YOW!

SOFTWARE DEVELOPMENT CONFERENCE

YOW! LONDON 2022

Architecture Fitness Functions

Organising and Governing Evolutionary Architectures

@patkua

GOTO Guide App

→ Download the app
→ Ask questions
→ Rate sessions

Patrick Kua
20+ years experience

Agile Software Development

Organisational Change

Systems Thinking

Technical Leadership Development

#Architect #Developer #Coach #Leader #CTO

#Life-long learner #Author #Speaker

@patkua

TechLead
ACADEMY

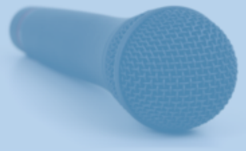
http://techlead.academy

Shortcut to Tech Leadership

Accelerate Your Journey From Maker to Multiplier

Join a guided workshop designed for online learning
https://www.patkua.com/shortcut-to-tech-leadership/

Communicate Like a CTO



Grow your influence and be better understood
https://techlead.academy/p/communication

Engineering Manager Essentials

A Strong Foundation for Effective EMs

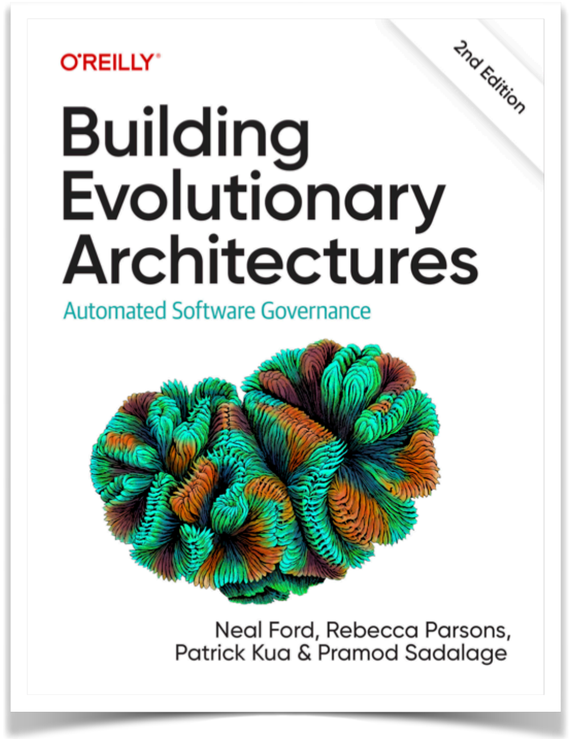
Uncover the core expectations of EMs with this guided online course
https://www.patkua.com/em-essentials

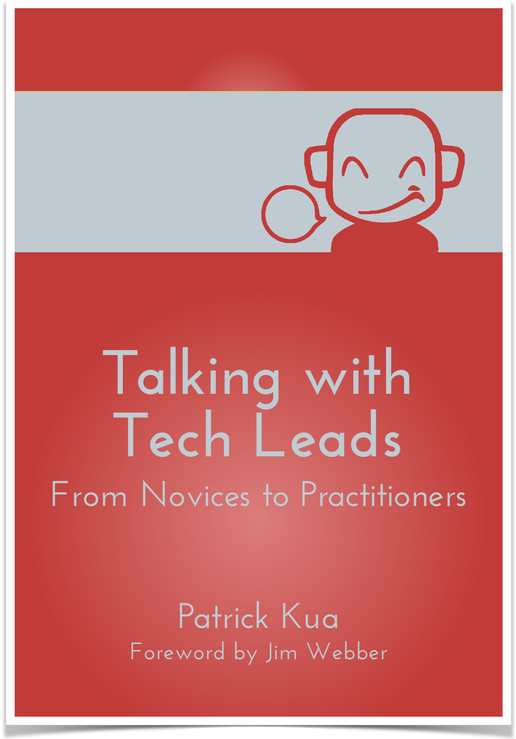
Systems Thinking Fundamentals

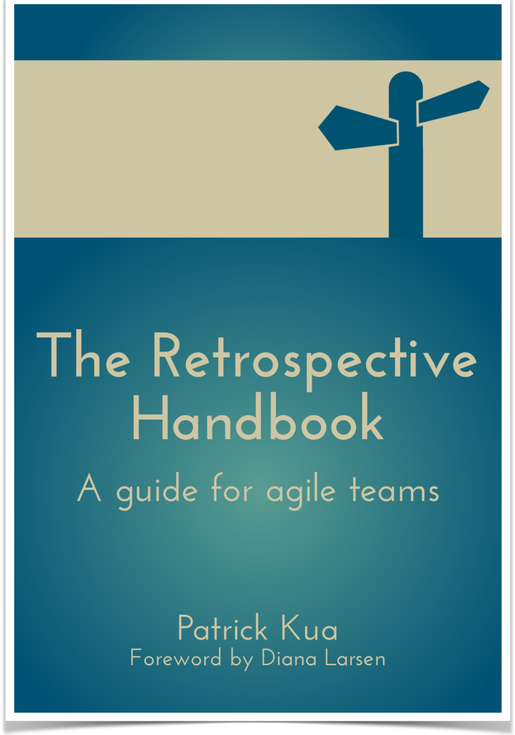
Manage systems, not people
https://techlead.academy/p/systems-thinking-fundamentals

Time Management for Technical Leaders

Productivity methods that pay back
https://techlead.academy/p/time-management





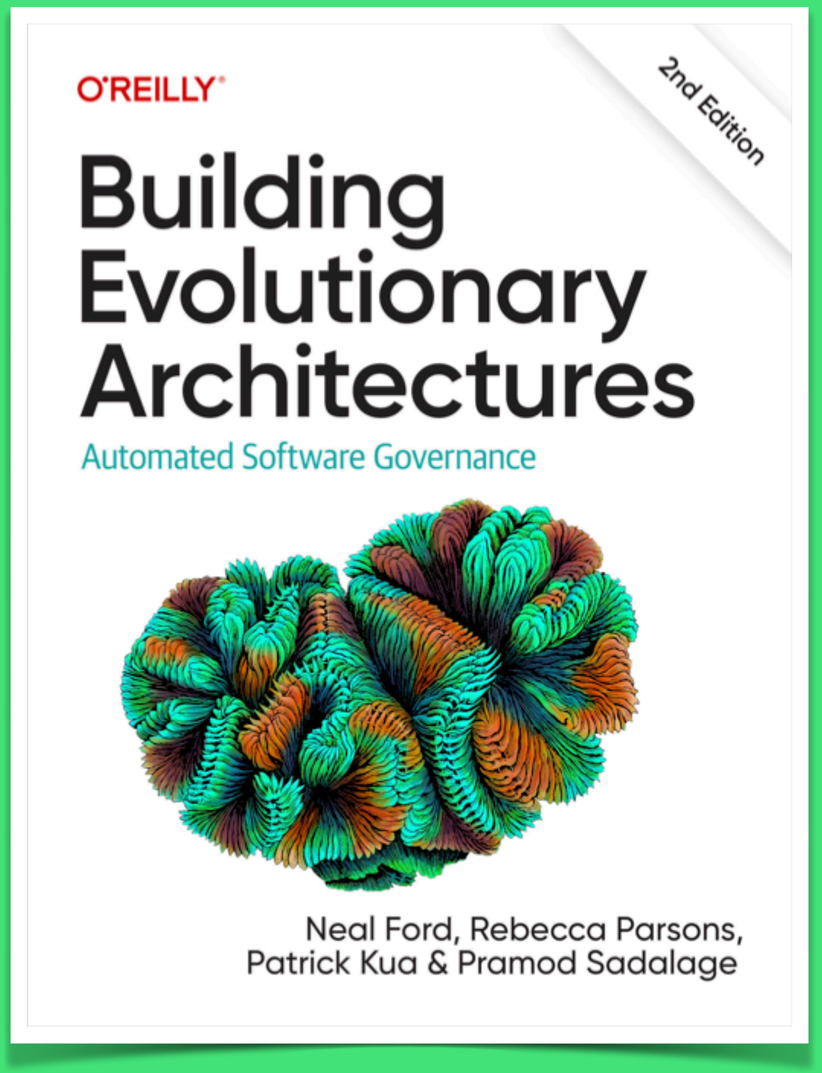


thekua.io/evolarch thekua.io/twtl thekua.io/retrobook

#Architect #Developer #Coach #Leader #CTO

#Life-long learner #Author #Speaker

@patkua



2nd Edition out soon

@patkua

DEFINITION

An evolutionary architecture supports
incremental, guided change
as a first principle along
multiple dimensions

@patkua

Software is like a garden

We can plan, but cannot control

What sort of garden do you want?

Architects = Software Gardeners

What sort of garden do you want?

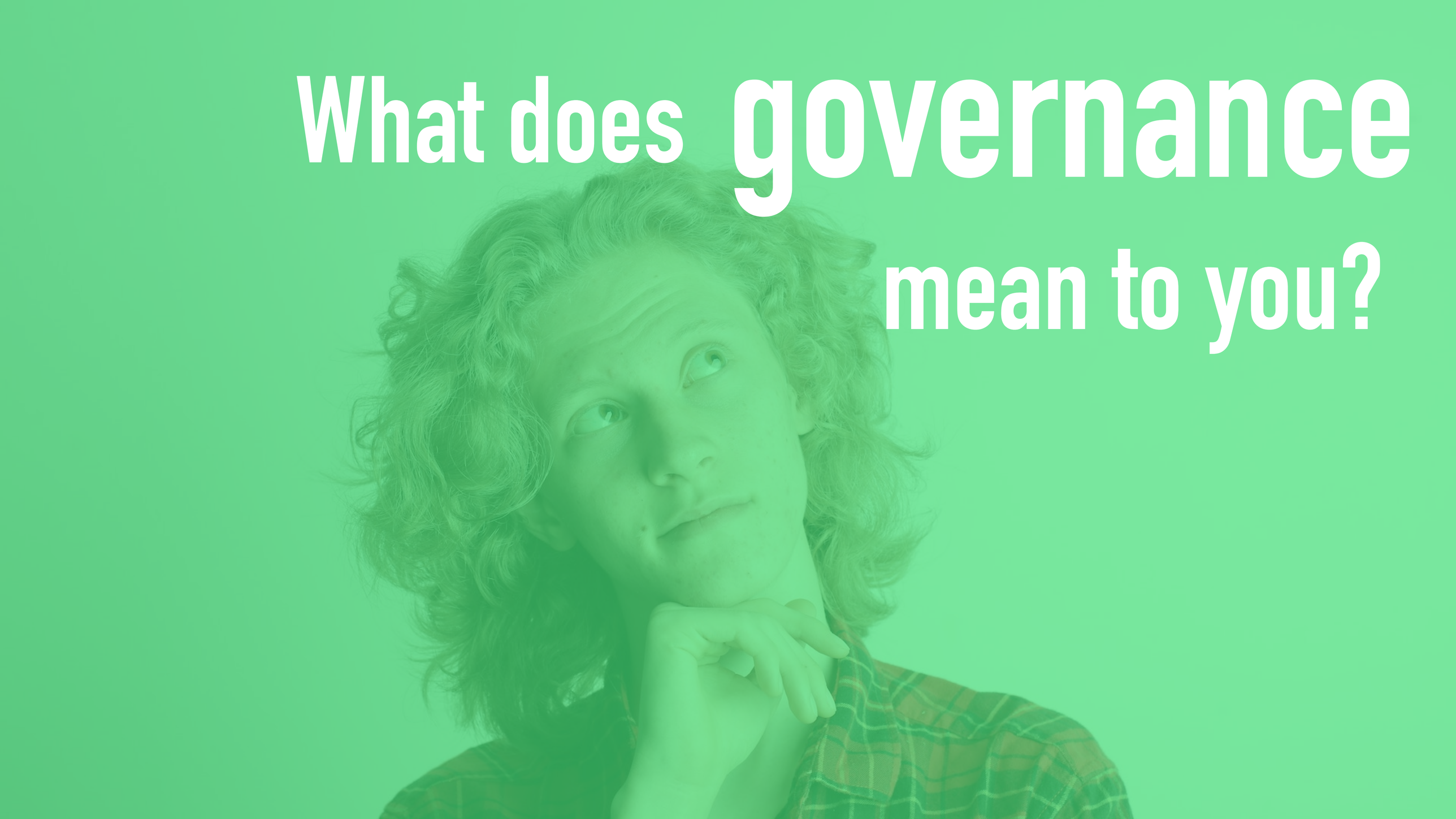
How do many software architects “garden”?

