ARCHITECTING FOR OPERATIONS

BORING IS AWESOME!

STEFFAN NORBERHUIS

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AUDIENCE

- Are you working in the industry?
- Are you operating infrastructure?
- What do you expect from this lecture?

SERVING THE CUSTOMER

IMPACT


MINDSET

COLLABORATION

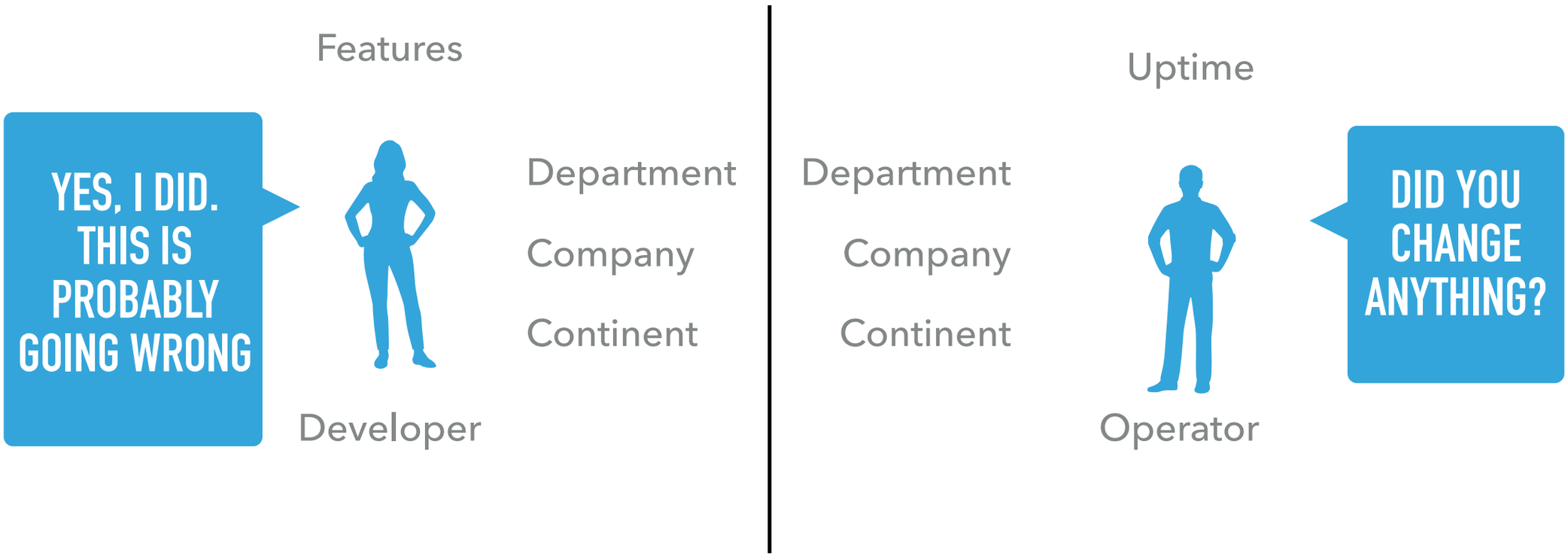
OVERVIEW

- Disruption
- Engineering a Sociotechnical System
- Building for Failure
- Failure is inevitable

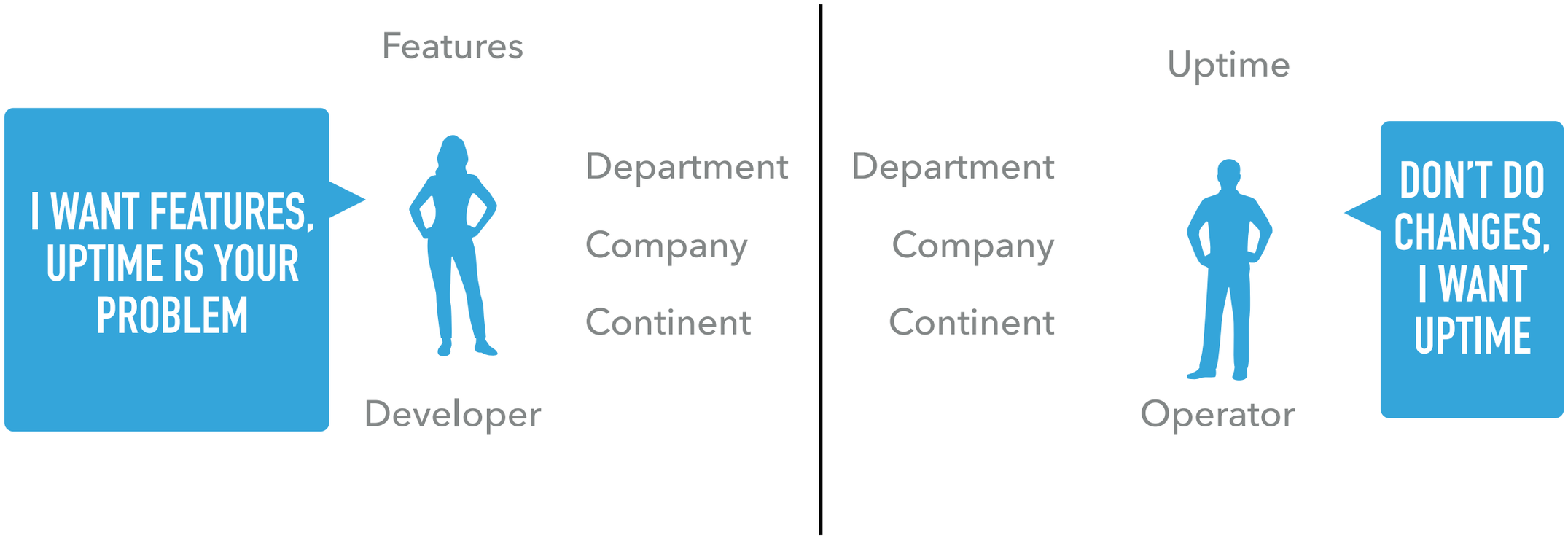
ARCHITECTING FOR OPERATIONS

DISRUPTION

DEVOPS


Features
YES, I DID. THIS IS PROBABLY GOING WRONG
Department
Company
Continent
Developer
Uptime
Department
Company
Continent
DID YOU CHANGE ANYTHING?
Operator

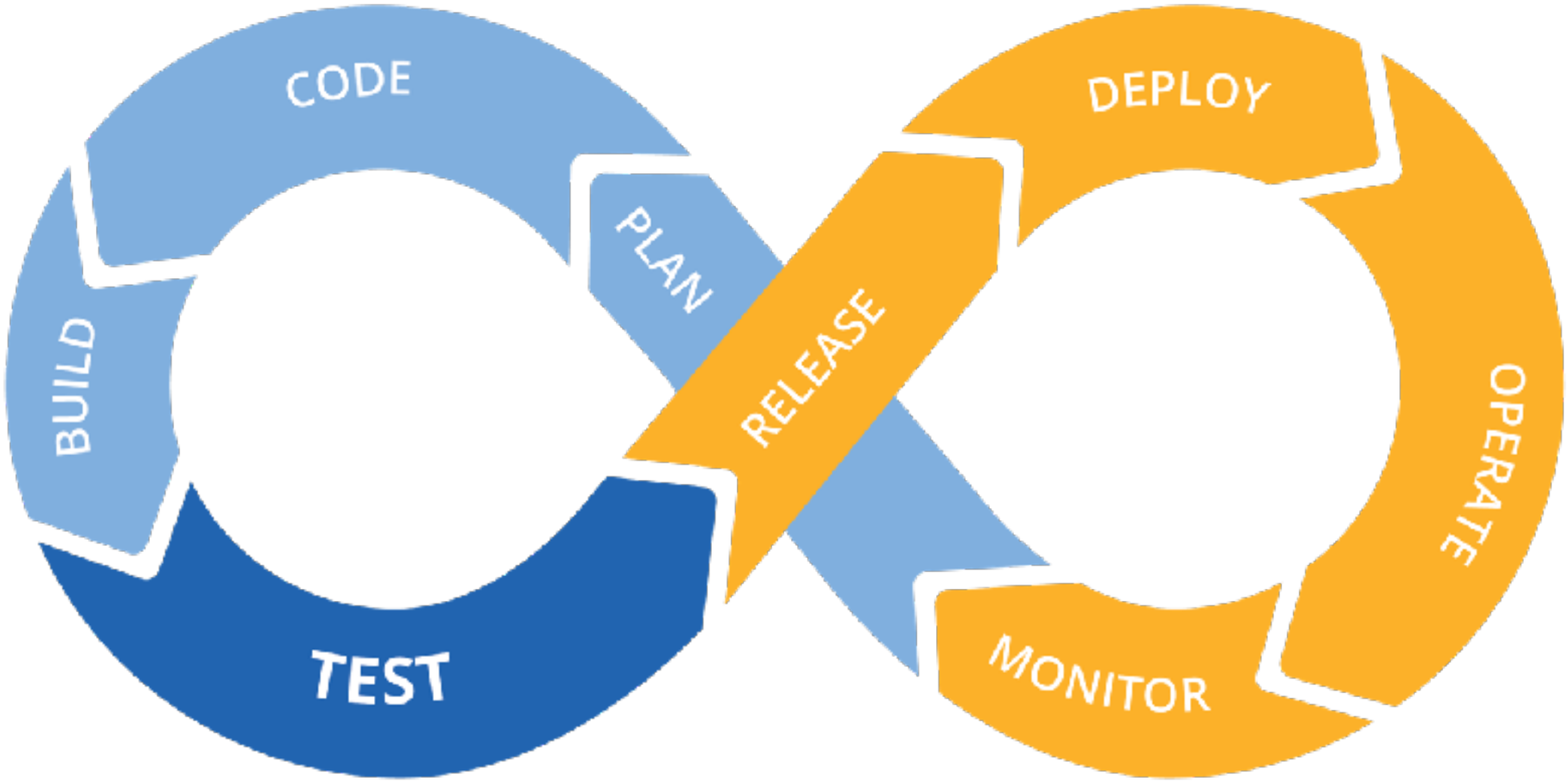
DEVOPS


Features
I WANT FEATURES, UPTIME IS YOUR PROBLEM
Department
Company
Continent
Developer
Uptime
Department
Company
Continent
Operator
DON'T DO CHANGES, I WANT UPTIME

ALIGN GOALS

YOU BUILD IT, YOU RUN IT

DEVOPS OWNERSHIP



CLOUD

CLOUD


I NEED A SERVER
Developer
Operator
I WILL ORDER IT. IT IS HERE IN 6 MONTHS

PAY WHAT YOU USE

Step 3: Configure Instance Details

Configure the instance to suit your requirements. You can launch multiple instances from the same AMI, request Spot Instances to take advantage of the lower pricing, assign an access management role to the instance, and more.

Number of instances	1
Purchasing option	Request Spot Instances
Network	vpc 2667e143 (172.31.0.0/16) (default) — Create new VPC
Subnet	subnet-d579c5a2(172.31.32.0/20) | Default in us-we — Create new subnet 4091 IP Addresses available
Auto-assign Public IP	Use subnet setting (Enable)
IAM role	None — Create new IAM role
Shutdown behavior	Stop
Enable termination protection	Protect against accidental termination
Monitoring	Enable CloudWatch detailed monitoring Additional charges apply.
Tenancy	Shared tenancy (multi-tenant hardware) Additional charges apply for dedicated tenancy.

Network interfaces

Device	Network Interface	Subnet	Primary IP	Secondary addresses
eth0	New network interface	subnet-d579c5a2	Auto-assign	Add

Cancel | Previous | Review and Launch | Next: Add Storage

CLOUD

- Operate technology without owning technology
- Infrastructure Agility with no planning
- Focus on your business

Source: What is Cloud Computing by AWS https://www.twitch.tv/videos/477810350?

WORK SHIFTED

- Architect combines
  - Development
  - Operations
- Architecture shifts to Cloud Components

ARCHITECTING FOR OPERATIONS

ENGINEERING A SOCIOTECHNICAL SYSTEM

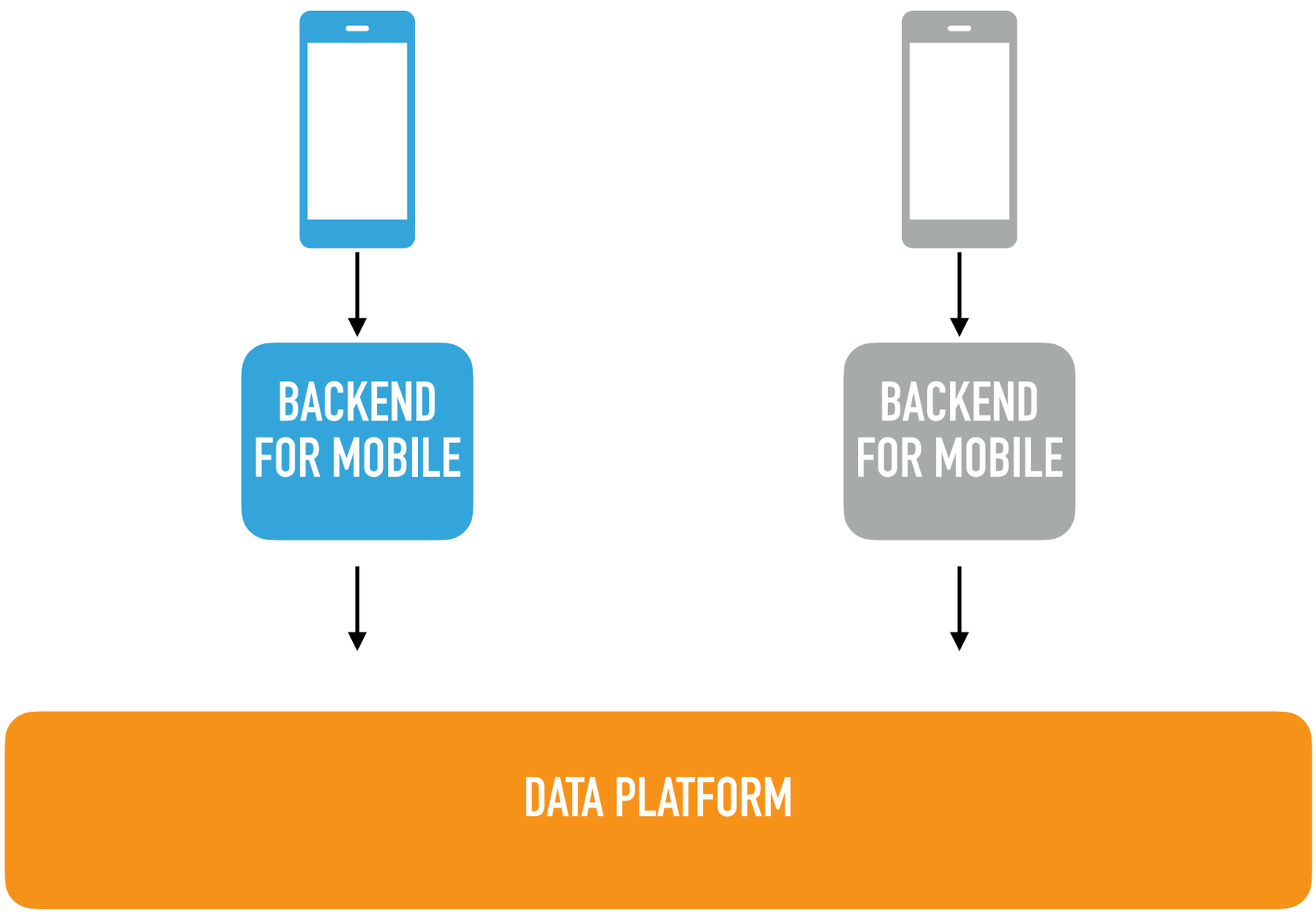
EVOLUTION

ARCHITECTURE STARTS WITH ORGANIZATION

ANY ORGANIZATION THAT DESIGNS A SYSTEM WILL PRODUCE A DESIGN WHOSE STRUCTURE IS A COPY OF THE ORGANIZATION'S COMMUNICATION STRUCTURE.

