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From Monolithic to Microservices: Evolving architecture patterns

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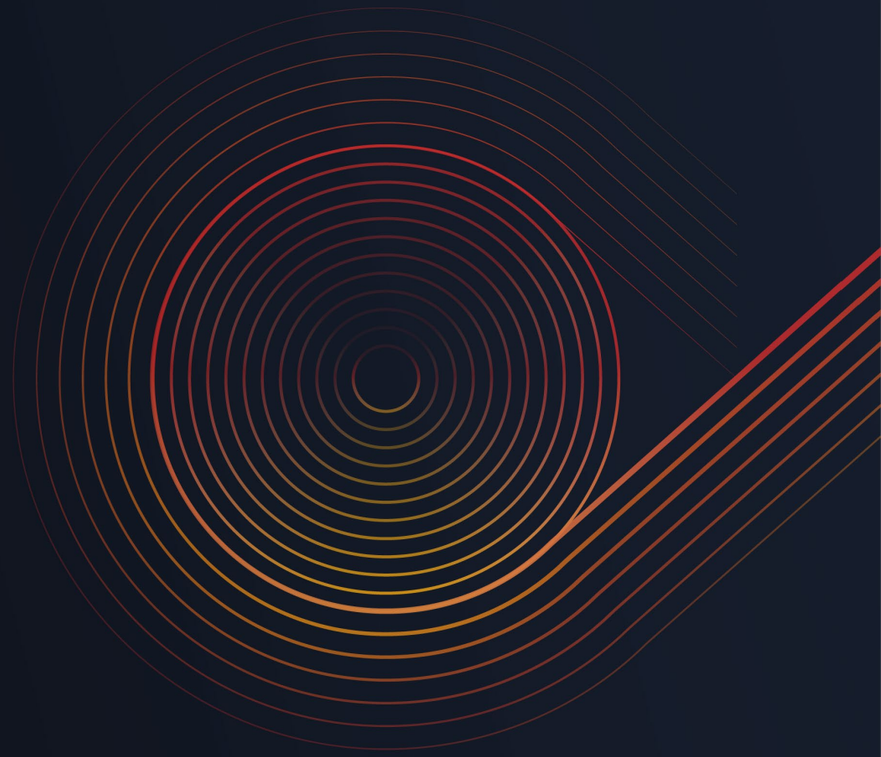
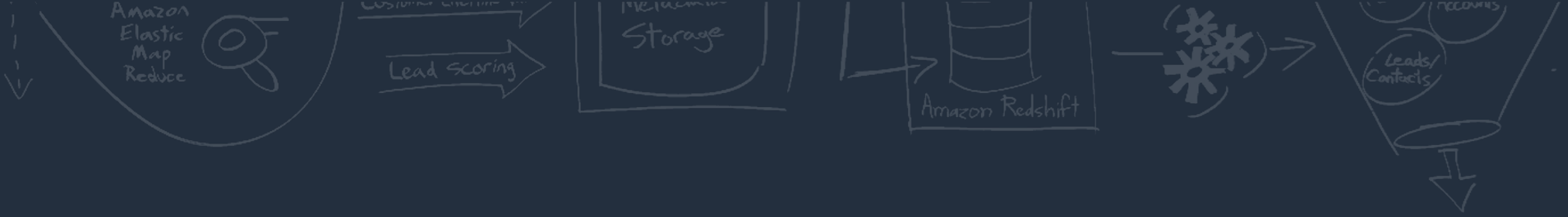
Amazon Internet Services Private Limited (AISPL)



Agenda



- Migration & modernization
- Breaking down the Monolith into Microservices to build Modern Applications
    - Architecture patterns
    - Operational model
    - Software delivery

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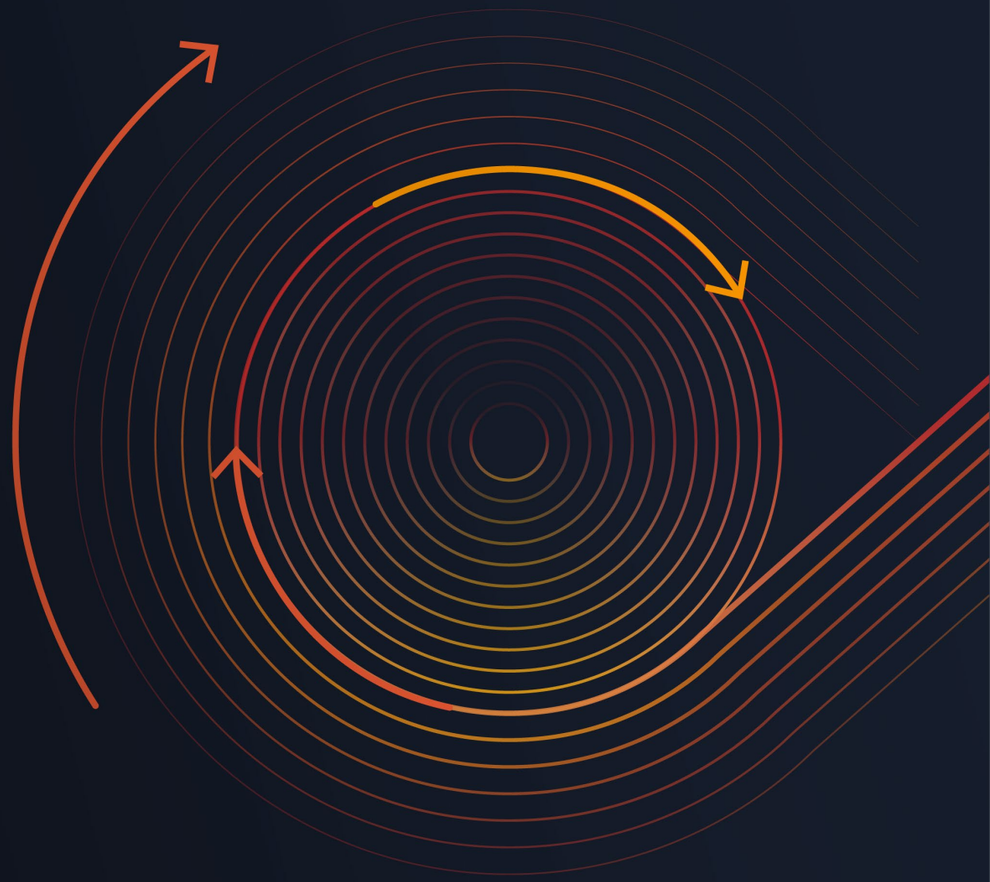
Migration & modernization



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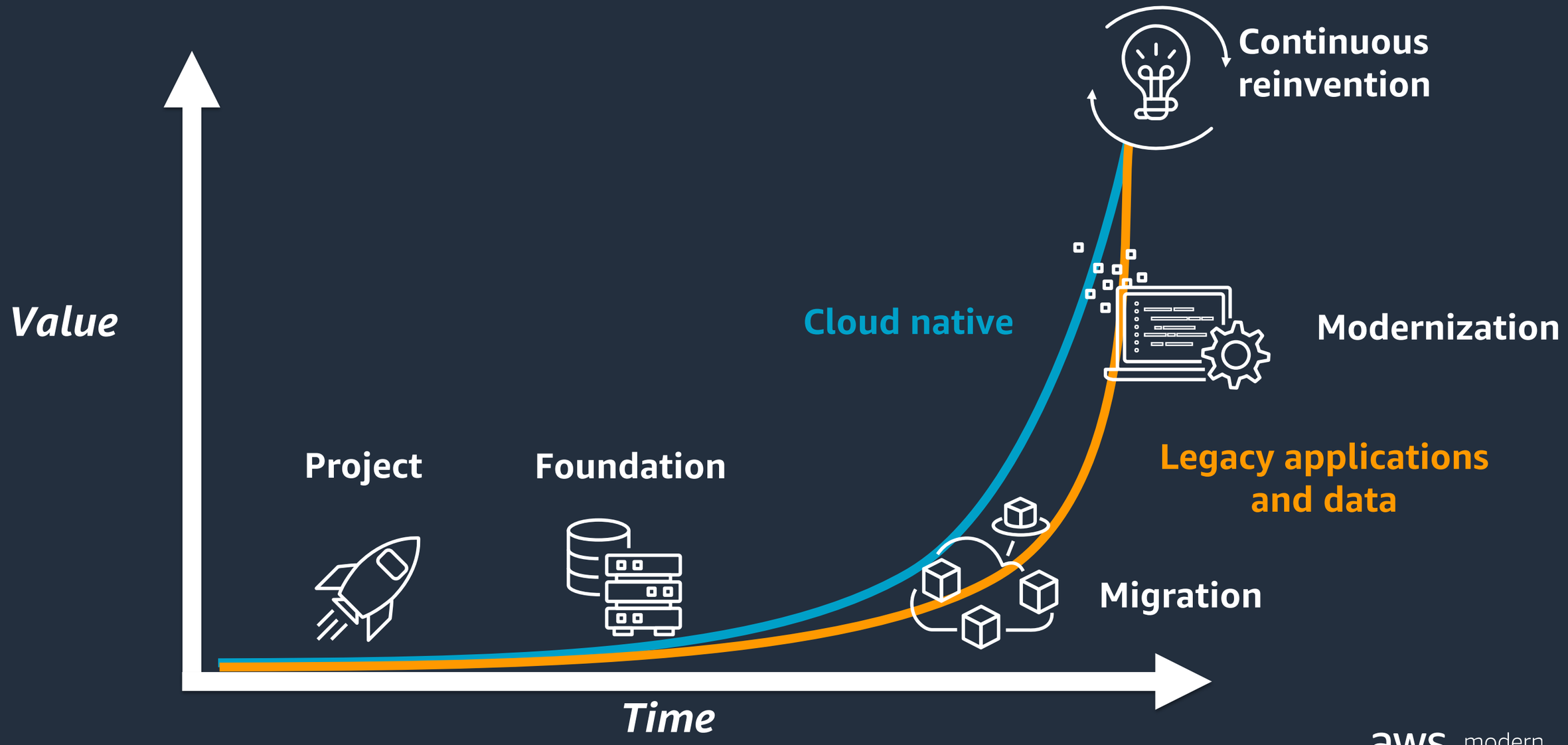
Getting started in your cloud journey