What is governance?

"The way that organisations are managed at the highest level and the systems for doing this"

Source: https://dictionary.cambridge.org/dictionary/english/governance

What does governance mean to you?



“You can´t do that”

“Wrong”

“You must do that”

“You can´t do that”

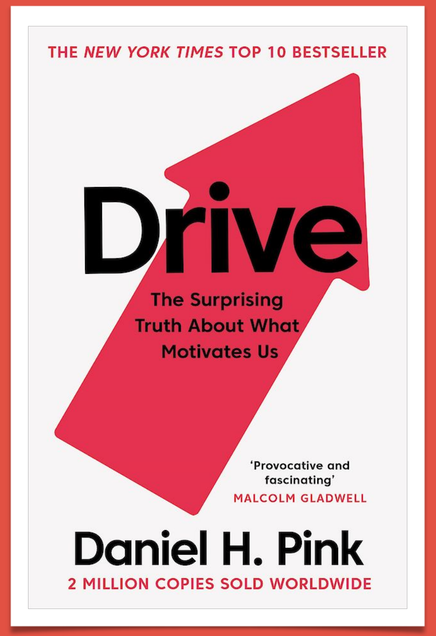
“Wrong”

“You must do that”

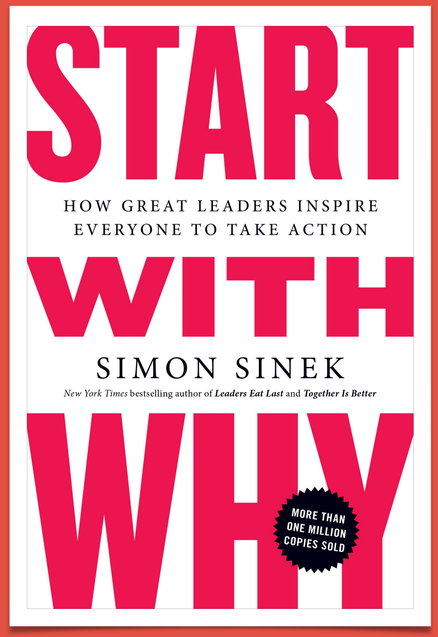
Nobody likes being judged

It´s also impossible to judge everything

What's missing?



Autonomy



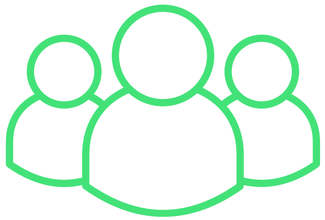
Context

Example

4 independent teams, each building microservices,
empowered to make any technical choices.

Without any governance,
what might we imagine after 2 years time?

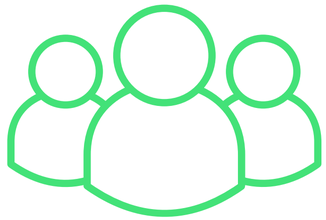
Example



React

Ruby on Rails

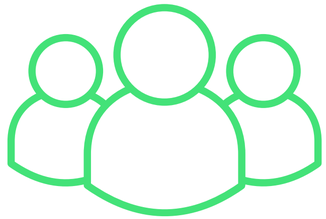
Selenium
Rspec



Vue

Spring

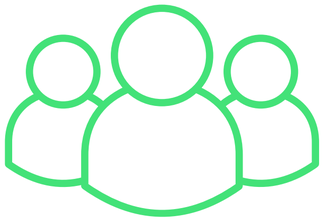
JUnit



Next.js

Micronaut

JBehave



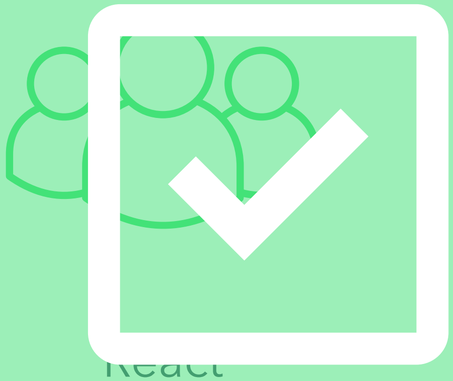
React

Ktor

Spek

Note: The differences are not necessarily bad, but may be undesirable

Example

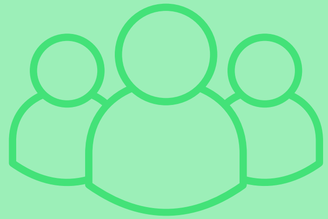


Autonomy

React

Vue

Next.js



React

Ruby on Rails

Spring

Micronaut

Ktor

Selenium

Rspec

Junit

Behat

Spek

Alignment

Note: The differences are not necessarily bad, but may be undesirable

Rules and constraints are important

Rules and constraints are important

But implementation matters

What does nature do?


“Fit for the environment”

Evolutionary architectures

are **guided** with

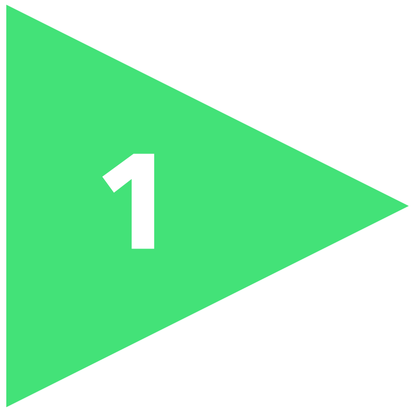
FITNESS FUNCTIONS

@patkua

What is a fitness function?

"An **objective** function that measures how close a given solution fits to a particular goal"

Steps



Identify what you care about

Fitness Functions

IMPORTANT

Low response time

Mobile responsive

Large # of users

Availability

Internationalisation & Localisation

UNIMPORTANT

Strong audit trail

Heavy legal compliance

Monitoring

Fitness Functions

IMPORTANT UNIMPORTANT

System Quality Attributes

Cross Functional Requirements

Non Functional Requirements

Fitness Functions

IMPORTANT

Low response time

Mobile responsive

Large # of users

Availability

Internationalisation & Localisation

UNIMPORTANT

Strong audit trail

Heavy legal compliance

Monitoring

Fitness Functions

IMPORTANT	UNIMPORTANT
Strong audit trail	Low response time
Large # of users	Monitoring
Mobile responsive	Internationalisation & Localisation
Availability	Heavy legal compliance

What is important?

Resiliency

Speed

Fail Fast

Strong consistency

Scale immediately

Tradeoffs

Simplicity

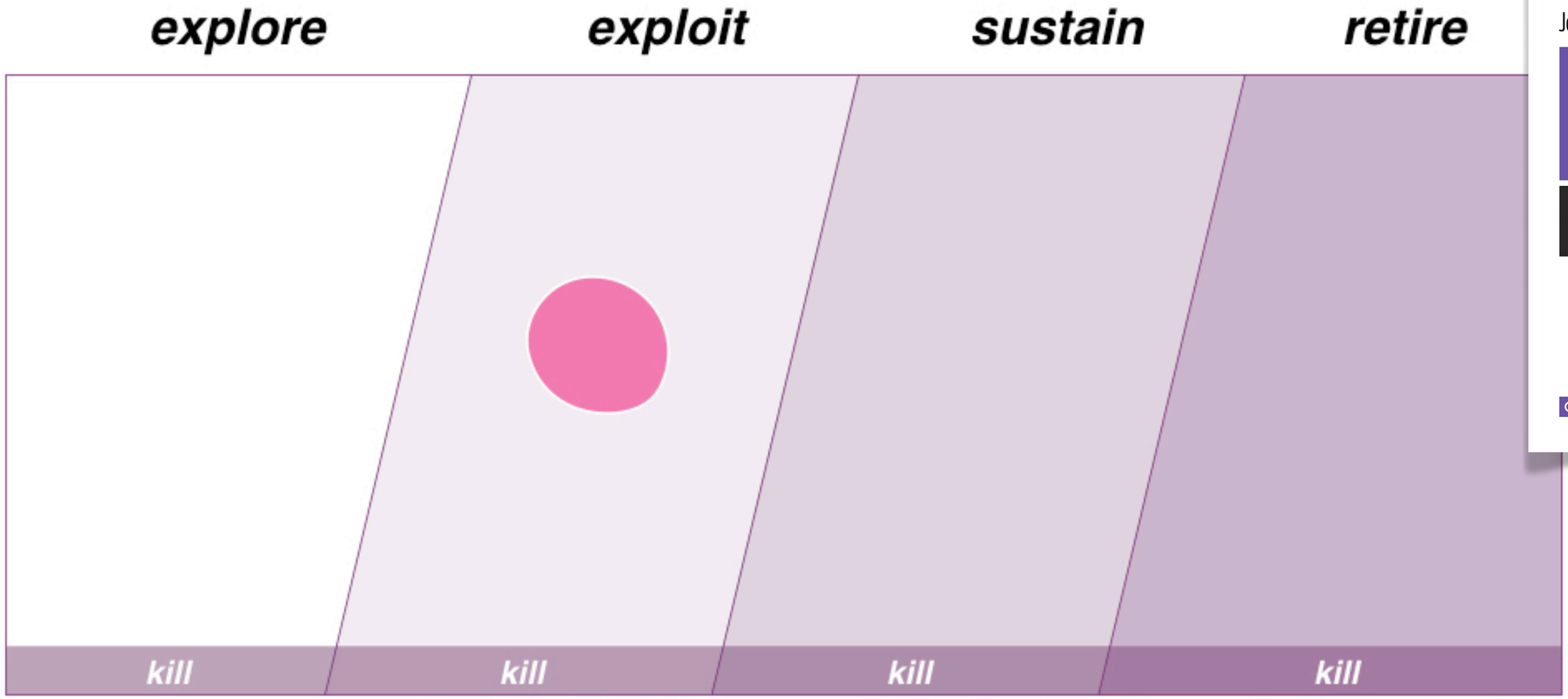
Significant duplication

Inconsistency

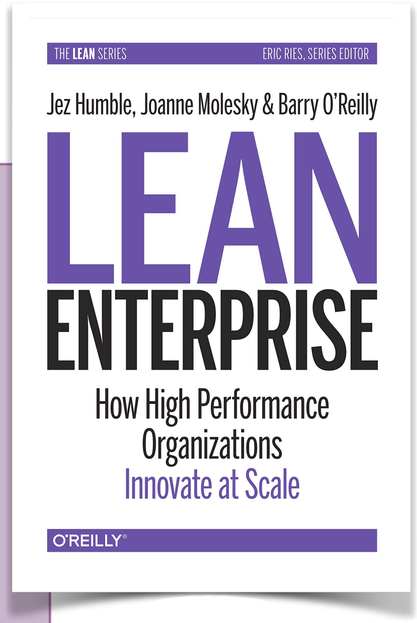
High coordination costs

“Google” only tooling

Fitness Changes Over Time

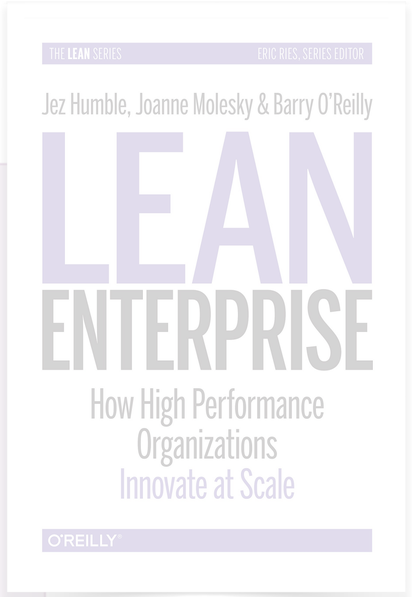


Humble, Molesky, O'Reilly, *Lean Enterprise: How High Performance Organizations Innovate At Scale*



