Risk

Risk Is Central to Software Engineering

- Every bug may cost more to fix later.
- But every change (even bug fixes) may introduce more bugs.
- There are lots of different kinds of risks in software projects!

Today

- Learning goals:
  - Understand how key risks threaten software project success
  - Two key principles that affect software risk: *second system effect* and *the mythical man month.*
    - (sorry — "man" is in the title of a book)

Technical Risks

- You chose to rely on a framework that was "almost done" — but it runs late.
- You rely on a platform, service, or framework that does not quite meet your needs
  - Or adds complexity without delivering enough value
- You underestimate the complexity of your own components

Financial Risks

- Running out of money (e.g., at a startup)
- Getting sued
- Need to give raises (for retention) but now can't hire needed staff

Requirements Risks

- Releasing software that does not meet user needs
  - (even if it is of high quality)
- Releasing software that frustrates users (poor UI)
- Releasing software too late

People-Related Risks

- People leaving
  - By choice (better job offer)
  - By circumstance or disaster (health problems)
  - By being fired (malfeasance)
  - By being stolen by Management to work on a higher-priority project

Management-Related Risks

- Management changes priorities
  - De-prioritizes a feature you invested in
  - Prioritizes a feature you *didn*'*t* invest in
- Management turnover
  - Suddenly spending a lot of time "managing up"

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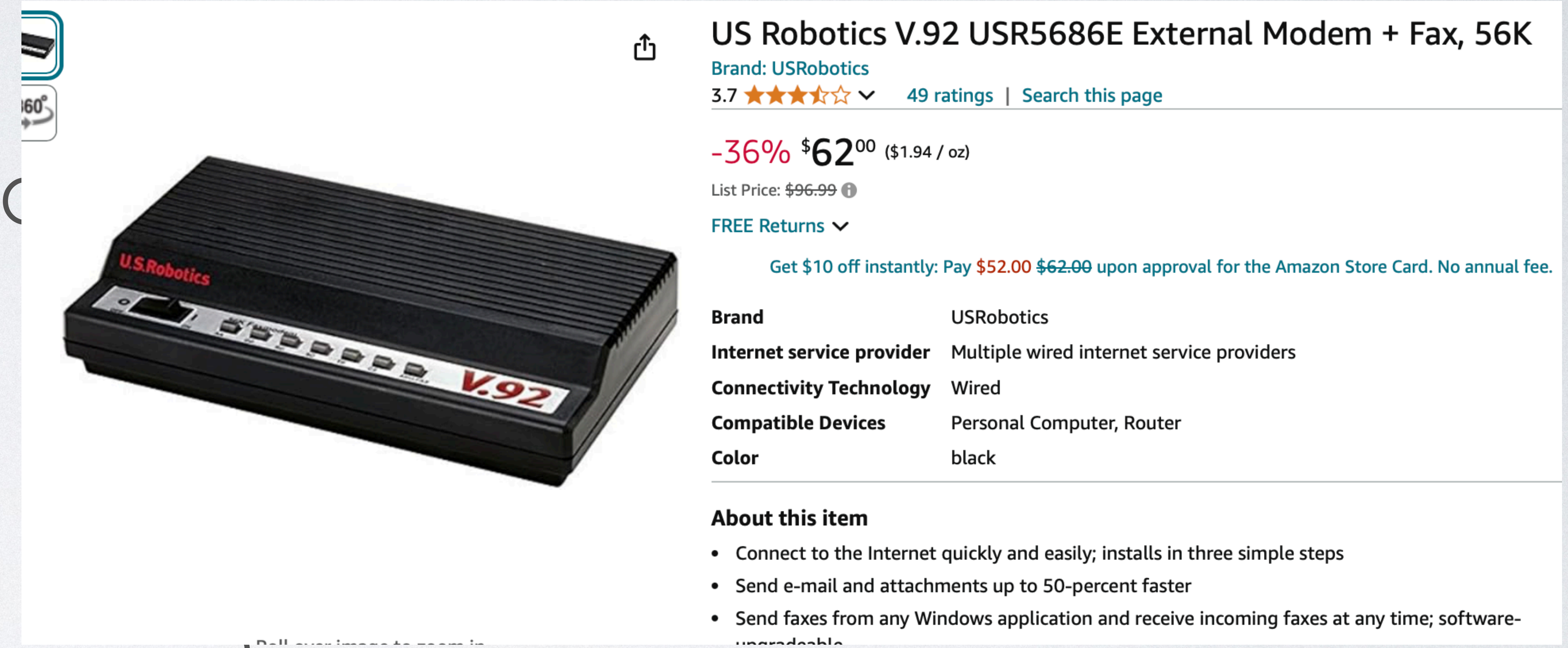

