DevOps: Culture, Agile Development, & Cloud Native Technologies

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Disrupting Trends

- The Social Coding Revolution:
  - More than 100 Million+ projects on public GitHub as of YE 2018
- Open Source is leading the innovation
- "Cloud Native" DevOps principles enabling "extreme agility" proven at scale
  - e.g., Netflix, AirBnB, Etsy.
- Enterprises follow suits with their own "Digital Transformation"
  - Complicated by Technology Debt, but essential to their survival.

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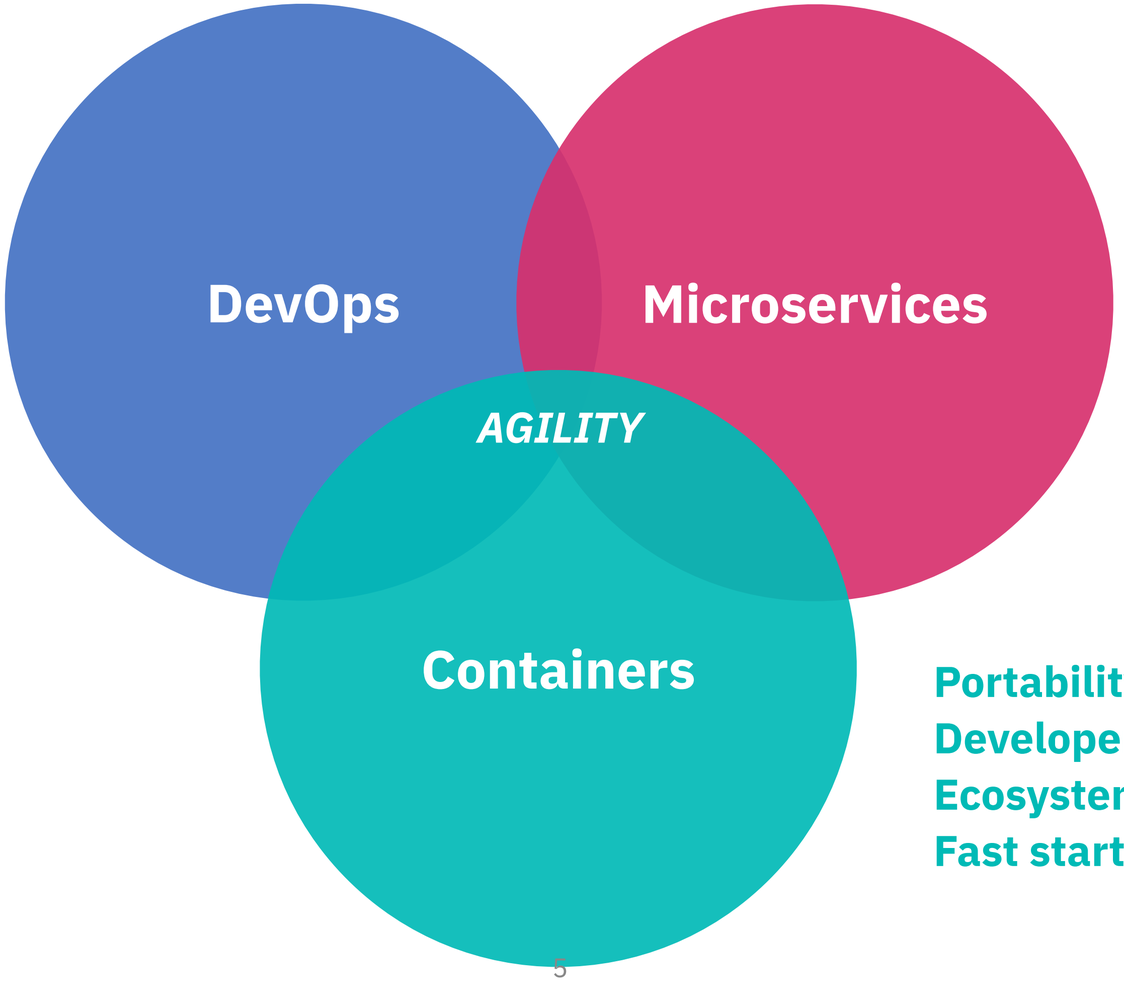
- **What if your application design allowed individual components to be replaced?**
  - Then you wouldn't have "big bang" release weekends

Agility is the goal

- Smart experimentation
- Moving in–market with maximum velocity and minimum risk
- Gaining quick valuable insight to continuously change the value proposition and quality

Agility: The Three Pillars

Cultural Change
Automated Pipeline
Everything as Code
Immutable Infrastructure



Loose Coupling/Binding
RESTful APIs
Designed to resist failures
Test by break / fail fast

Portability
Developer Centric
Ecosystem enabler
Fast startup

The Perfect Storm

DevOps for speed and agility
Microservices for small deployments
Containers for ephemeral runtimes

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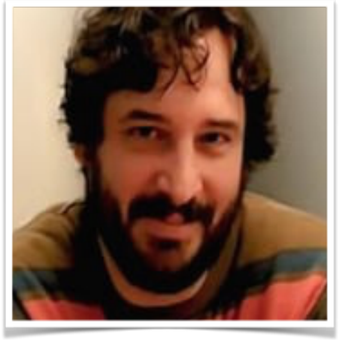

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- Agile 2008 Conference BoF "Agile Infrastructure"

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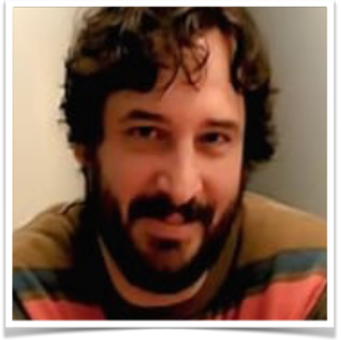

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2009 John Allspaw

- Velocity 2009 “10+ Deploys Per Day: Dev and Ops Cooperation at Flickr”

DevOpsDays 2009

- Patrick Debois (often called the Father of DevOps) created the first DevOpsDays conference in Ghent, Belgium in October 2009
- It was "**The conference that brings development and operations together**"
  - This is where the term DevOps was first used
- DevOpsDays is now a local conference held internationally several times a year in different cities

https://www.devopsdays.org

DevOpsDays 2019

40 Events in
21 countries
are scheduled
for 2019
(10 years later)

FEB 7 - 8, 2019
Charlotte

FEB 21 - 22, 2019
Geneva

MAR 8, 2019
Los Angeles

MAR 9, 2019
Natal

MAR 29 - 30, 2019
Vancouver

APR 3 - 4, 2019
Copenhagen

APR 9 - 10, 2019
Tokyo

APR 9 - 10, 2019
Atlanta

APR 10 - 11, 2019
Jakarta

APR 10 - 11, 2019
São Paulo

APR 16 - 17, 2019
Houston

APR 23 - 24, 2019
Seattle

APR 24 - 25, 2019
Baltimore

APR 29 - 30, 2019
Denver

MAY 2 - 3, 2019
Austin

MAY 2 - 3, 2019
Des Moines

MAY 9 - 10, 2019
Nashville

MAY 14 - 15, 2019
Zürich

MAY 14 - 15, 2019
Salt Lake City

MAY 17 - 18, 2019
Kyiv

MAY 24 - 25, 2019
Porto Alegre

MAY 29 - 30, 2019
Toronto

MAY 30, 2019
Boise

JUN 3 - 4, 2019
Portugal

JUN 8, 2019
Aracaju

JUN 25 - 28, 2019
Amsterdam

JUL 25 - 26, 2019
Indianapolis

AUG 6 - 7, 2019
Minneapolis

SEP 9, 2019
Cairo

SEP 10 - 12, 2019
Portland

SEP 19 - 20, 2019
Istanbul

SEP 23 - 24, 2019
Boston

SEP 26 - 27, 2019
London

OCT 1 - 2, 2019
Raleigh

OCT 16 - 18, 2019
Taipei

OCT 22 - 23, 2019
Oslo

OCT 22 - 23, 2019
Philadelphia

OCT 23 - 24, 2019
Detroit

OCT 28 - 30, 2019
Ghent

NOV 27 - 28, 2019
Berlin

Allspaw @ Velocity 2009

https://www.youtube.com/watch?v=LdOe18KhtT4

- Most people will cite John Allspaw (@allspaw) and Paul Hammond's Velocity 2009 presentation titled "**10+ Deploys Per Day: Dev and Ops Cooperation at Flickr**" as a pivotal moment in the Devops movement.

- "In the last week there were **67** deploys of **496** changes by **18** people" – Flickr Dev Blog, **December 17th 2008**.

https://conferences.oreilly.com/velocity/velocity2009/public/schedule/detail/7641

2011 Etsy Deploys to Production every ~25 min*

- In January 2011 (a month in which we did over **a billion** page views)
- Code committed by **76** unique individuals
- Was deployed to production by **63** different folks
- A total of **517** times

* Based on 22 days 10 hrs/day (517 / 22 / 10 = 2.35/hr)

...but these are "mythical" companies, right?

...big enterprisers can't possibly work like this, right?

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2016 DevOps Enterprise Summit

- **Ticketmaster** - 98% reduction in MTTR
- **Nordstrom** - 20% shorter Lead Time
- **Target** - Full Stack Deploy 3 months to minutes
- **USAA** - Release from 28 days to 7 days
- **ING** - 500 application teams doing DevOps
- **CSG** - From 200 incidents per release to 18

ticketmaster

NORDSTROM

USAA®

TARGET

ING

How are they doing this?

They have embraced the DevOps culture

“The term (development and operations) is an extension of agile development environments that aims to enhance the process of software delivery as a whole.”

–Patrick Debois, 2009

Why can't Dev and Ops work together?

