Production Hardened Services

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@ntschutta

Ah services!

Service all the things!

Seems like everything is aaS these days…

Infrastructure. Container. Platform.
Software. Function. Pizza.

Pretty sure about that last one…

Architecture as a Service…

How many services do *you* have in your world these days?

Turns out, microservices aren't a panacea!

It can be a real challenge to maintain a healthy micro(services)biome.

Should we just go back to monoliths we release semiannually?

Is it too late to change careers?

All services are equal. Some services are more equal than others.

Defining our SLOs is a critical step towards production hardened services.

Availability is one of our most important objectives.

What is the availability goal for this specific service?

Everyone wants 99.999%.

Everyone wants hot/hot.

Until they see the price tag.

If you have to ask…

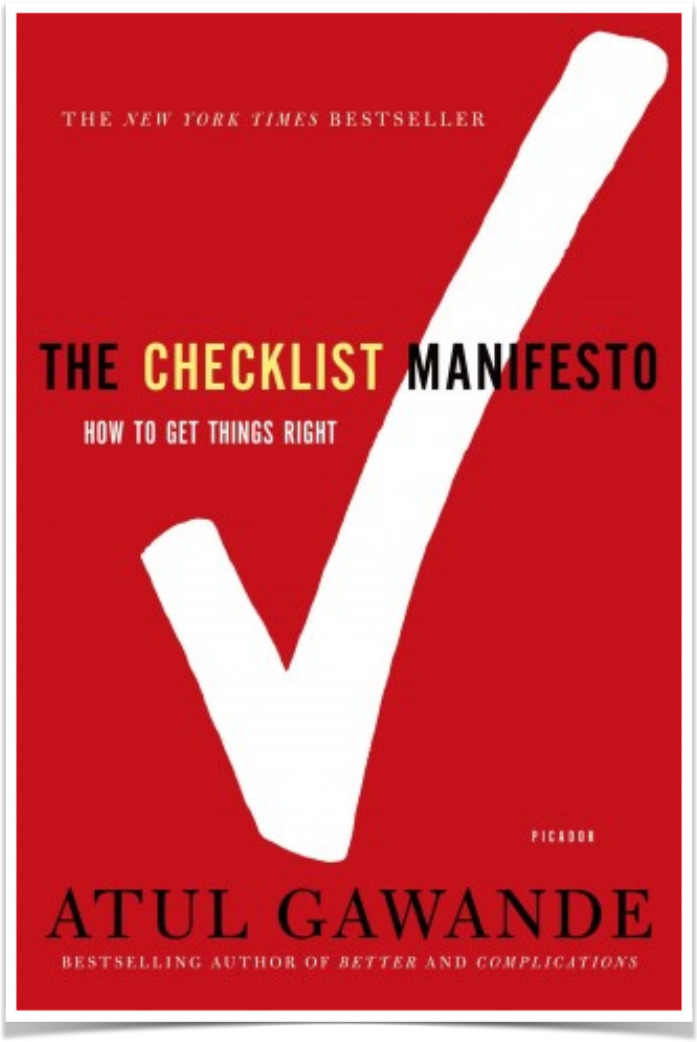
When we refer to an application or microservice as "production-ready," we confer a great deal of trust upon it: we trust it to behave reasonably, we trust it to perform reliably, we trust it to get the job done…

— Susan J. Fowler
Production-Ready Microservices

How do we know we can trust a service?

Consider having a checklist.

A checklist? Seriously?



http://atulgawande.com/book/the-checklist-manifesto/

You know who uses checklists?

Pilots. Surgeons.

Should be quantifiable and measurable.

“Fast” won’t cut it.

Stability.

Reliability.

Scalability.

Fault tolerance.

Performance.

Monitoring.

Documentation.

I know what some of you are thinking…

I don’t have time for all this.

We need to MOVE FAST.
And break things…

We're Agile. With a capital A.

How is your velocity when an outage brings your business to a halt?

Requires buy in from the grass roots level as well as management.

Stable and Reliable.

Our services are evolving. Constantly.

Feature not a bug.

Development moves quickly.

Always Be Releasing.

Bit like spinning plates…

Just takes one wobble to take down the entire system.

How do we make sure our services are stable and reliable?

Consistent development process.

Code passes new and existing tests before committing code.

Pair programming. Code reviews.

External, automated build system.

Build pipeline.

Feature toggles.

Thorough testing.

Linting, unit tests, regression tests, integration tests, etc.

Deployment pipeline.

Must have a standardized deployment process.

Staging, canary, blue/green deploys.

Find issues *before* our service hits production servers.

Staging - exact copy of production.

Real world without real world traffic.

Capacity is often a percentage of production.

Though some organizations have identical prod/staging hardware.

Staging is the real deal.

Code should have already passed all our internal checks.

Unit tests, linting, QA,
customer acceptance etc.

