AWS State, Local, and Education Learning Days

Boston

aws Learning Days
State, Local, and Education

Cloud Foundations

10:15am – 11:15am

200 level

Cloud architectural patterns:

Master Cloud Architecture: Build Secure, Scalable Solutions with AWS Best Practices and Enterprise-Grade Design Strategies.

11:30am – 12:30pm

200 level

Cultural Transformation Through FinOps:

Go Beyond Cost Management: FinOps unites teams to optimize cloud costs while driving efficient growth

1:30pm – 3:00pm

200 level

Cloud Lab Potpourri

Hands-On Cloud Adventure: Customize Your AWS Learning with Interactive Technical Workshops and Personalized Lab Experiences.

3:15pm – 4:15pm

300 level

Designing modern applications in AWS

Dive into Culture, Processes and Tools to: Reduce Costs, Boost Scalability, and Enhance Security with Cloud-Native Architectures.

Designing modern applications in AWS

A dive into culture, tools, processes

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aws Learning Days
State, Local, and Education

Who am I?

- AWS tenure: 12 years
- Run Critical Impact Engagements for AWS WWPS
- Often delivers talks about many topics, including DevOps at AWS and industry conferences
- Work with Education, SLG and Elections Customers
- Technical Areas of Expertise: DevOps, Information Security
- Enjoys traveling/living on a plane and Star Trek

Who am I?

- AWS tenure: 4.5 years
- WWPS EDU Northeast Leader
- Multidisciplined Geek / T-shaped Engineer
- Led tech teams in HED, HC, DIB
- Technical Areas of Expertise: Governance, Security, Organizational Transformation

Key takeaways

- Aligning culture to support building modern applications is the most important enabler
- Achieving operational excellence is foundational to adopting modern application best practices
- We treat ops as an investment, not a cost
- We align incentives for operational ownership with builders
- We examine our operations together, regularly

Architecting on AWS is different

- It’s not just about stringing together services, but about building scalable, elastic, resilient, secure, reliable and cost-efficient solutions using managed cloud-native services
- Leverage cloud-scale, robust infrastructure
- The cost model frees architects up to do more & more cost-efficiently; promotes innovation
- Emphasis on composable architectures of distributed, modular & reusable components; generally service-oriented
- Servers/hosts are no longer the atomic unit of architecture
- Infrastructure-as-code: infrastructure as cattle, not pets
- Hyperautomation as a strategy
- Expanded integration and orchestration pathways (asynchronous, event-driven, “everything-as-an-API” decoupling)

Agenda*

Scan QR code
for live feedback

Story: deployment automation at Amazon

How does Amazon do operations?

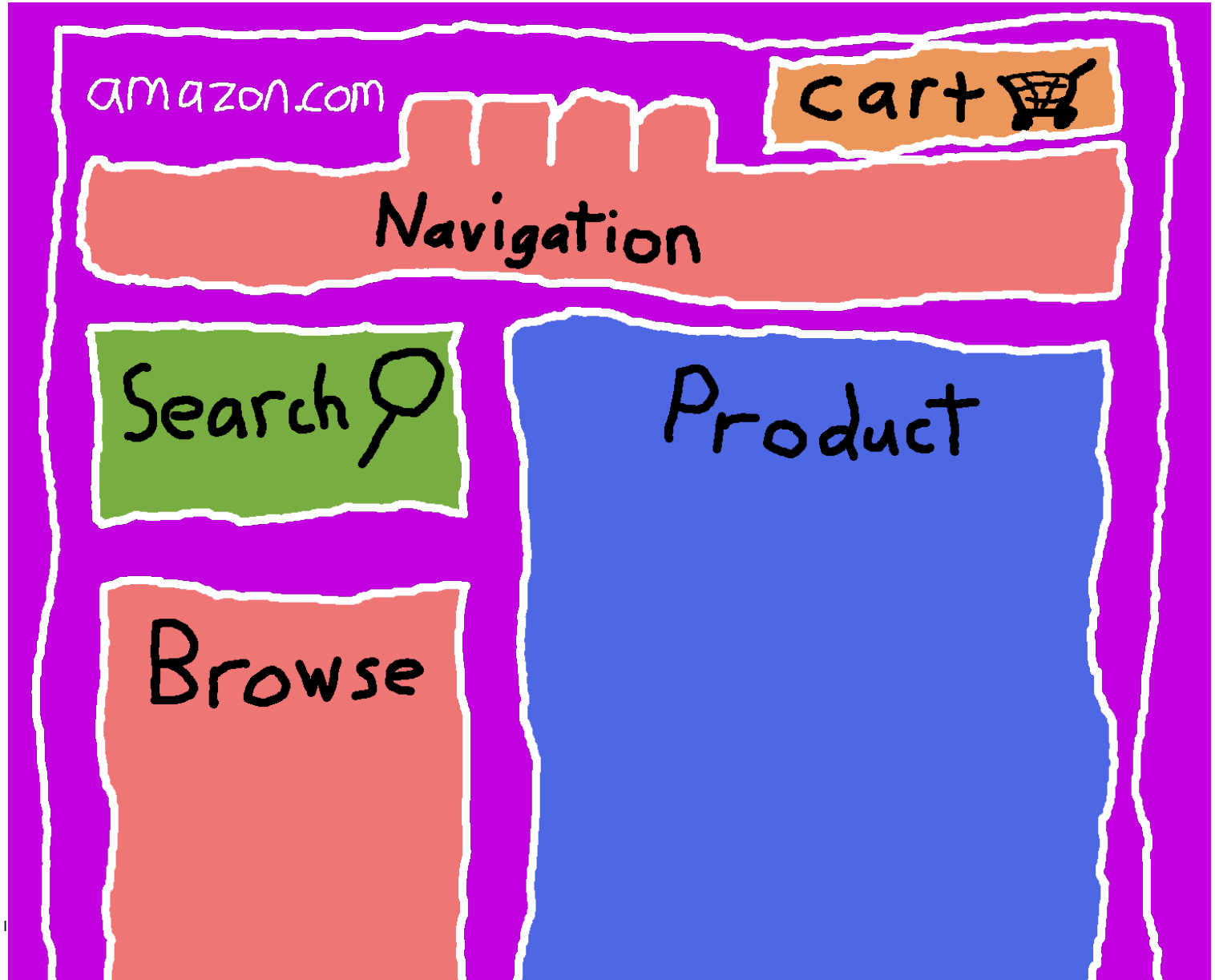
Mechanisms and Tools

- Help teams **learn** from each other
- Give teams **tools** to be successful
- Inform teams **proactively** about improvements

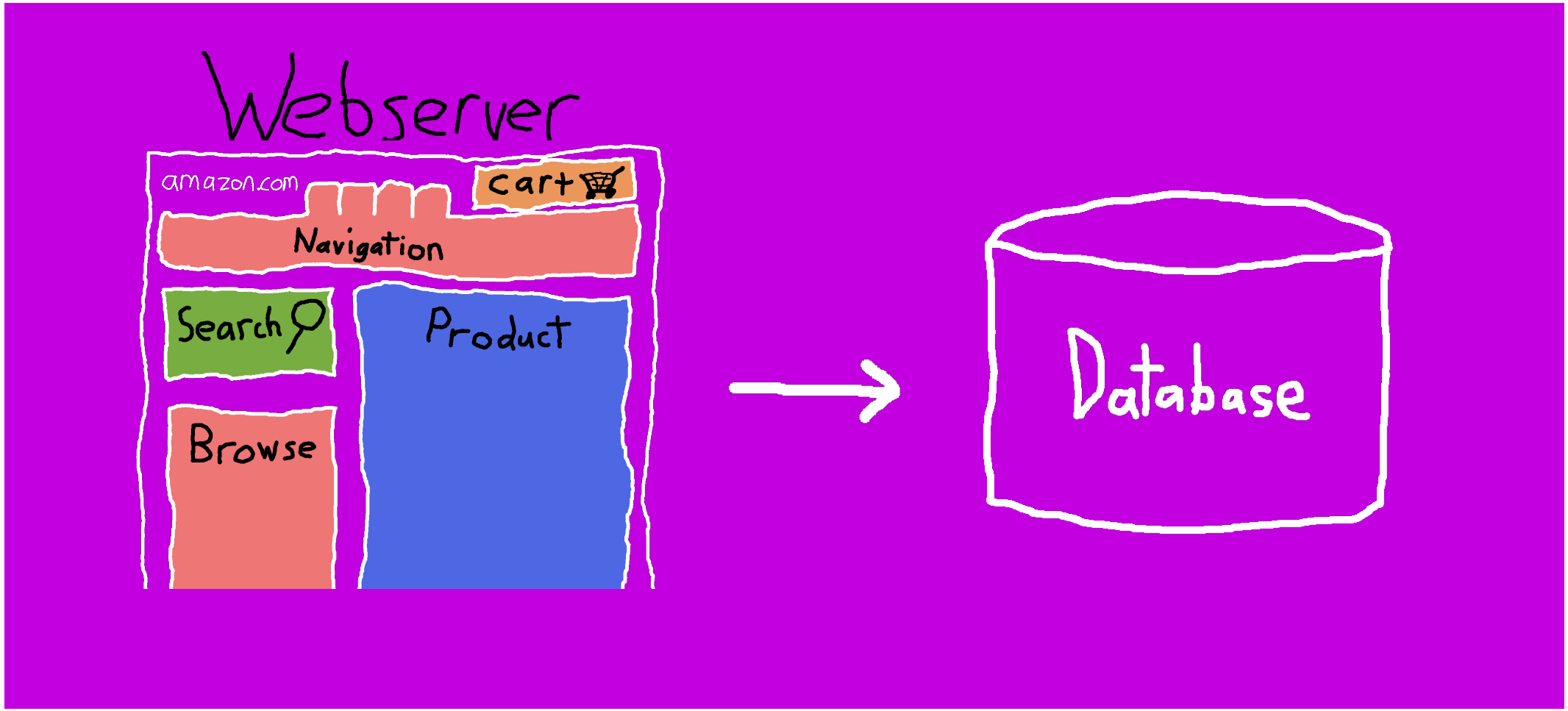
* We don’t need to use any of this content. Ask questions, interrupt, and steer the conversation!