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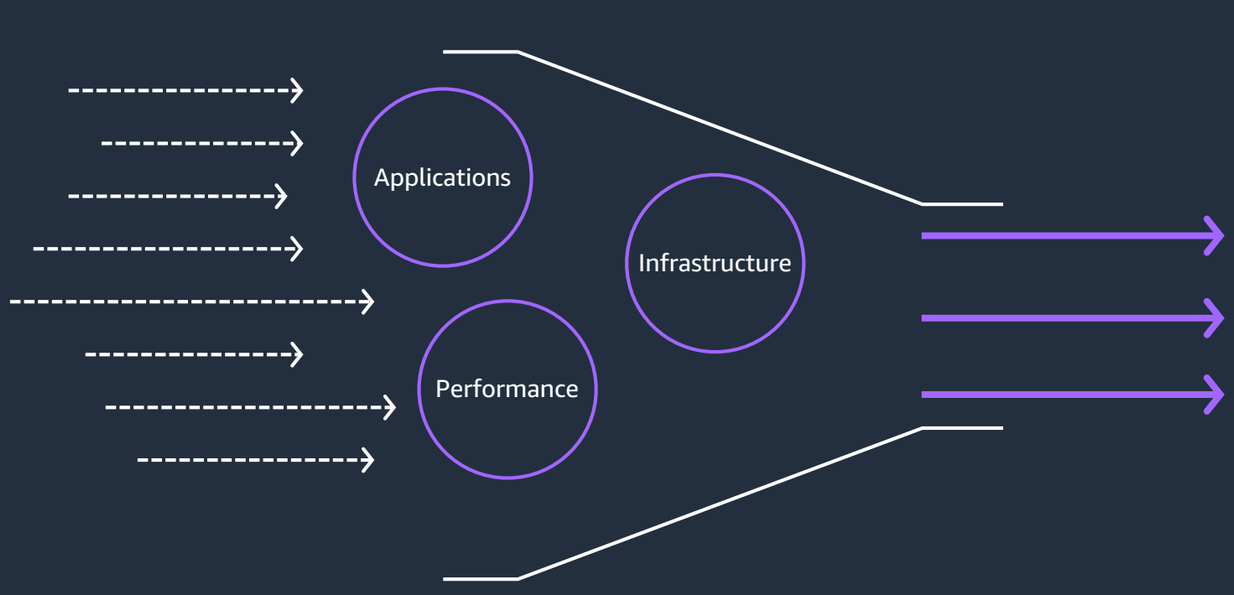
Migration planning

Current IT snapshot

Discover & organize data



Migration strategies for each workload (i.e. 7Rs)

- Refactor
- Replatform
- Repurchase
- Rehost
- Relocate
- Retain
- Retire

Level of effort

Migration strategy decision criteria should be based on both business and technical needs

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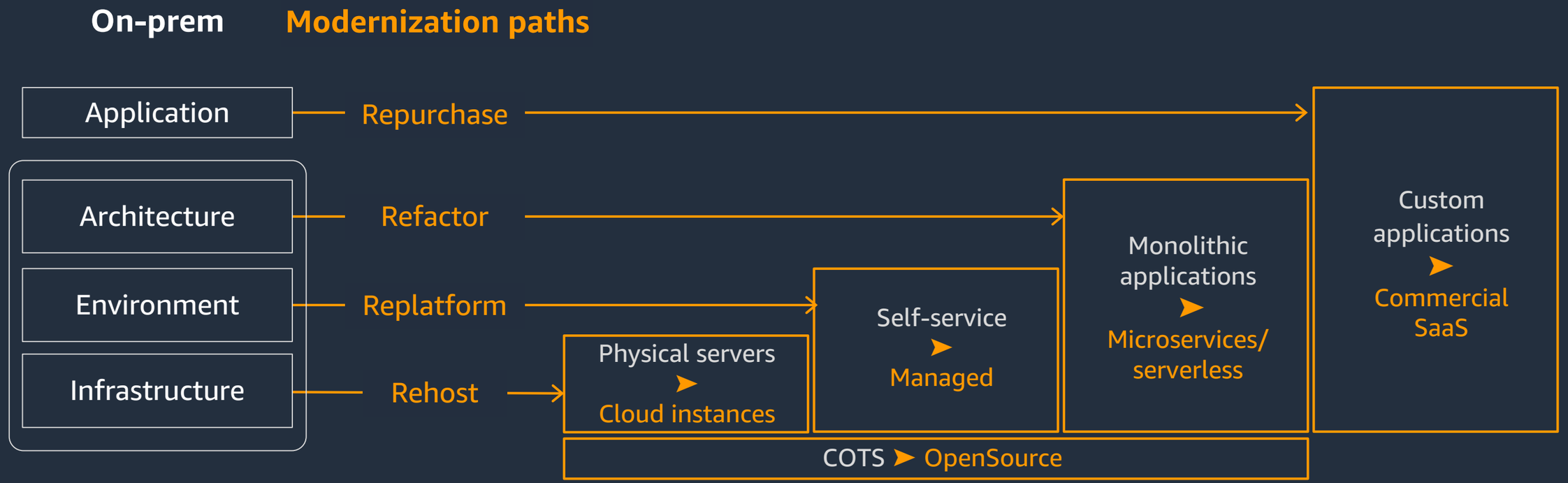
Modernization example



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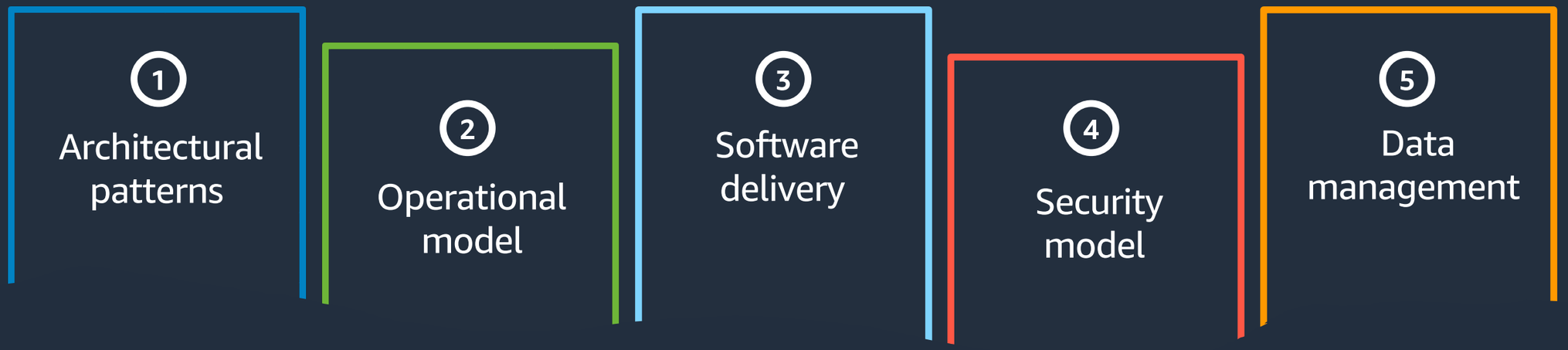
What changes have to be made in our new world?