Fitness Changes Over Time

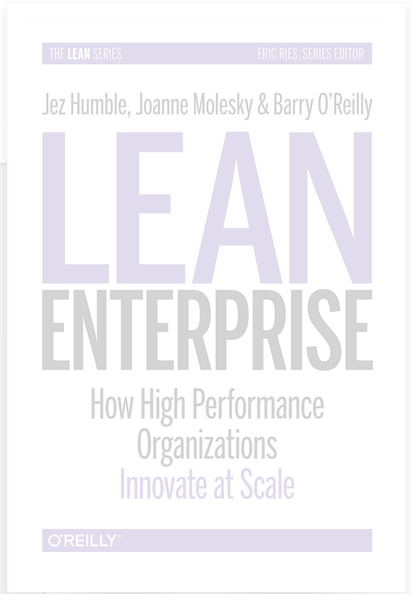
"Move fast and break things"



Humble, Molesky, O'Reilly, *Lean Enterprise: How High Performance Organizations Innovate At Scale*

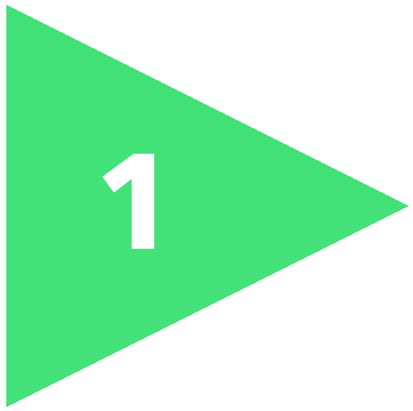
Fitness Changes Over Time

"Move fast with stable infrastructure"

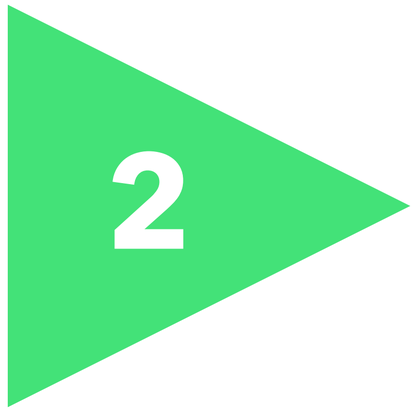


Humble, Molesky, O'Reilly, *Lean Enterprise: How High Performance Organizations Innovate At Scale*

Steps

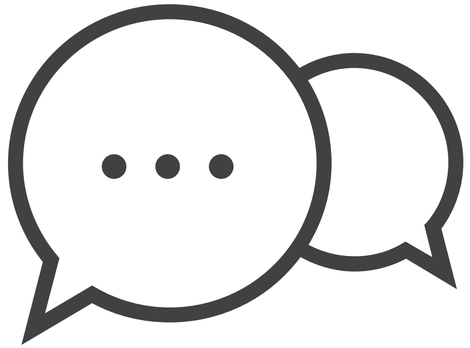


Identify what you care about



Define what “good” looks like

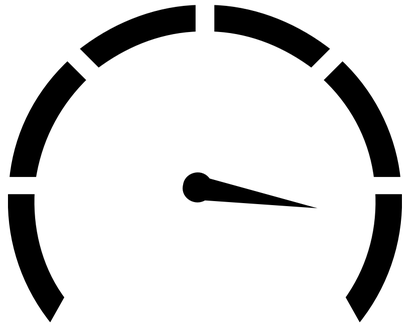
Example



Internationalisation & Localisation

Optimise for	> English Latin-based languages
Don’t optimise for	Non-latin languages
Why?	Target audience is mostly Western Europe
Tradeoff	Longer content cycles

Example



Deployment Speed

Optimise for

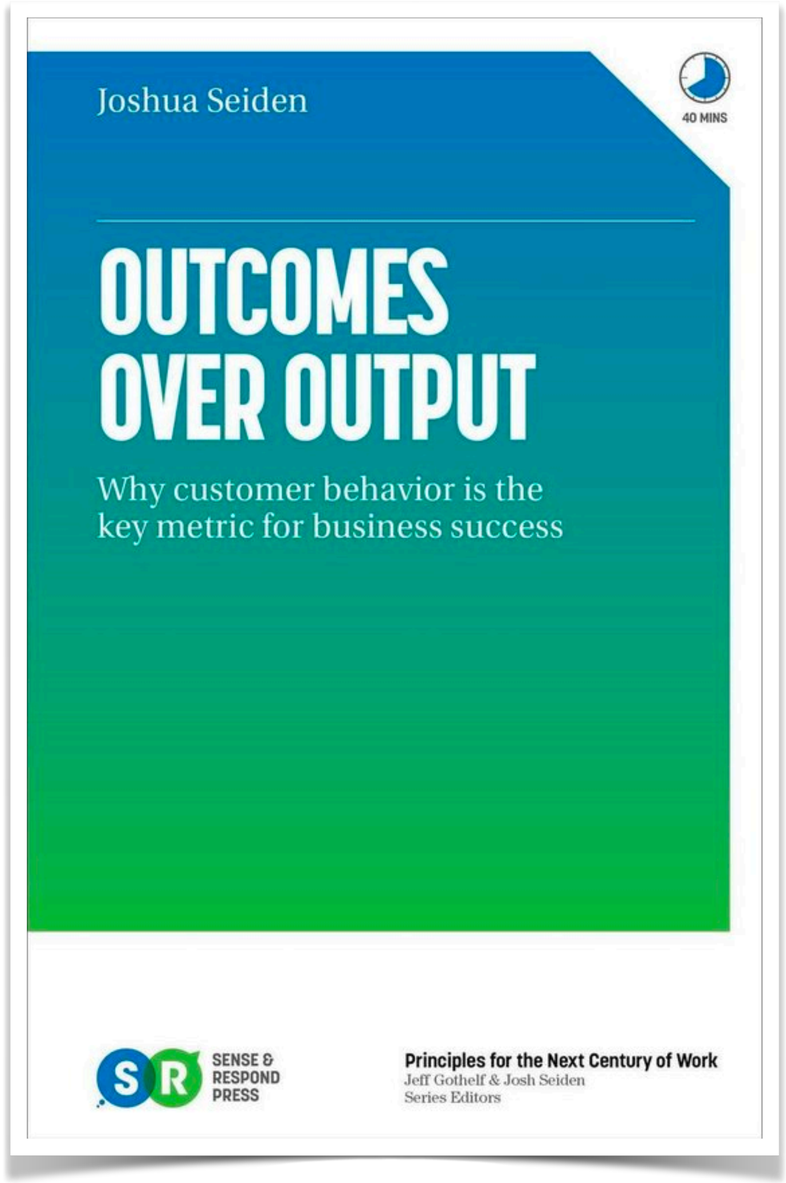
From monthly releases to 5+ per day

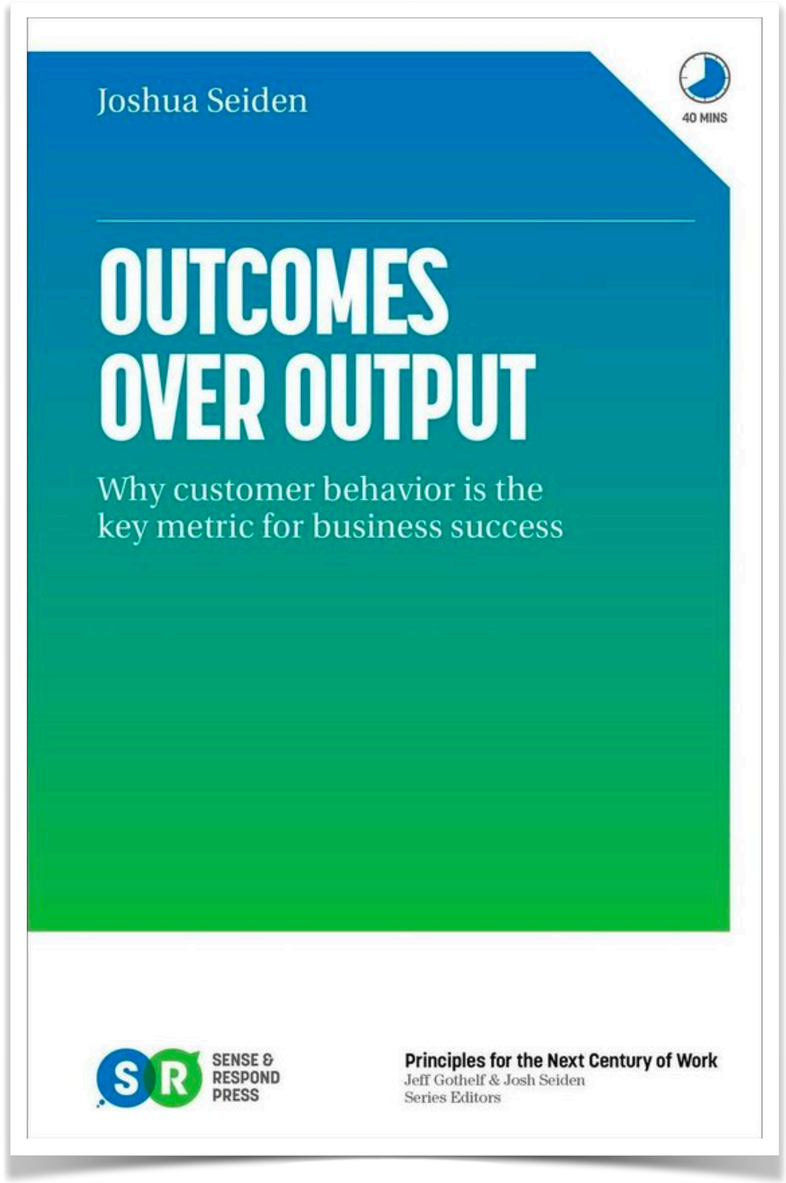
Why?