Story: Deployment automation at Amazon

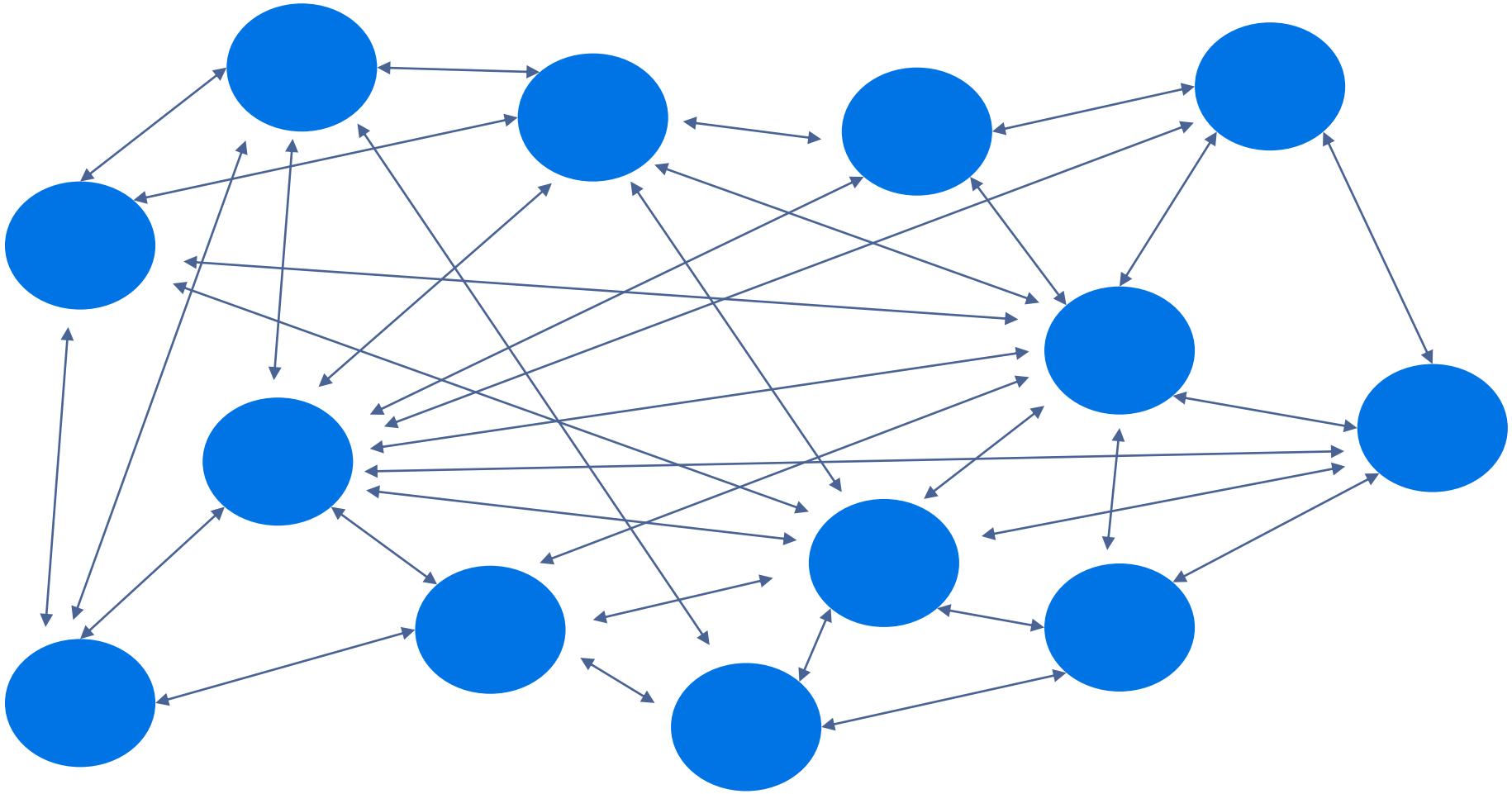
Transformation at Amazon: Early 2000s



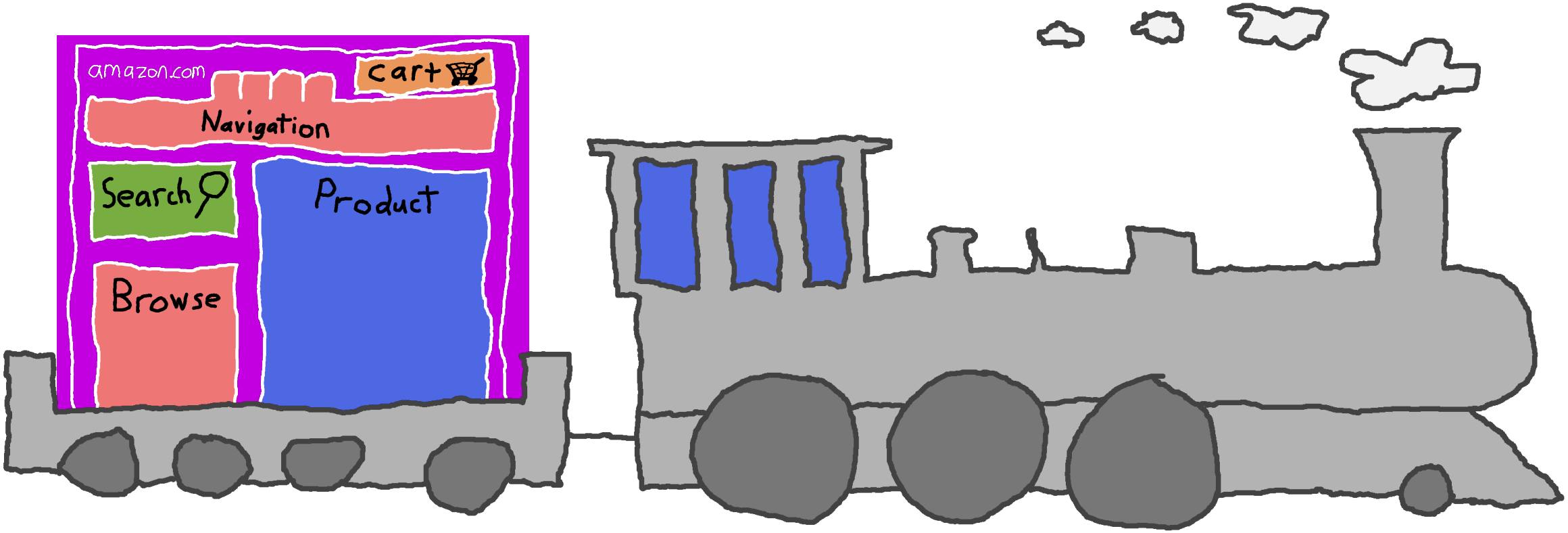
2-tier architecture



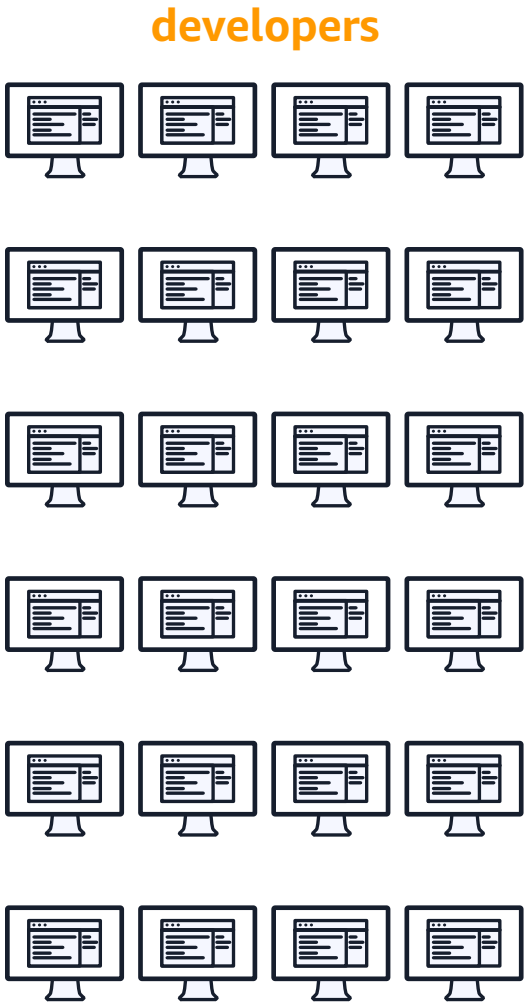
The cost of coordination

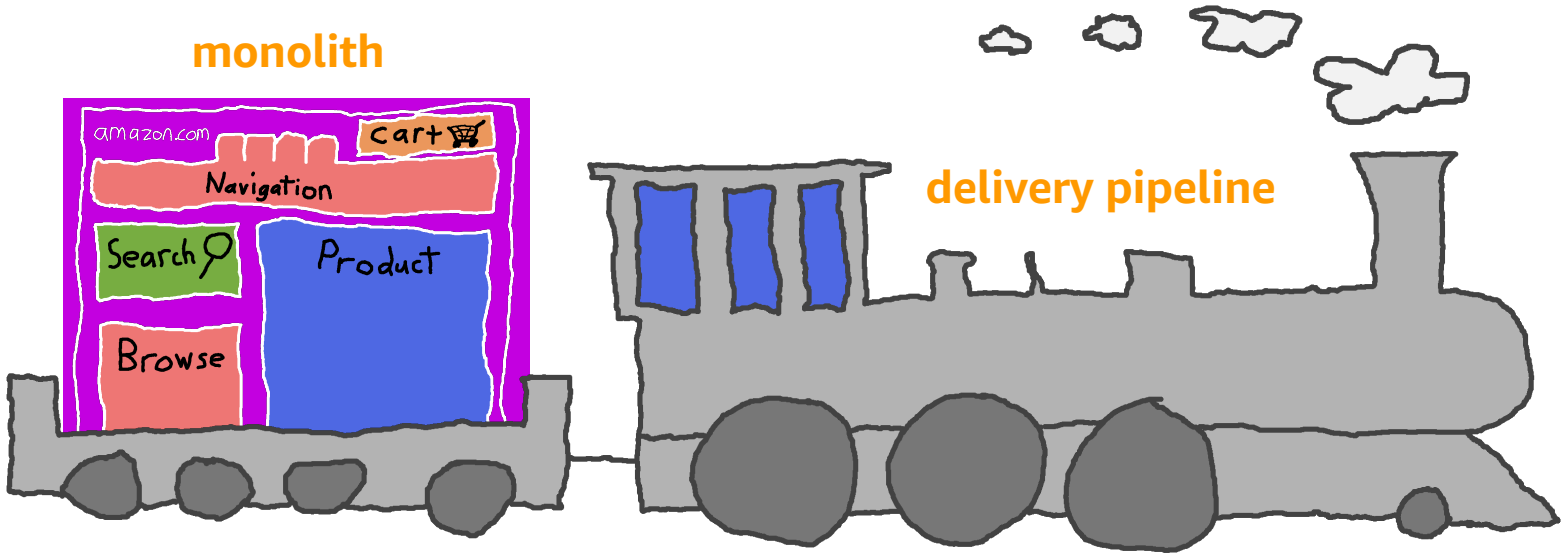


Release train: build, test, deploy, monitor

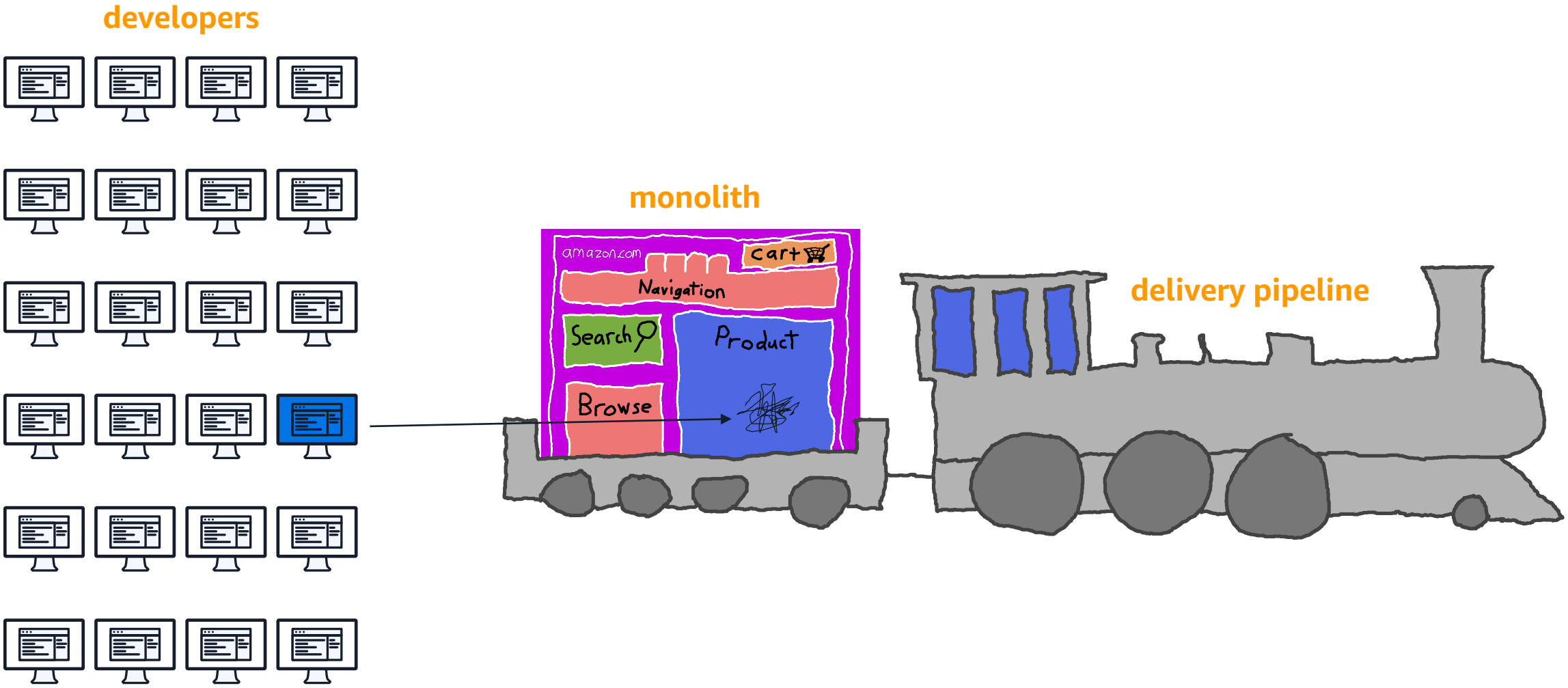


Lots of coordination

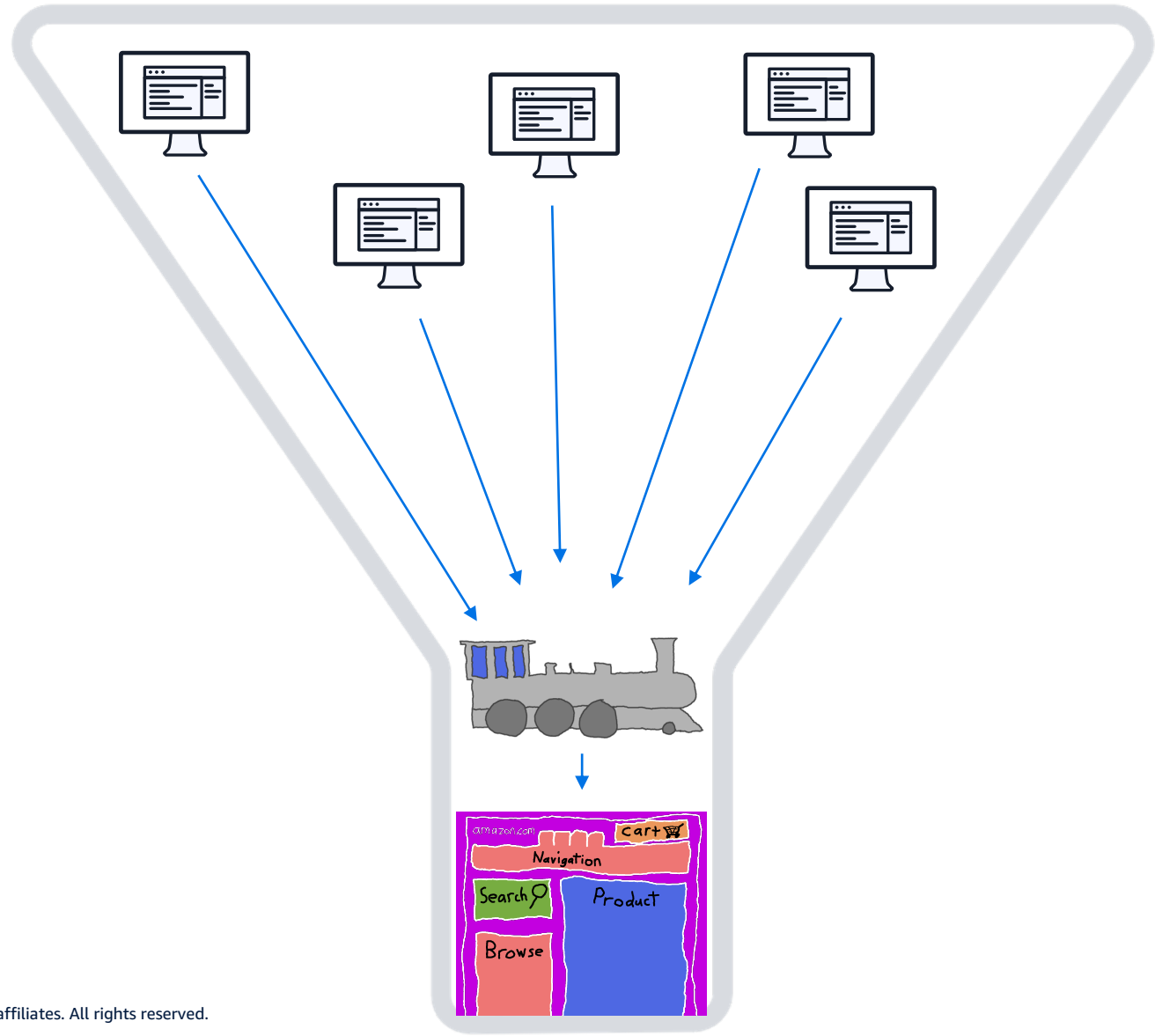




Lots that can go wrong



Bottlenecked processes



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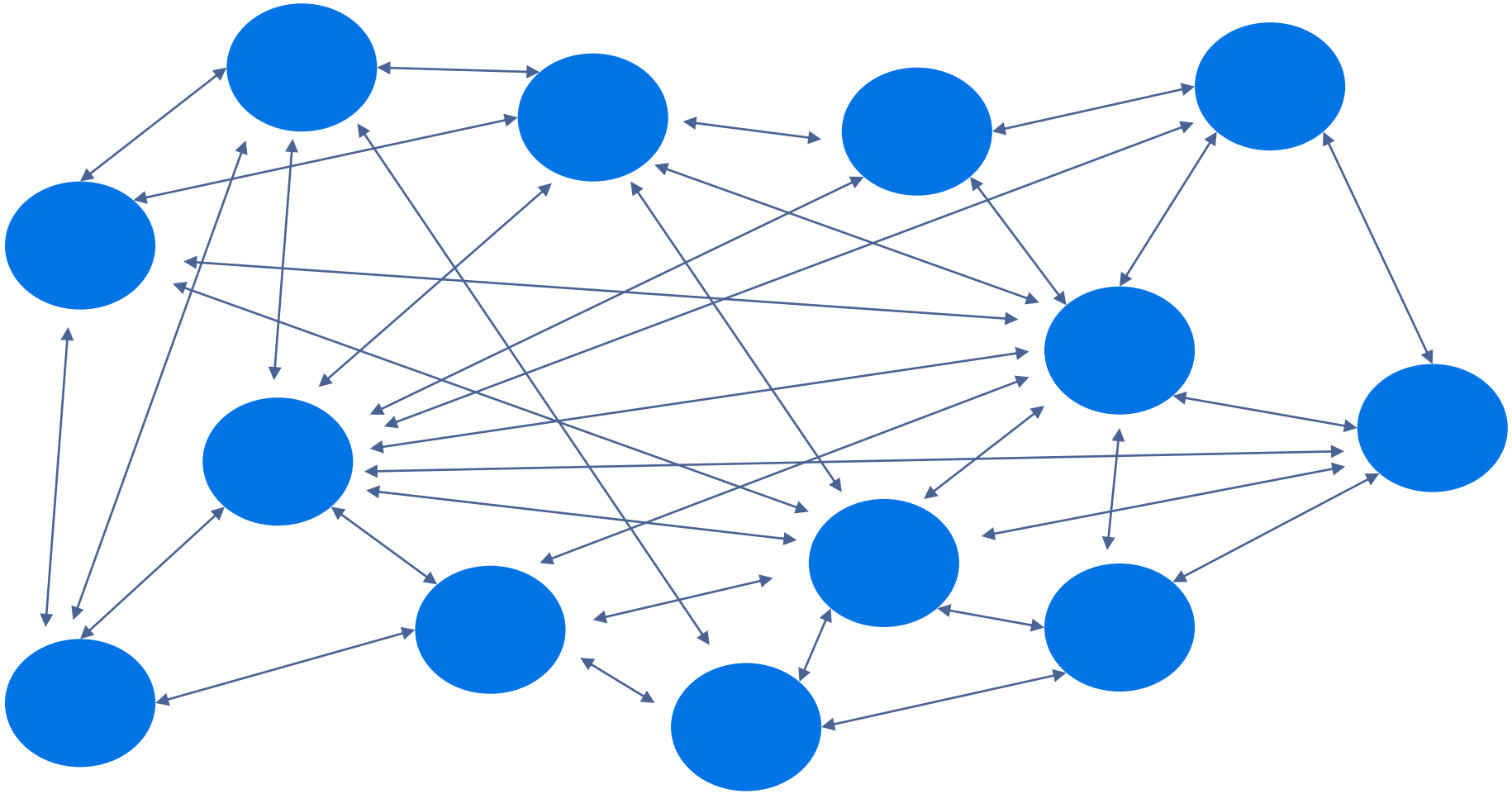
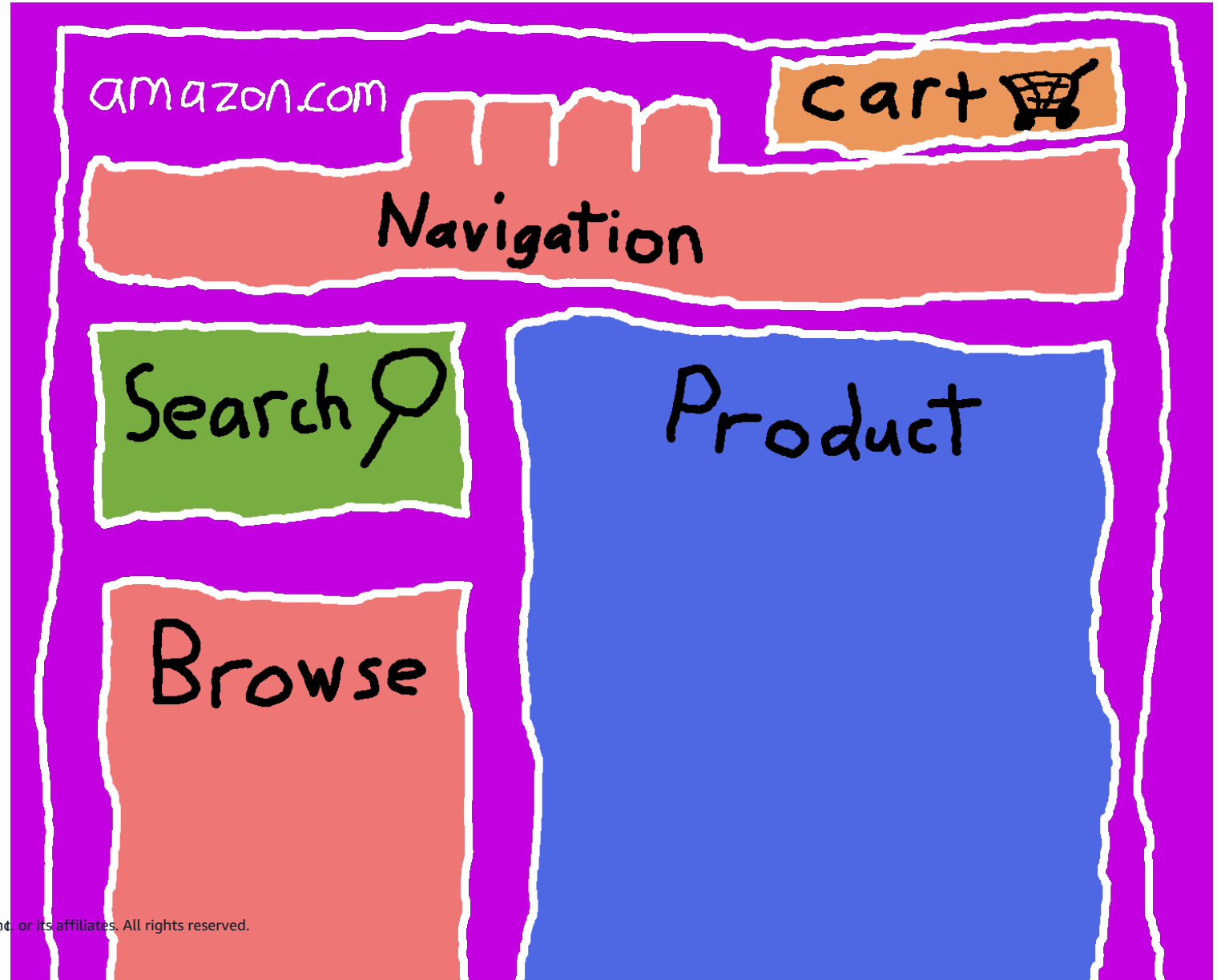
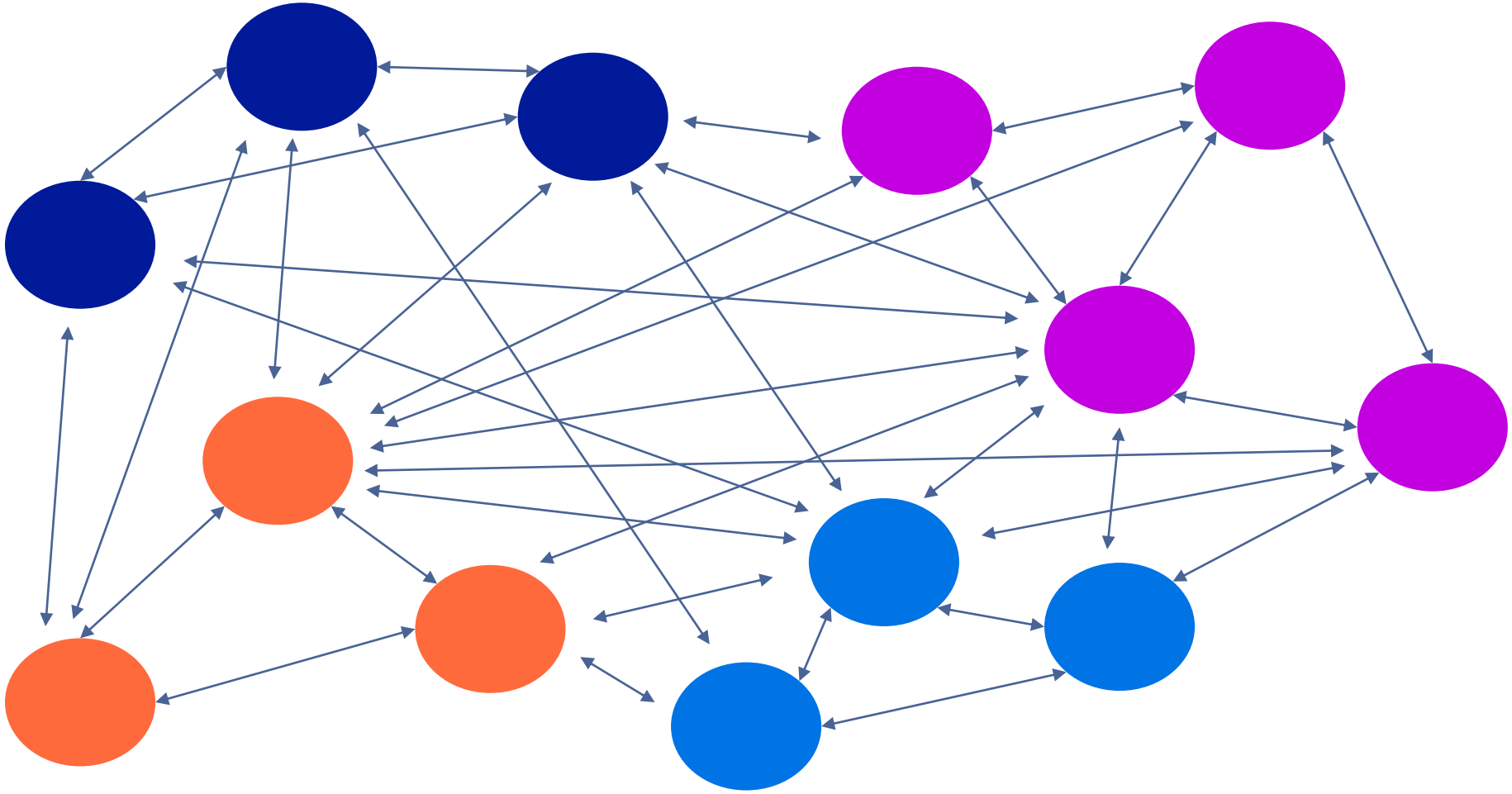