If it checks out in staging, it is going to canary - with real traffic.

Canary - aka the canary
in the coal mine.

Find out if we have issues before we do a full production push.

Some percentage of production - 5% or 10%.

Can be a sliding scale too - start with 5%, move up to 20% etc.

Canaries are serving real production traffic.

Find errors? Automated rollbacks.

How long should our canary stage last? As long as it takes. Hours. Days.


¯_(ツ)_/¯

https://twitter.com/KentBeck/status/596007846887628801

How about replacing
merge on GitHub.

On the fly.

Move Fast and Fix Things

vmg December 15, 2015

Anyone who has worked on a large enough codebase knows that technical debt is an inescapable reality: The more rapidly an application grows in size and complexity, the more technical debt is accrued. With GitHub's growth over the last 7 years, we have found plenty of nooks and crannies in our codebase that are inevitably below our very best engineering standards. But we've also found effective and efficient ways of paying down that technical debt, even in the most active parts of our systems.

At GitHub we try not to brag about the "shortcuts" we've taken over the years to scale our web application to more than 12 million users. In fact, we do quite the opposite: we make a conscious effort to study our codebase looking for systems that can be rewritten to be cleaner, simpler and more efficient, and we develop tools and workflows that allow us to perform these rewrites efficiently and reliably.

As an example, two weeks ago we replaced one of the most critical code paths in our infrastructure: the code that performs merges when you press the Merge Button in a Pull Request. Although we routinely perform these kind of refactorings throughout our web app, the importance of the merge code makes it an interesting story to demonstrate our workflow.

Merges in Git

We've talked at length in the past about the storage model that GitHub uses for repositories in our platform and our Enterprise offerings. There are many implementation details that make this model efficient in both performance and disk usage, but the most relevant one here is the fact that repositories are always stored *"bare"*.

This means that the actual files in the repository (the ones that you would see on your working directory when you clone the repository) are not actually available on disk in our infrastructure: they are compressed and delta'ed inside packfiles.

Because of this, performing a merge in a production environment is a nontrivial endeavour. Git knows several merge strategies, but the recursive merge strategy that you'd get by default when using `git merge` to merge two branches in a local repository assumes the existence of a working tree for the repository, with all the files checked out on it

How much do you agonize over a CSS change?

At this point, we should have very few production issues.

Most likely, we've found the problems in staging, canary, etc.

Your deployment pipeline should be *the* path to production. Period.

Avoid the temptation to perform hotfixes.

Bypassing the initial phases of the deployment pipeline often introduces new bugs into production, as emergency code fixes run the risk of not being properly tested.