Melvin E. Conway

CONWAY'S LAW



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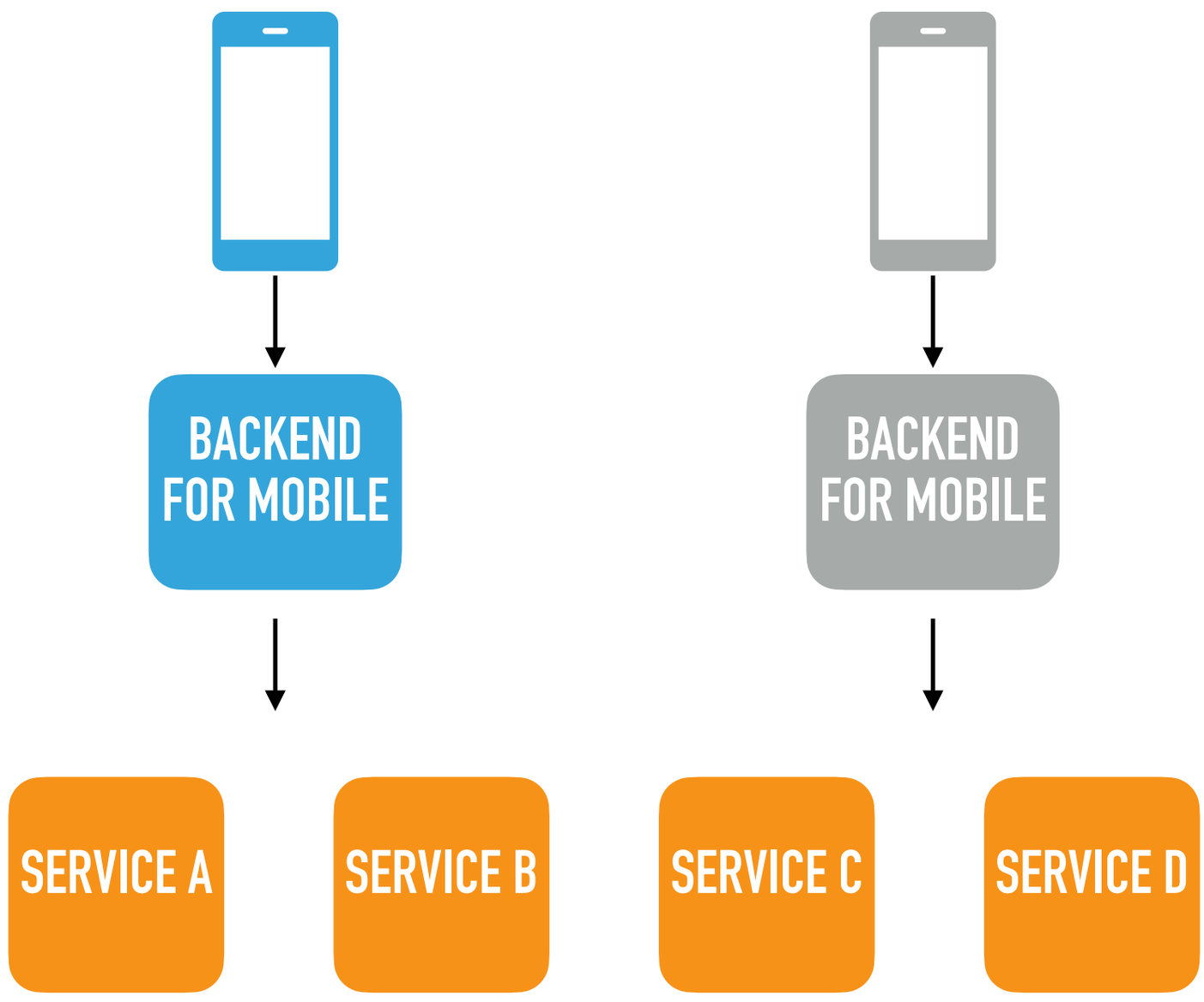
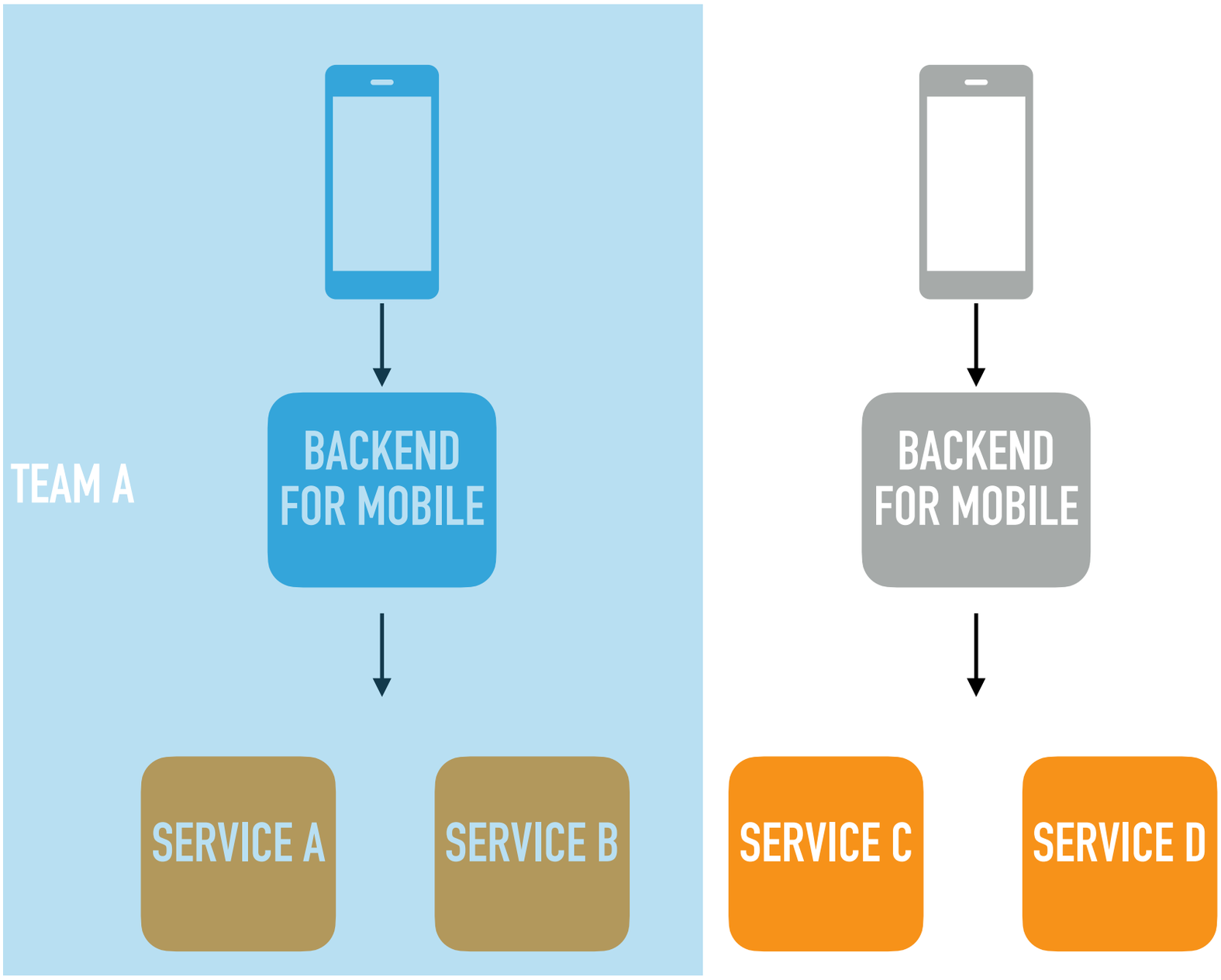
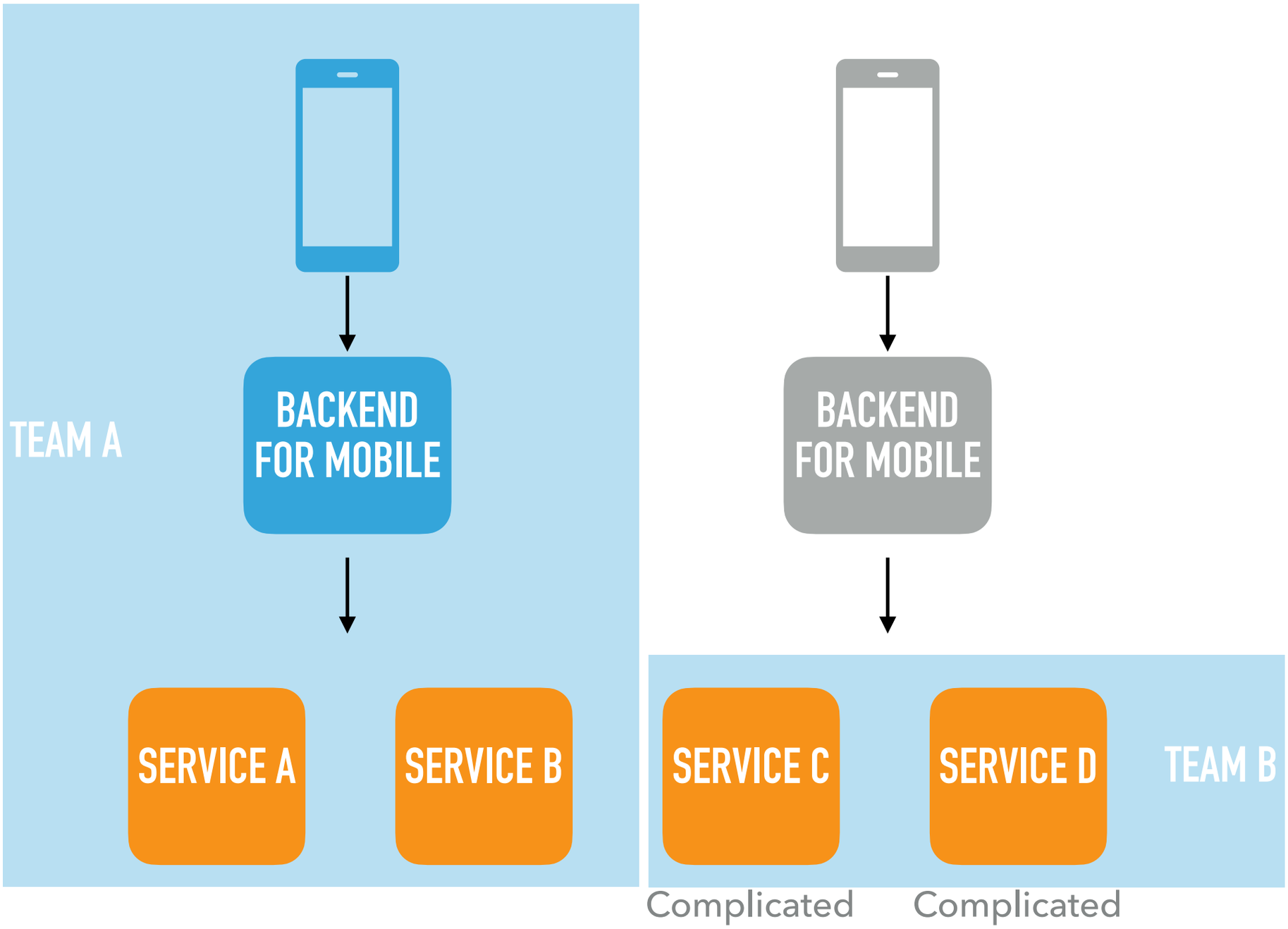

BACKEND FOR MOBILE
BACKEND FOR MOBILE
SERVICE A
SERVICE B
SERVICE C
SERVICE D

CONWAY'S LAW


TEAM A
BACKEND FOR MOBILE
SERVICE A
SERVICE B
BACKEND FOR MOBILE
SERVICE C
SERVICE D

CONWAY'S LAW


TEAM A
BACKEND FOR MOBILE
SERVICE A
SERVICE B
BACKEND FOR MOBILE
SERVICE C
SERVICE D
TEAM B
Complicated
Complicated

COMPLEXITY


FRONTEND


BACKEND


INFRA

STREAM ALIGNED

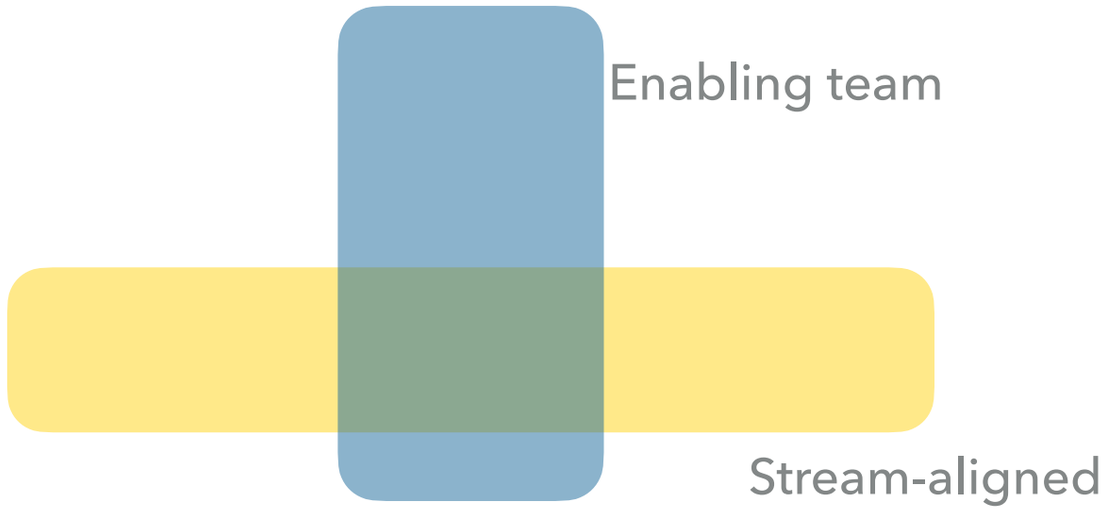
- Valuable stream of work
- Empowered to deliver value

Stream-aligned

Source: Team Topologies, https://www.youtube.com/watch?v=haejb5rzKsM

ENABLING TEAM

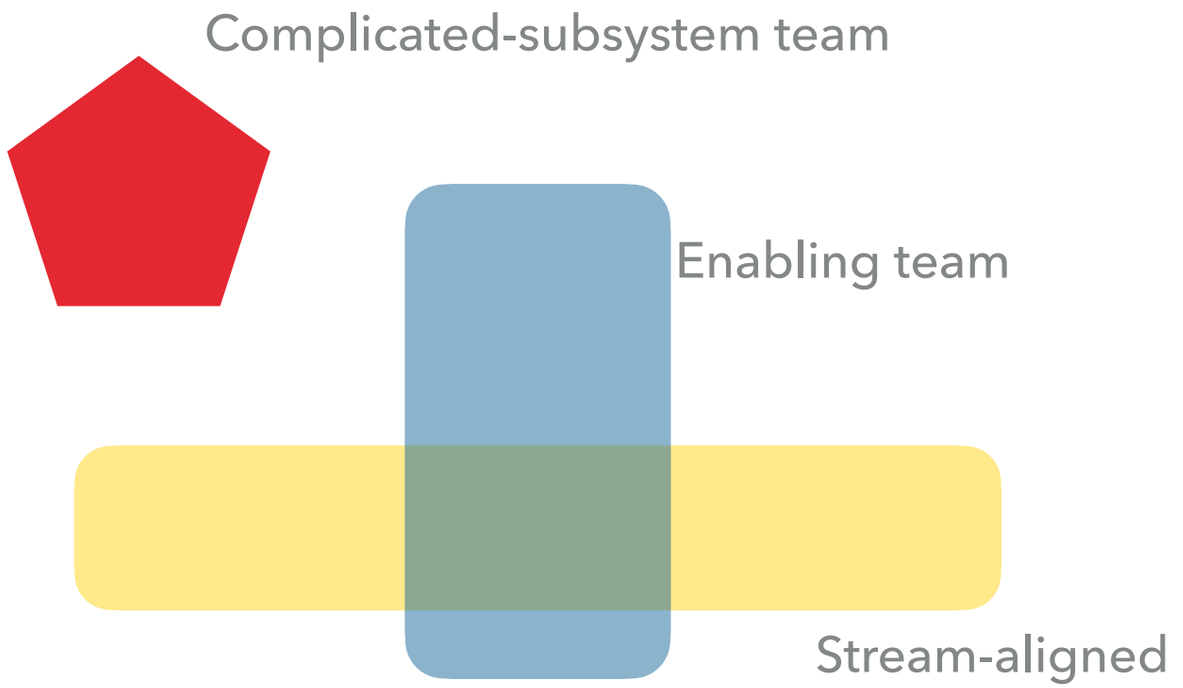
- Up skill stream-aligned team
- Servant Leadership
- Temporary



Source: Team Topologies, https://www.youtube.com/watch?v=haejb5rzKsM

COMPLICATED SUBSYSTEM

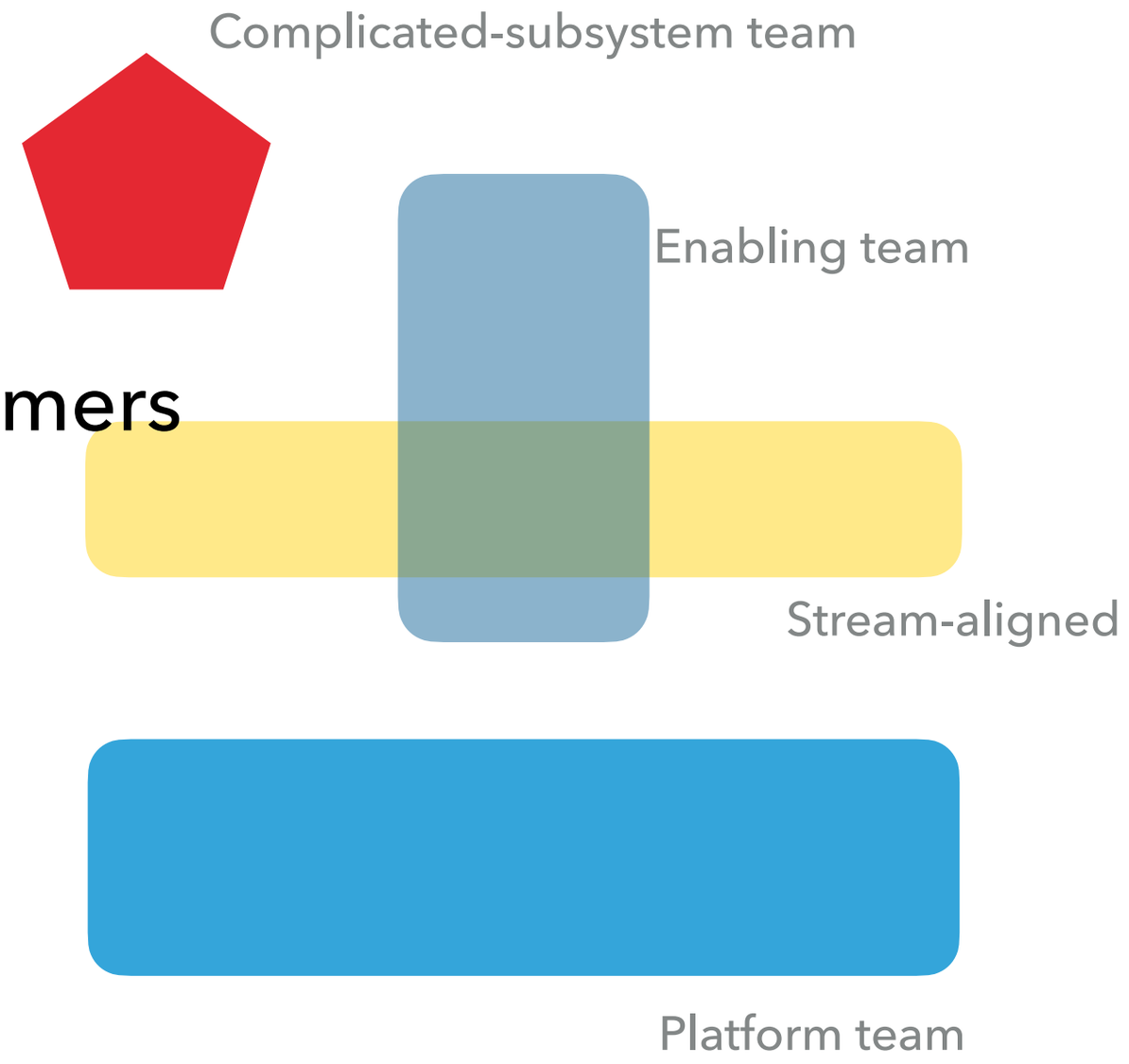
- Captures complexity
- Provides it as a service



