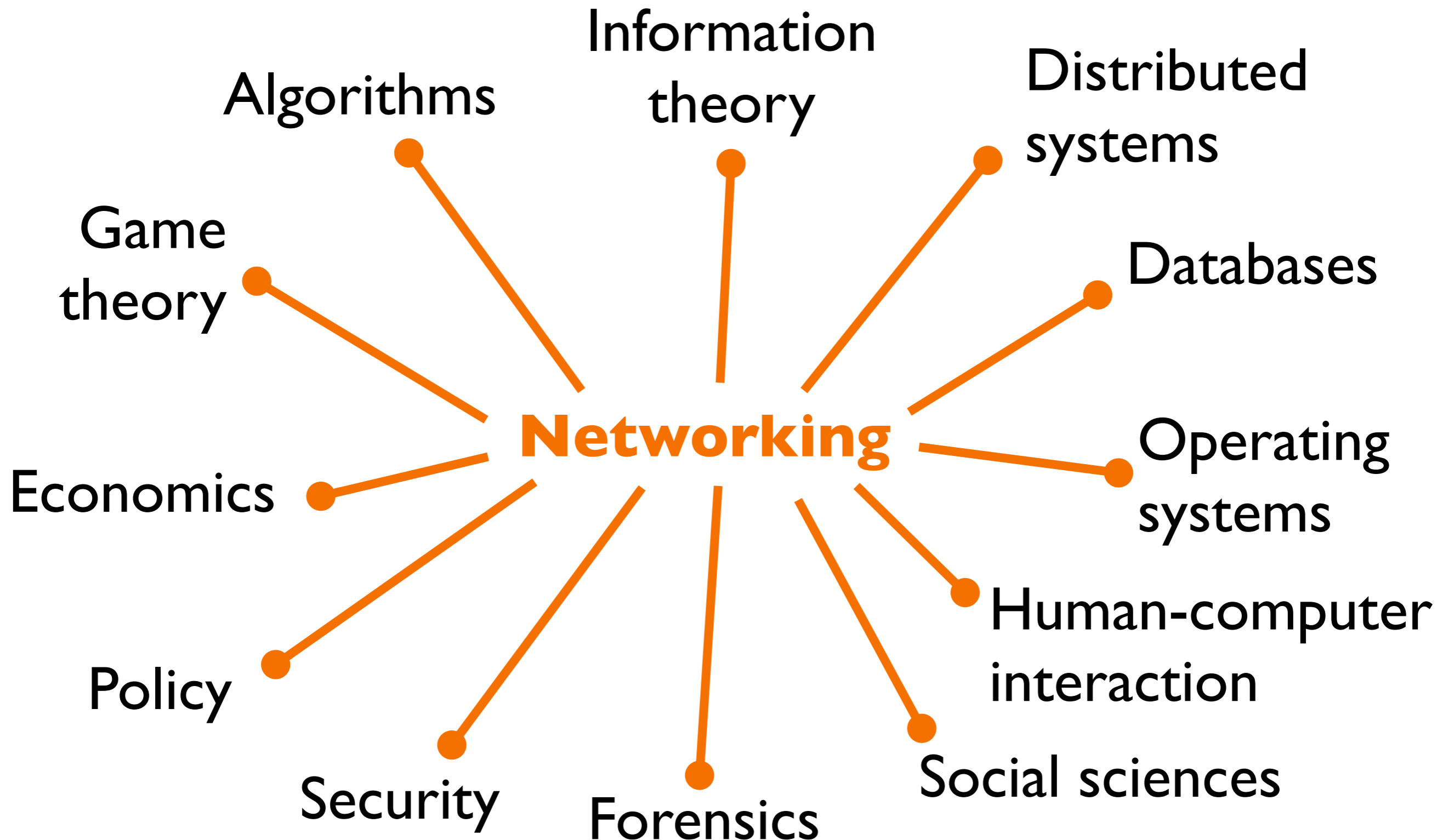
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# I. It's relevant



- Majority of new developments in computer systems are dependent on networking
- Far-reaching impacts

# I. It's relevant



# I. It's relevant



- What we learned matters too!
- April 18, 2010: Interception bug (?) sends 50,000 prefixes through China

```
1. <our host>          0.785ms # London
2. 195.66.248.229      1.752ms # London
3. 195.66.225.54       1.371ms # London
4. 202.97.52.101       399.707ms # China Telecom
5. 202.97.60.6         408.006ms # China Telecom
6. 202.97.53.121       432.204ms # China Telecom
7. 4.71.114.101        323.690ms # Level3
8. 4.68.18.254         357.566ms # Level3
9. 4.69.134.221        481.273ms # Level3
10. 4.69.132.14        506.159ms # Level3
11. 4.69.132.78        463.024ms # Level3
12. 4.71.170.78        449.416ms # Level3
13. 66.174.98.66       456.970ms # Verizon
14. 66.174.105.24      459.652ms # Verizon
[.. four more Verizon hops ..]
19. 69.83.32.3         508.757ms # Verizon
20. <last hop>         516.006ms # Verizon [USA]
```

[James Cowie / Renesys]

## 2. It's new



- We know how to do a lot of things pretty well, but they break when pushed to extremes
  - and these “extremes” happen every day
- ~35 years since the birth of the field
- But only ~15 years since networks in widespread use
  - tussles between businesses, P2P, malware, DDoS, etc. all fundamental but relatively new!
- Operating systems: ~30 years in widespread use
- Physics: ~13.75 billion years in widespread use

## 2. It's new



You can change not just the technology, but the field!

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- Network new people, new technologies, connect disciplines, “make order out of chaos” (–Jen Rexford)
- Start a new subfield!
  - In the last decade: Peer-to-peer, sensor networks, cloud / data centers, energy, Internet architecture
  - A new subfield every 2-3 years – rapid change



# 3. It's changing



- About 3/4 of the world not yet online!
- One trend: networks becoming more like operating systems
  - Simple to complex; open to secure; vertically integrated to virtualized
- Innovation more possible now than ever
  - Big innovative companies changing the Net
  - Build networked systems with software-defined networks, FPGAs, on global testbeds, etc.

# What it all adds up to...



You have the opportunity  
for big impact!

for big impact!

# Where to go from here



- Find inspiration in the top conferences: SIGCOMM, NSDI, Hotnets, CoNext, IMC, ...
- “10 Networking Papers” series in CCR
- Chat with me anytime
- Do great research
- Courses



- **Opportunity for more depth in Internet-related research**
  - Security
  - Operations and management
  - Diagnosing and debugging faults
  - Hot Topics: social networks, energy awareness, cloud computing on the network, ...



This  
Spring!

- Organized by Klara, Indy, & Brighten
- Survey a set of topics, e.g.: Statistics, game theory, streaming algorithms, queueing theory, control theory, ...
- Learn the basics, key results, taste of a full course
- One hr/week, 1-2 lectures on each topic
- Big success last spring!

# What remains



- **Sunday 11:59 pm: project report**
  - submit as PDF via email
- **Thursday Dec 16 1-4pm: poster session**
  - in the 2nd floor atrium outside 2405 SC
  - free food

Thank you!

# One more thing...



- ICES forms!