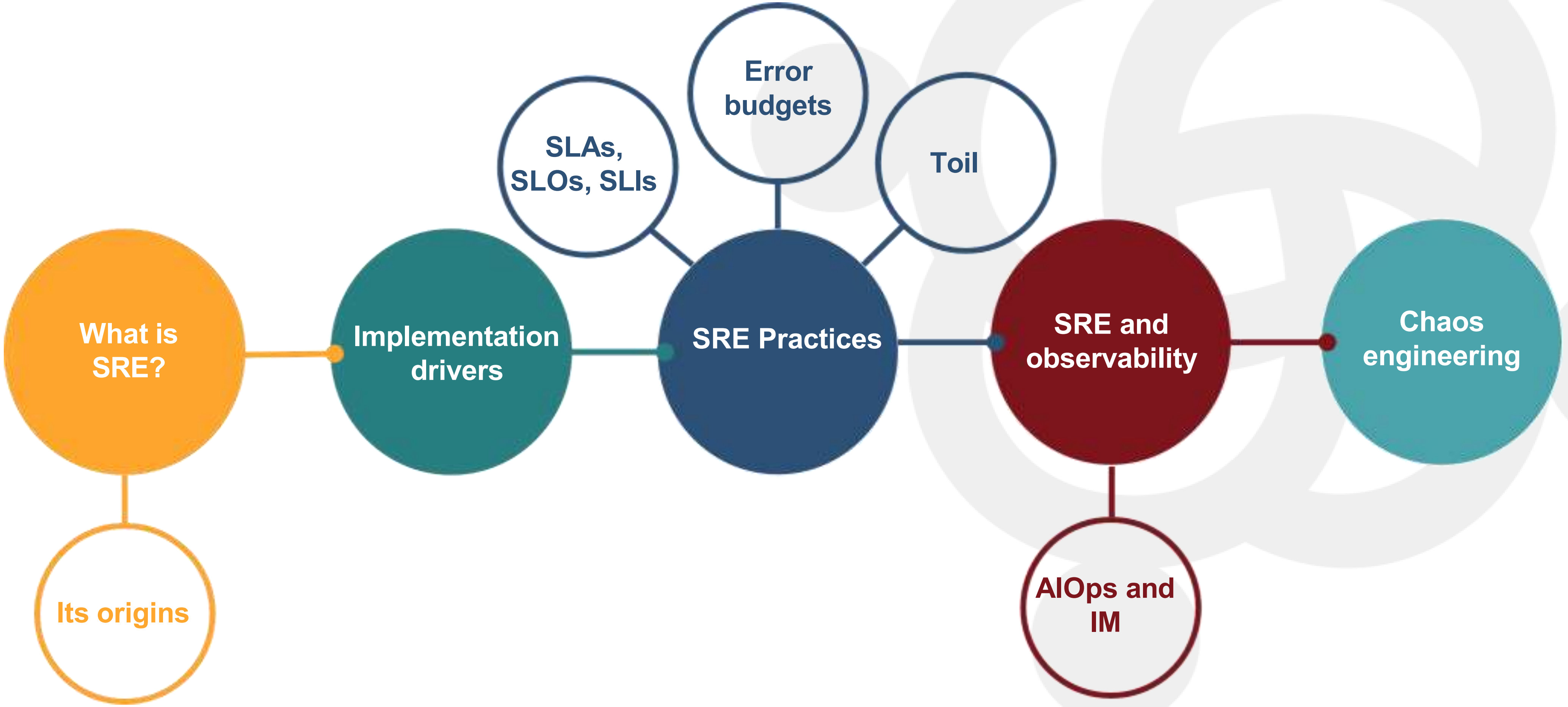
DevOps Institute
ADVANCING THE HUMANS OF DEVOPS

SRE and Incident Management

Flow: Talk map



What is SRE?

Its origins

Implementation drivers

SRE Practices

SLAs, SLOs, SLIs

Error budgets

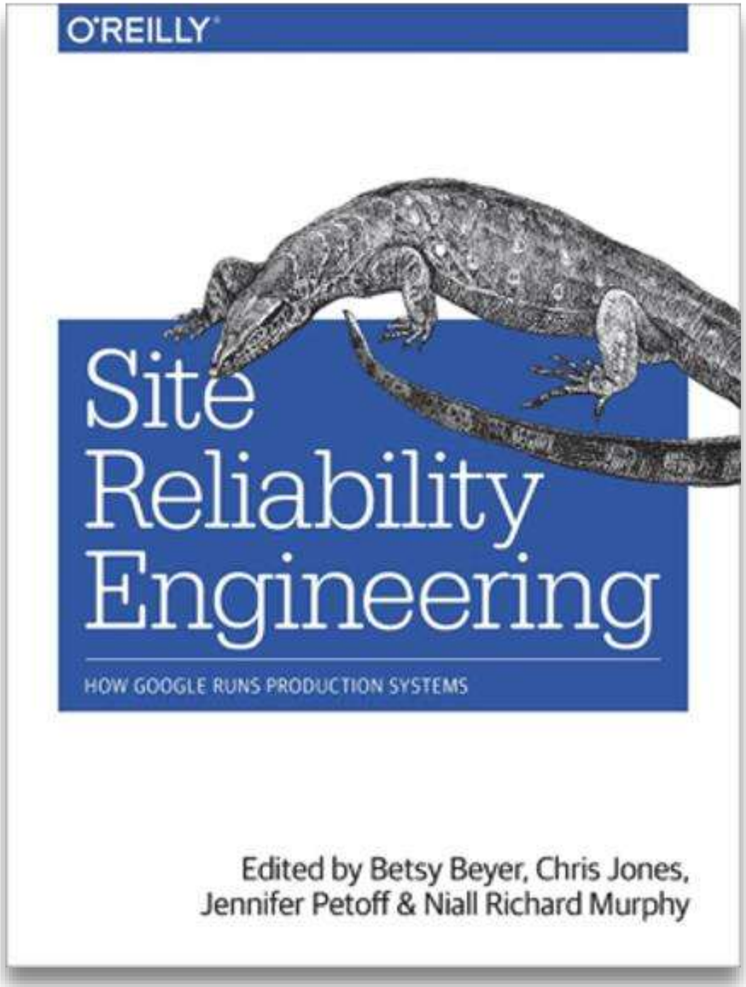
Toil

SRE and observability

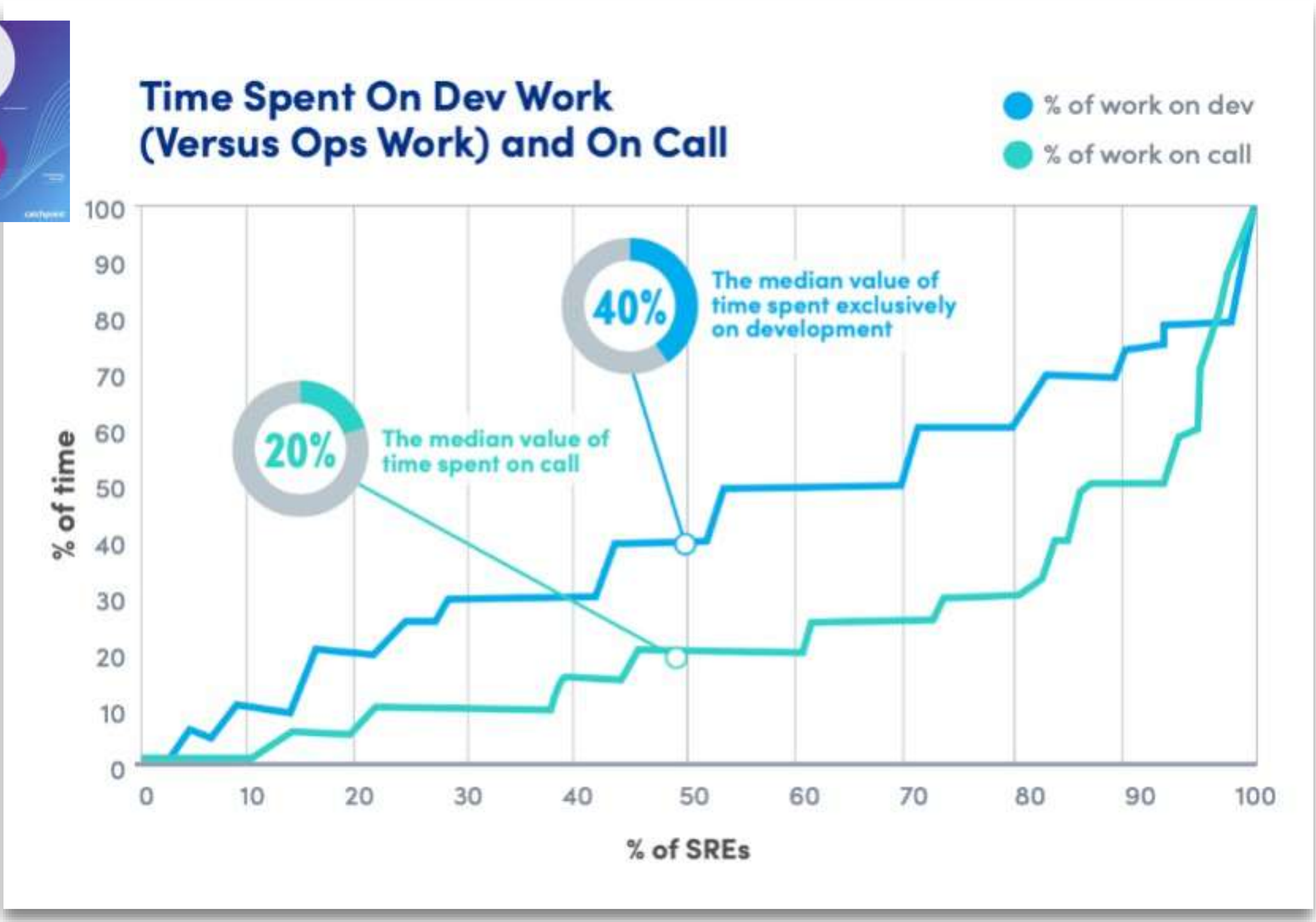
AIOps and IM

Chaos engineering

What is SRE?


O'REILLY
Site Reliability Engineering
HOW GOOGLE RUNS PRODUCTION SYSTEMS
Edited by Betsy Beyer, Chris Jones, Jennifer Petoff & Niall Richard Murphy

- *The goal is to create ultra-scalable and highly reliable distributed software systems*
- *SRE's spend* **50% of their time doing "ops" related work** *such as issue resolution, on-call, and manual interventions*
- *SRE's spend* **50% of their time on development tasks** *such as new features, scaling or automation*
- *Observability, monitoring, alerting and automation are a large part of SRE*

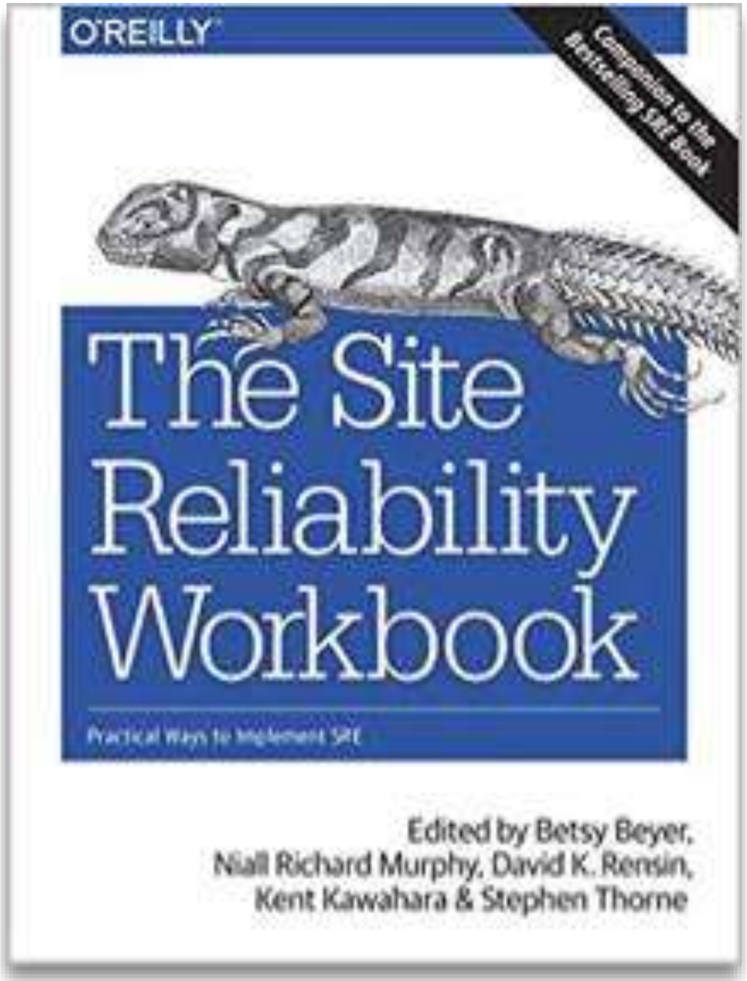


Time Spent On Dev Work (Versus Ops Work) and On Call

40% The median value of time spent exclusively on development

20% The median value of time spent on call

Where has the concept come from?



O'REILLY

Companion to the Bestselling SRE Book

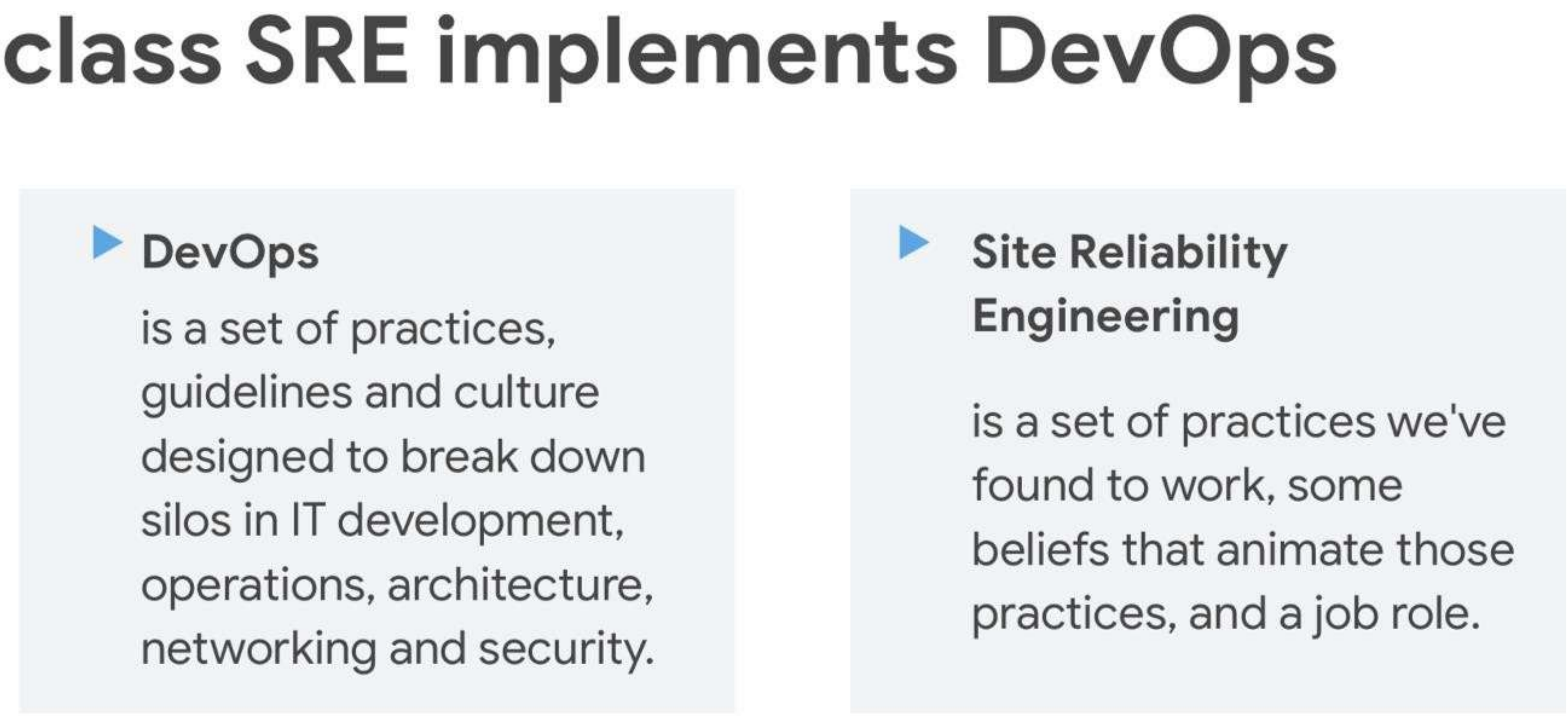
The Site Reliability Workbook

Practical Ways to Implement SRE

Edited by Betsy Beyer,
Niall Richard Murphy, David K. Rensin,
Kent Kawahara & Stephen Thorne

- *Site Reliability Engineering (SRE) is a discipline that incorporates aspects of software engineering and applies them to infrastructure and operations problems*
- *Created at Google around 2003 and publicized via SRE books*

> *"What happens when a software engineer is tasked with what used to be called operations."*
>
> *Ben Treynor, Google*



class SRE implements DevOps

- **DevOps**

  is a set of practices, guidelines and culture designed to break down silos in IT development, operations, architecture, networking and security.