Source: Team Topologies, https://www.youtube.com/watch?v=haejb5rzKsM

PLATFORM TEAM

- Thinnest Viable Platform
- Treat Stream-aligned as Customers



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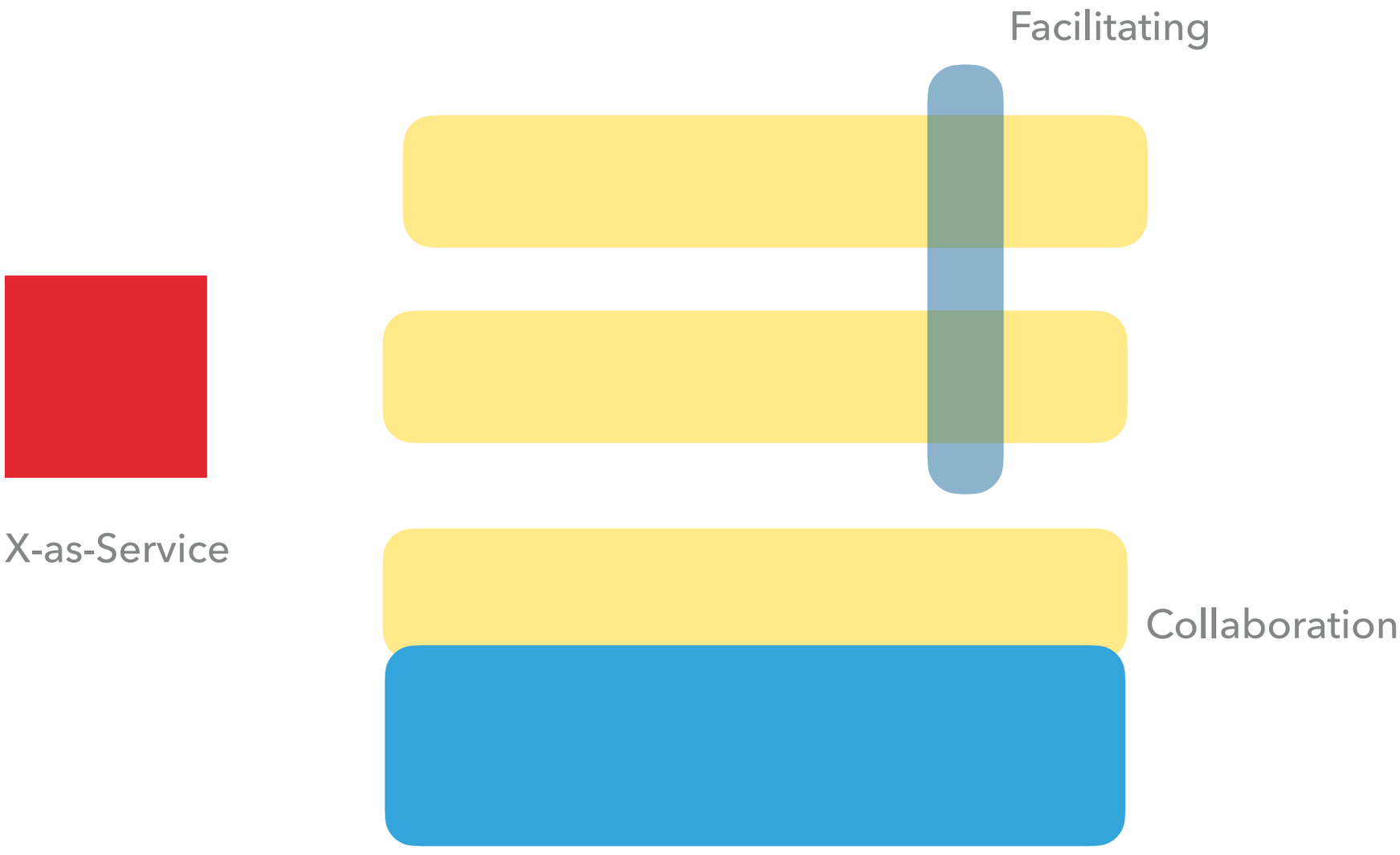
INTERACTION MODES



Source: Team Topologies, https://www.youtube.com/watch?v=haejb5rzKsM

LONG LIVED TEAM

CHESTERTONS FENCE

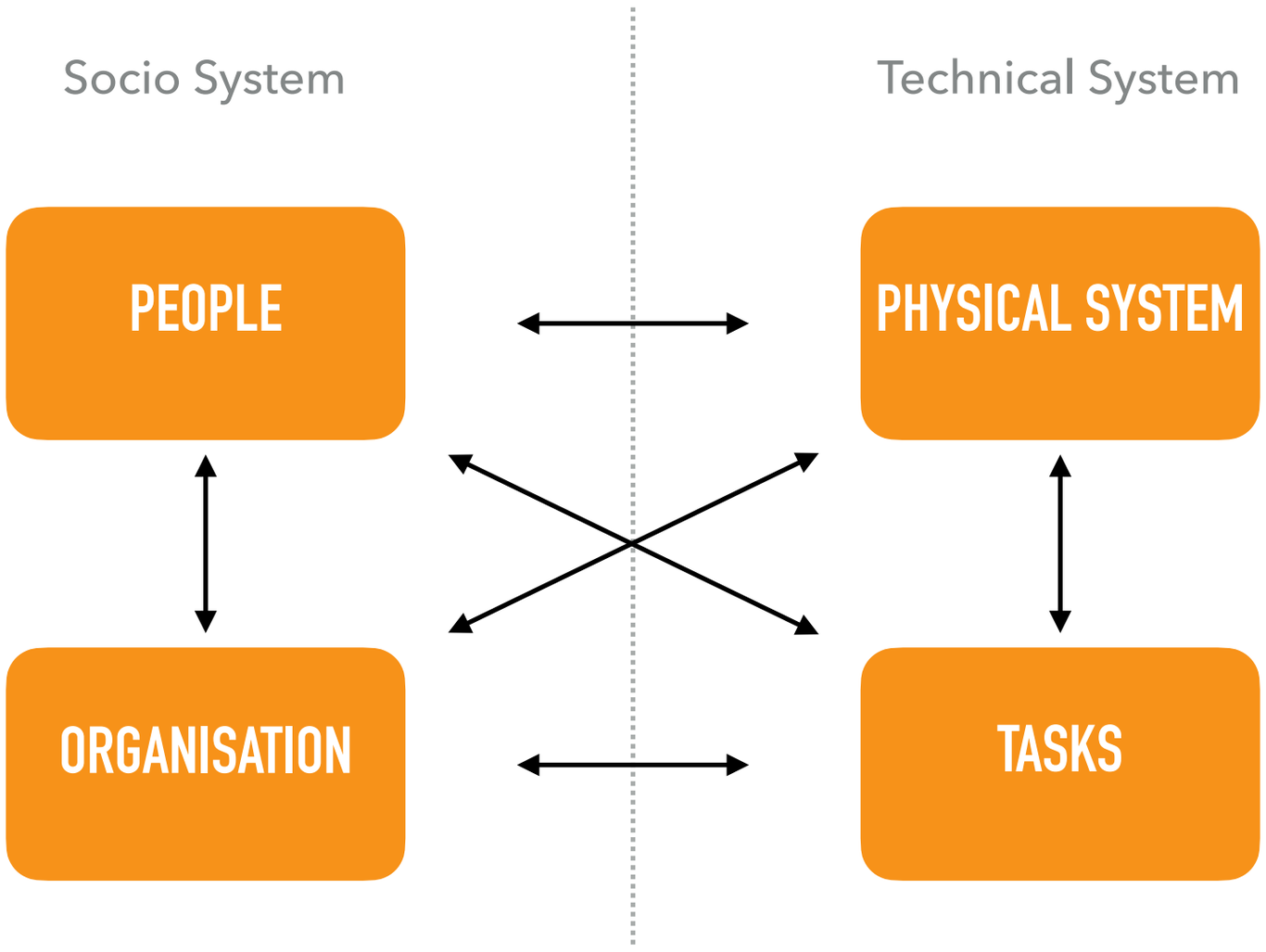
ARCHITECTURAL DECISION RECORDS

- Documents Architectural Decisions
- Documents Architectural Significant Requirements

- Collaborate through Pull Requests
- Show previous designs to show evolution in thinking

ABANDONED SOFTWARE

SOCIOTECHNICAL SYSTEM



ARCHITECTING FOR OPERATIONS

BUILDING FOR FAILURE

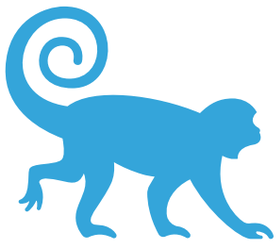
DEPLOYMENT STRATEGY

BIG BANG RELEASES

UNSTOPPABLE RELEASES

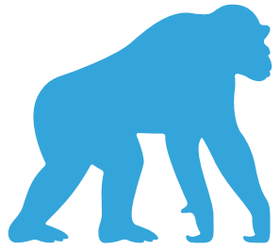
SMALL & ATOMIC

BUILDING FOR FAILURE



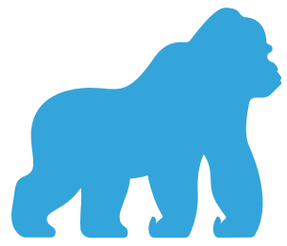
Continuous Integration

- Integrate daily to Main branch
- Run Tests to verify
- Automate



Continuous Delivery

- Main branch always in Release State
- Run Tests to verify
- Automate



Continuous Deployment

- Every change on Main branch is deployed
- Run Tests to verify
- Automate

BACKWARDS COMPATIBLE

BACKWARDS COMPATIBLE

ALWAYS PUSH TO PRODUCTION

FEATURE TOGGLES

SIMPLE FEATURE TOGGLES

```
function calculate(){

   if( featureToggle("use-new-algorithm") ){

      return newCalculation();

   }else{

      return oldCalculation();

   }

}
```

HOPE IS NOT A STRATEGY

DEALING WITH RISK USING LANGUAGE

- Can we deploy this?
  - Yes / No
  - No Risk
- How sure are we that we can deploy this?
  - 4 potential issues discussed
  - 2 bugs found

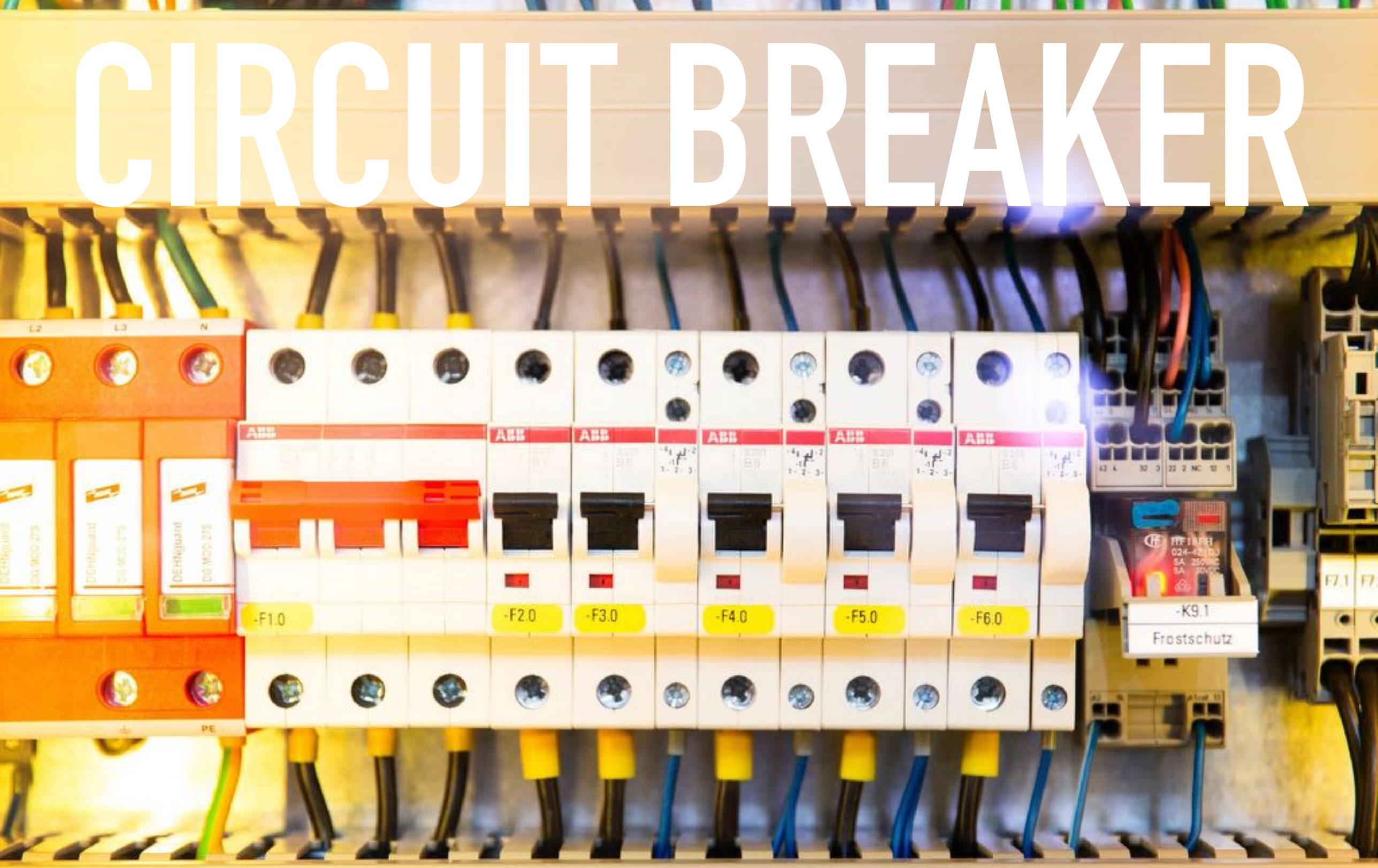
IF IT HURTS,
DO IT MORE OFTEN

GRACEFUL DEGRATION

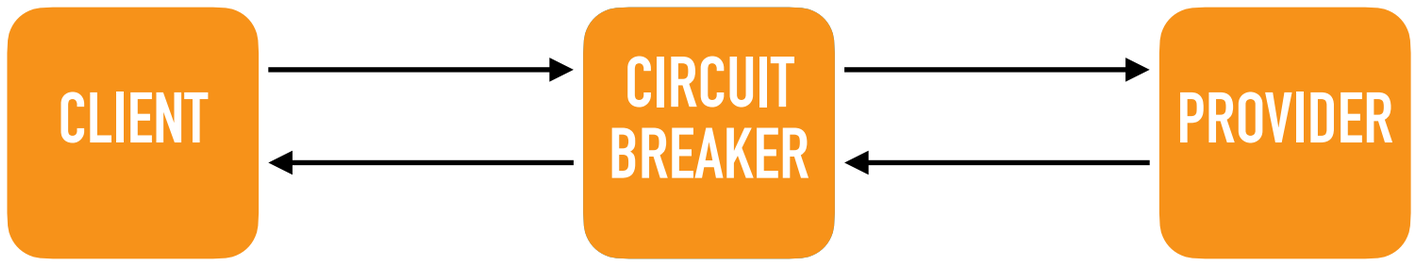
GRACEFUL DEGRADATION

- Return less precise data
  - Incomplete data
  - Cached data
  - Preset data
  - No data