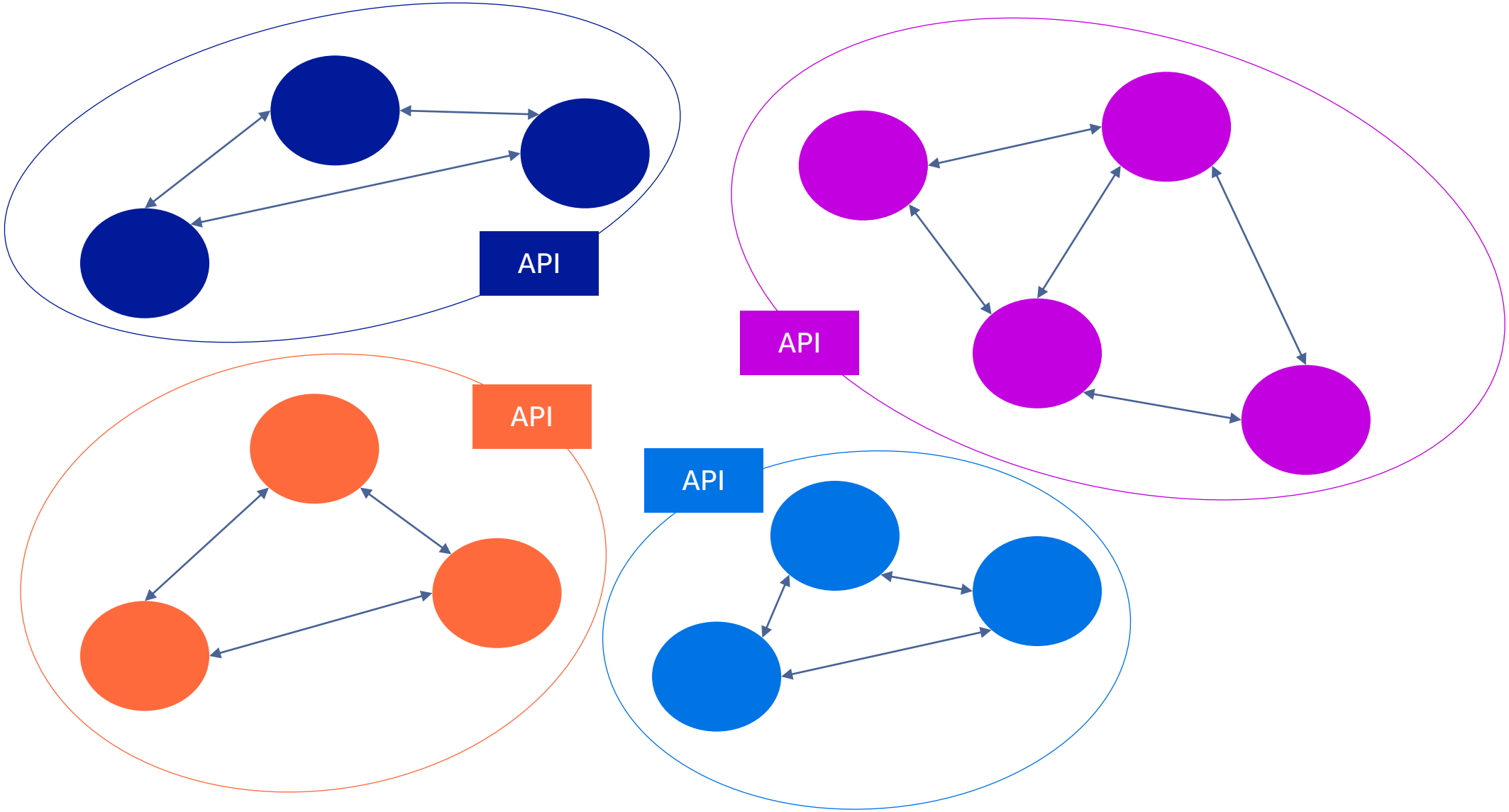
The teams behind the monolith



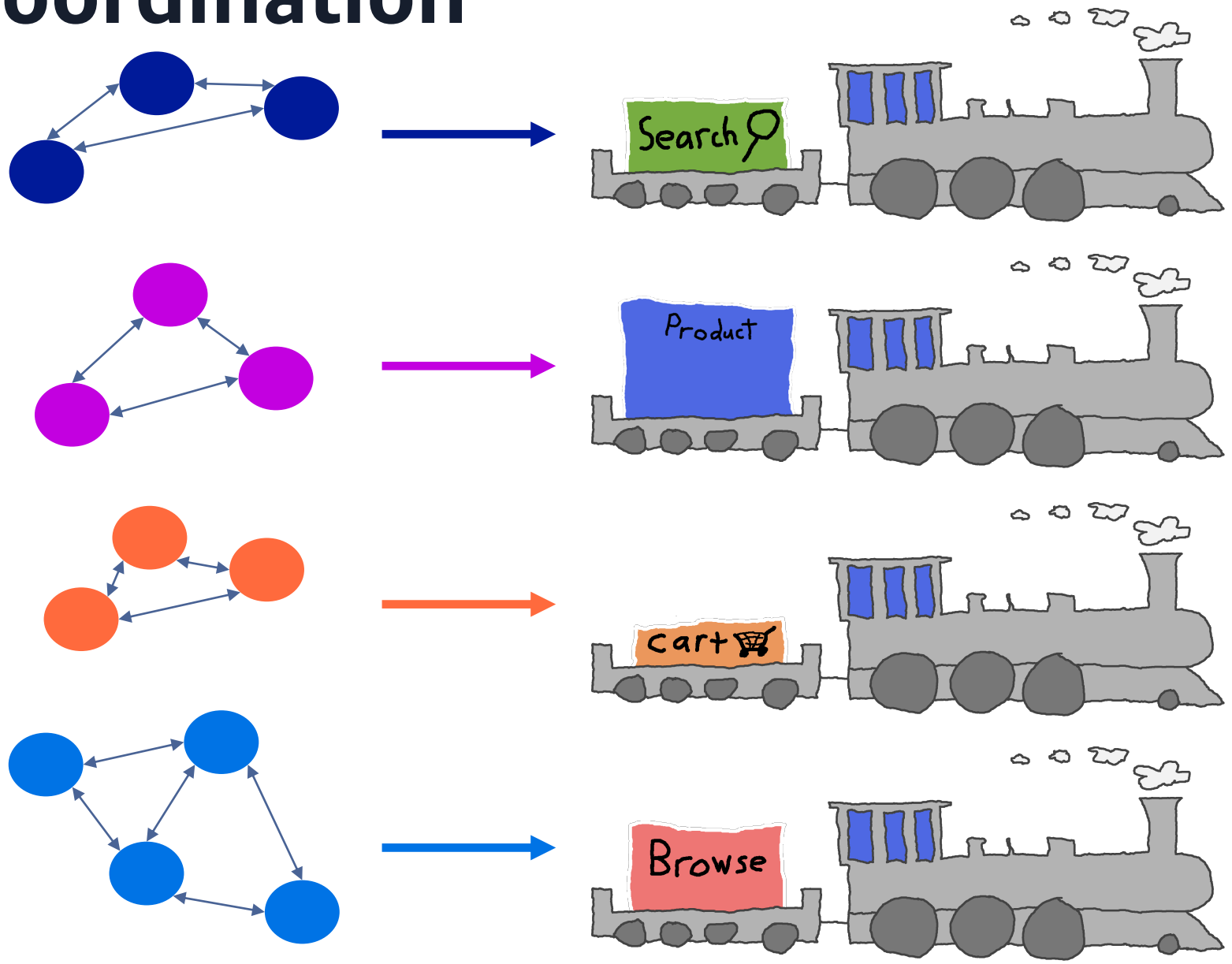
The cost of consensus building



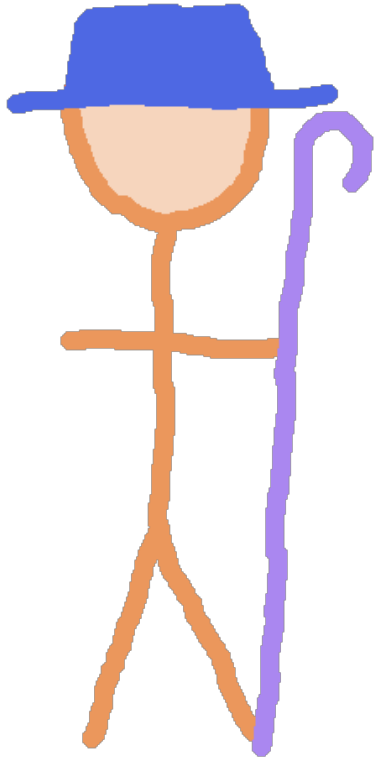
Increased autonomy

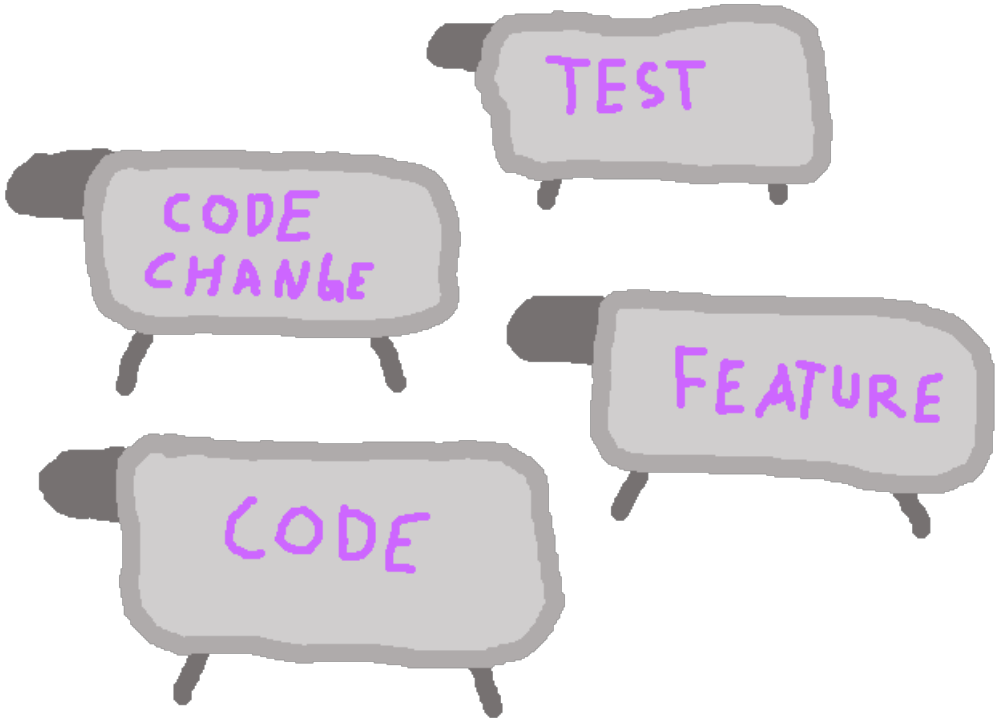


Reduced coordination

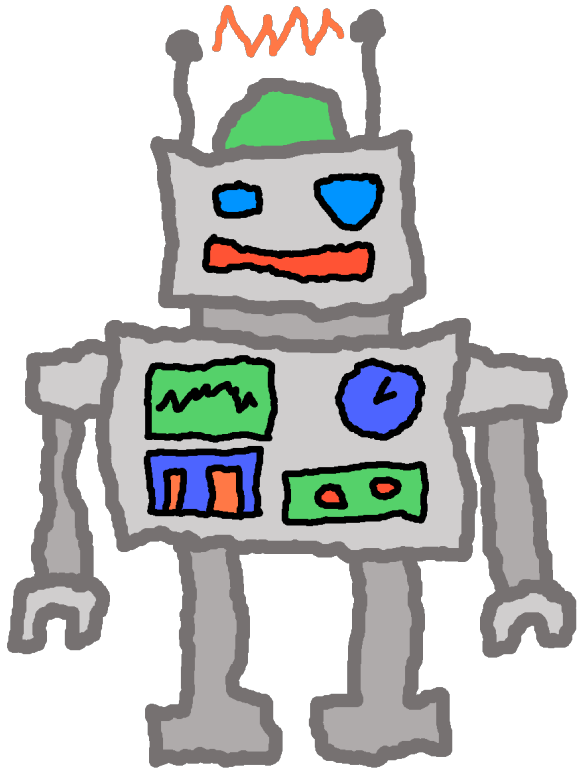


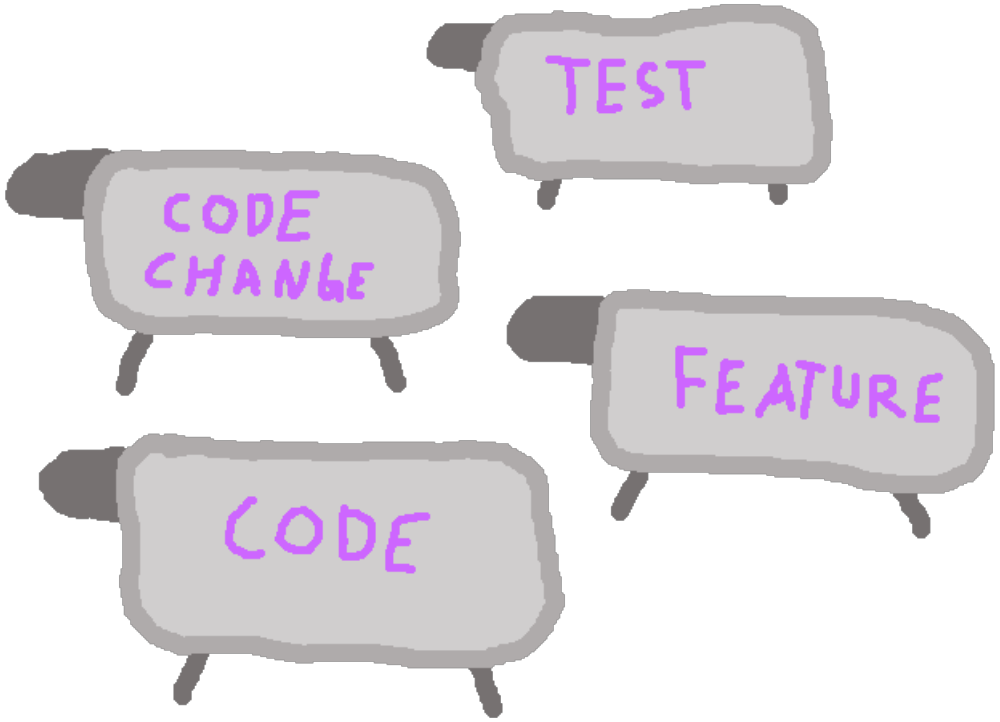
With independence comes responsibility



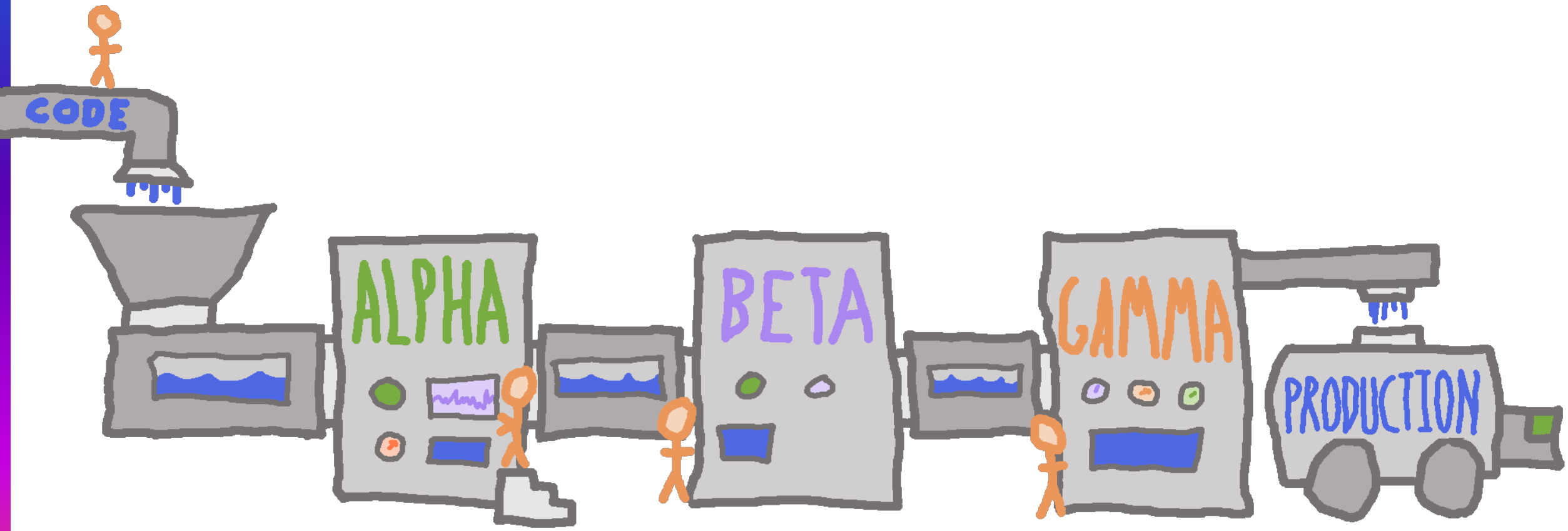


Deployment automation





Automated deployment pipelines



Principles of modern cloud system architecture

Systems

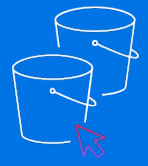
Build flexibly for the future with loosely coupled services and component-based architecture

Require auto-scaling and load balancing

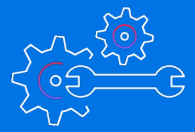
Use purpose-built services

Govern architecture across the enterprise

Ensure performance and skill alignment



Offer seamless storage functionality



Decouple infrastructure & experience

Work backwards from business needs

Leverage automation and containers

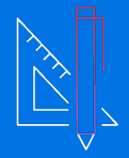
Principles of modern cloud system architecture

Experience

Deliver holistically with user-centered design, accessibility, and reusable components