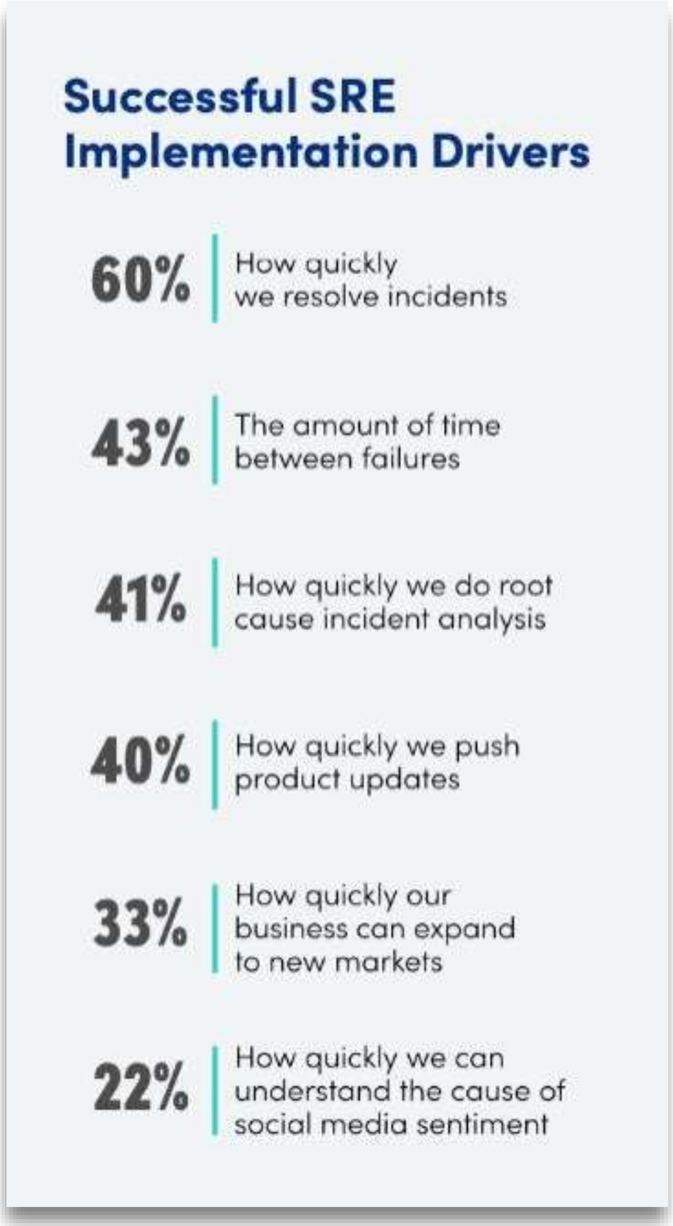
- **Site Reliability Engineering**

  is a set of practices we've found to work, some beliefs that animate those practices, and a job role.

2021 SRE Report

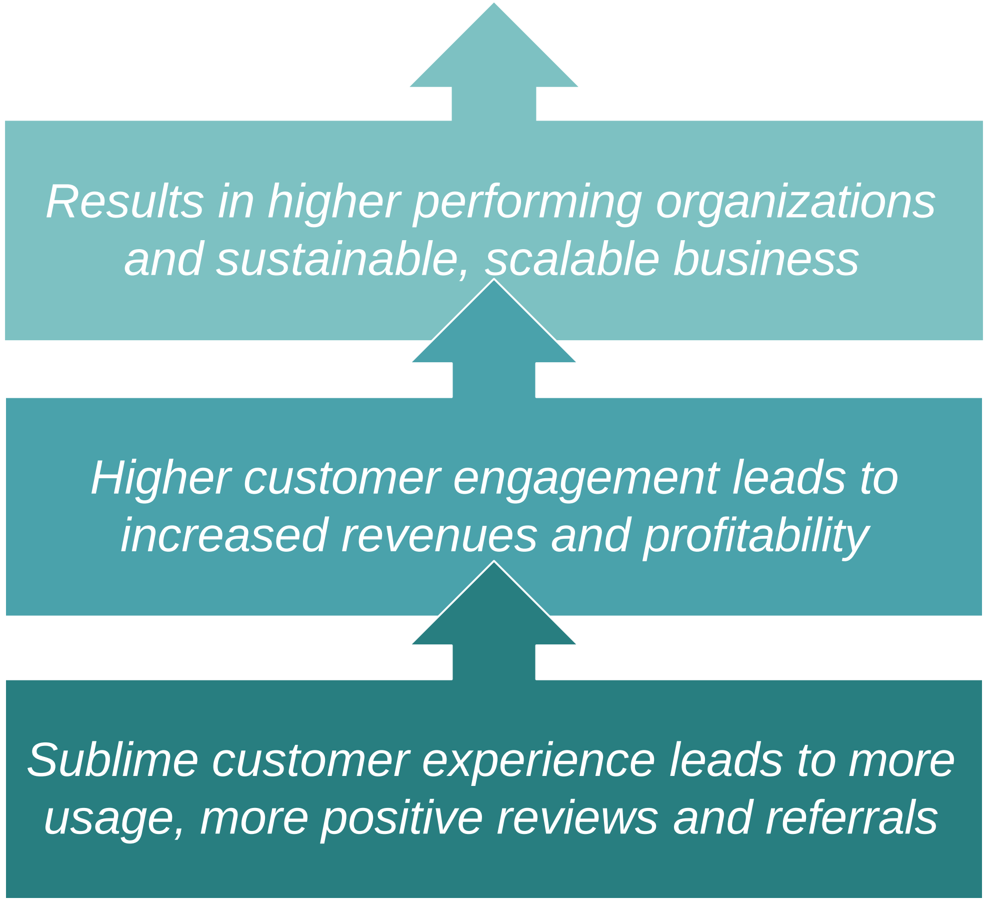
FREE TO BE AN SRE

catchpoint



Successful SRE Implementation Drivers

60%	How quickly we resolve incidents
43%	The amount of time between failures
41%	How quickly we do root cause incident analysis
40%	How quickly we push product updates
33%	How quickly our business can expand to new markets
22%	How quickly we can understand the cause of social media sentiment



Results in higher performing organizations and sustainable, scalable business

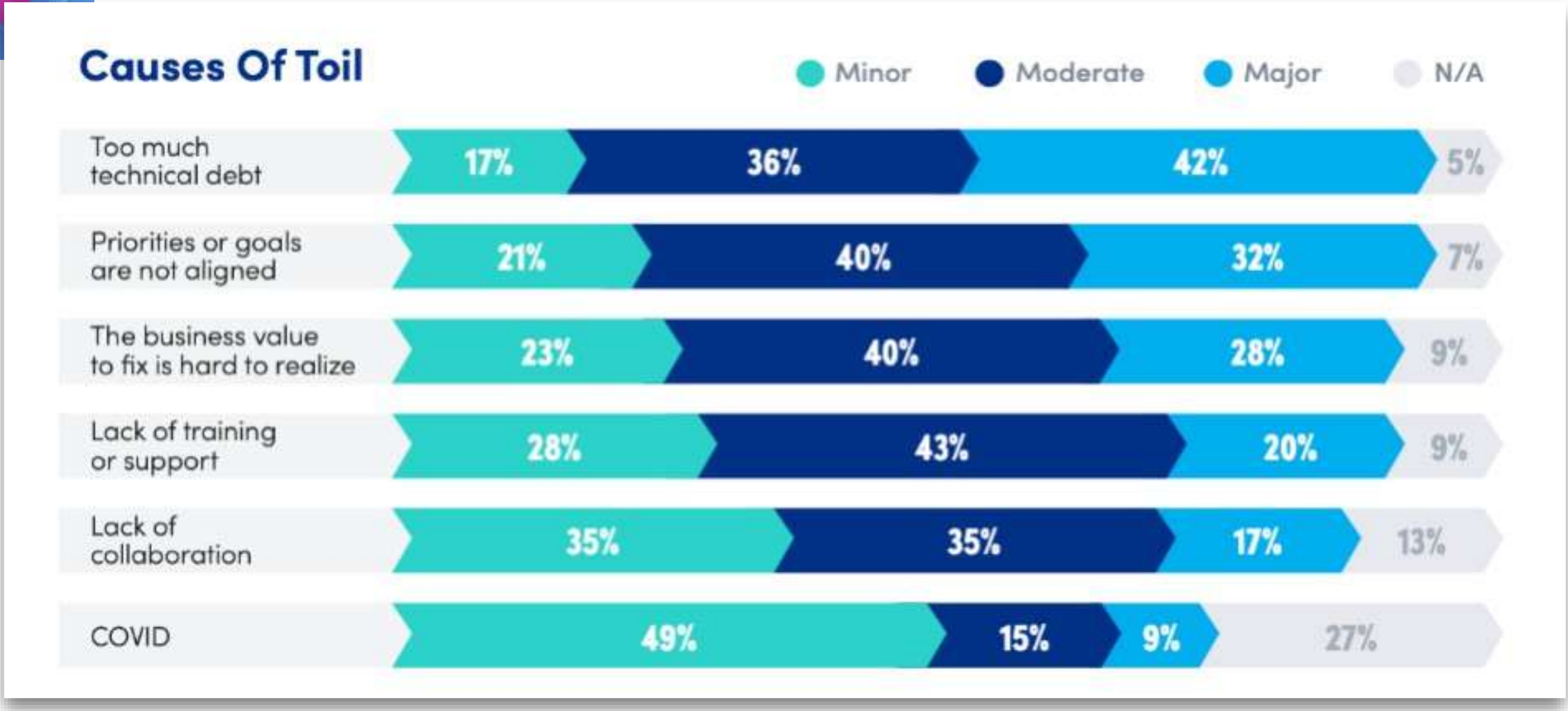
Higher customer engagement leads to increased revenues and profitability

Sublime customer experience leads to more usage, more positive reviews and referrals

Toil and the wisdom of production

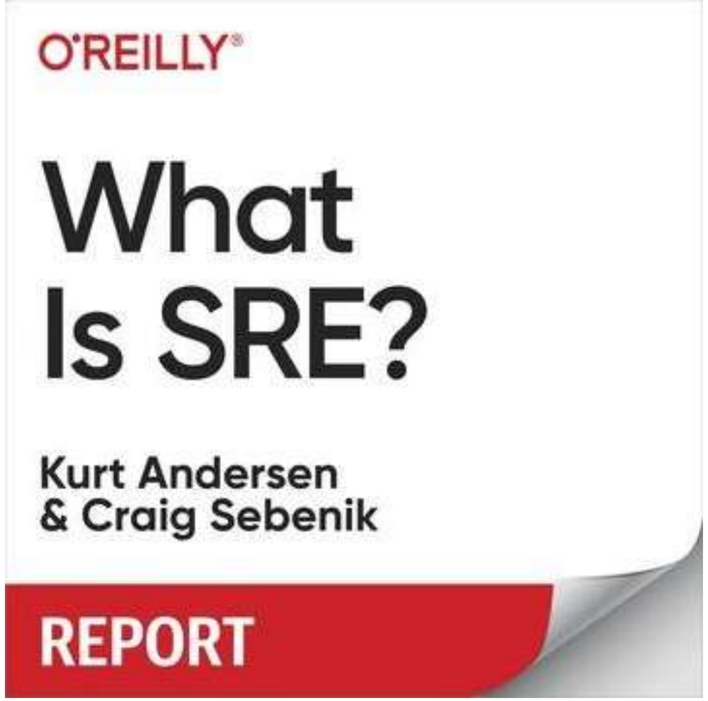
- *Any manual, mandated operational task is bad*
- *If a task can be automated, then it should be automated*
- *Tasks can provide the "wisdom of production" that will inform better system* design and behavior

SREs must have time to make tomorrow better than today



Causes Of Toil

Moving forward to SRE at Slack



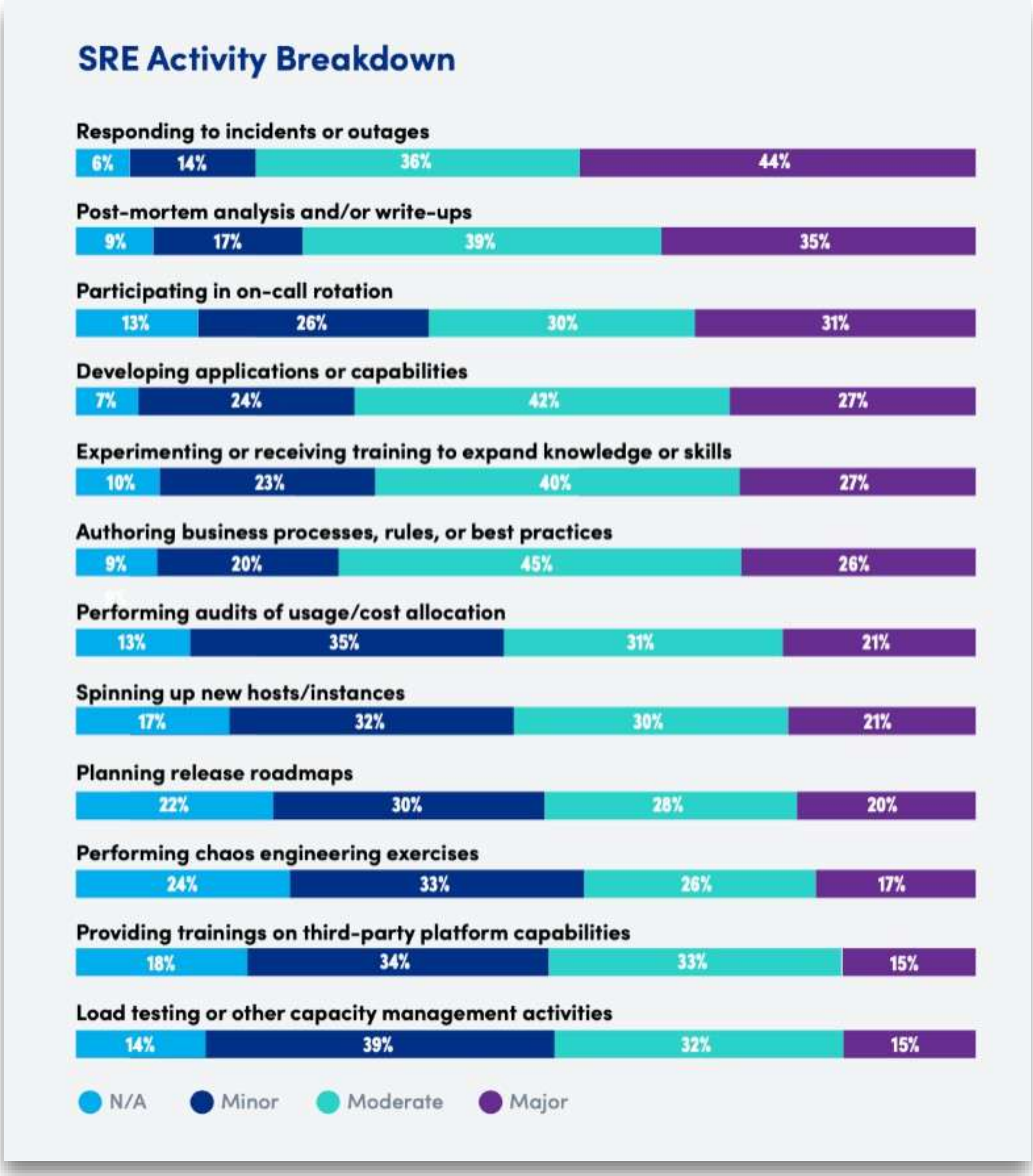
O'REILLY®

What Is SRE?

