

Teams

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Learning Goals

- Understanding common issues team face
- Solutions to common team issues



NEW COURSE: LANGUAGE DESIGN & PROTOTYPING

17-396/17-696 – SPRING 2020

Little languages are everywhere! Would you like to – or do you need to – design your own?

In this course, you will:

- Learn how to **critique a language design**
- Practice several **language prototyping** approaches (interpreters, transpilers, fluent APIs)
- Apply techniques for **evaluating language designs with users**
- **Design and prototype your own language** in the final project

Prof. Jonathan Aldrich – T/Th 3-4:20

<http://www.cs.cmu.edu/~aldrich/courses/17-396/>

HW 4 Discussion

- Discussion of Microservices answers...
- Interview Thursday with Ciera Jaspan

CASE STUDIES

Disclaimer: All pictures represent abstract developer groups or products to give a sense of scale; they are not necessarily the developers of those products or developers at all.

How to structure teams?

- Microblogging platform; 3 friends



Home | Timeline: You, Public | **Invite!** | Settings | Help

What your friends are doing. (over the last 24 hours)

RayReadyRay Happy to have my coffee, but reminded of a less pleasant scene from the movie Brain Candy, involving man enjoying his coffee. (2 minutes ago) [x](#)

Jack enjoying the music of my friends. (39 minutes ago) [x](#)

Florian just bought my plane ticket. will get to san francisco on the 16th of september. just in time to still see the drawing restraint exhibition. (about 1 hour ago) [x](#)

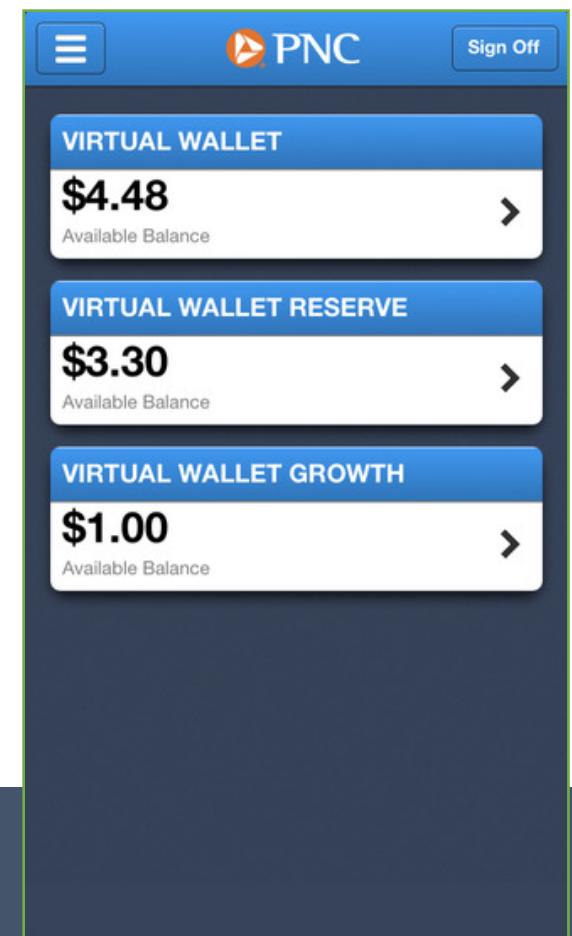
Crystal listening to Erlend Øye and making up for lost time. (about 1 hour ago) [x](#)

ev Waiting for slow bagel. Board mtng in 20 (about 1 hour ago) [x](#)

Jack twtr is sweating in anticipation of its imminent launch... (about 1 hour ago) [x](#)

How to structure teams?

- Banking app; 15 developers



How to structure teams?

- Mobile game;
- 50ish developers;
- distributed teams?



How to structure teams?

- Mobile game;
200ish developers



How to structure teams?

- Ride sharing app and self-driving cars; 1200 developers; 4 sites



TEAMS

Necessity of Groups

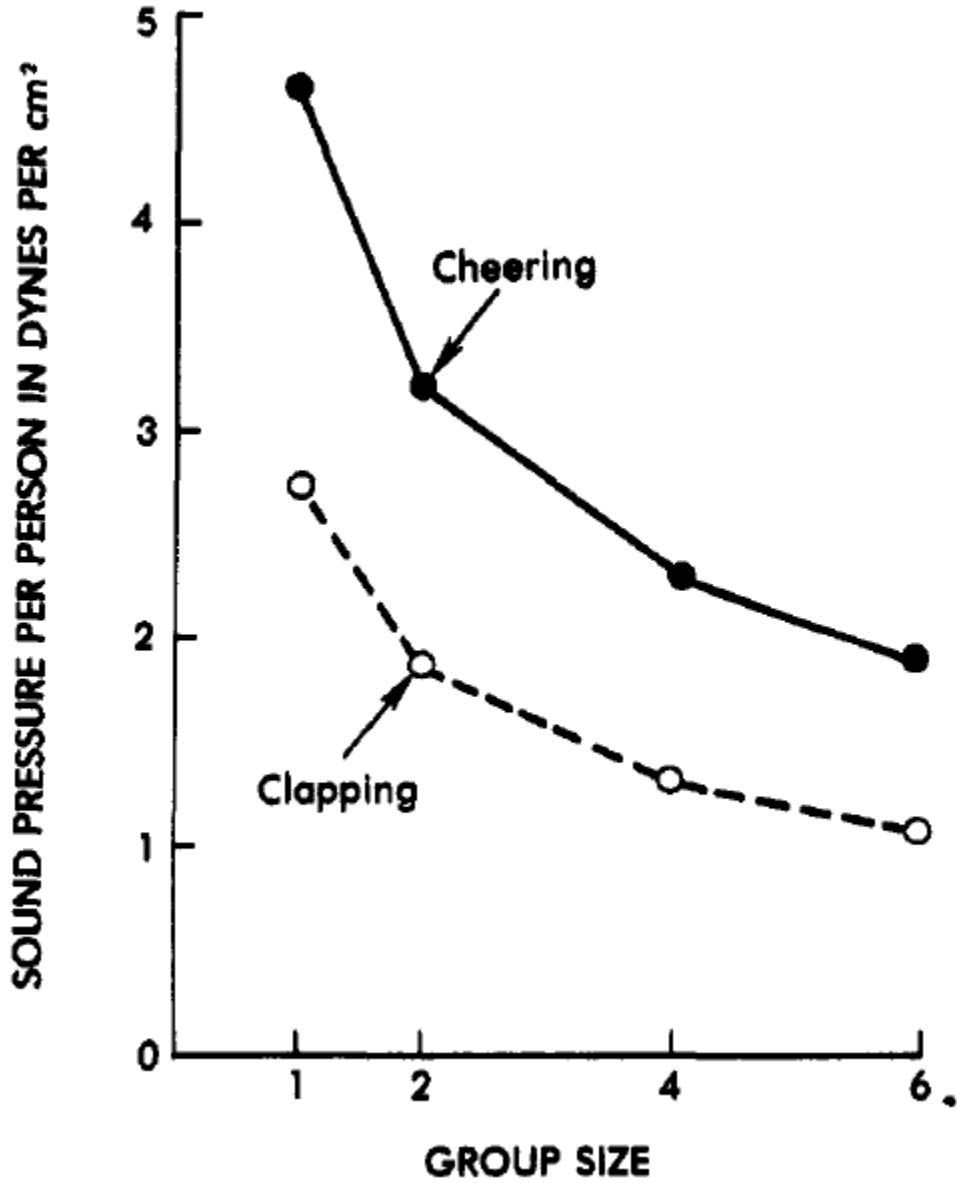
- Division of labor
- Division of expertise (e.g., security expert, database expert)

Team Issues

- Social loafing
- Groupthink
- Multiple/conflicting goals
- Process costs

TEAM ISSUES: SOCIAL LOAFING





Latane, Bibb, Kipling Williams, and Stephen Harkins. "Many hands make light the work: The causes and consequences of social loafing." *Journal of personality and social psychology* 37.6 (1979): 822.

Social loafing

- People exerting less effort within a group
- Reasons
 - Diffusion of responsibility
 - Motivation
 - Dispensability of effort / missing recognition
 - Avoid pulling everybody / "sucker effect"
 - Submaximal goal setting
- “Evaluation potential, expectations of co-worker performance, task meaningfulness, and culture had especially strong influence”

Karau, Steven J., and Kipling D. Williams. "Social loafing: A meta-analytic review and theoretical integration." *Journal of personality and social psychology* 65.4 (1993): 681.

Mitigation Strategies

- Involve all team members, co-location
- Assign specific tasks with individual responsibility
 - Increase identifiability
 - Team contracts, measurement
- Provide choices in selecting tasks
- Promote involvement, challenge developers
- Reviews and feedback
- Team cohesion, team forming exercises
- Small teams

Agile Practices as Mitigation?