— Susan J. Fowler
Production-Ready Microservices

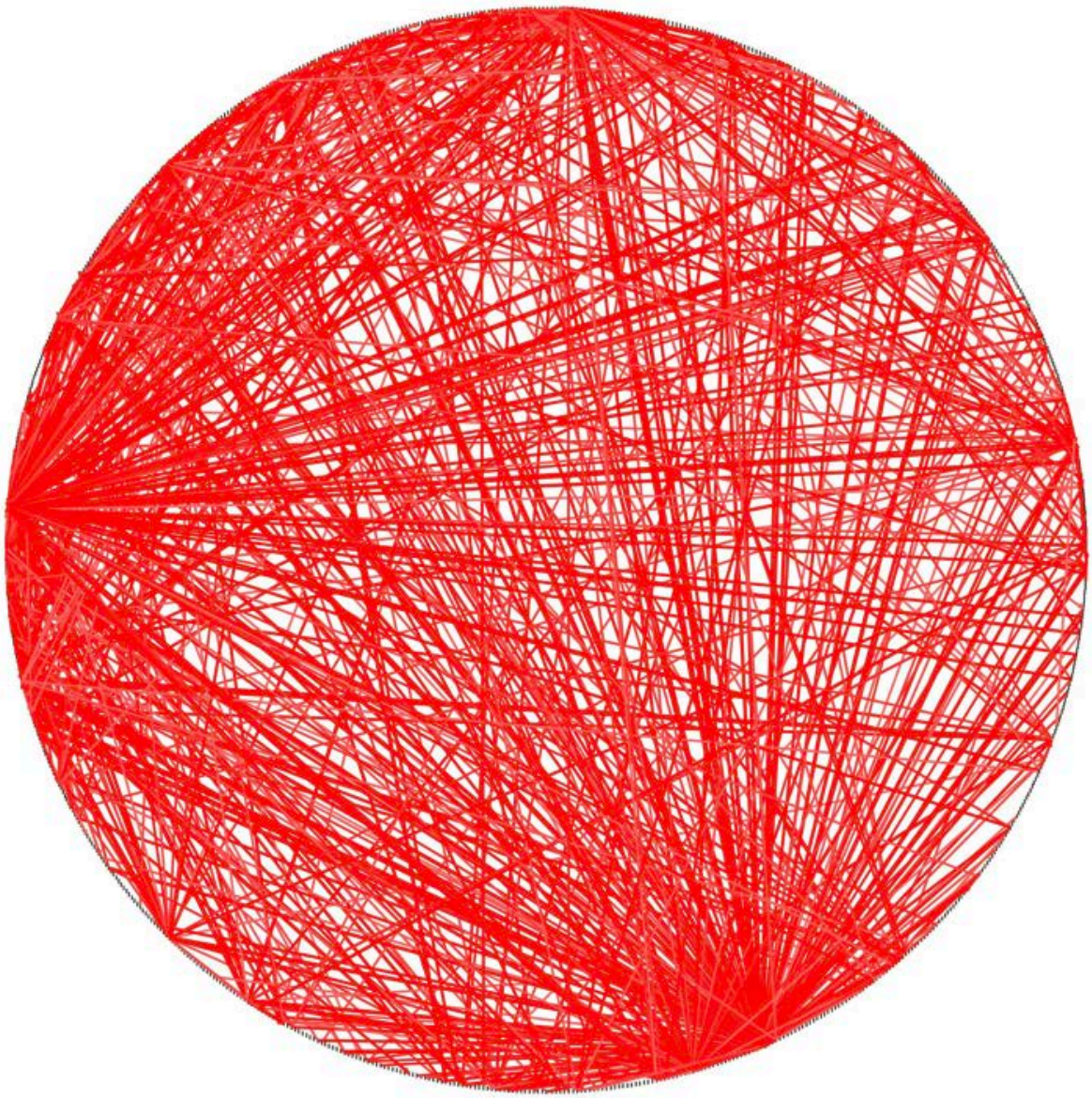
I've seen that movie…

Rollback to the last stable build.

Must also understand our dependencies.

And plan for their inevitable failure.

Dependency graphs get kind of crazy.



“Death Star Architecture.”

https://www.slideshare.net/adriancockcroft/goto-berlin

How do we mitigate a dependency failure?

Caching. Alternative services. Backups.

Depends on the criticality.

Insureds will submit claims during a natural disaster.

Better be able to accept the claim.

But we might not work
on it immediately.

Maybe we need to post messages to a queue, process when we're up.

Our services should
have a health check.

Part V. Spring Boot Actuator: Production-ready features

Spring Boot includes a number of additional features to help you monitor and manage your application when it's pushed to production. You can choose to manage and monitor your application using HTTP endpoints, with JMX or even by remote shell (SSH or Telnet). Auditing, health and metrics gathering can be automatically applied to your application.

Actuator HTTP endpoints are only available with a Spring MVC-based application. In particular, it will not work with Jersey unless you enable Spring MVC as well.

46. Enabling production-ready features

The `spring-boot-actuator` module provides all of Spring Boot's production-ready features. The simplest way to enable the features is to add a dependency to the `spring-boot-starter-actuator` 'Starter'.

> **Definition of Actuator**
>
> An actuator is a manufacturing term, referring to a mechanical device for moving or controlling something. Actuators can generate a large amount of motion from a small change.

To add the actuator to a Maven based project, add the following 'Starter' dependency:

```
<dependencies>
    <dependency>
        <groupId>org.springframework.boot</groupId>
        <artifactId>spring-boot-starter-actuator</artifactId>
    </dependency>
</dependencies>
```

For Gradle, use the declaration:

```
dependencies {
    compile("org.springframework.boot:spring-boot-starter-actuator")
}
```

47. Endpoints

Actuator endpoints allow you to monitor and interact with your application. Spring Boot includes a number of built-in endpoints and you can also add your own. For example the `health` endpoint provides basic application health information.

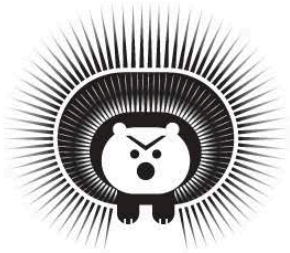
The way that endpoints are exposed will depend on the type of technology that you choose. Most applications choose HTTP monitoring, where the ID of the endpoint is mapped to a URL. For example, by default, the `health` endpoint will be mapped to `/health`.

The following technology agnostic endpoints are available:

Always Be (health) Checking.

Not healthy? Don’t route traffic to it.

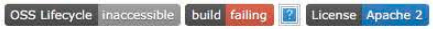
Circuit breakers for fun and profit.



HYSTRIX

DEFEND YOUR APP

Hystrix: Latency and Fault Tolerance for Distributed Systems



Hystrix is a latency and fault tolerance library designed to isolate points of access to remote systems, services and 3rd party libraries, stop cascading failure and enable resilience in complex distributed systems where failure is inevitable.

Full Documentation

See the Wiki for full documentation, examples, operational details and other information.

See the Javadoc for the API.