Kurt Andersen & Craig Sebenik

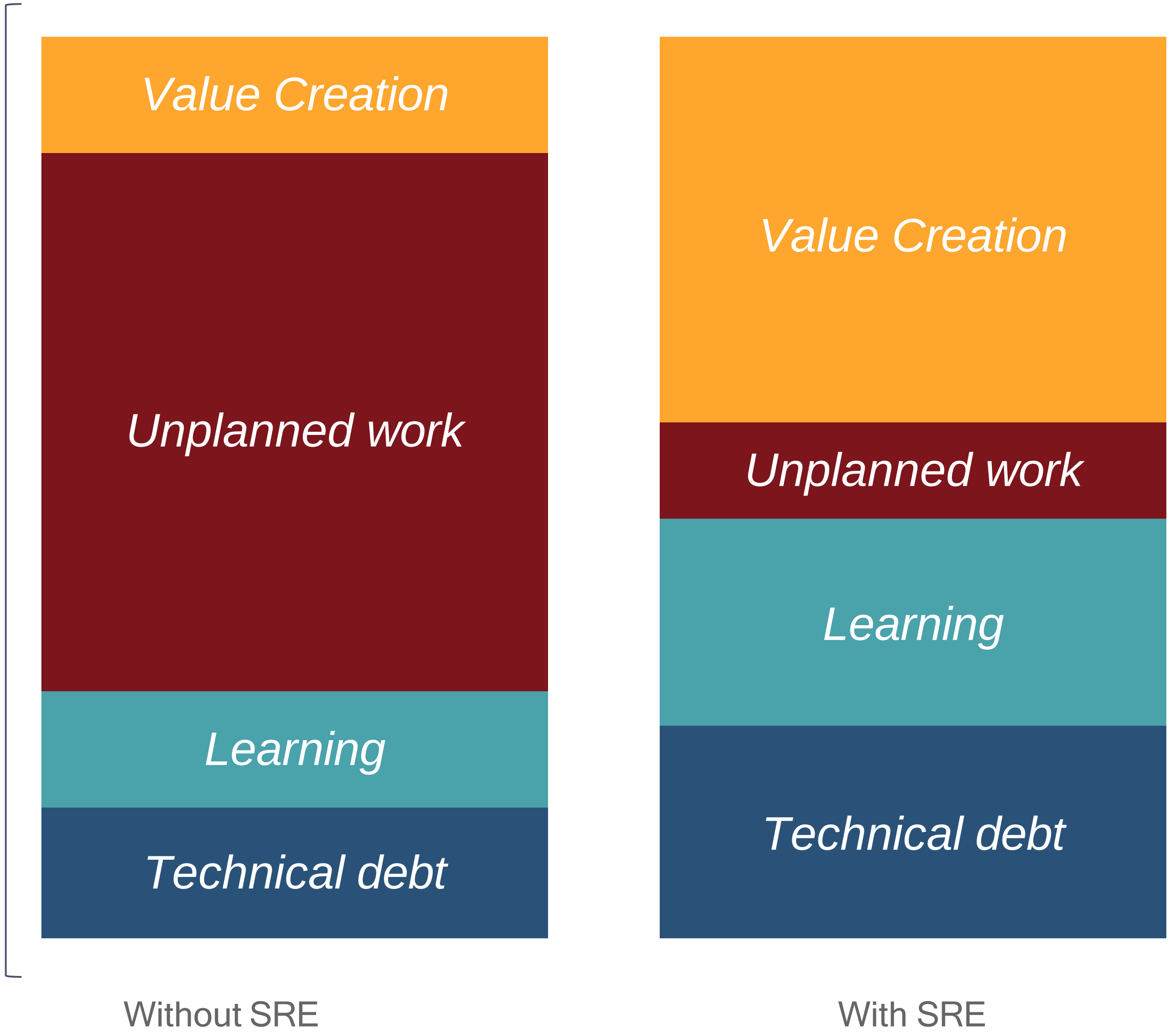
REPORT

- *Slack moved from 100 AWS instances to 15,000 instances over 4 years*
- *Excessive toil caused by low-quality, noisy alerting*
- *Ops teams were so consumed by interrupt-driven toil that they were unable to make progress on improving reliability*
- *Slack* **explicitly committed to the importance of reliability over feature velocity**
- *Operational ownership of services pushed back into the dev teams resulting in the teams making the code fixes necessary to stop the incident alerts*


SRE Activity Breakdown

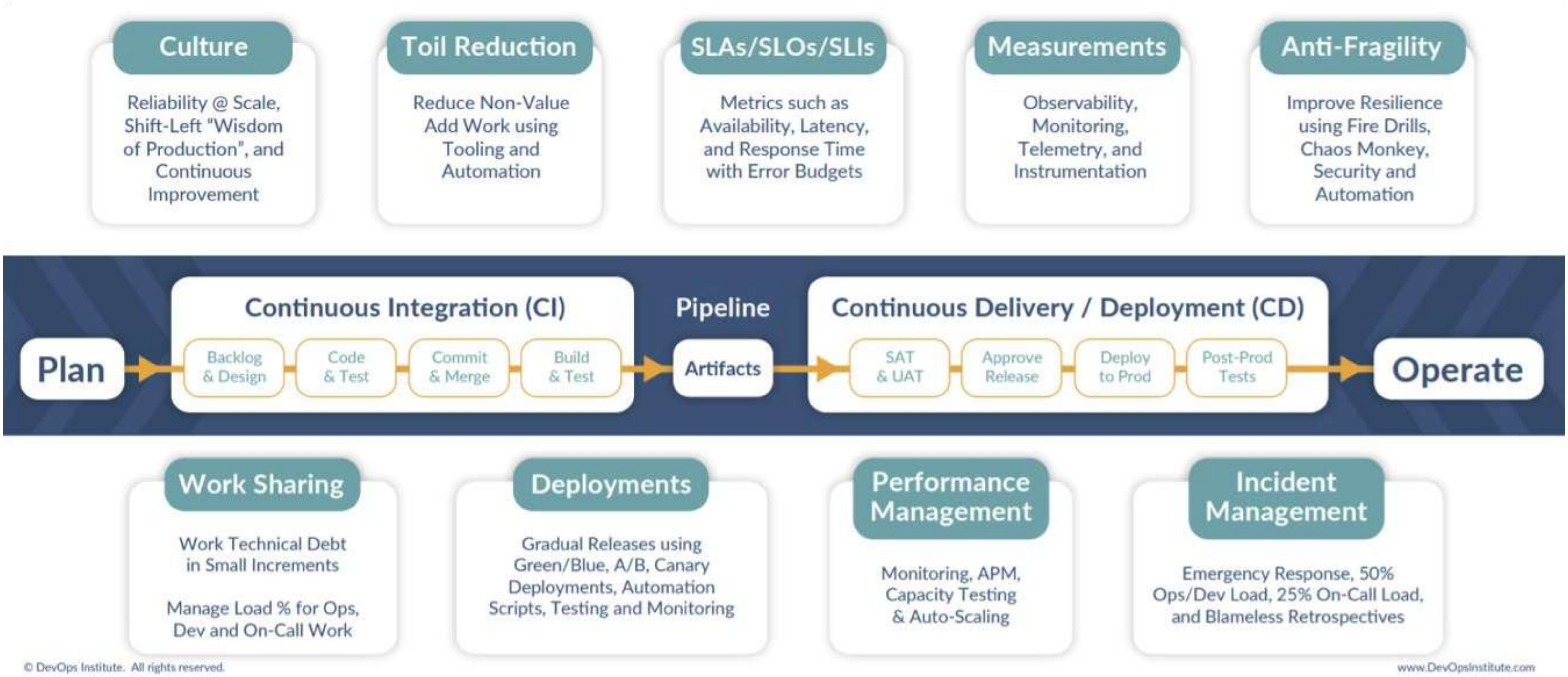
Reducing unplanned work and technical debt

What the team spends their time doing



How investing in SRE increases innovation

SRE principles and practices



Culture
Reliability @ Scale, Shift-Left "Wisdom of Production", and Continuous Improvement

Toil Reduction
Reduce Non-Value Add Work using Tooling and Automation

SLAs/SLOs/SLIs
Metrics such as Availability, Latency, and Response Time with Error Budgets

Measurements
Observability, Monitoring, Telemetry, and Instrumentation

Anti-Fragility
Improve Resilience using Fire Drills, Chaos Monkey, Security and Automation

Plan → Continuous Integration (CI): Backlog & Design, Code & Test, Commit & Merge, Build & Test → Pipeline: Artifacts → Continuous Delivery / Deployment (CD): SAT & UAT, Approve Release, Deploy to Prod, Post-Prod Tests → Operate

Work Sharing
Work Technical Debt in Small Increments

Manage Load % for Ops, Dev and On-Call Work

Deployments
Gradual Releases using Green/Blue, A/B, Canary Deployments, Automation Scripts, Testing and Monitoring

Performance Management
Monitoring, APM, Capacity Testing & Auto-Scaling

Incident Management
Emergency Response, 50% Ops/Dev Load, 25% On-Call Load, and Blameless Retrospectives

www.DevOpsInstitute.com

Source: The SRE Blueprint @ DevOps Institute

SLAs, SLOs and SLIs

Service Level...

In SRE services are managed to the SLO

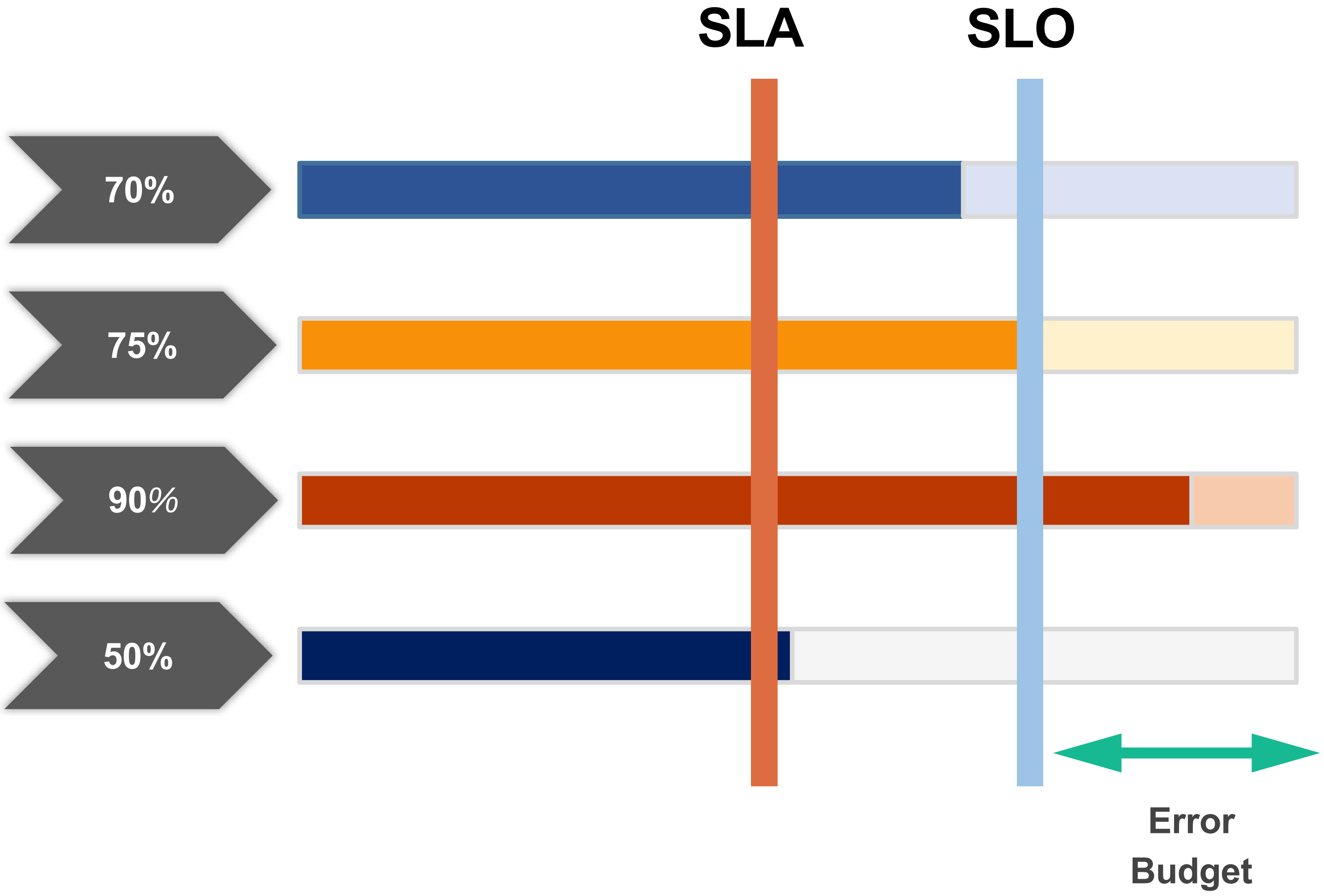
SLA	SLO	SLI
Agreement	*Objective*	*Indicator*
A business contract that comes into effect when your users are so unhappy you have to compensate them in some fashion	*Specify a target level for the reliability of your service e.g., what the success rate should be 98% (it's never 100%)*	*An indicator of the level of service that you are providing e.g., http request success rate 99%*

SLOs need consequences if they are violated

The VALET dimensions of SLO

	Dimension	SLO	Budget	Policy
V	*Volume/traffic*	*Does the service handle the right volumes of data or traffic?*	*Budget: 99.99% of HTTP requests per month succeed with 200 OK*	*Address scalability issues*
A	*Availability*	*Is the service available to users when they need it?*	*Budget: 99.9% availability/uptime*	*Address downtime issues/outages, zero downtime deployments*
L	*Latency*	*Does the service deliver in a user-acceptable period of time?*	*Payload of 90% of HTTP responses returned in under 300ms*	*Address performance issues*
E	*Errors*	*Is the service delivering the capabilities being requested?*	*0.01% of HTTP requests return 4xx or 5xx status codes*	*Analyze and respond to main status codes, new functionality or infrastructure may be required*
T	*Tickets*	*Are our support services efficient?*	*75% of service tickets are automatically resolved*	*Automate more manual processes*

Error budgets

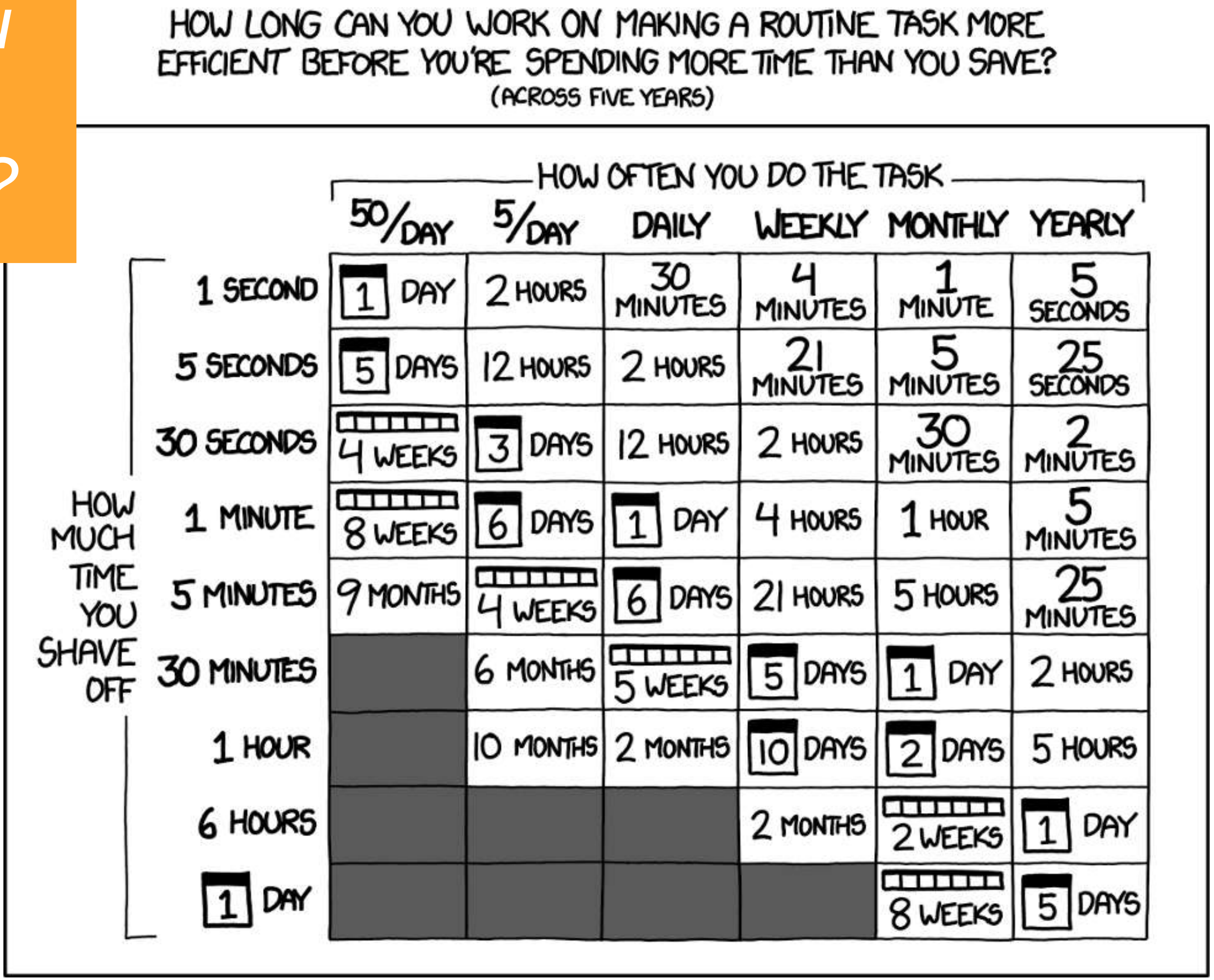


The SLO is a proxy for customer happiness

Error budgets by SLI and SLO

SLI	**SLO**	**ERROR BUDGETS**
[Metric identifier] [Operator] [Metric]	**[Objective] [SLI] [Period]**	**[Error Budget] [SLI]**
Home page request served in **< 100 ms**	**95% of** *home page requests served in < 100ms* **over past 24 hours**	**Allow 5% failure** *of home page requests served in < 100ms over past 24 hours*
95th percentile of Home page latency over 5 mins **< 200ms**	**99% of** *95th percentile of home page latency over 5 mins < 200ms* **for the past month**	**Allow 1% failure** *of 95% percentile home latency over 5 minutes < 200ms for the past month*
Requests should be completed **within 250 ms**	**95% of** *requests should be completed within 250 ms* **over 24 hours**	**Allow 5% failure** *of requests should be completed within 250 ms over 24 hours*
Services should be **available for 99.99% of time** *(based on* **heartbeat events** *from bounded system)*	*95% of Services should be available for 99.99% of time* **over 30 days**	**Allow 5% failure** *of services availability over 30 days*
Book page request response code **!= 5xx**	**99% of** *book page request response code !=5xx over the* **past 7 days**	**Allow for 1% failure** *of book page request response code != 5xx over the last 7 days*

Should you automate everything?