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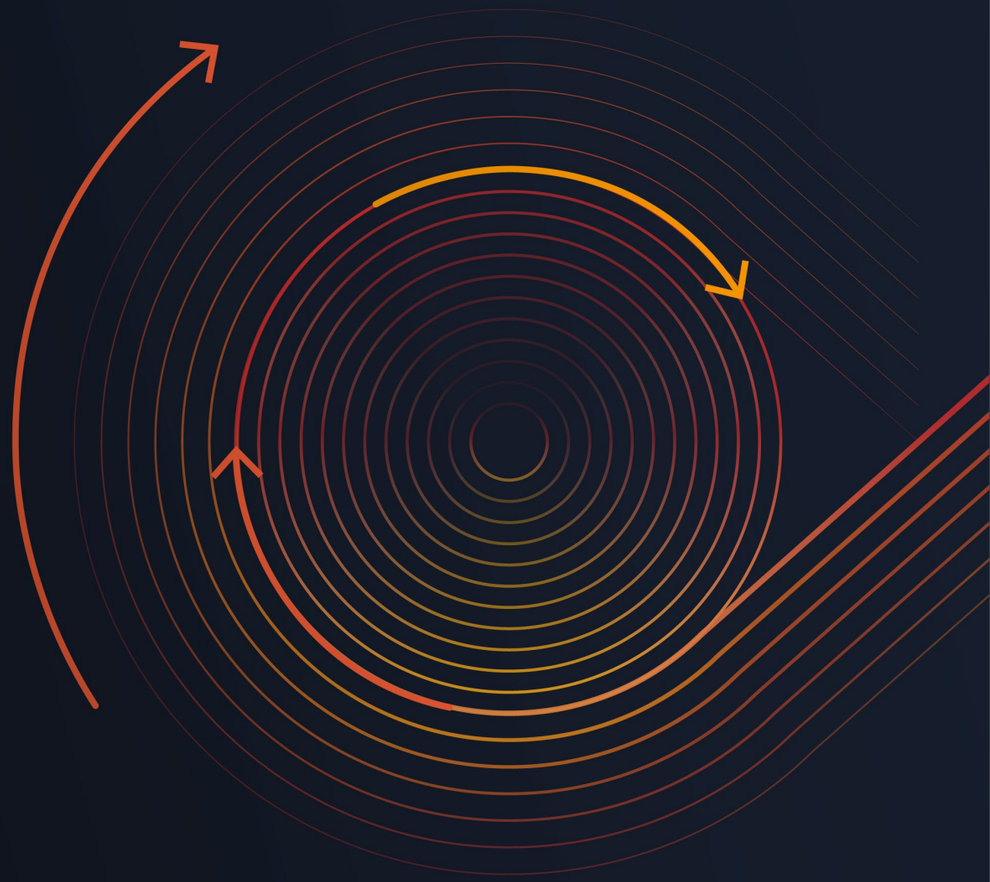
Changes to the architectural patterns



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Monoliths are OK

Monolith

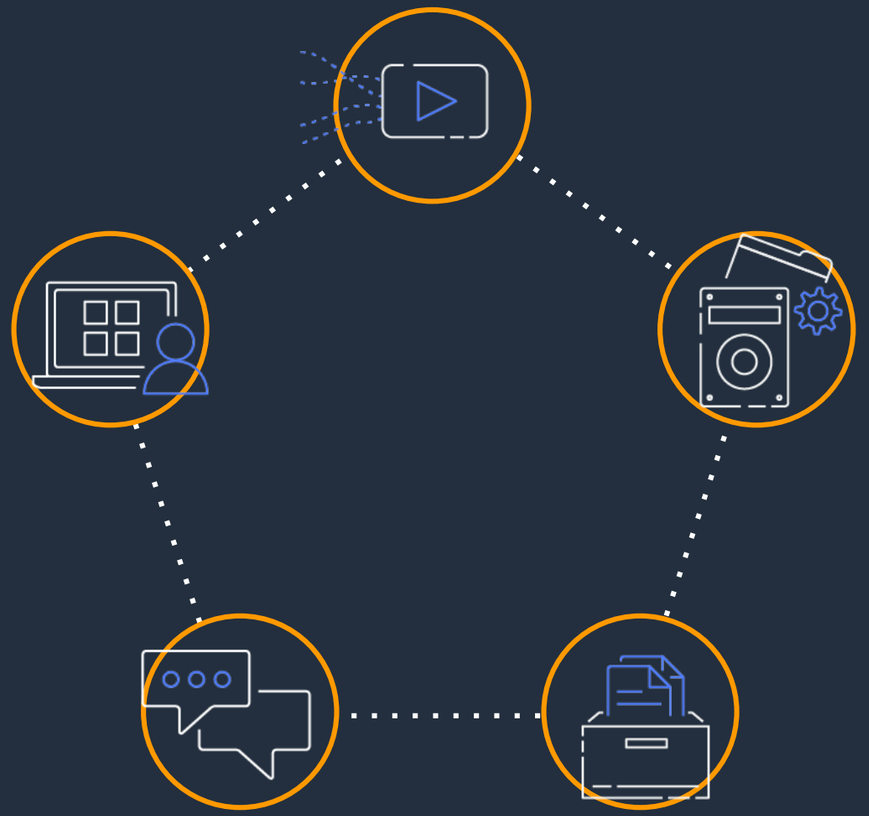
does everything

Monolith challenges

- Poor agility
- Tightly coupled
- Overprovisioning for scale
- Operational management
- Achieve high availability
- Hard to fail fast

Microservices

When the impact of change is small, release velocity can increase



Microservices

does one thing

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Common questions

How do I break the monolith?

What do I have in my environment?

How do I get started?

How do I get my team re-skilled?

What workloads do I move first?

What should I move to the cloud?

How do we manage workloads in the cloud?

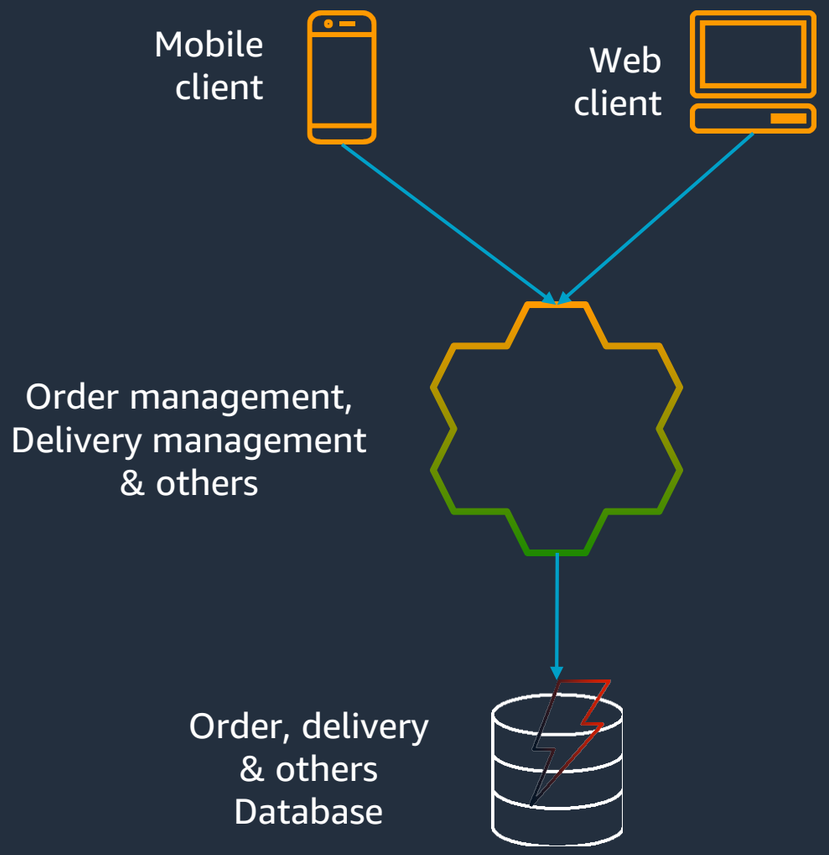
How do I migrate these workloads?