Responsibilities & Buy-In

- Involve team members in decision making
- Assign responsibilities (ideally goals not tasks)
- Record decisions and commitments; make record available

TEAM ISSUES: GROUPTHINK



Groupthink

- Group minimizing conflict
- Avoid exploring alternatives
- Suppressing dissenting views
- Isolating from outside influences
- -> Irrational/dysfunctional decision making



Star Wars: Episode I - The Phantom Menace (1999)

55% 59%

Critics Consensus: Burdened by exposition and populated with stock characters, *The Phantom Menace* gets the *Star Wars* prequels off to a bumpy – albeit visually dazzling – start.

Starring: Liam Neeson, Ewan McGregor, Natalie Portman

Director: George Lucas



Star Wars: Episode VI - Return of the Jedi (1983)

80% 94%

Critics Consensus: Though failing to reach the cinematic heights of its predecessors, *Return of the Jedi* remains an entertaining sci-fi adventure and a fitting end to the classic trilogy.

Starring: Mark Hamill, Carrie Fisher, Harrison Ford

Director: Richard Marquand



Star Wars: Episode V - The Empire Strikes Back (1980)

95% 97%

Critics Consensus: Dark, sinister, but ultimately even more involving than *A New Hope*, *The Empire Strikes Back* defies viewer expectations and takes the series to heightened emotional levels.

Starring: Mark Hamill, Harrison Ford, Carrie Fisher

Director: Irvin Kershner



Star Wars: Episode IV - A New Hope (1977)

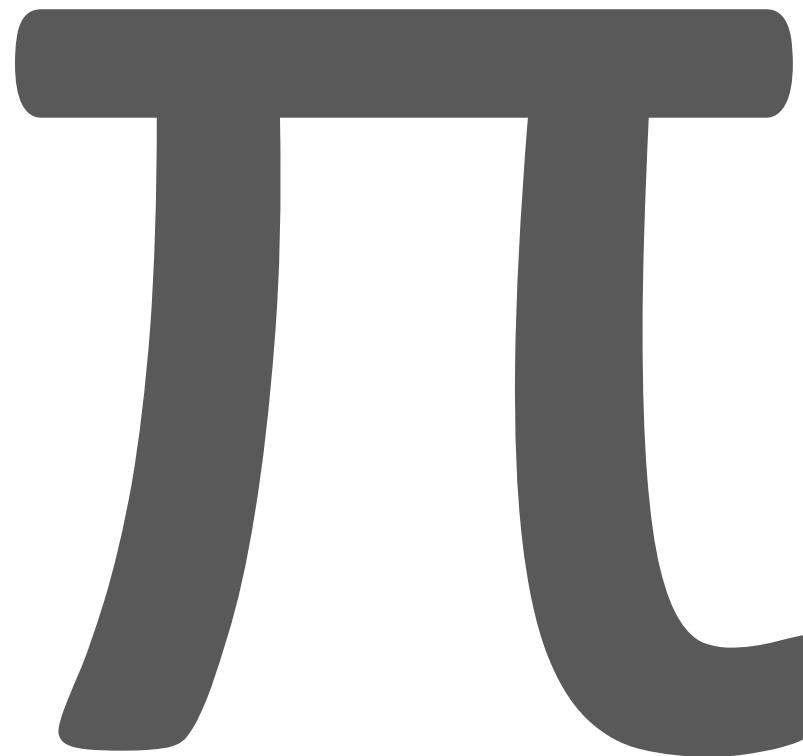
93% 96%

Critics Consensus: A legendarily expansive and ambitious start to the sci-fi saga, George Lucas opened our eyes to the possibilities of blockbuster filmmaking and things have never been the same.

Starring: Mark Hamill, Harrison Ford, Carrie Fisher

Director: George Lucas

Time and Cost Estimation



Causes of Groupthink

- High group cohesiveness, homogeneity
- Structural faults (insulation, biased leadership, lack of methodological exploration)
- Situational context (stressful external threats, recent failures, moral dilemmas)

Symptoms

- Overestimation of ability
 - invulnerability, unquestioned belief in morality
- Closed-mindedness
 - ignore warnings, stereotyping
 - innovation averse
- Pressure toward uniformity
 - self-censorship, illusion of unanimity, ...



Studies Show

- Gender-diverse management teams showed superior return on equity, debt/equity ratios, price/equity ratios, and average growth. -Rohner, U. and B. Dougan (2012)
- Gender-balanced teams were the most likely to experiment, be creative, share knowledge, and fulfill tasks. -Lehman Brothers Center for Women in Business. (2008)
- Gender diversity on technical work teams was associated with superior adherence to project schedules, lower project costs, higher employee performance ratings, and higher employee pay bonuses. -Turner, L. (2009)

Unconscious Bias



We all have shortcuts, or “schemas,” that help us make sense of the world. But our shortcuts sometimes make us misinterpret or miss things. That’s **unconscious bias**.

Unconscious bias

- Pervasive, cultural
- Raise awareness
- Explicit goals
- Measurement

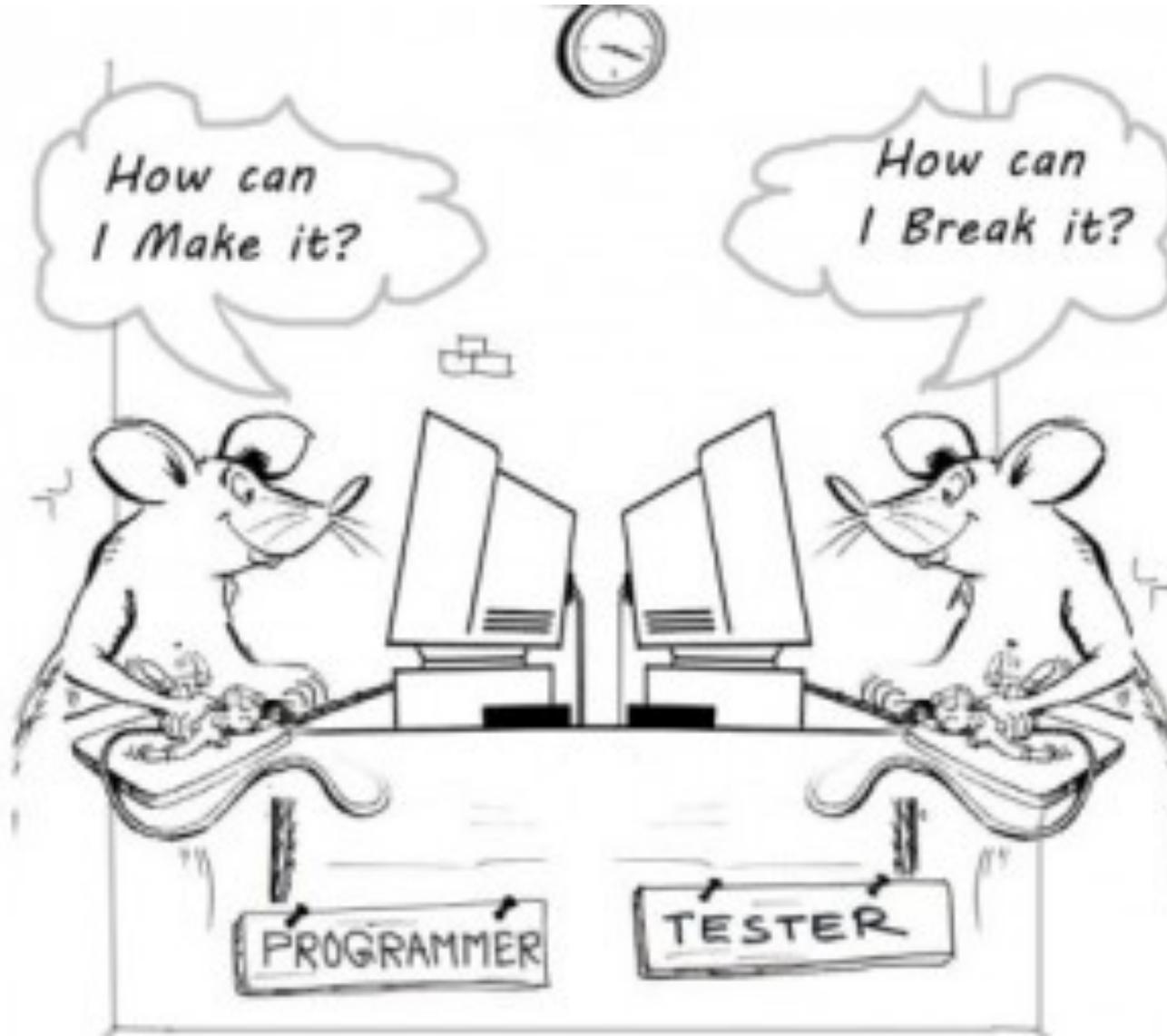
Mitigation Strategies

- Several agile techniques
 - Planning poker
 - Tests, continuous integration
 - On-site customers
- Diverse teams
- Management style
- Avoid HR evaluation by metrics
- Separate QA from development
- Outside experts
- Process reflection
- ...