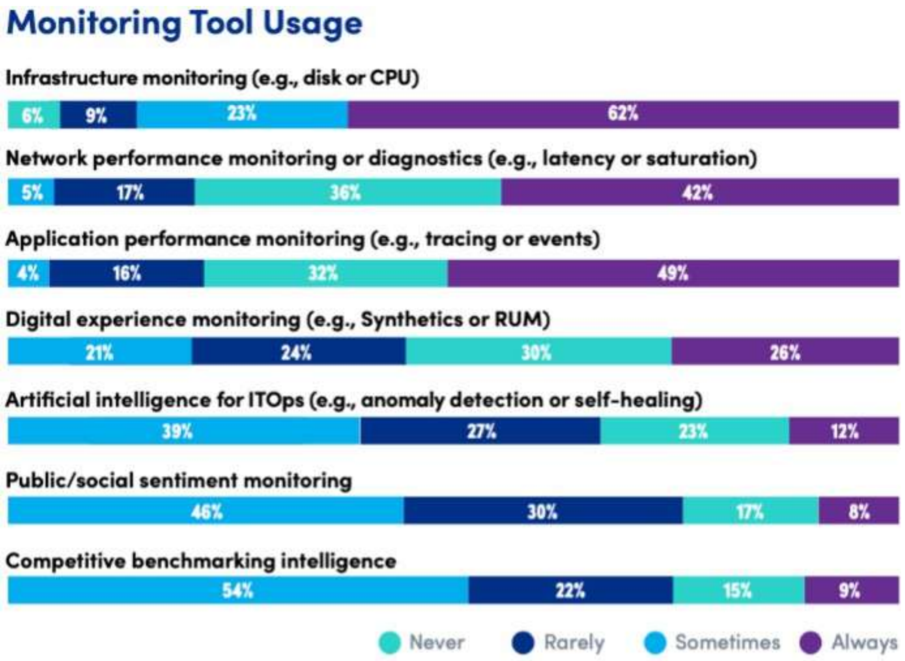


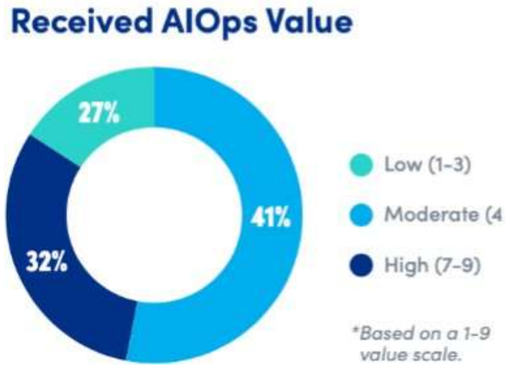
HOW LONG CAN YOU WORK ON MAKING A ROUTINE TASK MORE EFFICIENT BEFORE YOU'RE SPENDING MORE TIME THAN YOU SAVE?
(ACROSS FIVE YEARS)

	HOW OFTEN YOU DO THE TASK					
HOW MUCH TIME YOU SHAVE OFF	50/DAY	5/DAY	DAILY	WEEKLY	MONTHLY	YEARLY
1 SECOND	1 DAY	2 HOURS	30 MINUTES	4 MINUTES	1 MINUTE	5 SECONDS
5 SECONDS	5 DAYS	12 HOURS	2 HOURS	21 MINUTES	5 MINUTES	25 SECONDS
30 SECONDS	4 WEEKS	3 DAYS	12 HOURS	2 HOURS	30 MINUTES	2 MINUTES
1 MINUTE	8 WEEKS	6 DAYS	1 DAY	4 HOURS	1 HOUR	5 MINUTES
5 MINUTES	9 MONTHS	4 WEEKS	6 DAYS	21 HOURS	5 HOURS	25 MINUTES
30 MINUTES	■	6 MONTHS	5 WEEKS	5 DAYS	1 DAY	2 HOURS
1 HOUR	■	10 MONTHS	2 MONTHS	10 DAYS	2 DAYS	5 HOURS
6 HOURS	■	■	■	2 MONTHS	2 WEEKS	1 DAY
1 DAY	■	■	■	■	8 WEEKS	5 DAYS

SRE and Observability/Monitoring

Observability is a characteristic of systems; that they can be observed. It’s closely related to a DevOps tenet: ‘telemetry everywhere’, meaning that anything we implement is emitting data about its activities. It requires intentional behavior during digital product and platform design and a conducive architecture. It’s not monitoring. Monitoring is what we do when we observe our observable systems and the tools category that largely makes this possible.





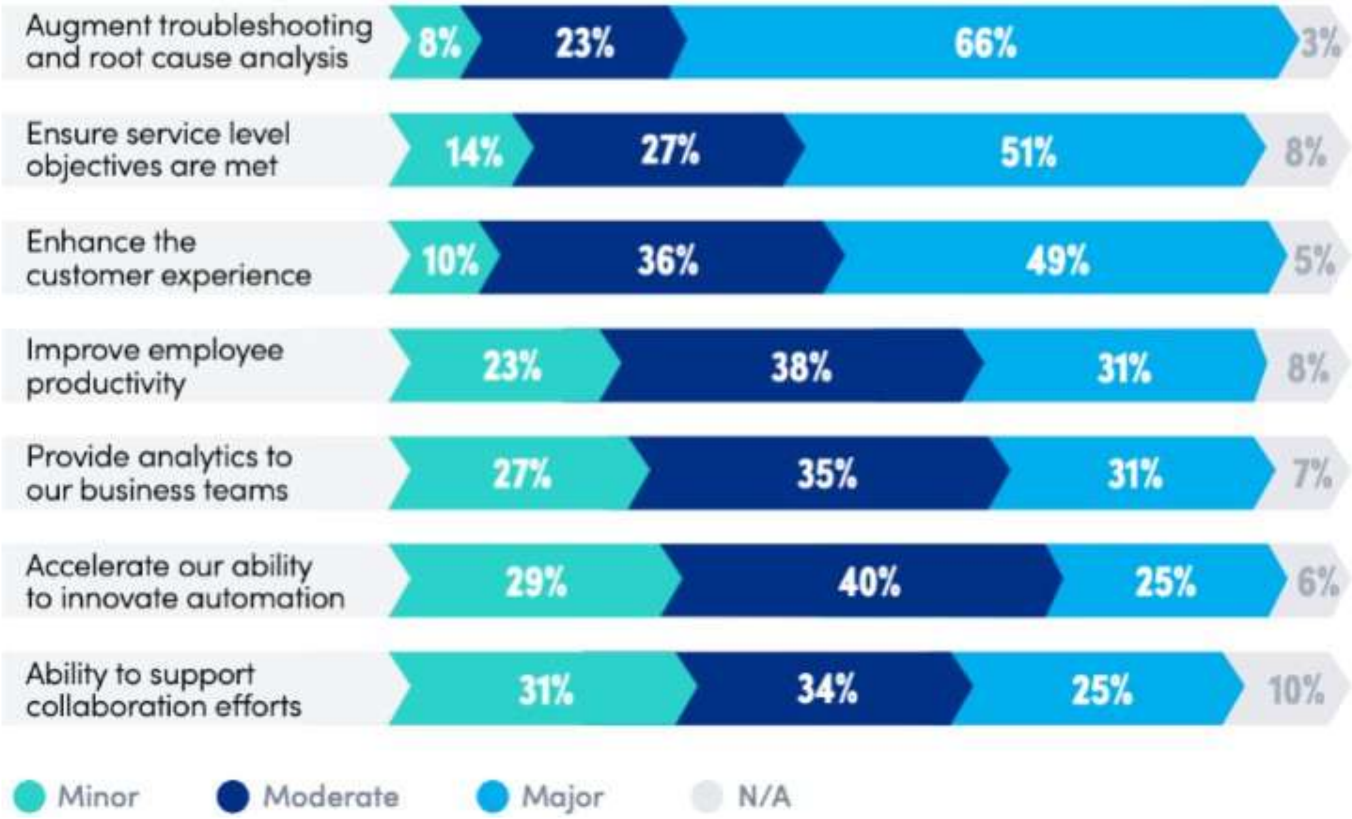
SRE persona

How Observability Supports SRE’s Goals

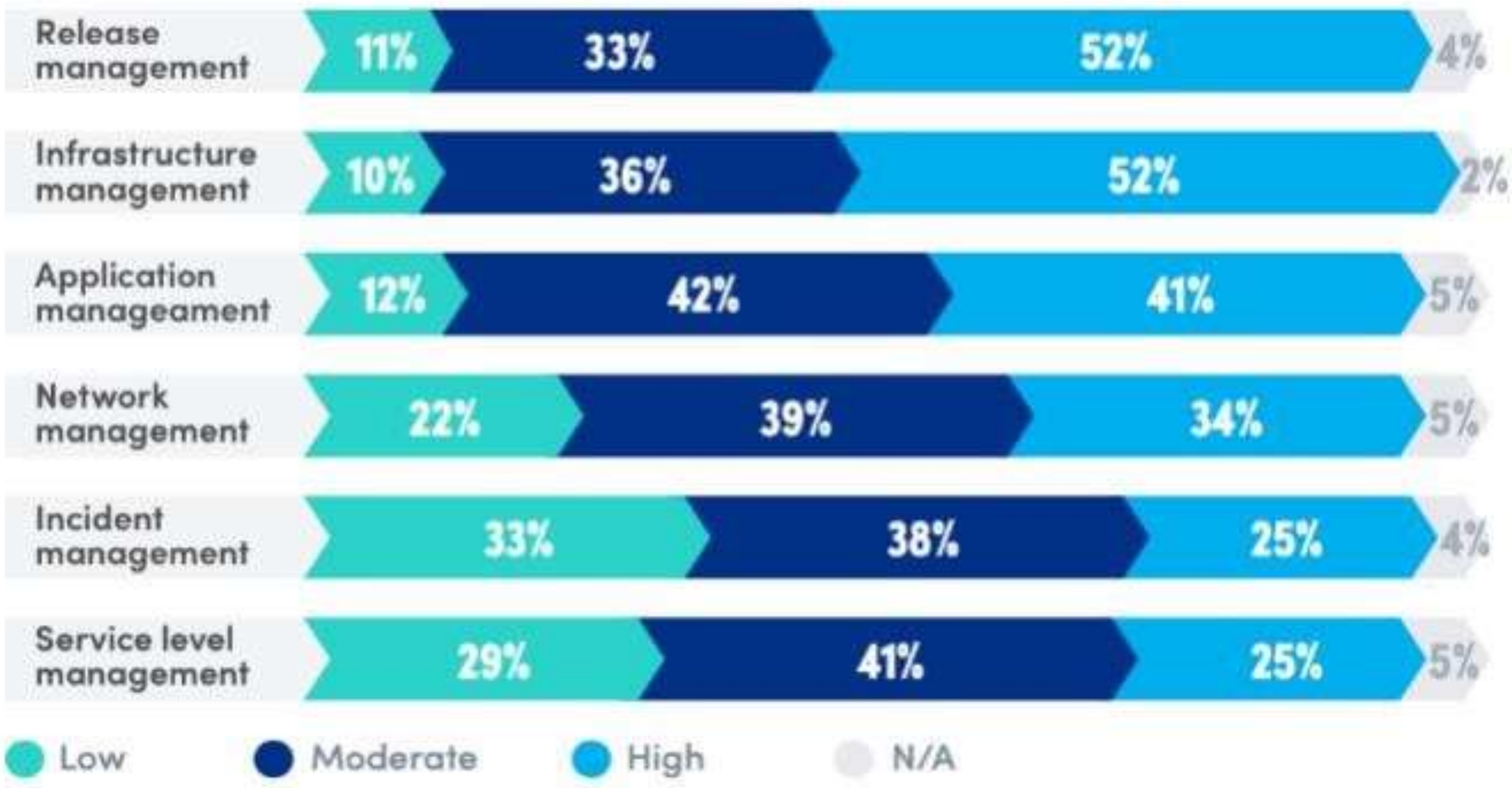
- *Reducing the toil associated with incident management – particularly around cause analysis – improving uptime and MTTR*
- *Providing a platform for inspecting and adapting according to SLOs and ultimately improving teams’ ability to meet them*
- *Offering a potential solution to improve when SLOs are not met, and error budgets are over-spent*
- *Relieving team cognitive load when dealing with vast amounts of data – reducing burnout*
- *Releasing humans and teams from toil, improving productivity, innovation and the flow and delivery of value*
- *Supporting multifunctional, autonomous teams and the “we build it, we own it” DevOps mantra*
- *Completing the value stream cycle by providing insights around value outcomes that can be fed back into the innovation phase*