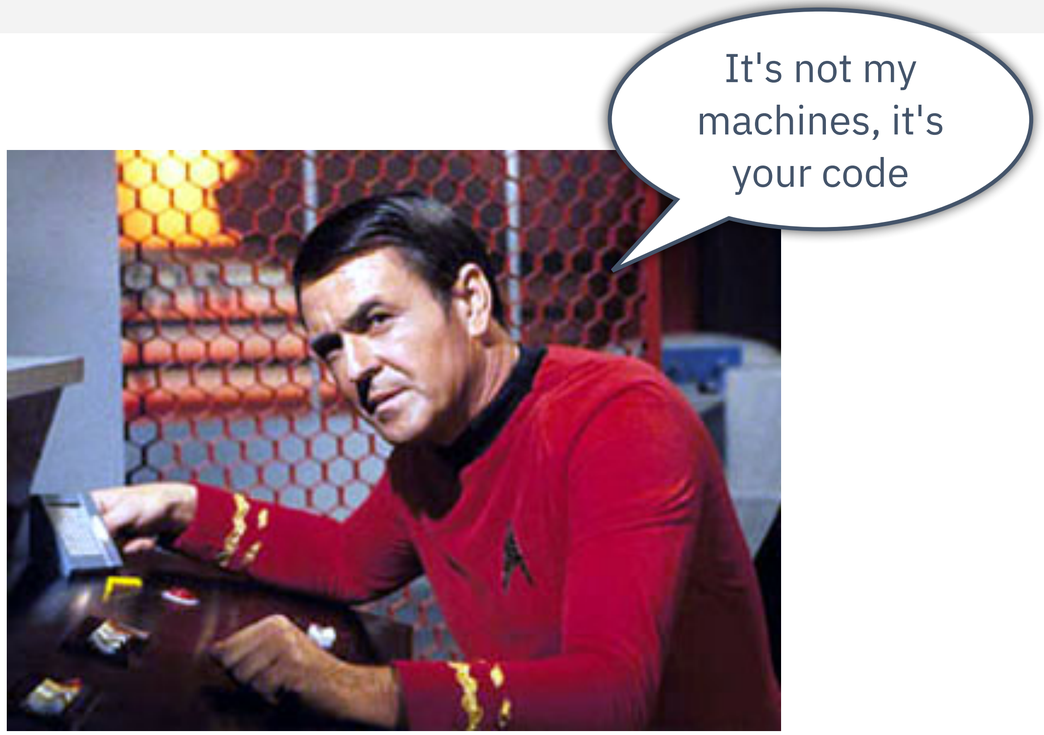
Dev verses Ops

Little bit weird

Sits closer to the boss

Thinks too hard

vs

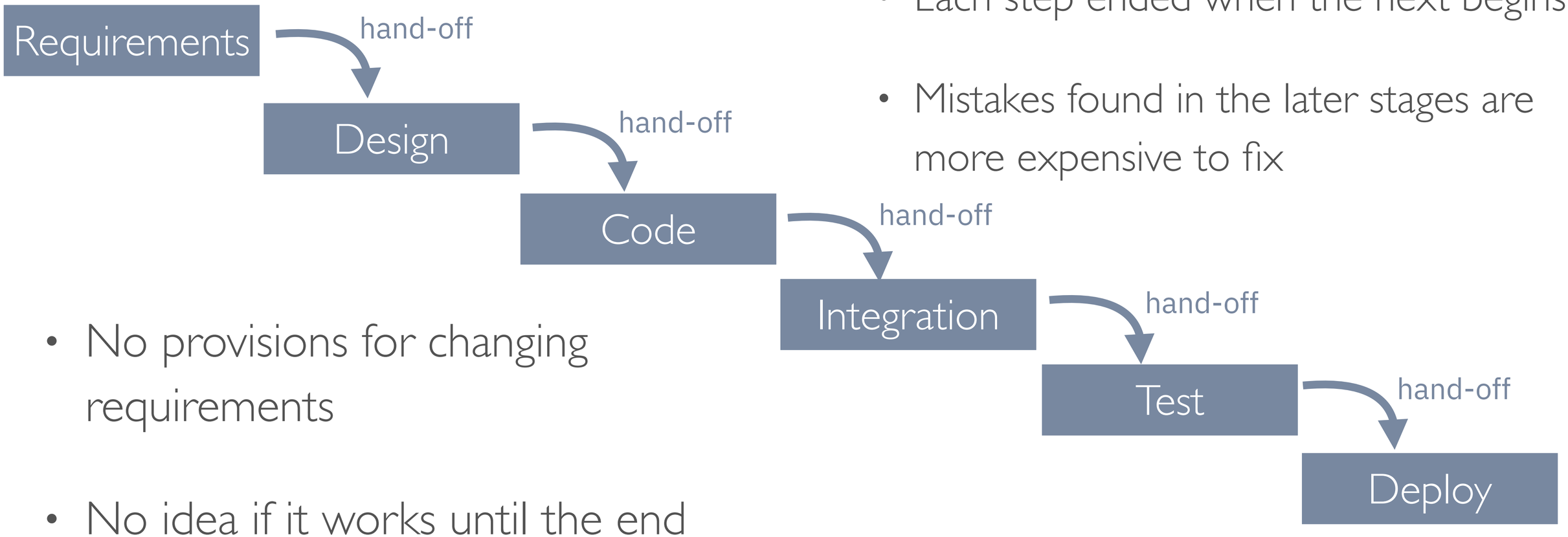


Pulls levers & turns knobs

Easily excited

Yells a lot in emergencies

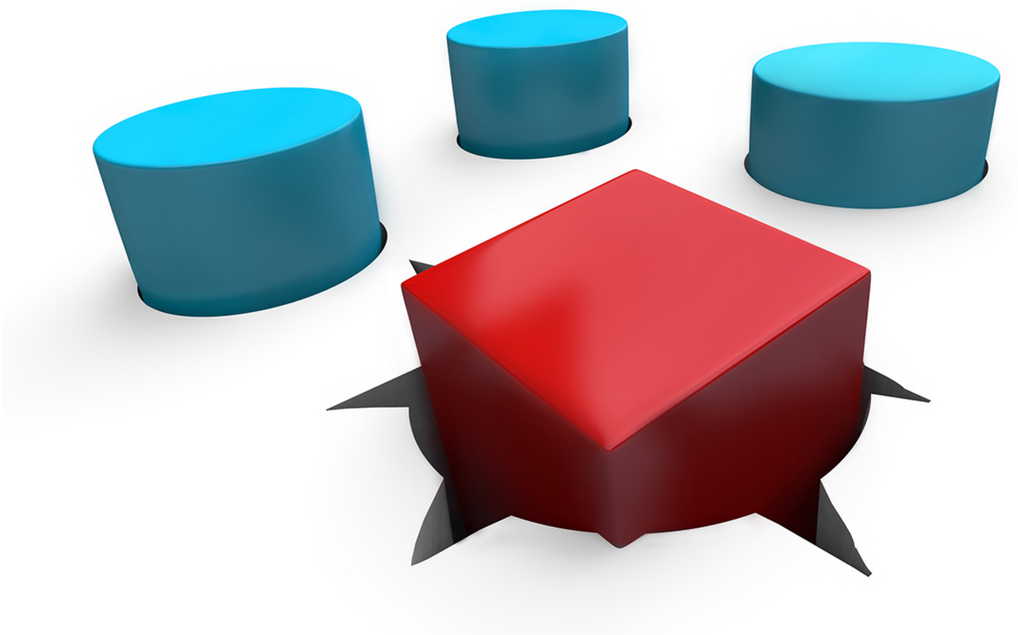
Traditional Waterfall Development



- Each step ended when the next begins
- Mistakes found in the later stages are more expensive to fix
- No provisions for changing requirements
- No idea if it works until the end

Problems with this approach?

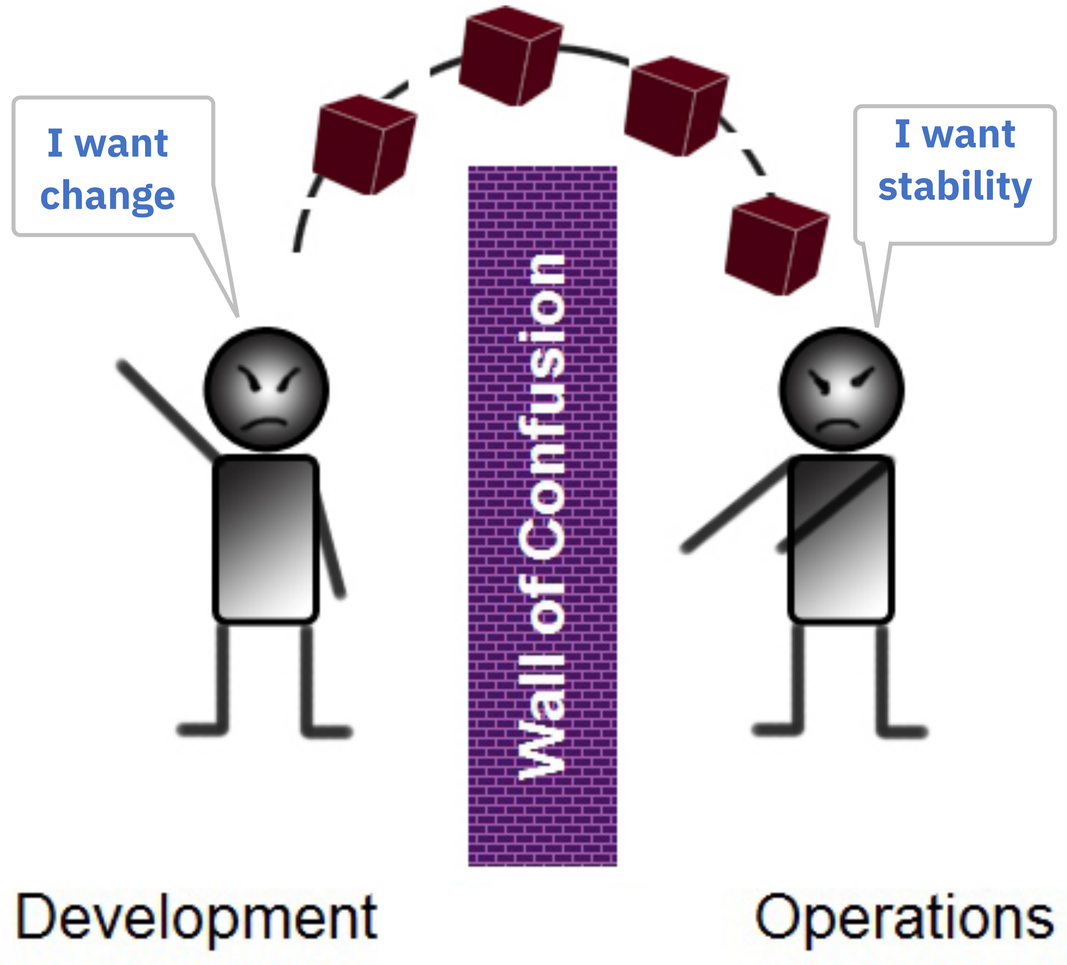
- There was usually a long time between software releases
- Because all of the teams worked separately, the development team was not always aware of operational roadblocks that might prevent the program from working as anticipated
- The people the furthest from the code who knew the least about it were deploying it into production



Diametrically Opposed Measurements

The Kobayashi Maru ...the no-win scenario

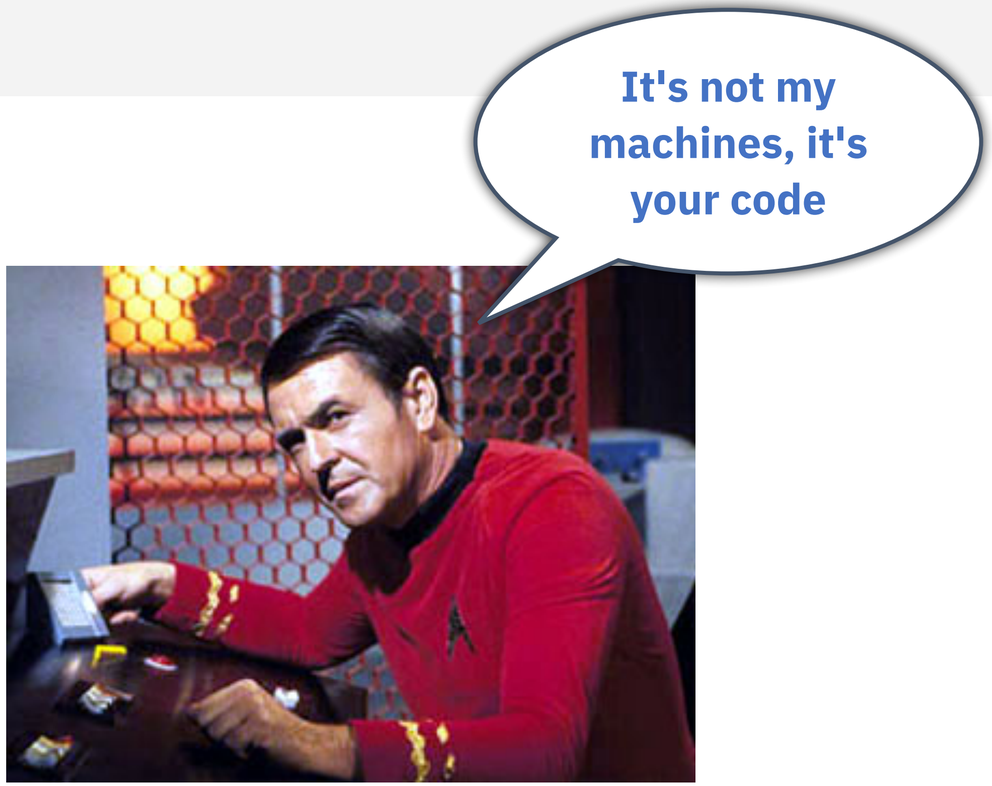
- **Development wants Innovation**
  - Keep up users' changing needs by developing and deploying new and enhanced capabilities.
- **Operations want Stability**
  - Ensure that users can use those services and applications and that their data and information is kept safe.



Source: Andrew Clay Shafer, Senior Director of Technology at Pivotal

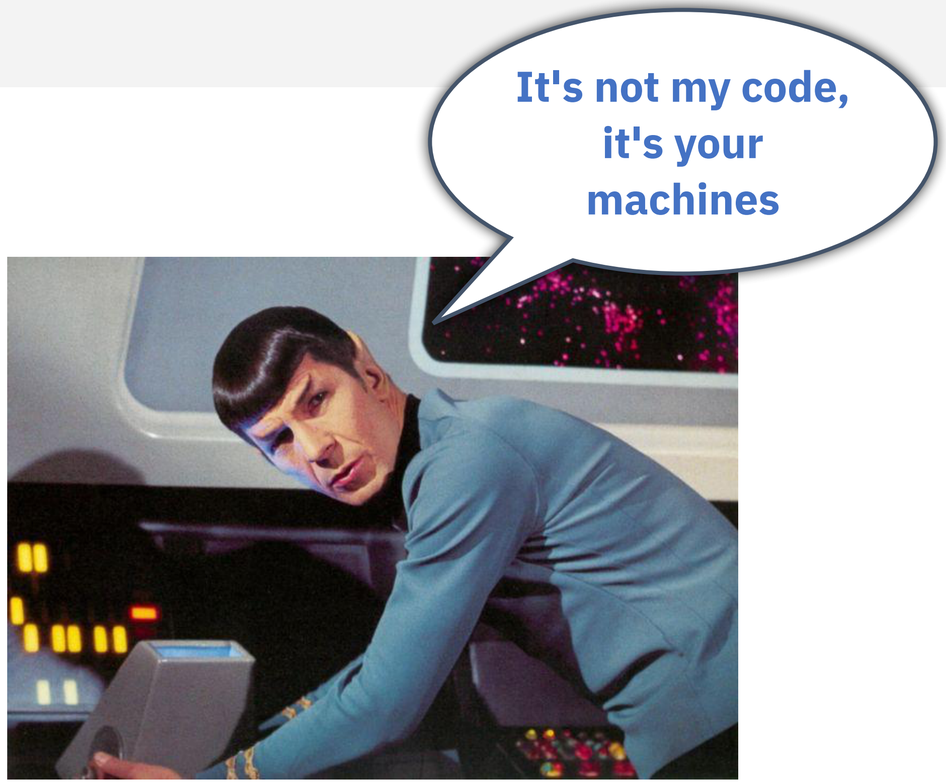
Operations View of Development

- Development teams throw dead cats over the wall
- Manually implemented changes
- Lack of back-out plans
- Lack of testing
- Environments that don’t look like Production



