



Building Effective Microservice Teams

*Learning from
Conway, Brooks, and Dunbar*

Mike Amundsen
CA Technologies
@mamund

Introduction



Mike Amundsen
@mamund

Profile Photo



Full Name Mike Amundsen

WeChat ID mike_amundsen

My QR Code 

Gender

Region

What's Up Not Set

LinkedIn Account Not Set



Mike Amundsen 



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API ACADEMY SERVICES



The API Academy team consists of industry experts who have been brought together by CA Technologies to provide expert consulting services for organizations that want to take their API programs to the next level.

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Email: apiacademy@ca.com

Creating Evolvable Hypermedia Applications



Building

Hypermedia APIs with HTML5 & Node

O'REILLY®

Mike Amundsen

O'REILLY®



Designing APIs for the Web

Mike Amundsen

VIDEO

Services for a Changing World

RESTful Web APIs



O'REILLY®

*Leonard Richardson,
Mike Amundsen & Sam Ruby*

O'REILLY®



Learning Client Hypermedia

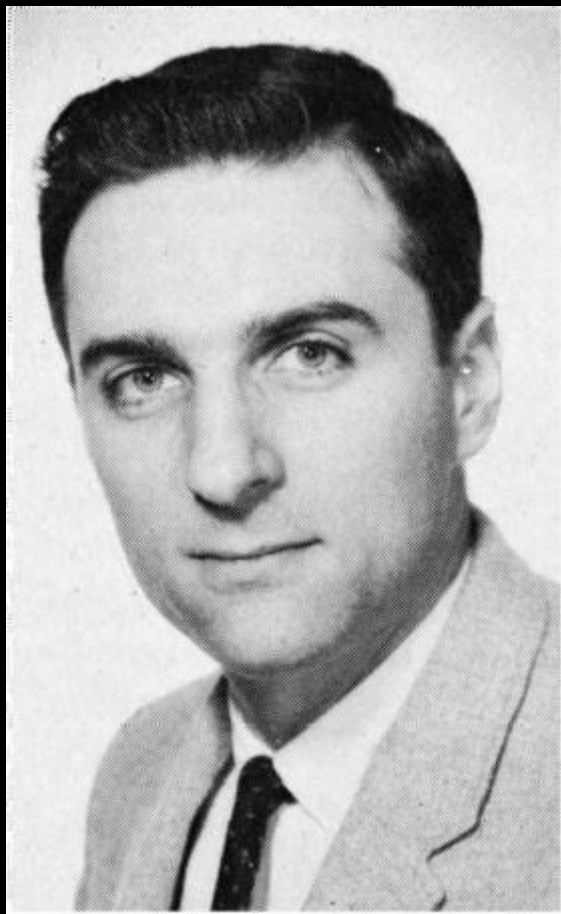
ENABLING CLIENT APPLICATIONS WITH THE POWER OF THE WEB

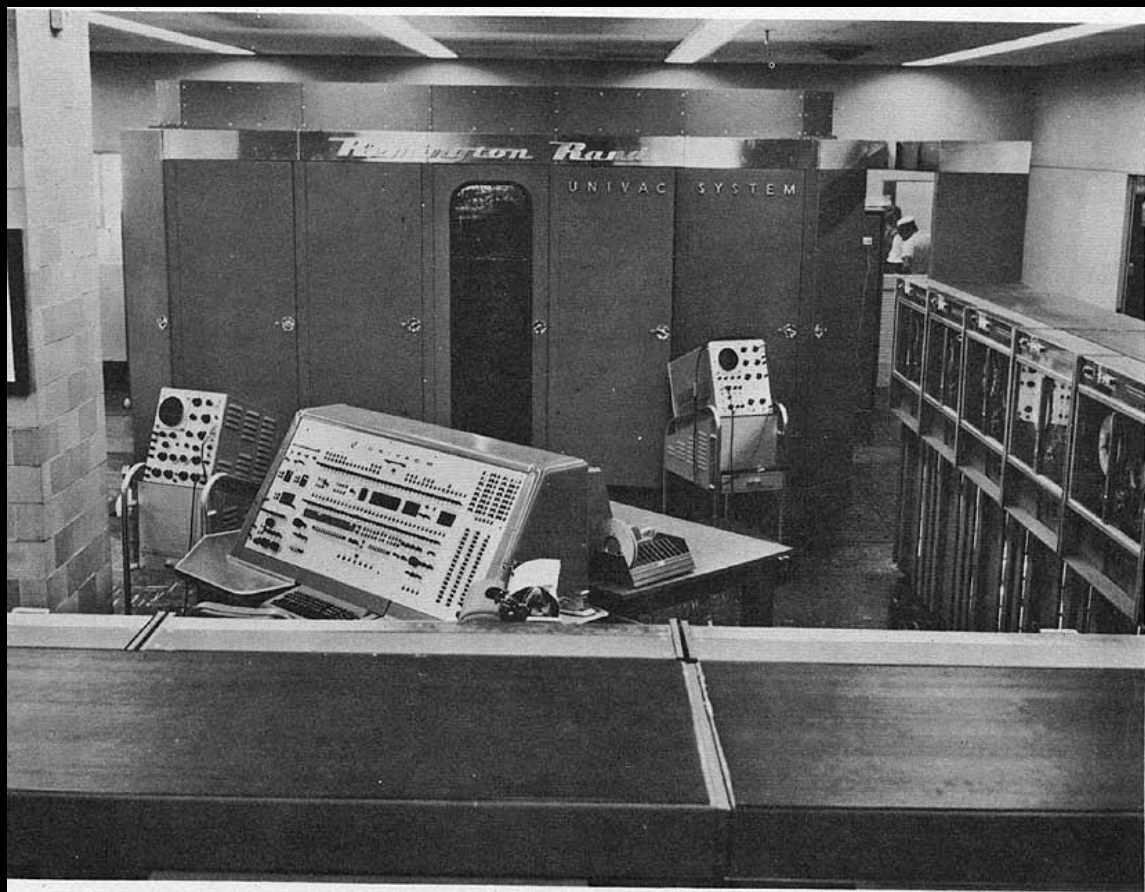
Mike Amundsen

Effective Teams

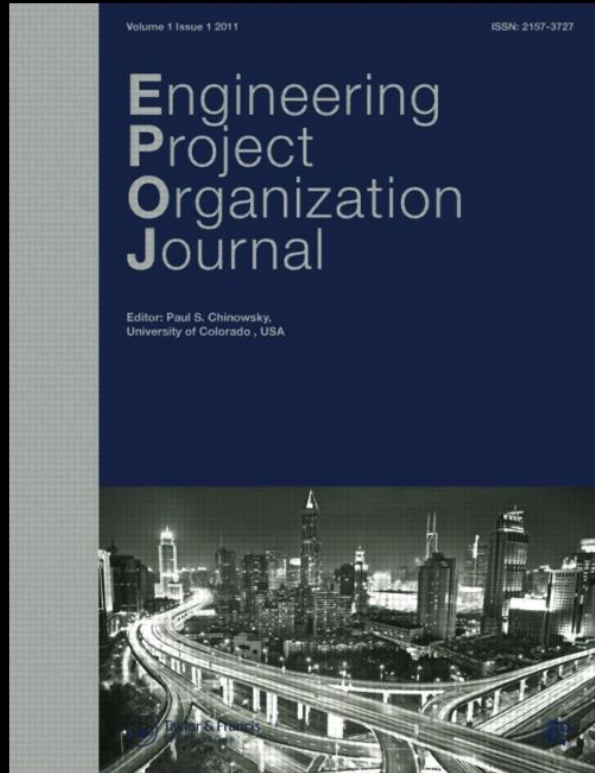
Effective Teams for Microservices

Melvin Conway





Project-Based Organizations



“Project-based organizations revolve around the concept that a group of individuals or firms join together with the explicit purpose of producing a tangible set of outputs”

-- Paul Chinowsky, EPOJ 2011

“How Do Committees Invent?”