Icons by Freepik and Phatplus from FlatIcon

Monitoring Data Usage Drivers

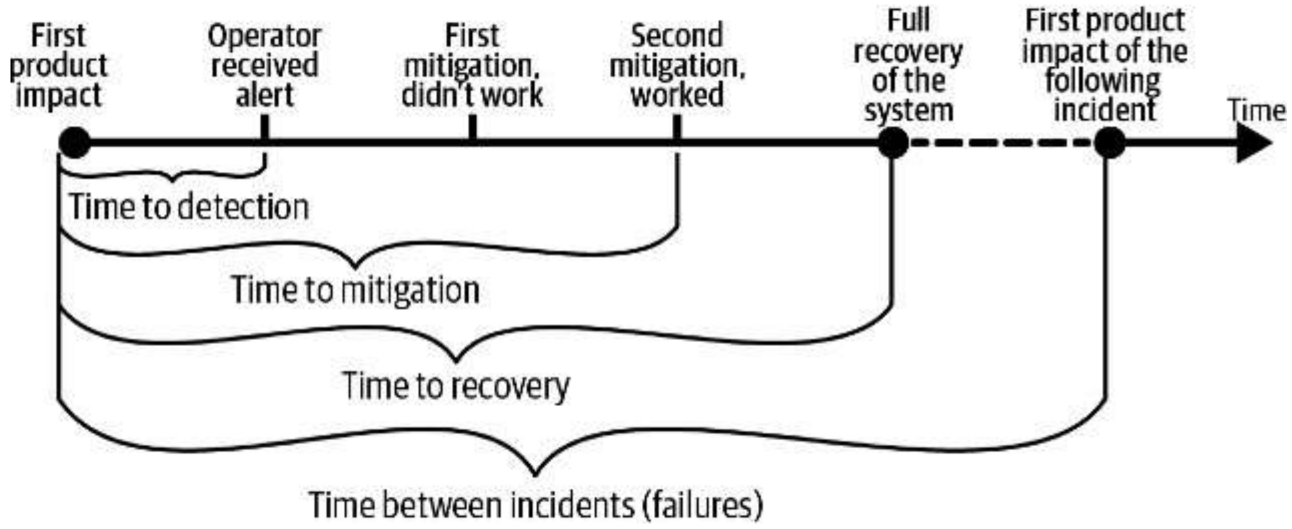


Use Case Automation Levels

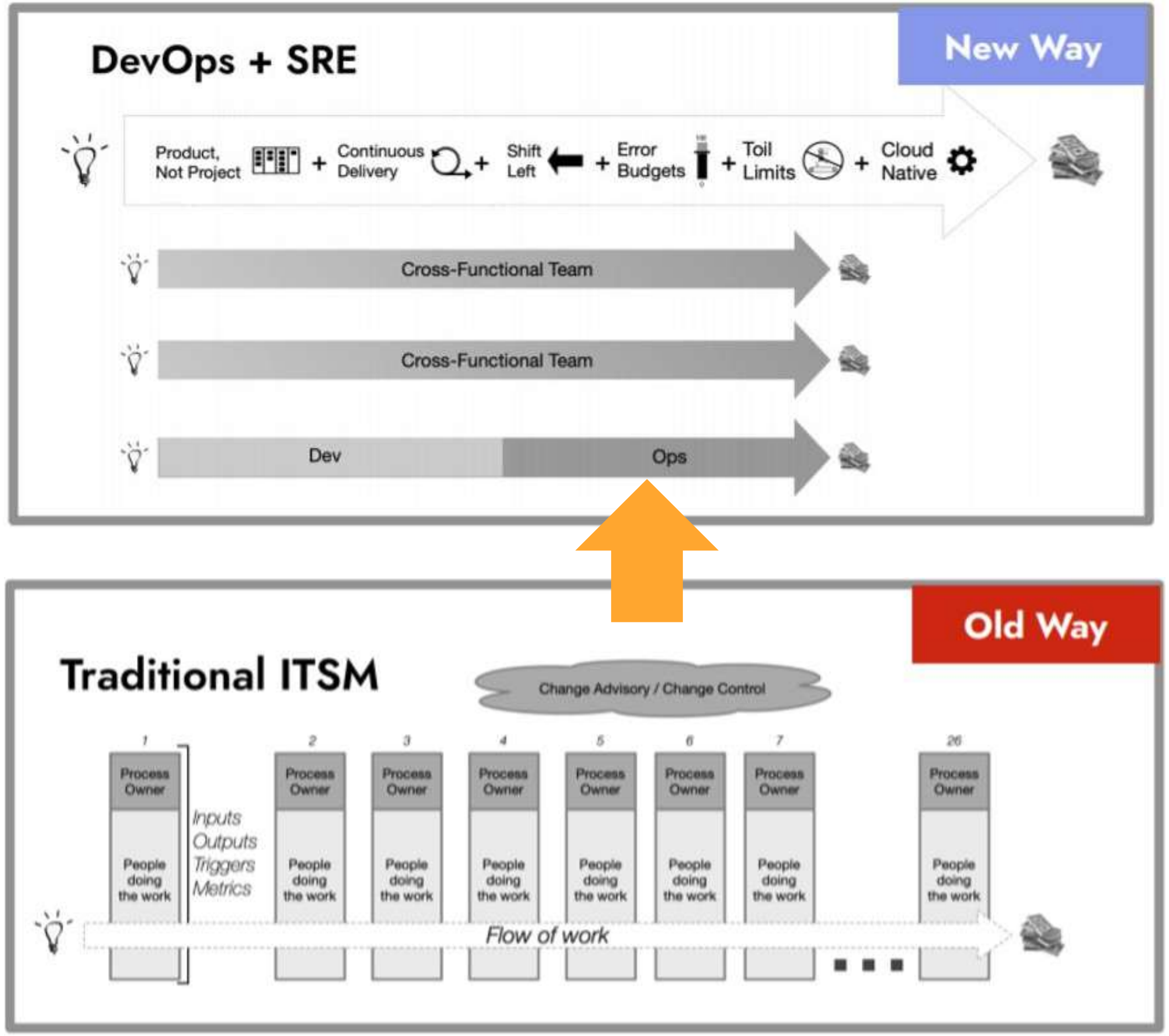


Good practices for Incident Management

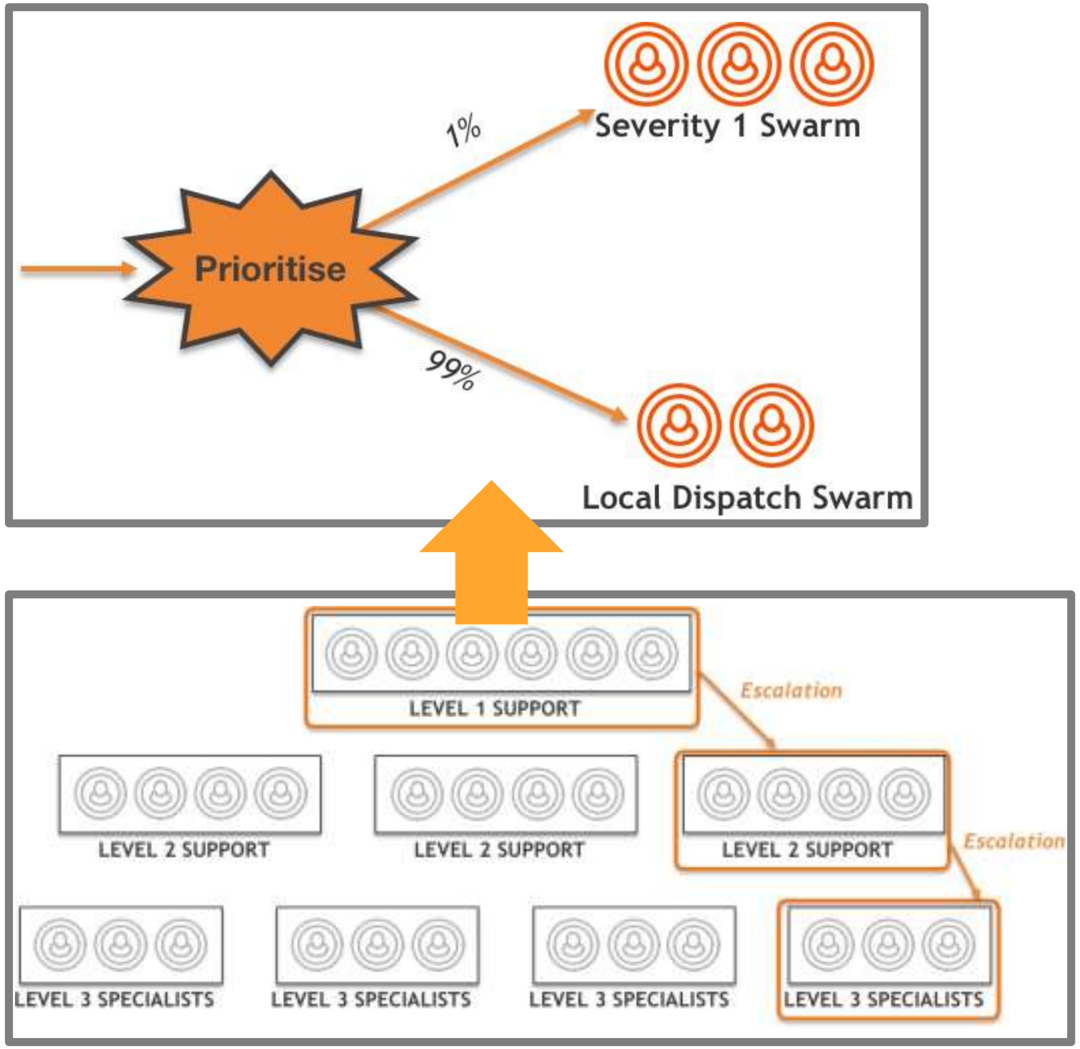
One of the key responsibilities of SRE is to manage incidents of the production system(s) that they are responsible for. Within an incident, SREs contribute to debugging the system, choosing the right immediate mitigation, and organizing the incident response if it requires broader coordination


First product impact
Operator received alert
First mitigation, didn't work
Second mitigation, worked
Full recovery of the system
First product impact of the following incident
Time
Time to detection
Time to mitigation
Time to recovery
Time between incidents (failures)

- *Defect prevention*
- *Strategies for deploy/roll back/ roll forward (Feature Flags, Blue-Green, Canary)*
- *Auto remediation*
- *Reverting system*

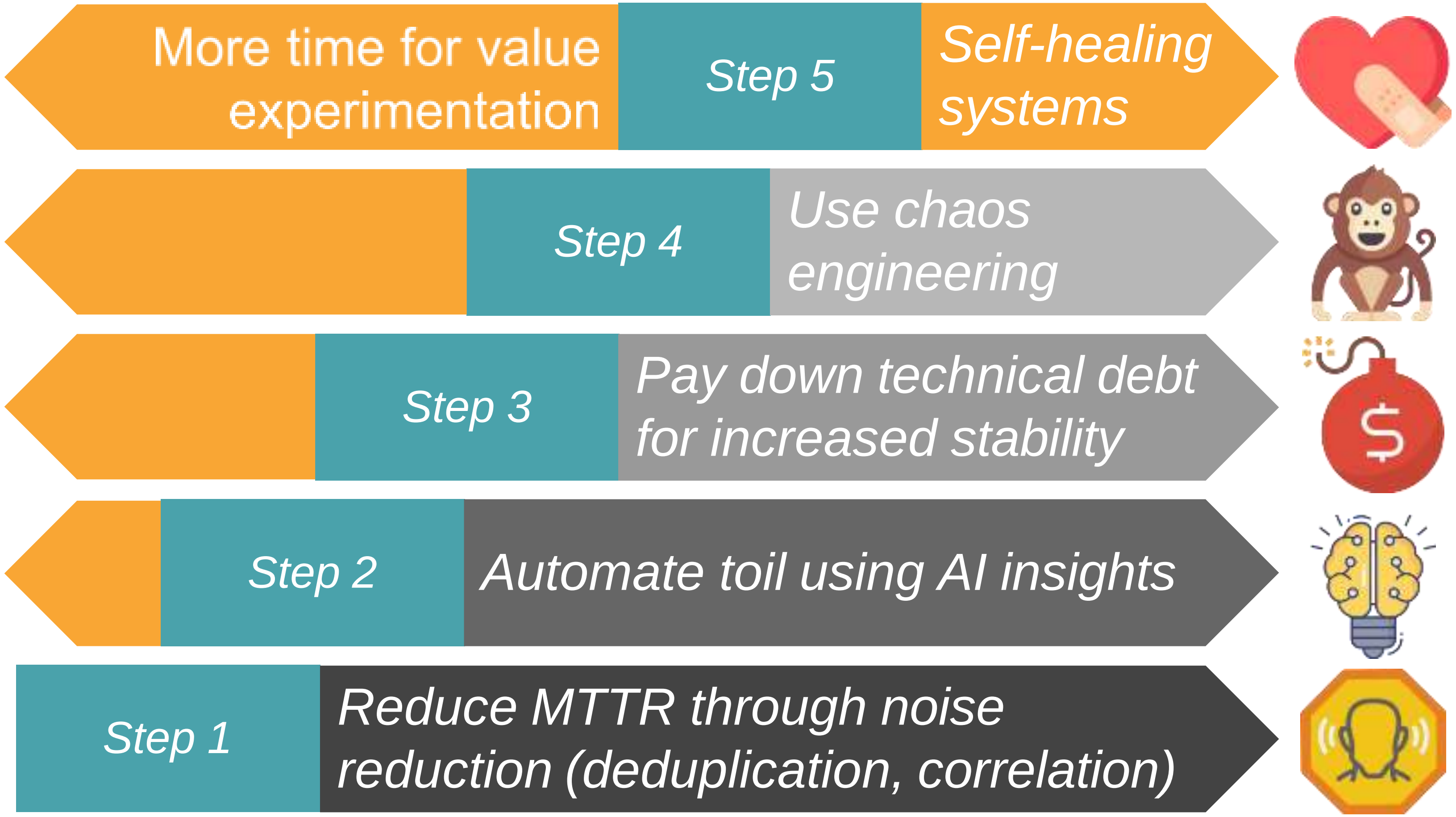


Source: Damon Edwards



Source: Jon Stevens-Hall

IM, Observability, AIOps and the SRE



Step 5

More time for value experimentation

Self-healing systems

Step 4

Use chaos engineering

Step 3

Pay down technical debt for increased stability

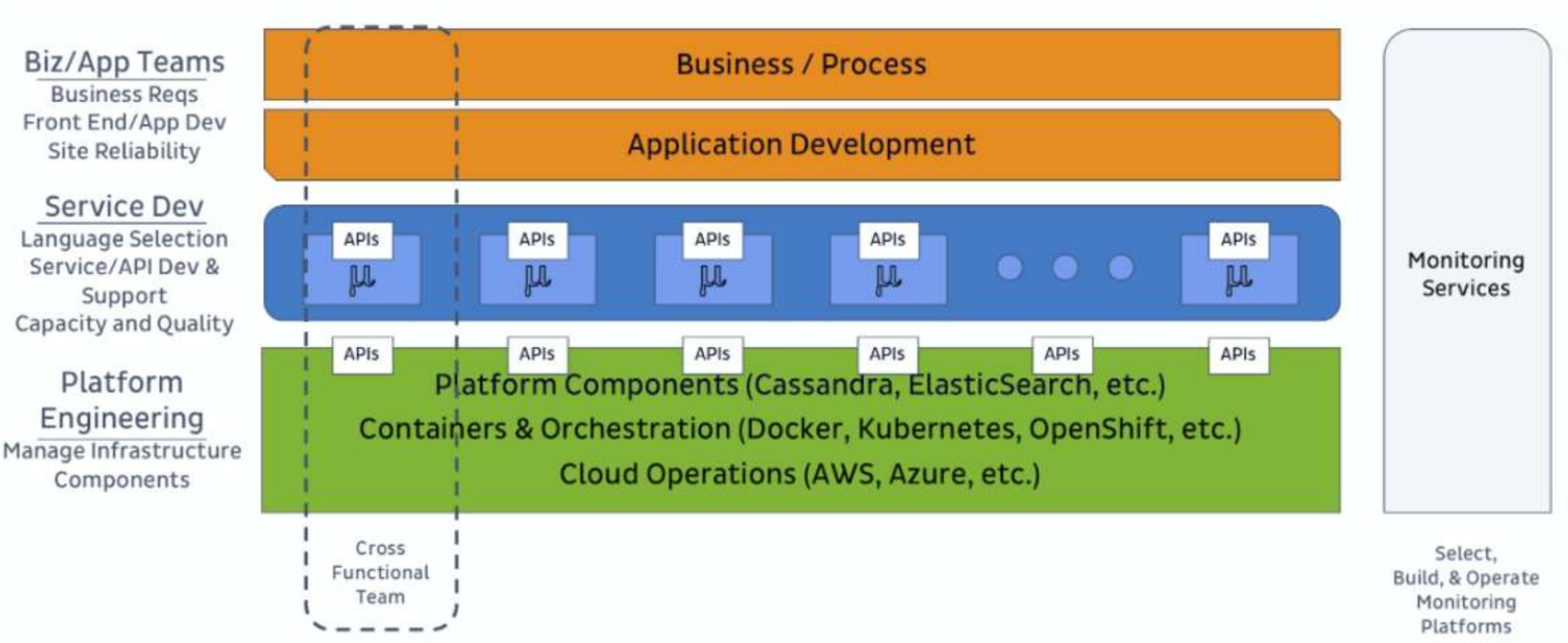
Step 2

Automate toil using AI insights

Step 1

Reduce MTTR through noise reduction (deduplication, correlation)

Platform SRE



Platform SRE ushers in self-service

- *The Platform provides “self-service” provision of infrastructure, functionalities, configurations and environments that can be consumed by development teams , third parties e.g. distributed teams and partners*
- *Embedded governance, controls and standards are built-in*
- *End-to-end deployment automation, infrastructure playbooks of a service or application*
- *Abstraction of infrastructure specific implementations for multi/hybrid cloud through runbooks and playbooks*
- *In-Source code, products built by platform teams can be extended or enhanced by SRE/Dev/Ops or any other*

Chaos Engineering

The discipline of experimenting on a distributed system in order to build confidence in the system’s ability to withstand turbulent conditions.