Development View of Operations

- All-or-nothing changes
- Change windows in the dead of night
- Implemented by people furthest away from the application
- Using cut-and-paste from Word documents called “run-books”



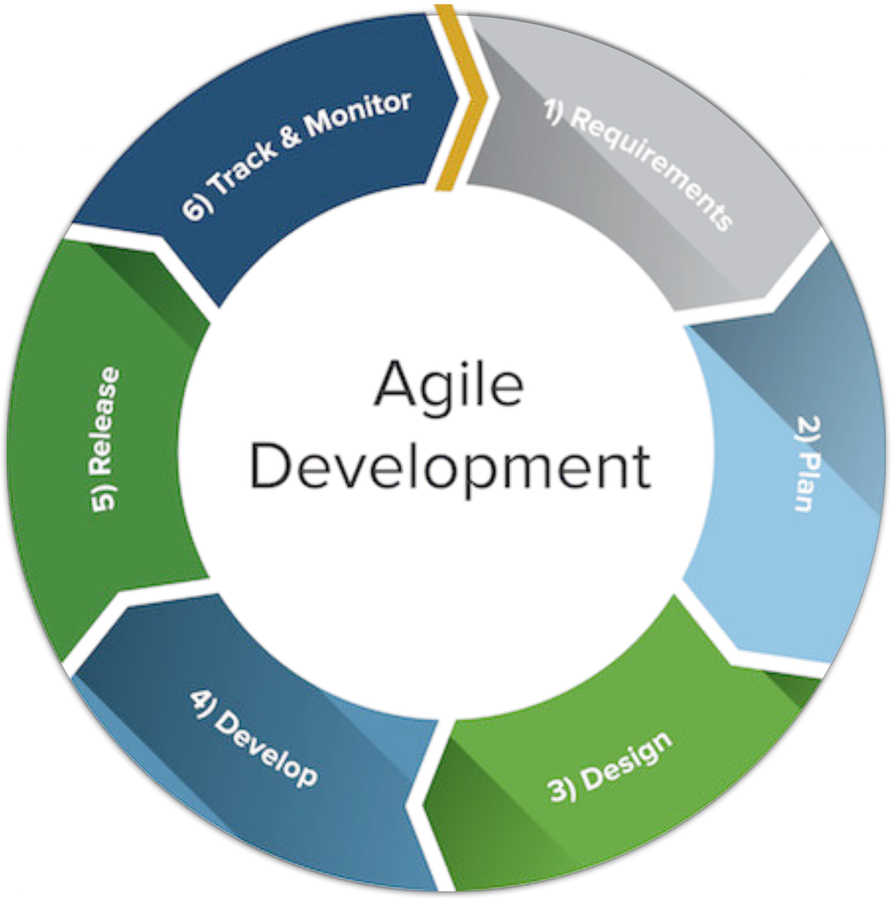
IT Silos Breed Apathy

“If the web site works, the developers get the praise
If the web site is down, operations gets the blame!”

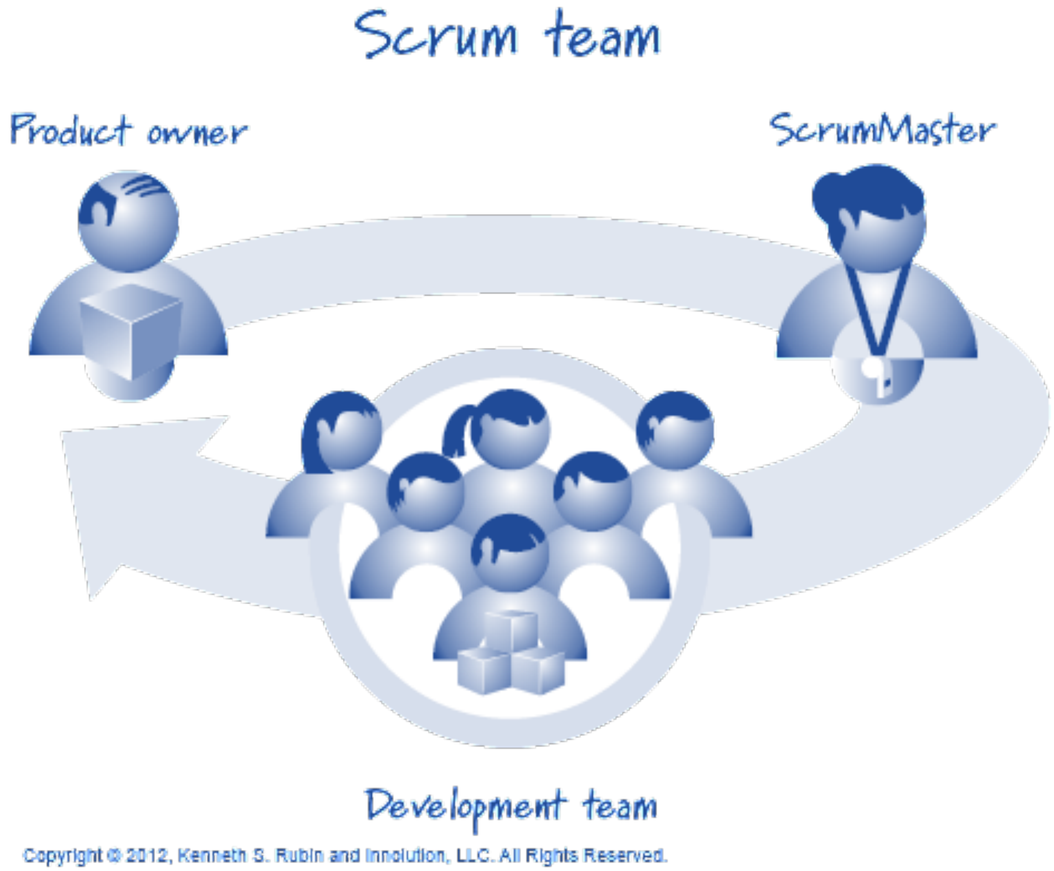
...Did I mention the Kobayashi Maru?

Agile Development

- Requirements and solutions evolve through the collaborative effort of **self-organizing** and **cross-functional** teams and their customers
- It advocates **adaptive planning**, evolutionary development, early delivery, and **continual improvement**
- It encourages rapid and flexible **response to change**



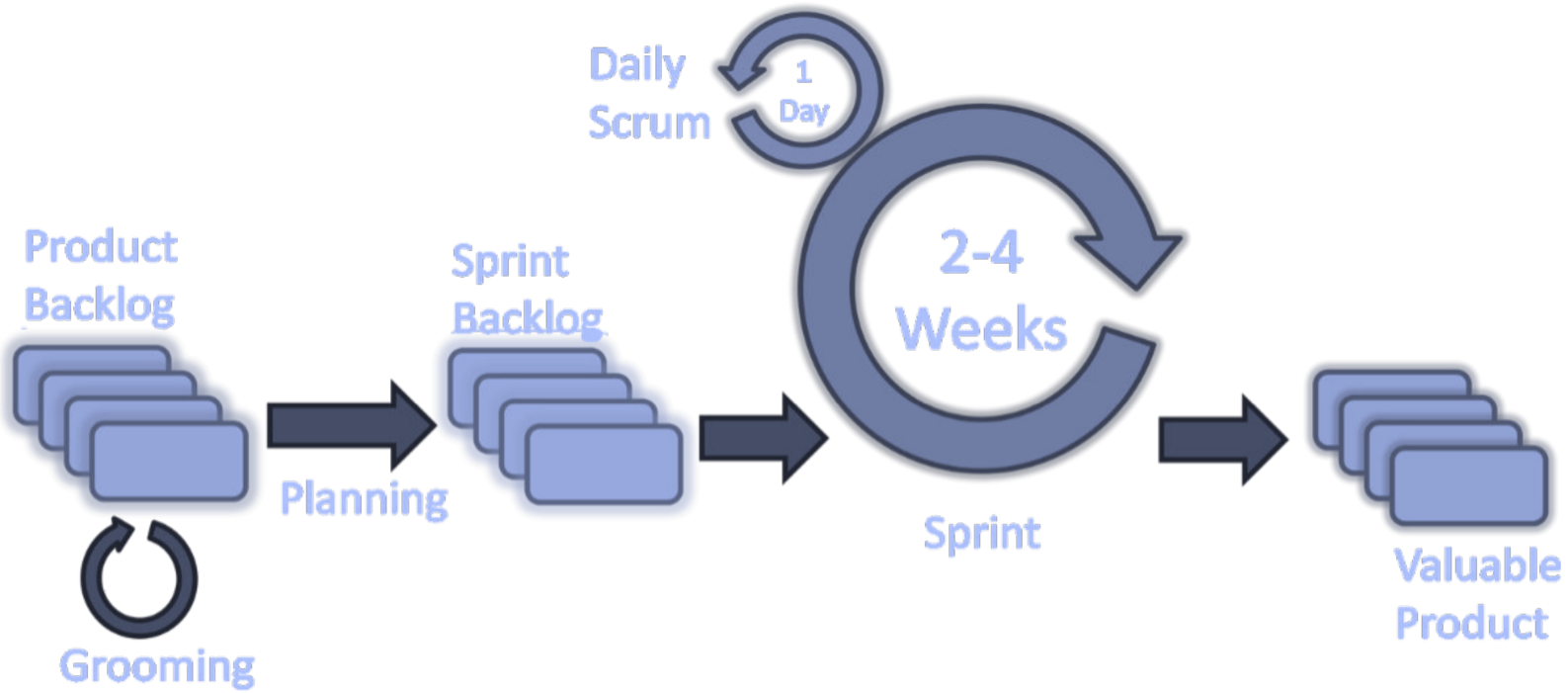
Agile Development



- ☑ Small team (5 +/- 2)
- ☑ Dedicated
- ☑ Co-located
- ☑ Cross-functional
- ☑ Self managing

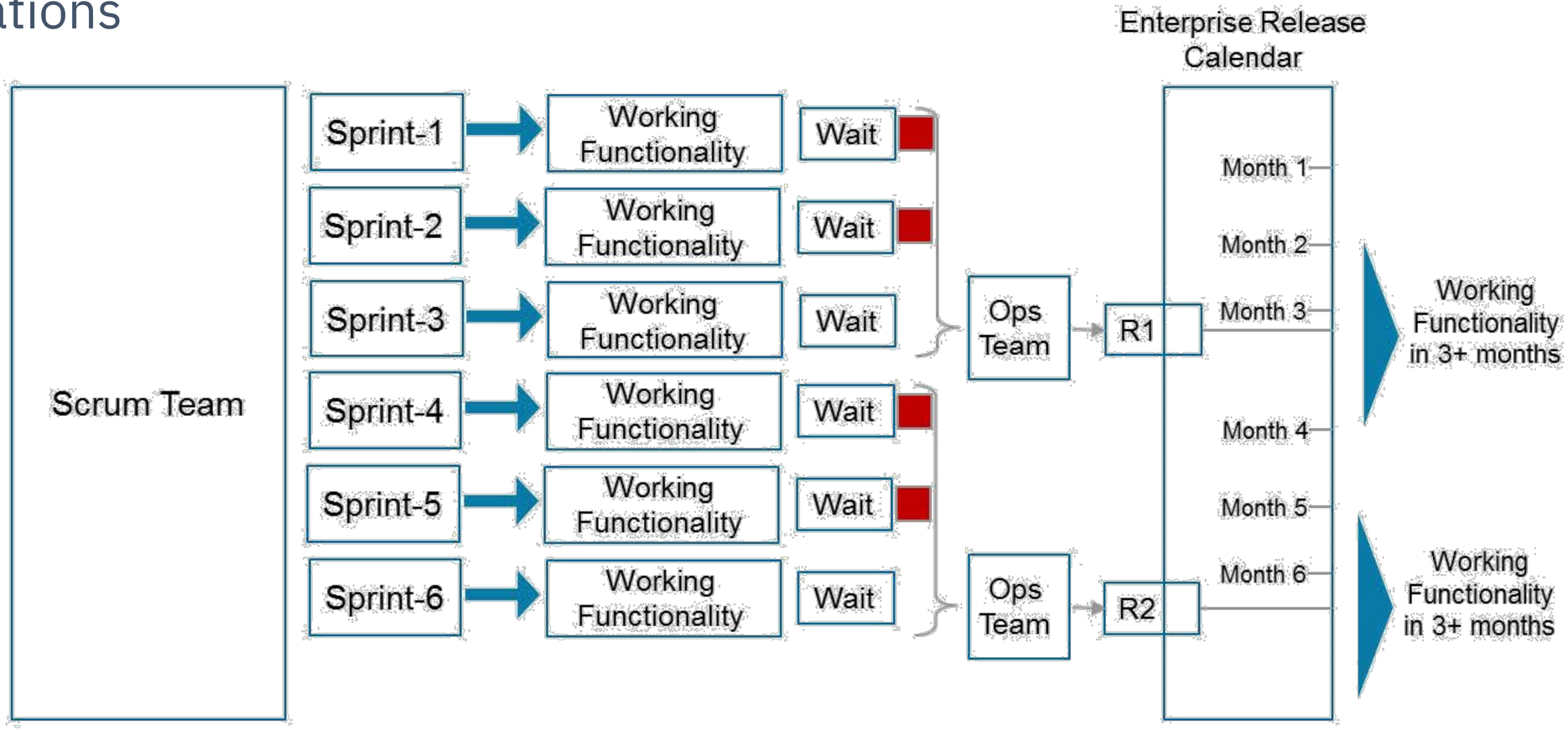
Working as an Agile Team

- Iterative Sprints
- Groomed Backlogs
- Customer Stories
- 2 Week Deliverables



Why isn’t Agile alone good enough?