Microservices refactoring

1. Implement new functionality as services
2. Extract services from the monolith

Microservices refactoring

Implement new functionality as services



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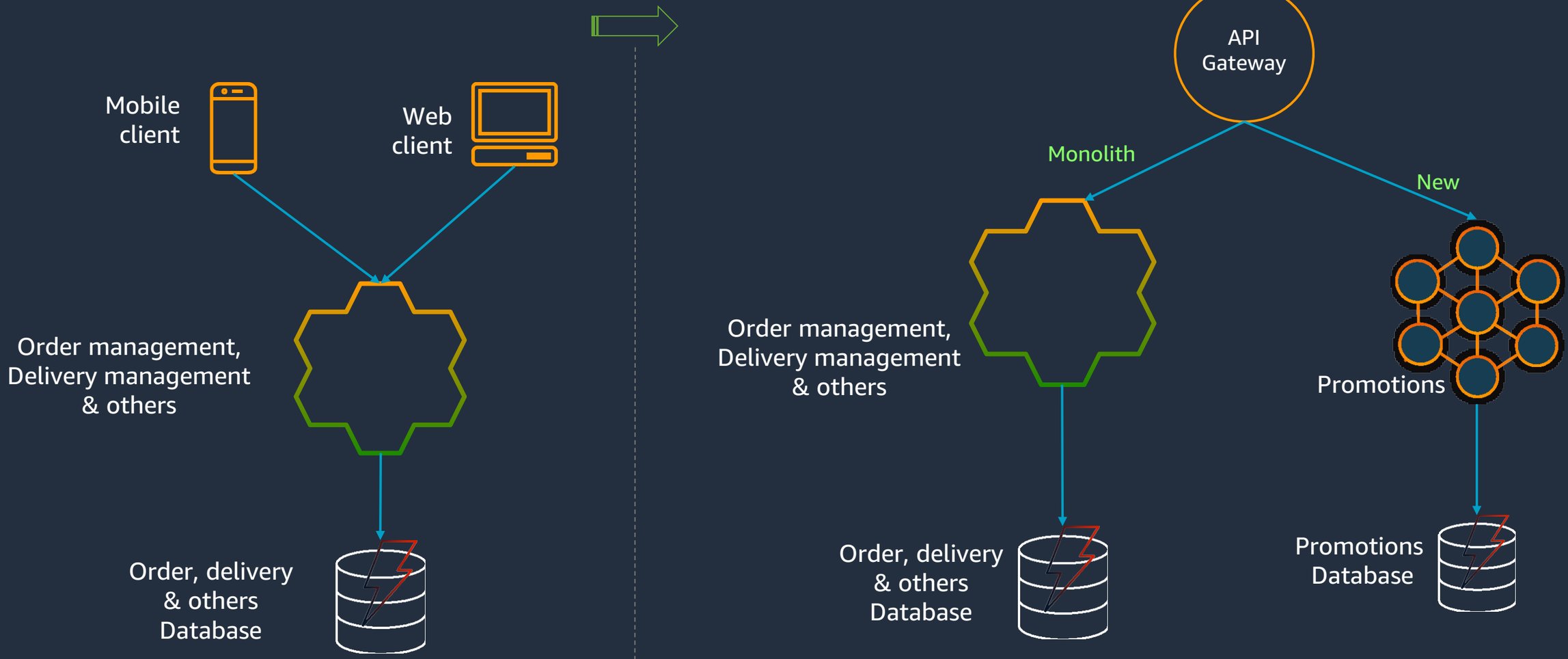
Microservices refactoring

Implement new functionality as services



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Breaking the Monolith

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How do I get started with decoupling?

- Start simple
- Decouple capability, not code
- Capabilities that change frequently and are important to the business
- Minimize dependency back to monolith
- Macro vs micro

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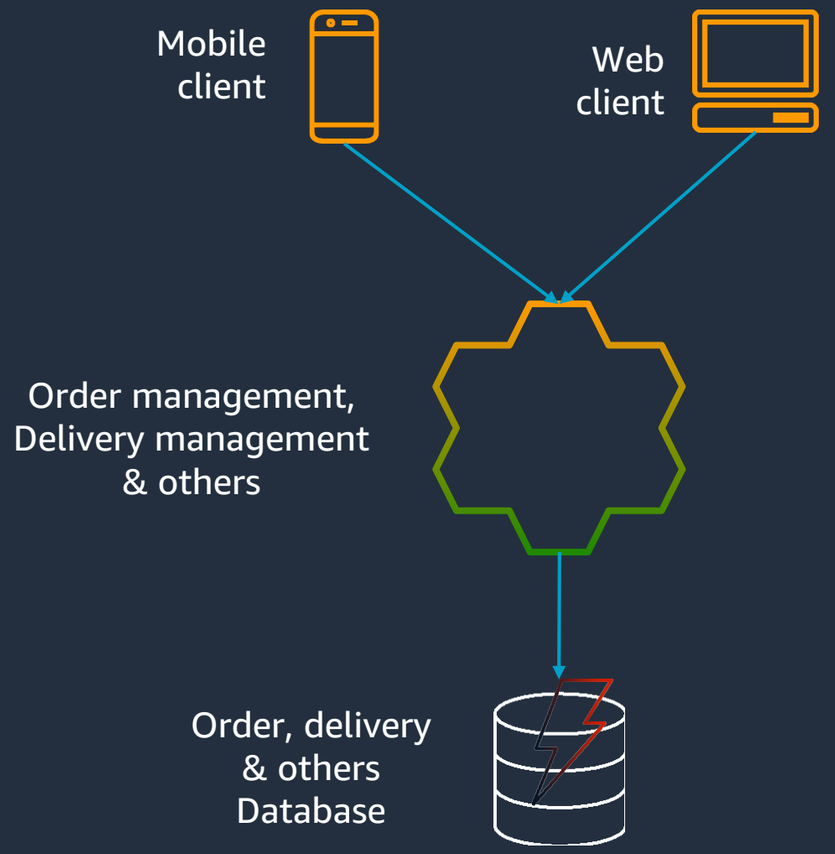
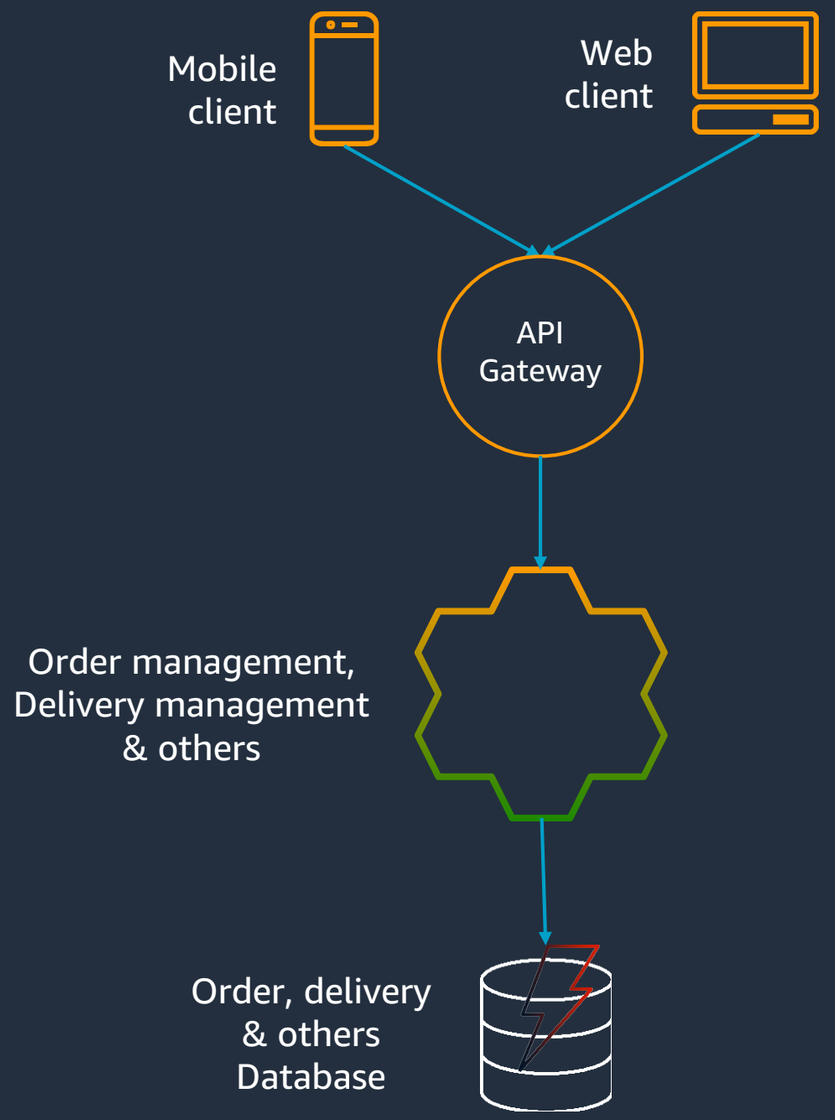
Sample Monolith Application