Harvard Business Review

REJECTED

DATAMATION

A GLOBAL INDUSTRY.
THE DATAMATION

100

HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

That kind of intellectual activity which creates a useful whole from its diverse parts may be called the *design of a system*. Whether the particular activity is the creation of specifications for a major weapon system, the formation of a recommendation to meet a social challenge, or the programming of a computer, the general activity is largely the same.

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Any organization that designs a system (defined more broadly here than just information systems) will inevitably produce a design whose structure is a copy of the organization's communication structure."

-- Mel Conway, 1967

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Conway's Law

ANNIVERSARY EDITION WITH FOUR NEW CHAPTERS



ESSAYS ON SOFTWARE ENGINEERING

THE MYTHICAL MAN-MONTH

FREDERICK P. BROOKS, JR.

ANNIVERSARY EDITION WITH FOUR NEW CHAPTERS



ESSAYS ON SOFTWARE ENGINEERING

THE
MYTHICAL
MAN-MONTH

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Brooks' Law

“Adding manpower to a late software project makes it later.”

-- Fred Brooks, 1975

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THE
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Intercommunication formula

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

-- *Fred Brooks, 1975*

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$$150 * (150-1) / 2 = 11,175$$

-- *Fred Brooks, 1975*

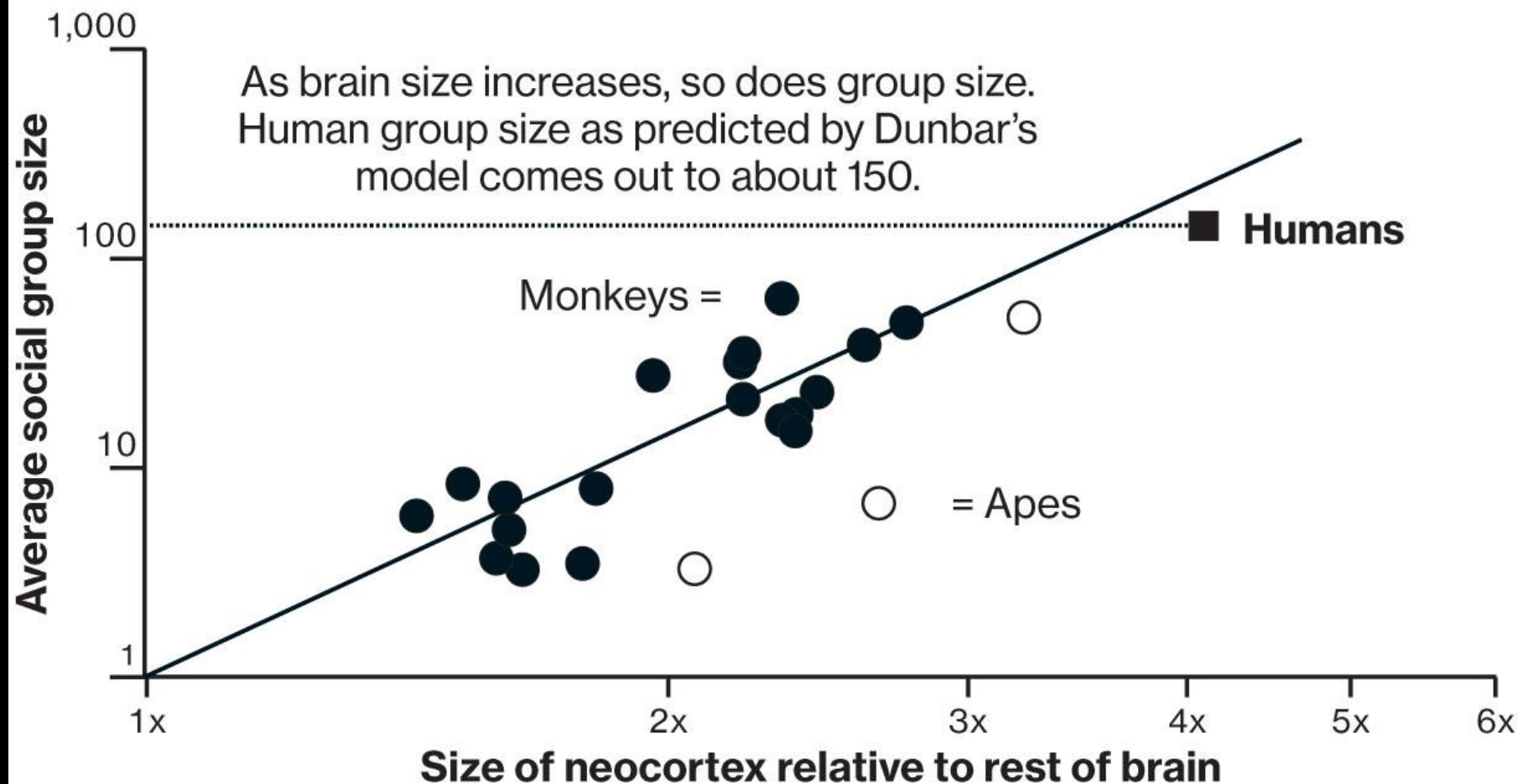


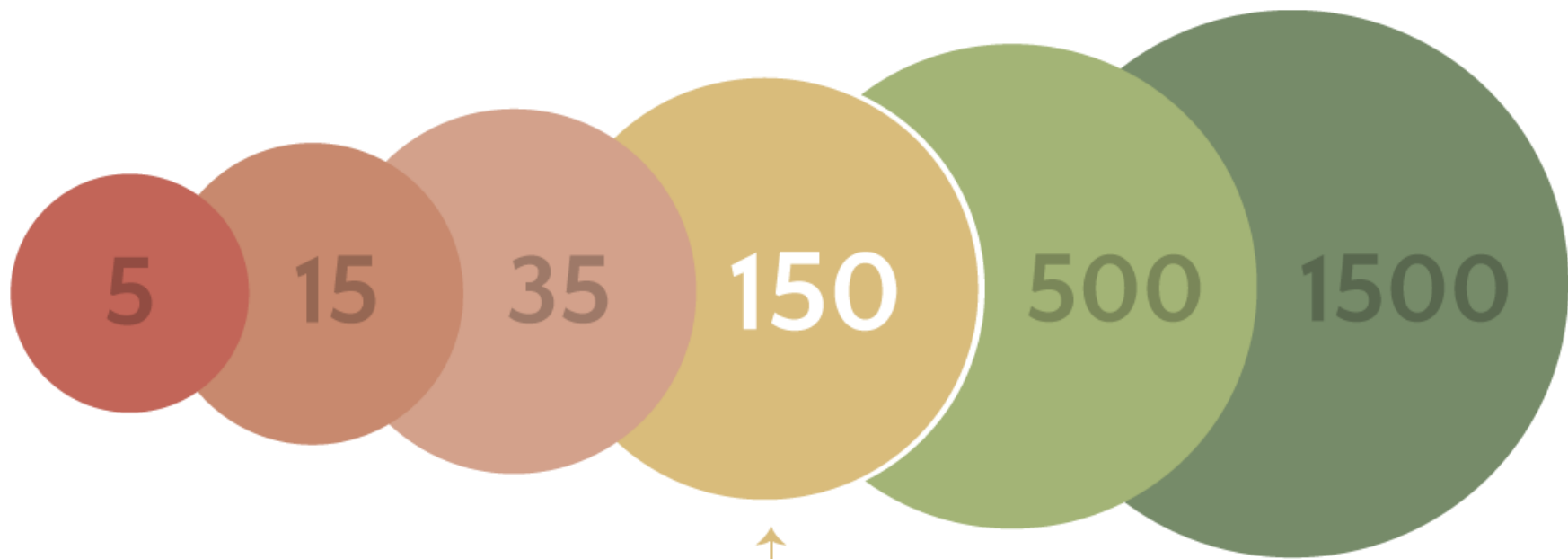
Dunbar's Number

A measurement of the “cognitive limit to the number of individuals with whom any one person can maintain stable relationships.”