Require scalable public and worker interfaces

Segment and personalize



Develop a unified design approach

Ensure performance and skill alignment

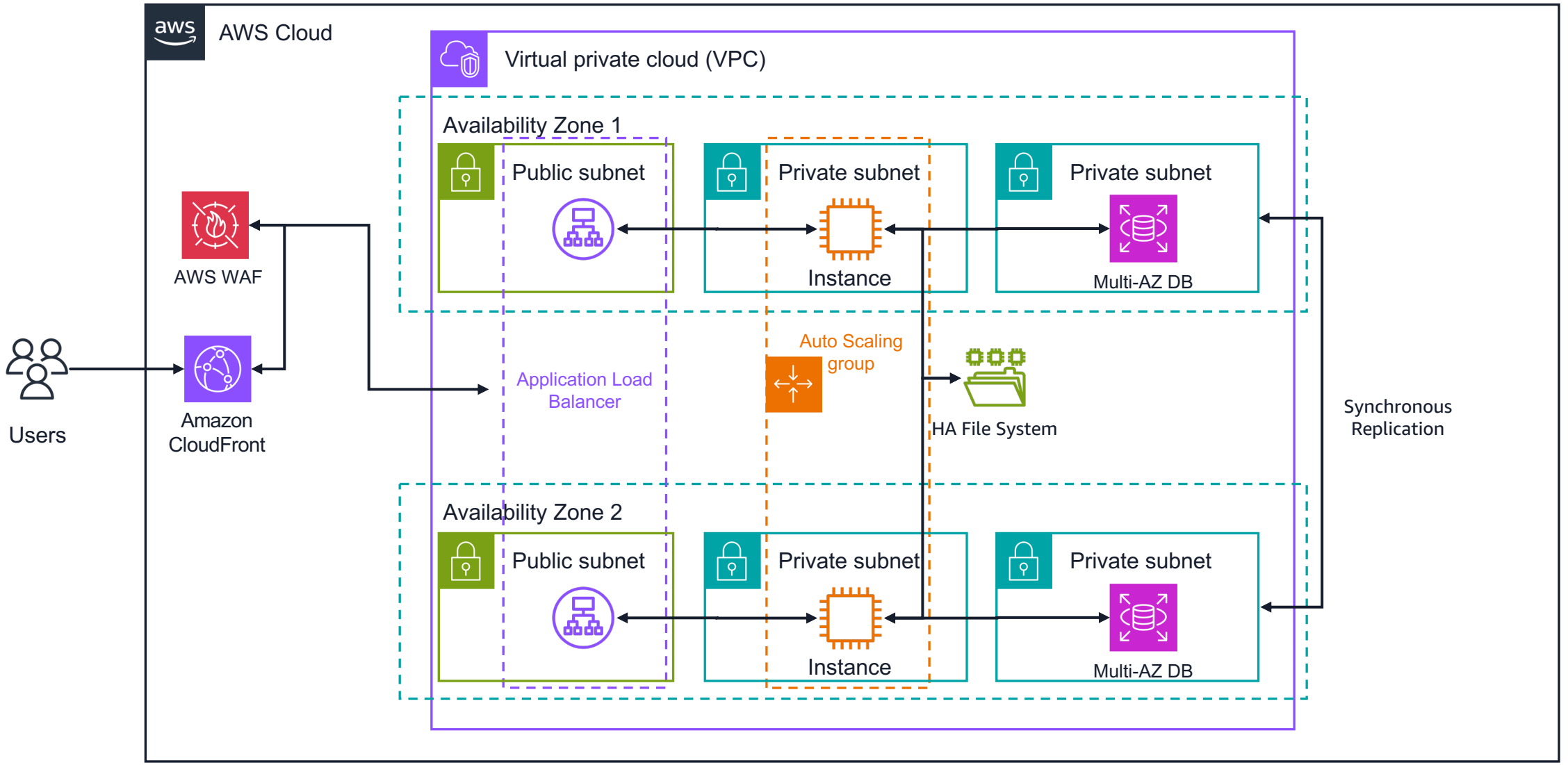
Use seamless data to make decisions

Decouple data and channels

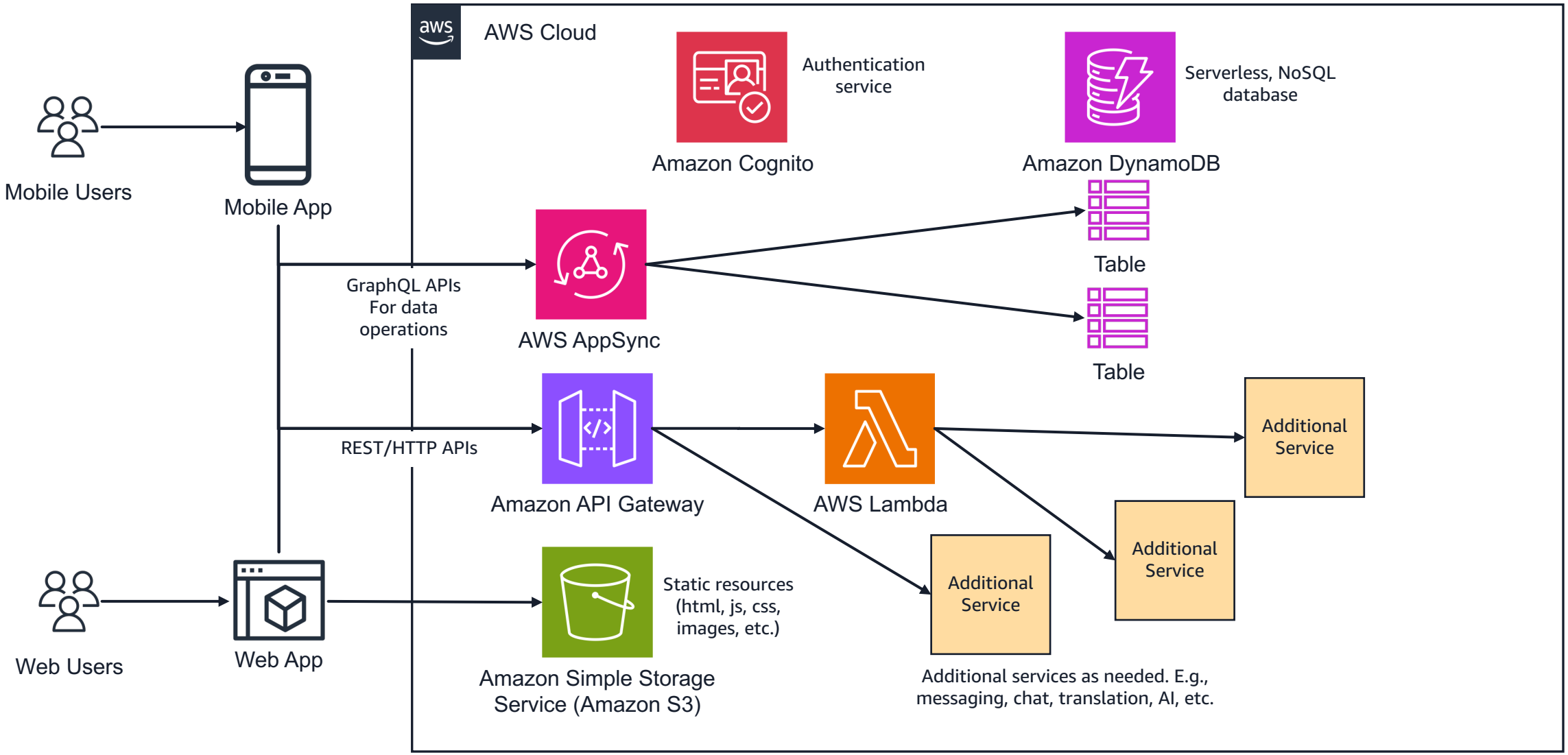
Work backwards from user needs

Leverage reusable components

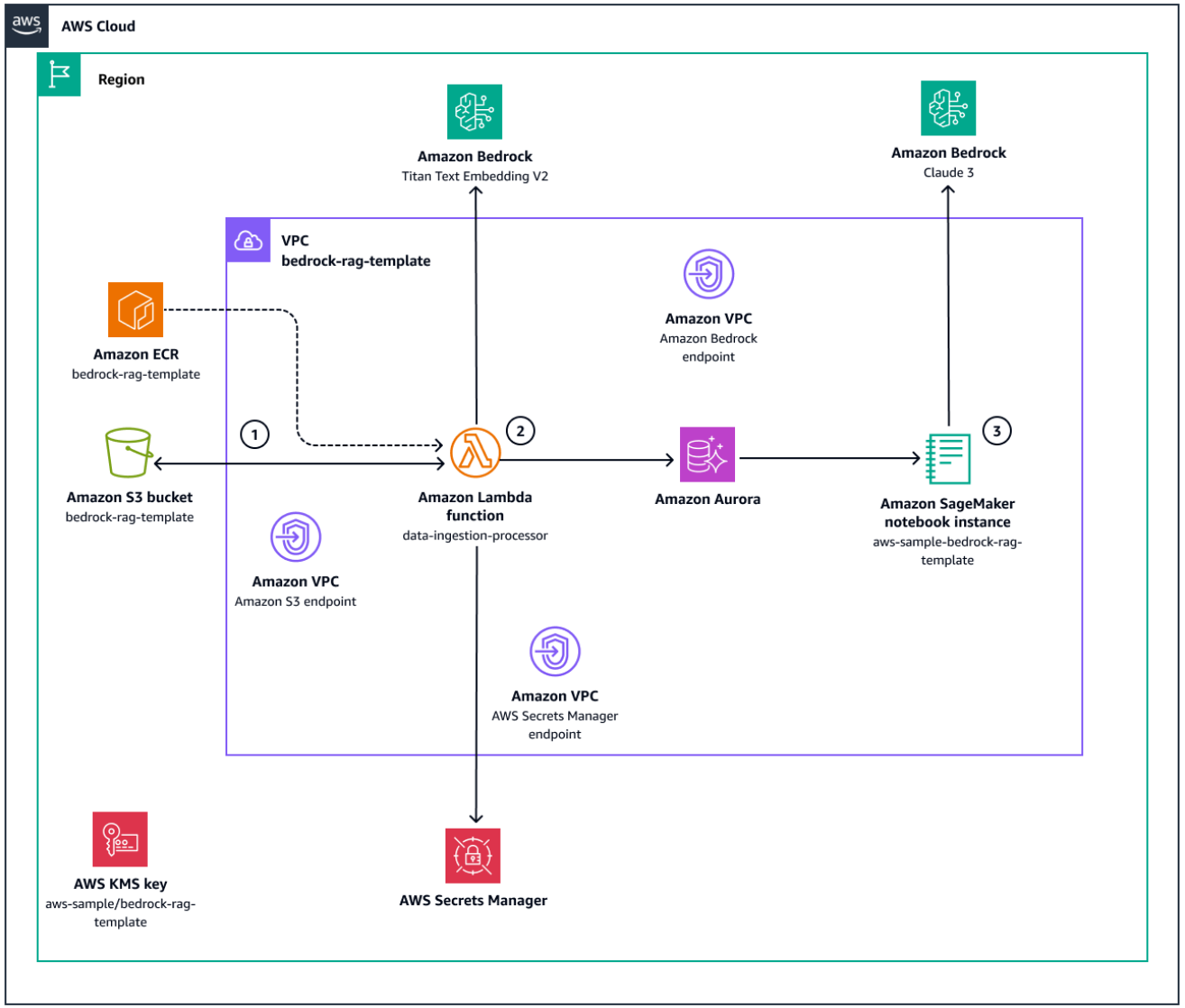
Highly available 3-Tier application



Serverless web/mobile application with APIs



Generative AI RAG Architecture

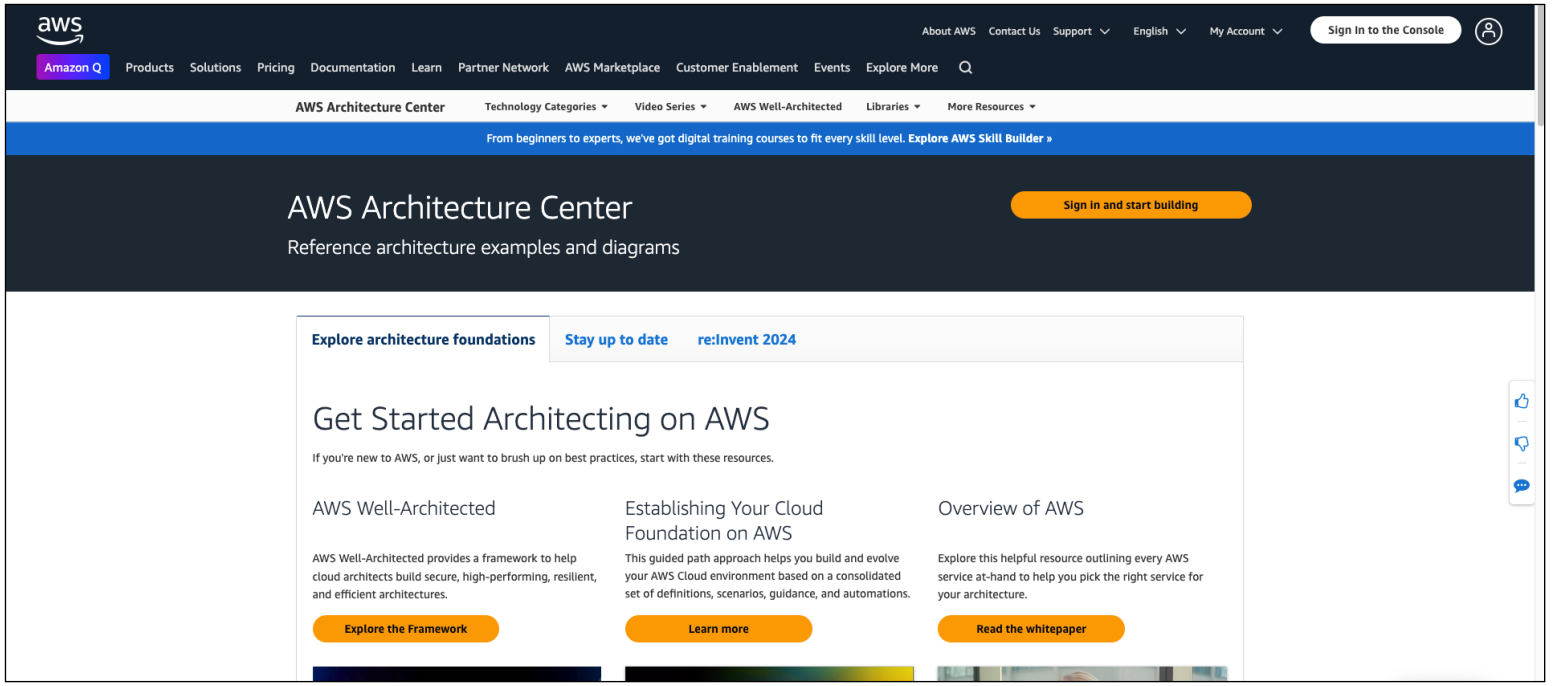


Source: https://docs.aws.amazon.com/prescriptive-guidance/latest/patterns/deploy-rag-use-case-on-aws.html

AWS Architecture Center

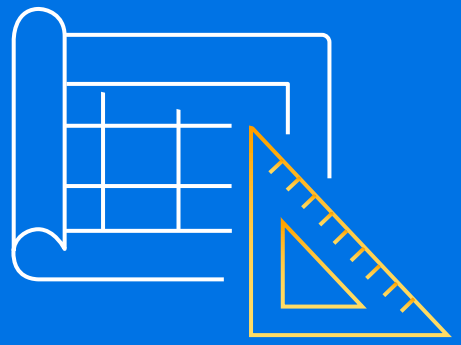
- Library of content including
  - Patterns
  - Reference Architectures
  - Guidance
  - Solutions, and more
- Links and other resources for architecting on AWS
- Video Series like ‘This is My Architecture’ and ‘How to Build This’
- Architecture Best Practices

https://aws.amazon.com/architecture



What is the AWS Well-Architected Framework?

Pillars & Lenses



Design principles

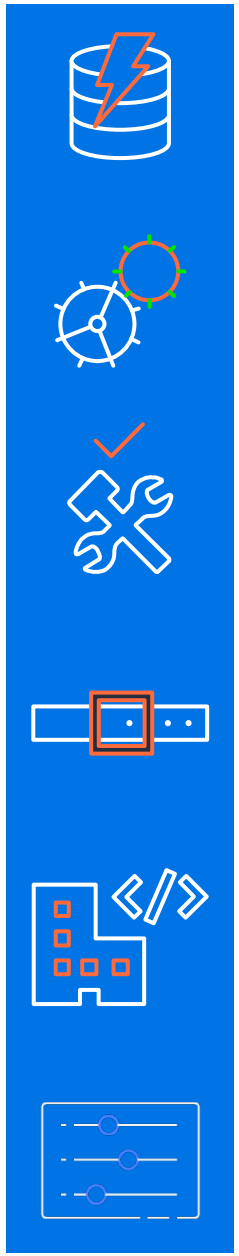
Questions

Best Practices

Pillars of the AWS Well-Architected Framework

How does Amazon do operations?

Lessons learned at Amazon for developing and delivering software



Decompose for agility
(microservices, two-pizza teams)

Automate everything

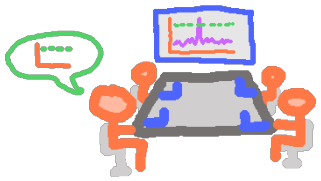
Standardized tools

Belts and suspenders
(governance, templates)

Infrastructure as code (IaC)

Continuous configuration
(feature flags, operational flags)

Who owns operations at Amazon?

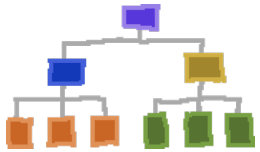


Service teams

- Fully own operations
- Innovate and invent

Platform engineering

- Raise standards through tools
- Reduce effort of teams
- Empower and unblock teams



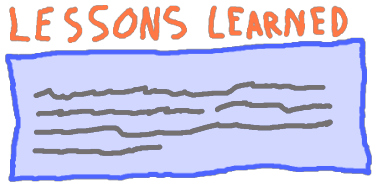
Management

- Reinforce culture
- Set standards
- Hold accountable
- Allocate resources

Help teams learn from each other

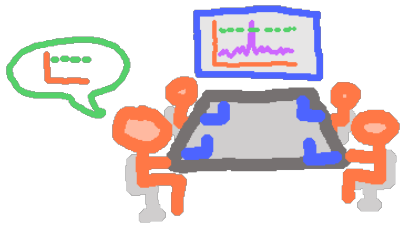
Help teams learn from each other

Ops wins



Incident retrospectives

Operational readiness reviews



Weekly ops meetings

Give teams tools to be successful

Give teams tools to be successful

- Deploy software easily and safely
- Manage dependencies and keep software and systems patched
- Respond to incidents and coordinate investigations
- Monitor, alarm, observe, and troubleshoot systems
- Build web services and websites that are secure and reliable
- Operate services efficiently
- Leverage AWS services with guardrails but without red tape

Software quality measurement: prevention

- Raise standards by verifying code commits and deployments
- Formal verification of algorithms
- Scanning codebases for upgradeable dependencies

Software quality measurement: reporting

Software (pipeline health)

- Inventory age, commit-to-deploy time, rollback rate, flaky tests, etc

Builders (productivity and pain)

- Oncall burden (page count, frequency of oncall)
- New builder time-to-onboard

Inform teams proactively about improvements

Inform teams proactively about improvements

- Disable deployment pipelines that don’t follow required standards
- Roll back deployments automatically from ”golden signal” metric anomalies
- Scan infrastructure and software for known configuration improvements
- Inspect infrastructure utilization metrics and look for wasted resources
- Perform upgrades by pushing “pull requests” to teams
- Set an annually “north star” goal

The Amazon Builders' Library

Firsthand articles from engineers who built AWS services:

- Caching
- Retries
- Fairness
- Safety
- More…

https://aws.amazon.com/builders-library/

Thank you!

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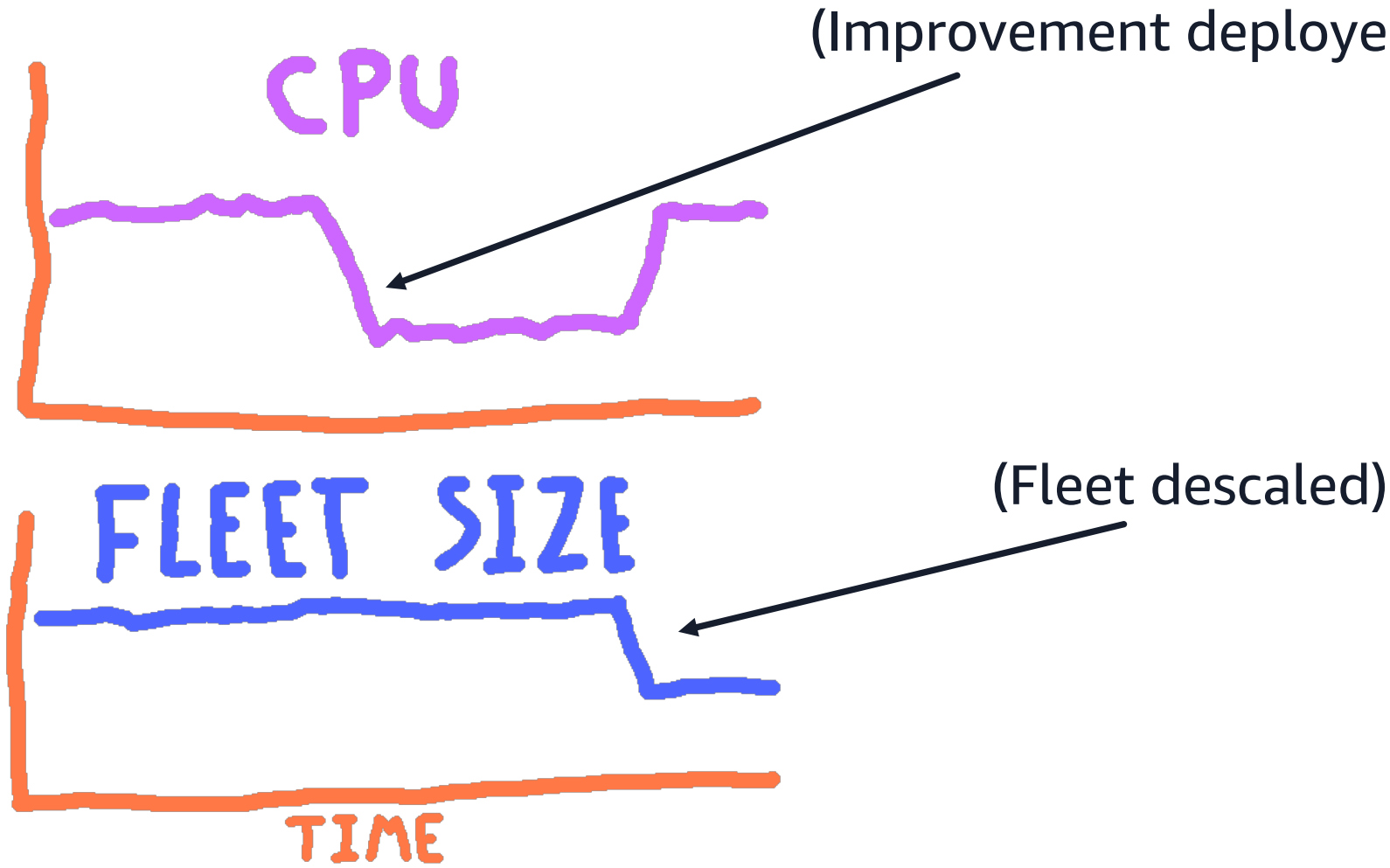
Please complete the survey for this session