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Brand: USRobotics

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Connectivity Technology	Wired
Compatible Devices	Personal Computer, Router
Color	black

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- Connect to the Internet quickly and easily; installs in three simple steps
- Send e-mail and attachments up to 50-percent faster
- Send faxes from any Windows application and receive incoming faxes at any time; software-upgradeable

Roll over image to zoom in

- Does anyone author DVDs anymore?
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Osborne 1

- First sold in 1981
- 4 MHz CPU, 64 KB RAM
- 5" monochrome CRT
- Portable (24.5 lbs)

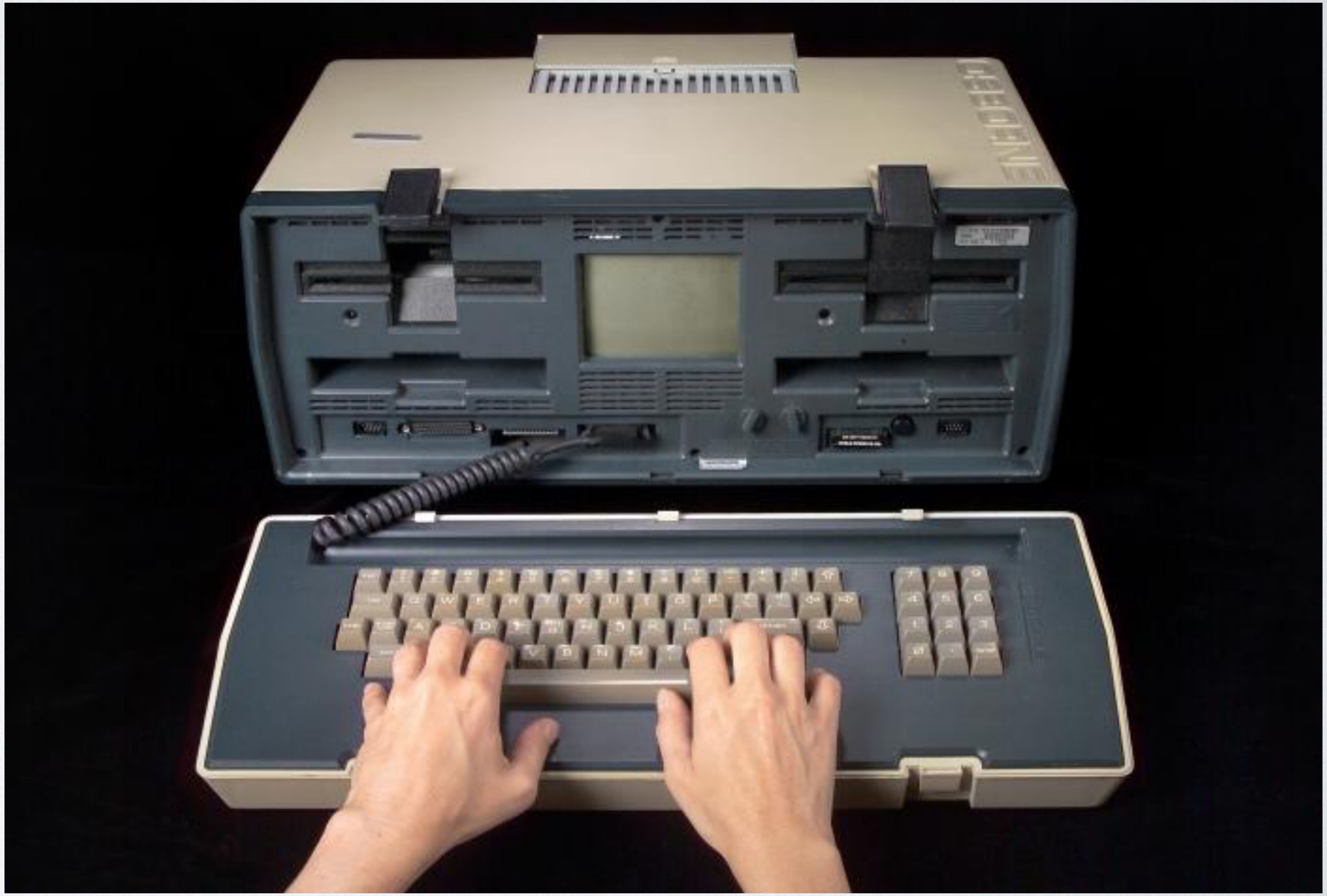

Image credit: Wikipedia

The Osborne Effect

https://en.wikipedia.org/wiki/Osborne_effect

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- Note: Kaypro machine sales were starting to cut into Osborne sales, so this may have been a factor too!

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Scenario #1: Old and Trusted, or New and Slick?

- You are starting a new web app development project.

- Worldwide math tutoring service. Connects tutors with students (who can afford to pay for the service). Vision: 24/7 tutoring. You can get help anytime, day or night, via worldwide staff.

- The year is 2030. React is old and stale (think of Ruby today). "Webby" is up and coming.

- Webby offers better performance, internationalization, and accessibility built-in.

- How will you decide? Changing later would be very expensive.

Scenario #2: Cut or Press Forward?

- One month until you promised your investors the app would launch.
- Two key features have five weeks of estimated work left:
  - AI-based tutor screening (otherwise will have to interview prospective tutors; very expensive)
  - Algorithm-based tutor matching (e.g., need a calculus expert to do calculus tutoring)

- Ideas:
  - Move engineers from A to B (or vice versa); defer the other feature
  - Ask engineers to work evenings and weekends
  - Hire engineers from elsewhere
  - Something else?

The Mythical Man-Month

- (sorry; this is the title of a book from 1975 by Fred Brooks)
- Brooks's Law: adding more people to a late software project makes it *later*
  - New people consume resources getting up to speed ("hey, can you explain…?")