Practical Help

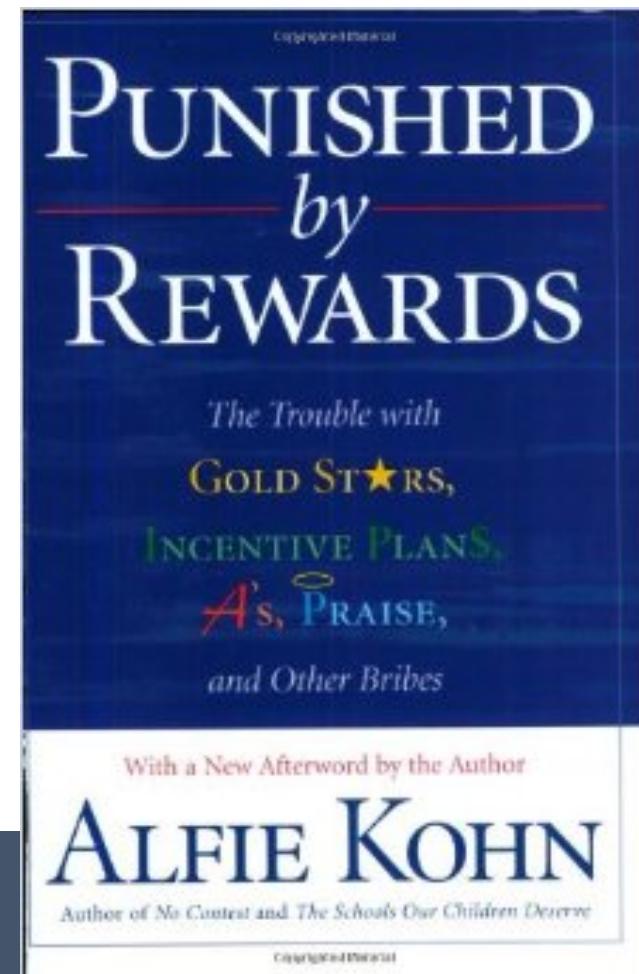


TEAM ISSUES: MULTIPLE/CONFLICTING GOALS



Incentives?

- Team incentives
- vs individual incentives?