Communication

- Google Group: HystrixOSS
- Twitter: @HystrixOSS
- GitHub Issues

What does it do?

1) Latency and Fault Tolerance

Stop cascading failures. Fallbacks and graceful degradation. Fail fast and rapid recovery.

Thread and semaphore isolation with circuit breakers.

2) Realtime Operations

Defend the neighborhood as it were.

Services won't live forever.
Plan for decommissioning.

Need a deprecation period.

Typically more a cultural issue than a technical one.

Monitoring is key - are we still seeing calls to the old endpoint?

Don’t just abandon a service!

Scalable.

We need to know the growth scale of our service.

How many requests can we handle per second? RPS.

We can look at current load levels.

We can (and should!)
perform load tests.

Potential fitness function…

Very important but we need to look beyond just our service.

A given service is just one part of a larger world.

What is the qualitative growth scale?

Linked to our business.

Do we need to scale by the number of users? Number of orders?

Isn’t tied to a particular service!

We will need to talk to our business partners to understand the drivers.

We will have to translate
those to our specific services.

Accurate growth scales are vital.

All services are equal. Some services are more equal than others.

Business critical services should have priority.

Resource isolation is your friend…
shared hardware hurts.

May want to engage in some capacity planning.

Ensure we have sufficient budget.

Or change your process…

Don’t neglect your dependencies.

Can they scale with you?

Better make sure they can!

Collaborate. Communicate.

Have a scalability review with the services you rely on.

What does your data growth look like?

What type of database makes the most sense? Relational? NoSQL?

Is eventual consistency ok?

Are you read heavy? Write heavy?

How do we scale our database?

`cf scale FOO` doesn't exempt us from thinking through scalability.

Fault Tolerant.

We can’t prevent catastrophes. But we can build failure resistant services.

Hope for the best…
prepare for the worst.

ROBERT MCMILLAN BUSINESS 10.13.15 7:00 AM

HER CODE GOT HUMANS ON THE MOON—AND INVENTED SOFTWARE ITSELF

Hamilton wanted to add error-checking code to the Apollo system that would prevent this from messing up the systems. But that seemed excessive to her higher-ups. "Everyone said, 'That would never happen,'" Hamilton remembers.
But it did. Right around Christmas 1968.

— ROBERT MCMILLAN

https://www.wired.com/2015/10/margaret-hamilton-nasa-apollo/

Failures, uh find a way.

Eliminate single points of failure!

Not sure what they might be?

Draw up the architecture.

What happens if *this* fails?

It can't fail? Yeah it can - what happens if it does?

Think through how
our service could fail.

It is hard. We are really good at thinking through the happy path.

But we need to think about the road less traveled.

Test for these failure scenarios. Does our service respond appropriately?

Only one way to really know…

https://github.com/Netflix/SimianArmy

Chaos engineering.

http://principlesofchaos.org

Intentionally break things.

Add latency.

Shut down an availability zone.

Kill a machine.

Shouldn't be ad hoc! Monitor and log.

Chaos can go rogue…

Some things will fall through the proverbial cracks.

Need to detect failures.

And add them to our testing suite.

Failures could be internal or external.

How is your exception handling?

Code will have bugs. Test thoroughly.

Extremely common for a dependency to cause our service to fail!

Downstream service…or a 3rd party library.

How does your service recover from a failure?

Resiliency testing.

Make your service fail. Repeatedly.

Load testing. But we covered that!

Where do you run your load tests?

Staging?

Good place to start…however it isn't the same as testing in production.

QA in Production

04 April 2017

Rouan Wilsenach

Rouan is a software developer. He spent a number of years working as a consultant, including at ThoughtWorks, developing applications for clients in the financial services, health, media and education sectors. He now works remotely for Tes, where he builds software to help teachers and schools. He likes writing and speaking at conferences.

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Contents

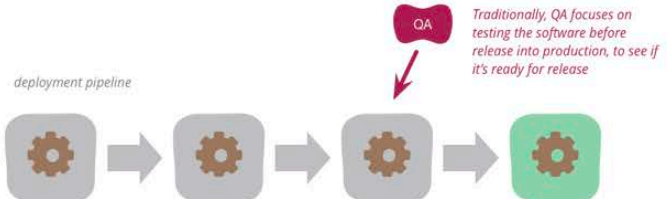
Gathering production data
- Critical success indicators
- Logging
- Metrics
- APIs

Learning from production data
- Alerting
- Dashboards

A QA approach rooted in reality
- Tests need to earn their keep
- Are you ready to adopt production QA practices?
- Finding the right balance

Gathering operational data about a system is common practice, particularly metrics that indicate system load and performance such as CPU and memory usage. This data has been used for years to help teams who support a system learn when an outage is happening or imminent. When things become slow, a code profiler might be enabled in order to determine which part of the system is causing a bottleneck, for example a slow-running database query.