CIRCUIT BREAKER

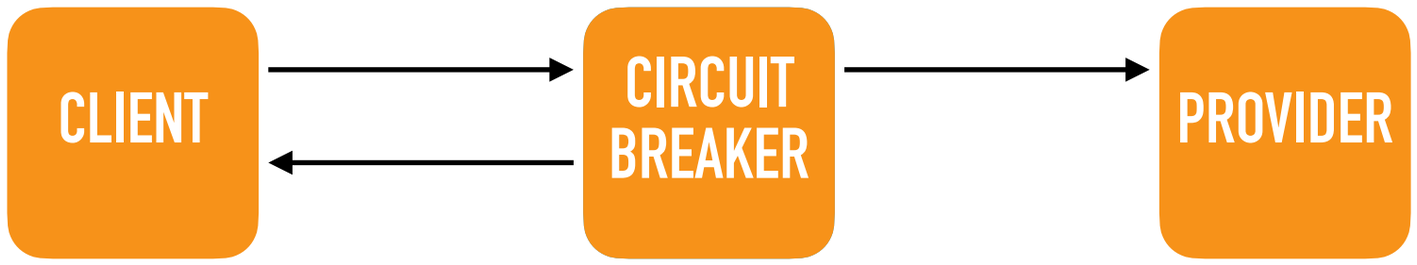


CIRCUIT BREAKER



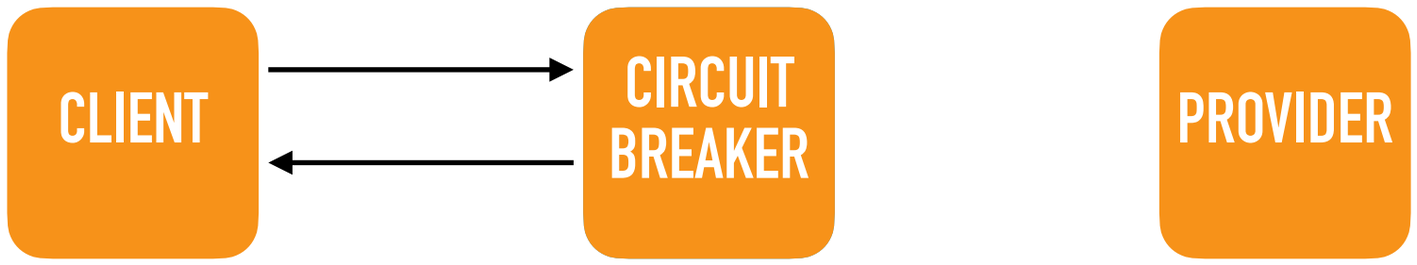
NORMAL

CIRCUIT BREAKER



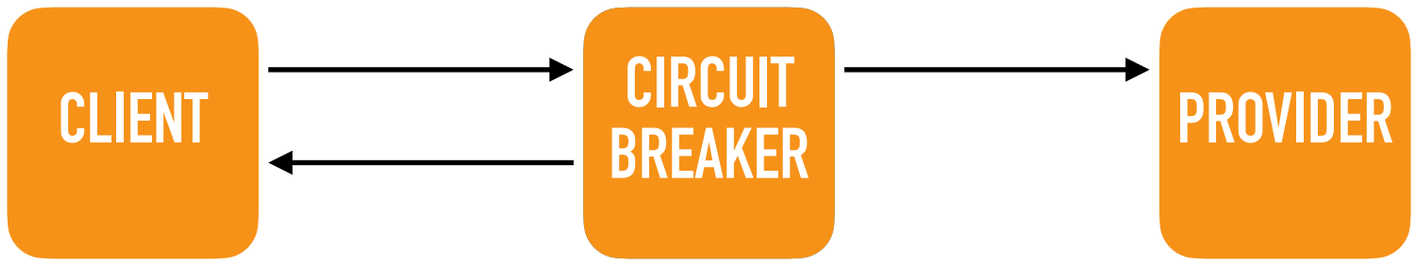
TIMEOUT

CIRCUIT BREAKER



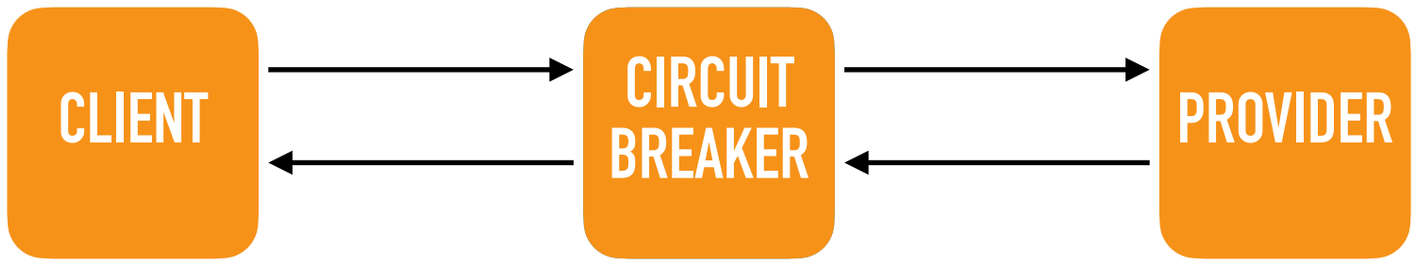
CIRCUIT OPEN

CIRCUIT BREAKER



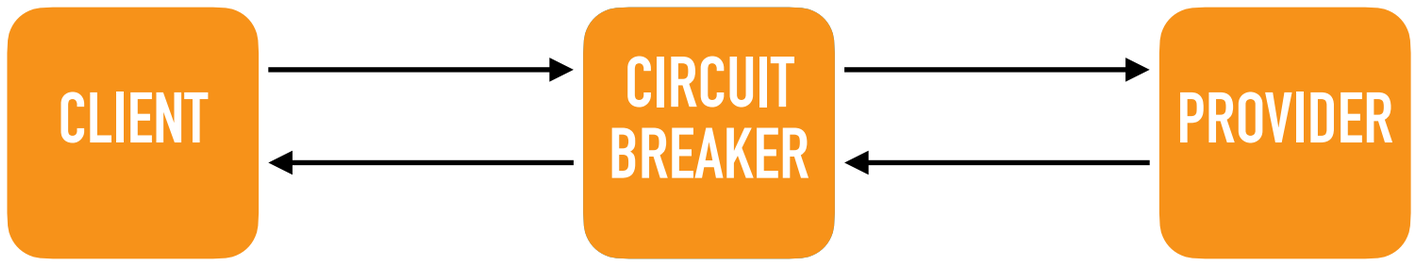
TRIAL

CIRCUIT BREAKER



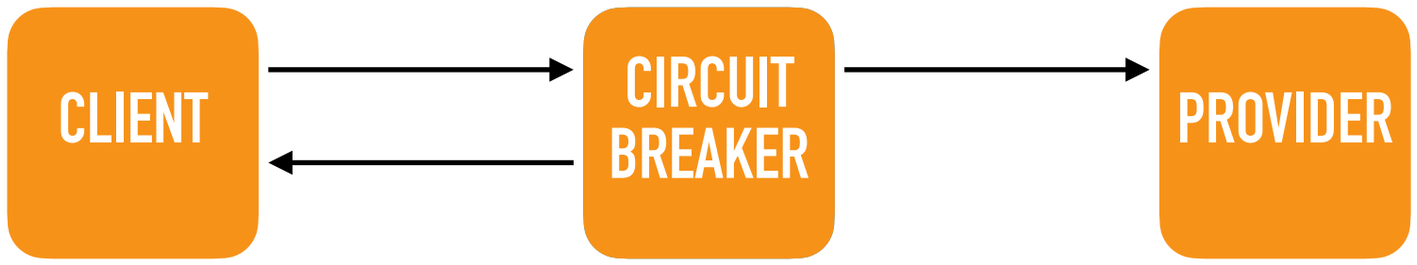
RECOVERY

CIRCUIT BREAKER



NORMAL

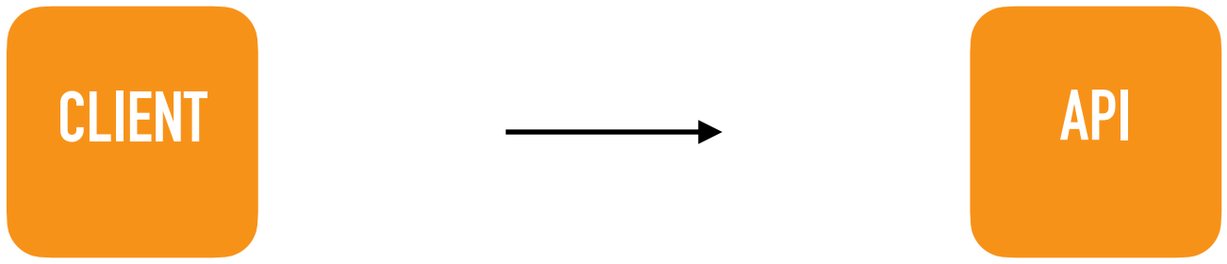
CIRCUIT BREAKER



TIMEOUT

ASYNCHRONOUS

ASYNCHRONOUS



Source: Asynchronous patterns for Cloud Functions by Preston Holmes https://cloud.google.com/community/tutorials/cloud-functions-async

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EVENT DRIVEN

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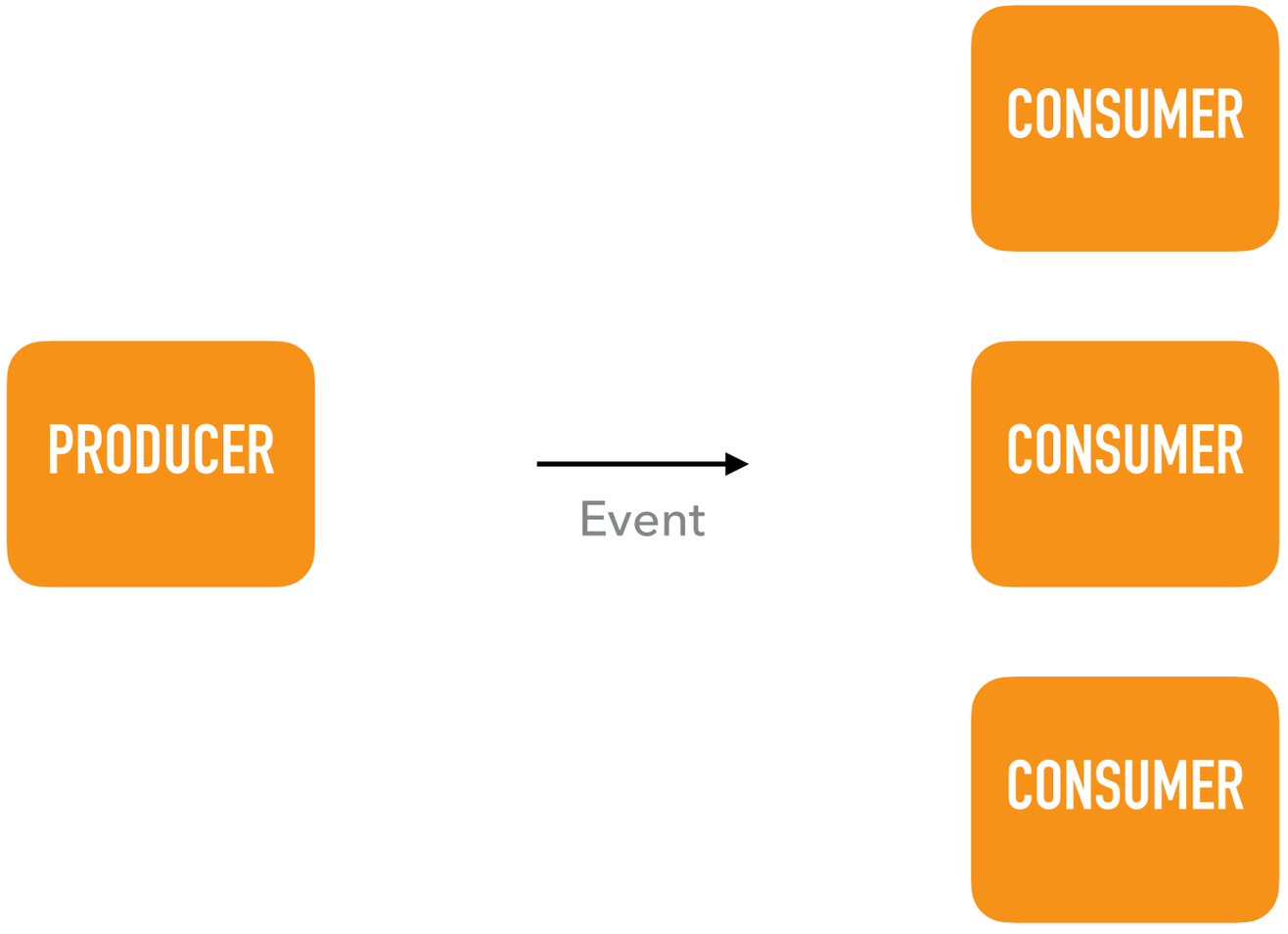
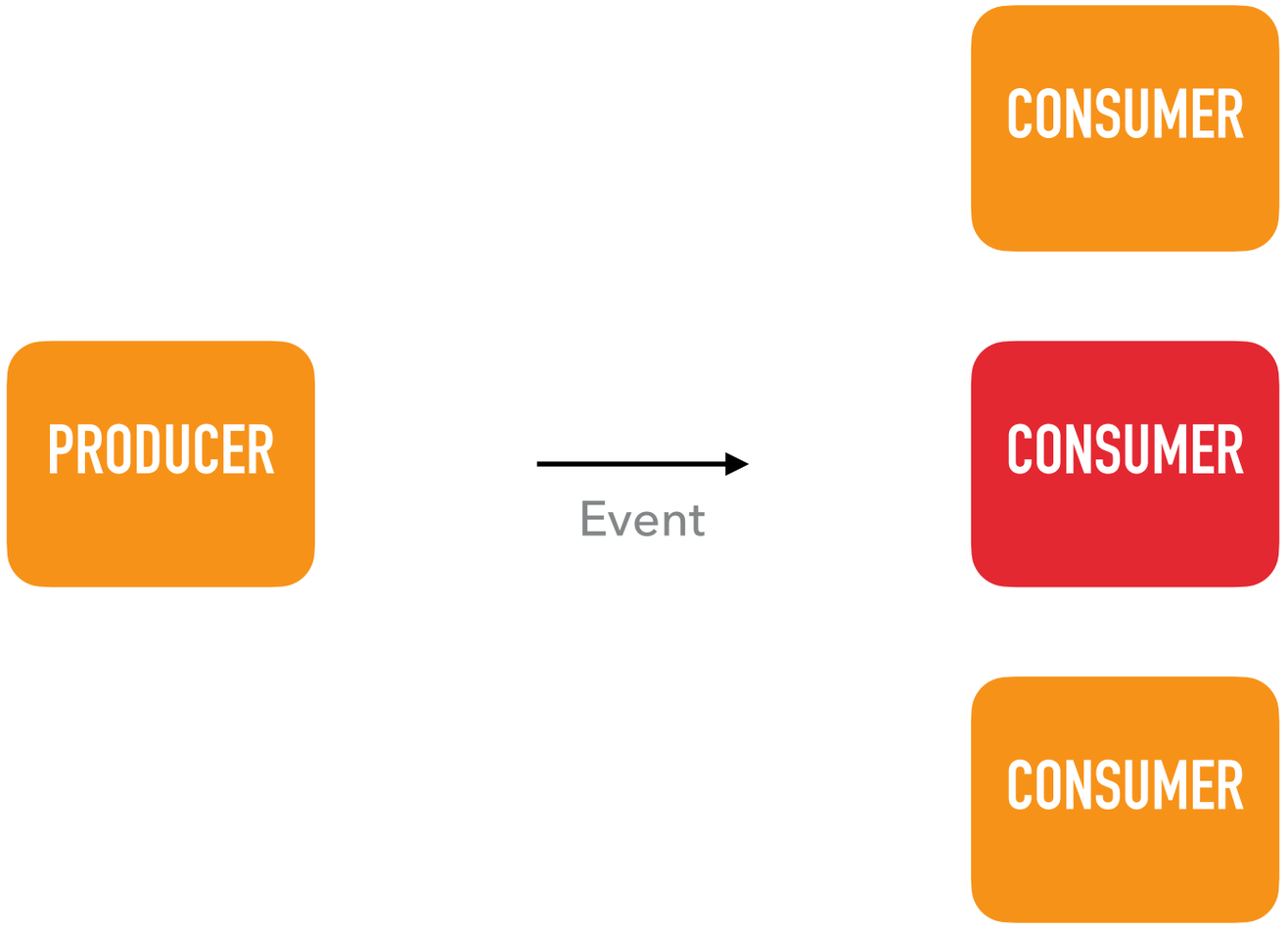


Source: Event Driven by Martin Fowler https://martinfowler.com/articles/201701-event-driven.html

EVENT DRIVEN



Source: Event Driven by Martin Fowler https://martinfowler.com/articles/201701-event-driven.html

QUALITY VS INNOVATION

SITE RELIABILITY ENGINEERING

- How much quality have we agreed upon? (SLA)
- How much quality do we provide? (SLI)
- How much quality do we want? (SLO)

Source: Site Reliability Engineering ISBN: https://landing.google.com/sre/sre-book/toc/

QUANTIFY QUALITY


ERROR BUDGET

TOIL

TOIL

- Designate Engineer
  - Focus on incidents
  - Shields the team
  - Engineers solutions
  - Close collaboration with Product Owner

OBSERVABILITY

FALSE POSITIVES

USER NOTIFICATIONS

ARCHITECTING FOR OPERATIONS

FAILURE IS INEVITABLE

RUNTIME

DATA

COMPLEX SYSTEMS

SCIENTIFIC APPROACH

SCIENTIFIC APPROACH

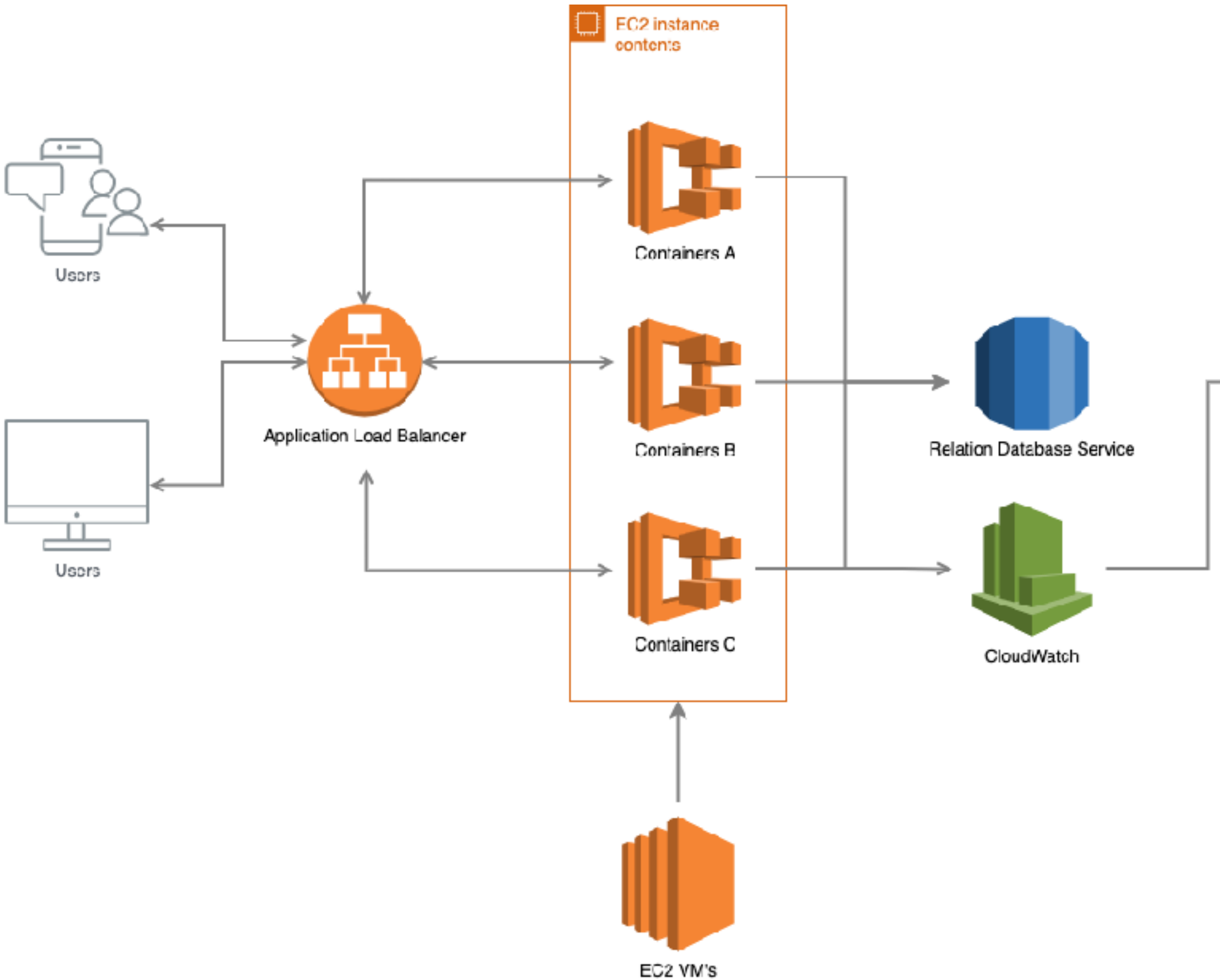
- Describe objectively
- Formulate a hypothesis
- Derive an experiment
- Observe outcomes