  - New people introduce more bugs
    - New people re-introduce old bugs
  - More people increase communication overhead (meetings…)

Communication Overhead

- Group intercommunication formula: n(n − 1)/2.
- Example: 50 developers give 50 × (50 – 1)/2 = 1,225 channels of communication.
- Moral: keep teams small (not 50!)

source: https://en.wikipedia.org/wiki/The_Mythical_Man-Month

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- Therefore, the *second* system is the riskiest!
- I did this in my second system — even though I knew about the Second System Effect!

Incremental Slippage

- Q: How does a project get one year late?

- A: One day at a time.

Awareness–Understanding Matrix

	Aware	**Not aware**
Understand	**Known knowns**: Things we are aware of and understand	**Unknown knowns:** Things we are not aware of but do understand or know implicitly
Don't understand	**Known unknowns:** Things we are aware of but don't understand	**Unknown unknowns:** Things we are neither aware of nor understand

https://en.wikipedia.org/wiki/There_are_unknown_unknowns

Inherent Vs. Accidental Complexity

- Some problems bring *inherent complexity*
  - Tax software is inherently complex because it has to be at least as complex as the tax code (law)
  - Automated driving software has to handle the complexities of physics *and* driving laws *and* human behavior
- But some software systems make problems *even harder*
  - You've seen these systems too

Conway's Law

- "[O]rganizations which design systems…are constrained to produce designs which are copies of the communication structures of these organizations."

- Therefore, organizational structure poses architectural risks!

https://en.wikipedia.org/wiki/Conway's_law

Surfacing Risk

- Ask team members: what might go wrong?
  - A diverse team is more likely to identify more risks
- Then you can make mitigation plans.

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- New laws in 37 US states require tutors to hold *tutoring licenses*
- Addison-Wesley (textbook manufacturer) launches a new web-based tutoring service
- Now what?

Conclusion

- Surfacing risks in many categories enables you to mitigate them
- Mitigating risks often requires tradeoffs
- Know:
  - *Second system effect*
  - *Mythical man month: Adding new people to a late software project makes it later*