I've observed a recent trend that combines the meticulousness of this traditional operational monitoring with a much broader view of the quality of a system. While operational data is an essential part of supporting a system, it is also valuable to gather data that helps provide a picture of whether the system as a whole is behaving as expected. I define "QA in production" as an approach where teams pay closer attention to the behaviour of their production systems in order to improve the overall quality of the function these systems serve.



…an ecommerce company that accidentally ran its tests against its production ordering systems. It didn't realize its mistake until a large number of washing machines arrived at the head office.

— Sam Newman
Building Microservices

Synthetic transactions.

And be sure everyone knows when you're doing it.

Especially downstream dependencies!

Load testing shouldn’t be a one off.

Can be automated and run on a cadence.

Probably not during your peek traffic hours mind you…

Ultimate goal - reduce the impact on our users.

Roll back.

Fail over.

Automate, automate, automate.

All services are equal. Some services are more equal than others.

What is the impact of
this service failing?

Categorize incidents and outages by severity and scope.

Severity - impact to the business.

Scope - how much of the business is impacted?

Monitored.

Four components to monitoring.

Logging.

What would you say
my service is doing?

Log anything that is useful.

Just don't put in any personally identifying information (PII).

Ever.

Some things alone aren't PII but when combined with other items…

Tracing can be difficult.
Correlation IDs help.

Dashboards.

View the health of a service.

More on this in a minute!

Alerting.

A key metric is out of band.

Allows us to detect an issue and fix it before our customers even notice.

Pager duty.

Must be sustainable.

Provide clear, concise on call documentation.

Vital that we think about just what we should be monitoring.

What *is* a key metric?

Some pertain solely to the infrastructure our service runs on.

CPU utilization, RAM utilization, threads, database connections…

These often impact more than just our service.

Others key metrics are specific to our service.

Additionally we need to know the availability, latency, response time…

Basically anything that we identified earlier as part of our SLO.

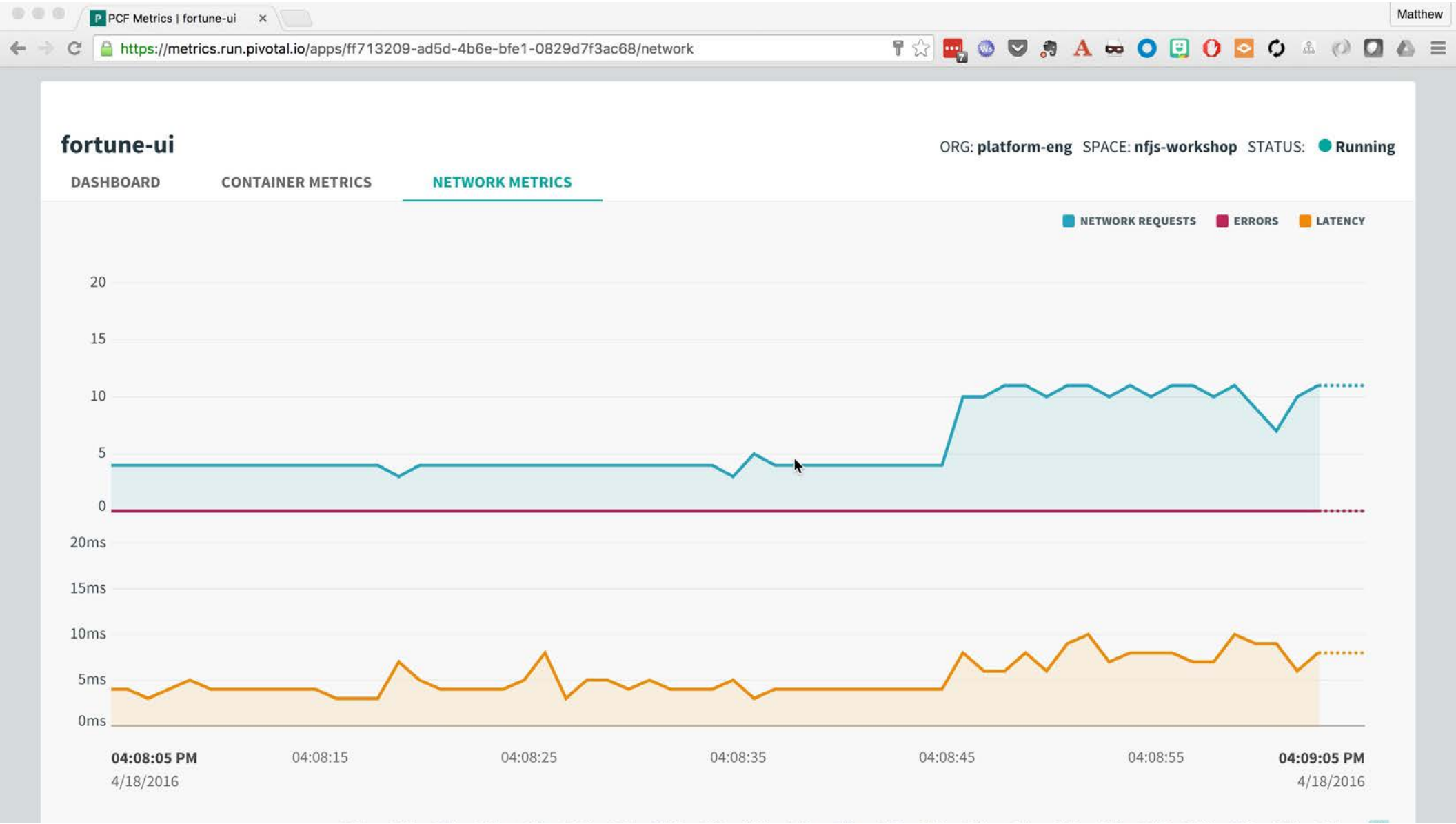
Monitor errors and exceptions as well.