LOOK FOR CHANGE

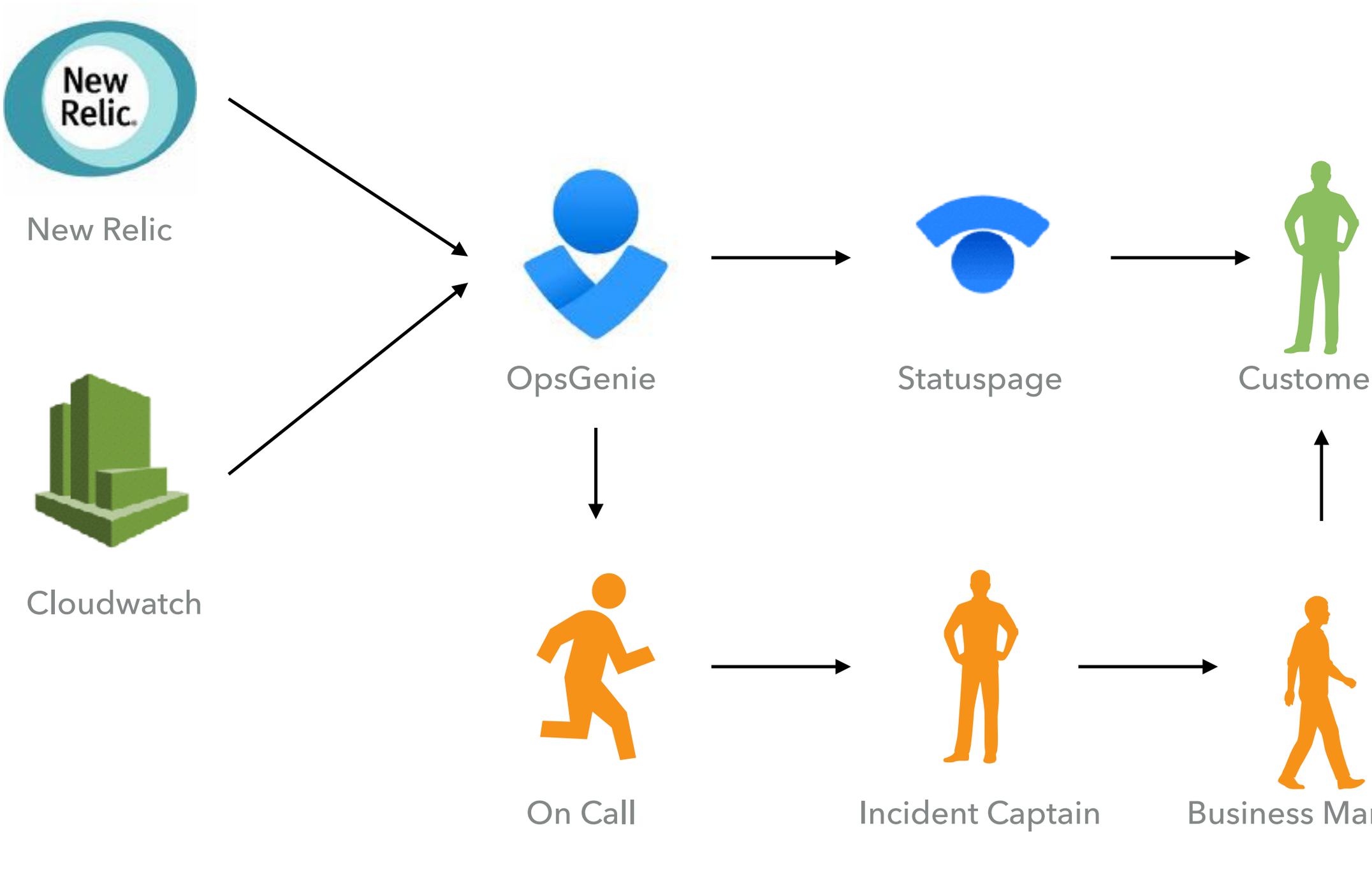
POST MORTEM

TRANSPARENCY

FAILURE IS INEVITABLE



COMMUNICATION



POST MORTEM TEMPLATE

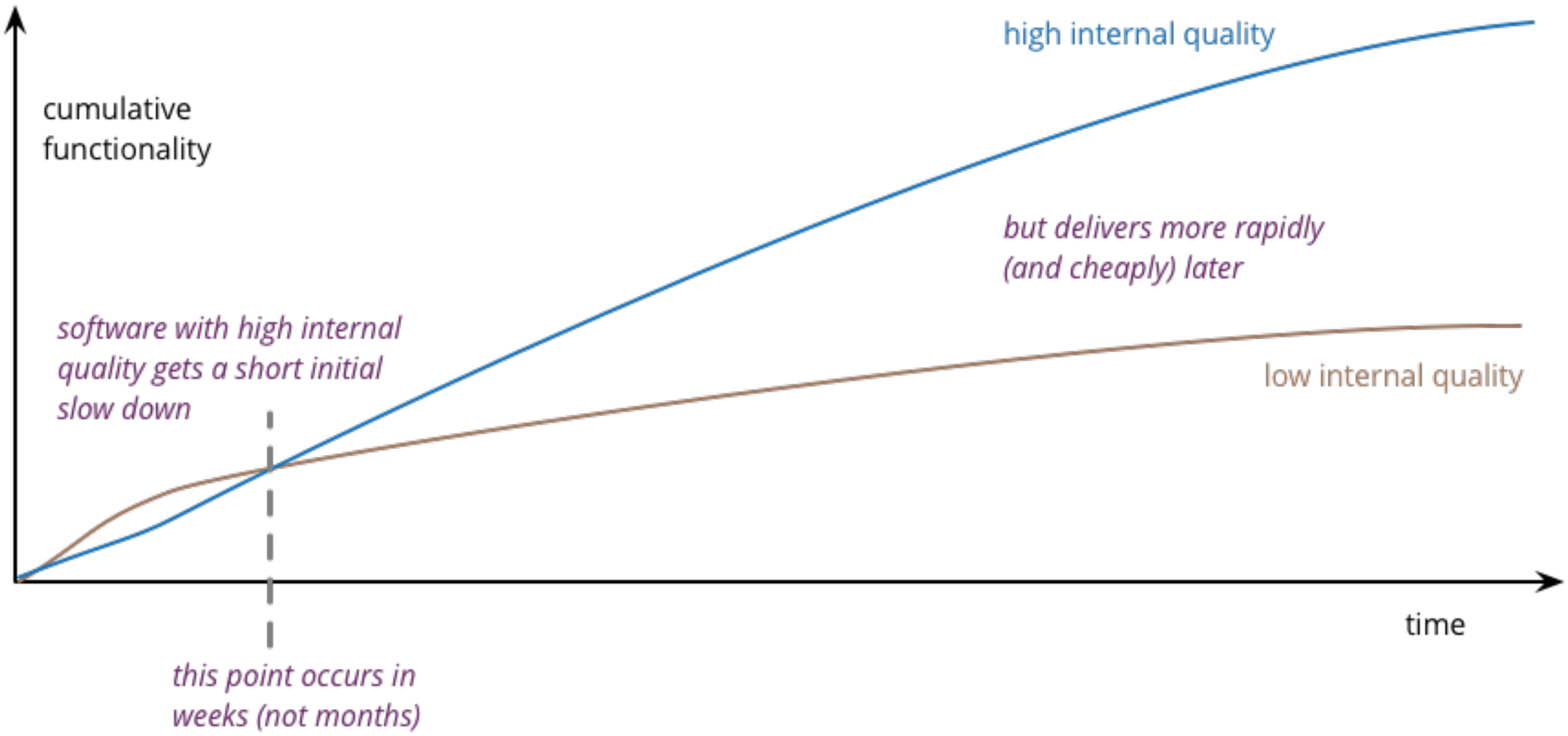
- Timeline: What happened?
  - Impact
  - Resolutions
- Root Cause
- Follow up
  - Public Communication
  - Improvements
    - Organisational
    - Technical

Source:https://response.pagerduty.com/after/post_mortem_process/

UNIQUE FAILURES

NO WORK AROUND

QUALITY

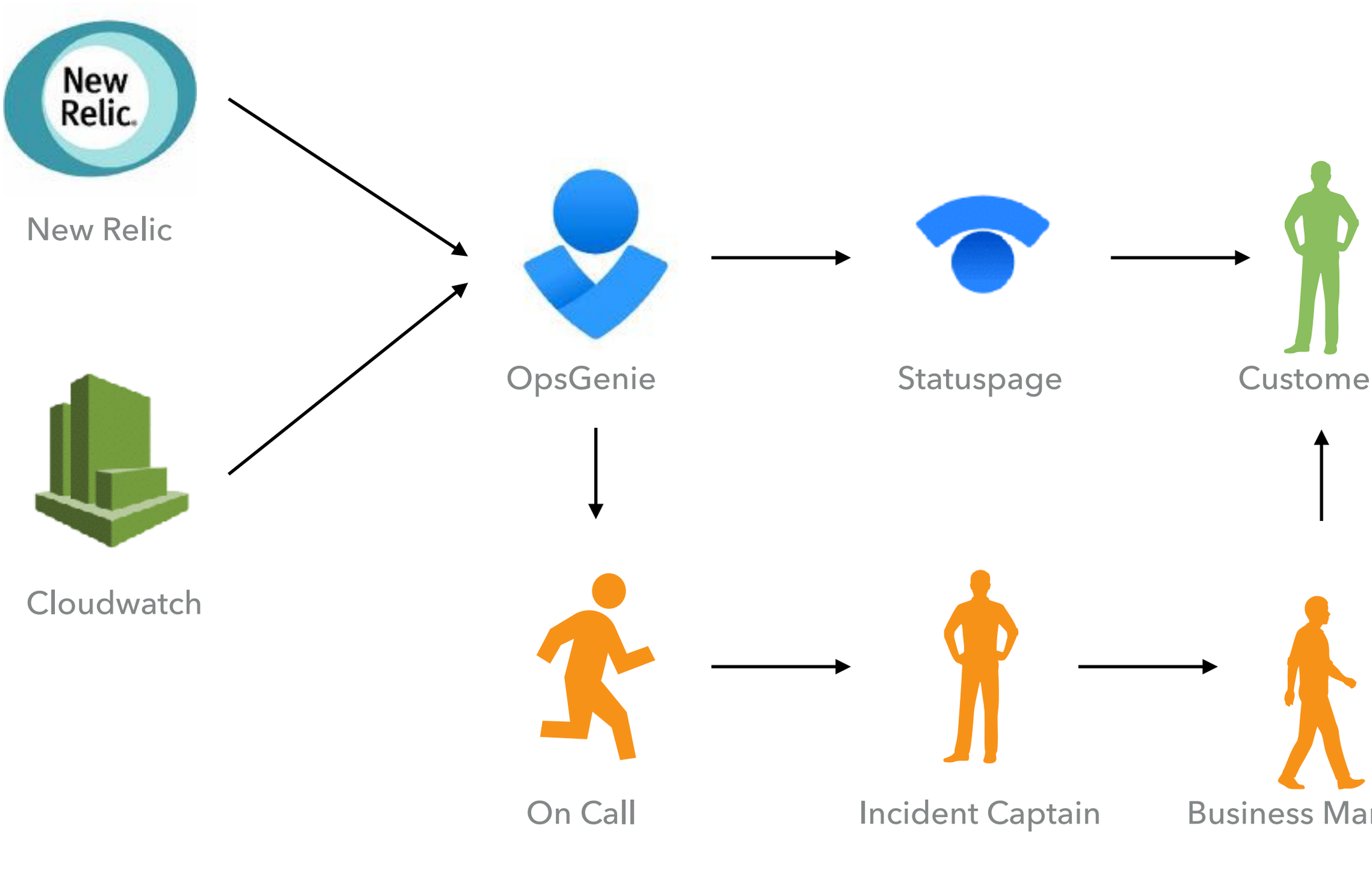


Source: Is High Quality Software Worth the Cost? By Martin Fowler https://www.martinfowler.com/articles/is-quality-worth-cost.html

BROKEN WINDOW THEORY

TRAIN YOUR OPERATIONS

COMMUNICATION



STAGING

ATTRIBUTION

- Sources are on bottom of the slides
- All pictures are from unsplash.com and their creators

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- steffan@norberhuis.nl

ANY QUESTIONS?

FURTHER READING

Source: AWS Well-Architected Framework Whitepaper https://aws.amazon.com/architecture/well-architected/

ARCHITECTING FOR OPERATIONS

INFRASTRUCTURE AS CODE

BENEFITS

- Automation
- Version control
- Code Review
- Testing
- Documentation
- Reuse

Source: 5 Lessons Learned From Writing Over 300,000 Lines of Infrastructure Code by Yevgeniy Brickman
https://www.youtube.com/watch?v=RTEgE2Icyk4 https://www.youtube.com/watch?v=RTEgE2Icyk4

INFRASTRUCTURE AS CODE

AWS CloudFormation

HashiCorp Terraform

Troposphere

Pulumi

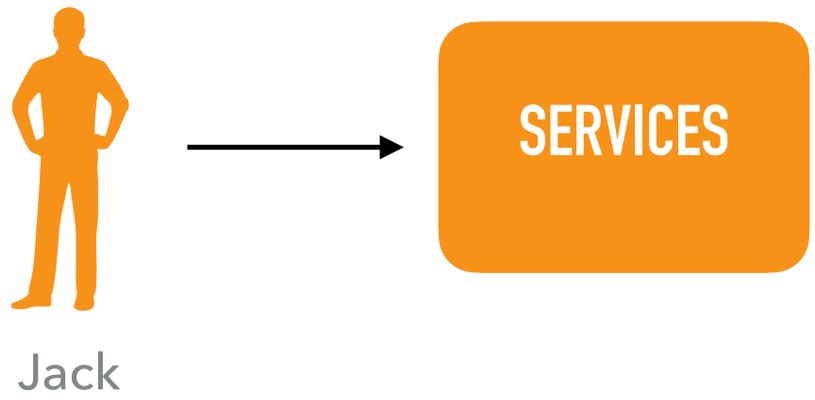
Azure Resource Manager

AWS Cloud Development Kit

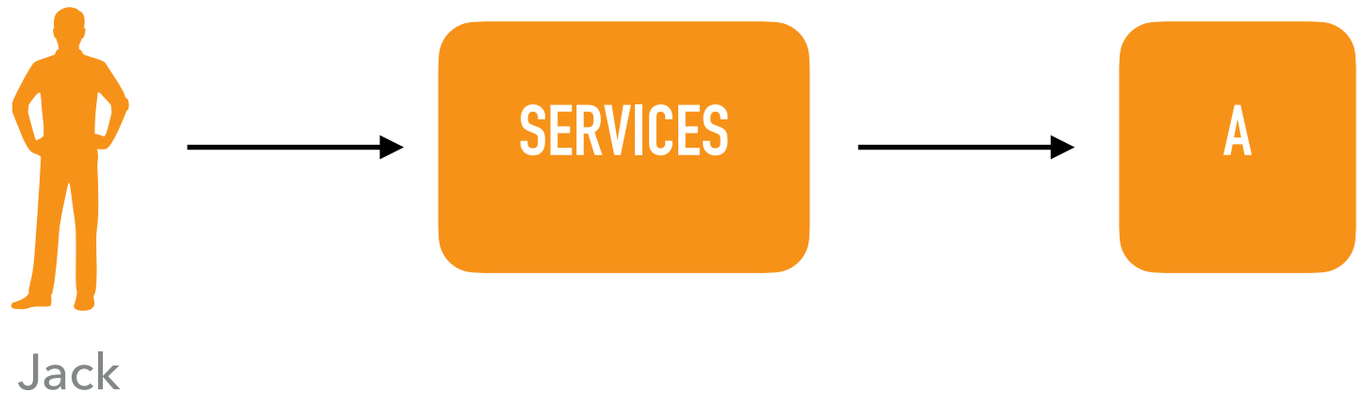
JSON / YAML | Declarative | DOM | Componentized