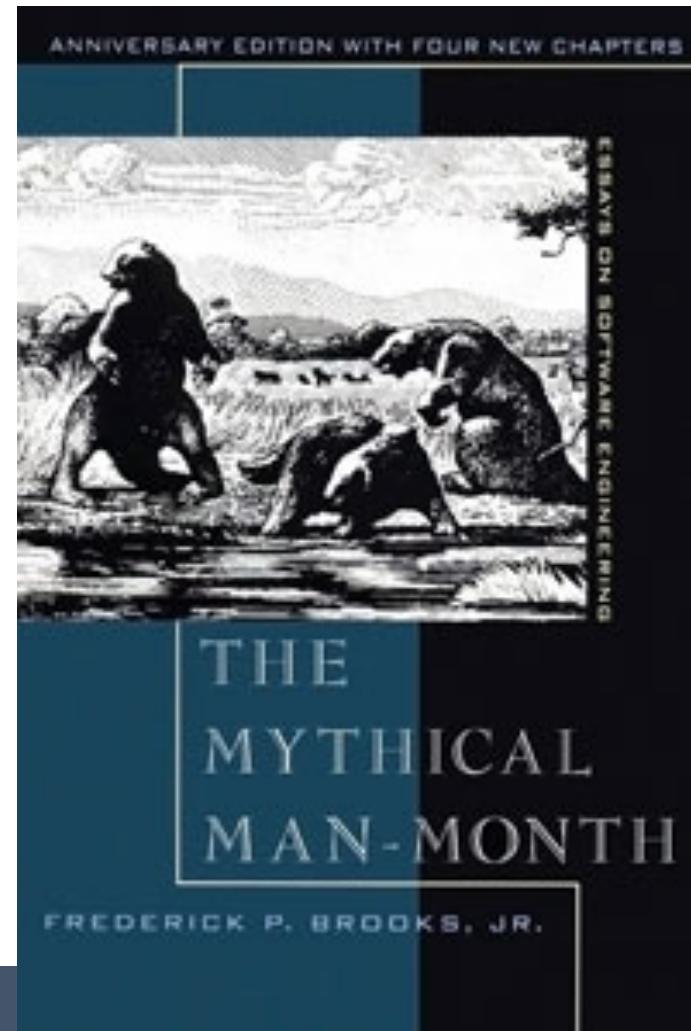


TEAM ISSUES: PROCESS COSTS

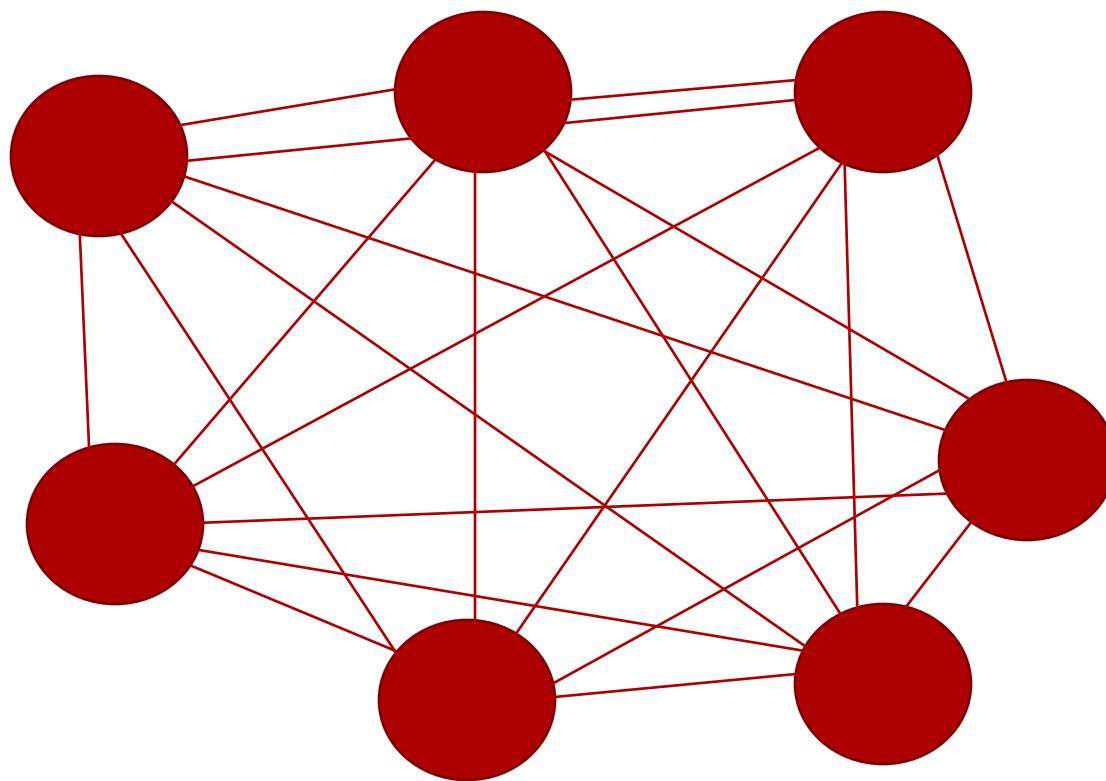
Mythical Man Month

- Brooks's law: *Adding manpower to a late software project makes it later*

1975, describing experience at IBM developing OS/360

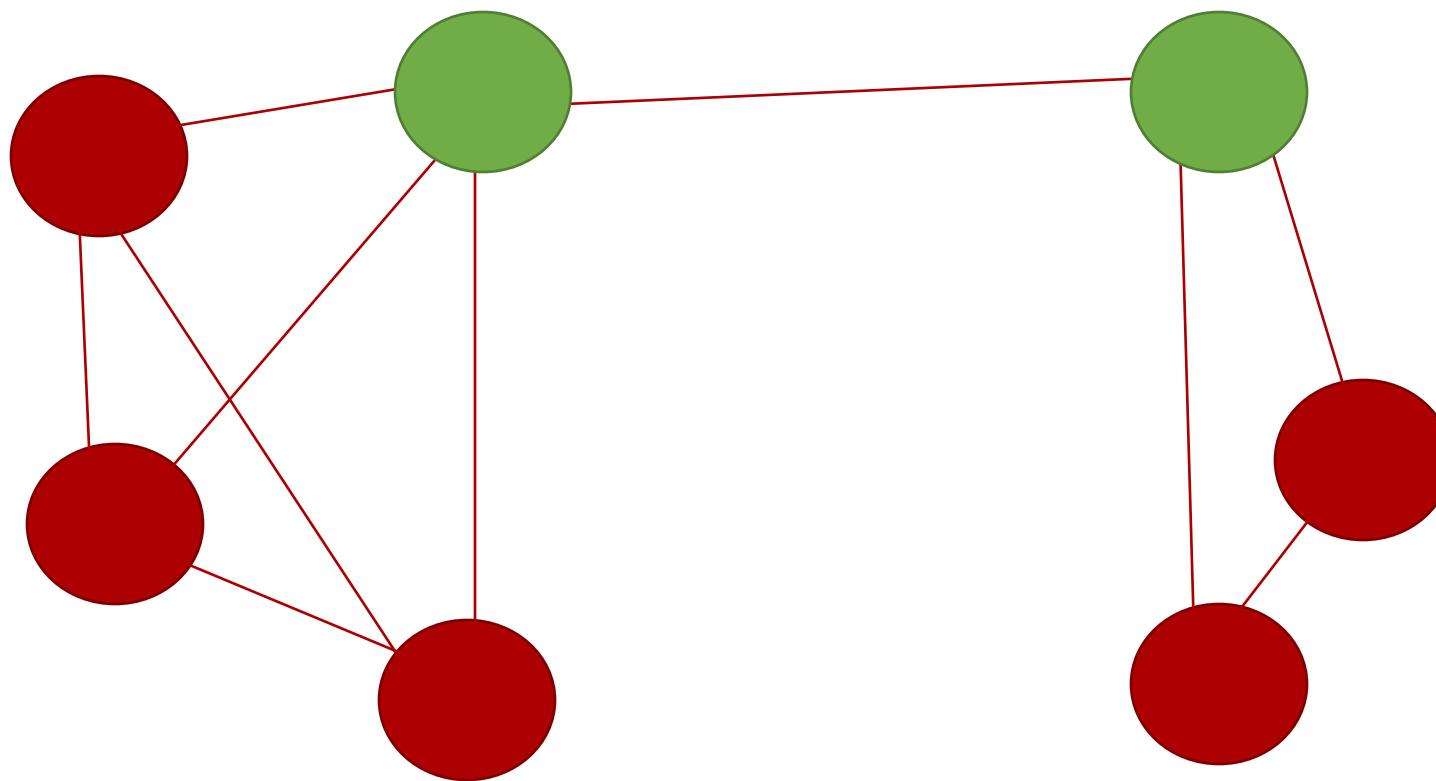


Process Costs


$$n(n - 1) / 2$$

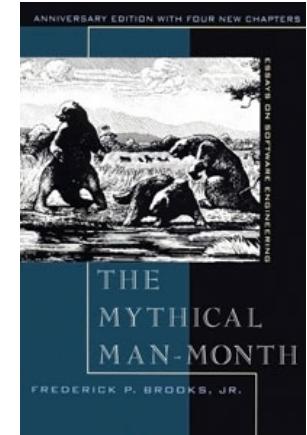
communication links

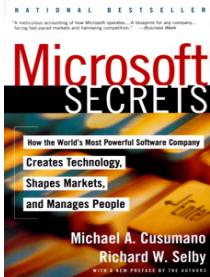
Process Costs



Brook's Surgical Teams

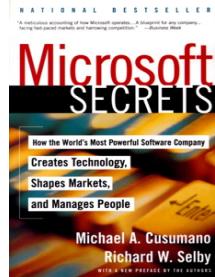
- Chief programmer – most programming and initial documentation
- Support staff
 - Copilot: supports chief programmer in development tasks, represents team at meetings
 - Administrator: manages people, hardware and other resources
 - Editor: editing documentation
 - Two secretaries: one each for the administrator and editor
 - Program clerk: keeps records of source code and documentation
 - Toolsmith: builds specialized programming tools
 - Tester: develops and runs tests
 - Language lawyer: expert in programming languages, provides advice on producing optimal code.





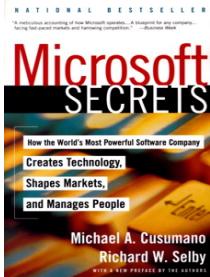
Microsoft's Small Team Practices

- Vision statement and milestones (2-4 month), no formal spec
- Feature selection, prioritized by market, assigned to milestones
- Modular architecture
 - Allows small federated teams (Conway's law)
- Small teams of overlapping functional specialists



Microsoft's Small Team Practices

- Feature Team
 - 3-8 developers (design, develop)
 - 3-8 testers (validation, verification, usability, market analysis)
 - 1 program manager (vision, schedule communication; leader, facilitator) – working on several features
 - 1 product manager (marketing research, plan, betas)



Microsoft's Small Team Practices

- "Synchronize and stabilize"
- For each milestone
 - 6-10 weeks feature development and continuous testing
 - frequent merges, daily builds
 - 2-5 weeks integration and testing ("zero-bug release", external betas)
 - 2-5 weeks buffer

Amazon Teams

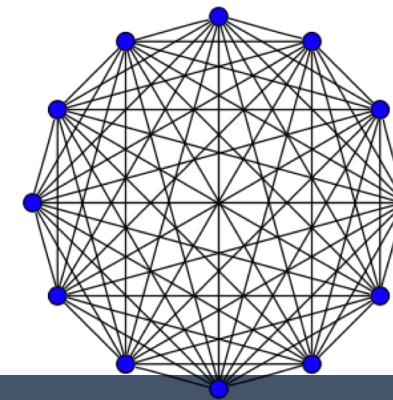
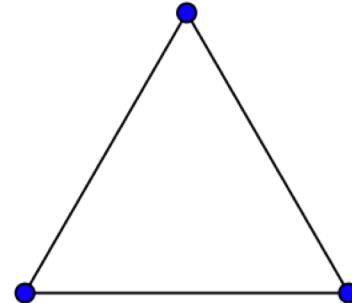


Agile Practices (e.g., Scrum)

- 7+/-2 team members, collocated
- Self managing
- Scrum master (rotating role)
- Product owner / customer representative

Large teams (29 people) create around six times as many defects as small teams (3 people) and obviously burn through a lot more money. Yet, the large team appears to produce about the same amount of output in only an average of 12 days' less time. This is a truly astonishing finding, though it fits with my personal experience on projects over 35 years.

- Phillip Amour, 2006, CACM 49:9



Establish communication patterns

- Avoid overhead
- Ensure reliability
- Constraint latency
- e.g. Issue tracker vs email; online vs face to face