Identify normal, warning and critical thresholds for your metrics.

Can be hard to figure out early on.
Need a certain amount of history.

Not just a prod thing. We need to monitor staging. Validates the monitors.

Metrics should be displayed on a dashboard of some sort.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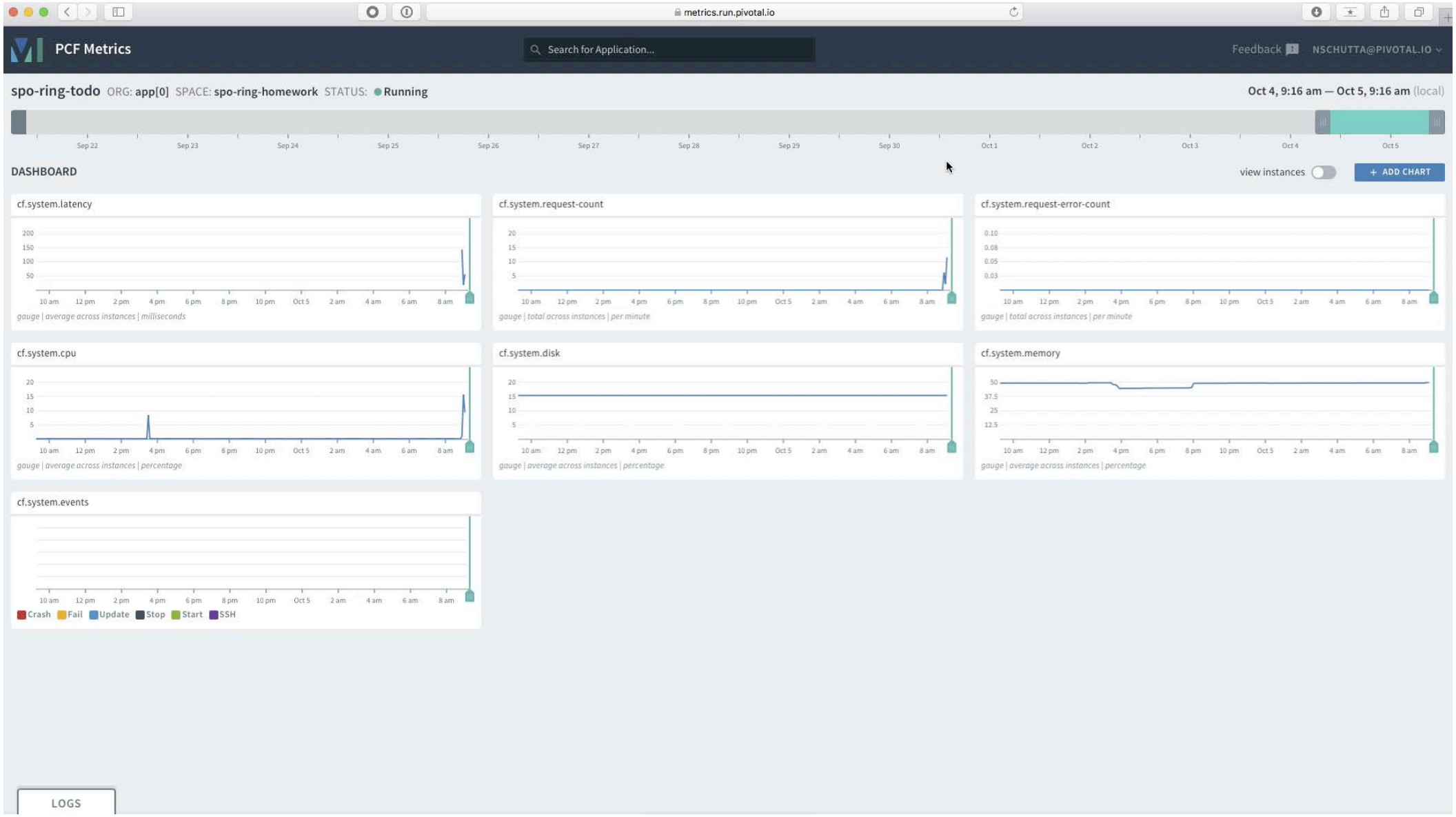
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Oct 4, 9:16 am — Oct 5, 9:16 am (local)
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DASHBOARD
view instances
+ ADD CHART
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gauge | average across instances | milliseconds
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gauge | total across instances | per minute
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gauge | average across instances | percentage
cf.system.disk
gauge | average across instances | percentage
cf.system.memory
gauge | average across instances | percentage
cf.system.events
Crash Fail Update Stop Start SSH
LOGS