Add API Layer for abstraction

- Security
- Resiliency
- Operations monitoring
- Real-Time
- Lifecycle management
- Metering

… and more



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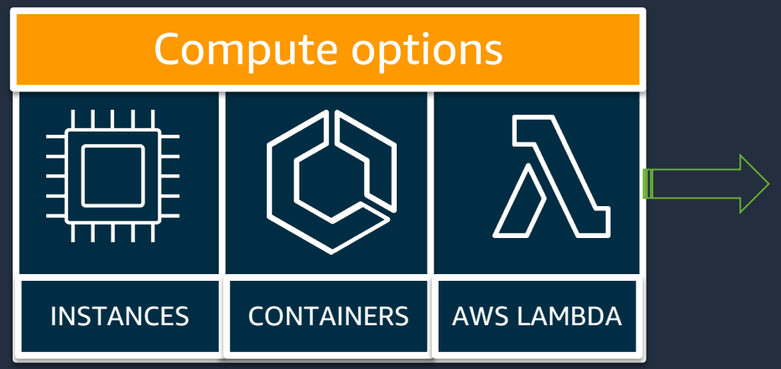
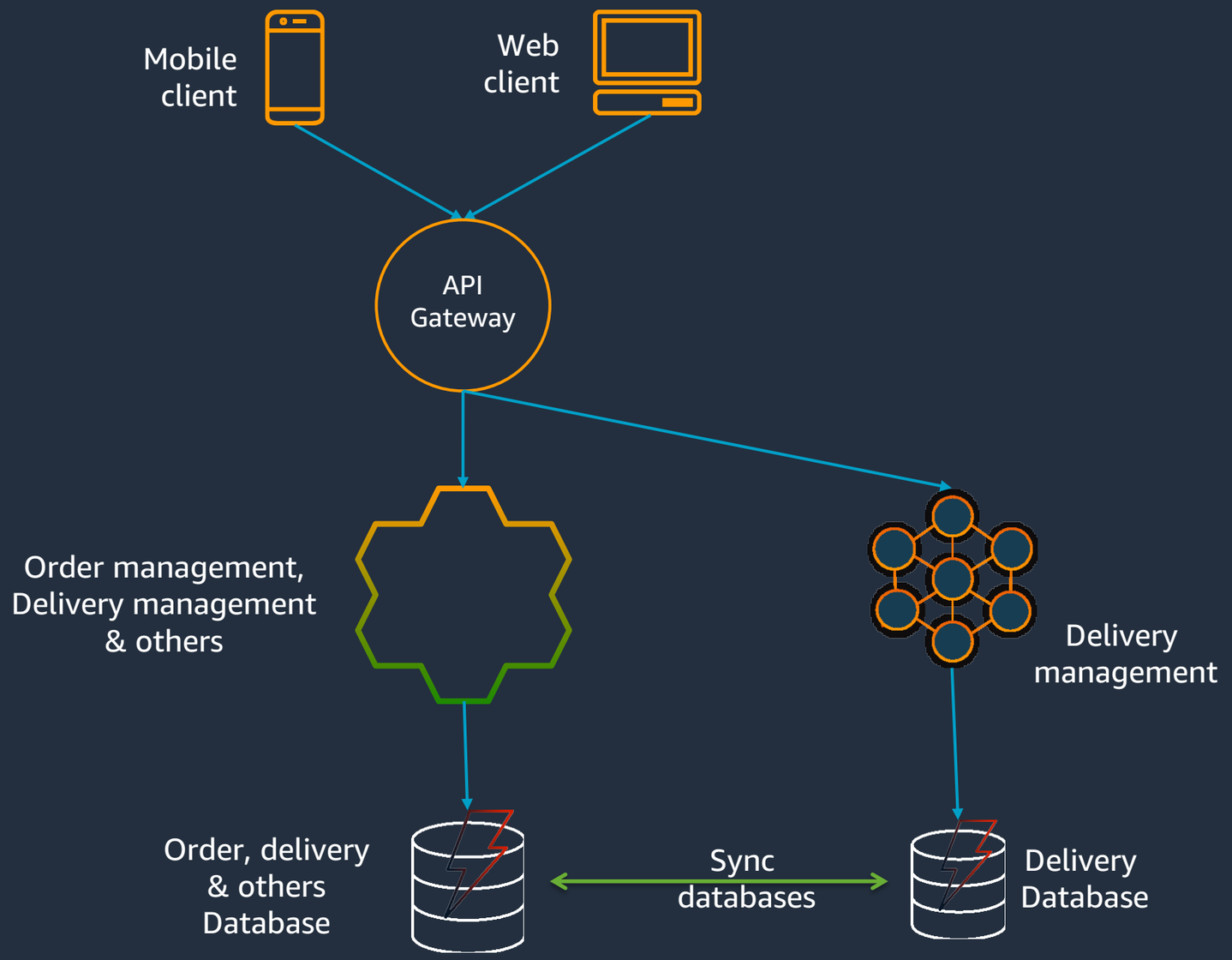
Strangler Pattern