Properties of a Chaos Experiment

- *Define steady state*
- *Formulate hypothesis*
- *Outline methodology*
- *Identify blast radius*
- *Observability is key*
- *Readily abortable*

Getting started with Chaos Engineering

From a technical point of view, they are easy to set up and do not have to be sophisticated in terms of implementation

- *Get relevant people in a room who are responsible for a system or set of systems*
- *Shut off a component that the system should be robust enough to tolerate without it*
- *Record the learning outcomes and bring the component back online*

Apply It: Build a Game Day event
What / Who / When / Where / How

Note*: You don't need to run your GameDay in production! Insights can come from conducting experiments first in a staging or test environment*

Implementation challenges

And how to overcome them

You don’t have enough cross-team usage or buy-in

Your difficult and dense process is slowing down incident response

Postmortems are underutilized and don’t encompass in-depth learnings

You wait for incidents to happen

You stop at incident management without SLOs

Loop in sales, support and customer success

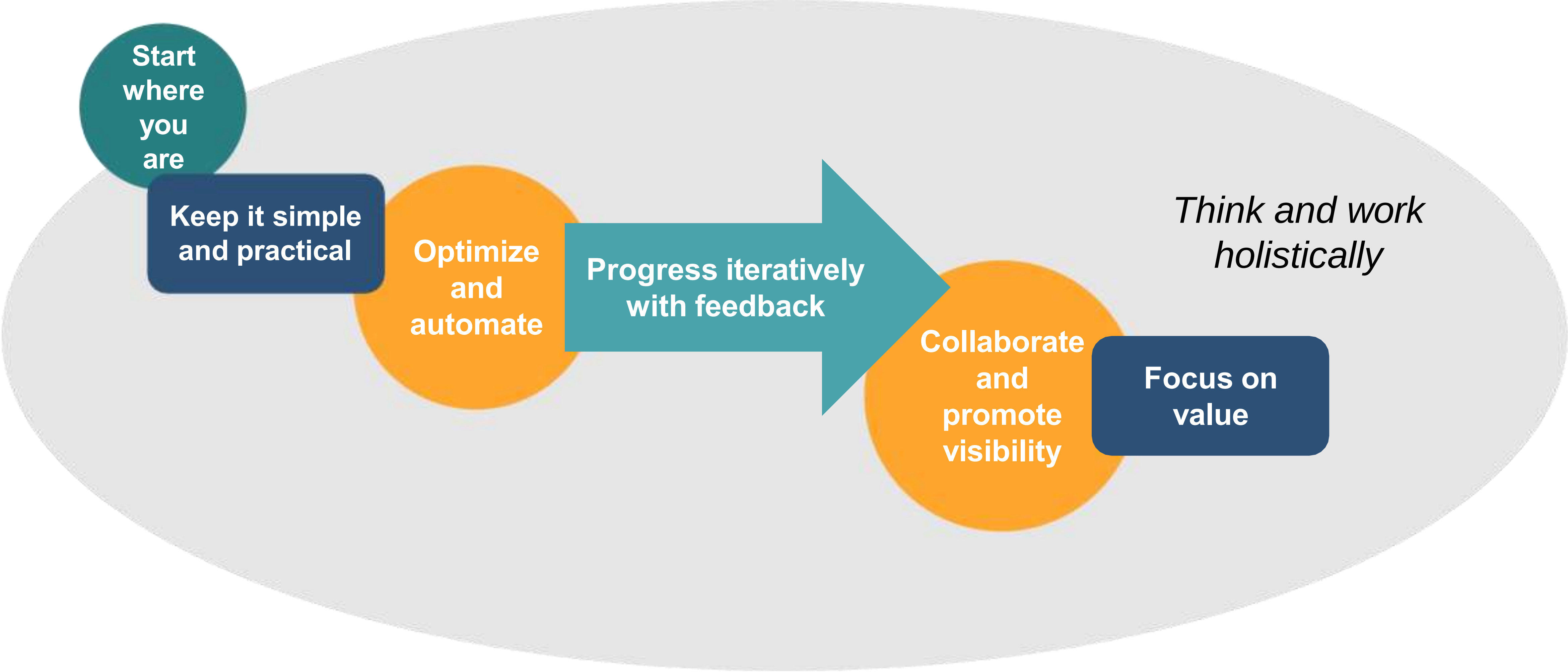
Customize lightweight, lean checklists

Automate: turn unstructured postmortems into a taxonomy with metadata & data

Practice chaos engineering

Automate: visualize your metrics

Where to start



Start where you are

Keep it simple and practical

Optimize and automate

Progress iteratively with feedback

Collaborate and promote visibility

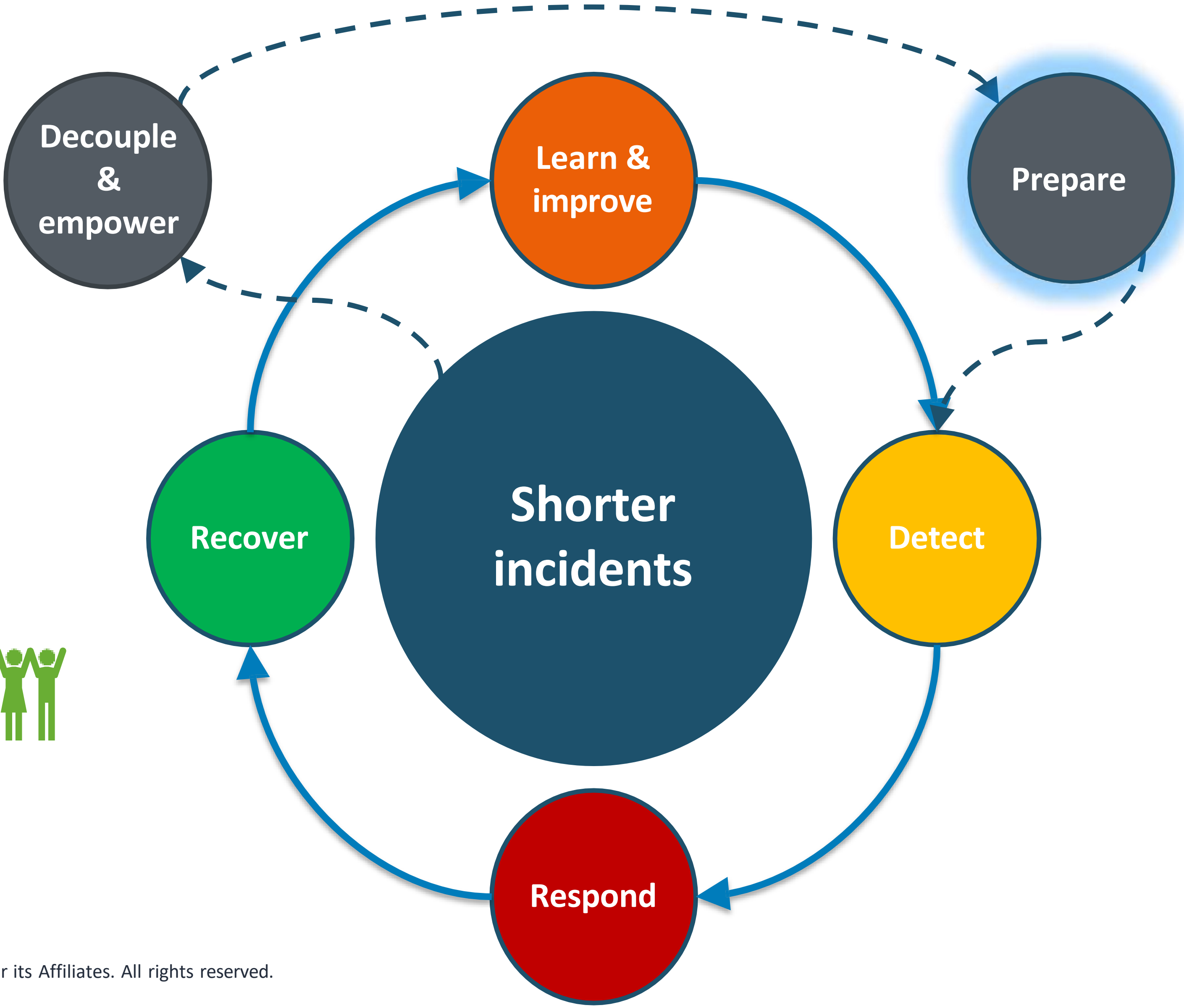
Focus on value

Think and work holistically

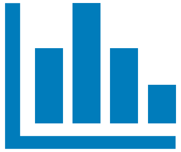
Agenda

- The uptime flywheel - prepare
- Prepare for downtime
- AWS Services for incident management
- The uptime flywheel – learn
- Chaos engineering
- AWS Fault Injection Simulator
- Summary and Marketplace next steps

The uptime flywheel @ AWS



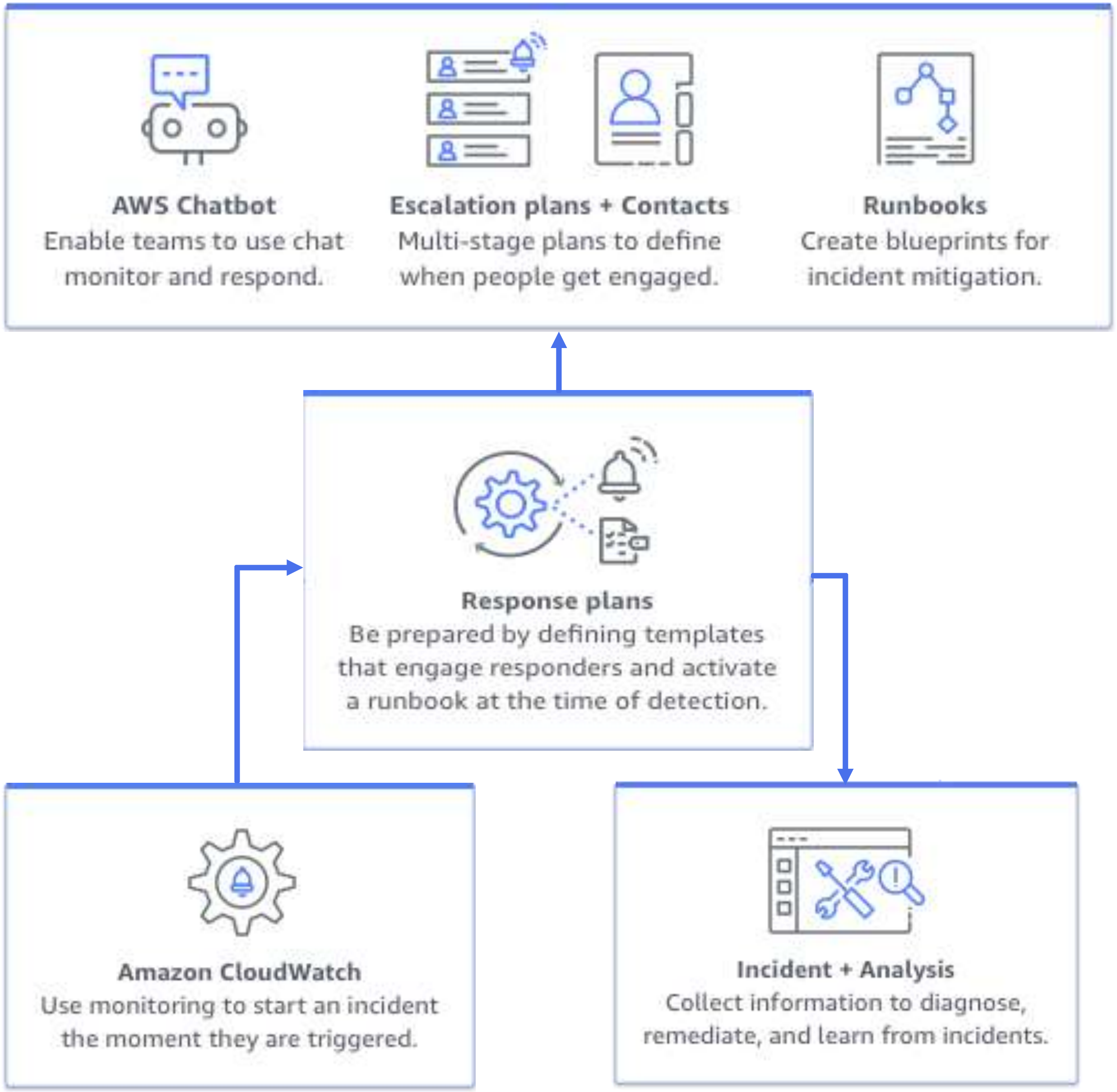
"2-pizza" teams



Weekly OpsMetrics meeting

Prepare for downtime

1. Detect
   - What could go wrong?
   - How would I know?
2. Respond and recover
   - Who needs to be engaged?
   - What do they need to do to diagnose?
     - Procedures and scripts
     - Where do we collaborate?
3. Learn and improve
   - How did we respond?
   - What actions will we take?



AWS Chatbot
Enable teams to use chat monitor and respond.

Escalation plans + Contacts
Multi-stage plans to define when people get engaged.

Runbooks
Create blueprints for incident mitigation.

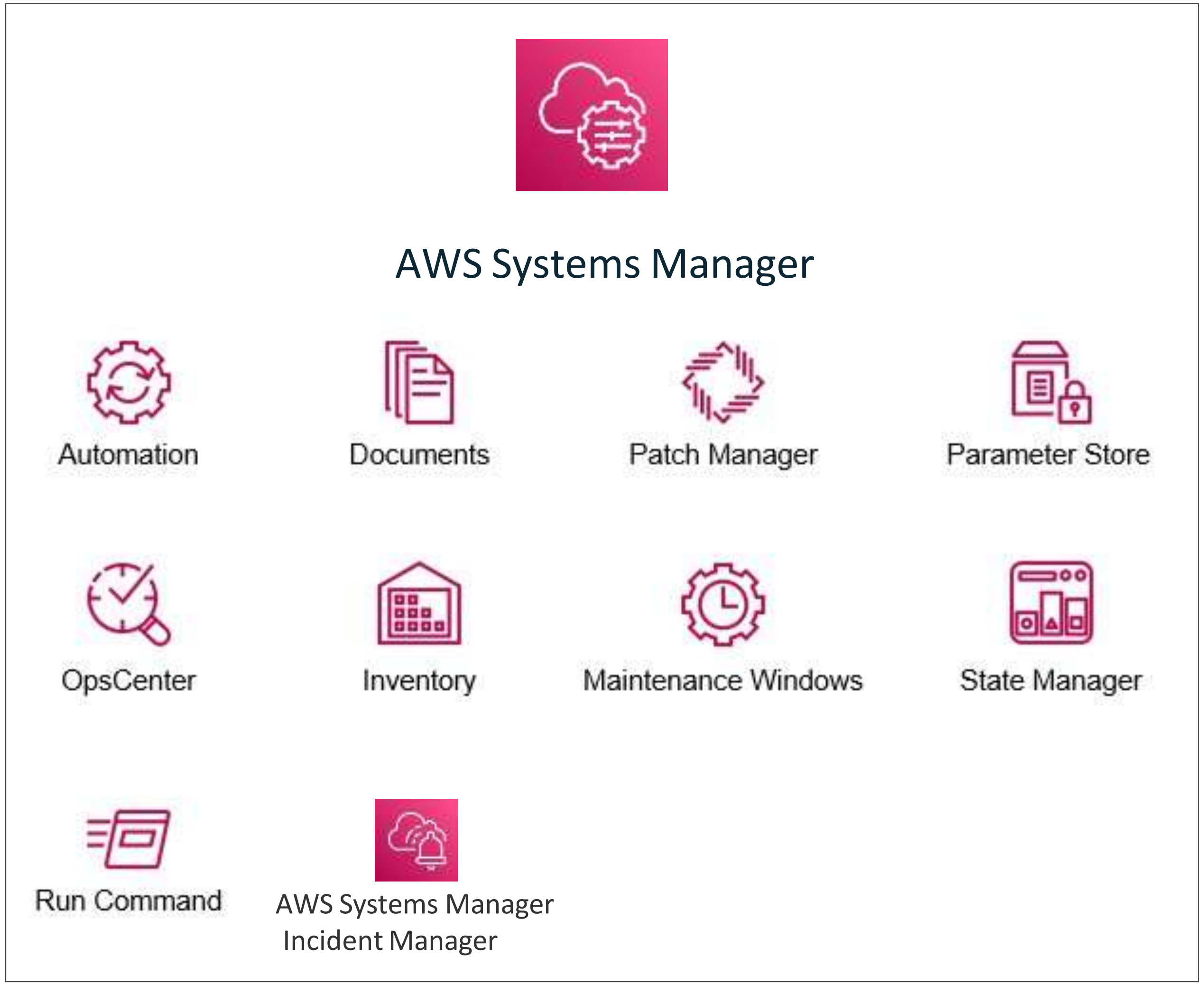
Response plans
Be prepared by defining templates that engage responders and activate a runbook at the time of detection.