Track: Cloud Fundamentals
Session: Designing modern applications in AWS

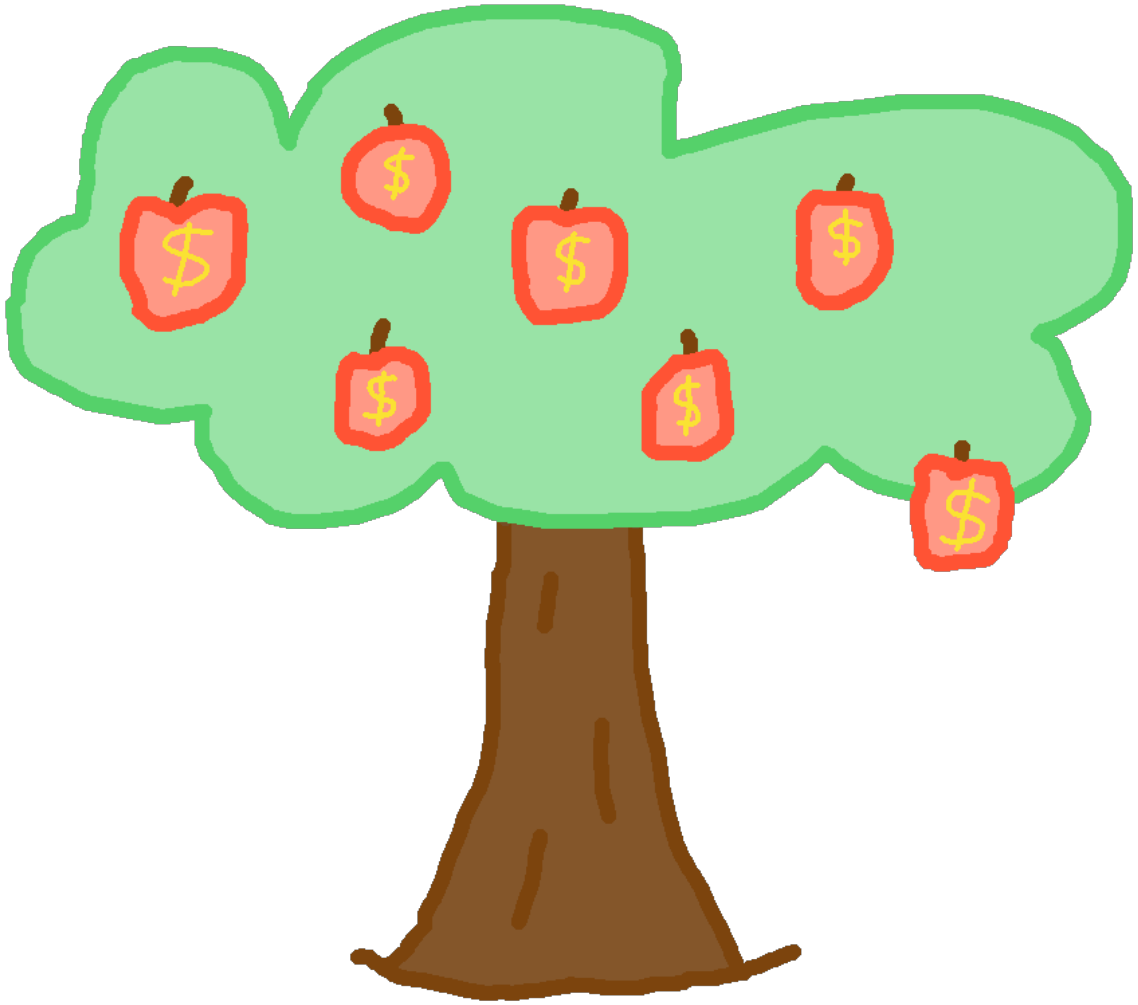
aws Learning Days
State, Local, and Education

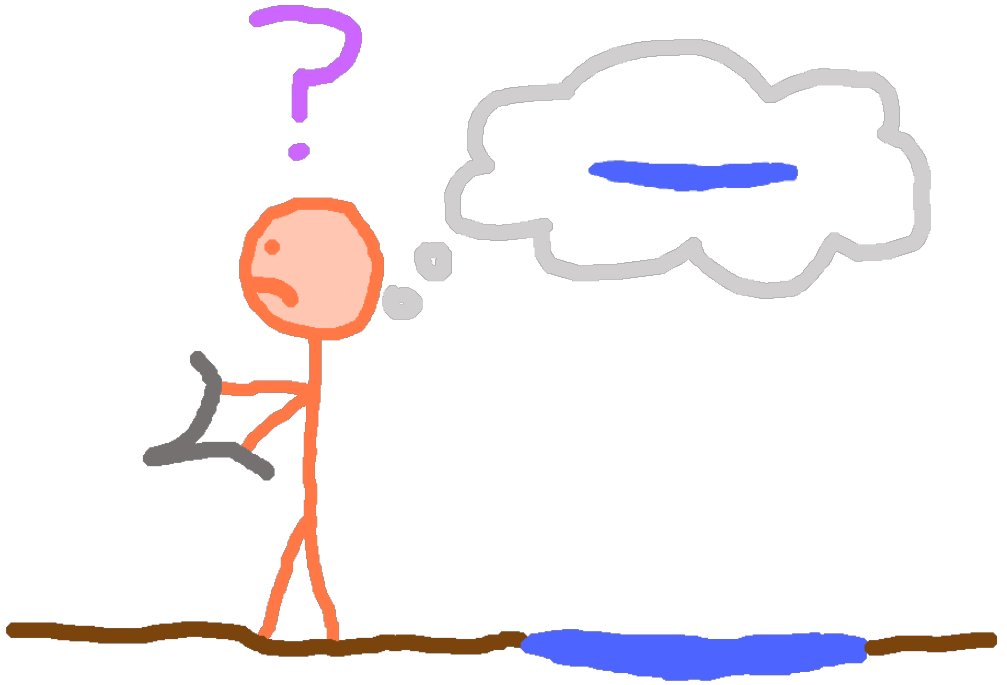
Story: The ops win

Deploying an efficiency improvement

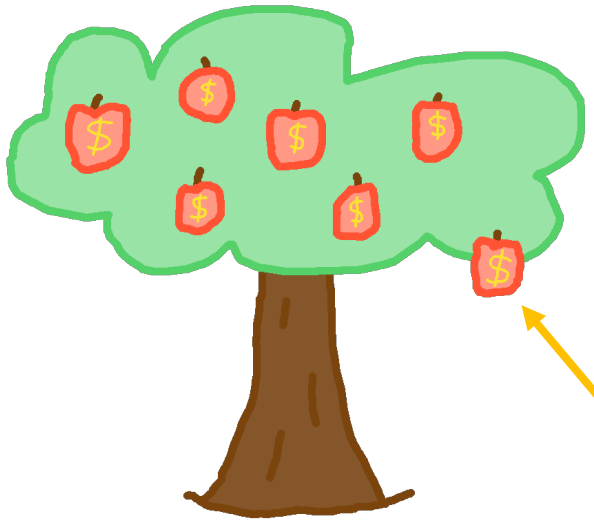


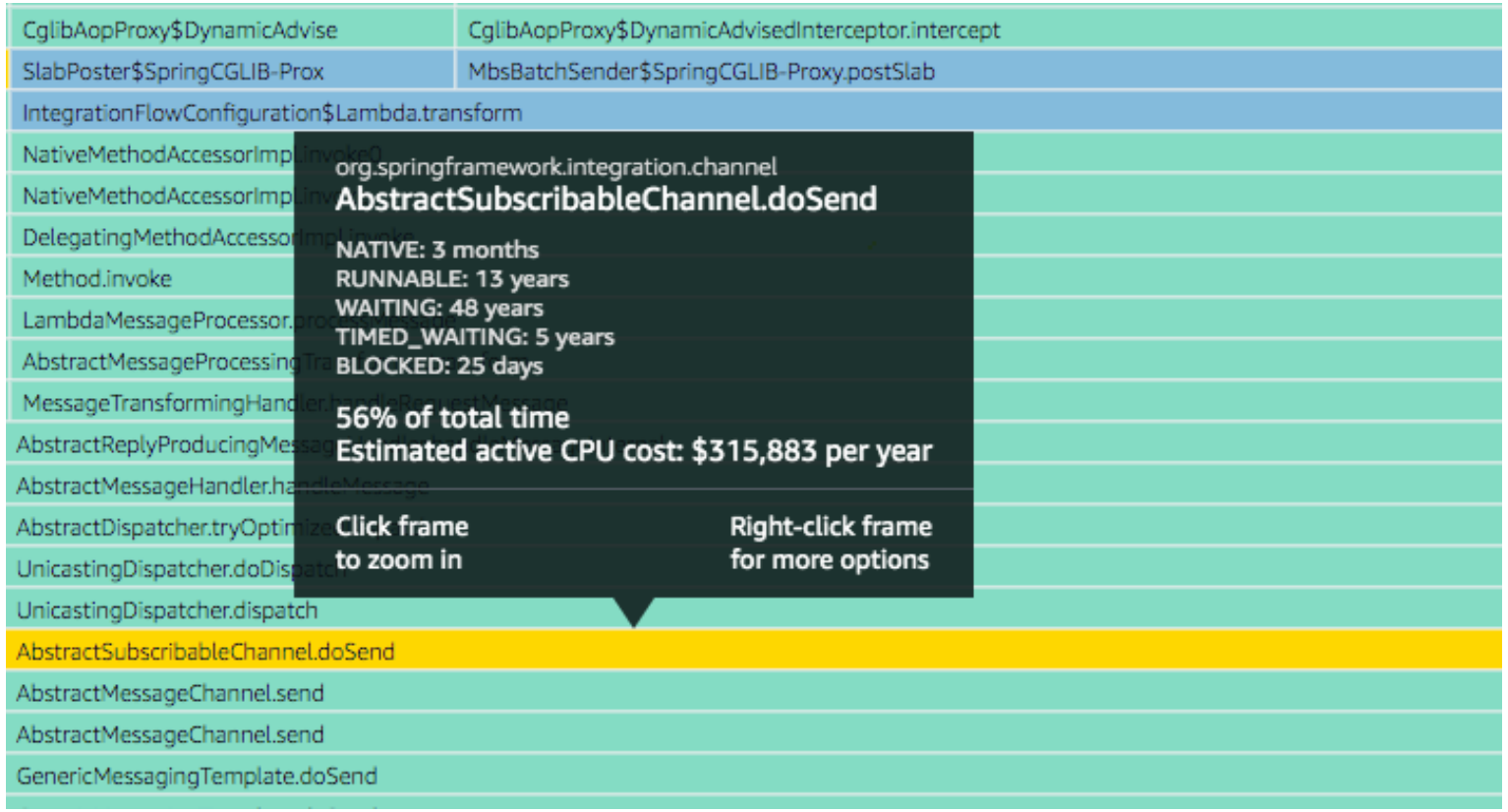
Find easy optimizations in code

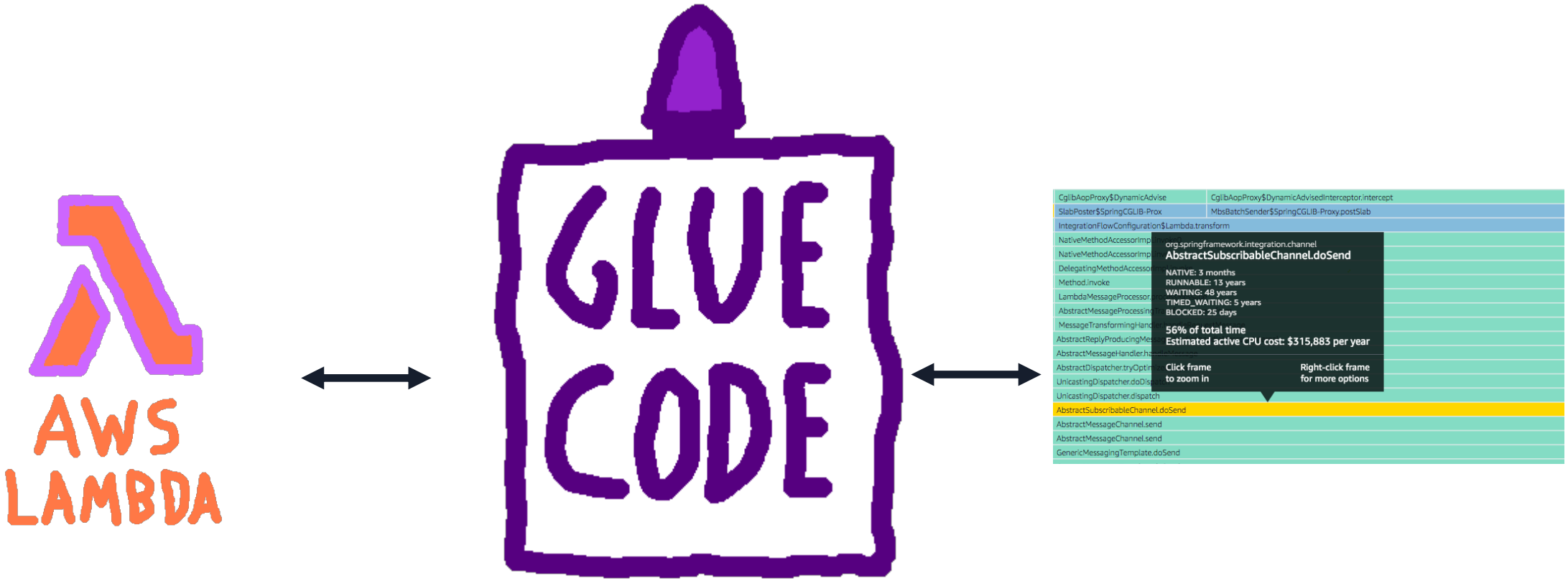




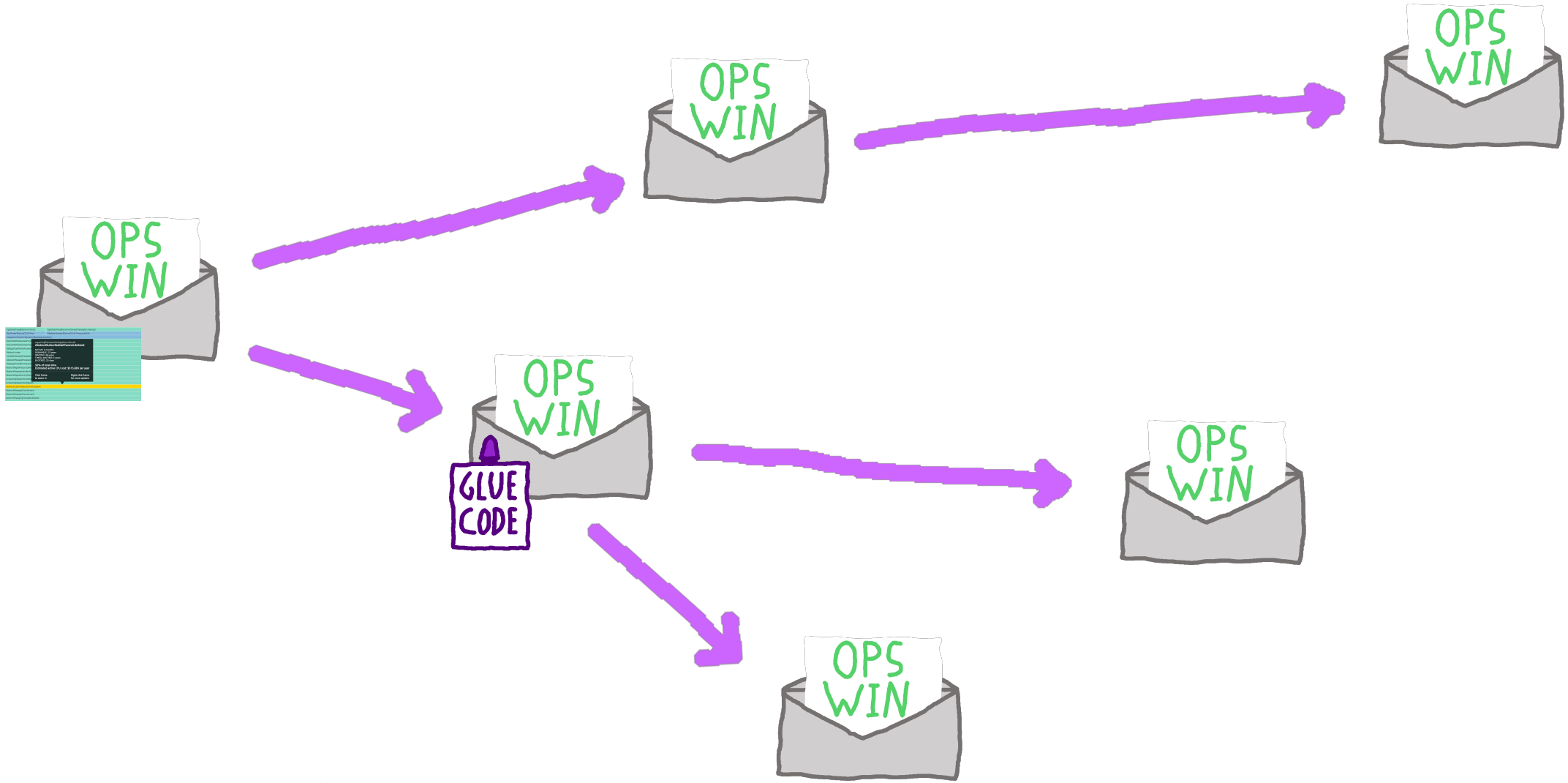
Using a profiler to find low-hanging fruit