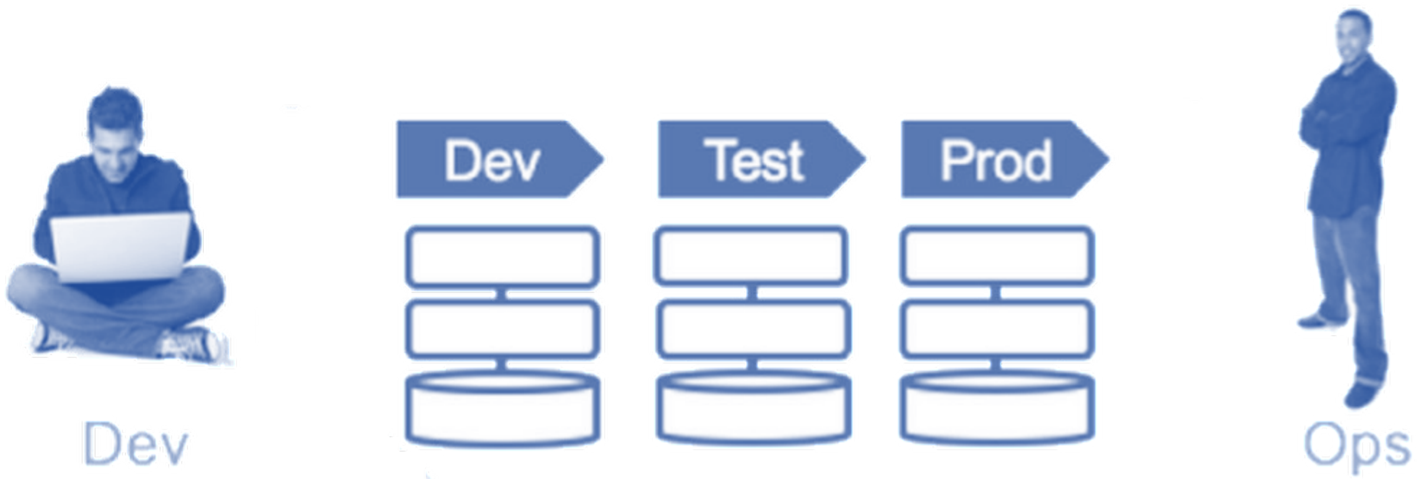
- While Agile improved the speed and accuracy of software for developers, it did nothing for operations



https://www.scrumalliance.org/community/articles/2014/april/devops-and-agile

The results of 2 speed IT

- Many development teams just got frustrated by ops not being able to deliver at the speed of development



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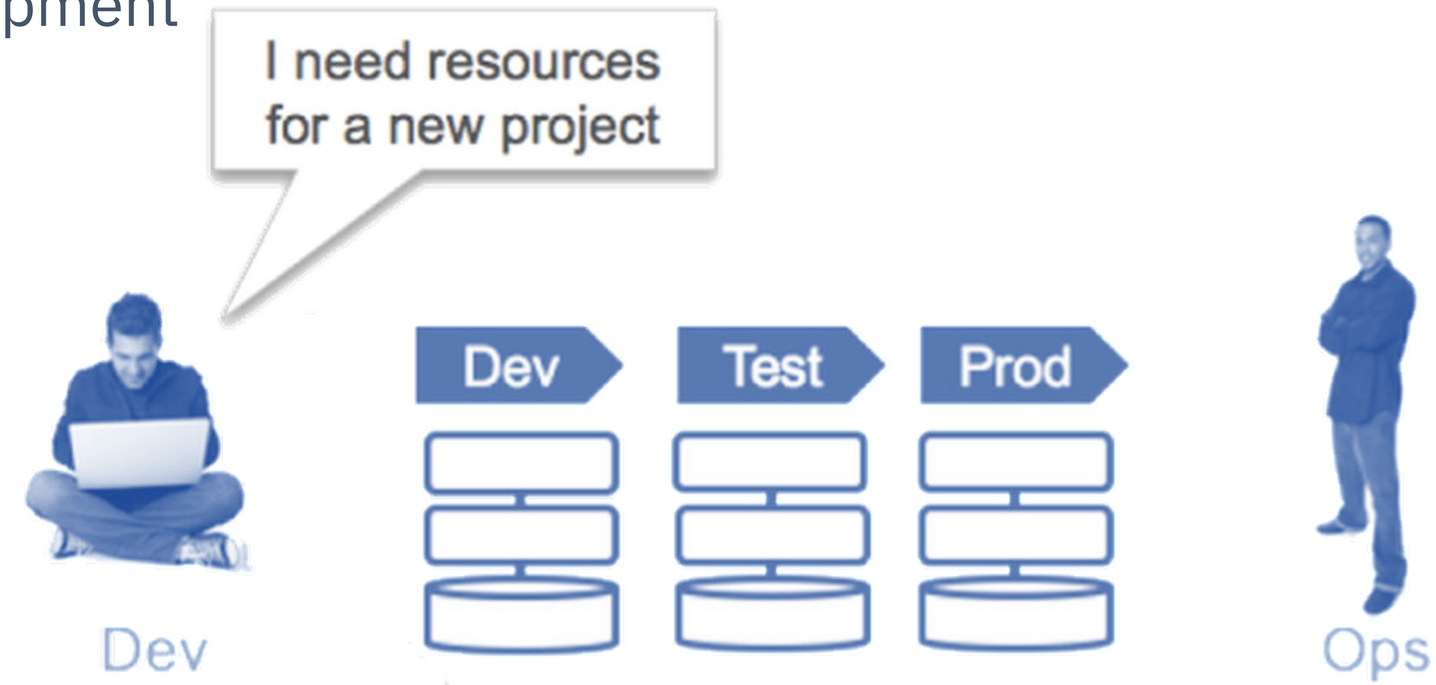

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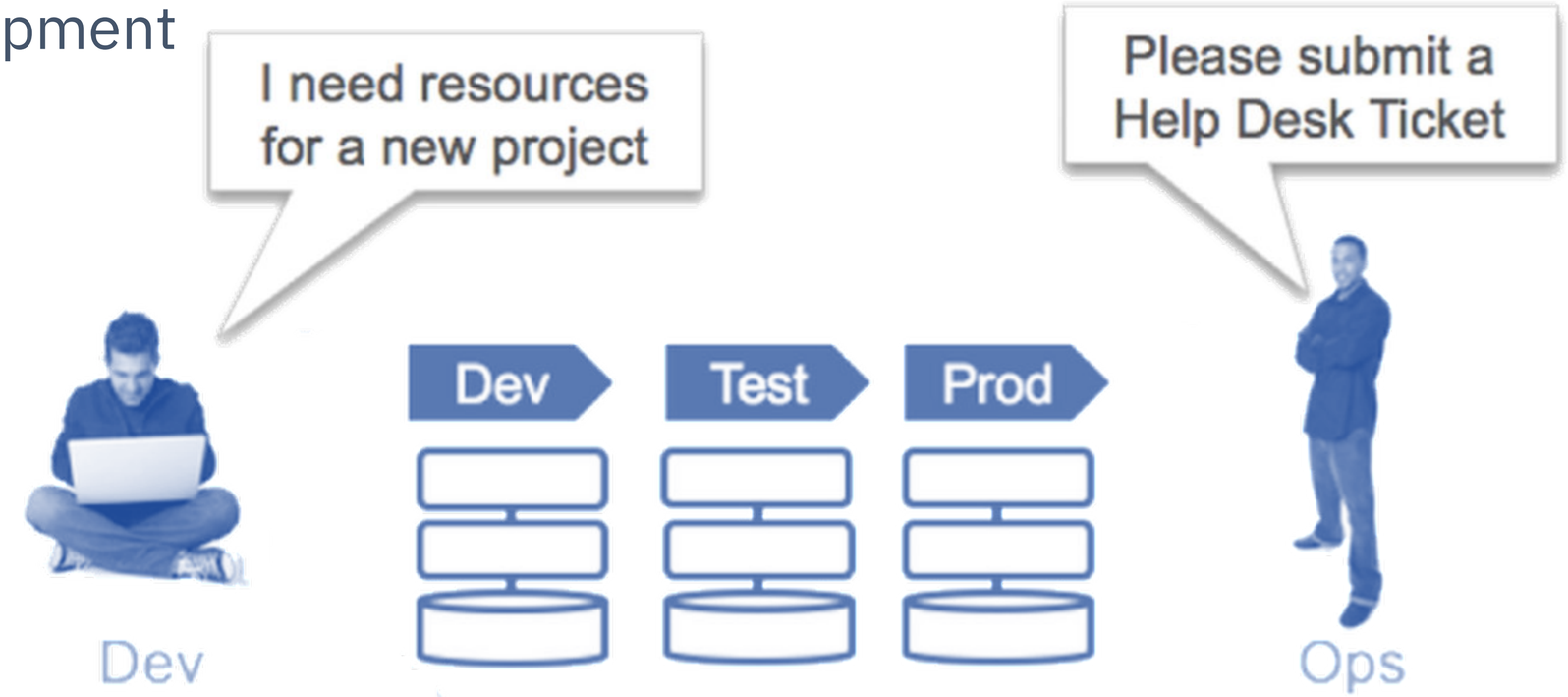

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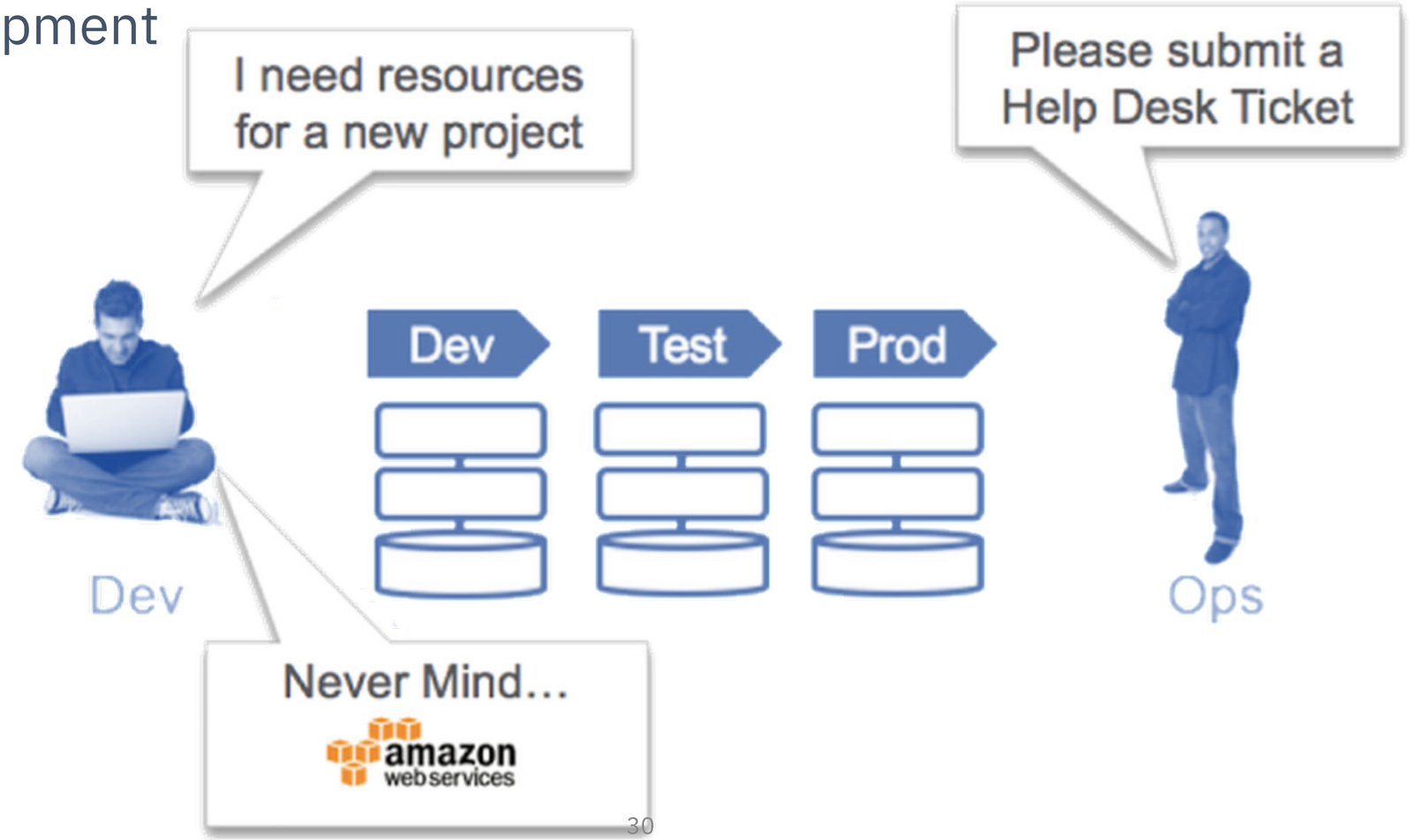


DevOps is Agile with Ops

What is DevOps?