Quicker turn around in case of bug fixes, etc

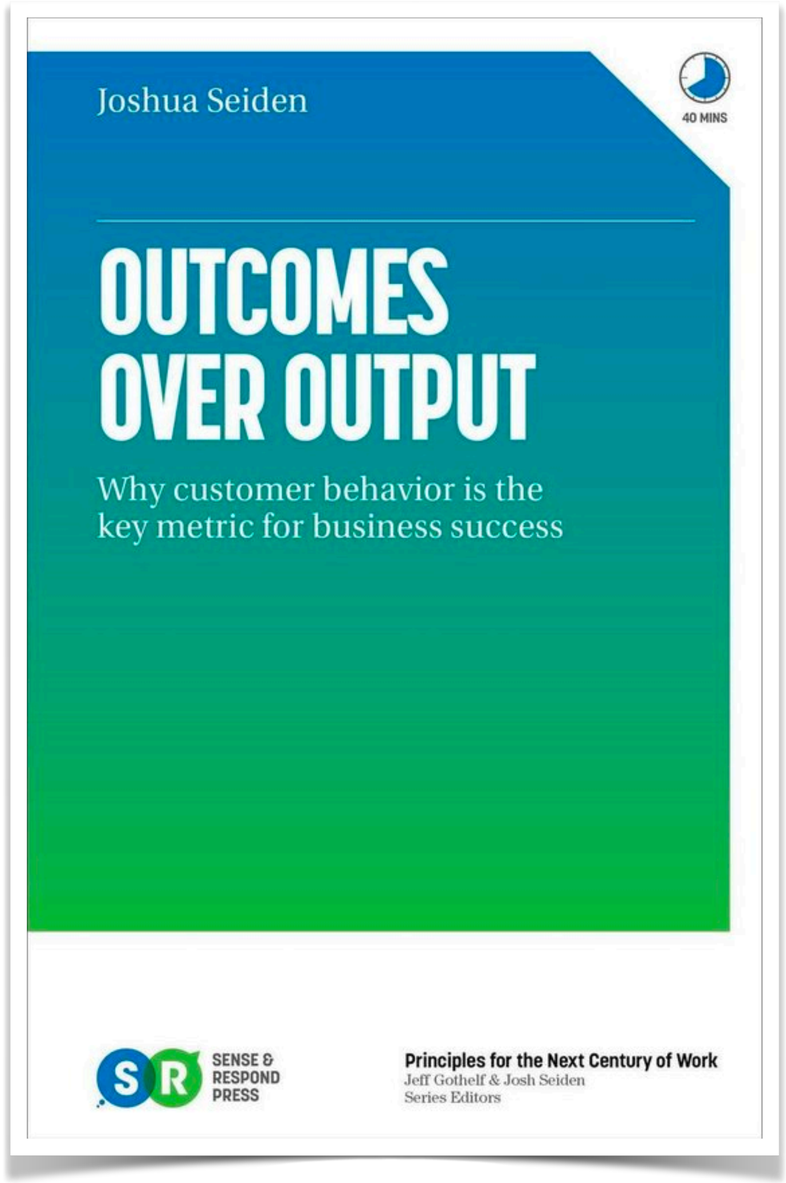
Tradeoff

Investment in automation
Rearchitect parts


Joshua Seiden
40 MINS
OUTCOMES OVER OUTPUT
Why customer behavior is the key metric for business success
SENSE & RESPOND PRESS
Principles for the Next Century of Work
Jeff Gothelf & Josh Seiden
Series Editors



Good product management



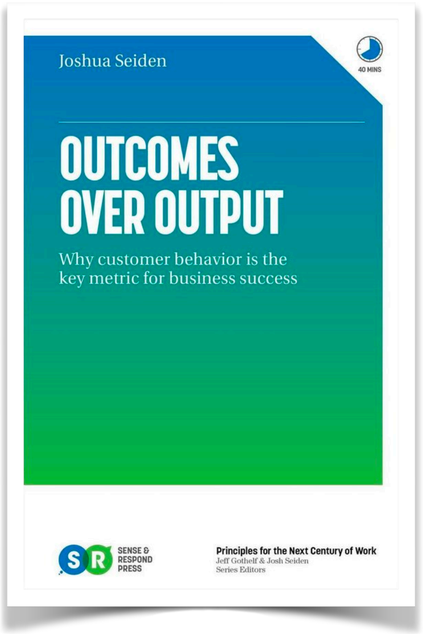
Good product management

Good technical leadership (i.e. governance)

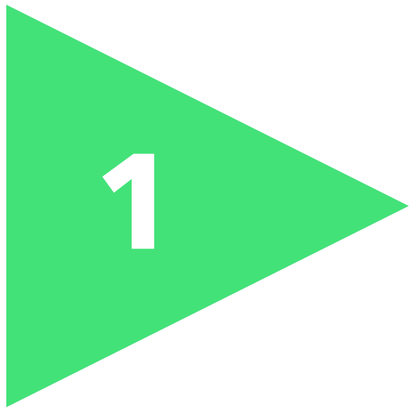
Fitness functions help us define a

“good outcome”

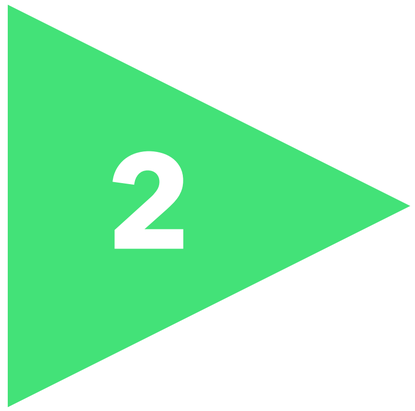
without specifying the implementation



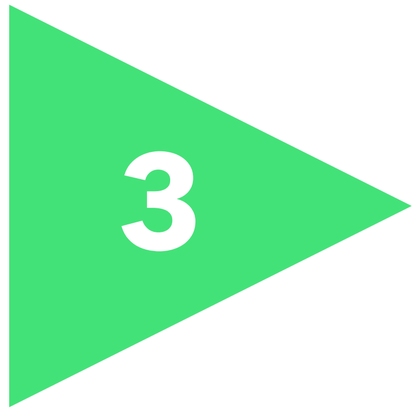
Steps



Identify what you care about

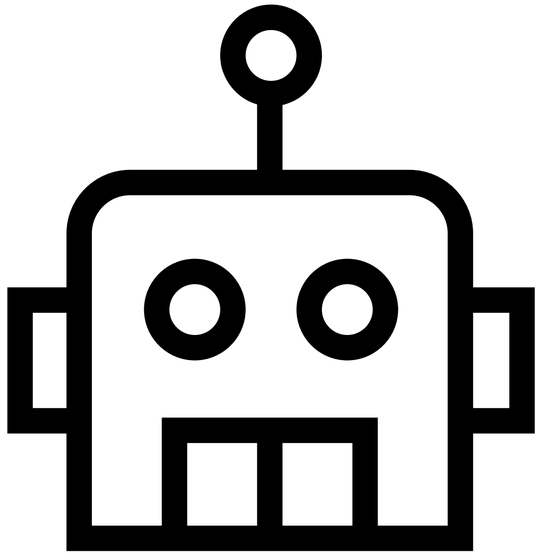


Define what “good” looks like

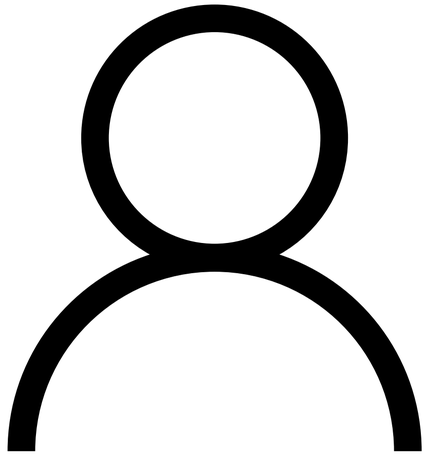


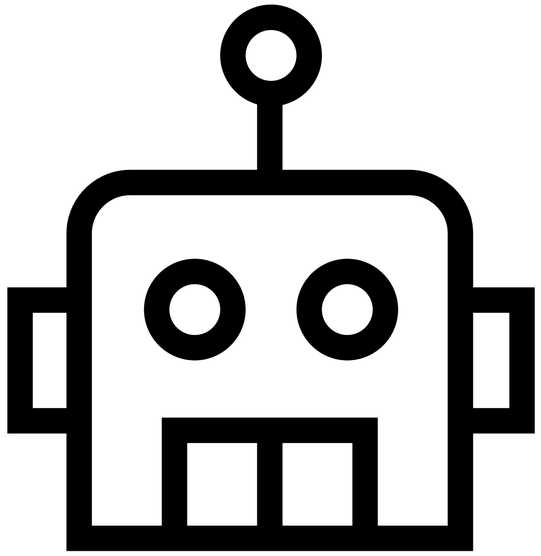
Define fitness function(s)

Fitness functions provide guardrails

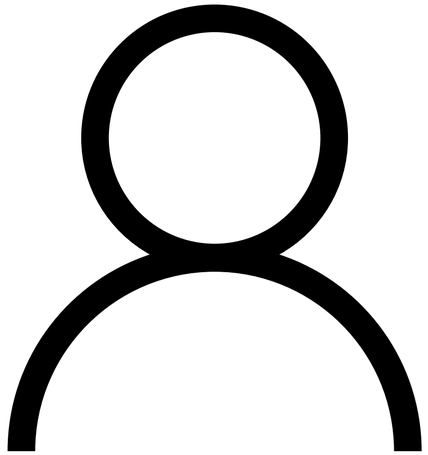


over





over



(Not always possible)

EXAMPLES

Challenge

How do you get teams to build resilient services?

Problem

We are building a streaming service that is used worldwide. We can't afford major downtime, therefore we want to make sure our systems are as resilient as possible

“Naive” Solution

Let’s add a testing team who will focus on running resiliency tests

“Naive” Solution

Product Team

Product Team

Product Team

Product Team

Product Team

Product Team

Testing Team

“Naive” Solution


Product Team


Product Team


Product Team


Product Team


Product Team


Product Team

What happens if we add more product teams?


Testing Team

“Naive” Solution

Product Team

Product Team

Product Team

Product Team

Product Team

Product Team

Testing Team

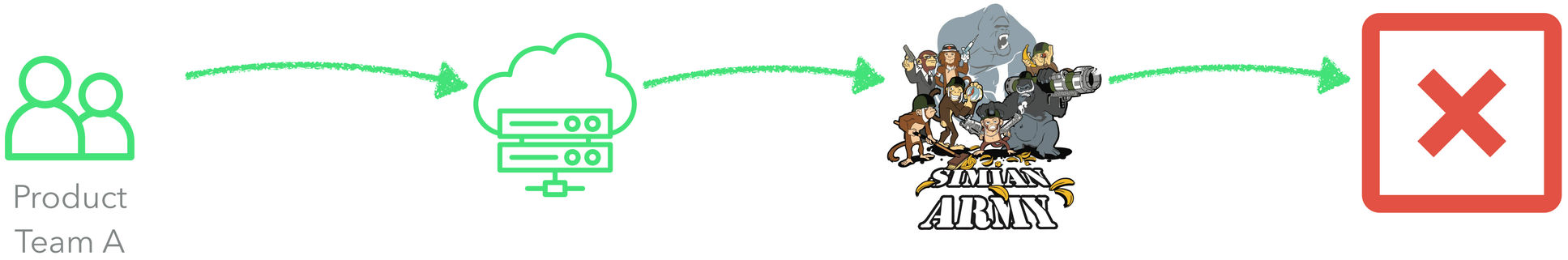
Default reaction: Add more people

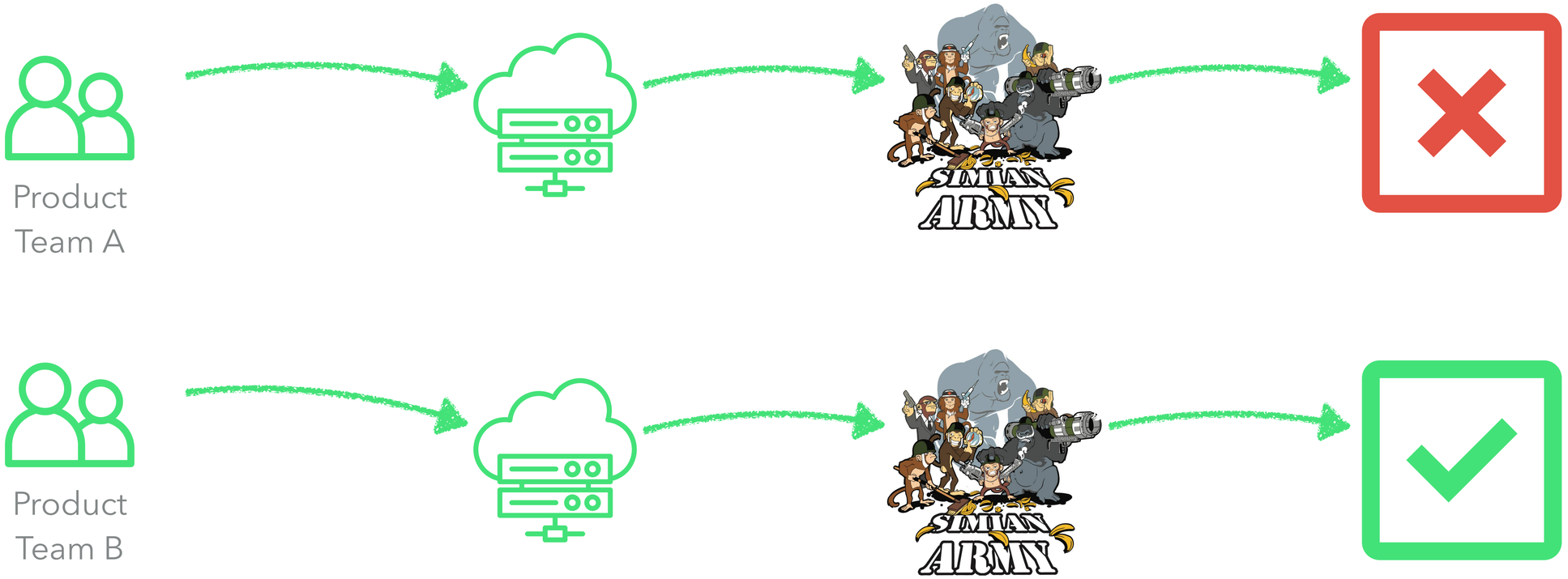
Can we scale this somehow?