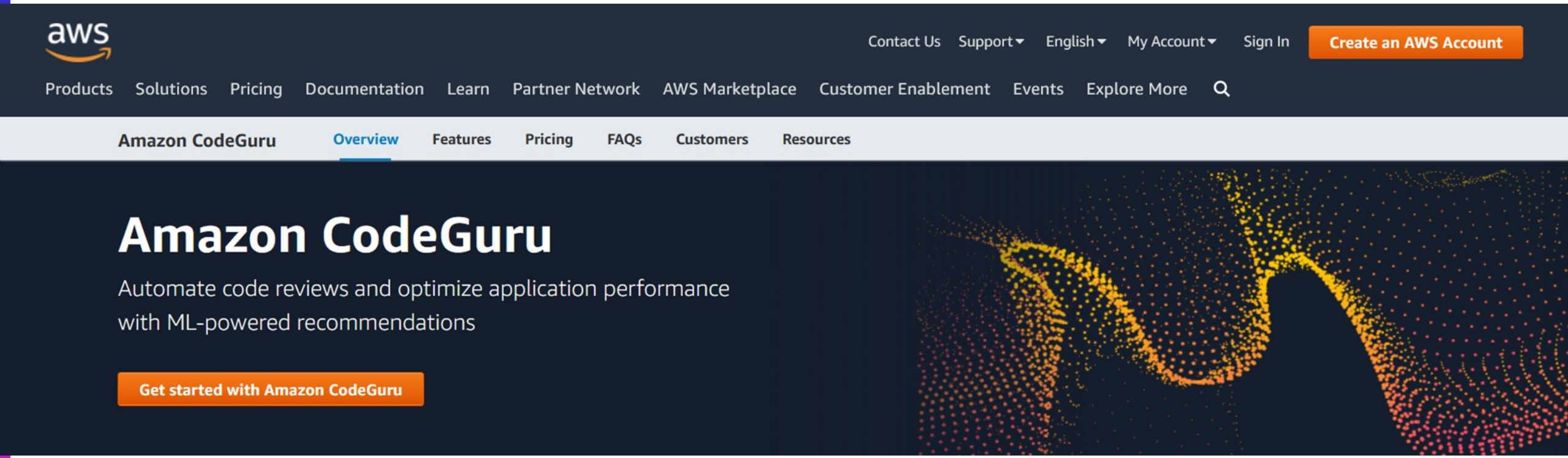






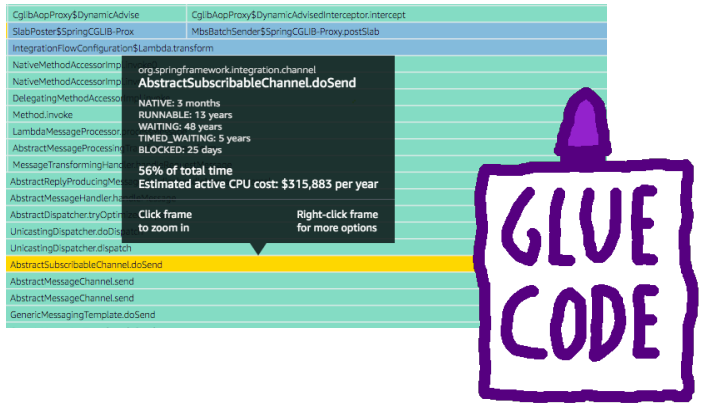
The ripple effect



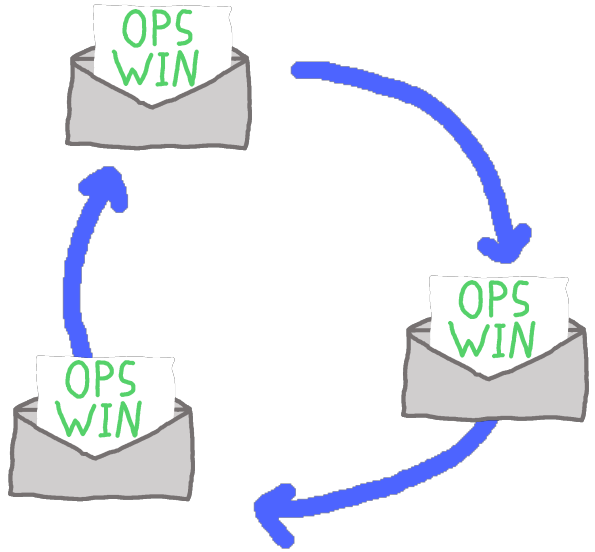


The ripple effect

Takeaways: the ops win



Share best practices

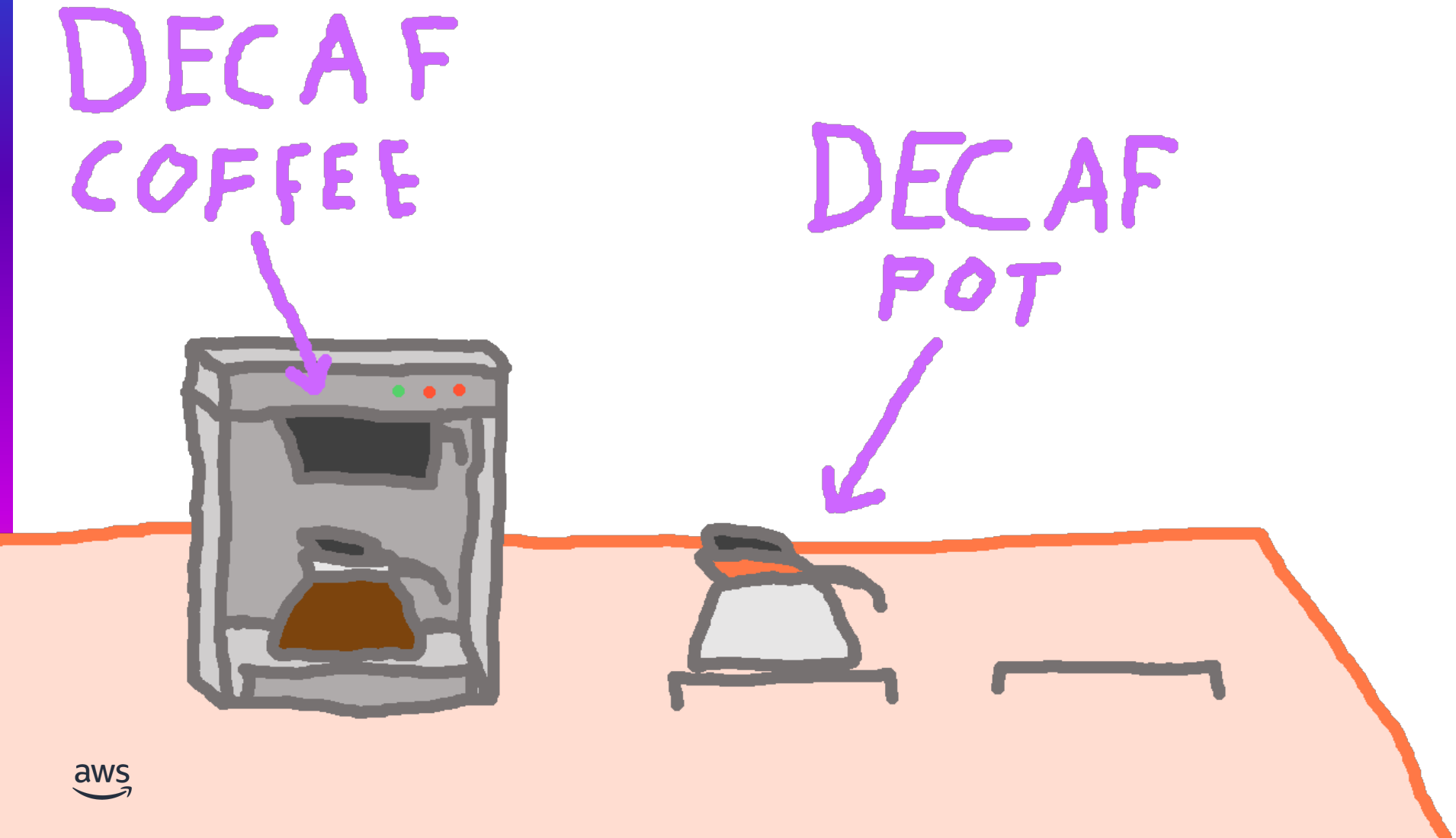


Reinforce ops culture

Story: The retrospective

Early one morning . . .

Wrong coffee, wrong pot



COE: Correction of error

[89458] Decaf coffee brewed in a non-decaf pot

Summary

At 8:45 am Pacific on 4/24/2018 on the 12th floor of Alexandria, an operator inadvertently brewed decaf coffee into the "medium roast, non-decaf" coffee pot. The operator was attempting to brew decaf coffee, but chose the wrong pot to brew it into.

Metrics / Graphs

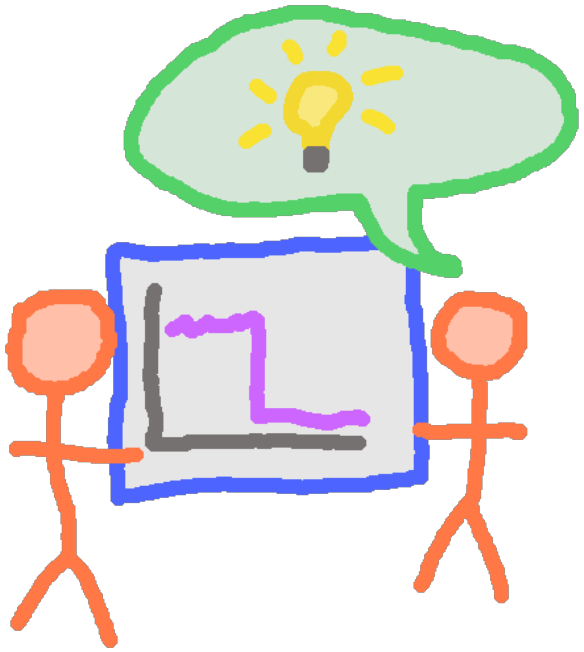
- Number of pots of coffee brewed incorrectly during incident: 1
- Number of customers who unknowingly took a cup of decaf coffee: 2 (estimated)

Customer Impact

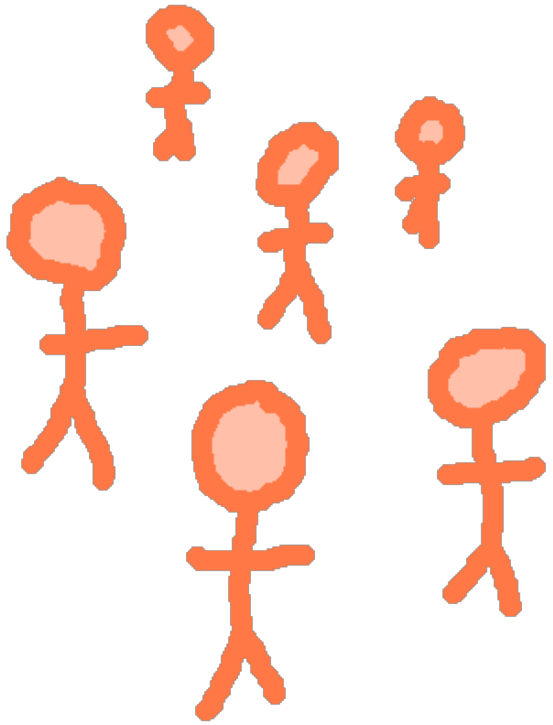
While there are no metrics available to prove this, we know that there were at least two people who took coffee from the pot. One engineer had a half cup of coffee at his desk. That engineer did not move the pot from the brewing station into its holding spot, so that suggests that at least one other person had coffee. The one confirmed engineer chose to drink the cup of coffee anyway.

Amazon’s approach to failing successfully
https://www.youtube.com/watch?v=yQiRli2ZPxU

Goals of retrospectives



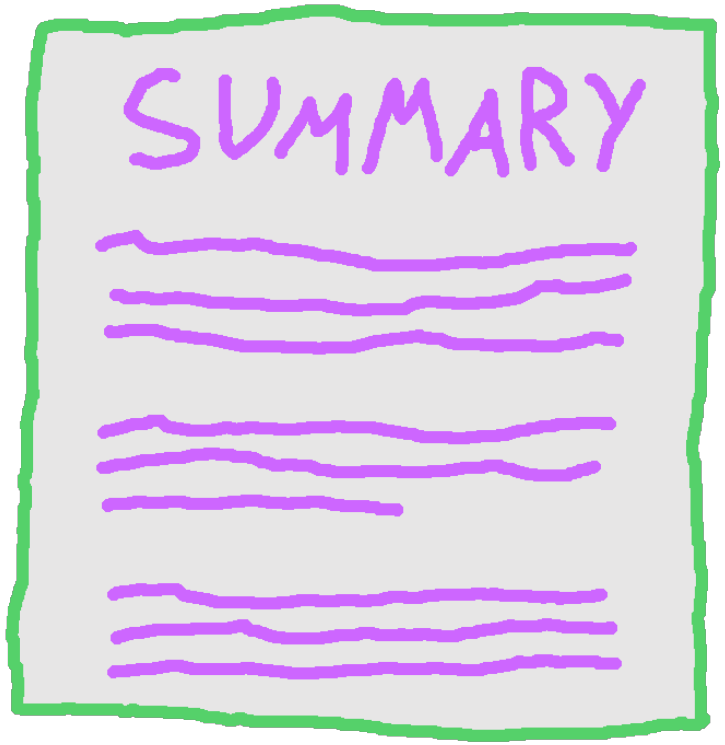
Improve systems



Teach others

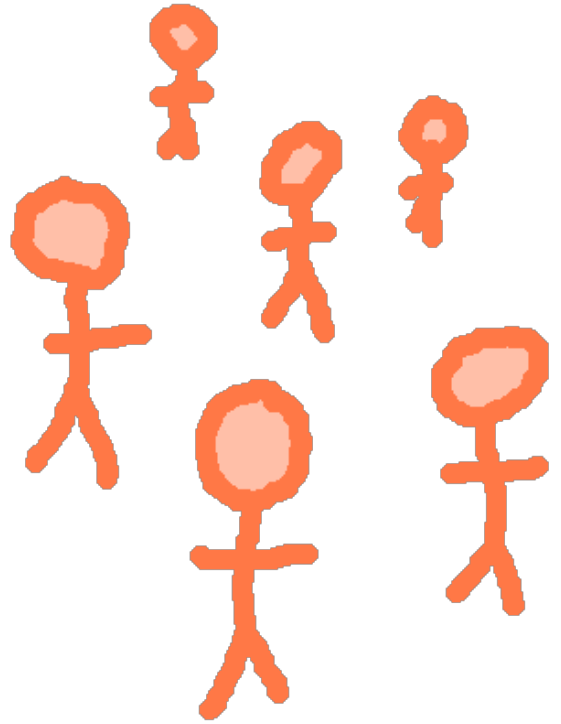
Improve tools

Summary



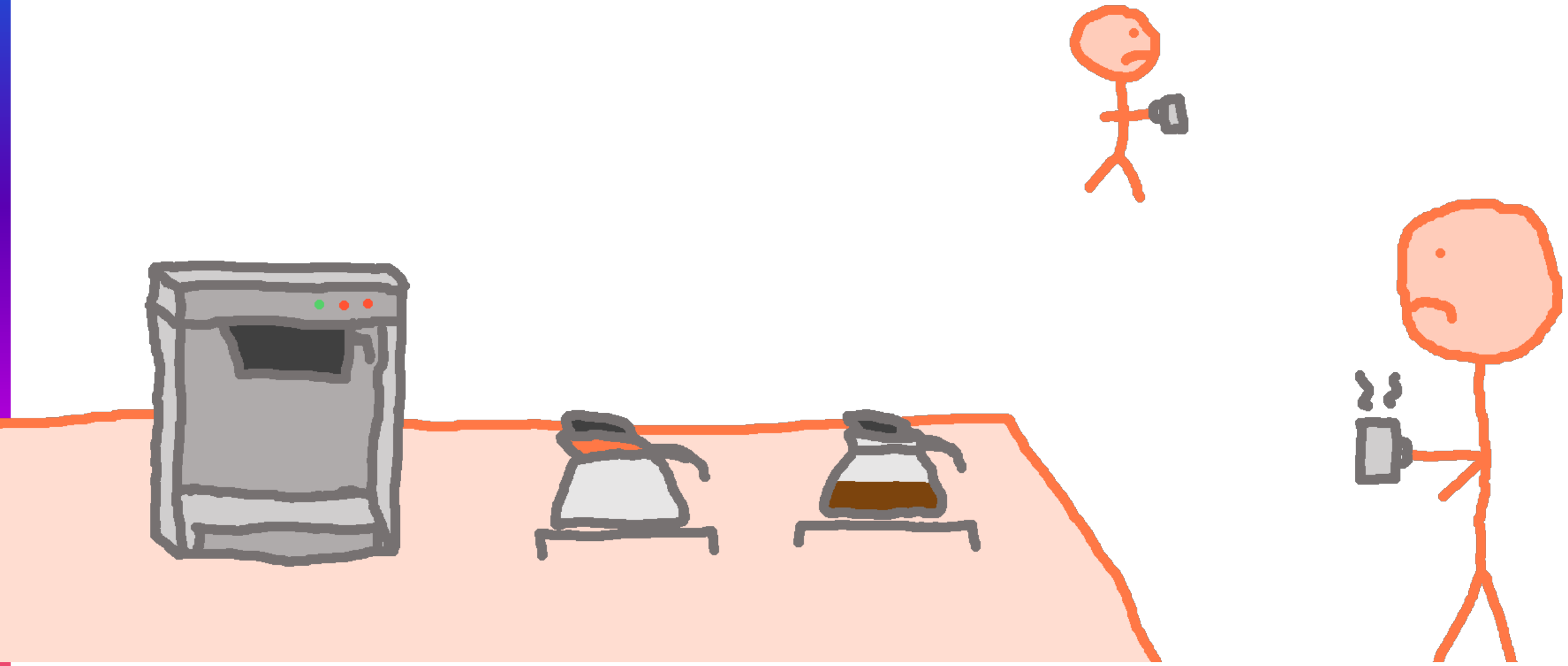
Non-punitive
(no names!)

3 paragraphs

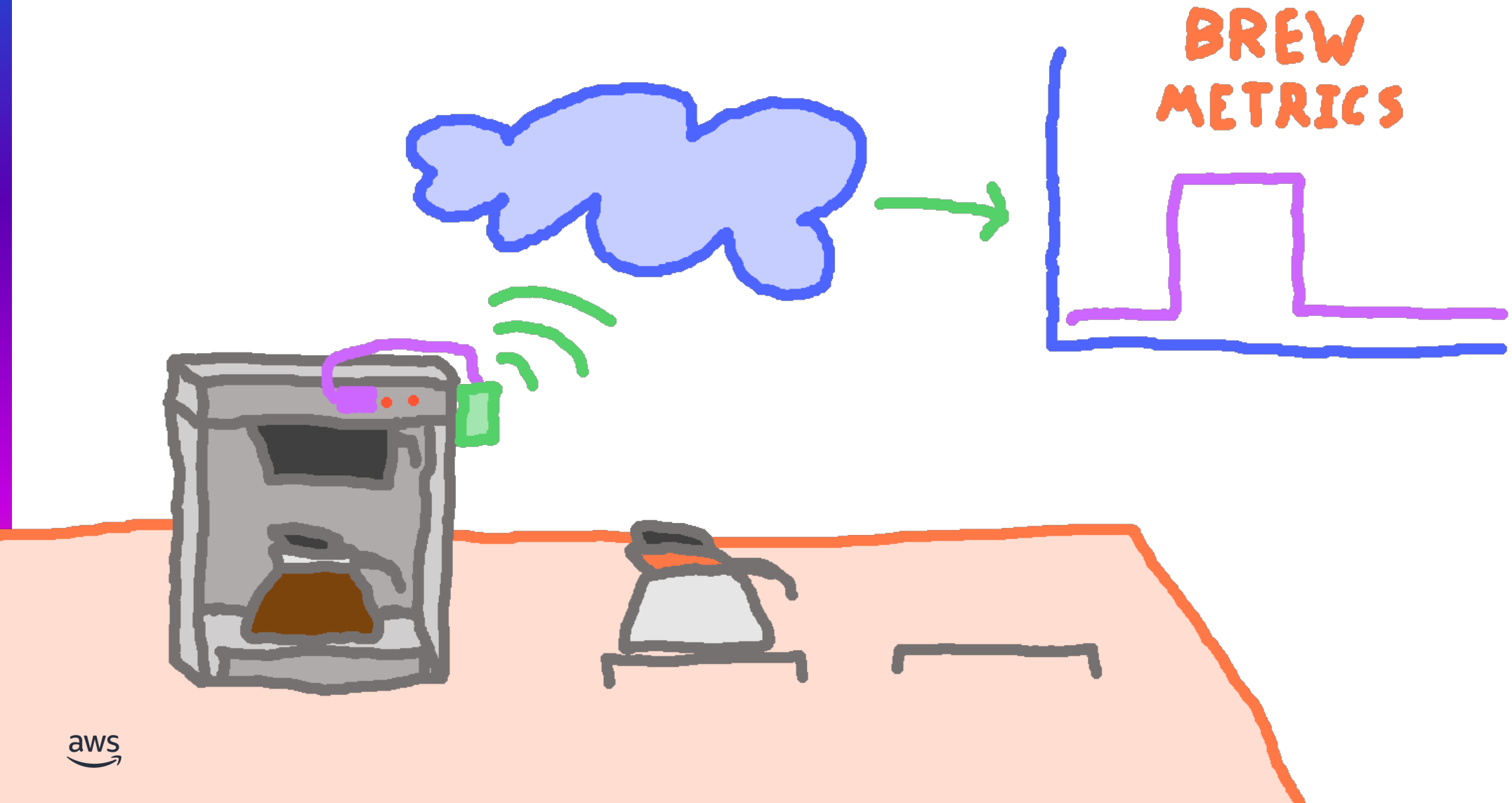


Understandable by anyone
(no jargon!)