Source: AWS CDK by AWS re:Invent https://www.youtube.com/watch?v=Lh-kVC2r2AU

SLOW FEEDBACK LOOP



SLOW FEEDBACK LOOP



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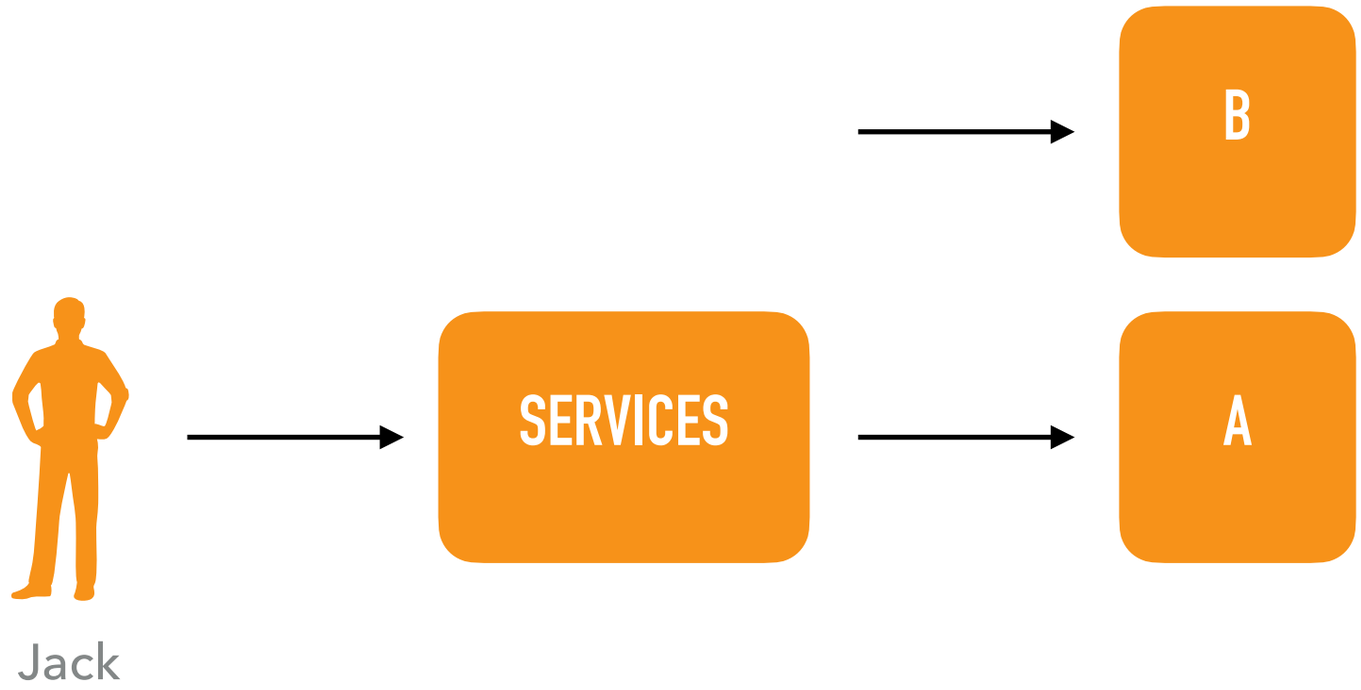

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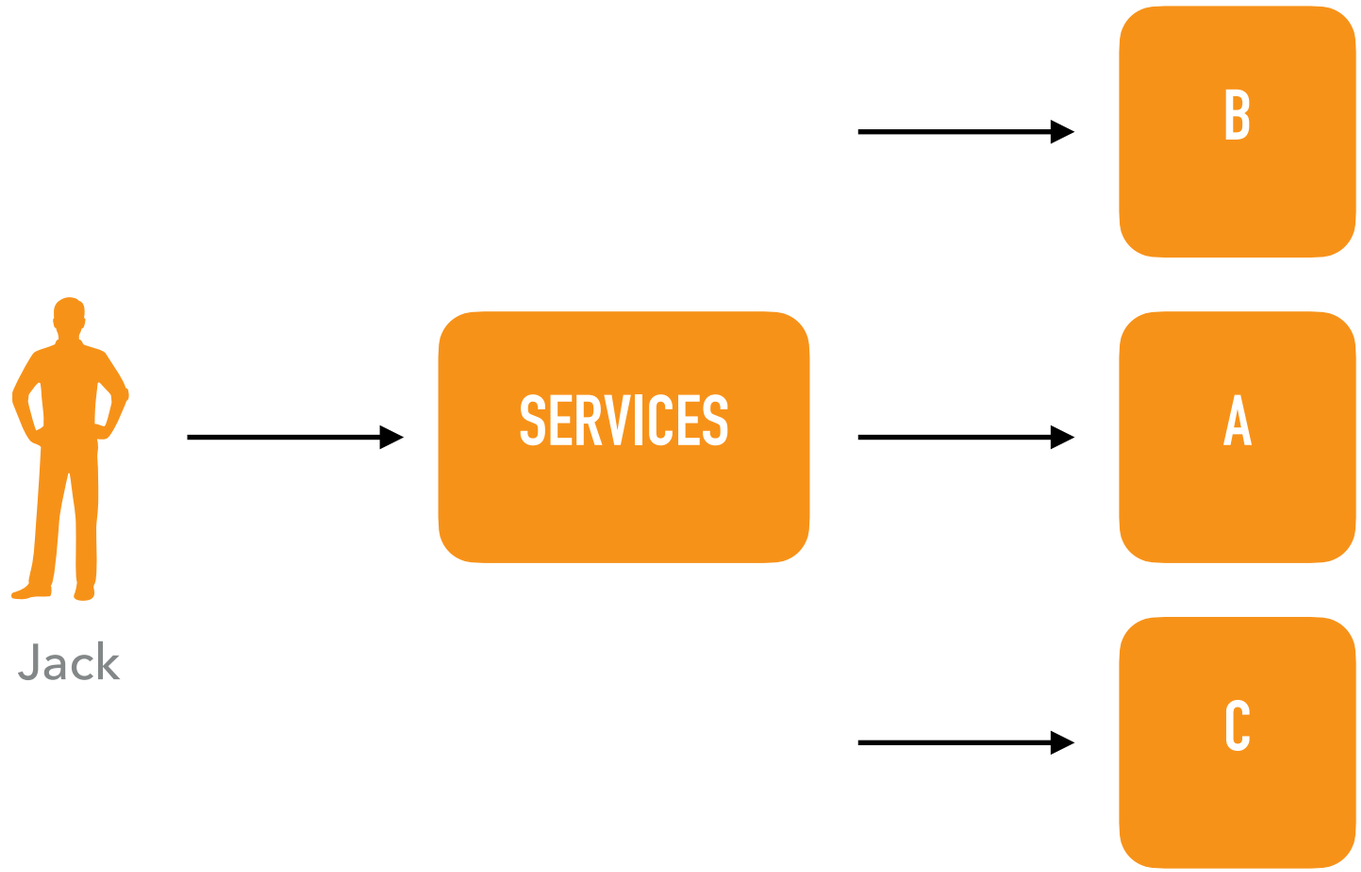

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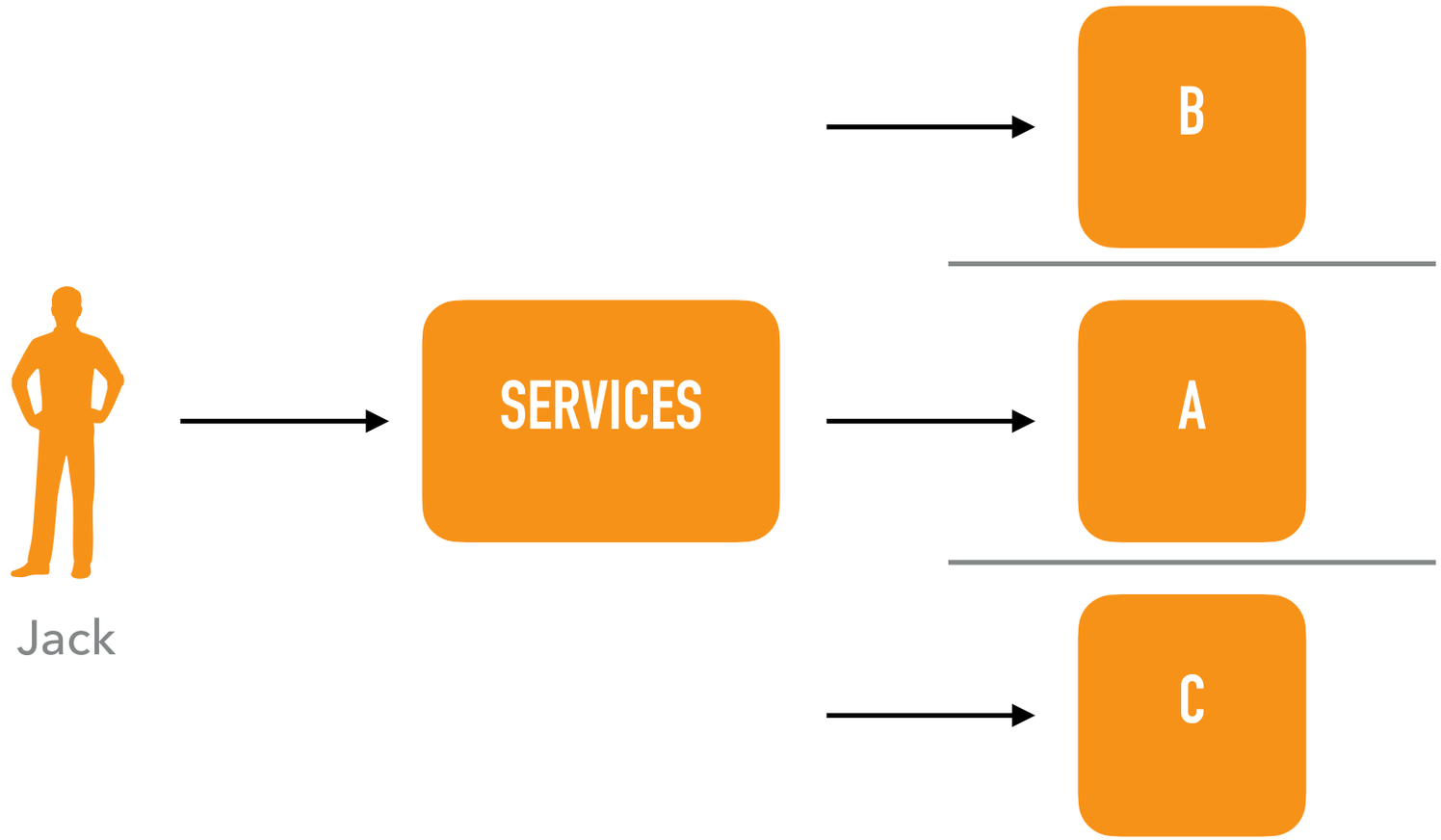

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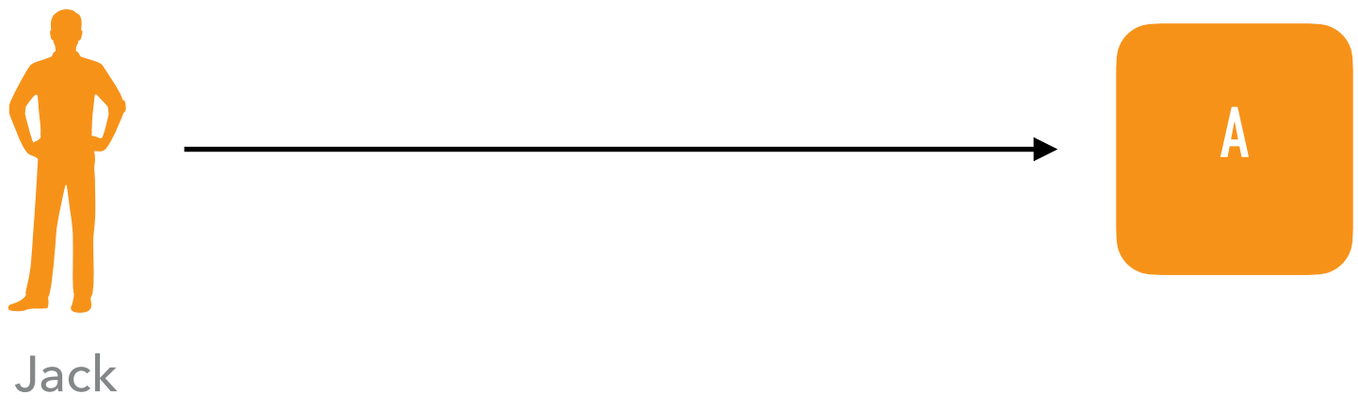
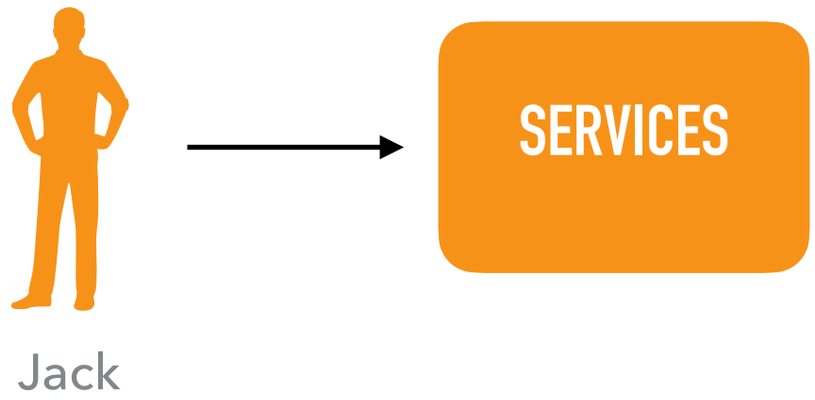


COLLISIONS DURING DEVELOPMENT



COLLISIONS DURING DEVELOPMENT

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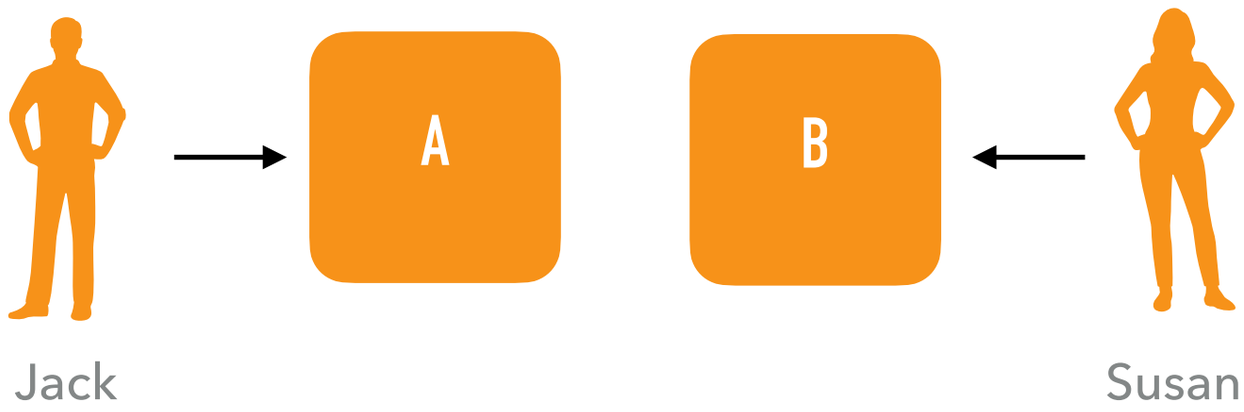
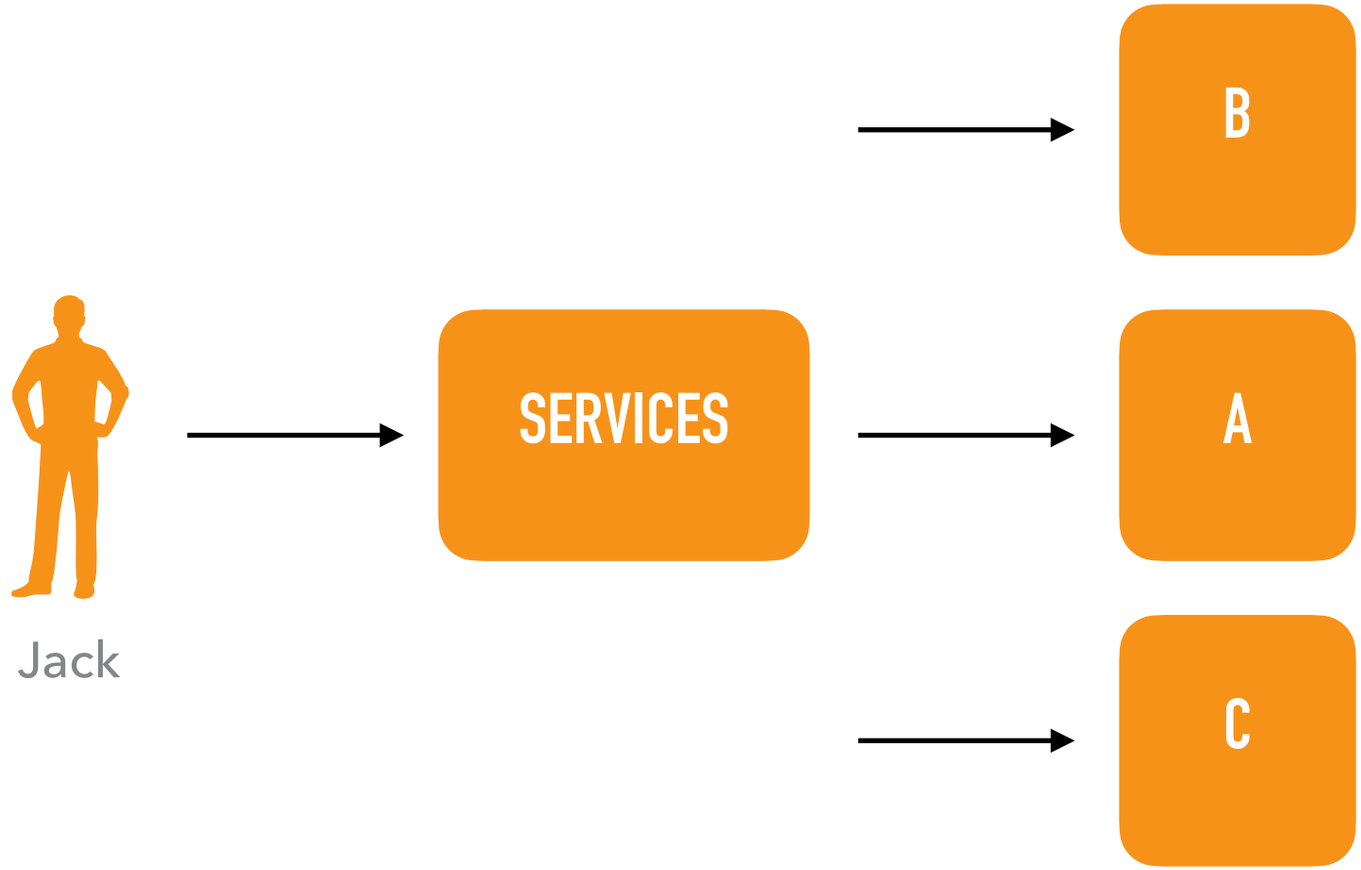