Can we scale this somehow?

Yes. Through automation

Birth of the Simian Army


Product
Team A
SIMIAN
ARMY


Product
Team A
SIMIAN
ARMY
Product
Team B
SIMIAN
ARMY

Birth of the Simian Army

Automated

Continuous

Holistic

PS Simian Army also evolved

Chaos Monkey

https://github.com/netflix/chaosmonkey

Spinnaker's Swabbie

https://github.com/spinnaker/swabbie

Spinnaker

Future of Conformity Monkey

Tradeoffs

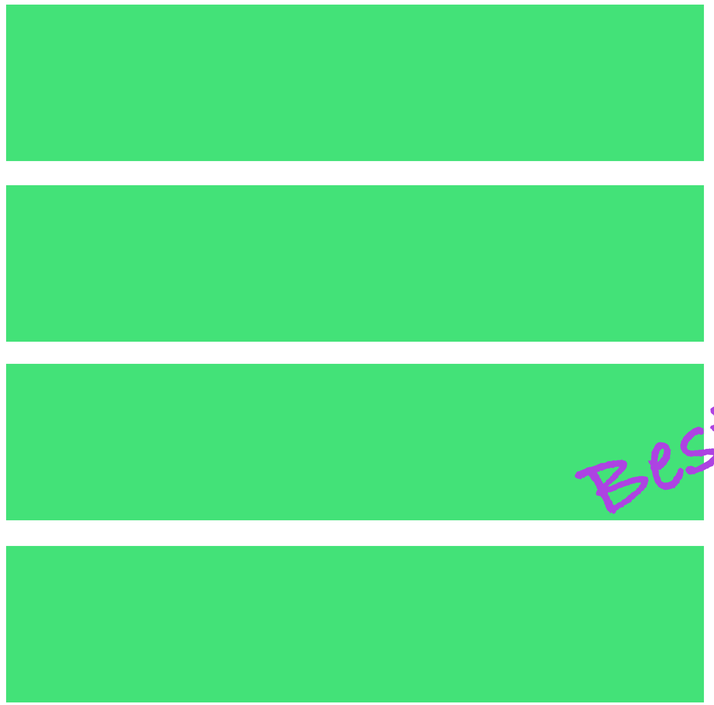
Initial investment

Slower to innovate

Challenge

How can you make sure teams are following a layered architecture?

Layered Architecture



User Interface

depends on

Service Layer

depends on

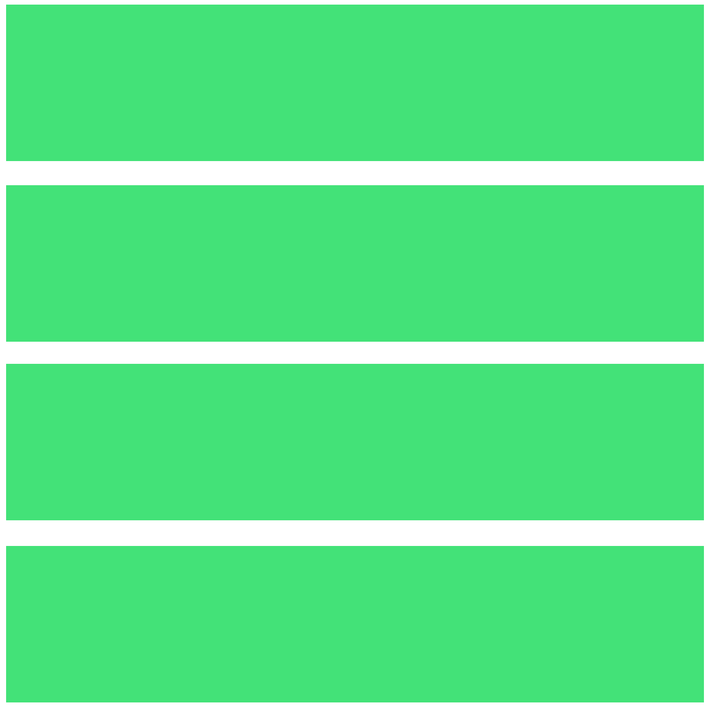
Persistance Layer

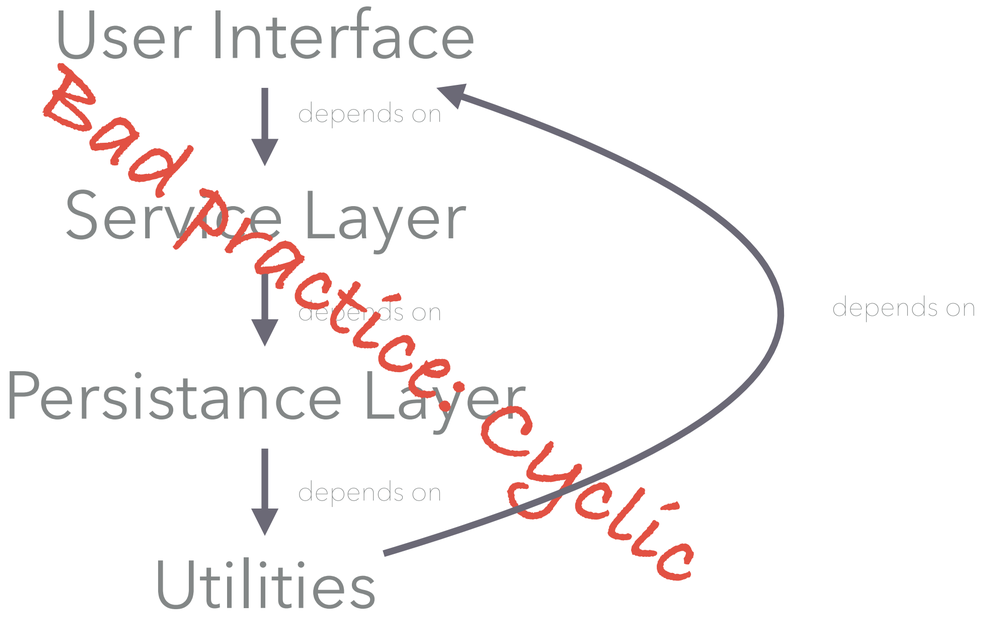
depends on

Utilities

Best Practice: Unidirectional

Layered Architecture





“Naive” Solution

Code review

Design review

Architecture review

Fitness Function for Layering

```
@Test public void ensureNoCyclicDependenciesExist() {
    Collection packages = jDepend.analyze();
    assertFalse("Cycles exist", jDepend.containsCycles());
}
```


Source: https://github.com/clarkware/jdepend

Fitness Function for Layering

```
@Test public void ensureCorrectLayering() throws Exception {
    JDepend jDepend = buildNewJDepend();
    DependencyConstraint constraint = new DependencyConstraint();
    JavaPackage util = constraint.addPackage("com.thekua.util");
    JavaPackage repository = constraint.addPackage("com.thekua.dao");
    JavaPackage web = constraint.addPackage("com.thekua.web");

    web.dependsOn(util);
    repository.dependsOn(util);
    web.dependsOn(repository);

    jDepend.analyze();

    assertTrue("Dependency layers violated",
        jDepend.dependencyMatch(constraint));
}
```


Source: https://github.com/clarkware/jdepend

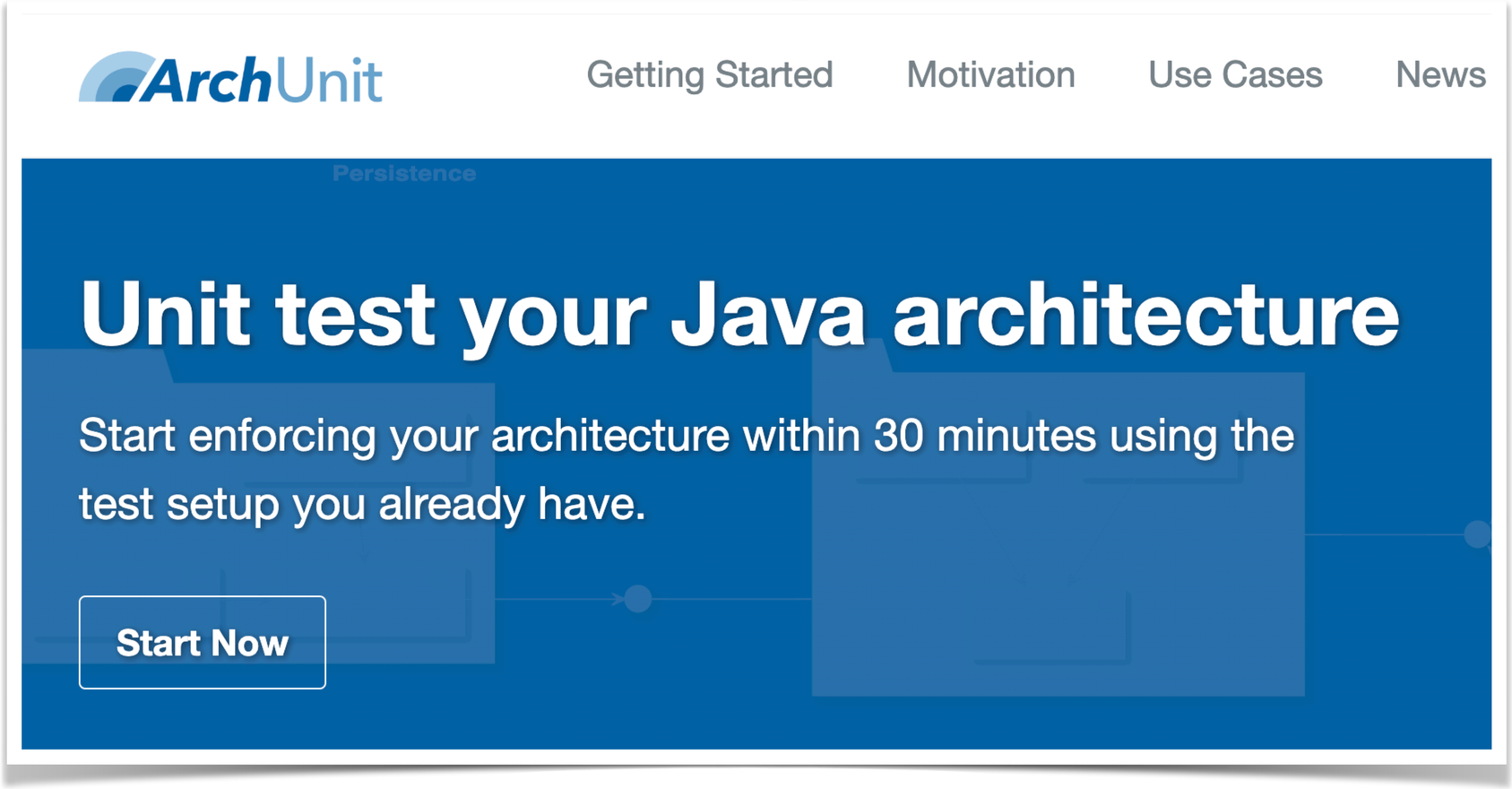
Multiple Implementations

Fitness Function for Layering

Since Java 9

```
module com.thekua.web {
    requires com.thekua.util
    requires com.thekua.dao
    ...
}
module com.thekua.dao {
    requires com.thekua.util
    ...
}
module com.thekua.util {
    ...
}
```