DevOps is a recognition that Development and Operations needs to stop working alone in their "siloed" towers and start working together

- To do this we need:
  - A **culture** of collaboration valuing openness, trust, and transparency
  - An **application design** that does not require entire systems to be redeployed just to add a single function
  - **Automation** that accelerates and improves the consistency of application delivery so that we can develop and deliver software with speed and stability
  - A dynamic software-defined, **programmable platform** to continuously deploy onto

DevOps has Three Dimensions

1. Culture
2. Methods
3. Tools

“While tools and methods are important
… it’s the culture that has the biggest impact”

“Culture is the #1 success factor in DevOps. Building a culture of shared responsibility, transparency and faster feedback is the foundation of every high performing DevOps team.”

–Atlassian

How do you change a culture?

How do you change a culture?

- You must change the way people **think**
- You must change the way people **work**
- You must change the way people are **organized**
- You must change the way people are **measured**

You must change the way people think

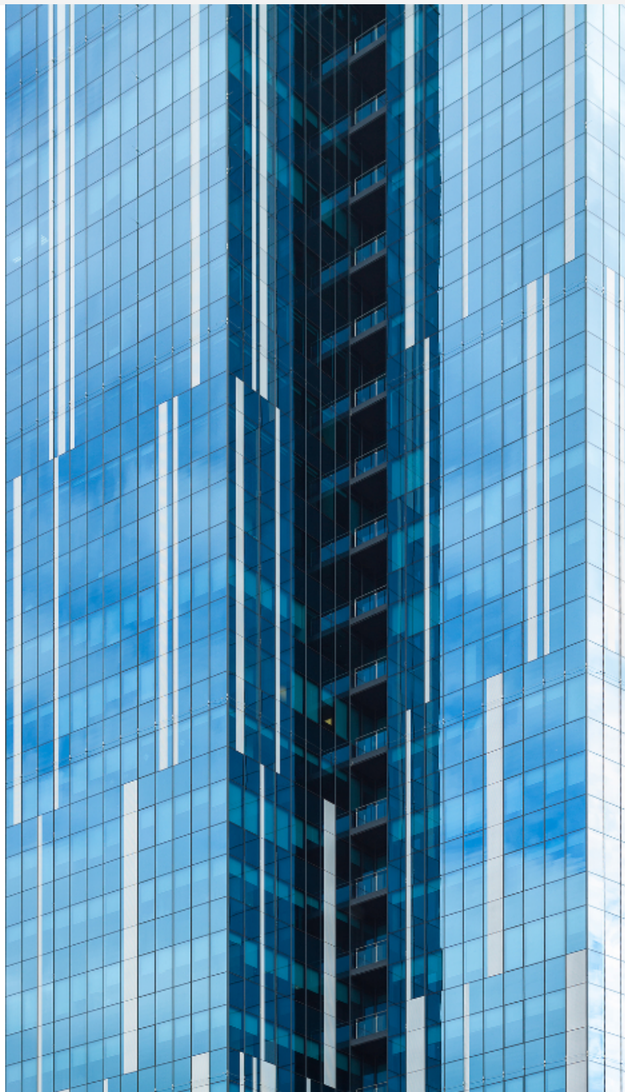
DevOps Thinking

- Social Coding
- Behavior Driven and Test Driven Development
- Working in small batches*
- Build Minimum Viable Products for gaining insights*
- Failure leads to understanding

* from Lean Manufacturing

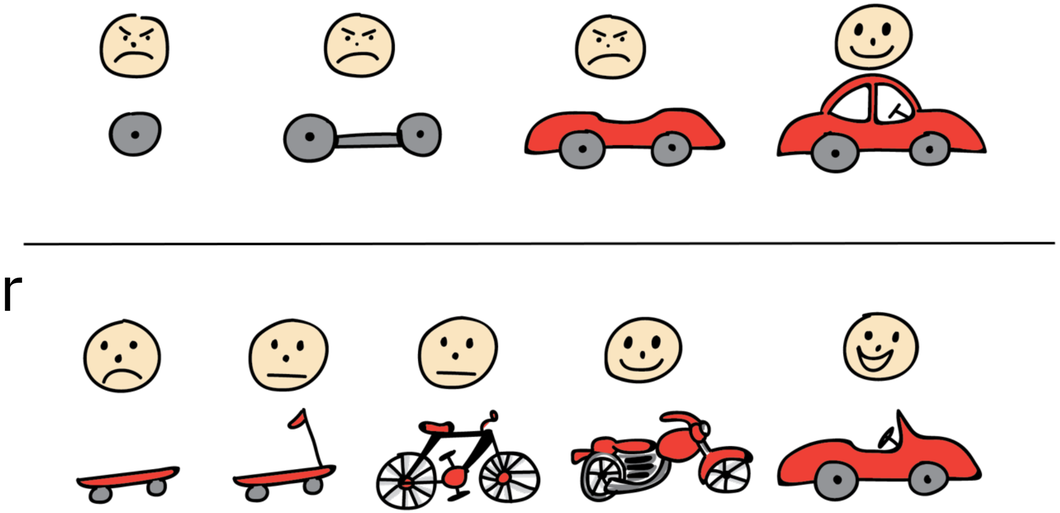
Think Social Coding

- Repositories are **public** and everyone is encouraged to Fork the code and contribute to the project
- **Discuss** the new feature with the repo owner and agree to develop it
- Open an **Issue** and assign it to yourself so that everyone knows what you are working on
- **Fork** the code, create a **branch**, and make your changes
- Issue a **Pull Request** when you are ready to review and merge your work back into the main project



Think Minimum Viable Product

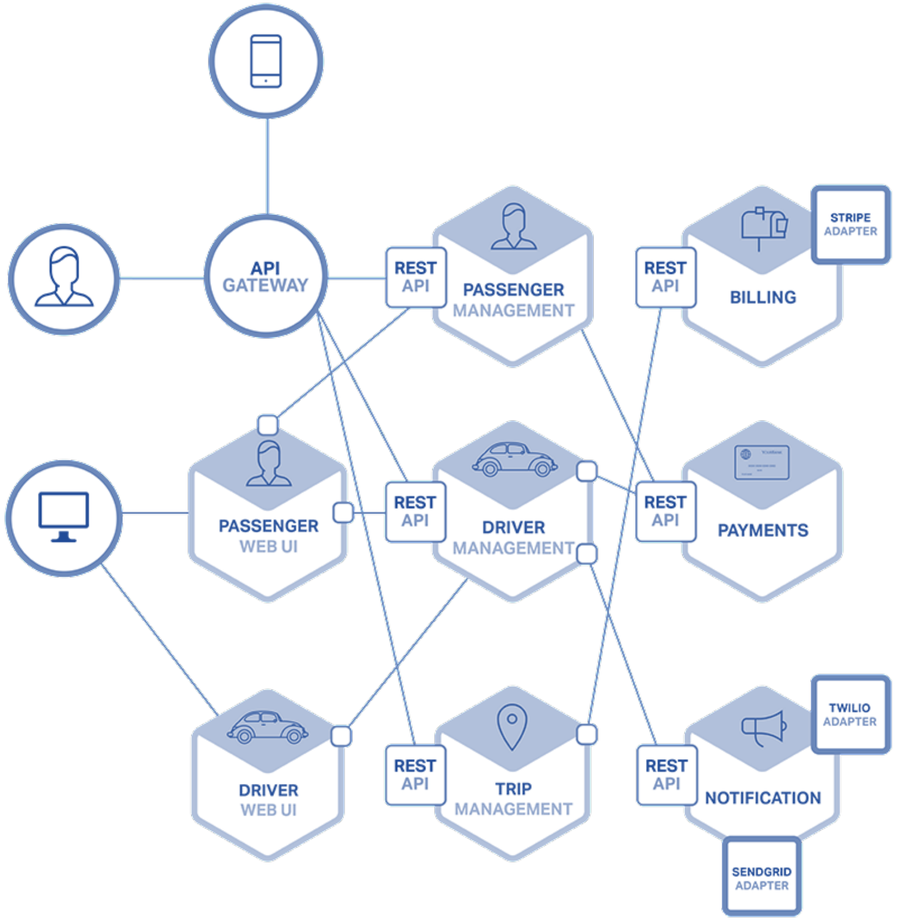
- MVP is NOT the result of "Phase 1" of a project
- It IS the cheapest/easiest thing you can build to start testing your **value hypothesis** and **learning**
- The former focuses on *delivery*, while the latter focuses on *learning*
- At the end of each MVP you decide whether to pivot or persevere



https://blog.crisp.se/2016/01/25/henrikkniberg/making-sense-of-mvp

Think Cloud Native

- **The Twelve-Factor App** describes patterns for cloud-native architectures which leverage microservices
- Applications are design as a collection of stateless microservices
- State is maintained in separate databases and persistent object stores
- Resilience and horizontal scaling is achieved through deploying multiple instances
- Failing instances are killed and re-spawned, not debugged and patched (cattle not pets)
- DevOps pipelines help manage continuous delivery of services



https://www.nginx.com/blog/introduction-to-microservices/

Think Microservices

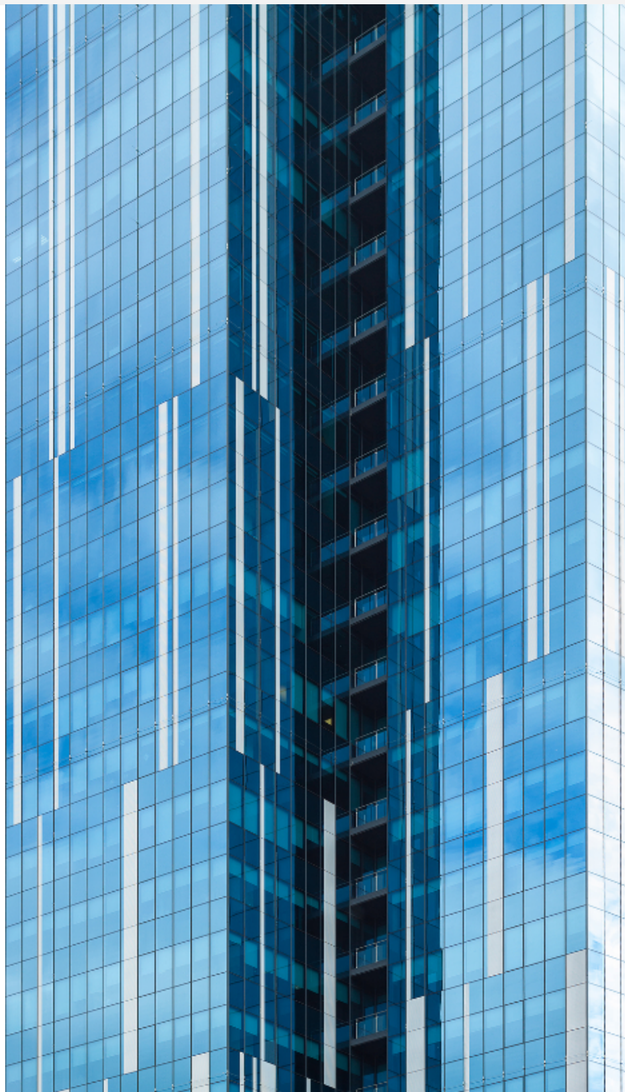
"...the microservice architectural style is an approach to developing a single application as a suite of small services, each running in its own process and communicating with lightweight mechanisms, often an HTTP resource API. These services are built around business capabilities and independently deployable by fully automated deployment machinery."

- James Lewis and Martin Fowler

“Since failure is inevitable, architect your software to be resilient and to scale horizontally.”