Design opportunity

Awareness

- Notifications
- Brook's documentation book
- Email to all
- Code reviews

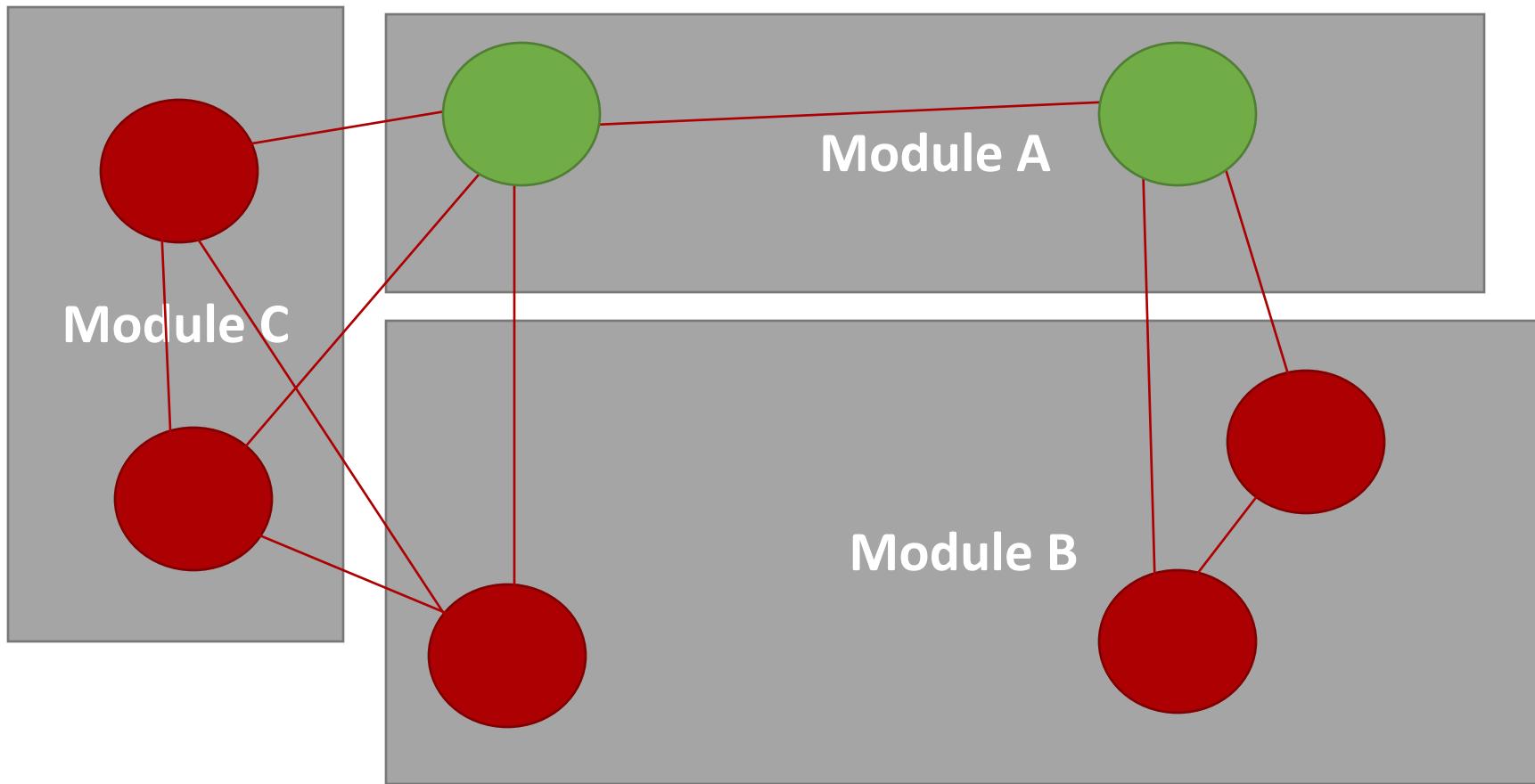
Conway's Law

“Any organization that designs a system (defined broadly) will produce a design whose structure is a copy of the organization's communication structure.”

— *Mel Conway, 1967*

“If you have four groups working on a compiler, you'll get a 4-pass compiler.”

Congruence



Socio-Technical Congruence

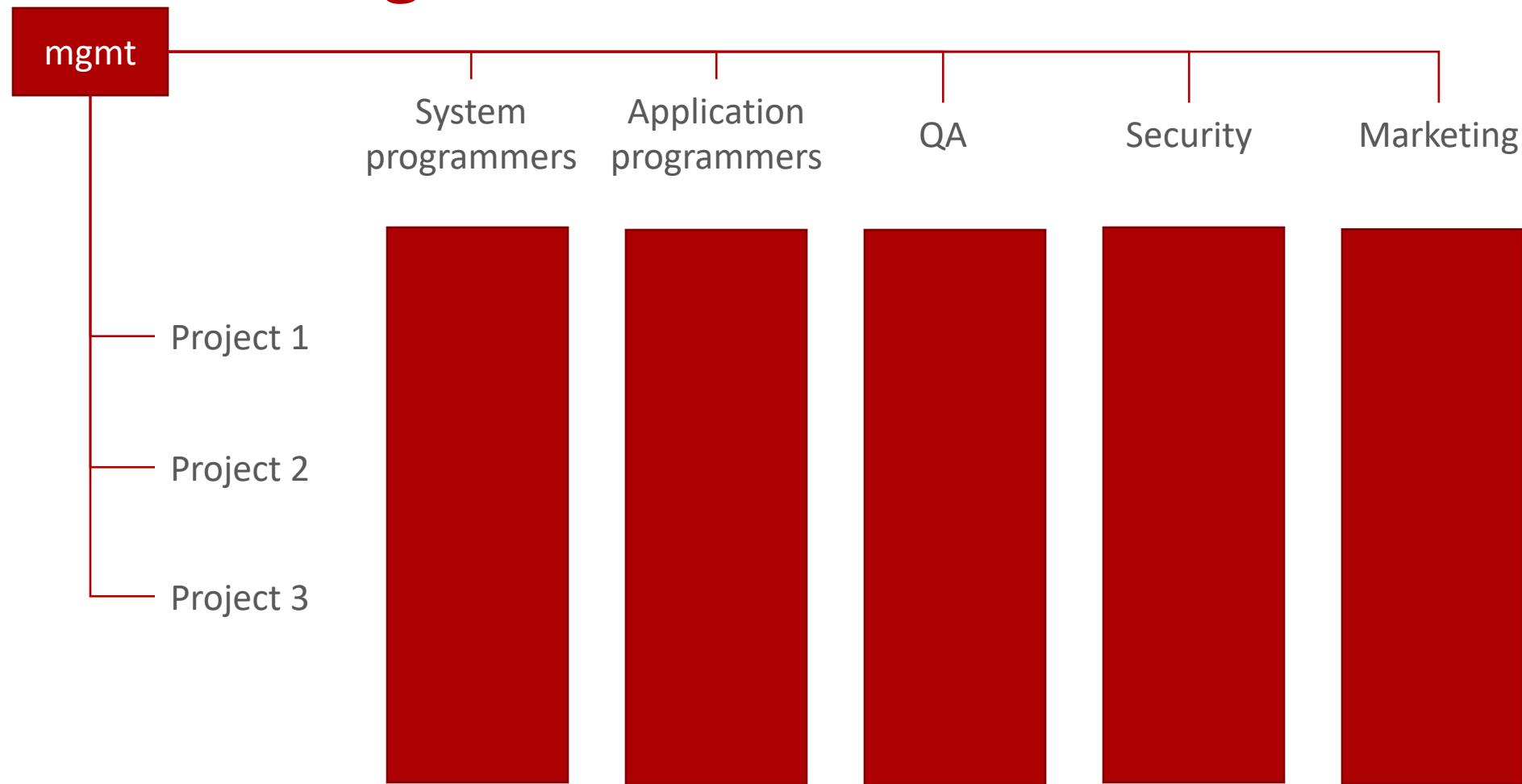
- Structural congruence
- Geographical congruence
- Task congruence
- IRC communication congruence

Teamwork Guidelines

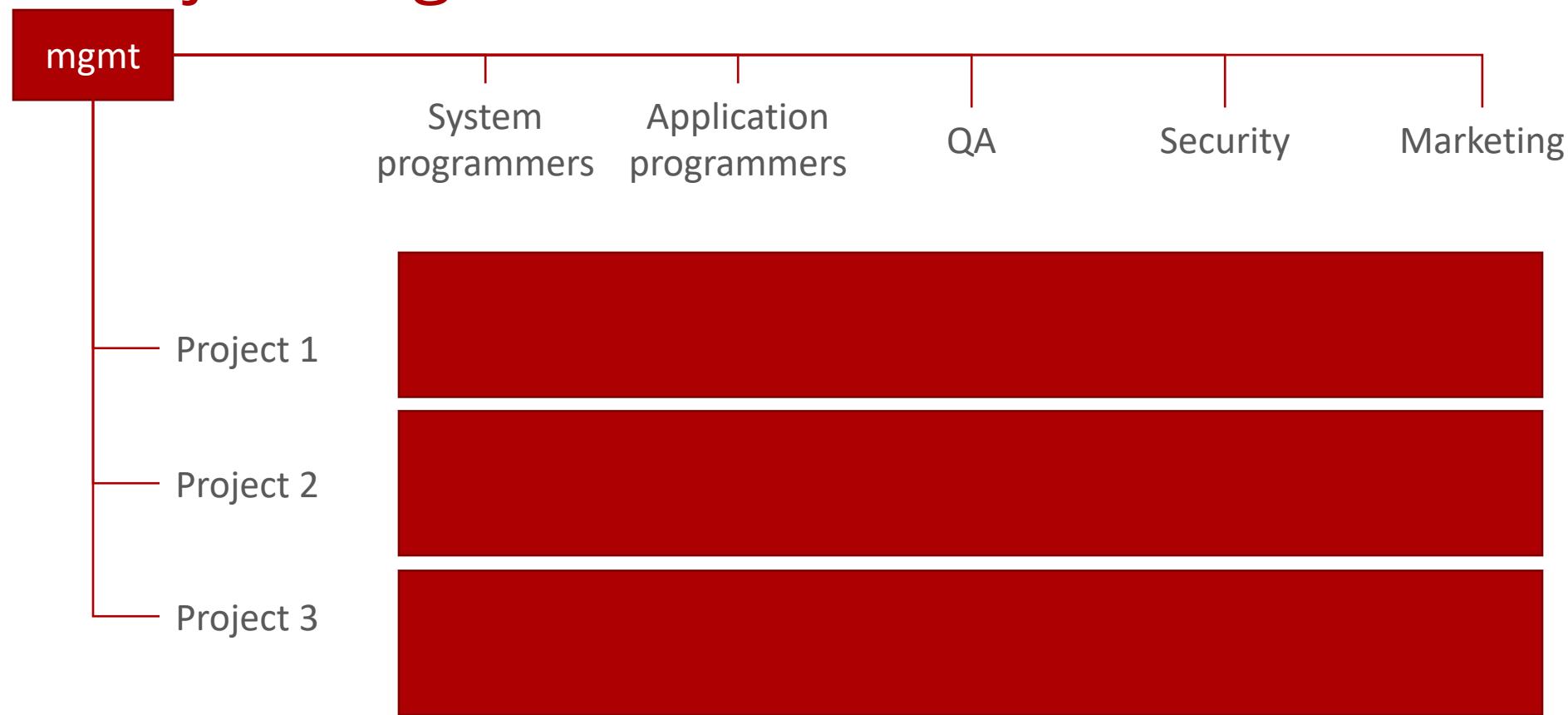
- Respect Conway's Law
 - Code structure and team structure should align
- Seek well-defined, stable interfaces

Agile Practices as Mitigation?