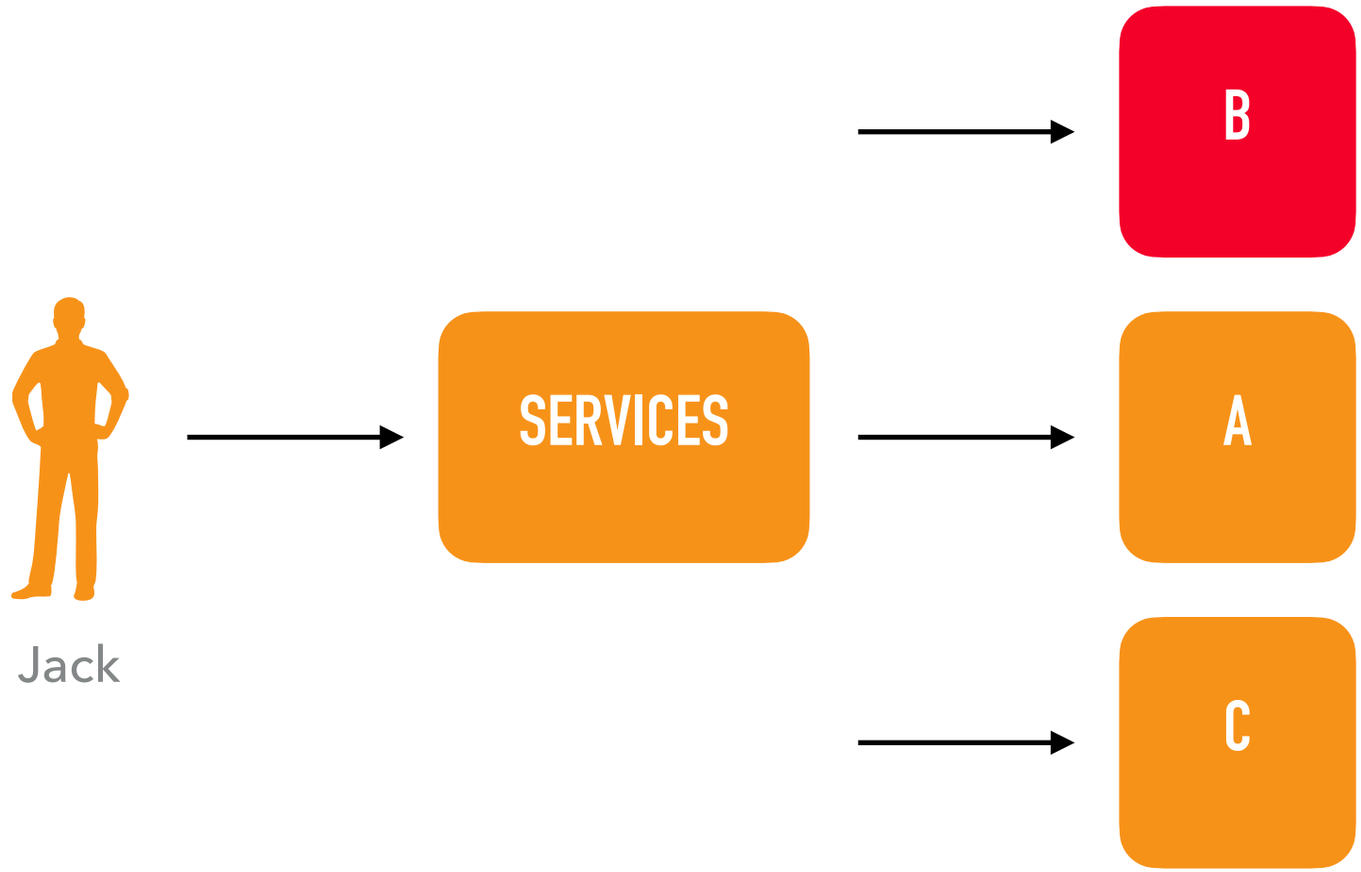
COLLISIONS DURING DEVELOPMENT

COLLISIONS DURING DEVELOPMENT

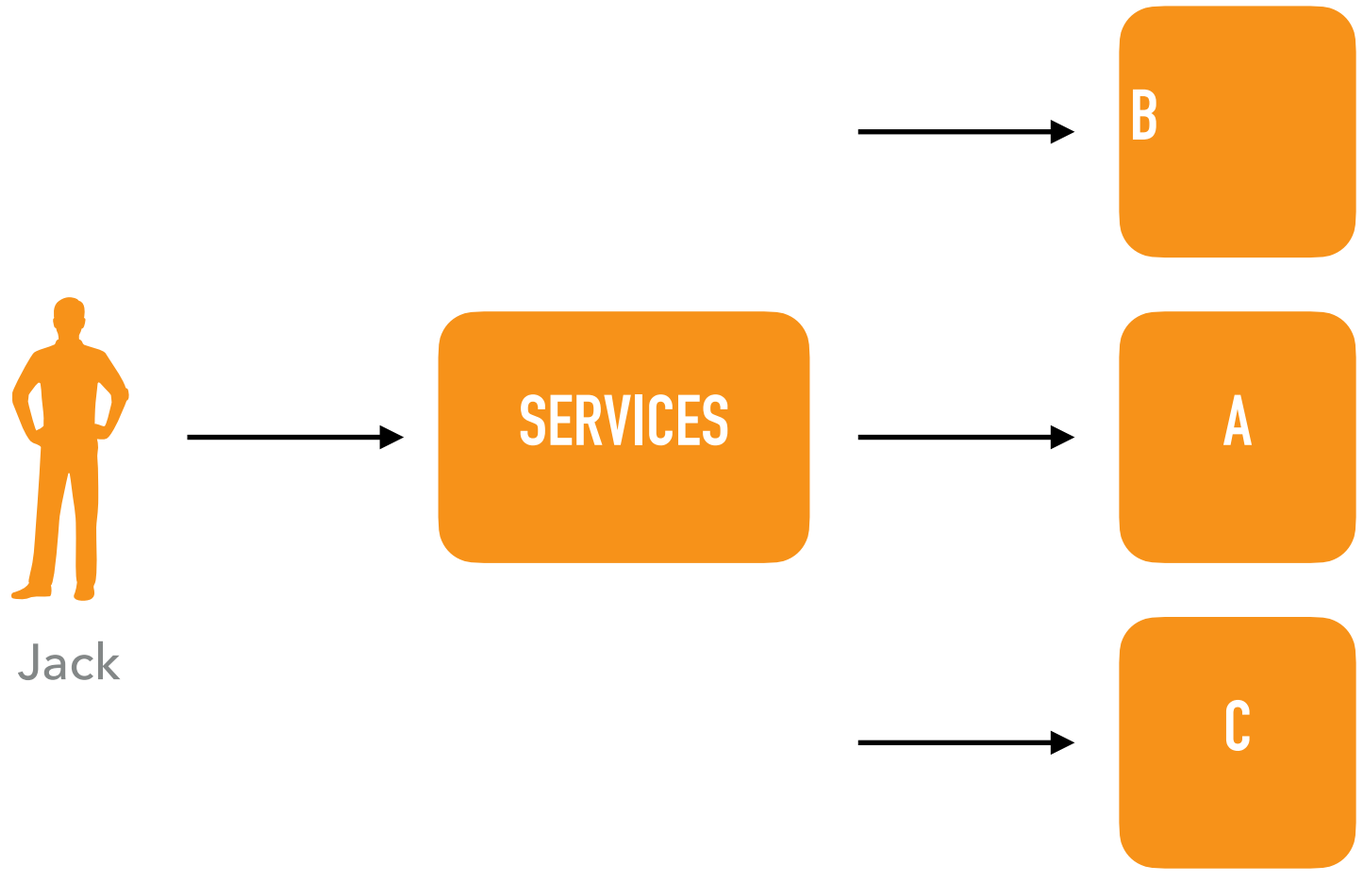
PROBLEMS



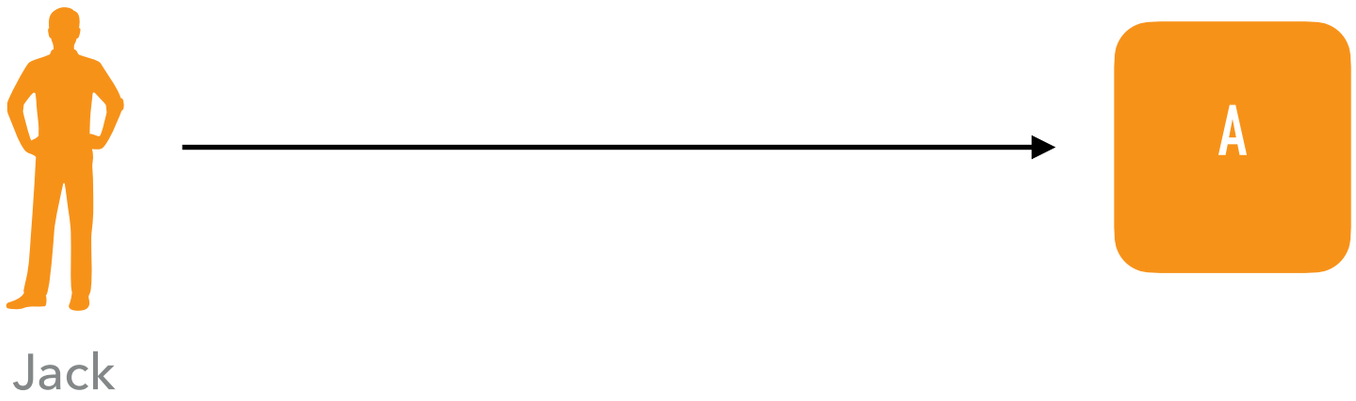
PROBLEMS: BUGS



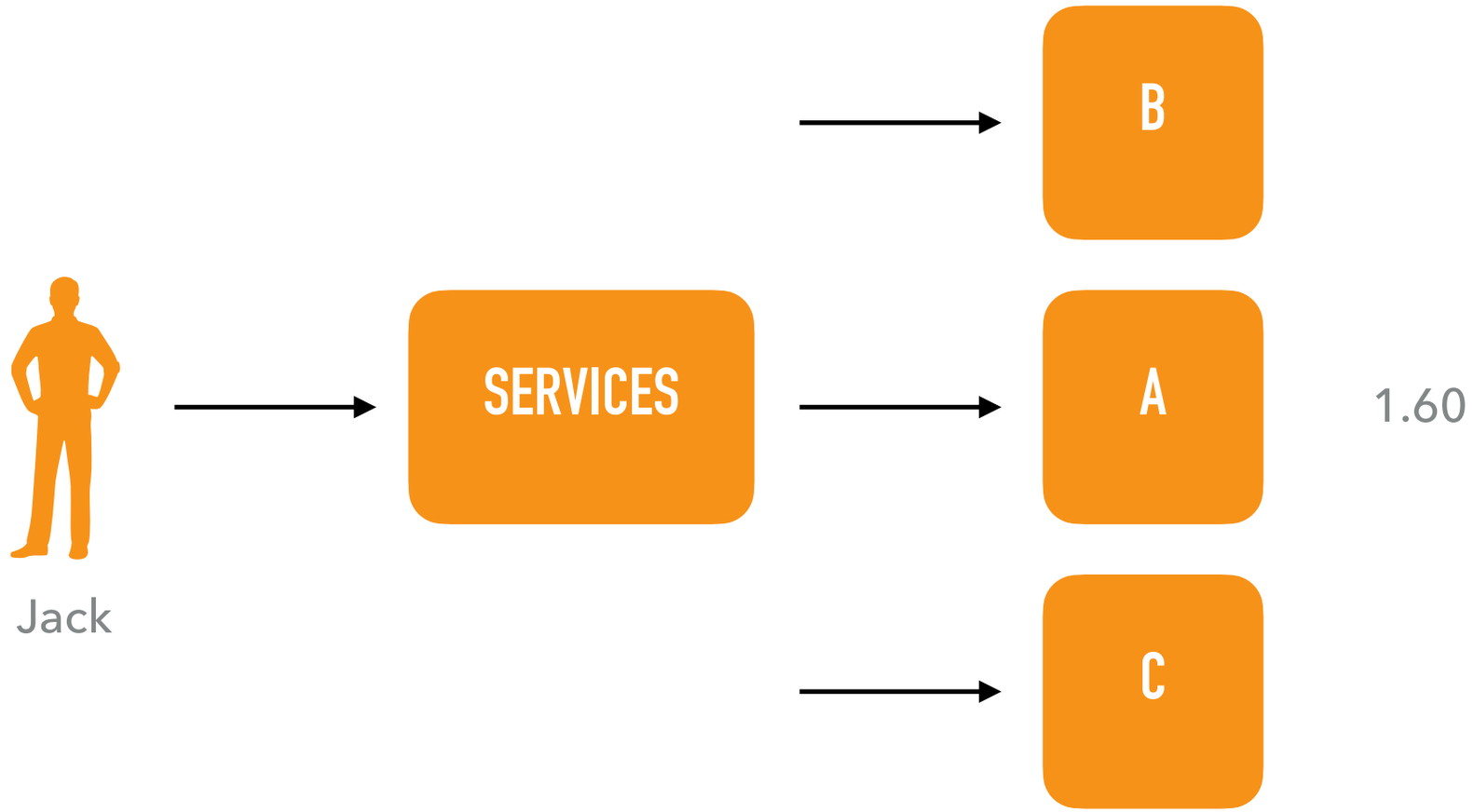
PROBLEMS: DRIFT



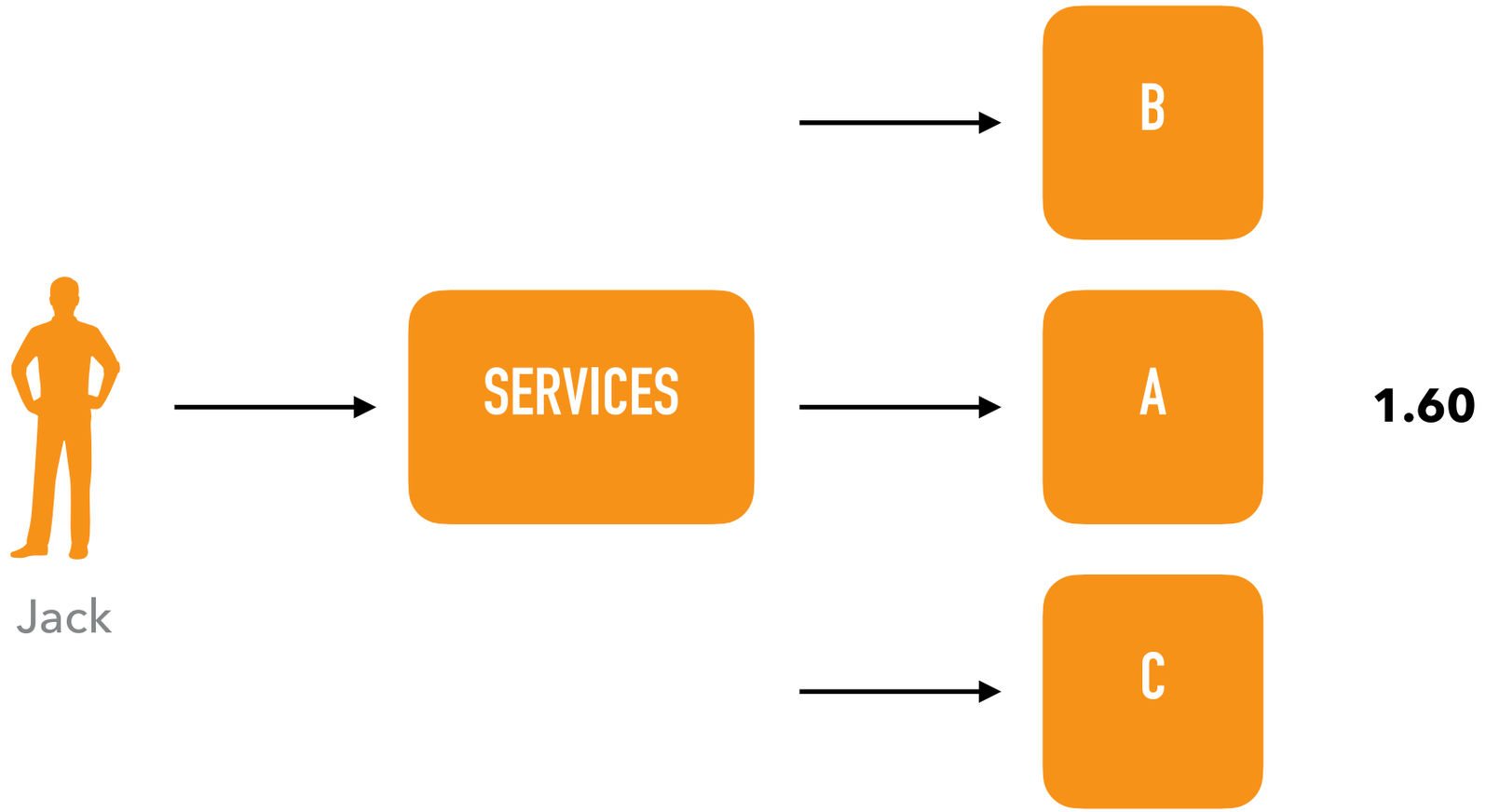
PROBLEMS



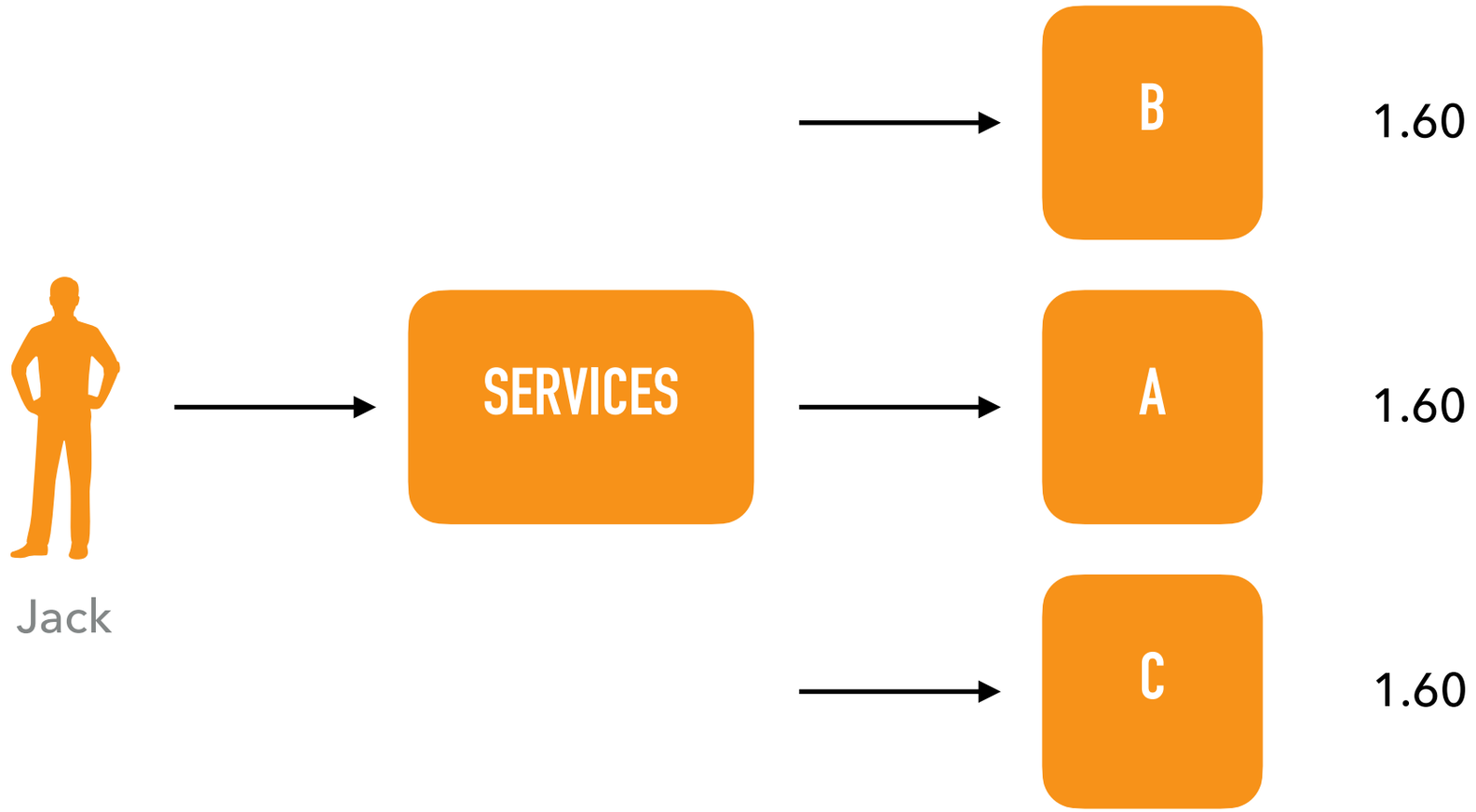
TAGGING/BRANCH DEADLOCKS



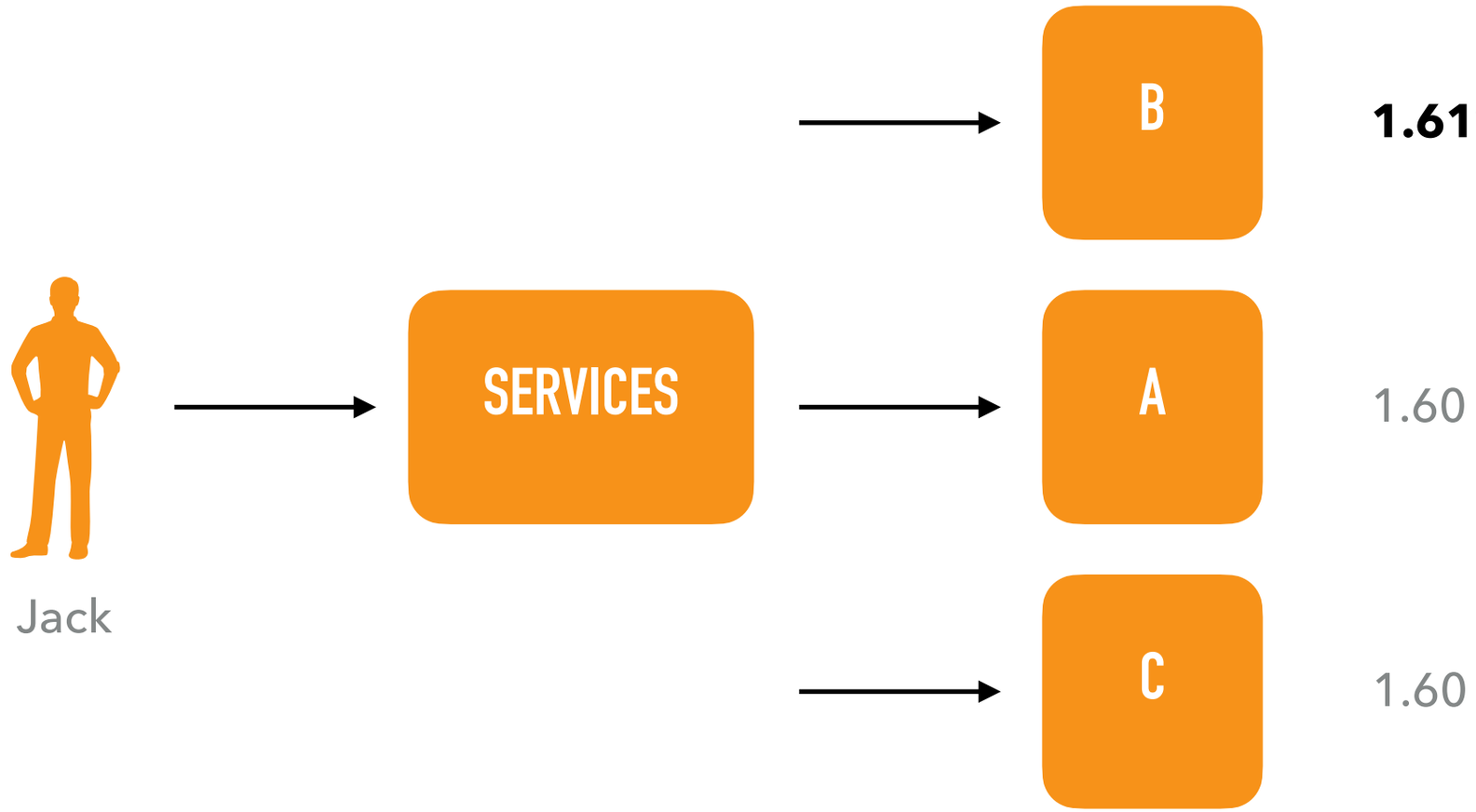
TAGGING DEADLOCKS



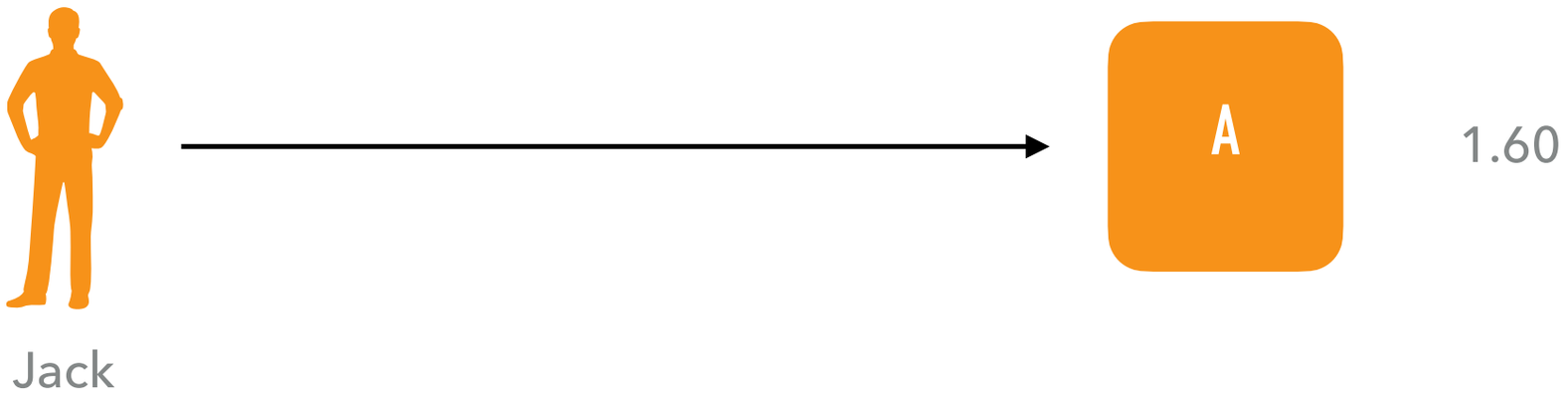
TAGGING DEADLOCKS



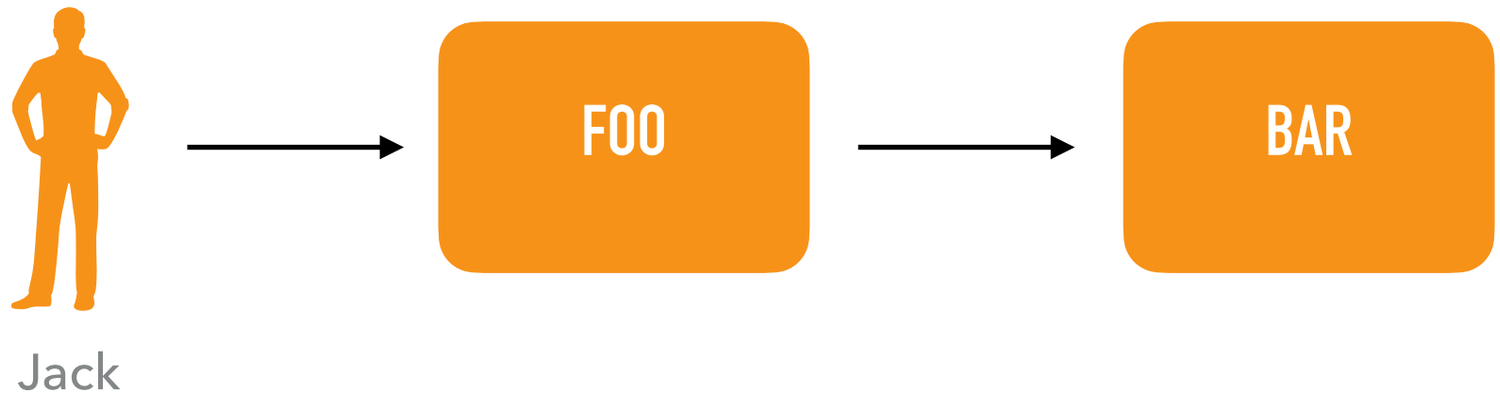
TAGGING DEADLOCKS



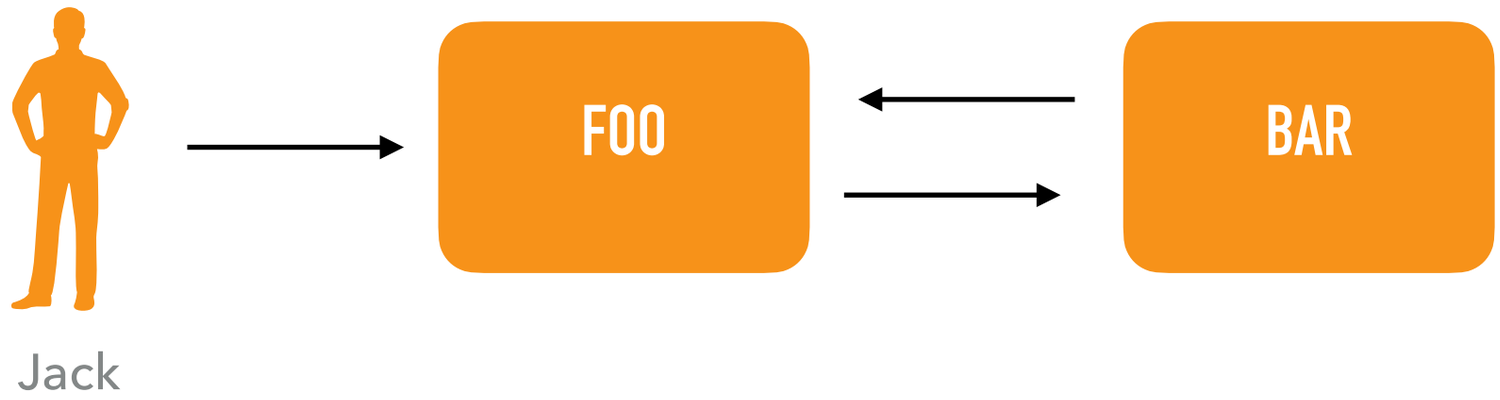
TAGGING DEADLOCKS



CYCLOMATIC DEPENDENCY



CYCLOMATIC DEPENDENCY



CHALLENGES

- Feedback speed
- Parallel development
- Complexity
- Different lifecycles
- Different teams

Source: Happy Terraforming! By Armin Coralic: https://www.youtube.com/watch?v=G06j6HLWyYo

GUIDELINES

- Less frequent changes, higher risk, in lower layers
- Small blocks
- No cyclomatic dependencies
- Decouple independent services
- Only deploy pipelines manually

ARCHITECTURE

DOMAIN

CONFIG