Retire & Rewrite

vs

Extract & Reuse





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Serverless Compute

AWS Lambda

Serverless event-driven code execution

Short-lived

All language runtimes

Data-source integrations

AWS Fargate

Serverless compute engine for containers

Long-running

Bring existing code

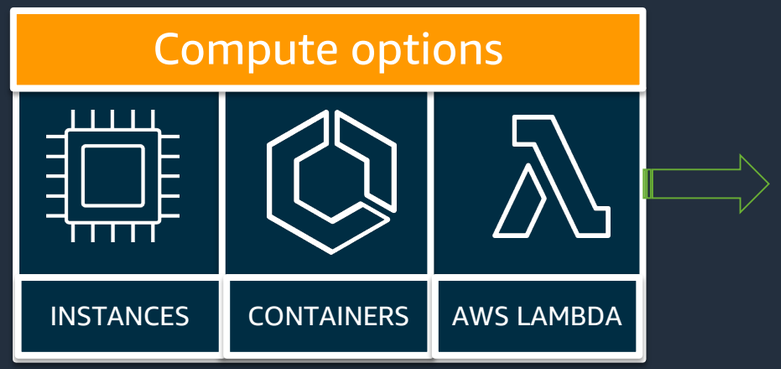
Fully managed orchestration

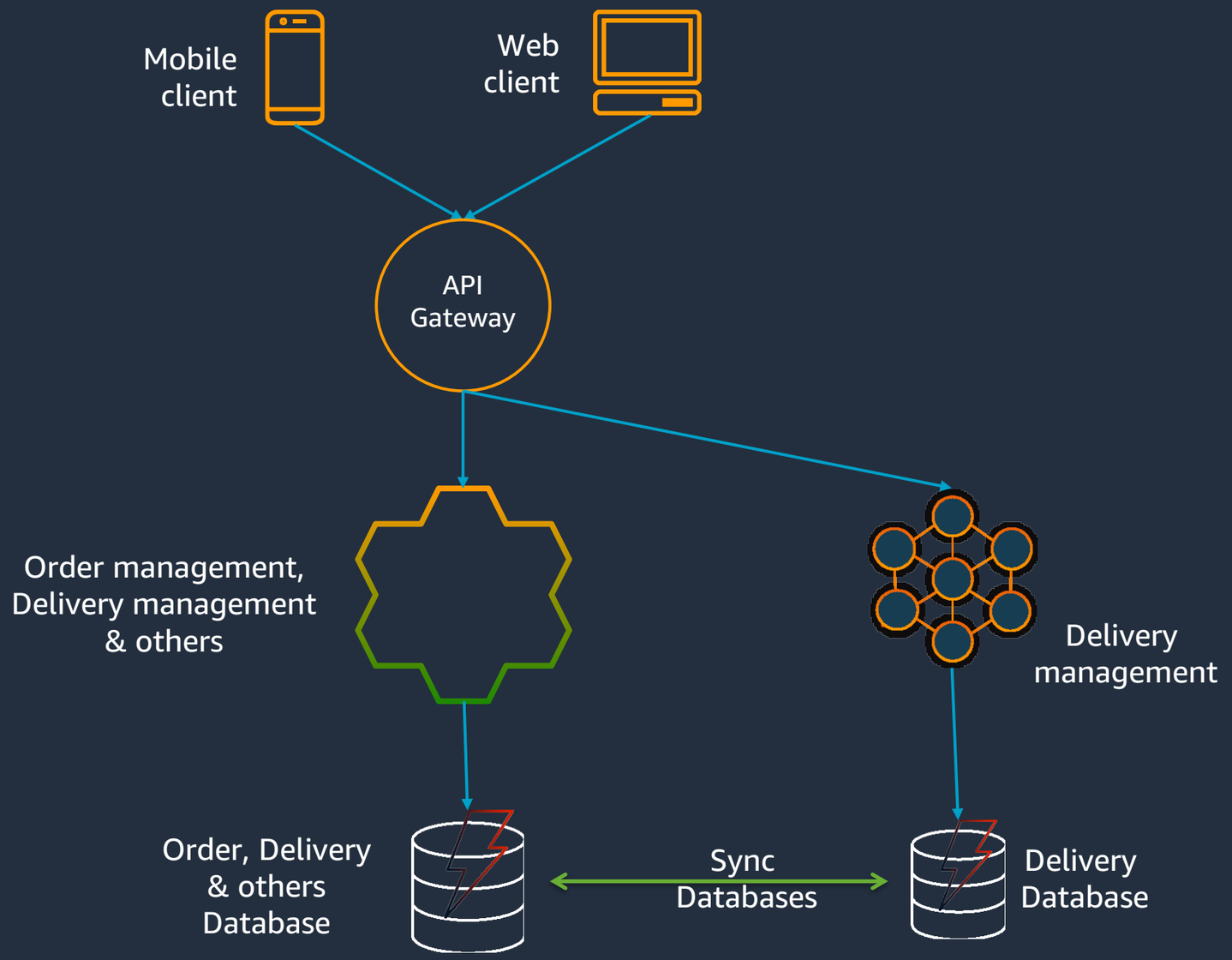
Straggler Pattern

Retire & Rewrite

vs

Extract & Reuse





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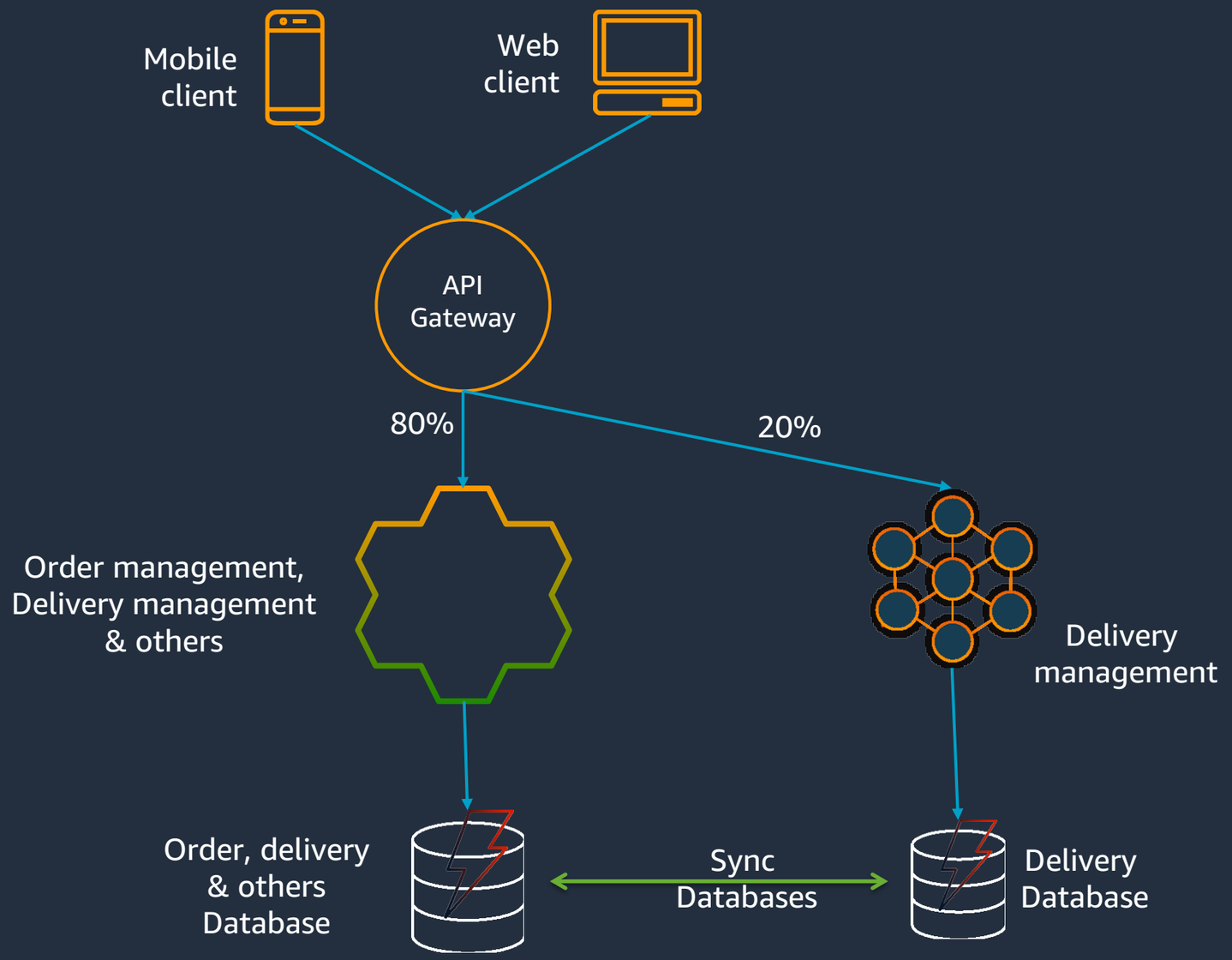
Toggle Traffic