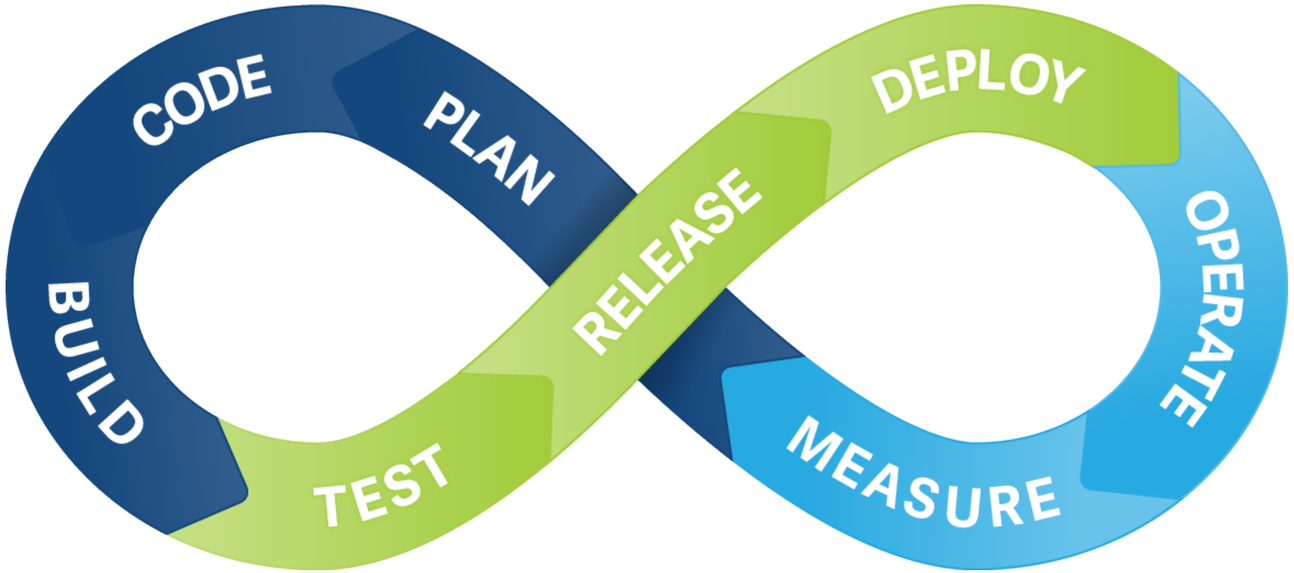
Design for Failure

- **Embrace failures** - they will happen!
  - Move from: How to avoid —> How to identify & what to do about it
  - Move from: Pure operational concern —> developer concern
- External calls to other services that you don't control are especially prone to problems
  - Use separate thread pools
  - Time out quickly
- **Circuit breaker pattern** – identify problem and do something about it to avoid cascading failures
- **Bulkhead pattern** - Isolation from start to limit scope of failure (separate thread pools)
- **Monkey testing** – test by breaking (yes, on purpose! see: Netflix Chaos Monkey and Simian Army)



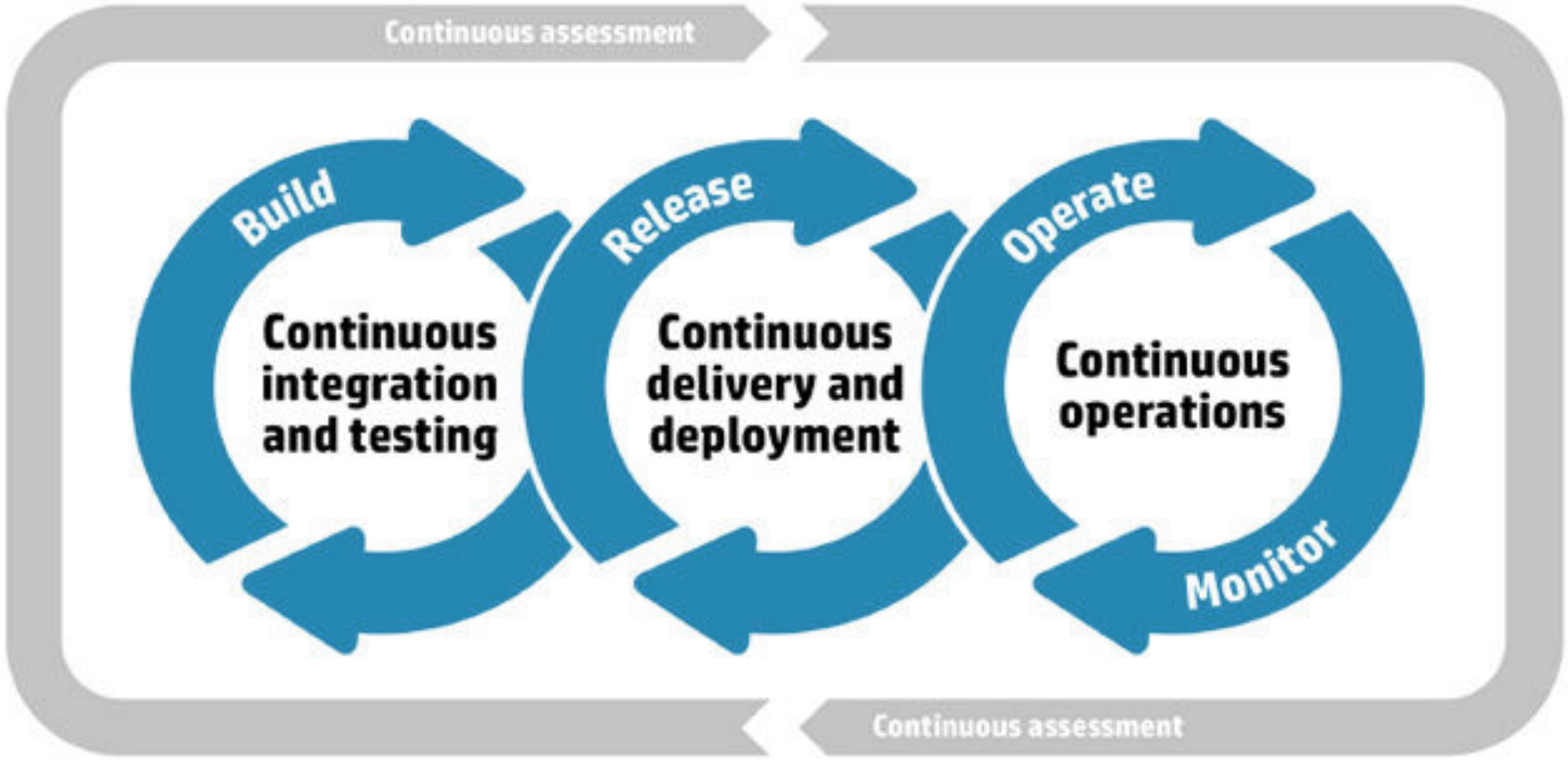
Think Continuous Automation

- Continuous Integration (CI)
- Continuous Delivery (CD)
- Build Automation
- Canary Rollouts / Blue-Green
- Failing Forward
- Application Release Automation



Automation is not just about speed... it's about repeatability.

Think Continuous Improvement



Actually it's a continuous pipeline that exists in a giant feedback loop

“Being able to recover quickly from failure is more important than having failures less often.”

–John Allspaw, CTO at Etsy

http://www.kitchensoap.com/2010/11/07/mttr-mtbf-for-most-types-of-f/

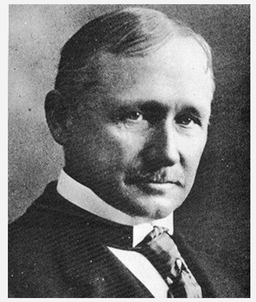
How do you change a culture?

You must change the way people work

DevOps

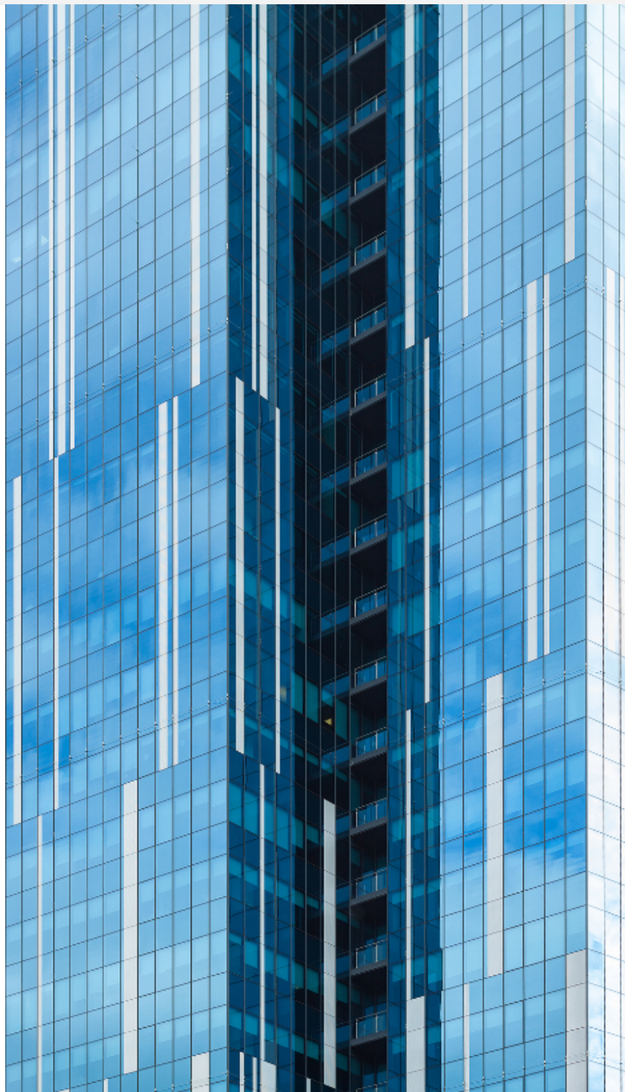
We have worked the same way since the industrial revolution

Taylorism



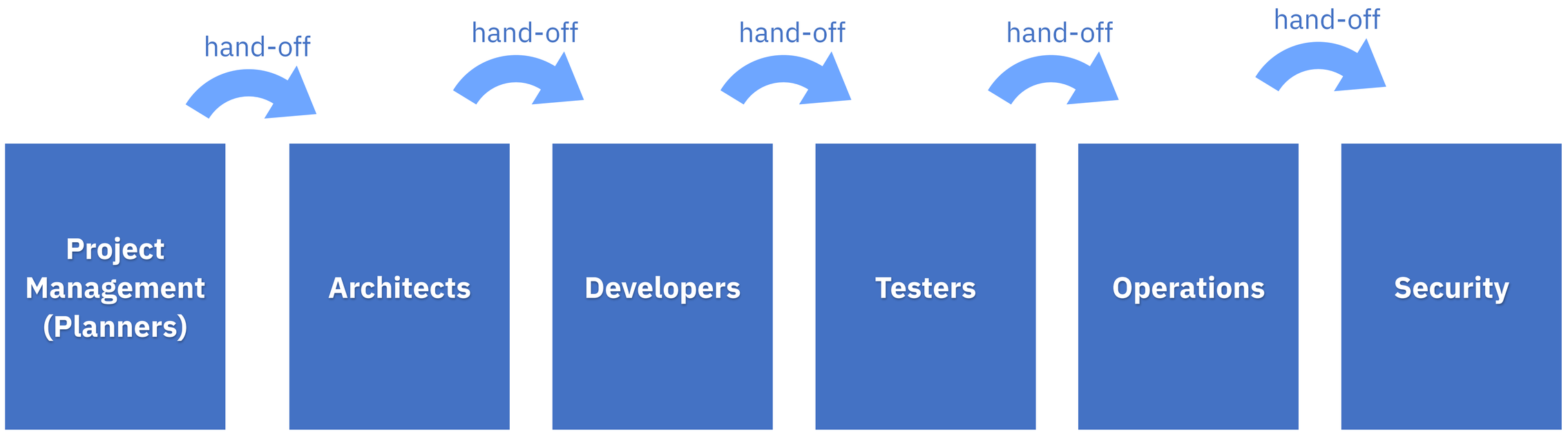
Named after the US industrial engineer **Frederick Winslow Taylor** (1856-1915) who in his 1911 book ***'Principles Of Scientific Management'*** laid down the fundamental principles of large-scale manufacturing through **assembly-line** factories.

- Adoption of **Command and Control Management**
  - The dominant method of management in the Western world
- Organizations divided into (ostensibly) independent **functional silos**
  - Workers are separated into task specific roles for greater efficiency
- **Decision-making** is separated from work
  - Managers do the planning and decide what workers should do
  - Workers mindlessly do the tasks they are ask to accomplish



Impact of Taylorism on Information Technology

Optimized roles may work great making cars (assembly line), not so good for software development (yields waterfall / silos)



Software Development is NOT like Assembling Automobiles

In software development, most of the parts don't even exist yet

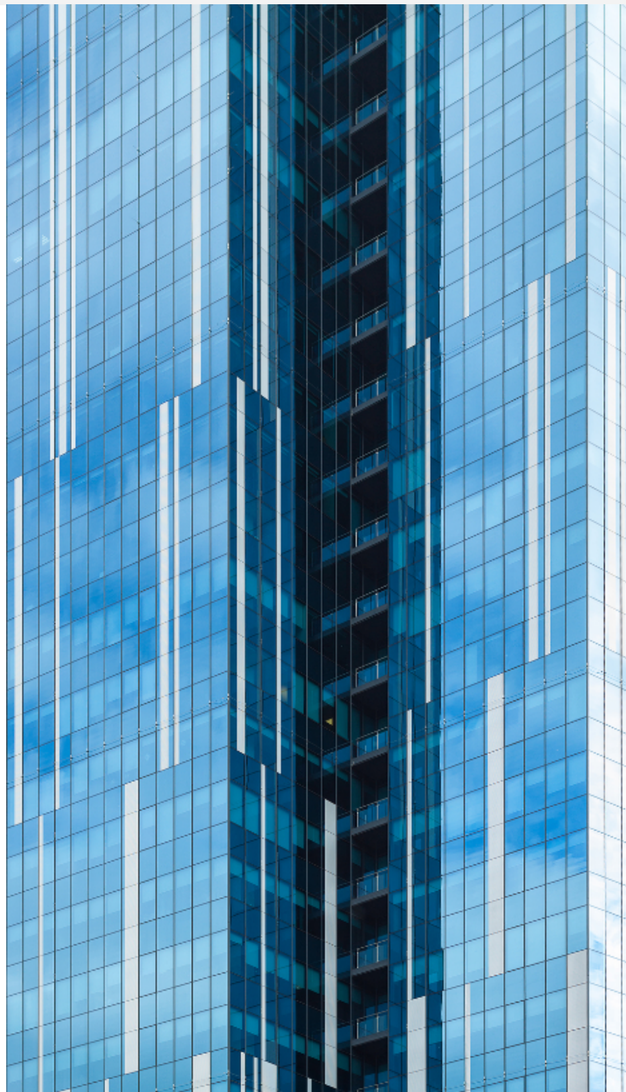
1928 Ford Rouge Complex Model A assembly line negative from the Ford Motor Company archives.