DATA

APPLICATION

SECRETS

INFRA

VPC

NETWORK

GLOBAL

ALERTING

CONFIG

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SECURITY

NAMING STANDARDISATION

- Environment
- Application
- Component

- Examples:
  - /prod/billing/foo
  - /dev-susan/billing/foo
  - staging-billing-foo

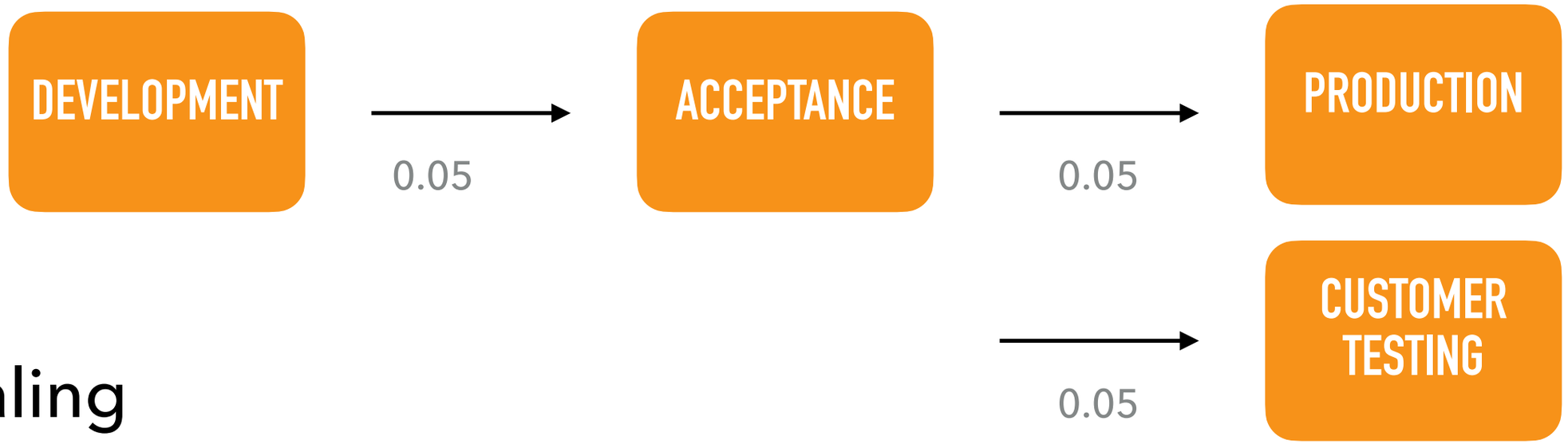
CODE TRACEABILITY

- Tag:
  - github.com/org/teamA/billing-infrastructure/stackA
- Naming:
  - Billing-application-foo -> GitHub.com/org/billing/infrastructure/src/application/foo

IDENTICAL ENVIRONMENTS

- Scaling

IDENTICAL ENVIRONMENTS



- Scaling
- Multiple environments

IDENTICAL ENVIRONMENTS

- Scaling
- Multiple environments
- Acceptance tests everything

OPEN SOURCE

- Terraform: https://github.com/terraform-community-modules
- AWS CDK: https://cdkpatterns.com/
- AWS CloudFormation: https://aws.amazon.com/quickstart/?
- Gruntwork*: https://www.gruntwork.io/

PATH OF ENLIGHTENMENT

DEVOPS METRICS

LEAD TIME

DEPLOYS

CHANGE FAILURE RATE

MEAN TIME TO RECOVERY

Source: Accelerate!

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TEST DRIVEN DEVELOPMENT