Fitness Function for Layering



Fitness Function for Layering


```
...
@ArchTest
static final ArchRule services_should_not_access_controllers =
  noClasses().that().resideInAPackage("..repository..")
    .should().accessClassesThat().resideInAPackage("..web..");

@ArchTest
static final ArchRule persistence_should_not_access_services =
  noClasses().that().resideInAPackage("..util..")
    .should().accessClassesThat().resideInAPackage("..repository..");

...
```


Fitness Function for Layering

Automated

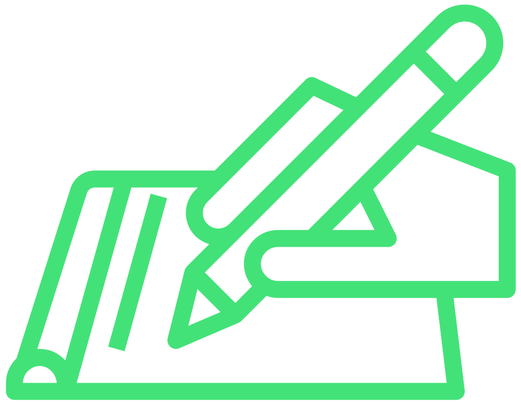
Triggered

Atomic

Challenge

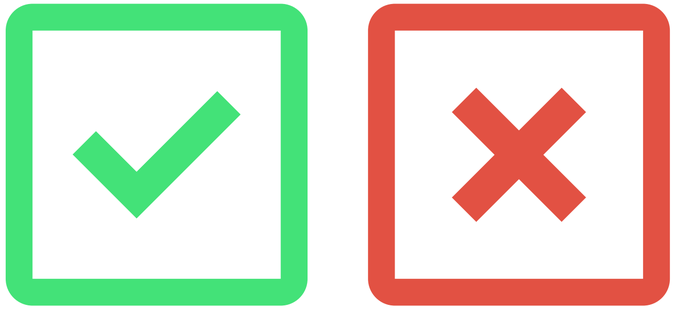
In a microservices environment, with lots of teams, how do you make sure each service is easily monitorable

“Naive” Solution



Operations requirement

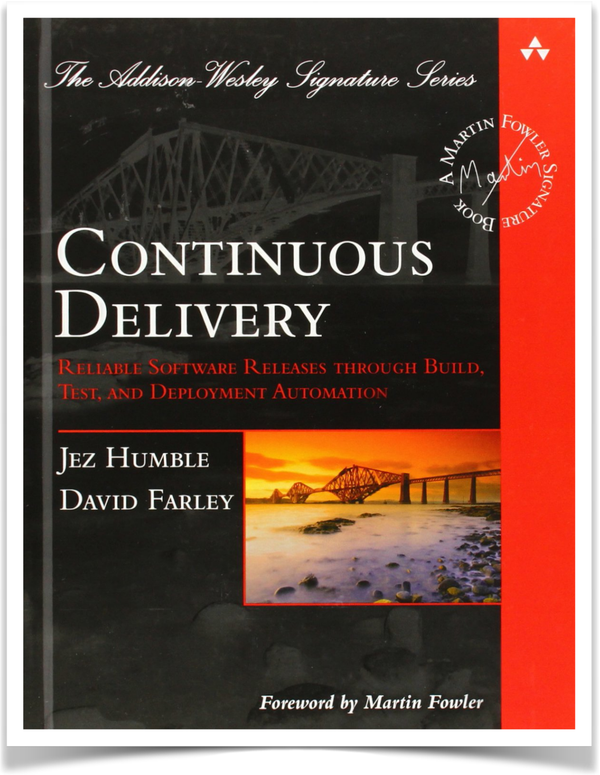
Inspection



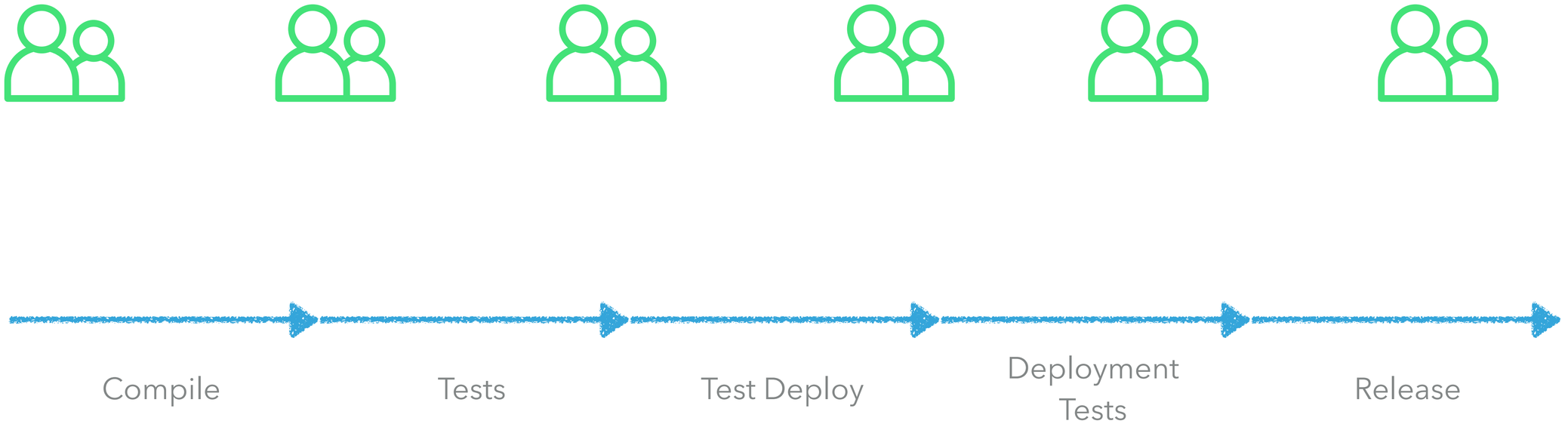
Right or wrong

Remember this?

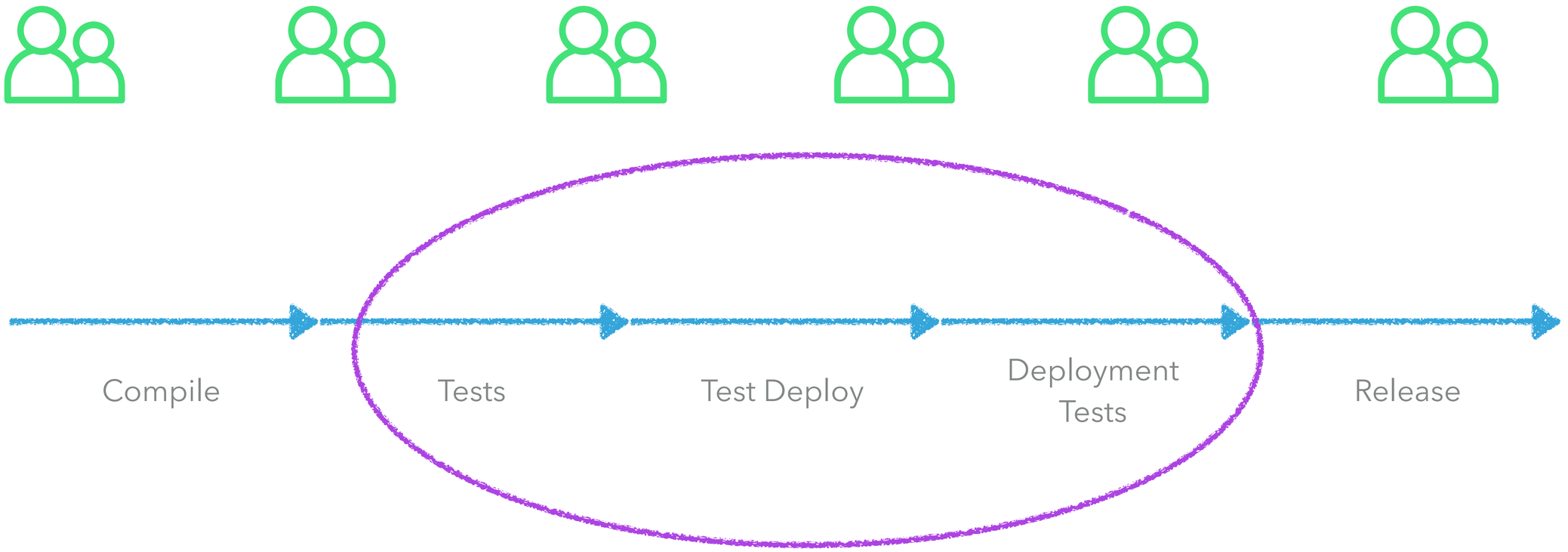
CD automation



CD automation



CD automation



Automated fitness functions

Service is monitorable

Test code

```
@Test public void eachServiceHasAStatusPage() throws Exception {
    ...
    WebDriver webDriver = new ChromeDriver();
    String STATUS_PAGE_LOCATION = “/location”
    driver.get(“https://service.host” + STATUS_PAGE_LOCATION);
    ...

}
```


Service is monitorable

Test code

```
@Test public void eachServiceHasAStatusPage() throws Exception {
    ...
    WebDriver webDriver = new ChromeDriver();
    String STATUS_PAGE_LOCATION = “/location”
    driver.get(“https://service.host” + STATUS_PAGE_LOCATION);
    ...
    // assert status page contents here
}
```


Service is monitorable

Automated

Triggered

Atomic

Challenge

How do you make sure content is understandable?

Think about a government website...

Think about a government website...

What comes to mind?

What comes to mind?

gov.uk

Reading skills

Children quickly learn to read common words (the 5,000 words they use most). They then stop reading these words and start recognising their shape. This allows people to read much faster. Children already read like this by the time they're 9 years old.

People also do not read one word at a time. They bounce around - especially online. They anticipate words and fill them in.

Your brain can drop up to 30% of the text and still understand. Your vocabulary will grow but this reading skill stays with you as an adult. You do not need to read every word to understand what is written.

This is why we tell people to write on GOV.UK for a 9 year old reading age.

"This is why we tell people to write on GOV.UK for a 9 year old reading age."

Source: https://www.gov.uk/guidance/content-design/writing-for-gov-uk

gov.uk

Renew

You must renew your passport before you can travel if either:

- your passport has expired
- you do not have enough time left on it

How much time you need on your passport depends on the country you're visiting. Check the entry requirements of the country you want to travel to.

> There are different rules if your passport is lost, stolen or damaged or you need to change your name or personal details.

If your passport is burgundy or has 'European Union' on the cover, you can still use it as long as it's valid for travel.

Renew online

Use this service to renew your passport online. It costs £75.50.