-- *Robin Dunbar, 1992*

The Social Cortex





Dunbar's Number

the max number of relationships a person can maintain



Dunbar Groups

Intimate friends: 5

Trusted friends: 15

Close friends: 35

Casual friends: 150

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Conway's (first) Law

***Conway's (first) Law
tells us TEAM SIZE is important***

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tells us TEAM SIZE is important***

SO...

Make the teams as small as necessary.

***Aim for “Dunbar level 1” (5),
possibly “Dunbar level 2” (15),
be wary of teams above that size.***

***If you don't have
a personal relationship
with every member of your team,
it is probably TOO BIG.***

So... what about other Conway Laws?

Conway's Second Law

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Doing it Over

“There is never enough time to do something right, but there is always enough time to do it over.”

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Trade Offs

Efficiency-Thoroughness Trade Offs (ETTOs)

The
ETTO



Principle:

Efficiency-Thoroughness Trade-Off

Why Things That Go Right Sometimes Go Wrong.



E R I K H O L L N A G E L



Satisficing v. Sacrificing

“Satisficing is explained as a consequence of limited cognitive capacity.”

Sacrificing is explained as a consequence of the intractability of the work environment”

-- Eric Hollnagel, 2009

Satisficing v. Sacrificing



*Problem too complicated?
Ignore details.*

*Not enough resources?
Give up features.*

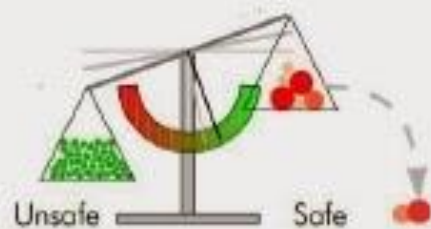
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ETTOs are “normal” and result in success more often than failure.

Two interpretations of safety

Safety-I

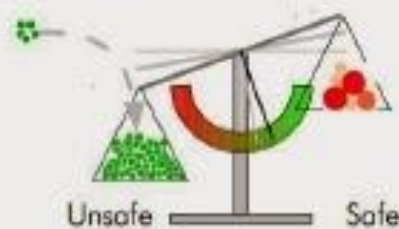
Safety means that the number of things that go wrong (accidents / incidents / near misses) is as low as possible.



Safety can be achieved by first finding and then eliminating or weakening the causes of adverse outcomes.

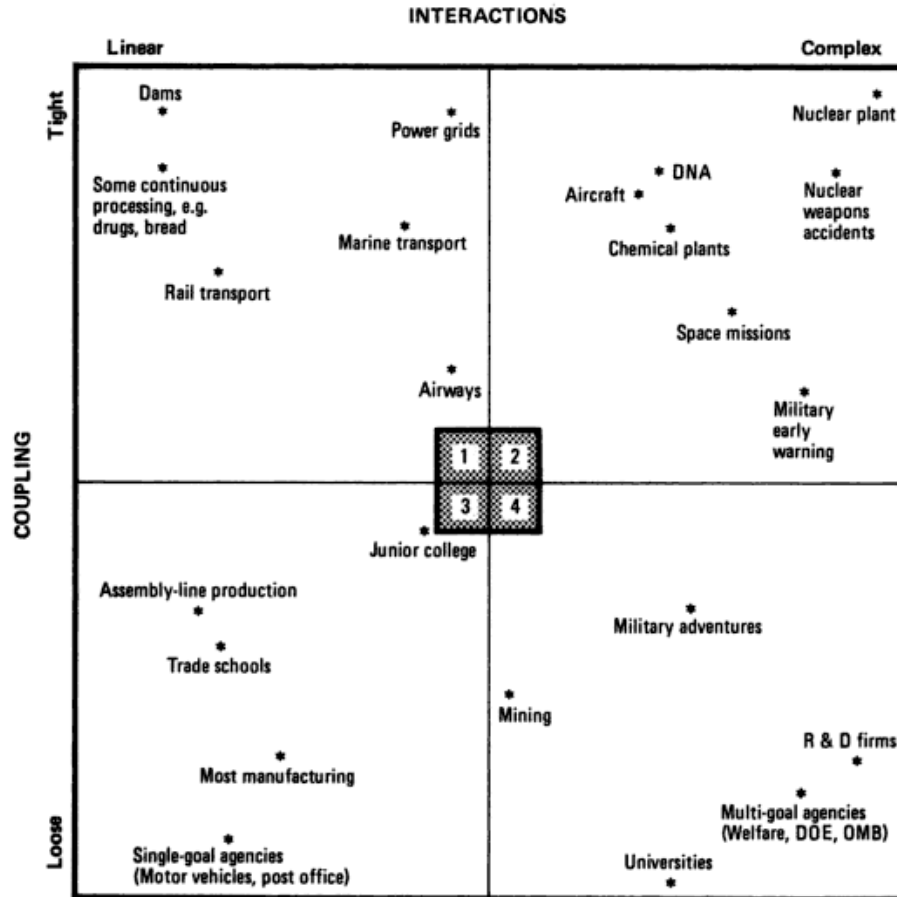
Safety-II Resilience

Safety means that the number of things that go right is as high as possible. Safety is the ability to succeed under varying conditions.



Safety requires an understanding of everyday performance. Safety can be achieved by strengthening this ability.

FIGURE 3.1
Interaction/Coupling Chart



The enemy is intractability.



Increasing Intractability

- 1. Systems grow too large*
- 2. Rate of change increases*
- 3. Overall expectations keep rising*

-- Eric Hollnagel, 2009

Key benefits of Continuous delivery



***Conway's Second Law
tells us PROBLEM SIZE is important***

***Conway's Second Law
tells us PROBLEM SIZE is important***

so...

Make the solution as small as necessary.

***If you (or your team)
cannot explain ALL the code
in your release package,
your release is TOO LARGE***

Conway's Third Law

HOW DO COMMITTEES INVENT?

by MELVIN E. CONWAY

That kind of intellectual activity which creates a useful whole from its diverse parts may be called the *design* of a system. Whether the particular activity is the creation of specifications for a major weapon system, the formation of a recommendation to meet a social challenge, or the programming of a computer, the general activity is largely the same.

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stages of design

The initial stages of a design effort are concerned more with structuring of the design activity than with the system itself.² The full-blown design activity cannot proceed until certain preliminary milestones are passed. These include:

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We shall see in detail later that the very act of organiz-

design organization criteria

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Homomorphism

“There is a homomorphism from the linear graph of a system to the linear graph of its design organization”

-- Mel Conway, 1967

ho·mo·mor·phism

/ˌhōməˈmɔrfɪzəm/

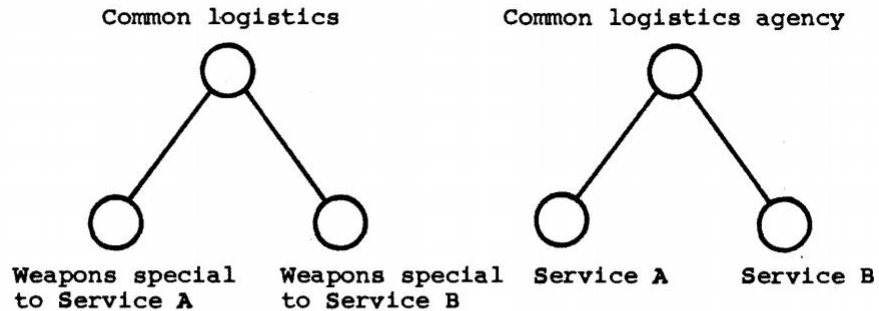
noun

MATHEMATICS

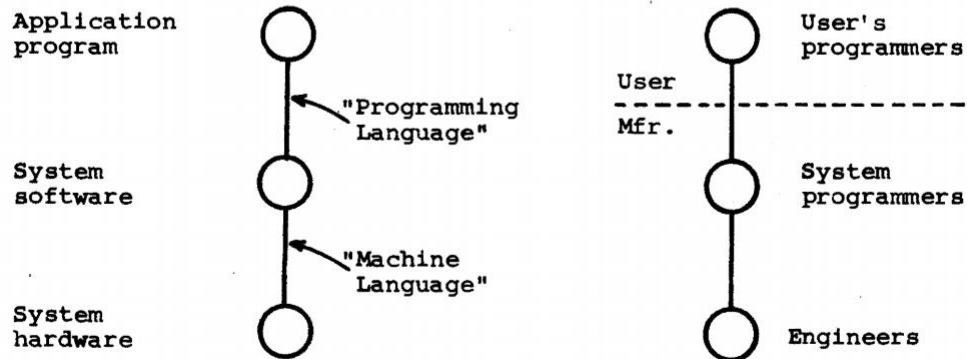
a transformation of one set into another that preserves in the second set the relations between elements of the first.