mattklein123 Follow
Engineer @lyft
Oct 25 · 4 min read

Lyft's Envoy dashboards

Front/edge Envoy per-host row

I've given quite a few talks about observability in the age of the service mesh (most recent slides, unfortunately this talk series has not been recorded yet). Visibility into the inherently unstable network is one of the most important thing that Envoy provides and I'm asked repeatedly for the source of the dashboards that we use at Lyft. In the interest of "shipping" and getting something out there that can help folks, we are releasing a snapshot of our internal Envoy dashboards.

What we are releasing is unfortunately *not* going to be readily consumable. It is also not an OSS project that will be maintained in any way. The goal is to provide a snapshot of what Lyft does internally (what is on each dashboard, what stats do we look at, etc.). Our hope is having that as a reference will be useful in developing new dashboards for your organization.

But we should be alerted when things start to go wonky.

We shouldn't be staring at our dashboards all day!

Alert on all of our key metrics, SLOs etc.

Absence of a key metric is also an avertable offense!

Alerts should be actionable.

Create an on call book to assist team monitoring the service.

How to mitigate, resolve, etc.

Step by step instructions.
Do not make asumptions.

Follow the 3 AM Rule.

Write it assuming the person reading will be half asleep.

Do not be clever. Think simple.

We don't rise to the level of our expectations, we fall to the level of our training.

— Archilochus

https://mobile.twitter.com/walfieee/status/953848431184875520

This all implies an on call rotation.

Sorry.

Everyone should do it. Rotations need to be sustainable.

Pair up.

One week or less with at least a month off in between.

One developer on call for 3 years?

Not so much.

Documented.

What does your service do?

How does it work?

What does it depend on?

Ever say something like “the documentation is useless”?

It doesn't have to be.

Golden rule!

Do it for those that come after you.

Don’t forget, sometimes *you* are the person that comes after you!

How long does it take for a new team member to be productive? Weeks?

Months?

Solid onboarding guide.

Make sure it is updated.

Documentation should be easy to find.

Probably a website/wiki.

Updating the wiki should be a normal part of the developer workflow.

Consider a simple (low ceremony) template.

Description - what does your service do? Don’t skimp here.

An architectural diagram or three.

Contact information as well as the on call rotation.

Links to helpful things like the repo, dashboard link, on call book.

FAQ.

Onboarding/development guide.

Coding standards.

Development pipeline.

Whatever helps the team understand.

Everyone should "get it" and be able to describe it. So have them do it.

Shouldn’t be a static thing!

Documentation should be reviewed along with the architecture.

Production Readiness Reviews.

Not a one time, up front thing.

Services should be reviewed and audited regularly.

Does not have to be high ceremony!

Get the team together - SREs, Devs, etc. Draw up the architecture.

Do we have a shared understanding of what the system does?

Do we have a shared understanding of our requirements?

As we talk through it, we will discover bottlenecks.

The Wombat service has a lower availability level than we need.

We will find interesting failure cases.

"When month end falls on the Super Blue Blood Moon."

Review should result in a new architecture diagram or two.

And probably some new items on the backlog.

Perform an audit.

Go back to your checklist. Does the service meet our requirements?