Customer impact

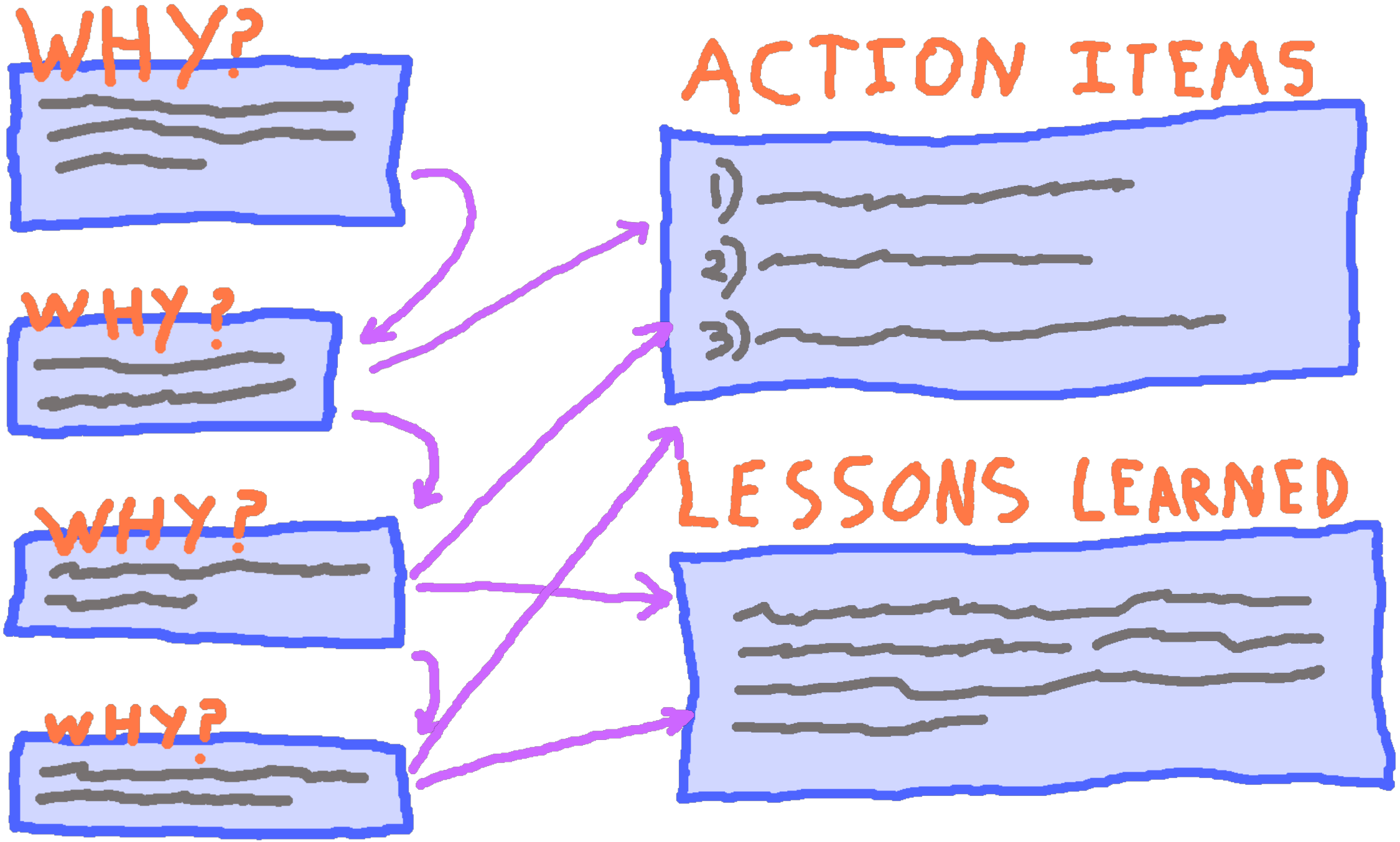


Graphs and timeline

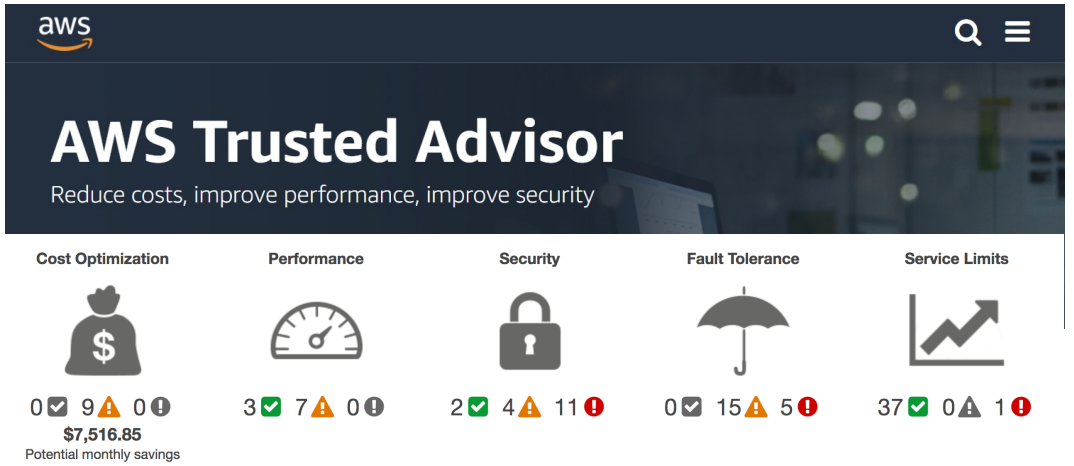


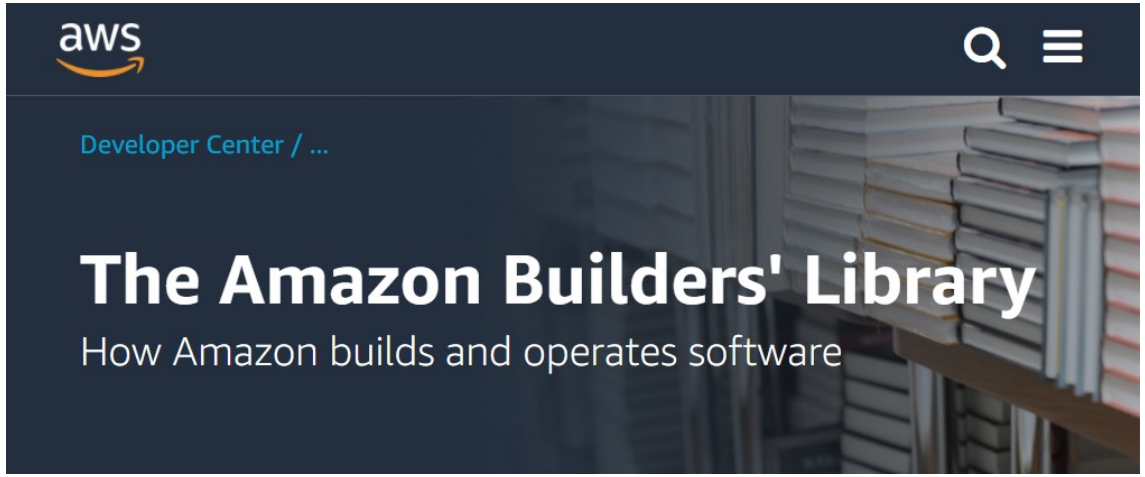
Timeline

- 08:29 – Operator accidentally selects “decaf” coffee packet
- 08:30 – Operator selects “regular” coffee pot
- 08:31 – Operator loads coffee and starts brewing
- 08:32 – Operator goes back to desk
- 08:36 – Coffee finishes brewing
- 08:?? – Someone removes carafe from coffee maker and takes a cup
- 08:45 – Operator returns and takes the first cup
- 09:25 – Operator returns for another cup
- 09:26 – Operator realizes that the coffee tastes different than normal
- 09:27 – Investigation begins
- 09:29 – Original coffee packet retrieved, confirmed decaf
- 09:30 – Decaf label transferred to regular carafe

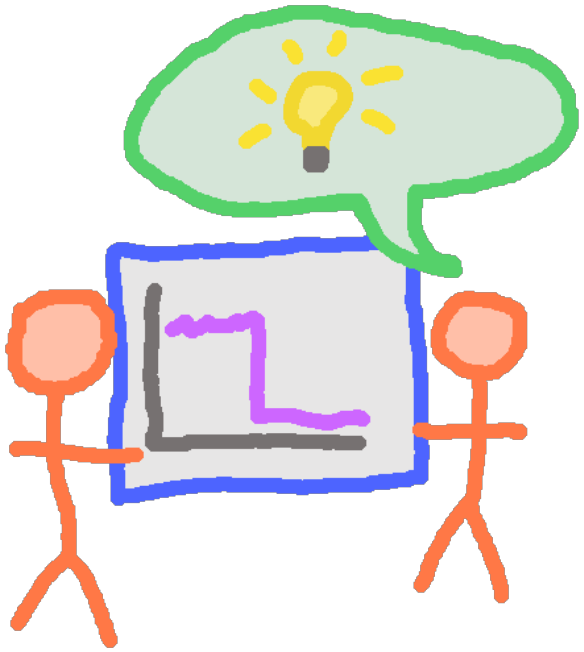

WHY?
WHY?
WHY?
WHY?
ACTION ITEMS
1)
2)
3)
LESSONS LEARNED

Sharing and improving broadly

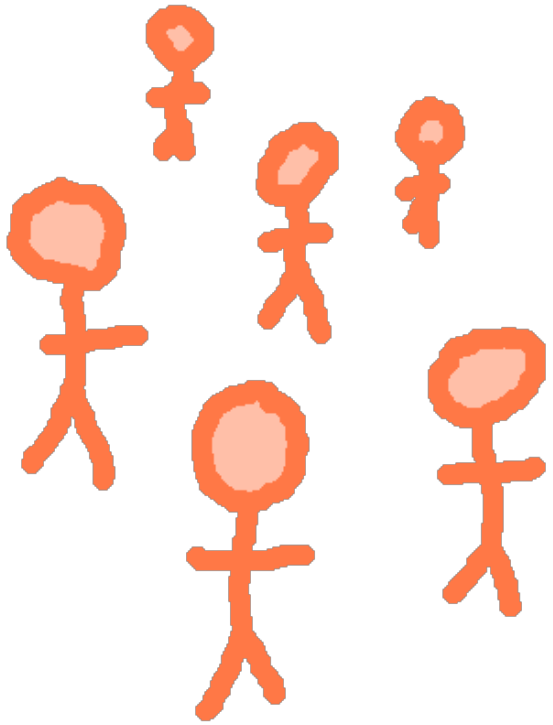




Takeaways: The retrospective



Improve systems

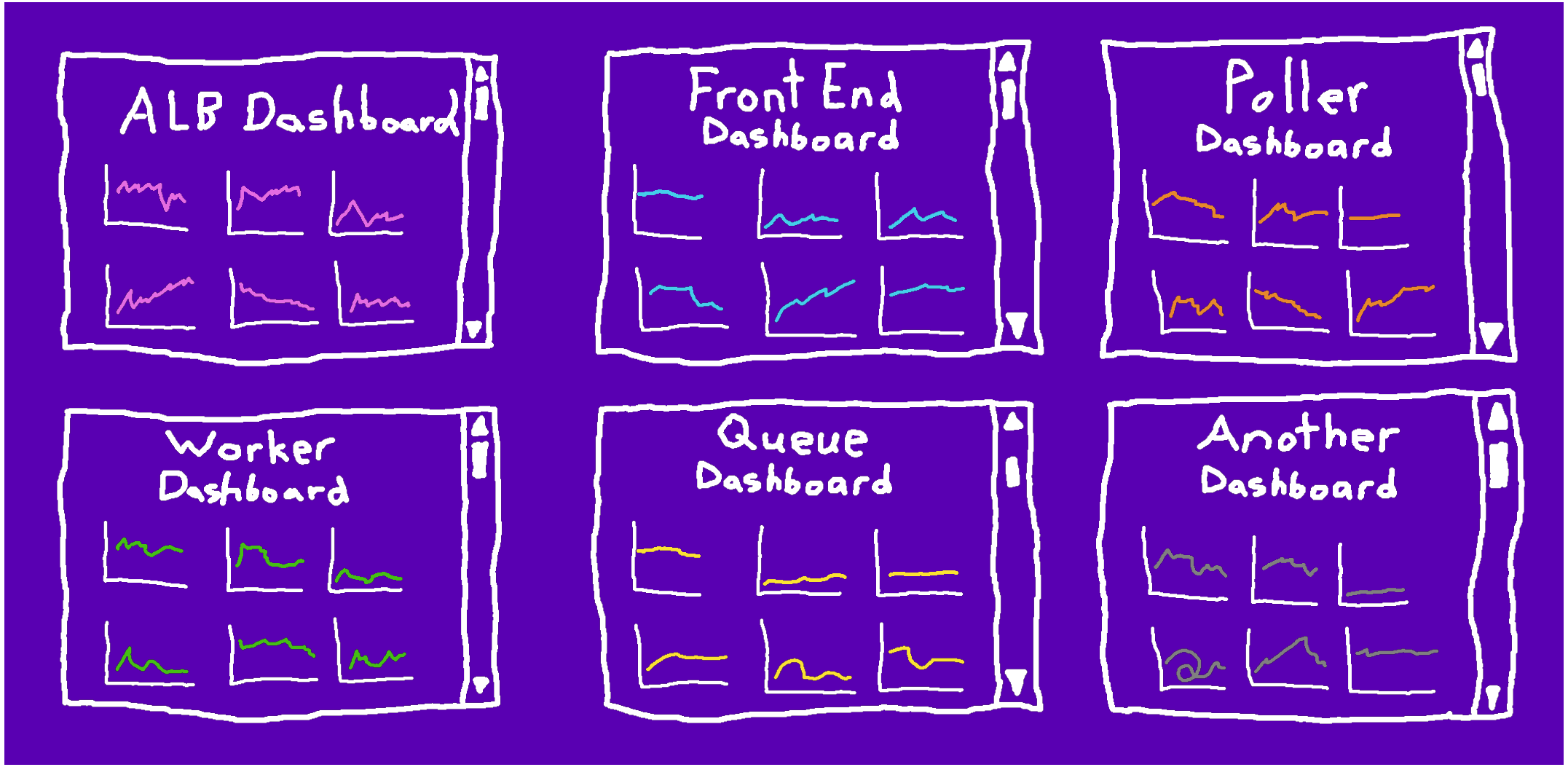


Teach others

Improve tools

Story: The ops meeting

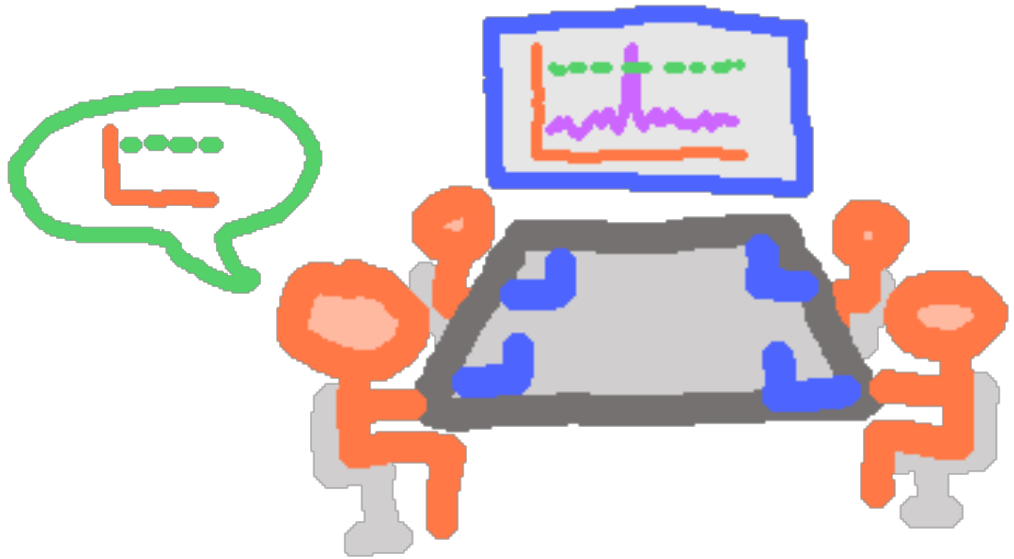
Dashboards!



https://aws.amazon.com/builders-library/building-dashboards-for-operational-visibility/

Morning metrics

Weekly team operations meeting



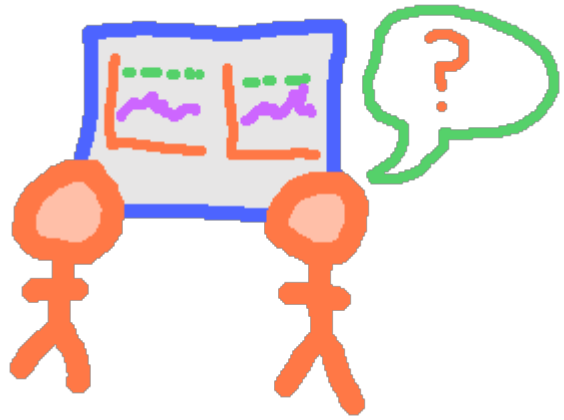
Weekly ops agenda

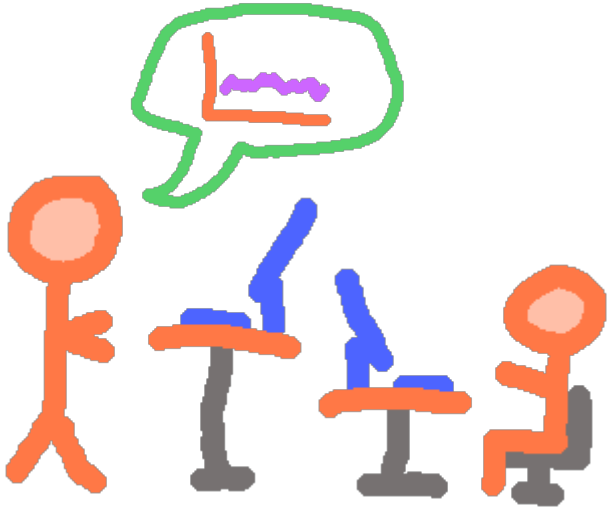
Wins

Retrospectives

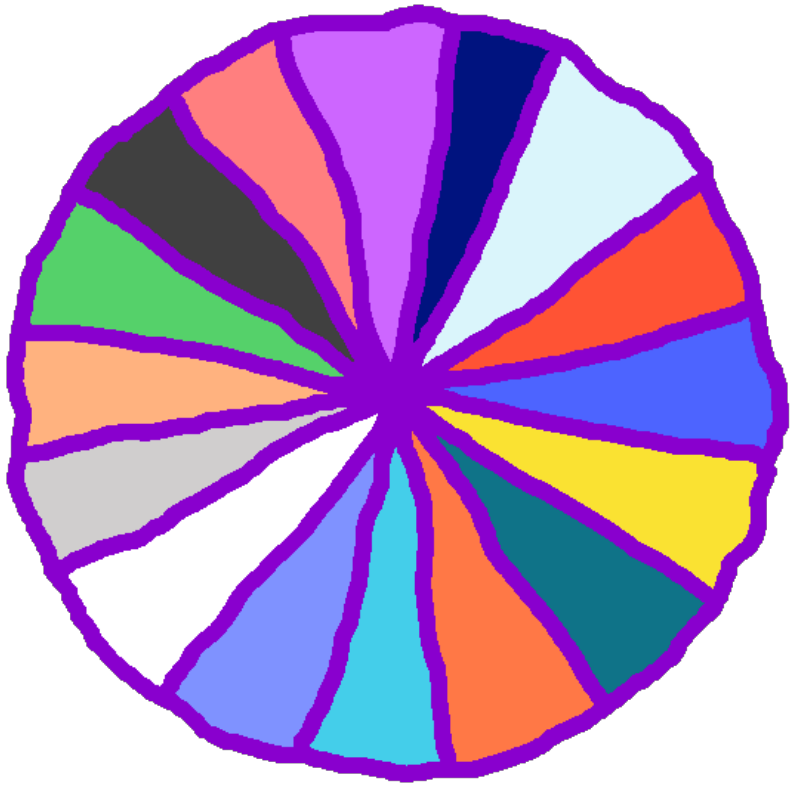
Dashboards

Weekly operations meeting(s)