Amazon CloudWatch
Use monitoring to start an incident the moment they are triggered.

Incident + Analysis
Collect information to diagnose, remediate, and learn from incidents.

AWS Systems Manager

Centralize operational data from multiple AWS services and automate tasks across your AWS resources



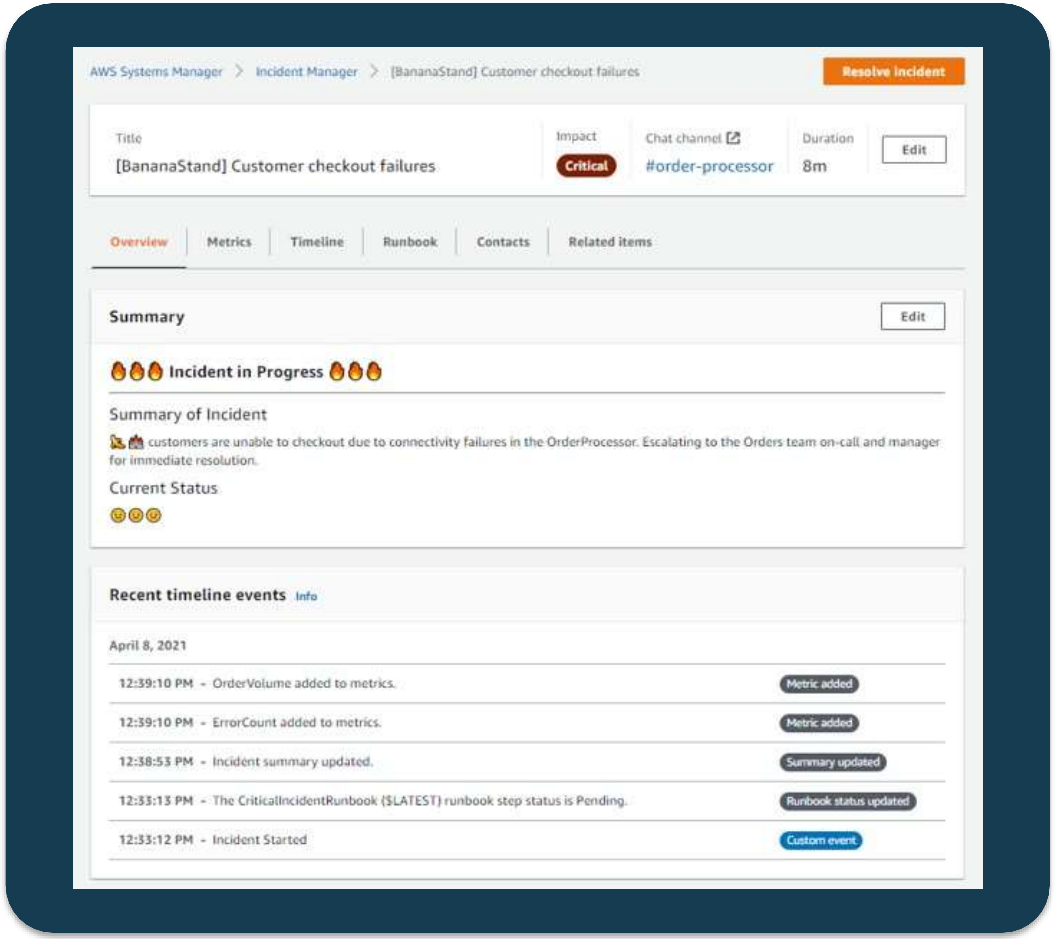
Benefits

- Simplify resources and application management
- Easy to operate and securely manage multi-cloud infrastructures at scale
- Resolve critical application availability and performance
- Prepare for and manage incidents efficiently with automated response

Incident Manager

Resolve application issues faster with automated response plans

- Specify a response plan to critical application alarms, including who to engage, what runbook to follow, and where to collaborate
- Notify the right people immediately with SMS, voice, and escalations (additional partner integrations coming soon)
- Single console to track incidents from detection to mitigation and post-incident analysis, including timeline, runbooks, metrics, etc.
- Collaborate in Slack via AWS Chatbot to resolve incidents
- Identify post-incident action items, such as improving alarms or automating runbooks steps, using Amazon's post-incident analysis template and track them in OpsCenter


AWS Systems Manager > Incident Manager > [BananaStand] Customer checkout failures
Resolve incident
Edit
Overview
Metrics
Timeline
Runbook
Contacts
Related items
Edit
Info

Title: [BananaStand] Customer checkout failures

Impact: Critical

Chat channel: #order-processor

Duration: 8m

Summary

🔥🔥🔥 Incident in Progress 🔥🔥🔥

Summary of Incident

customers are unable to checkout due to connectivity failures in the OrderProcessor. Escalating to the Orders team on-call and manager for immediate resolution.

Current Status

🙂🙂🙂

Recent timeline events

April 8, 2021

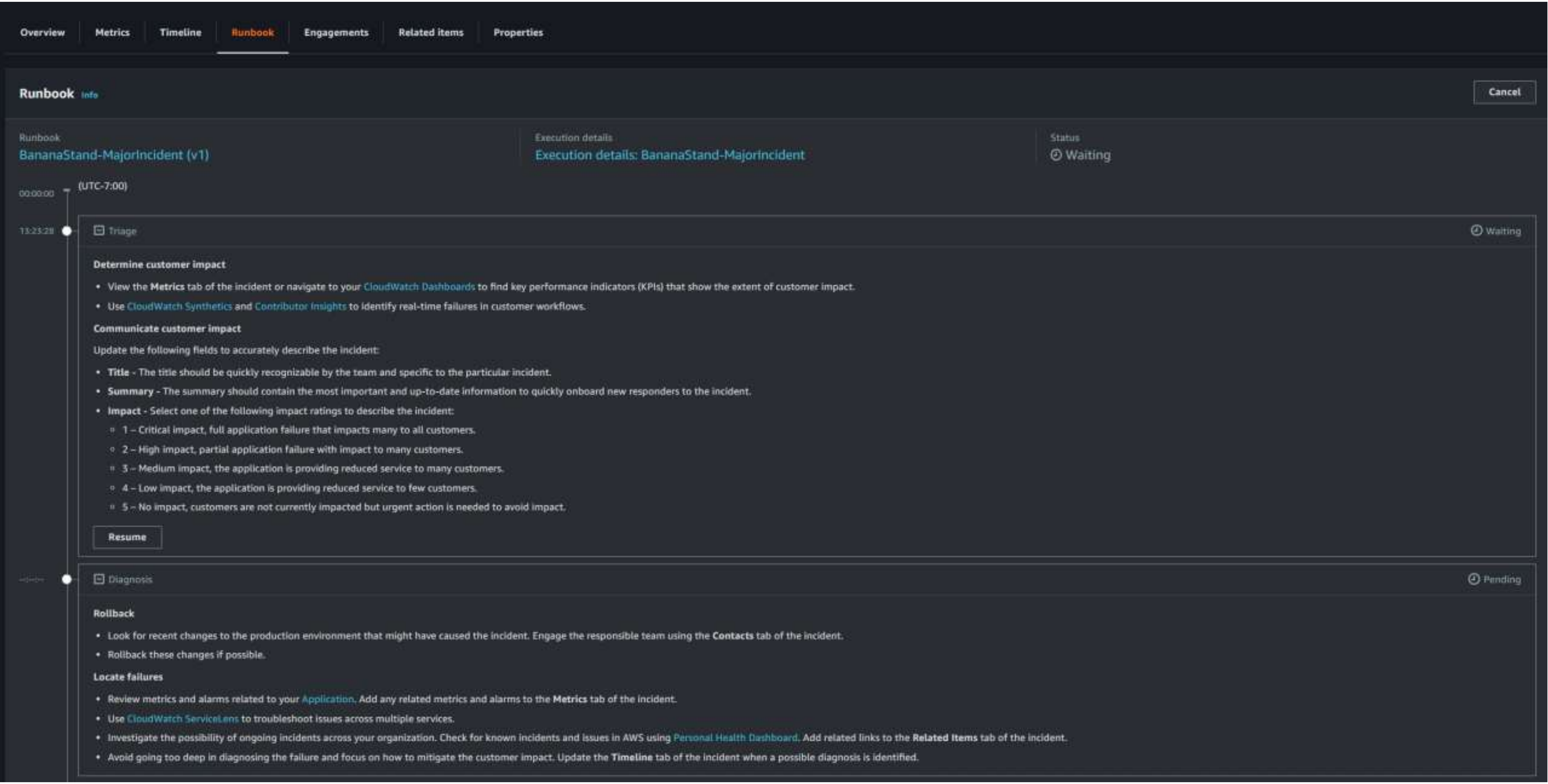
12:39:10 PM - OrderVolume added to metrics. Metric added

12:39:10 PM - ErrorCount added to metrics. Metric added

12:38:53 PM - Incident summary updated. Summary updated

12:33:13 PM - The CriticalIncidentRunbook ($LATEST) runbook step status is Pending. Runbook status updated

12:33:12 PM - Incident Started Custom event



Runbook

Runbook: BananaStand-MajorIncident (v1)

Execution details: Execution details: BananaStand-MajorIncident

Status: Waiting

(UTC-7:00)

Triage — Waiting

Determine customer impact

- View the **Metrics** tab of the incident or navigate to your CloudWatch Dashboards to find key performance indicators (KPIs) that show the extent of customer impact.
- Use CloudWatch Synthetics and Contributor Insights to identify real-time failures in customer workflows.

Communicate customer impact

Update the following fields to accurately describe the incident:

- **Title** - The title should be quickly recognizable by the team and specific to the particular incident.
- **Summary** - The summary should contain the most important and up-to-date information to quickly onboard new responders to the incident.
- **Impact** - Select one of the following impact ratings to describe the incident:
  - 1 – Critical impact, full application failure that impacts many to all customers.
  - 2 – High impact, partial application failure with impact to many customers.
  - 3 – Medium impact, the application is providing reduced service to many customers.
  - 4 – Low impact, the application is providing reduced service to few customers.
  - 5 – No impact, customers are not currently impacted but urgent action is needed to avoid impact.

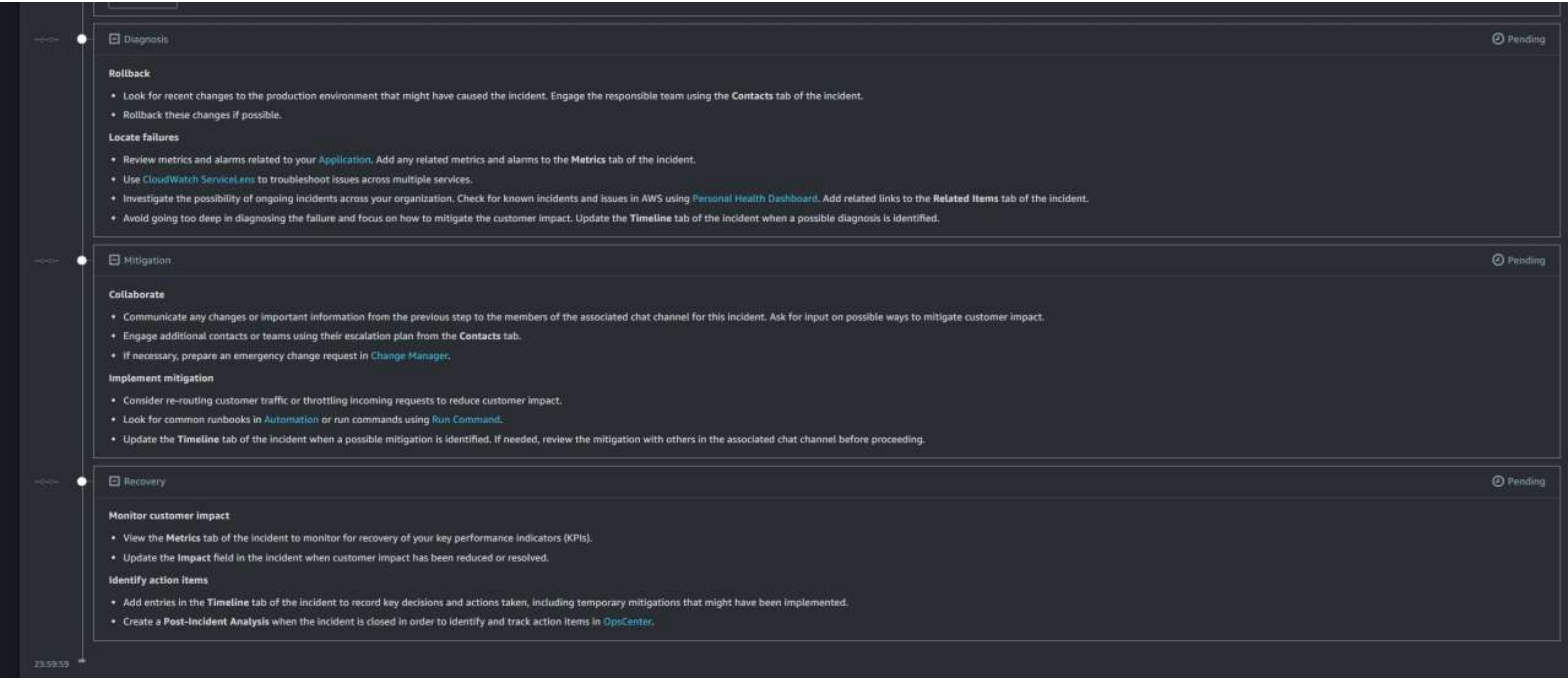
Diagnosis — Pending

Rollback

- Look for recent changes to the production environment that might have caused the incident. Engage the responsible team using the **Contacts** tab of the incident.
- Rollback these changes if possible.

Locate failures

- Review metrics and alarms related to your Application. Add any related metrics and alarms to the **Metrics** tab of the incident.
- Use CloudWatch ServiceLens to troubleshoot issues across multiple services.
- Investigate the possibility of ongoing incidents across your organization. Check for known incidents and issues in AWS using Personal Health Dashboard. Add related links to the **Related Items** tab of the incident.
- Avoid going too deep in diagnosing the failure and focus on how to mitigate the customer impact. Update the **Timeline** tab of the incident when a possible diagnosis is identified.



Diagnosis

Pending

Rollback

- Look for recent changes to the production environment that might have caused the incident. Engage the responsible team using the **Contacts** tab of the incident.
- Rollback these changes if possible.

Locate failures

- Review metrics and alarms related to your Application. Add any related metrics and alarms to the **Metrics** tab of the incident.
- Use CloudWatch ServiceLens to troubleshoot issues across multiple services.
- Investigate the possibility of ongoing incidents across your organization. Check for known incidents and issues in AWS using Personal Health Dashboard. Add related links to the **Related Items** tab of the incident.
- Avoid going too deep in diagnosing the failure and focus on how to mitigate the customer impact. Update the **Timeline** tab of the incident when a possible diagnosis is identified.

Mitigation

Pending

Collaborate

- Communicate any changes or important information from the previous step to the members of the associated chat channel for this incident. Ask for input on possible ways to mitigate customer impact.
- Engage additional contacts or teams using their escalation plan from the **Contacts** tab.
- If necessary, prepare an emergency change request in Change Manager.

Implement mitigation

- Consider re-routing customer traffic or throttling incoming requests to reduce customer impact.
- Look for common runbooks in Automation or run commands using Run Command.
- Update the **Timeline** tab of the incident when a possible mitigation is identified. If needed, review the mitigation with others in the associated chat channel before proceeding.