SYSTEM

DESIGN ORGANIZATION

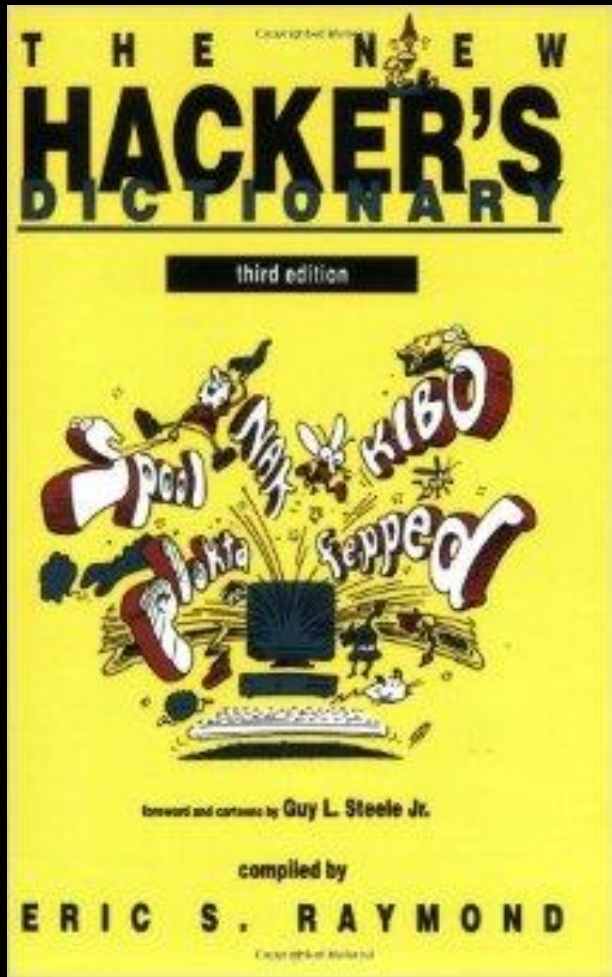


3a. A Weapon System



3b. A Computer System

Figure 3 Two examples of identity of structure between a system and its design organization.



Homomorphism

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

- *Eric S. Raymond, 1991*

Conway's Third Law
*tells us **CROSS-TEAM INDEPENDENCE***
is important.

***Conway's Third Law
tells us CROSS-TEAM INDEPENDENCE
is important.***

***So...
Make each team fully independent.***

***If you have to hold a release
until some other team is ready,
you are not an
INDEPENDENT TEAM***

Conway's Fourth Law

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"The structures of large systems tend to disintegrate during development, qualitatively more so than with small systems."



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-- Mel Conway, 1967

¹A related, but much more comprehensive discussion of the behavior of disintegrating organizations is found in John Kenneth Galbraith's, *The New Industrial State* (Boston, Houghton Mifflin, 1967). See especially Chapter VI, "The Incentives."

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Three reasons Disintegration occurs...

Disintegration: Reason #1

“The realization that the system will be large, together with organization pressures, make irresistible the temptation to assign too many people to a design effort”

-- Mel Conway, 1967

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ANNIVERSARY EDITION WITH FOUR NEW CHAPTERS



ESSAYS ON SOFTWARE ENGINEERING

THE
MYTHICAL
MAN-MONTH

FREDERICK P. BROOKS, JR.

Brooks' Law

Adding manpower to a late software project makes it later.

-- Fred Brooks, 1975

Disintegration: Reason #2

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“Application of the conventional wisdom of management to a large design organization causes its communication structure to disintegrate.”

-- Mel Conway, 1967

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Dunbar's Number

A measurement of the “cognitive limit to the number of individuals with whom any one person can maintain stable relationships.”

-- *Robin Dunbar, 1992*

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Disintegration: Reason #3

“Homomorphism insures that the structure of the system will reflect the disintegration which has occurred in the design organization.”

-- Mel Conway, 1967

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Communication dictates design.



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***Conway's Fourth Law
tells us TIME is against LARGE teams.***

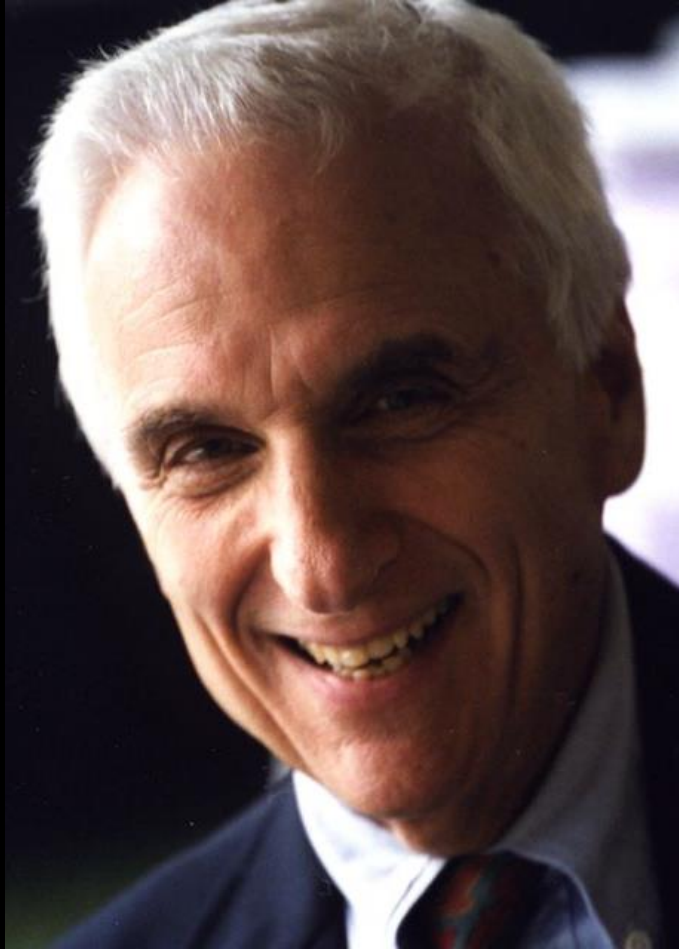
***Conway's Fourth Law
tells us TIME is against LARGE teams.***

So...