Test application rollback, if required



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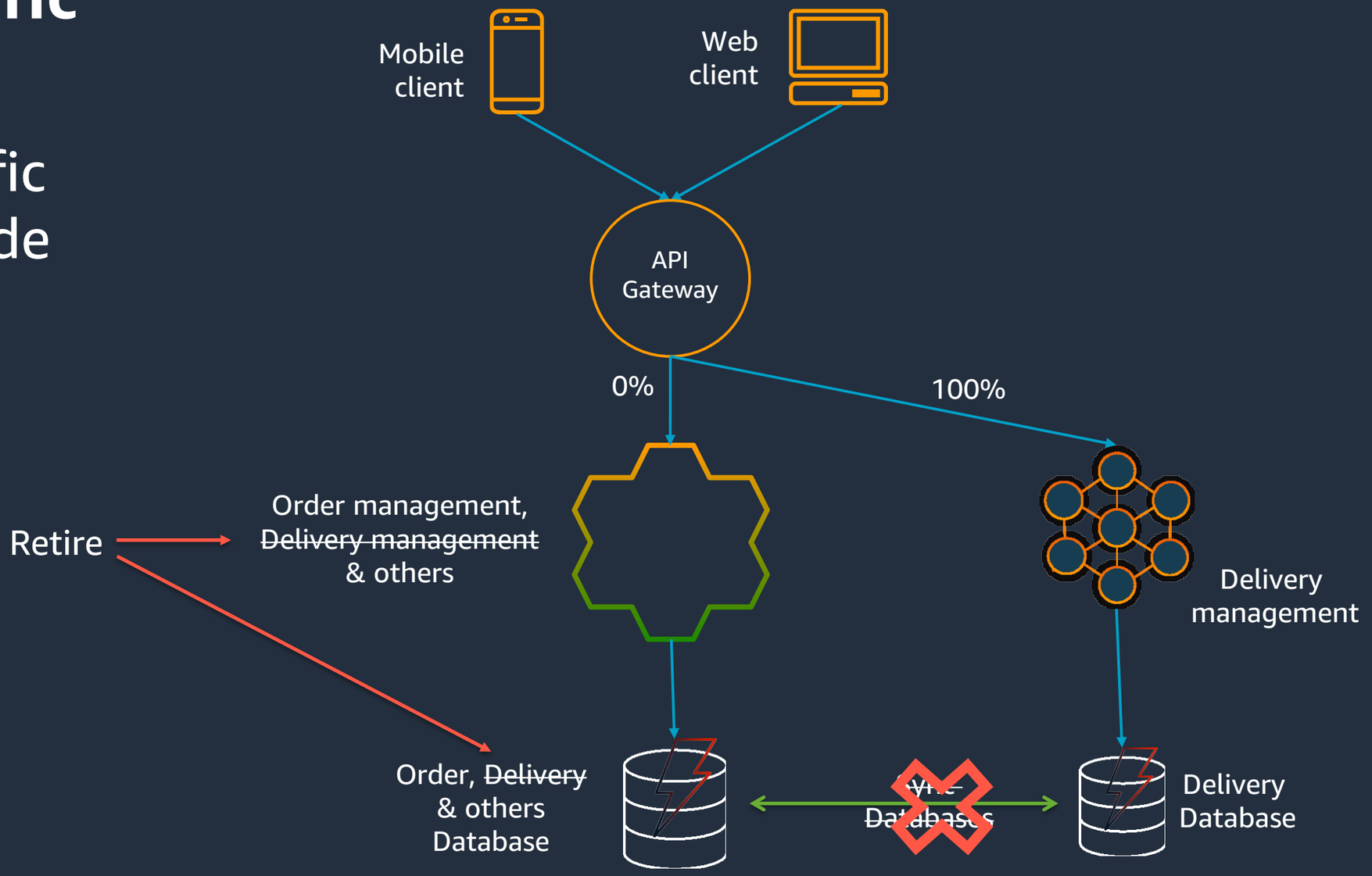
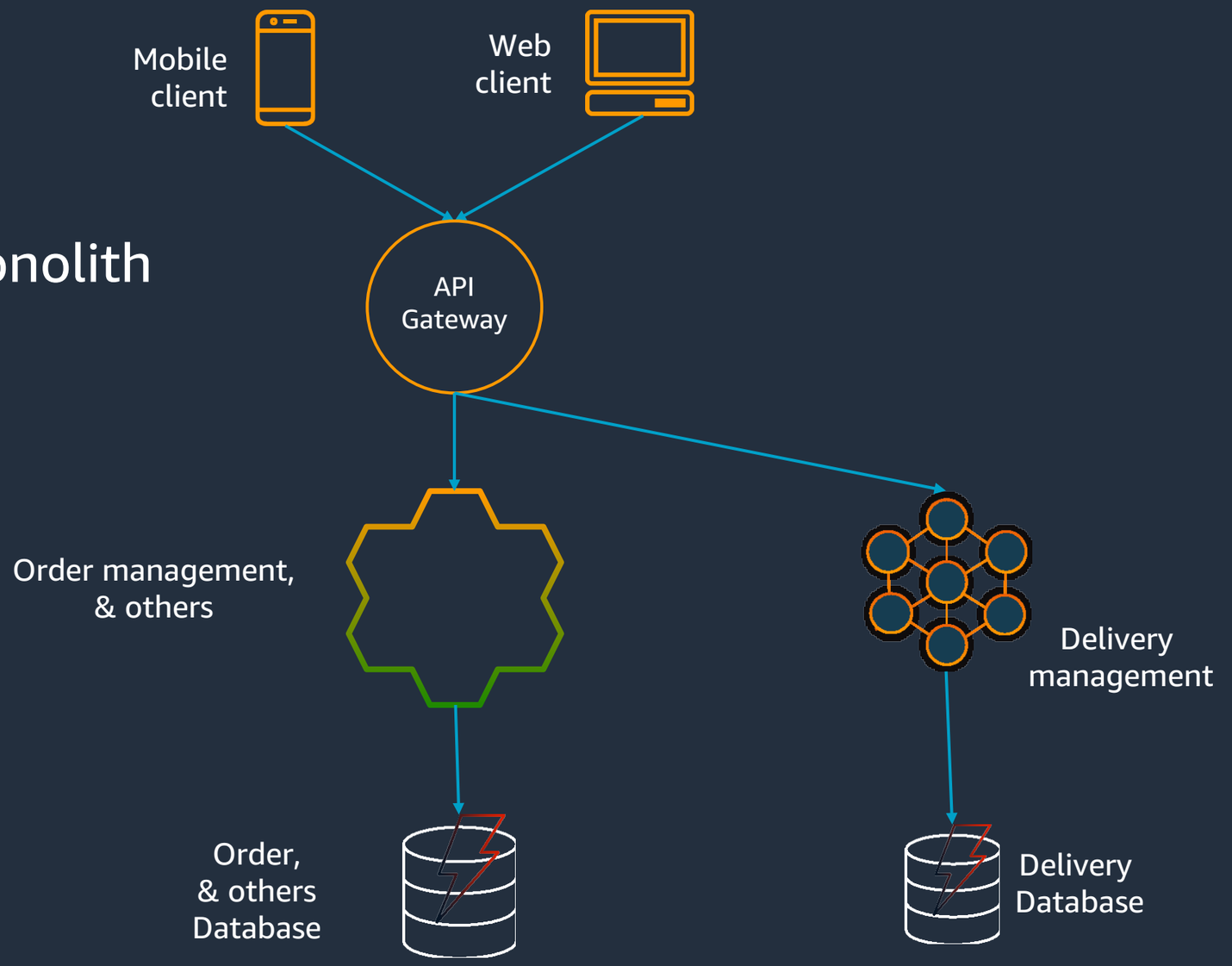
Toggle Traffic

Redirect traffic
Retire old code



Coexistence

Continue refactoring the Monolith



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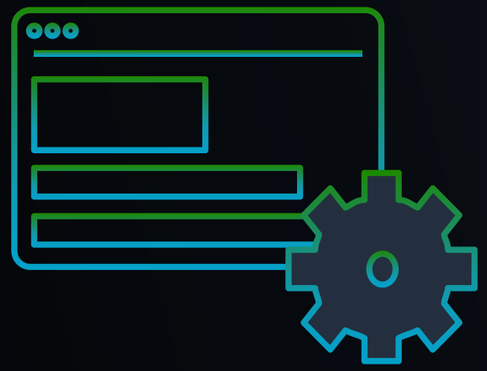