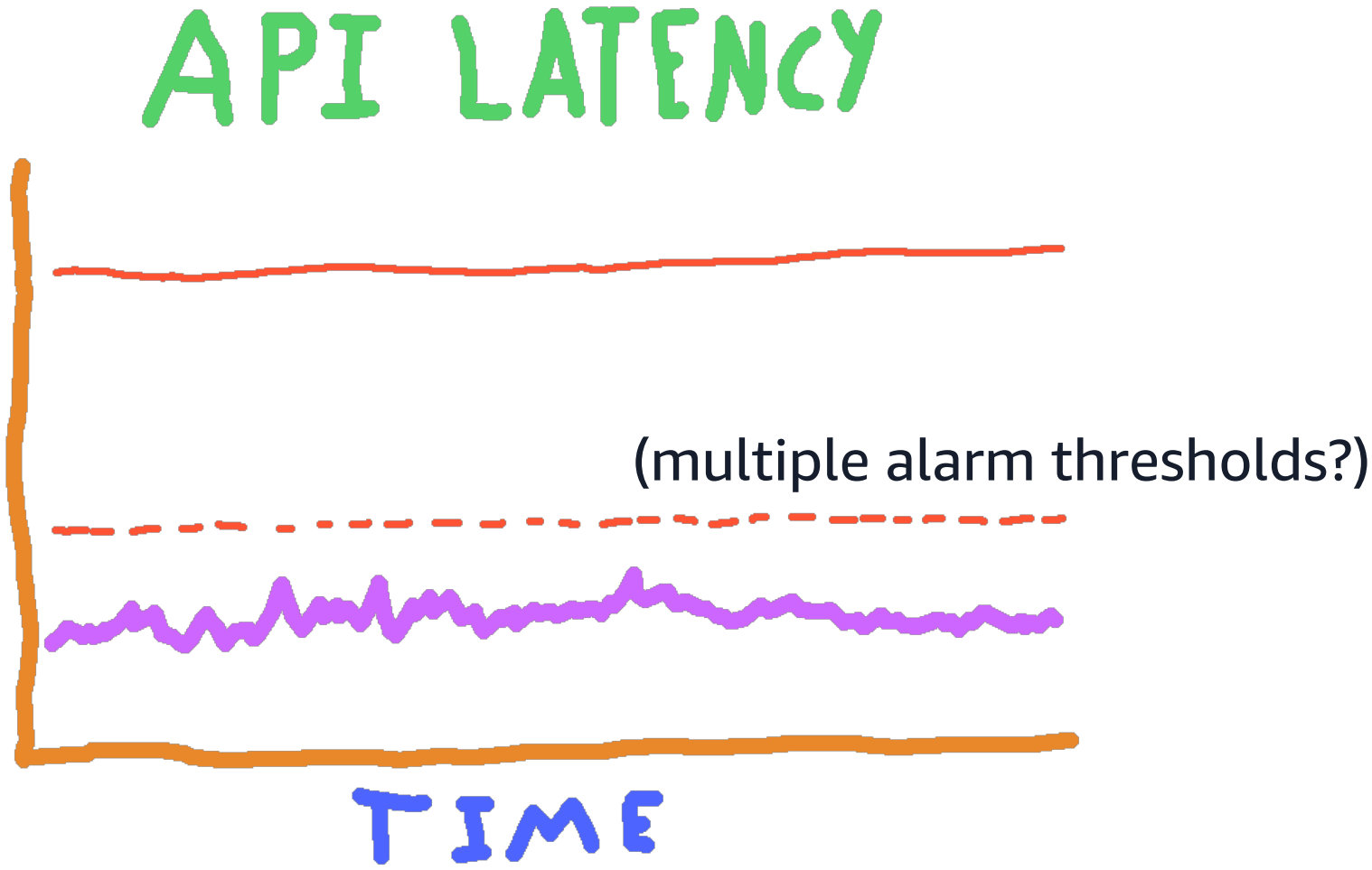


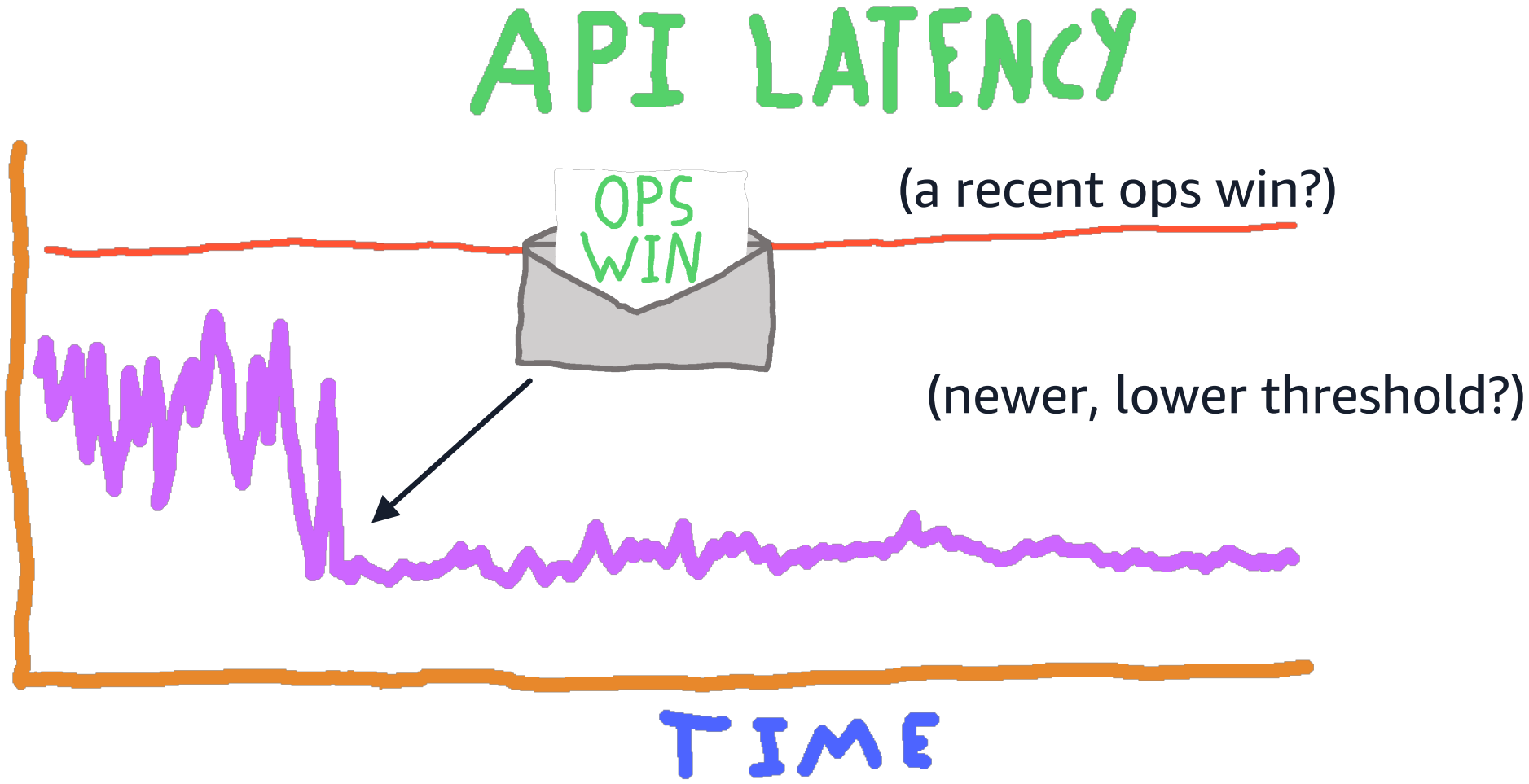
Spinning the wheel



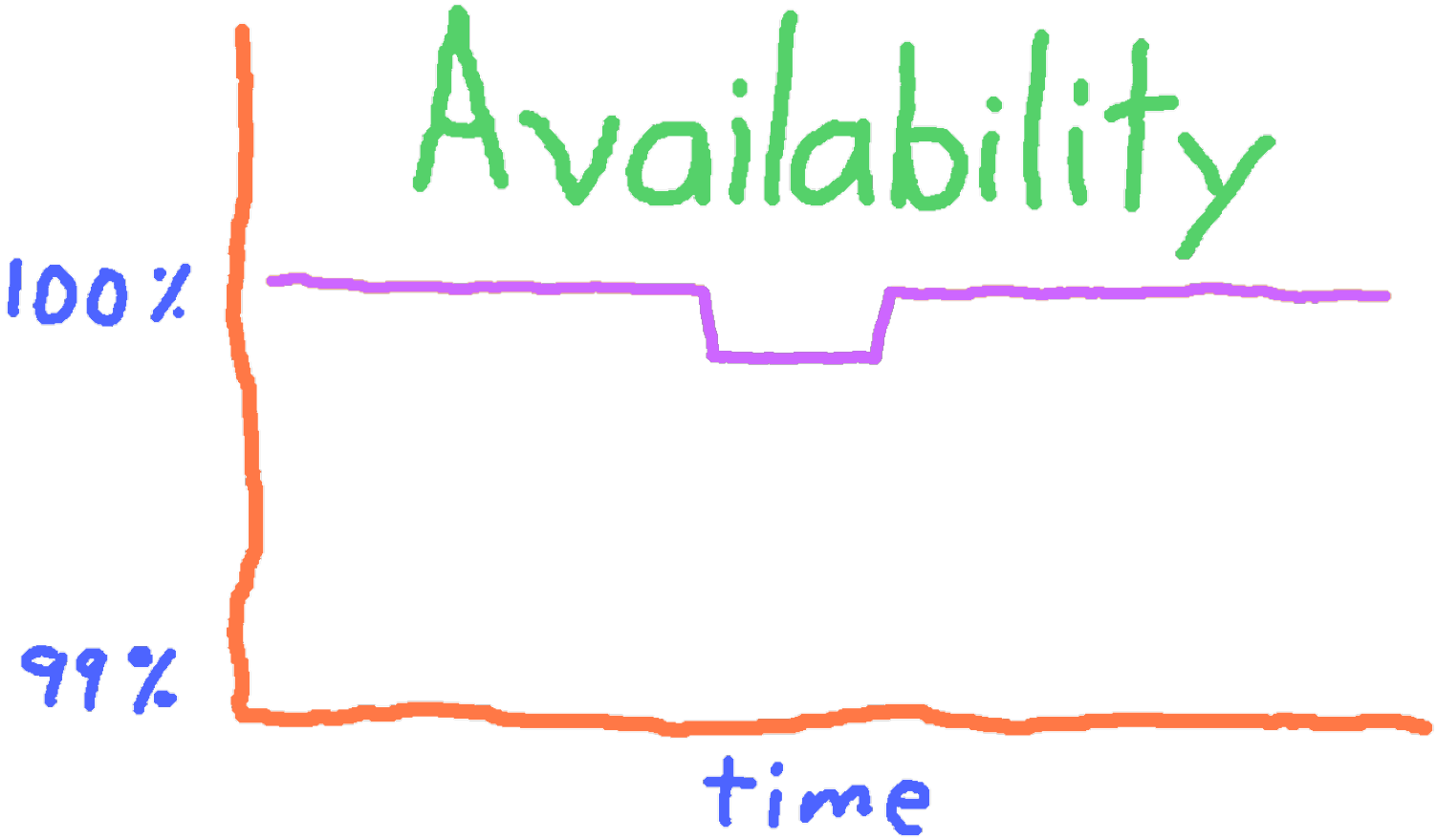
https://github.com/aws/aws-ops-wheel

Feedback on dashboard metrics





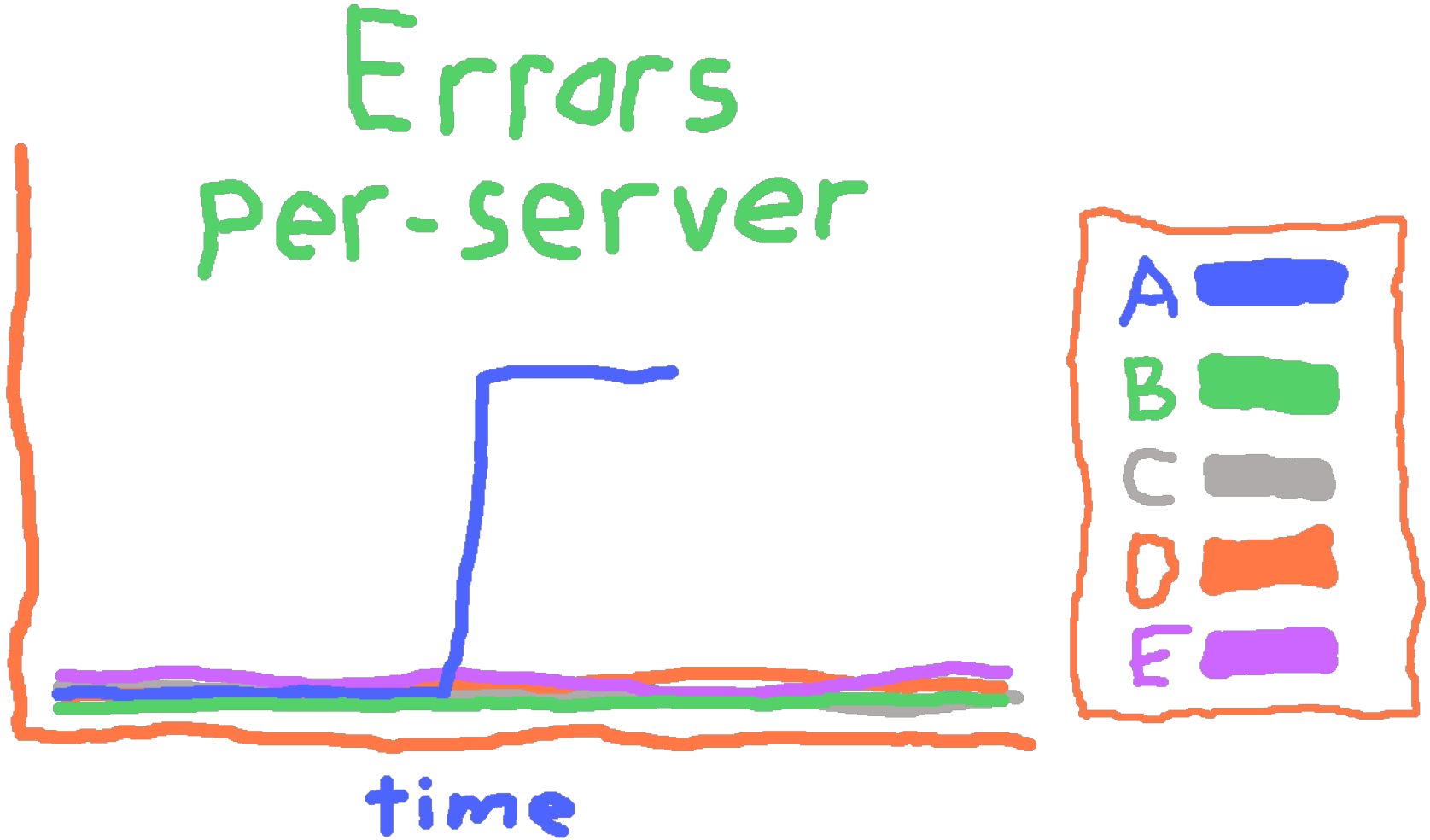
Overall availability



Per-instance availability

Per-instance availability

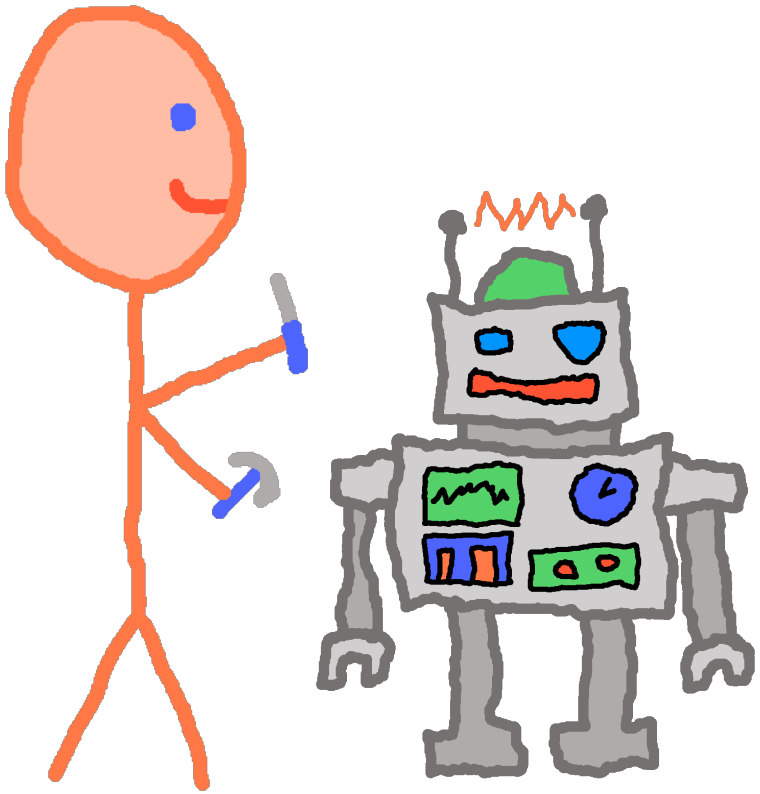
Top-N instances by error count



Amazon CloudWatch Contributor Insights

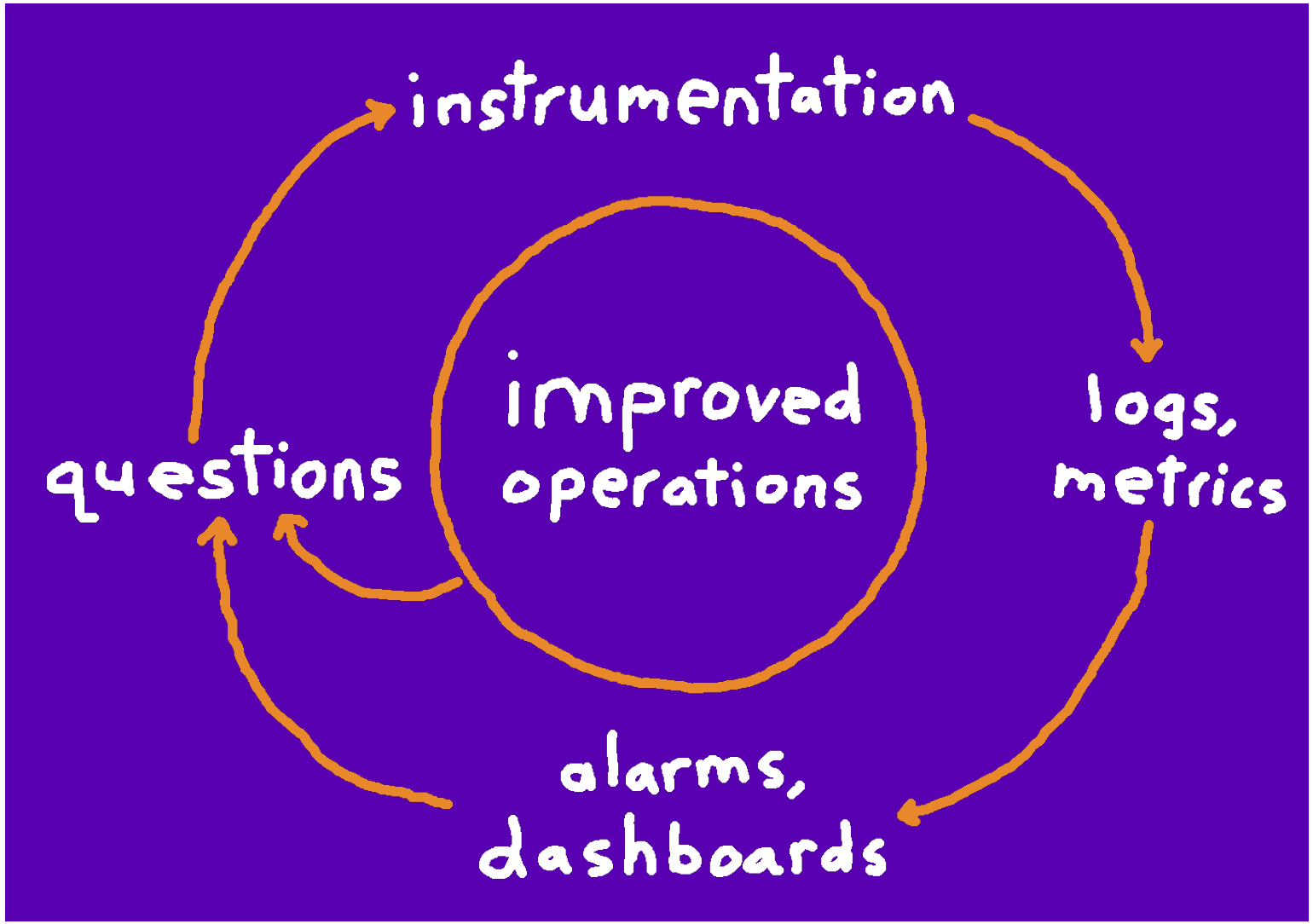
Amazon CloudWatch Contributor Insights allows you to easily view the top contributors impacting the performance of your systems and applications in real-time.

Automation

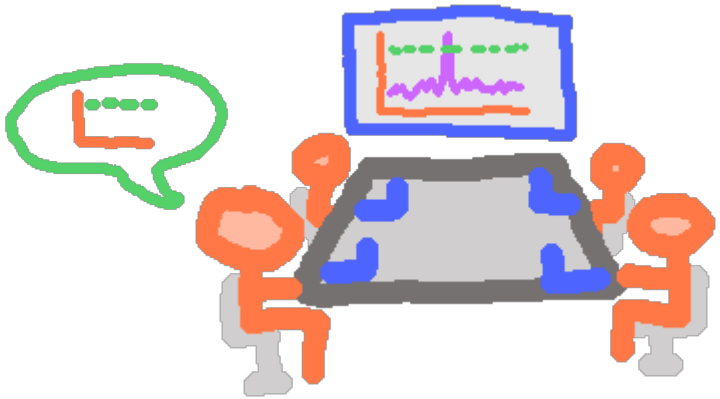


https://aws.amazon.com/builders-library/implementing-health-checks/

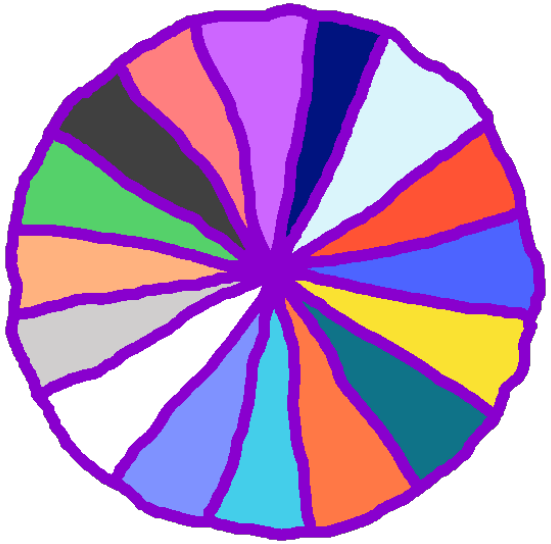
The cycle of monitoring



Takeaways: The ops meeting



Learn from each other



Practice regularly