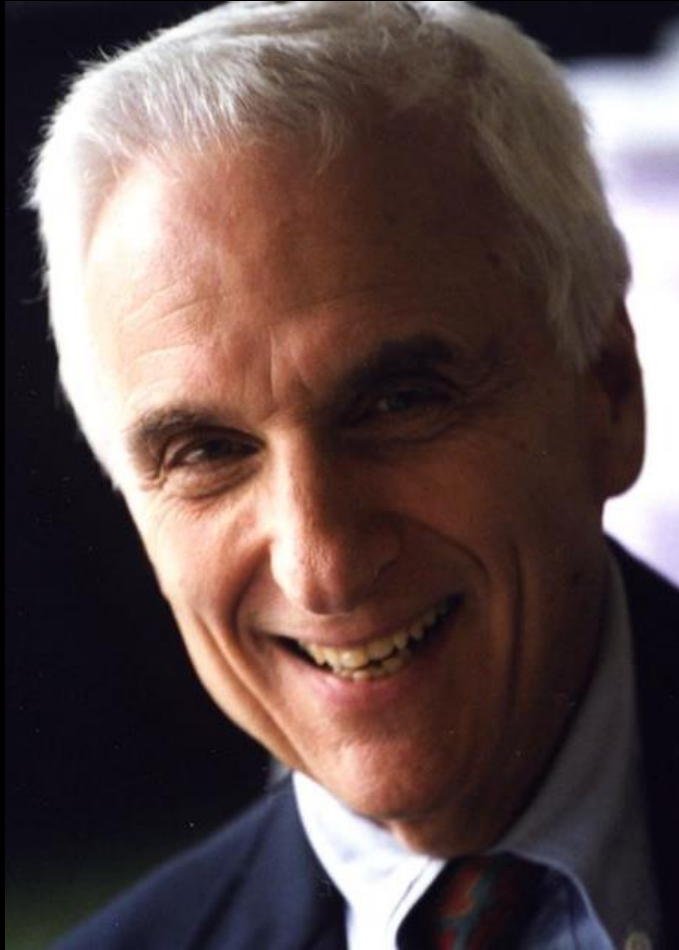
Make release cycles short and small.

***If your release dates are often missed,
your release SIZE is TOO BIG.***

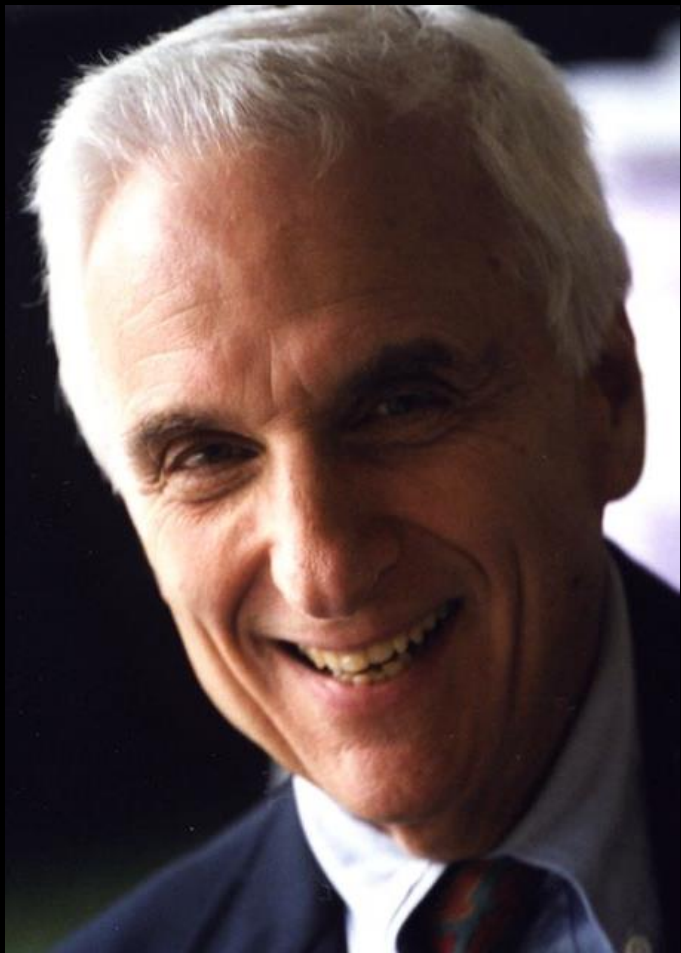
So, let's review our options...



***Conway's Laws
can help us succeed***

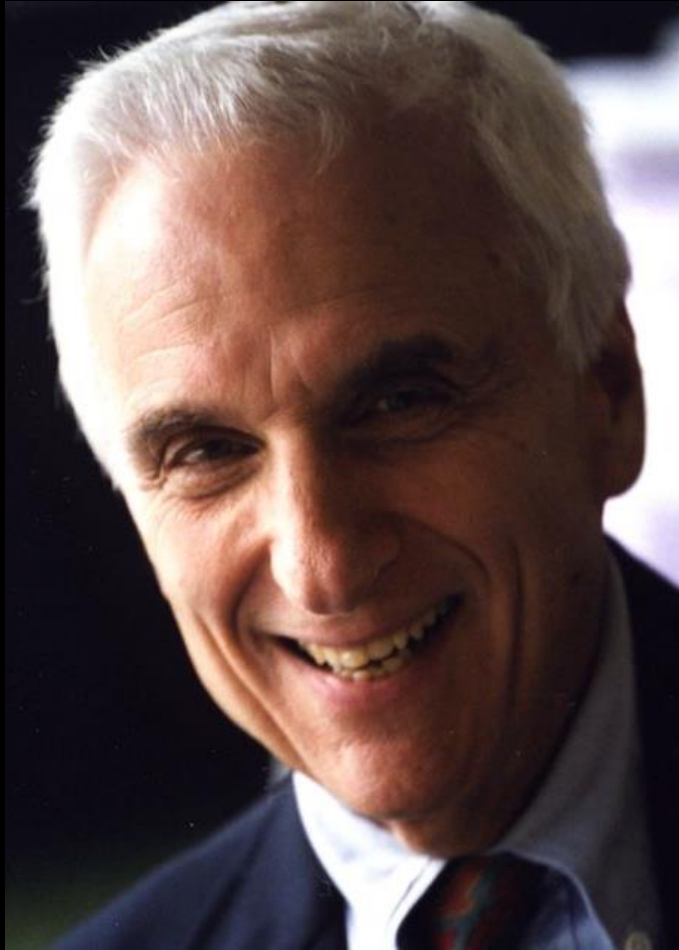


***Conway's Laws
can help us succeed
when working with
microservice teams.***



Conway's First Law

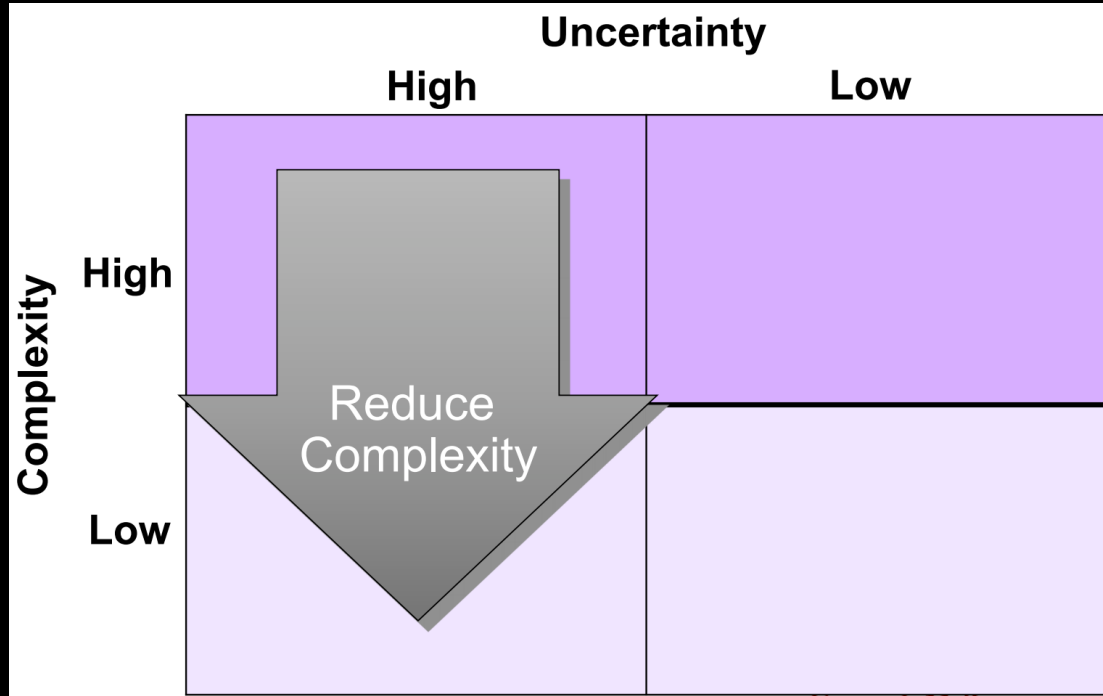
A system's design is a copy of the organization's communication structure.