You'll need:

- a digital photo
- a credit or debit card
- your passport

Renew online ›

gov.uk

Manual

Periodic

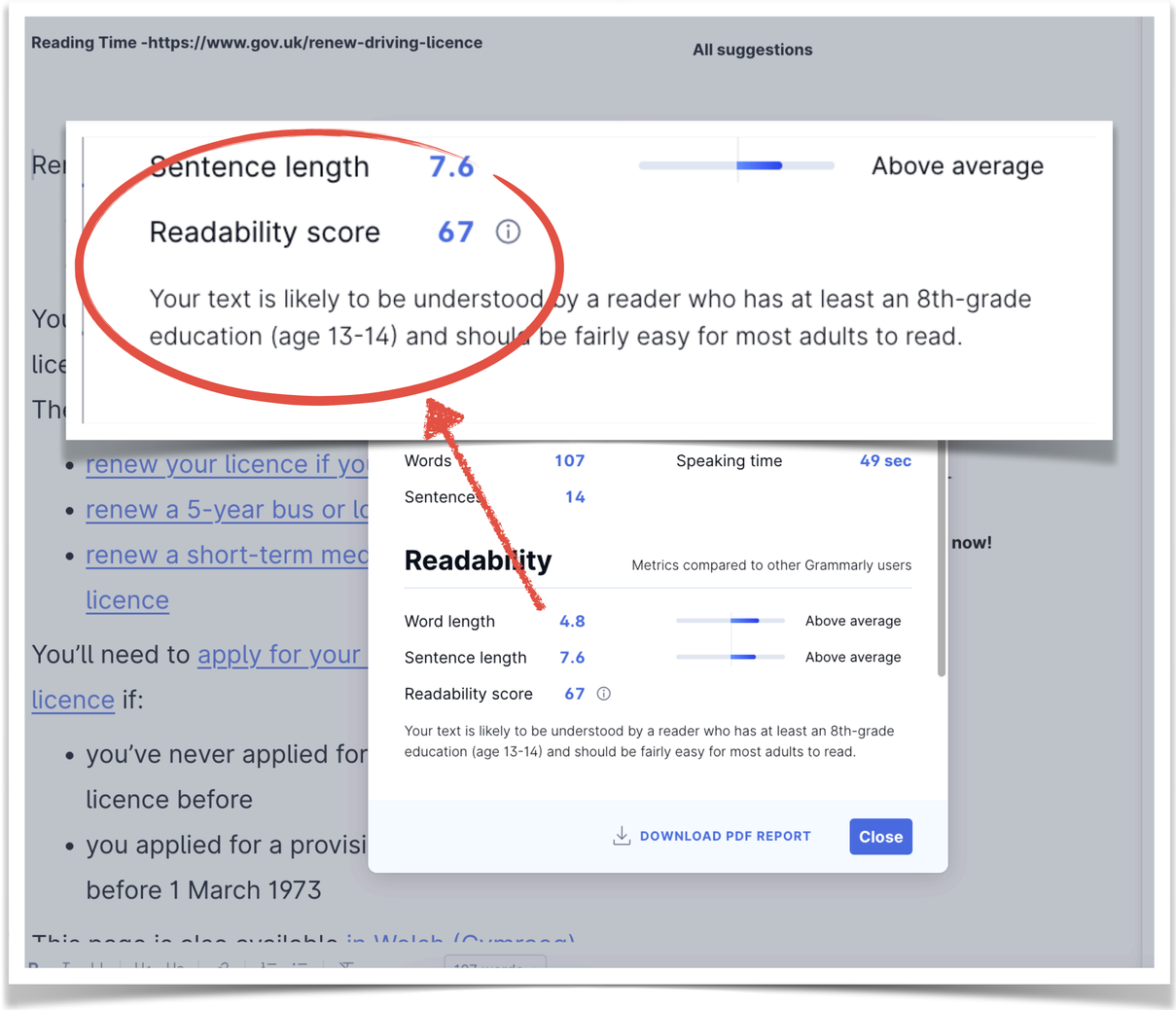
Atomic

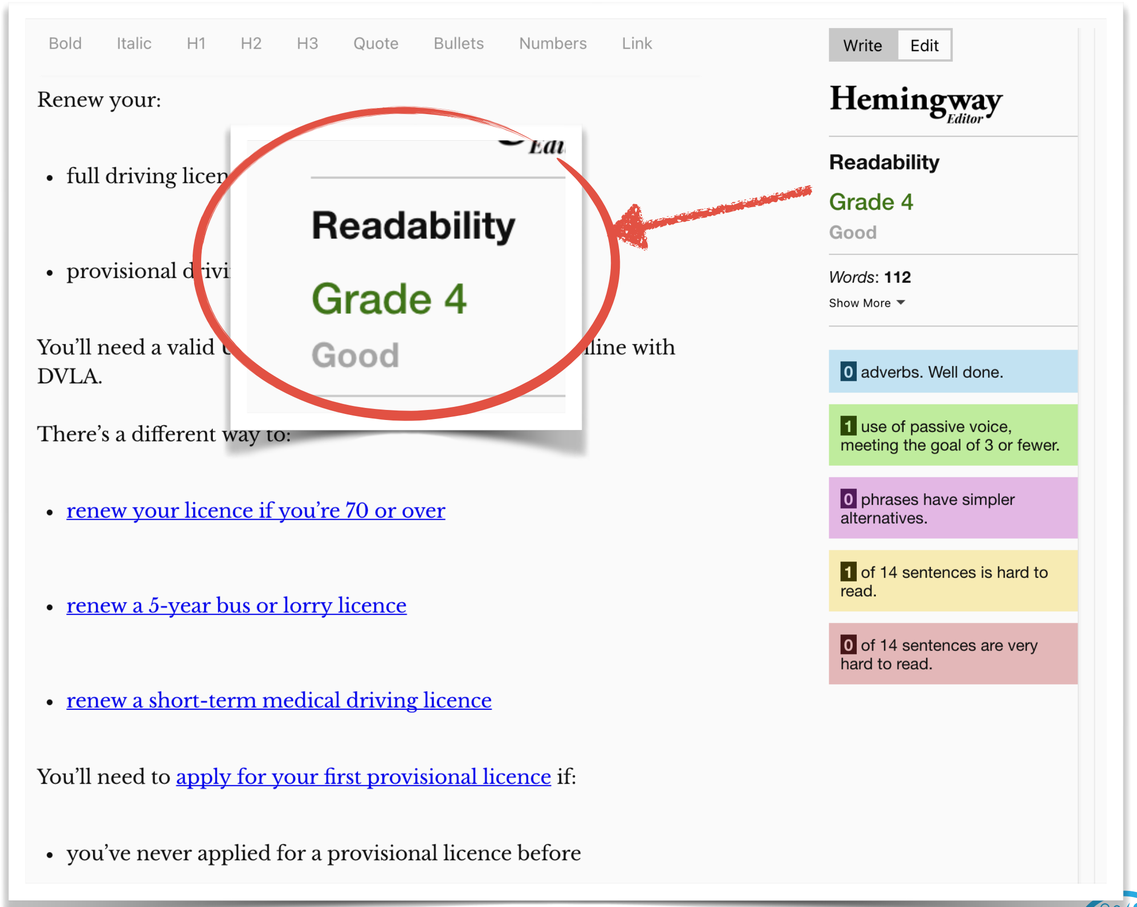
Potential Next Step?

Improved Tooling

grammarly

Hemingway





techlead.academy

Challenge

How do you make sure all dependencies are secure?

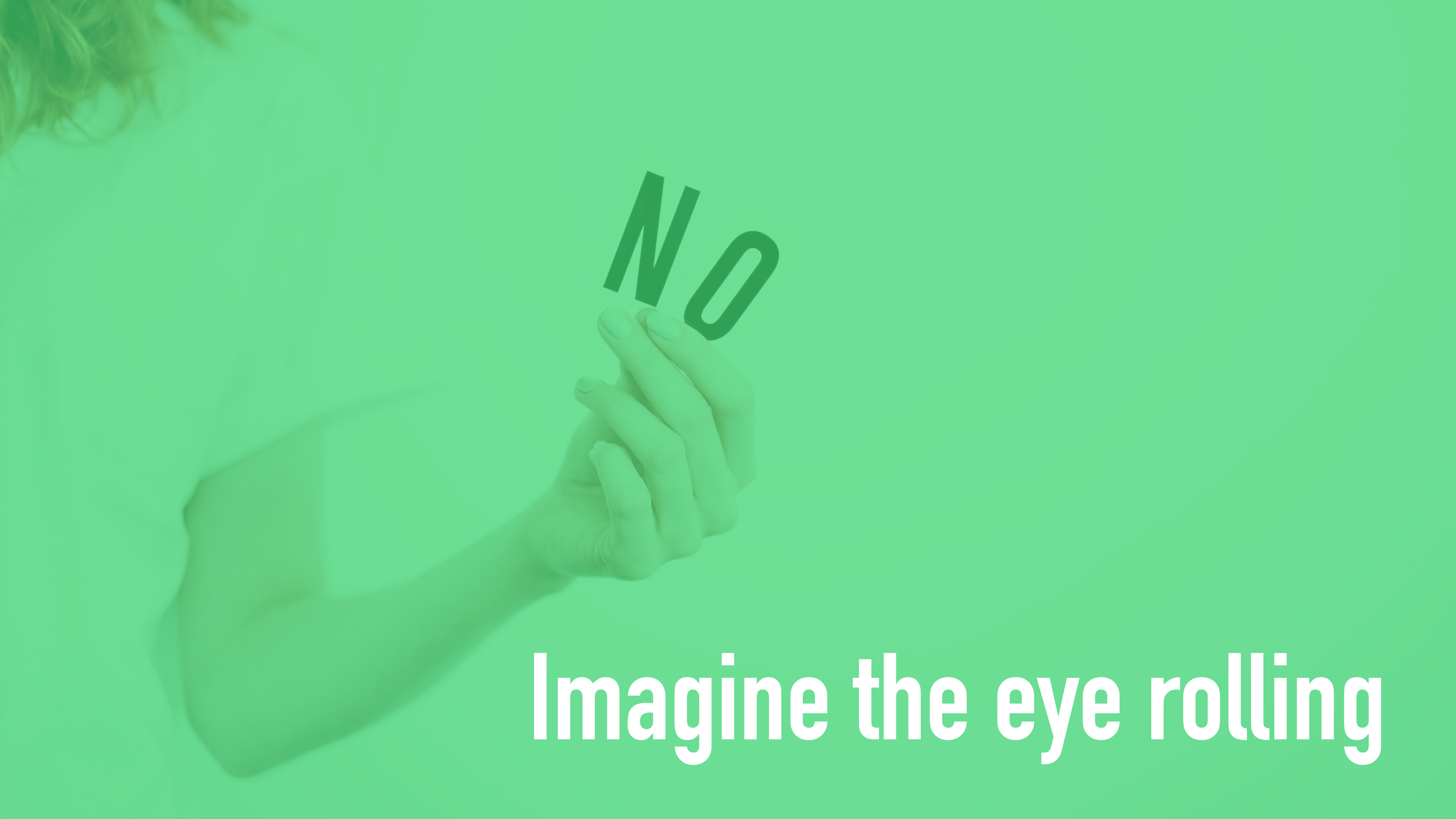
https://en.wikipedia.org/wiki/Log4Shell

(Nov 2021)