DevOps represents the reincarnation of "craft work"

...because software development is always bespoke

Taylorism is not appropriate for Craft Work

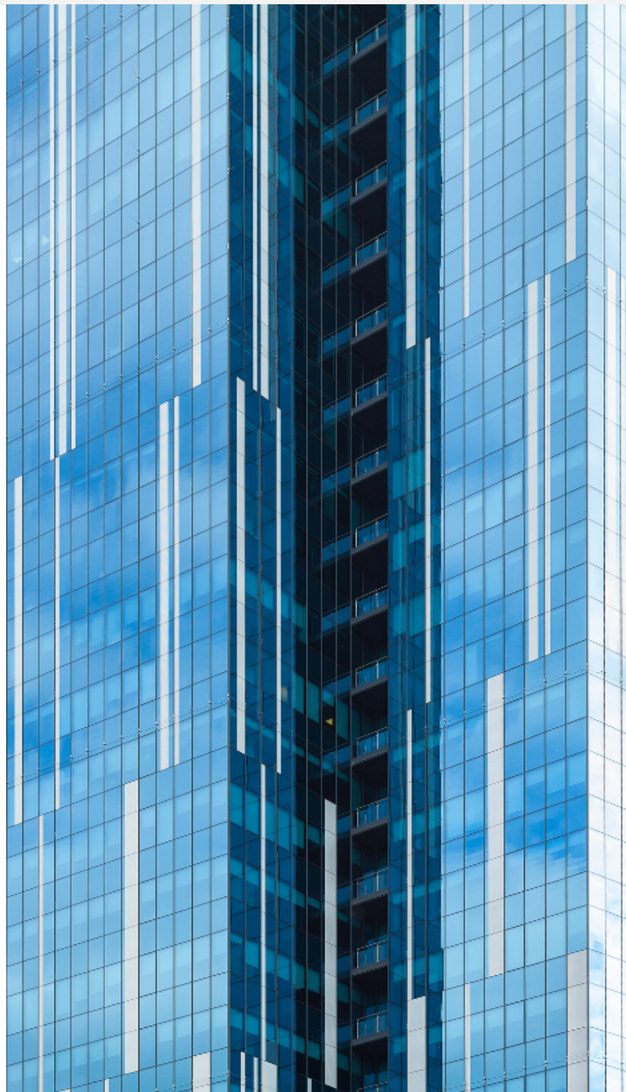
- Taylorism may have been good during the industrial revolution, but not so much in the technology revolution
- Automation has resolved many problems which Taylor sought to address
- The people power requirements have been lowered
- Taylorism is not appropriate for "knowledge" work like software development



Software Engineering vs Civil Engineering

The project model is fundamentally flawed

- **Software development efforts are usually run as if they were civil engineering projects**
  - When a project is complete, the system gets tossed over the wall to operations to run and maintain as part of a "business as usual" effort
  - All the people in the project team get reallocated to new work
- **The project model is fundamentally flawed as a way of doing software development**
  - Software development should be treated as product development instead



https://continuousdelivery.com/2012/10/theres-no-such-thing-as-a-devops-team/

Working DevOps

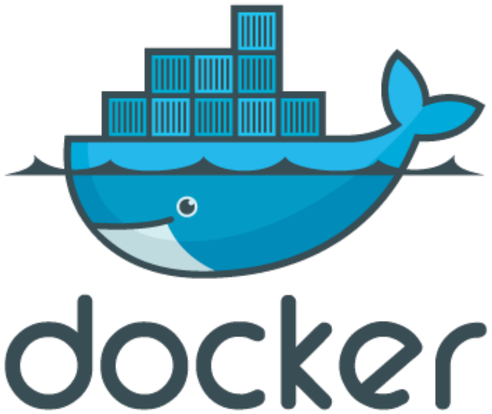
- Facilitate a culture of **teaming and collaboration**
- Establish **agile development** as a shared discipline with operations
- **Automate relentlessly** to enable rapid DevOps response
- Push **smaller releases faster**, measure and remediate impact

A Clash of Work Cultures

Traditional Ops		DevOps
Manual configuration changes to critical infrastructure	→	Automated deployment to all environments
Application architectures defined by network design	→	Network design defined by application architectures
Bespoke infrastructure built once, then maintained	→	Ephemeral infrastructure created for each new deployment
Risk managed through change windows	→	Risk managed through progressive activation
Process biased toward “build once”	→	Processes re-engineered for high volume, rapid throughput of changes

Immutable Delivery

- Applications are packaged in containers
- Same container that developer runs on their laptop runs in production
- Rolling updates with immediate roll-back
- Declarative runtime that scales horizontally

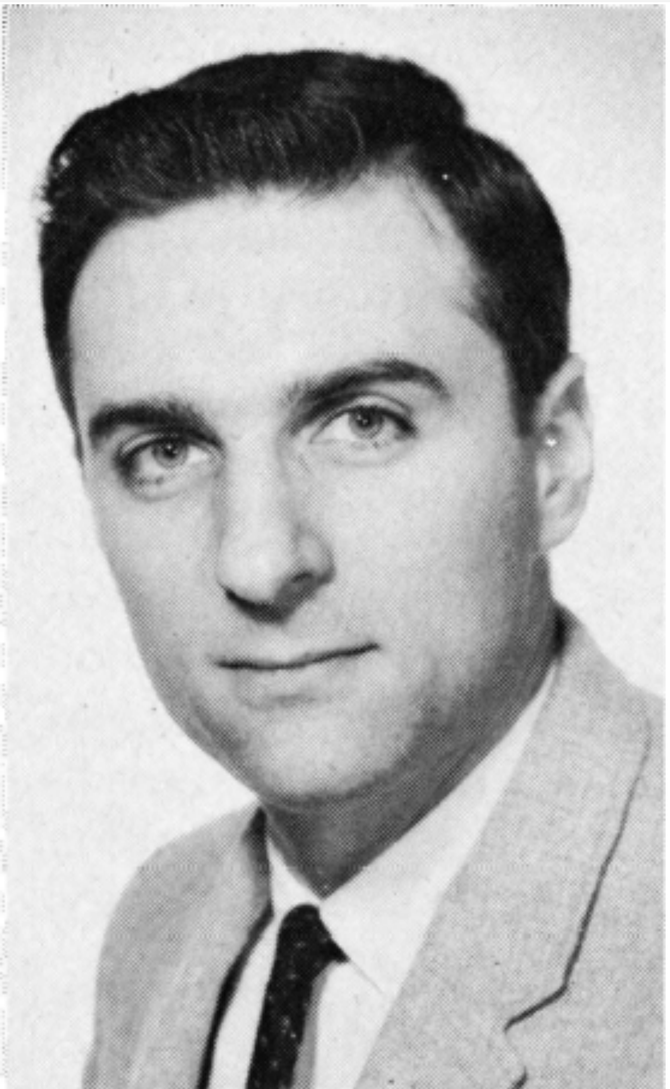


“DevOps is about breaking down the silos and working as a Single Agile Team.”

How do you change a culture?

You must change the way people are organized

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

- Melvin Conway, Datamation, 1968

e.g., if you ask an organization with 4 teams to write a compiler... you will get a 4-pass compiler!

http://www.melconway.com/Home/Conways_Law.html

Traditional Organization around Technology (Bad)

Organization Structure

User Interface Team

Application Team

Database (DBA) Team

Application Structure

Traditional Organization around Technology (Bad)

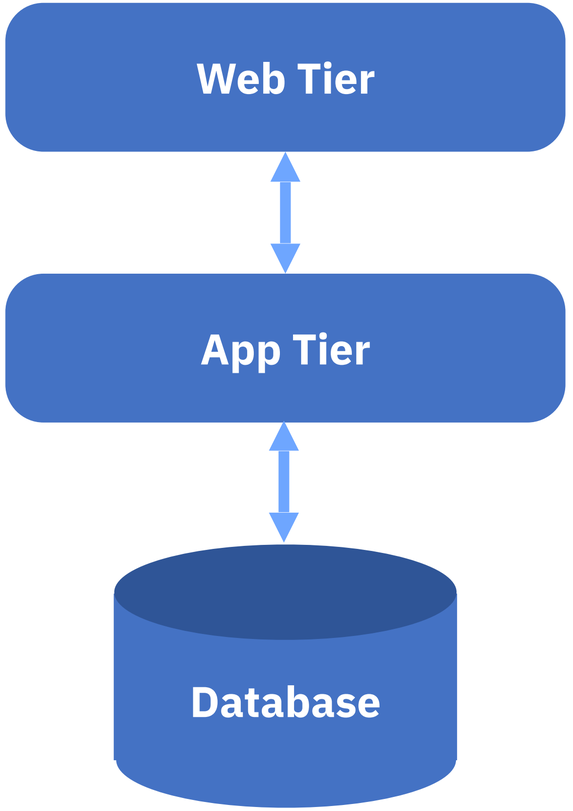
Organization Structure

User Interface Team

Application Team

Database (DBA) Team

Application Structure



Organization around Business Domains (Good)

Login
Registration
Users

Account Team

Personalization

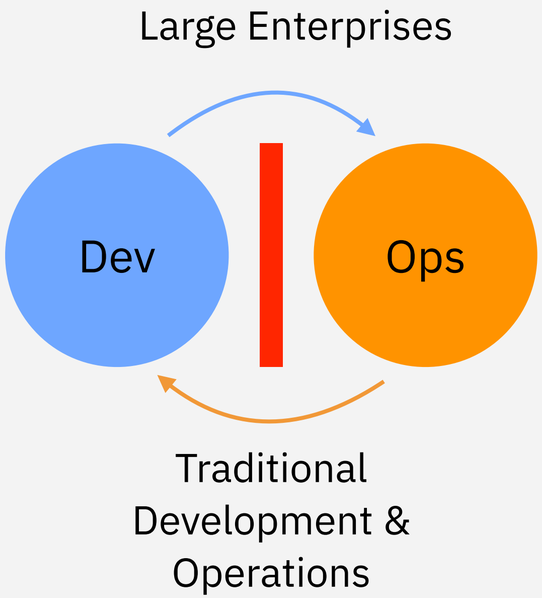
Personalization Team

Inventory
Shipping
Receiving

Warehouse Team

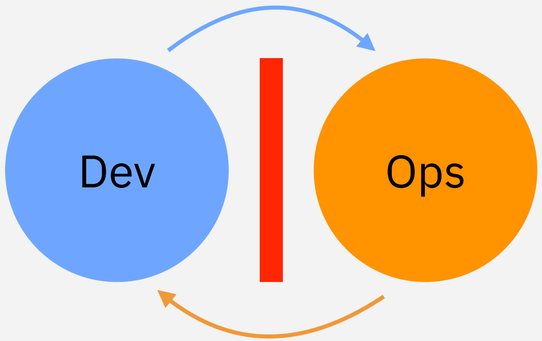
“If you are not going to organize around business domains, you are not going to get the full benefit of DevOps”

Different Perspectives of DevOps

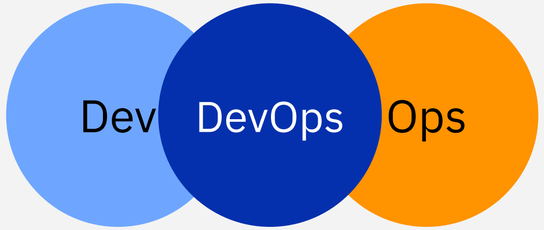


Different Perspectives of DevOps

Large Enterprises



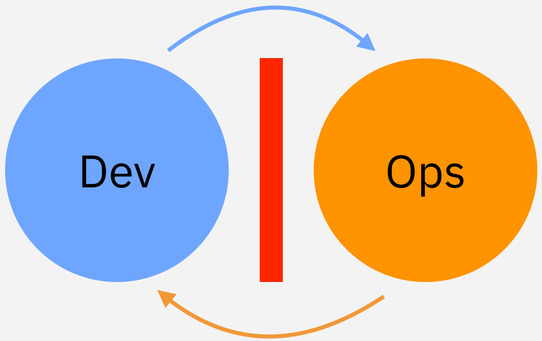
Traditional
Development &
Operations



DevOps is a separate team

Different Perspectives of DevOps

Large Enterprises



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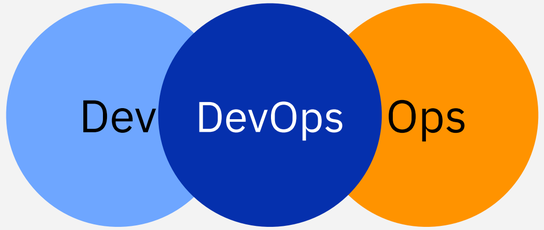