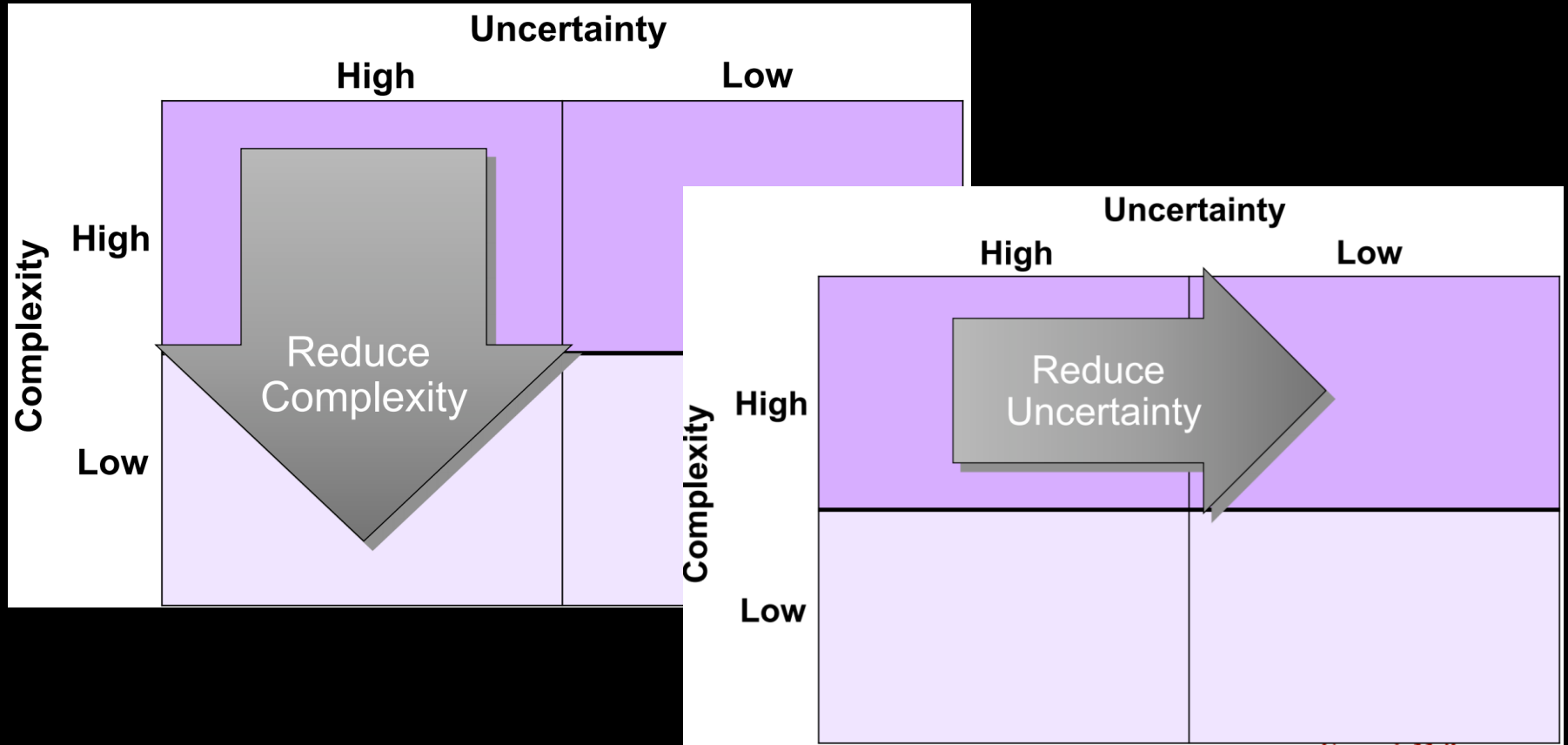
Conway's First Law

*A system's design is a copy
of the organization's
communication structure.*

***Actively manage
communications within the
teams and across teams.***



James Herbsleb: *“Tactics for Global Software Development”*

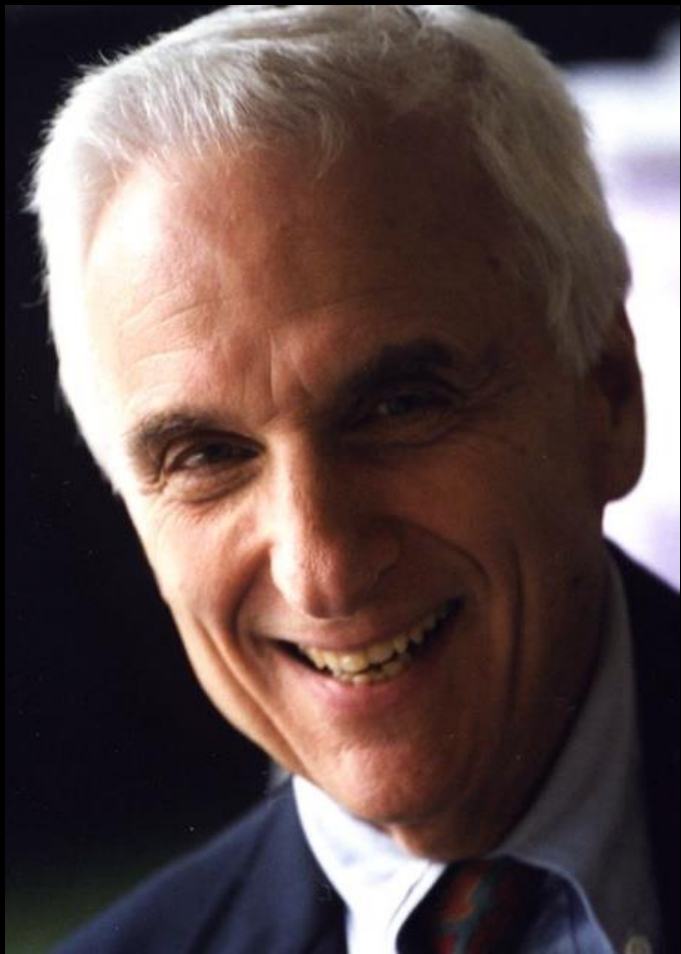


James Herbsleb: *“Tactics for Global Software Development”*

Increase communications

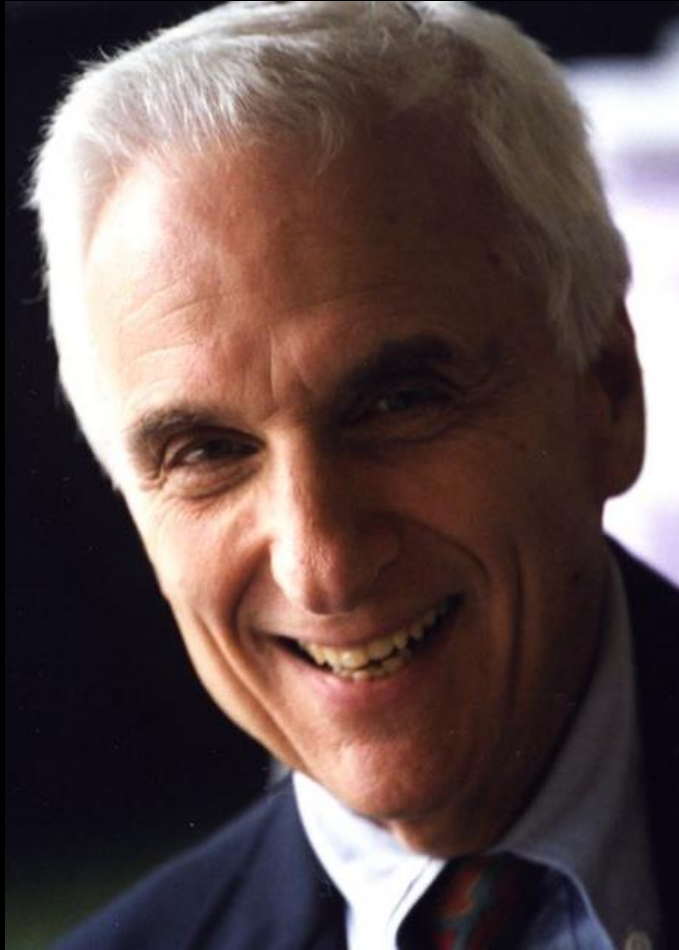
- Real-time Chat Tools
- Video Conferencing
- Online Forums/News Groups
- Wiki and Web Sites