“Naive” Solution

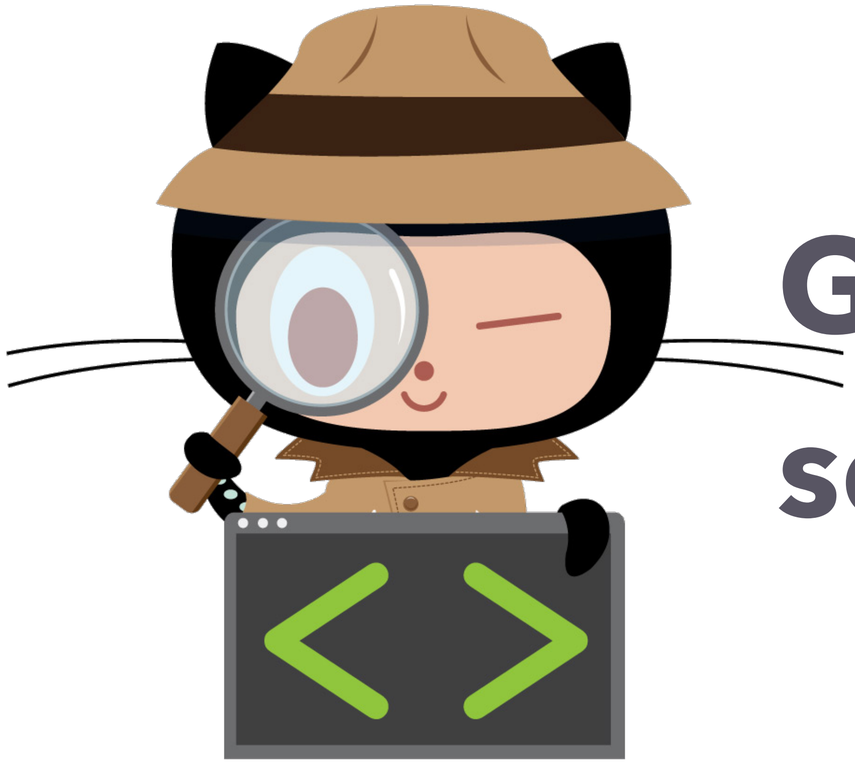
“Security review”

“Only approved libraries”



Imagine the eye rolling

GitHub



GitHub CVE scanning

GitHub Security Alerts

Alert

Security alerts

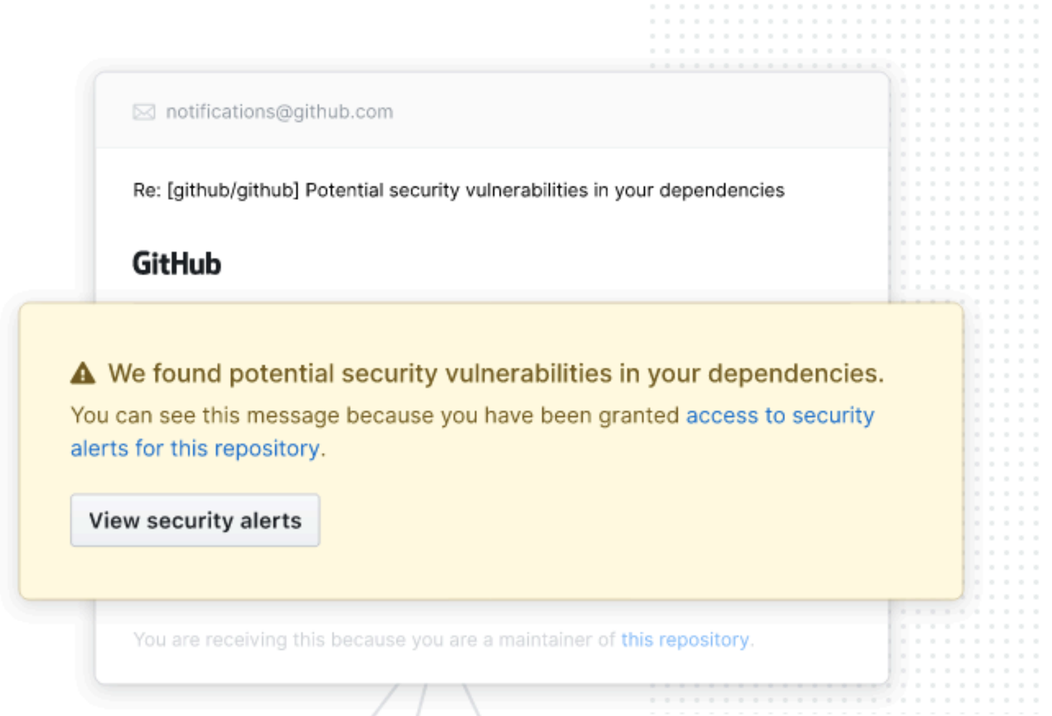
GitHub reviews every security vulnerability to identify and alert affected repositories. We source our vulnerability information from industry experts to provide the details project owners need to understand and remediate risks.

Research-driven vulnerability data

GitHub tracks vulnerabilities in packages from supported package managers using data from security researchers, maintainers, and the National Vulnerability Database— including release notes, changelog entries, and commit details. All discoverable in the GitHub Advisory Database.

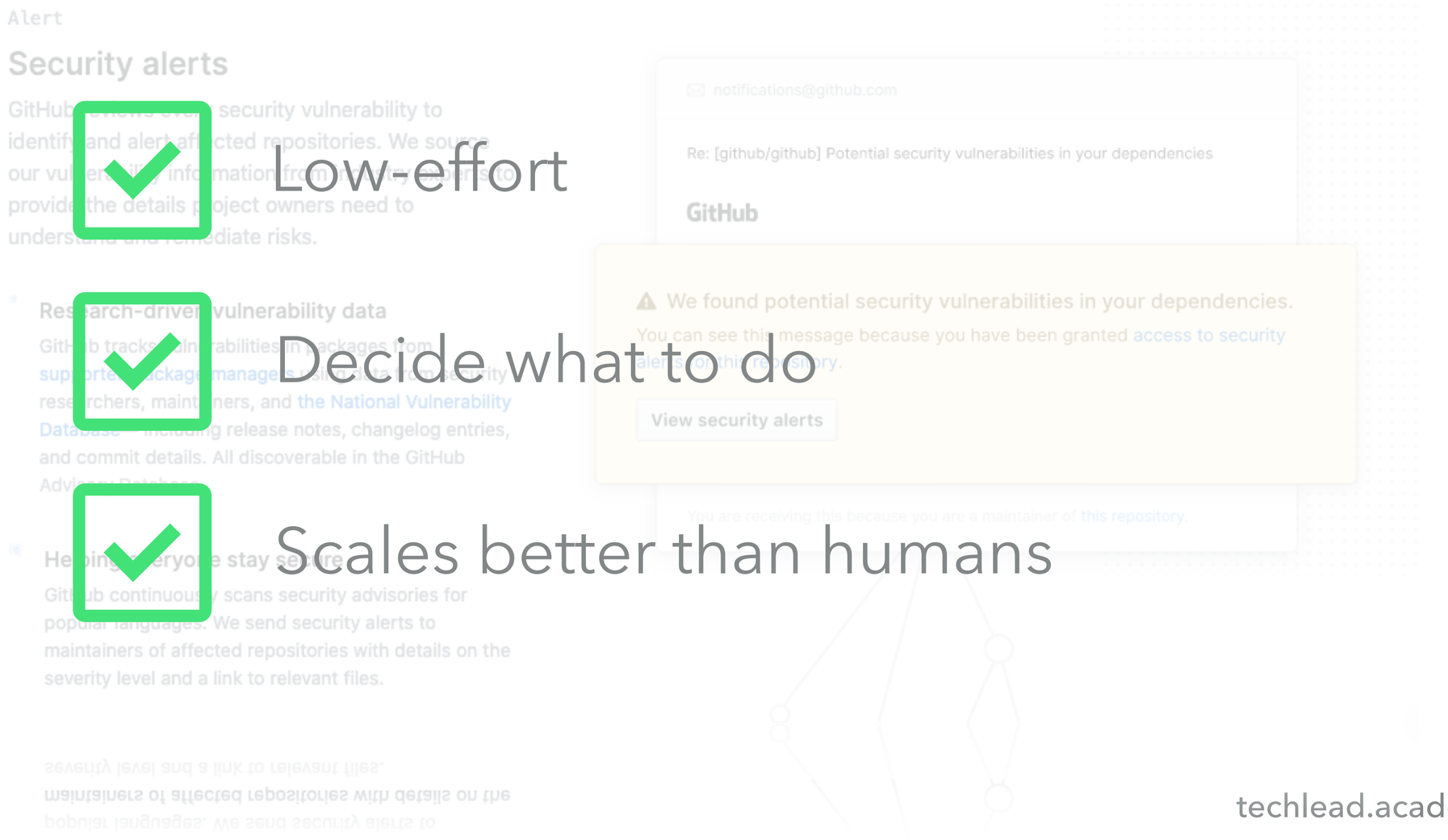
Helping everyone stay secure

GitHub continuously scans security advisories for popular languages. We send security alerts to maintainers of affected repositories with details on the severity level and a link to relevant files.



GitHub Security Alerts

- Low-effort
- Decide what to do
- Scales better than humans



GitHub

Automated

Continuous

Atomic

Challenge

How do you make sure prod servers are locked down?

Imagine this scenario

"Web servers should only have secure HTTPS (443) port open"

Imagine this scenario

How do you prove this is the case in production?

- Production Support
- On Call
- SSH access

“Naive” Solution

Log on, once a week and review open ports

Improved Solution

Log on, once a week and review open ports

Automated script to report on ports of all machines

Improved Fitness Function

Log on, once a week and review open ports

Automated script to report on ports of all machines

Use DevSecOps tooling

Example with 

https://community.chef.io/tools/chef-inspec

```
describe port(80) do
  it { should_not be_listening }
end

describe port(443) do
  it { should be_listening }
  its('protocols') {should include 'https'}
end
```

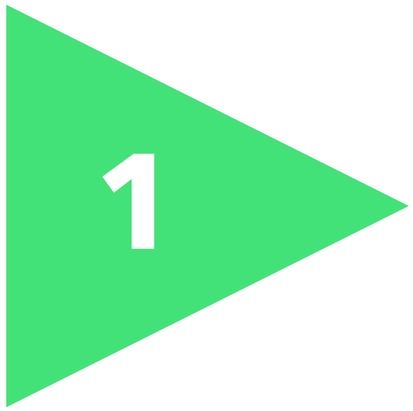

Other cool stuff

https://community.chef.io/tools/chef-inspec

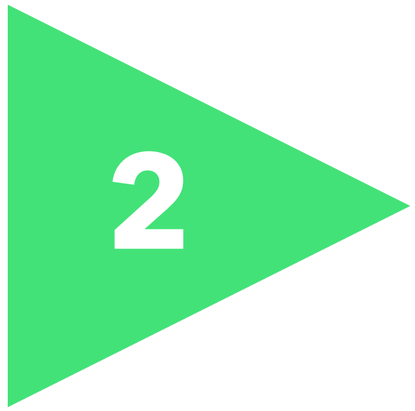
```
# Disallow insecure protocols by testing

describe package('telnetd') do
  it { should_not be_installed }
end

describe inetd_conf do
  its("telnet") { should eq nil }
end
```


What sort of garden do you want?

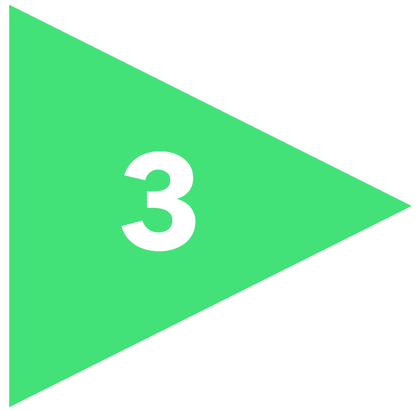
Steps



Identify what you care about



Define what “good” looks like



Define fitness function(s)

DEFINITION

An evolutionary architecture supports **incremental, guided** change as a first principle along **multiple dimensions**

Evolutionary architectures

are **guided** with

FITNESS FUNCTIONS

@patkua

Questions?

@patkua