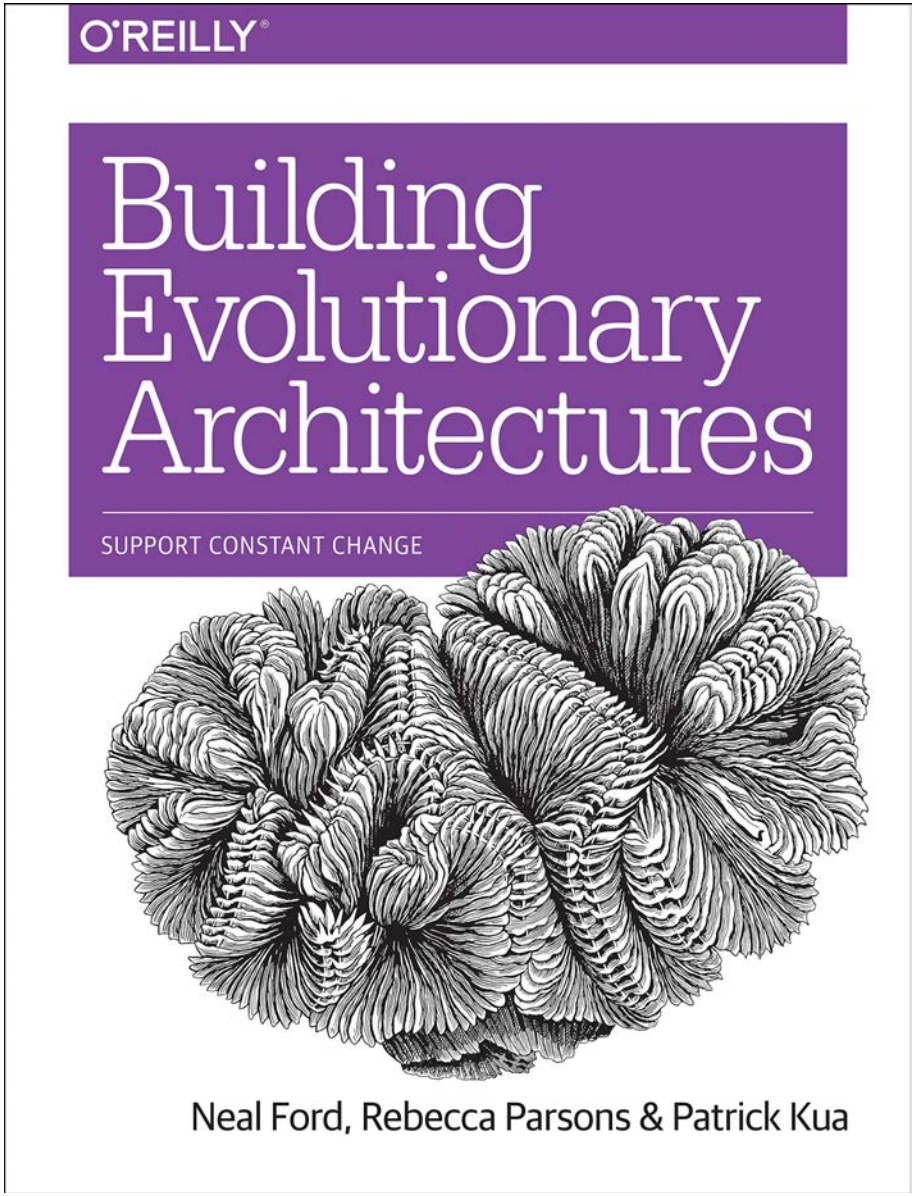
Probably results in some new things in our backlog!

Now we can create a production readiness roadmap.

What do we need to fix and when can/should we fix it.

Drive prioritization of the work.

A lot of this is manual. But some of it can be automated!



http://evolutionaryarchitecture.com

Fitness functions!

Basically, a set of tests we execute to validate our architecture.

How close does this particular design get us to our objectives?

Ideally, all automated. But we may need some manual verifications.

For example…

All service calls must respond within 100 ms.

Cyclomatic complexity shall not exceed X.

Hard failure of an application will spin up a new instance.

Reviews and audits should not be additional red tape.

Should not be overly bureaucratic.

Couple of hours…depending on the complexity of the system.

Next steps.

Check your culture.

Work on that checklist.

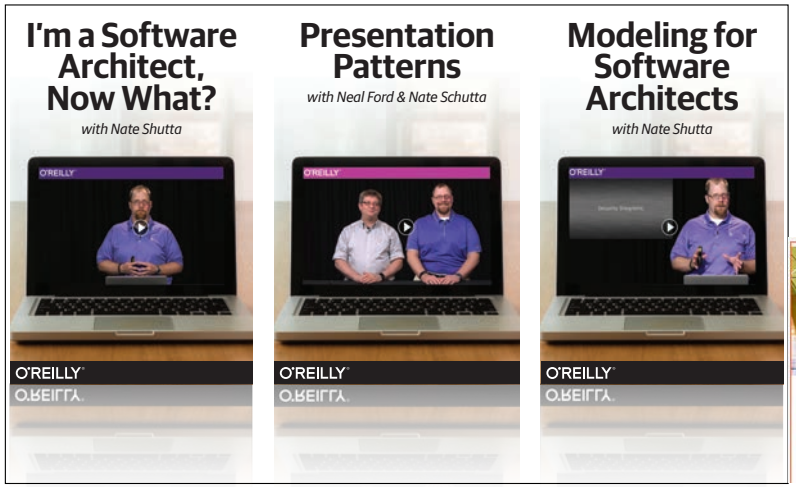
Review some services!

Adapt and change.

Good luck!

Questions?

Thanks!



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