Matrix Organization



Project Organization



Case Study: Brøderbund

- As the functional departments grew, staffing the heavily matrixed projects became more and more of a nightmare. To address this, the company reorganized itself into “Studios”, each with dedicated resources for each of the major functional areas reporting up to a Studio manager. Given direct responsibility for performance and compensation, Studio managers could allocate resources freely.
- The Studios were able to exert more direct control on the projects and team members, but not without a cost. The major problem that emerged from Brøderbund’s Studio reorganization was that members of the various functional disciplines began to lose touch with their functional counterparts. Experience wasn’t shared as easily. Over time, duplicate effort began to appear.

Case Study



Commitment & Accountability

- Conflict is useful, expose all views
- Come to decision, commit to it
- Assign responsibilities
- Record decisions and commitments; make record available

Bell & Hart – 8 Causes of Conflict

- Conflicting resources.
- Conflicting styles.
- Conflicting perceptions.
- Conflicting goals.
- Conflicting pressures.
- Conflicting roles.
- Different personal values.
- Unpredictable policies.

VIRTUAL TEAMS

Virtual Teams?

Computer Supported Collaborative Work (CSCW): Technology-assisted collaboration

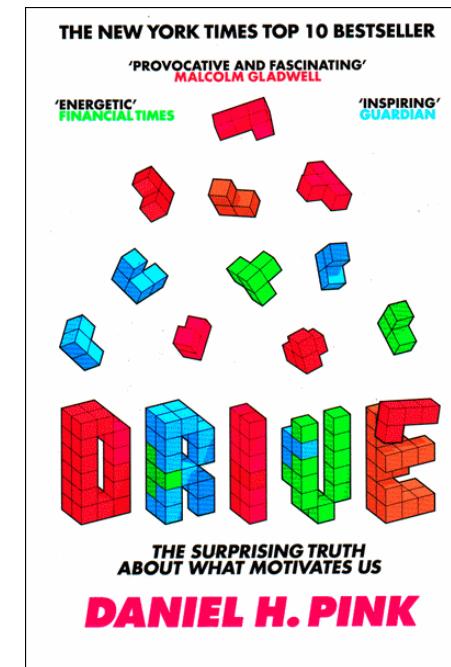
- Many failures
- Isolated, but very significant, success
 - Jazz, Github, ...