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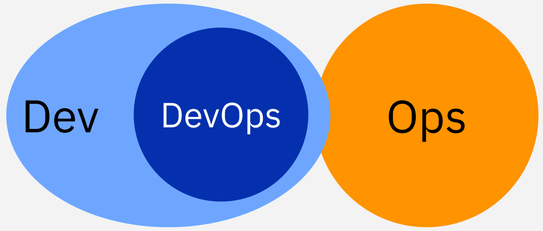
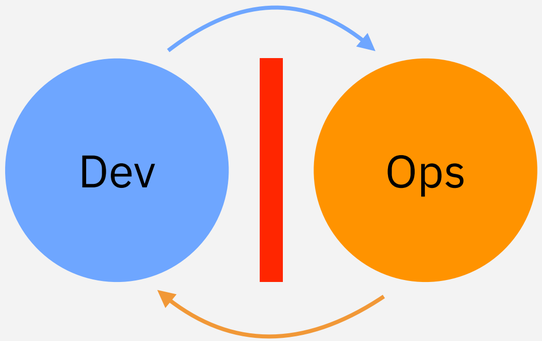


DevOps is something Devs do

Different Perspectives of DevOps

Large Enterprises



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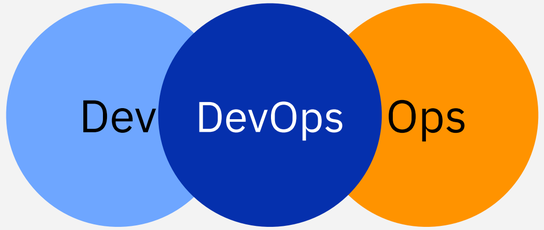

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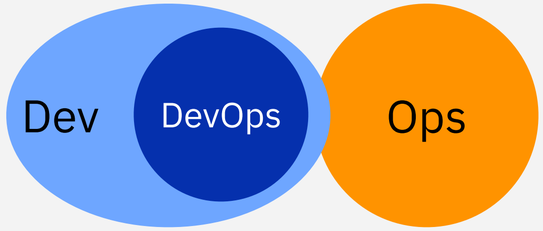

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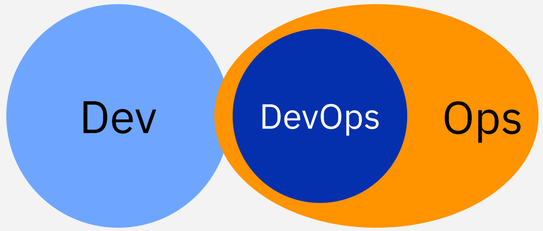
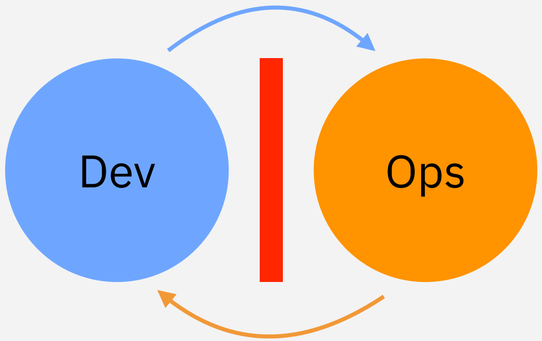


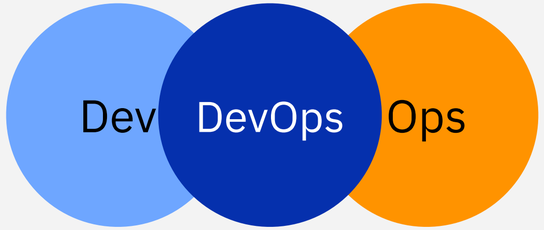
DevOps is something Ops does

Different Perspectives of DevOps

Large Enterprises



Traditional Development & Operations



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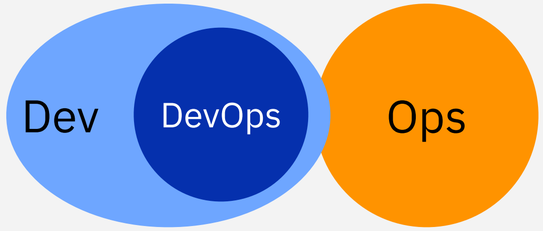

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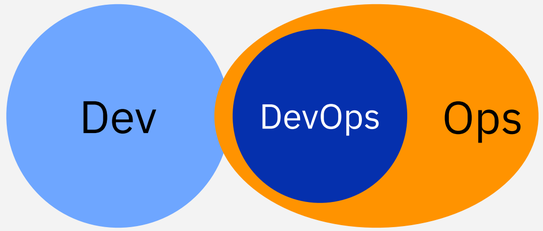


DevOps is something Ops does

Cloud Native Startups

DevOps is the company culture

There's No Such Thing as a "DevOps Team"

That’s an anti-pattern

DevOps Organizational Objective

Shared Consciousness

...with

Distributed (local) Control

“Bad behavior arises when you abstract people away from the consequences of their actions.”

– Jez Humble

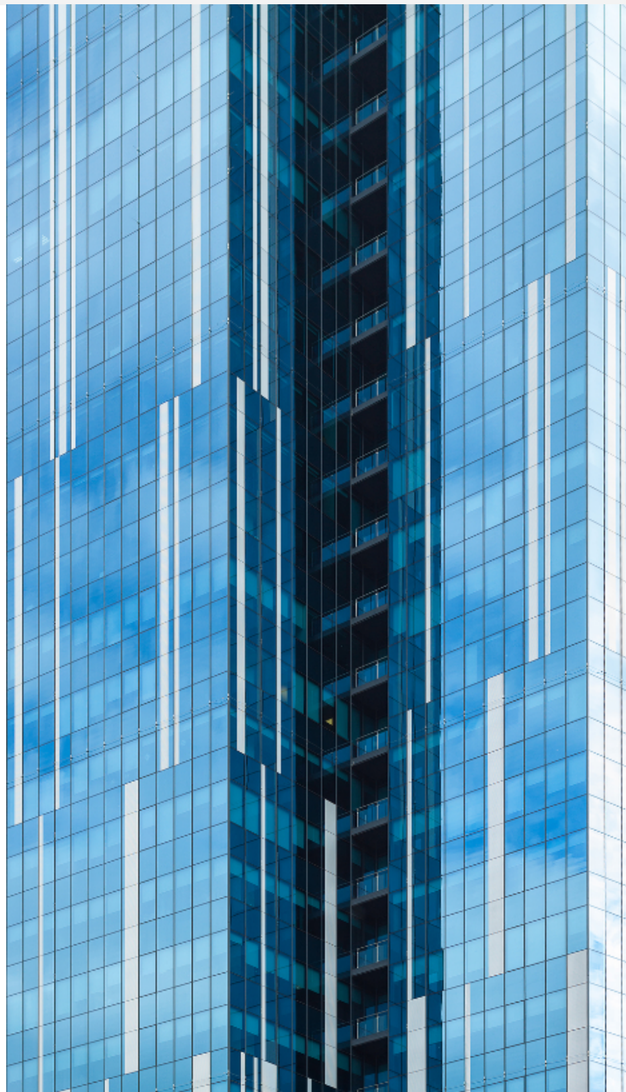
https://continuousdelivery.com/2012/10/theres-no-such-thing-as-a-devops-team/

Functional Silos Breed Bad Behavior

- Bad behavior arises when you abstract people away from the consequences of their actions.
- Functional silos abstract people away from the consequences of their actions.
- For example: By adding a QA Team, developers are abstracted away from the consequences of writing buggy code.

Actions have Consequences

- **Make people aware of the consequences of their actions**
  - Create cross-functional teams - or -
  - Have developers rotate through operations teams
  - Have operations people attend developer standups and showcases
- **Make people responsible for the consequences of their actions**
  - Having developers on Pager Duty, or own the SLA for the products and services they build



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“You build it, you run it!”

–Werner Vogels, CTO of Amazon

How do you change a culture?

You must change the way people are measured

On the folly of rewarding for A, while hoping for B

"Whether dealings with monkeys, rats, or human beings, it is hardly controversial to state that most organisms seek information concerning what activities are rewarded, and then seek to do (or at least pretend to do) those things, often to the exclusion of activities not rewarded. The extent to which this occurs of course will depend on the perceived attractiveness of the rewards offered, but neither operant nor expectancy theorists would quarrel with the essence of this notion."

–Steven Kerr, Ohio State University

Academy of Management Journal, Dec 1975

You get what you measure

Measure what Matters

...because you get what you Measure

- If you measure widget production you will get **lots of widgets**
- If you measure lines of code you will get **many lines of code**
- If you measure people against each other by ranking them, you will get **anti-social behavior**
- But if you measure developers by their social interaction and sharing... you will get **Social Coders!**

DevOps Changes the Objective

- Old School is focused on Mean Time To Failure (MTTF)
  - Make sure you never go down
- DevOps is focused on Mean Time To Recovery (MTTR)
  - You will go down, make sure you can recover quickly!

Vanity Metrics

...good for feeling awesome, bad for action

- Consider the total number of daily “hits” to your website is 10,000
- Now what? (what does a "hit" represent?)
  - Do you really know what actions you took in the past that drove those visitors to you?
  - Do you really know which actions to take next?
  - In most cases, I don’t think it’s very helpful

Actionable Metrics

- Imagine you add a new feature to your website, and you do it using an A/B split-test in which 50% of customers see the new feature and the other 50% don't.
- A few days later, you take a look at the revenue you've earned from each set of customers, noticing that group B has 20% higher revenue per-customer.
- **Think of all the decisions you can make:**
  - Obviously, roll out the feature to 100% of your customers
  - Continue to experiment with more features like this one and …
  - Realize that you've probably learned something that's particular valuable to your customers.

http://tim.blog/2009/05/19/vanity-metrics-vs-actionable-metrics/

Top 4 Actionable Metric

1. **Mean Lead Time**
   - How long does it take from idea to production?
2. **Release Frequency**
   - How often can you deliver changes?
3. **Change Failure Rate**
   - How often to changes fail?
4. **Mean Time to Recovery (MTTR)**
   - How quickly can you recover from failure?

Nicole Forsgren - AWS re:Invent 2017: Tools Won't Fix Your Broken DevOps
https://www.youtube.com/watch?v=gsjCWrCUjNg

“Measurements should encourage innovation and collaboration, and not punish failure”

DevOps Maturity Matrix*

* Cloud Computing: The Cloud and DevOps by Dave Linthicum

Maturity Level	People	Process	Technology
Level 1 Ad Hoc	• Silo based • Blame and finger-pointing • Dependent on experts • Lack of accountability	• Manual processes • Tribal knowledge the norm • Unpredictable and reactive	• Manual builds and deployments • Manual testing • Environmental inconsistencies
Level 2 Repeatable	• Managed communications • Limited knowledge sharing	• Processes established within silos • No standards • Can repeat what is known, but can't react to unknowns	• Automated builds • Automated tests written as part of story development • Painful but repeatable releases
Level 3 Defined	• Collaboration exists • Shared decision making • Shared accountability	• Process automated across the software life cycle • Standards across organization	• Automated build and test cycle for every commit • Push button deployments • Automated user and acceptance testing
Level 4 Measured	• Collaboration based on shared metrics with a focus on removing bottlenecks	• Proactive monitoring • Metrics collected and analyzed against business goals • Visibility and predictability	• Build metrics visible and acted on • Orchestrated deployments with automatic rollbacks • Nonfunctional requirements defined and measured
Level 5 Optimized	• A culture of continuous improvement permeates through the organization	• Self-service automation • Risk and cost optimization • High degree of experimentation	• Zero downtime deployments • Immutable infrastructure • Actively enforce resiliency by forcing failures

Key Takeaways

- DevOps is about breaking down the silos and working as a Single Agile Team
- Culture is the #1 success factor in DevOps. Building a culture of shared responsibility, transparency and faster feedback is the foundation of every high performing DevOps team
- DevOps starts with learning how to work differently. It embraces cross-functional teams with openness, transparency, and respect as pillars
- Being able to recover quickly from failure is more important than having failures less often
- Measurements should encourage innovation and collaboration, and not punish failure (blameless culture)

“If you want to build a ship, don’t drum up the men to gather wood, divide the work, and give orders. Instead, teach them to yearn for the vast and endless sea.”

– Antoine de Saint-Exupery*

* Author of The Little Prince

We don’t "DO" DevOps

We become DevOps

Thank You

Thank You