Reduce the effort required to locate and interact with the 'right people'



Conway's Second Law

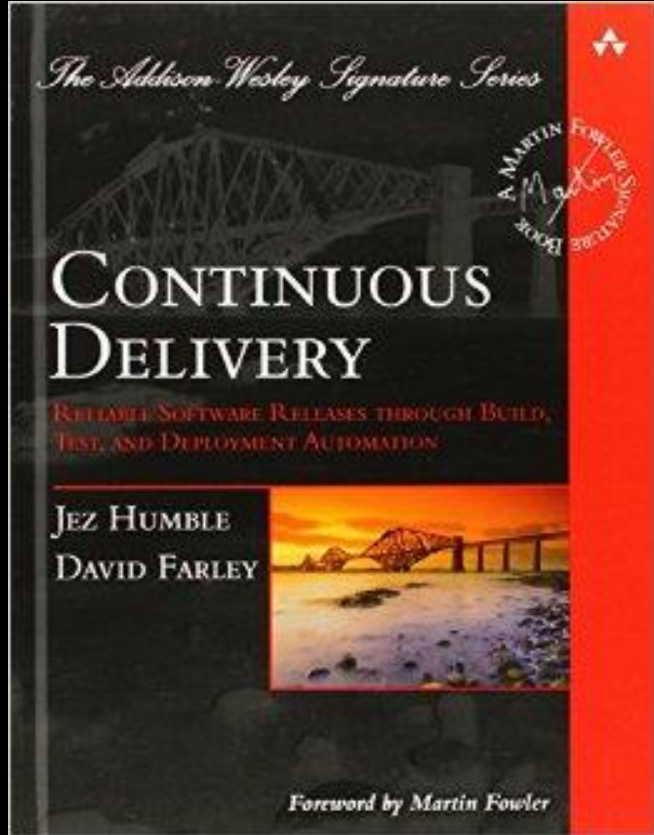
*There is never enough time
to do something right, but
there is always enough time
to do it over.*



Conway's Second Law

*There is never enough time
to do something right, but
there is always enough time
to do it over.*

***Remember the process is
continually repeating.***



Continuous Delivery

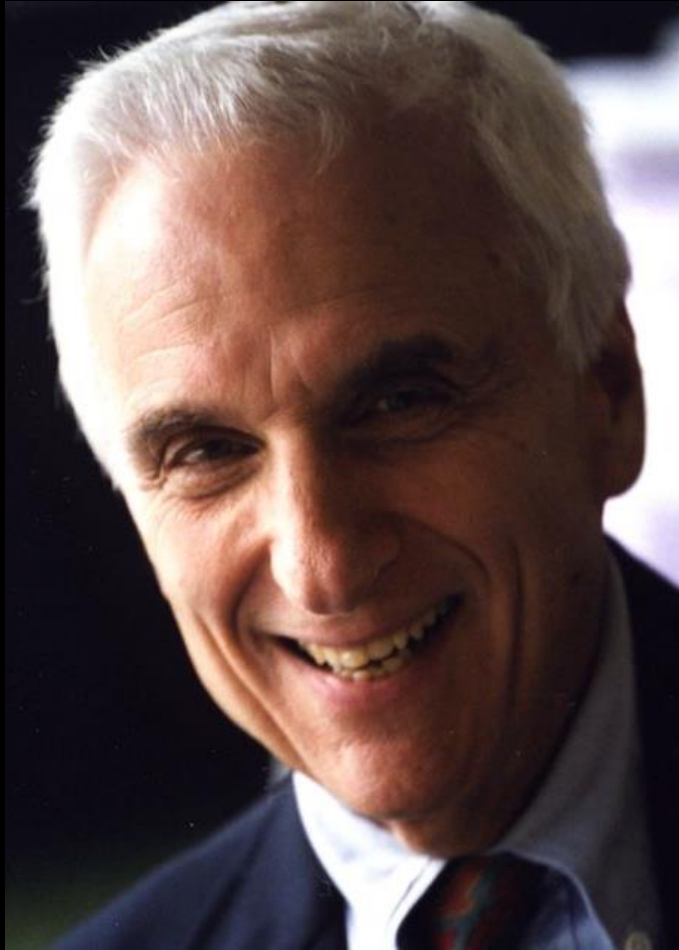
“The core concept of making small frequent changes, and testing at every step, reduces the risk inherent in deploying new code.”

Jez Humble, Thoughtworks.

Support continuous processes

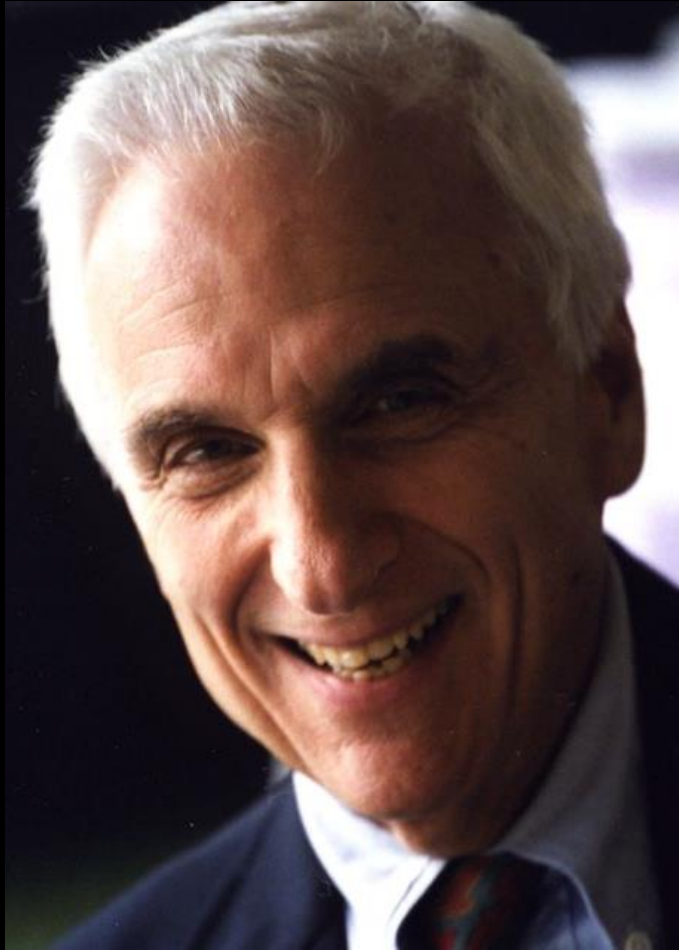
- Implement small changes
- Test immediately
- Deploy constantly

Shorten the feedback loop as much as possible.



Conway's Third Law

*There is a homomorphism
from the linear graph of a
system to the linear graph of
its design organization.*



Conway's Third Law

*There is a homomorphism
from the linear graph of a
system to the linear graph of
its design organization.*

***Organize teams in order to
achieve desired system.***



Microservices

Organized around
business capabilities.

Products, not projects.

Martin Fowler, Thoughtworks

UI
specialists



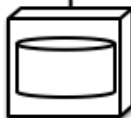
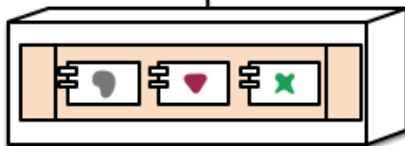
middleware
specialists



DBAs



Siloed functional teams...