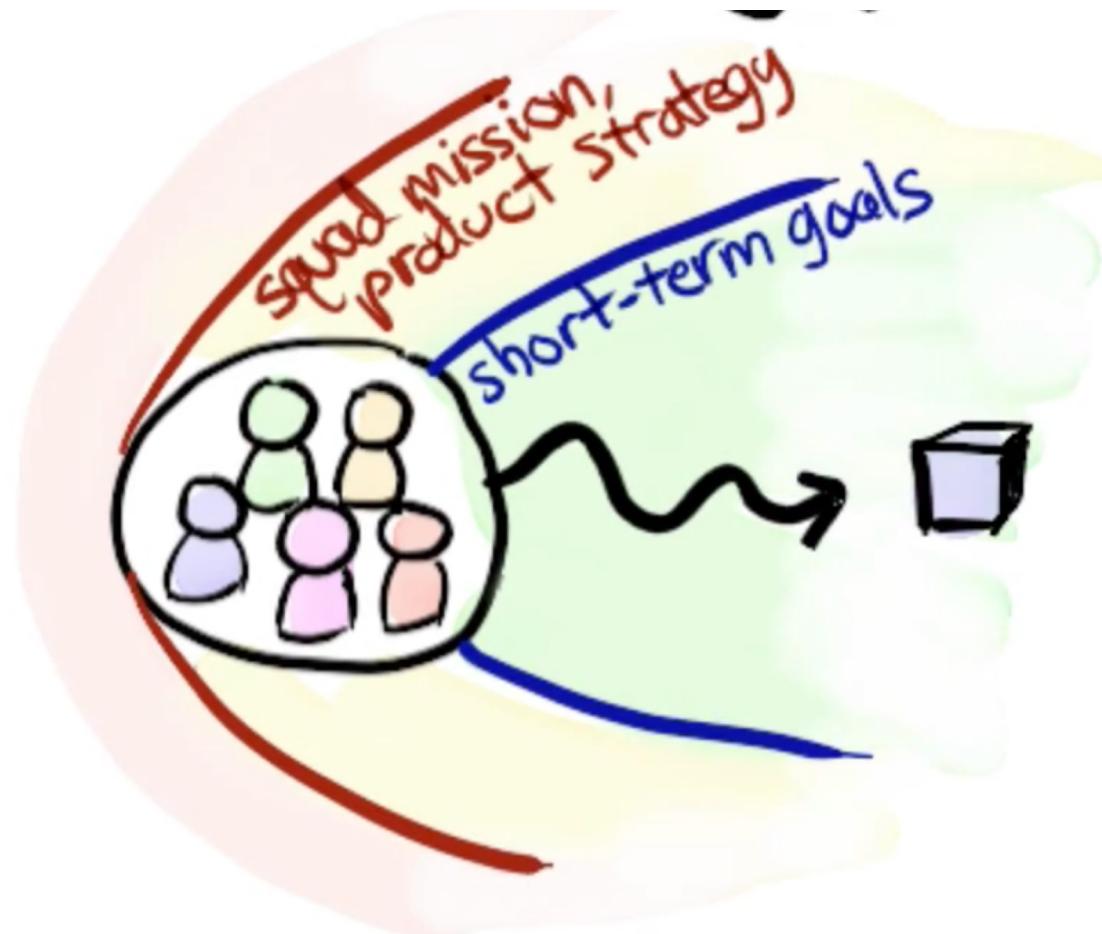
SPOTIFY SQUADS

Principles

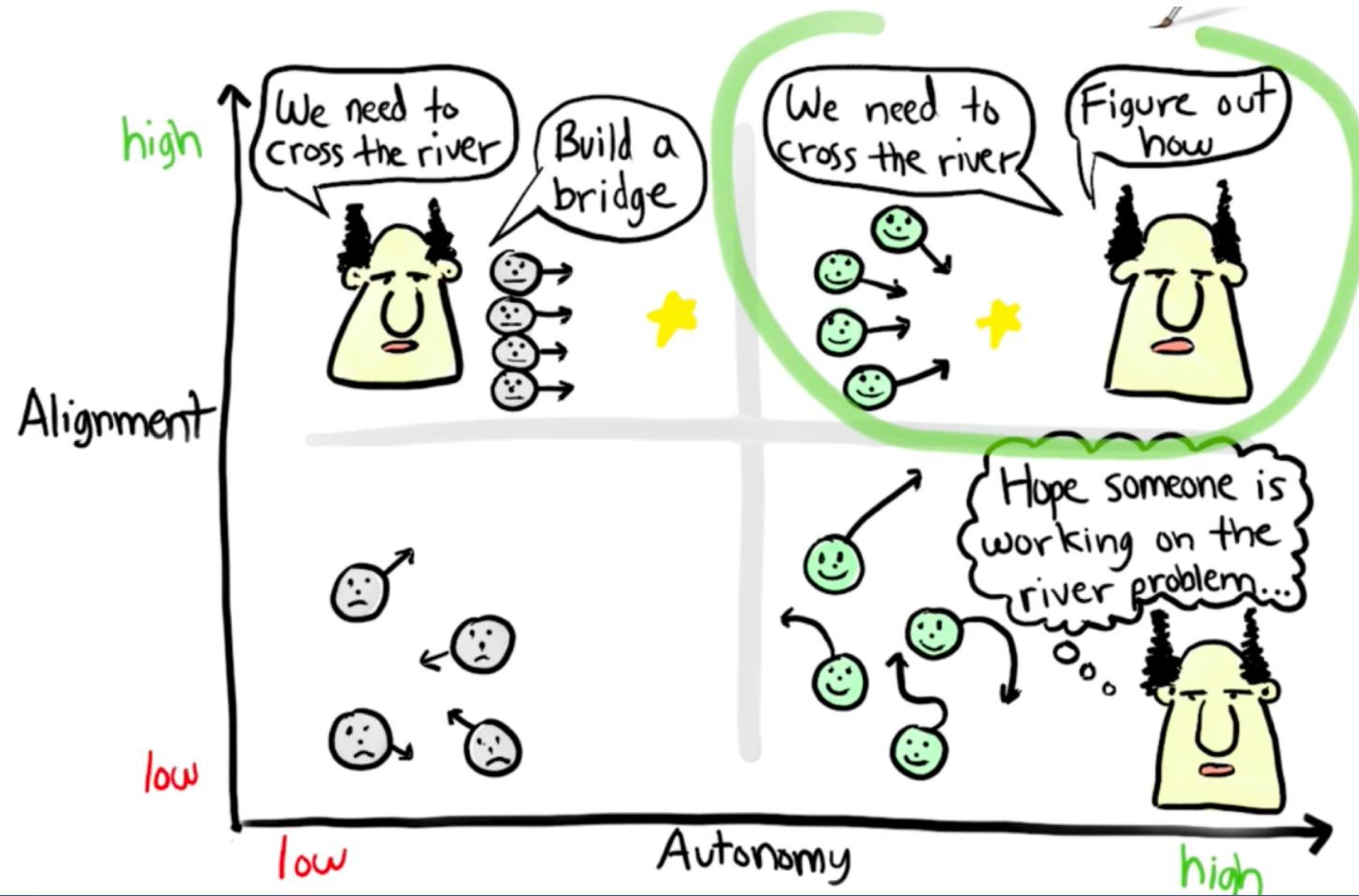
- Rules are a good start, then break them when needed
- Agile > Scrum
- Principles > Practices
- Autonomy, Mastery, Purpose
- *Be autonomous, but don't sub-optimize!*