Recovery

Pending

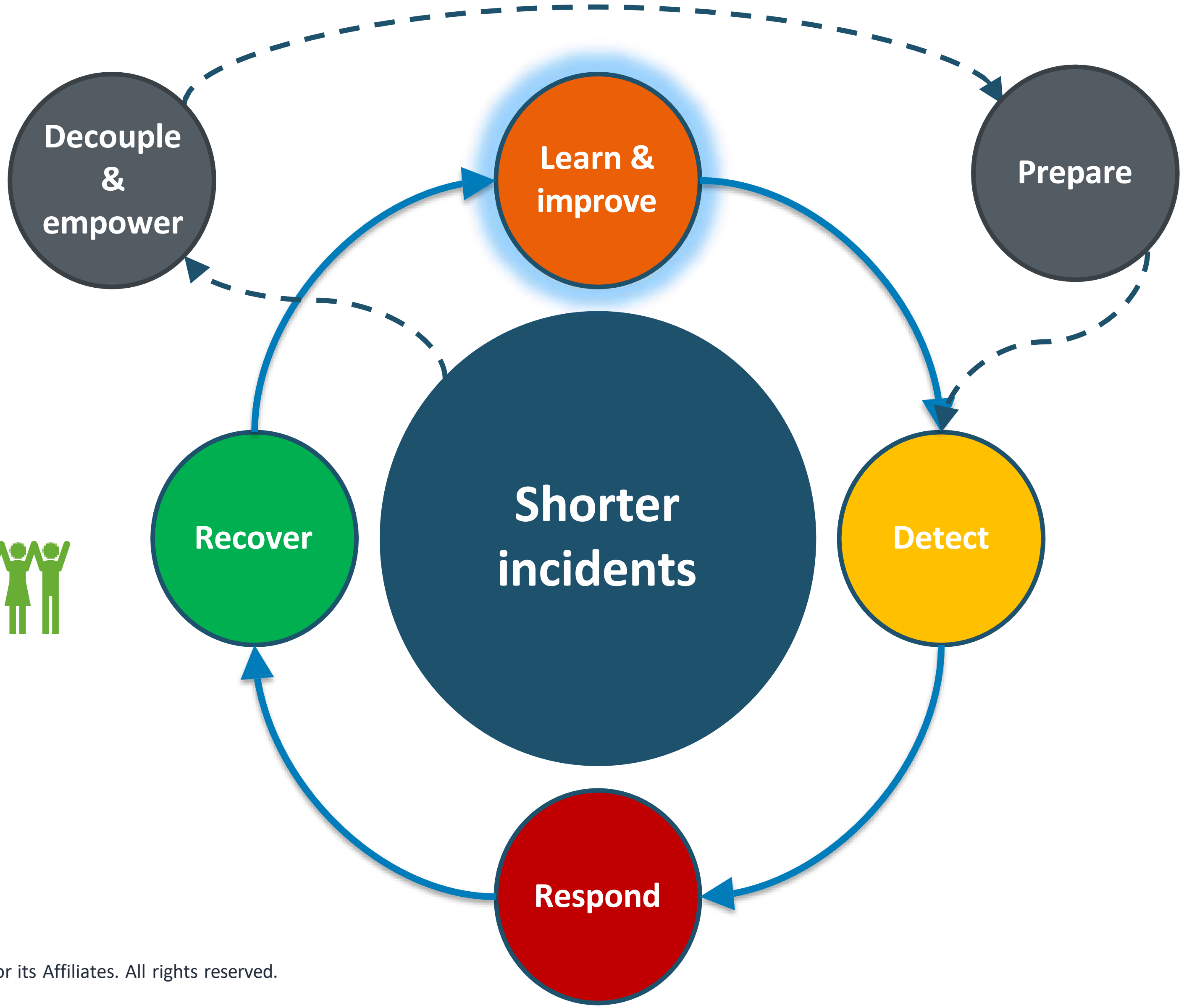
Monitor customer impact

- View the **Metrics** tab of the incident to monitor for recovery of your key performance indicators (KPIs).
- Update the **Impact** field in the incident when customer impact has been reduced or resolved.

Identify action items

- Add entries in the **Timeline** tab of the incident to record key decisions and actions taken, including temporary mitigations that might have been implemented.
- Create a **Post-Incident Analysis** when the incident is closed in order to identify and track action items in OpsCenter.

The uptime flywheel @ AWS



Decouple & empower

Learn & improve

Prepare

Shorter incidents

Recover

Detect

Respond

“2-pizza” teams

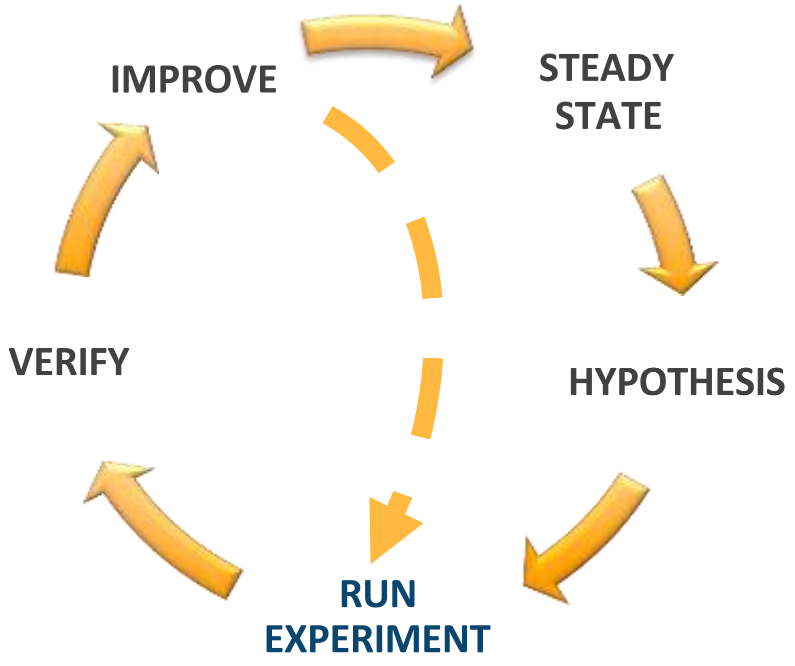
Weekly OpsMetrics meeting

Chaos engineering

Experiment to ensure that the impact of failures is mitigated

Chaos experiment

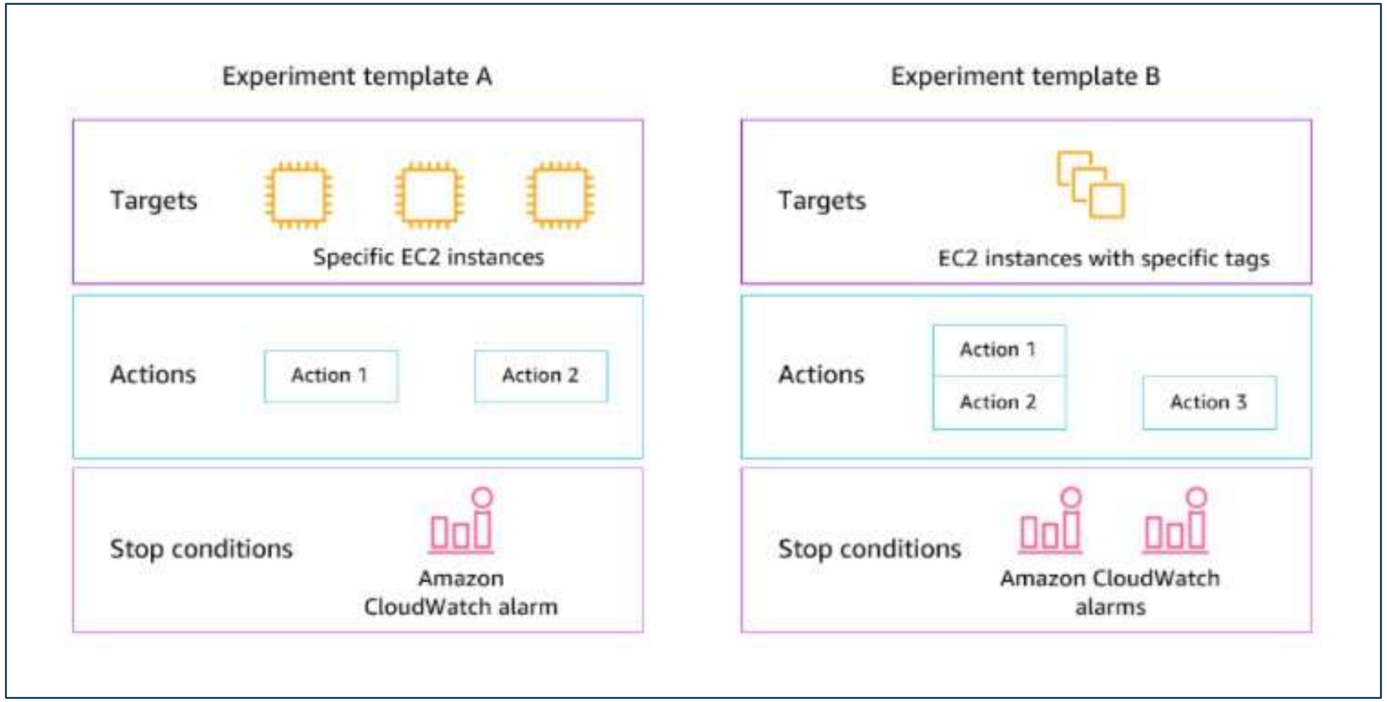
- Inject events that simulate
    - Hardware failures, like servers dying
    - Software failures, like malformed responses
    - Nonfailure events, like spikes in traffic or scaling events
    - Any event capable of disrupting steady state



AWS Fault Injection Simulator

Improve resiliency and performance with controlled experiments

- A fast and easy way to get started with fault injection experiments
- Validate how your application performs on AWS
- Safeguard fault injection experiments
- Improve application performance, resiliency, and observability
- Get comprehensive insights by generating real-world failure conditions



Experiment template A

Targets: Specific EC2 instances

Actions: Action 1, Action 2

Stop conditions: Amazon CloudWatch alarm

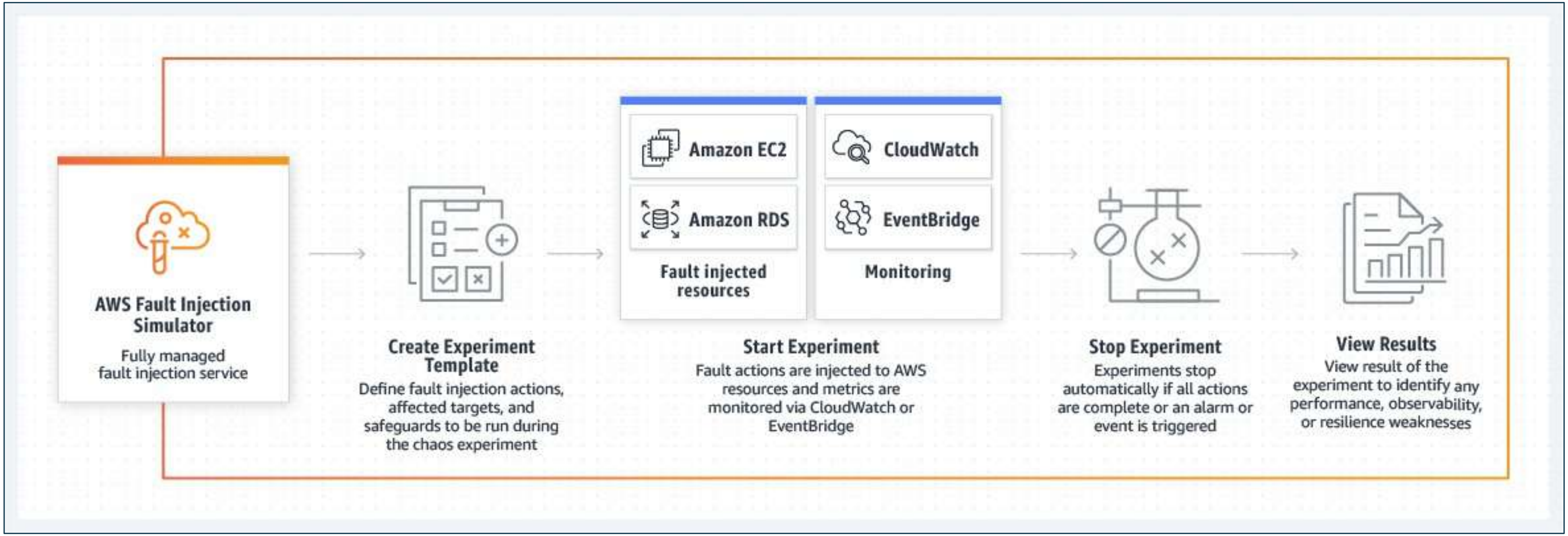
Experiment template B

Targets: EC2 instances with specific tags

Actions: Action 1, Action 2, Action 3

Stop conditions: Amazon CloudWatch alarms

AWS Fault Injection Simulator



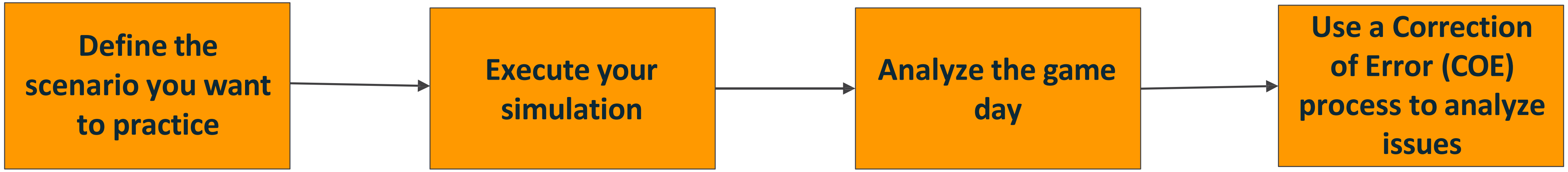
AWS Fault Injection Simulator
Fully managed fault injection service
Create Experiment Template
Define fault injection actions, affected targets, and safeguards to be run during the chaos experiment
Amazon EC2
Amazon RDS
Fault injected resources
CloudWatch
EventBridge
Monitoring
Start Experiment
Fault actions are injected to AWS resources and metrics are monitored via CloudWatch or EventBridge
Stop Experiment
Experiments stop automatically if all actions are complete or an alarm or event is triggered
View Results
View result of the experiment to identify any performance, observability, or resilience weaknesses

AWS Fault Injection Simulator use case: periodic game days

Why conduct a game day?

- Simulate a failure or event to test systems, processes, and team responses
- Should cover the areas of operations, security, reliability, performance, and cost
- Can be carried out with replicas of your production environment using AWS CloudFormation
- Should involve all personnel who normally operate a workload

Game day process


Define the scenario you want to practice

Execute your simulation

Analyze the game day

Use a Correction of Error (COE) process to analyze issues

AWS Marketplace: Destination for third-party solutions to use with AWS

DevOps Core practices

Collaboration & communication

Microservices and everything-as-code

Continuous integration

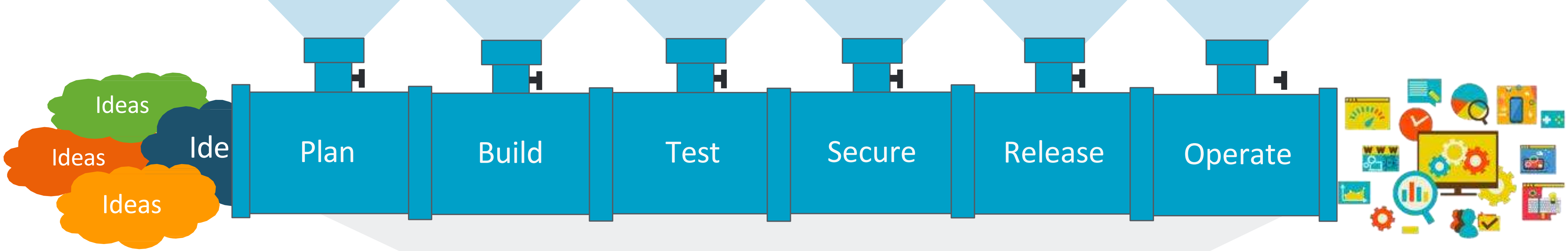
Testing & quality management

Continuous delivery

Security & compliance

Monitoring & observability

Incident management



Sample AWS Marketplace solution providers

Gremlin PagerDuty moogsoft bigpanda

JFrog TRICENTIS LaunchDarkly MICRO FOCUS splunk> HashiCorp CHEF New Relic. CloudBees.

1,600+ vendors | **8,000+** products

aws marketplace

8,000+ *listings* • **1,600+** *ISVs* • **24** *regions* • **290,000+** *customers* • **1.5M+** *subscriptions*

GitLab
JFrog
circleci
harness
CloudBees.
armory

puppet
Quali
TRICENTIS
MICRO FOCUS
sumo logic
LaunchDarkly

GENYMOTION
TREND MICRO
PagerDuty
Gremlin
New Relic.
Gatling

dynatrace
APPDYNAMICS
CONTRAST SECURITY
CORESTACK

And more coming soon!

How can you get started?

Find

A breadth of DevOps solutions:

dynatrace

perspectium

PagerDuty

Gremlin

APPDYNAMICS
part of Cisco

New Relic.

moogsoft

splunk>

sumo logic

THUNDRA

lumigo

bigpanda

Buy

Through flexible pricing options:

Free trial

Pay-as-you-go

Budget alignment

Bring Your Own License (BYOL)

Private Offers

Billing consolidation

Enterprise Discount Program

Private Marketplace

Deploy

With multiple deployment options:

SaaS

Amazon Machine Image (AMI)

CloudFormation Template

Containers

Amazon EKS/ Amazon ECS

AI / ML models

AWS Data Exchange

AWS Control Tower