... lead to siloed application architectures.
Because Conway's Law

UI specialists



middleware specialists

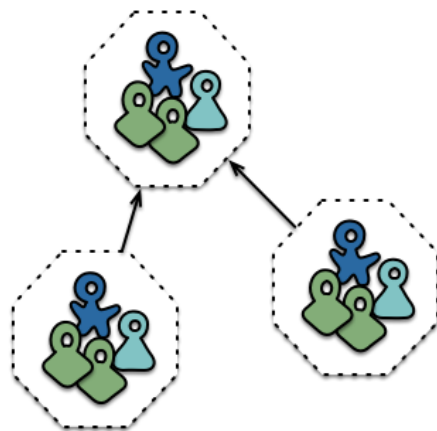
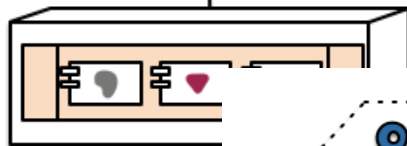


DBAs

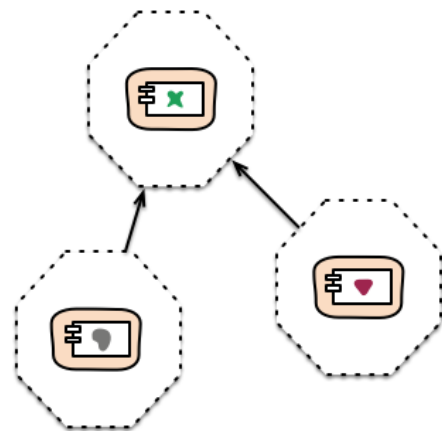


Siloed functional teams...

... lead to siloed applica
Bec



Cross-functional teams...

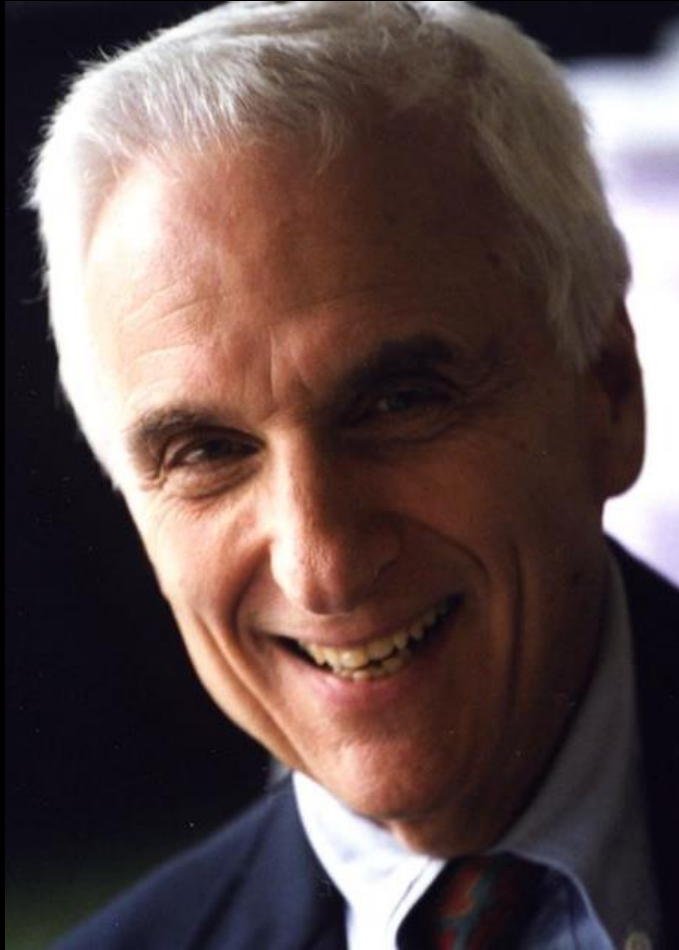


... organised around capabilities
Because Conway's Law

Organize teams by product or BU

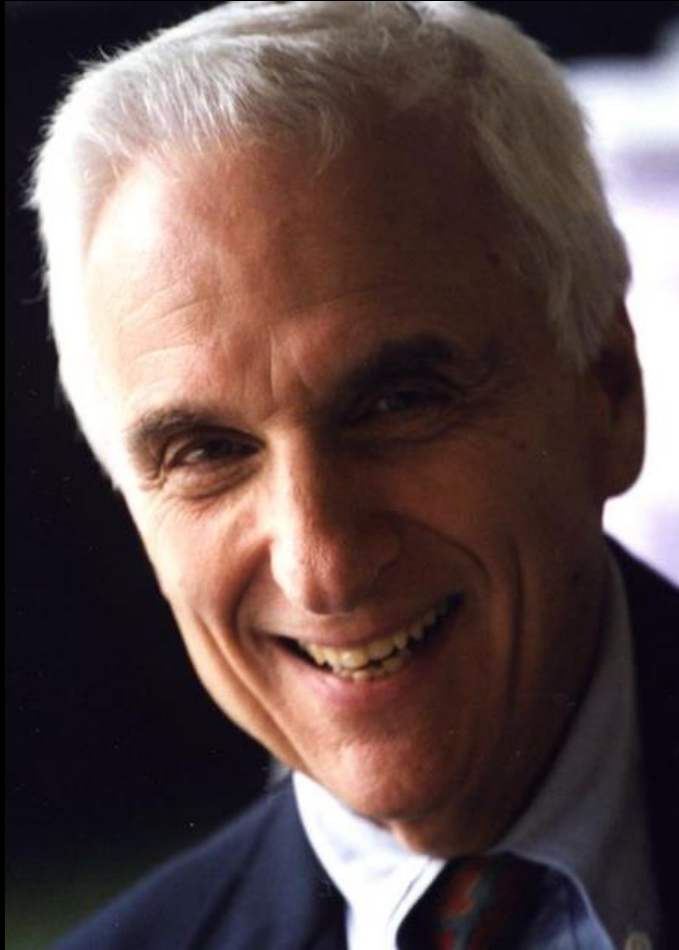
- Combine design, develop, test, & deploy
- Include storage, business process, & UI
- Allow teams autonomy *within* their boundary
- Require teams to *inter-operate*, not integrate

Make sure teams own their complete lifecycle.



Conway's Fourth Law

The structures of large systems tend to disintegrate during development.



Conway's Fourth Law

The structures of large systems tend to disintegrate during development.

Keep your teams as small as necessary, but no smaller.

Sizing Teams



Jeff Bezos, Amazon



Sizing Teams

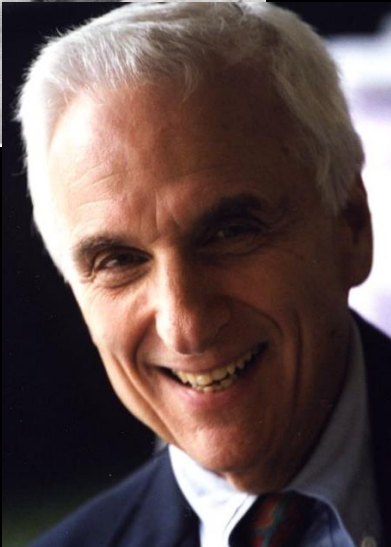
If a team can't be fed with two pizzas, it's too big.

Jeff Bezos, Amazon

Make team as small as necessary

- Resist urge to grow teams in response to deadlines
- Consider Dunbar's groups when sizing teams
- Be prepared to break into smaller teams

It's better to be "too small" than to be "too big."



Conway's Lessons

1. Increase communications
2. Support continuous process
3. Organize teams by products
4. Make teams as small as necessary



Building Effective Microservice Teams

*Learning from
Conway, Brooks, and Dunbar*

<http://g.mamund.com/2015-10-qcon-teams>

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