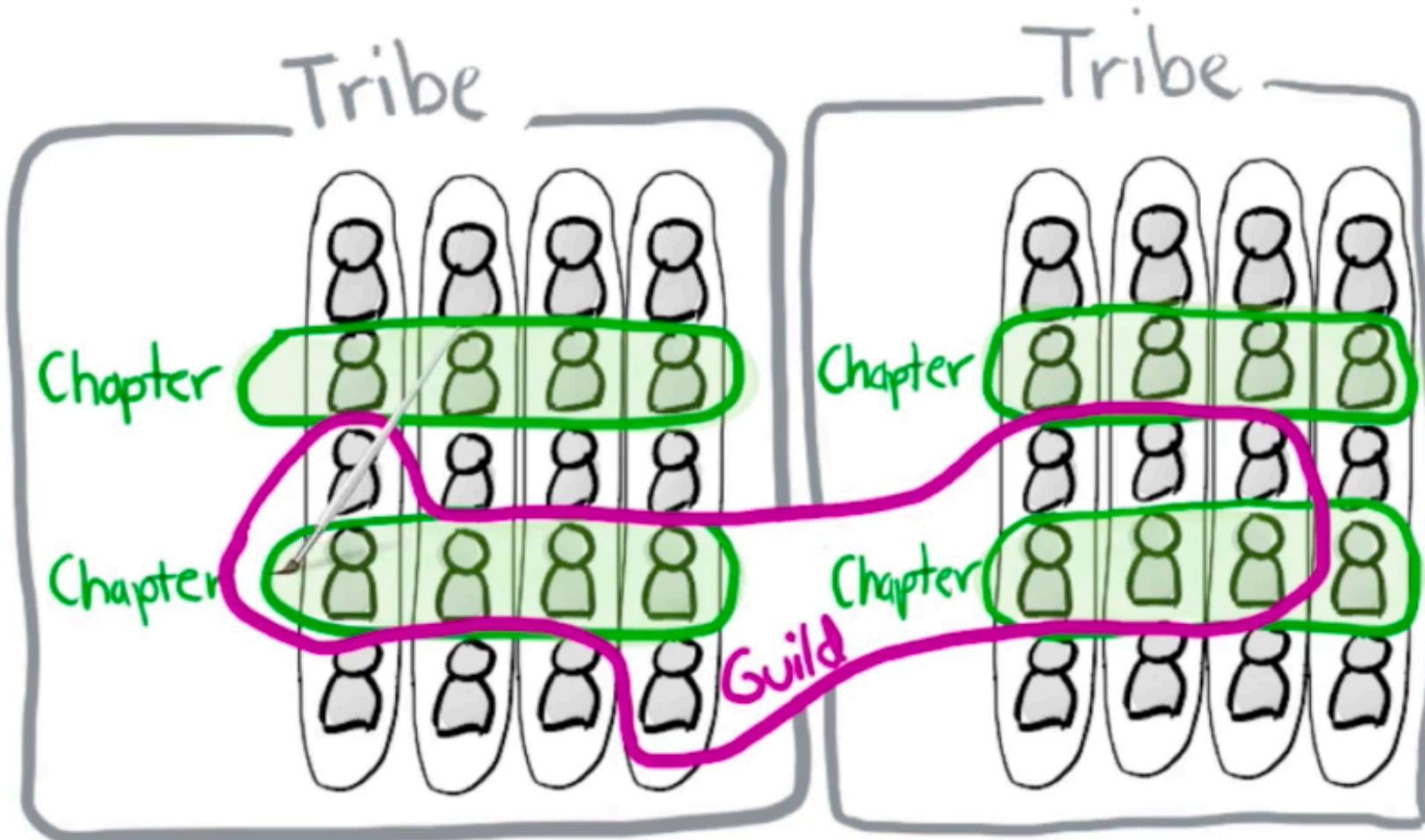
Autonomous Squads



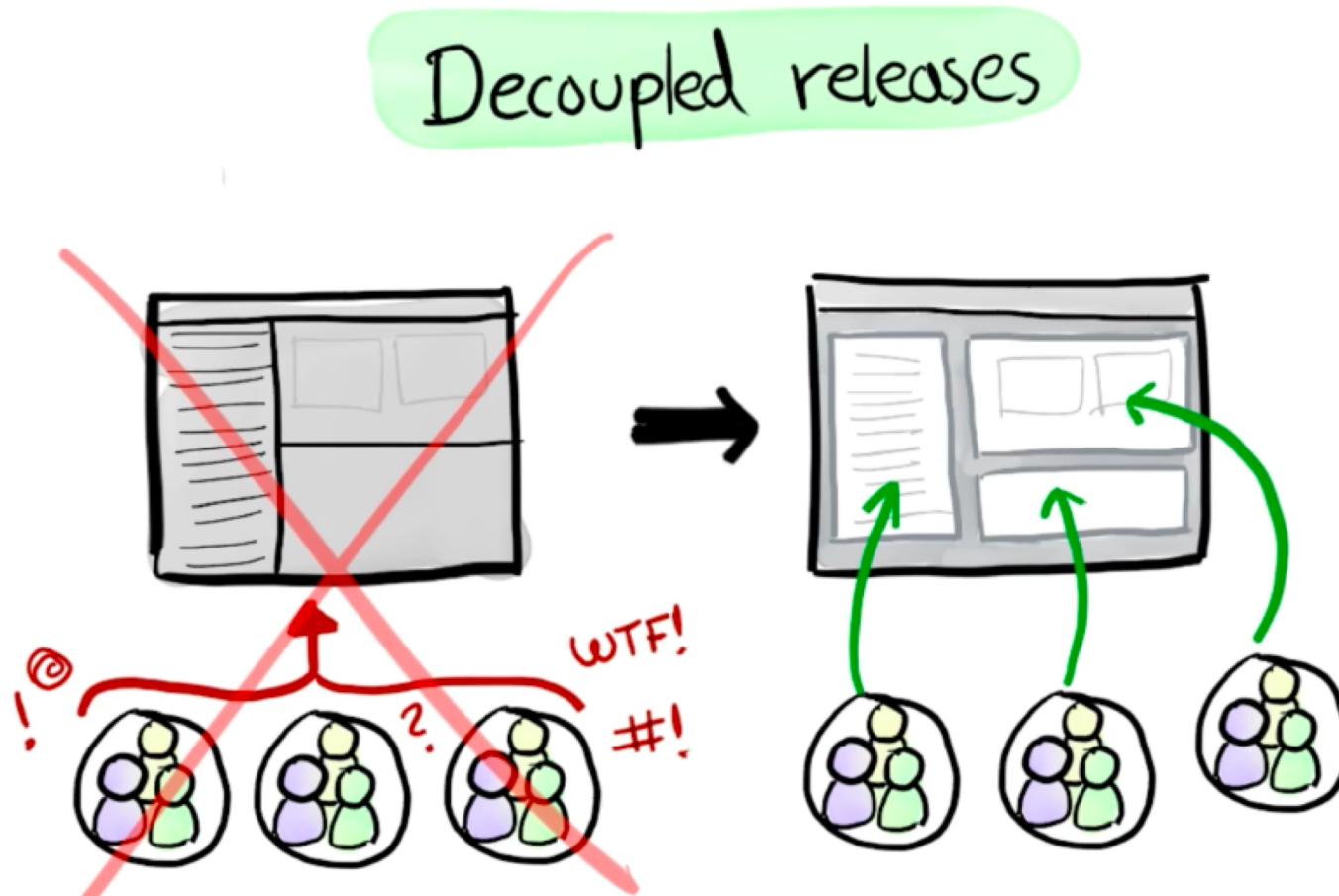
Aligned Autonomous squads



Squads, Tribes, Chapters, Guilds

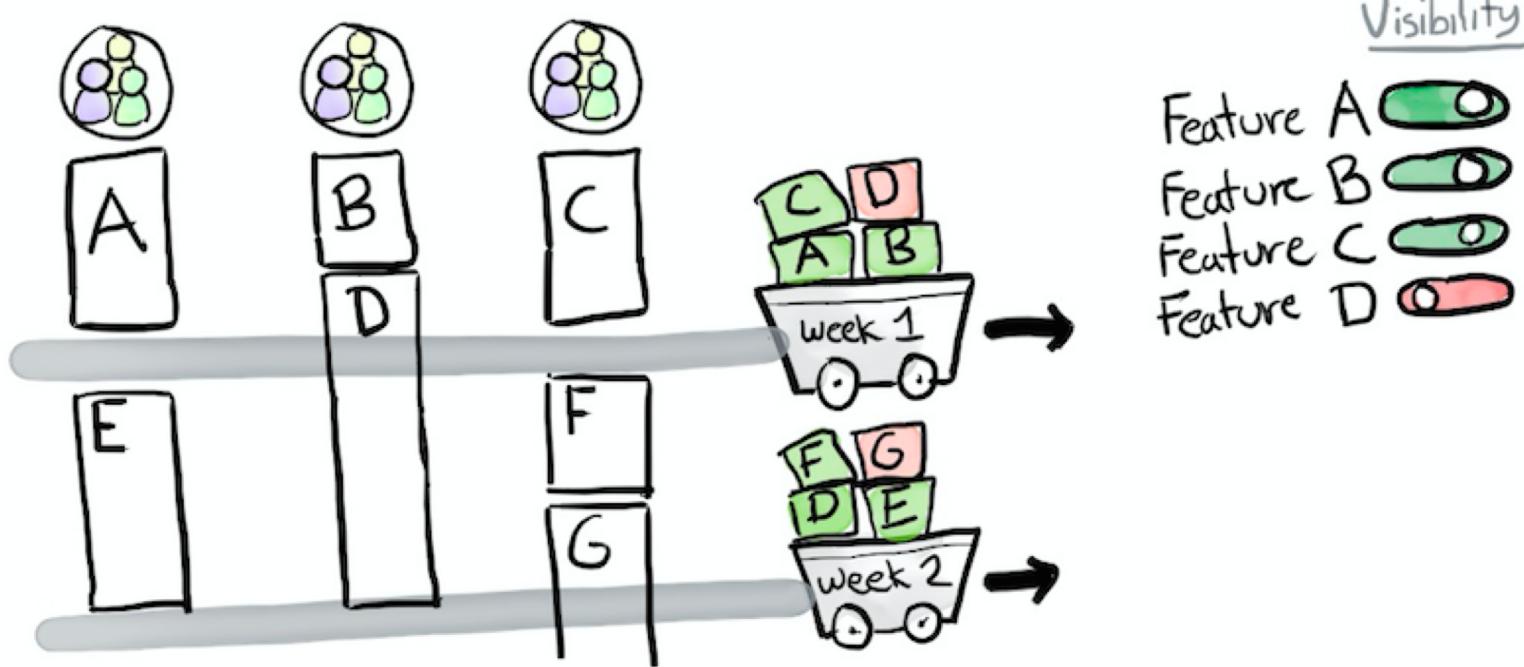


Getting into production



Decouple teams and releases

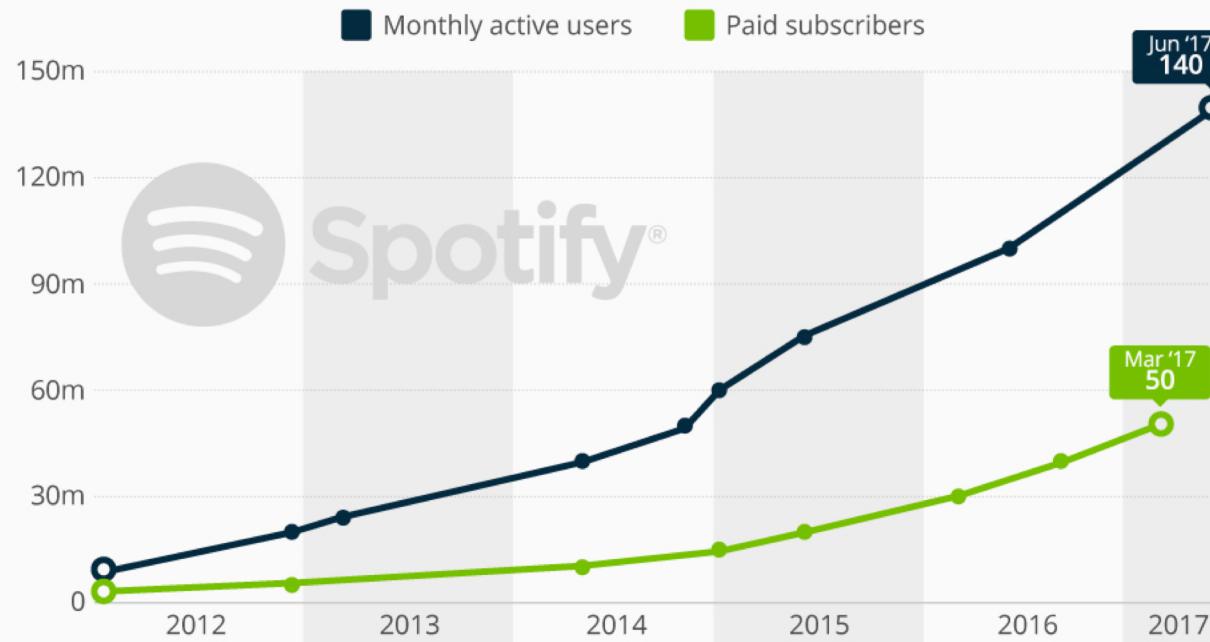
Release Trains + Feature Toggles



Context

Spotify Boasts 140M Active Users, 50M Premium Subs

Worldwide monthly active users and paid subscribers of Spotify (in millions)



@StatistaCharts

Source: Spotify

statista

Discussion

- Benefits?
- Challenges?
- Implementation pitfalls?

GENERAL GUIDELINES

Hints for team functioning

- Trust them; strategic not tactical direction
- Reduce bureaucracy, protect team
- Physical colocation, time for interaction
- Avoid in-team competition (bonuses etc)
- Time for quality assurance, cult of quality
- Realistic deadlines
- Peer coaching
- Sense of elitism
- Allow and encourage heterogeneity

Team Fusion

- Forming, Storming, Norming, Performing
- Preserve existing teams, resist project mobility

Elitism Case Study: The Black Team

- Legendary team at IBM in the 1960s
- Group of talented ("slightly better") testers
 - Goal: Final testing of critical software before delivery
- Improvement over first year
- Formed team personality and energy
 - "adversary philosophy of testing"
 - Cultivated image of destroyers
 - Started to dress in black, crackled laughs, grew mustaches
- Team survived loss of original members

DeMarco and Lister, Peopleware, Chapter 22

Troubleshooting Teams

- Cynicism as warning sign
- Training to improve practices
- Getting to know each other; celebrate success; bonding over meals
- “A meeting without notes is a meeting that never happened”

Further Reading

- Mantle and Lichy. Managing the Unmanageable. Addison-Wesley, 2013
 - Very accessible and practical tips at recruiting and management
- DeMarco and Lister. Peopleware. 3rd Edition. Addison Wesley, 2013
 - Anecdotes, stories, and tips on facilitating teams, projects, and environments
- Sommerville. Software Engineering. 8th Edition. Chapter 25