APIs are the front door of microservices

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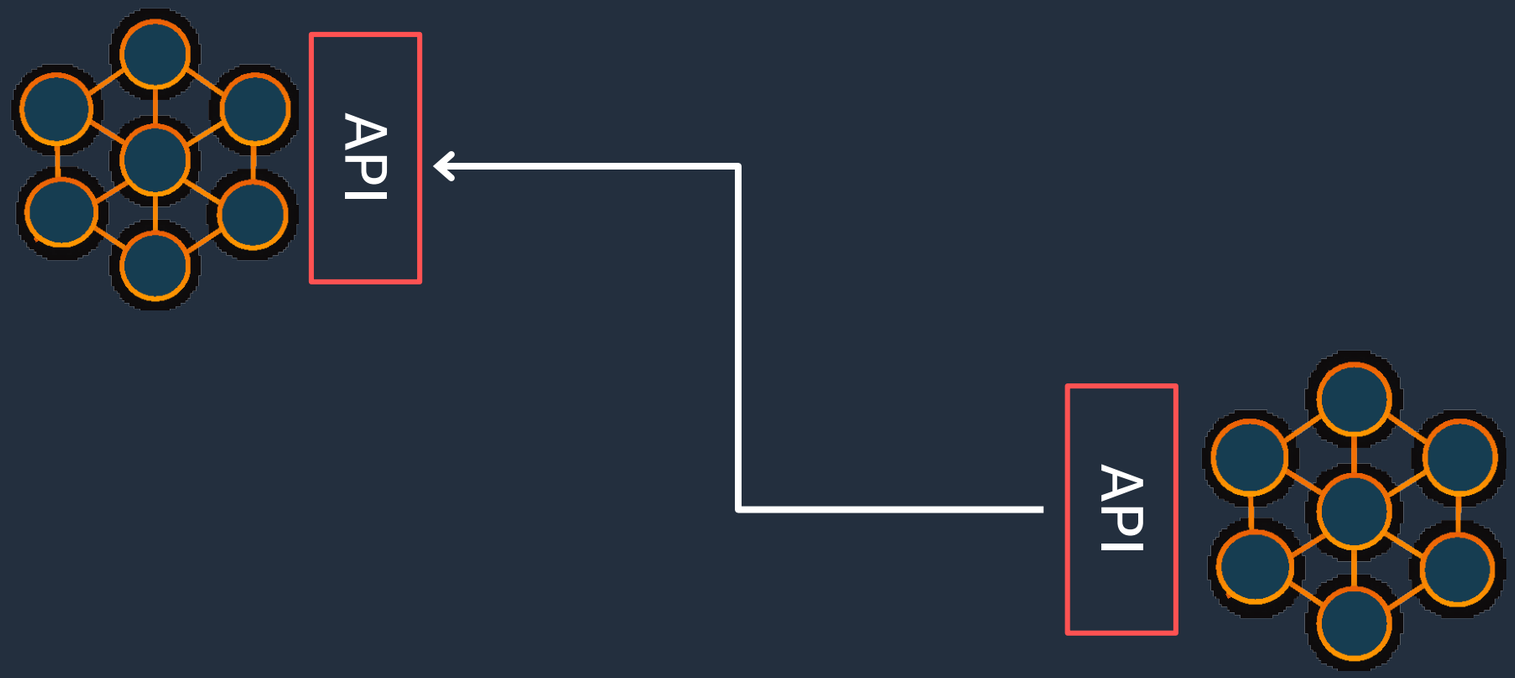
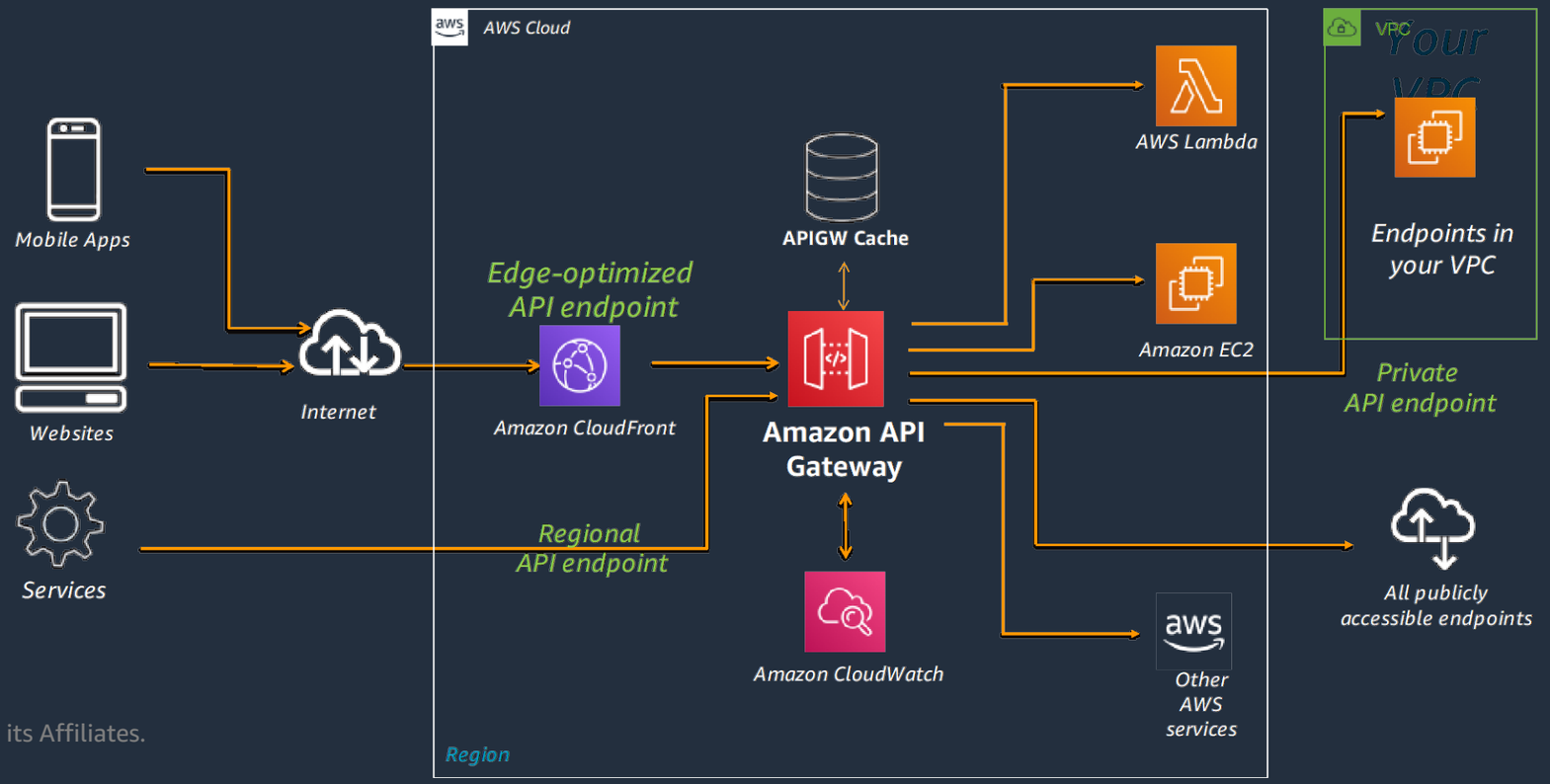
APIs are hardened contracts



Amazon API Gateway - RESTful APIs and WebSocket APIs

- Create a unified API frontend for multiple microservices
- DDoS protection, caching and throttling for your backend
- Authenticate and authorize requests to a backend
- Throttle, meter, and monetize API usage by third-party developers



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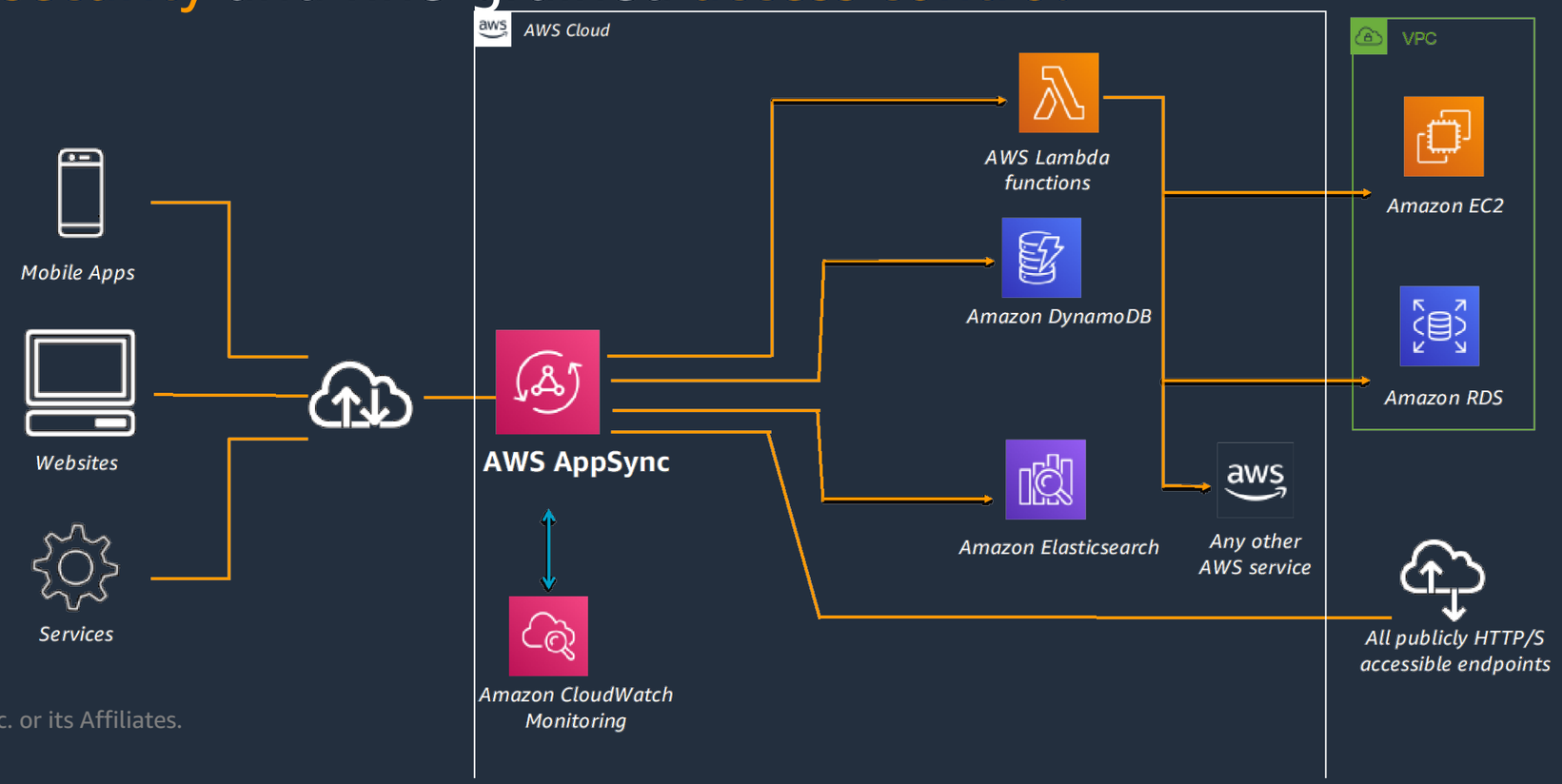
AWS AppSync - Managed GraphQL APIs

- Offline data synchronization - Interact with and update your data, even when offline, with the Amplify DataStore
- Data querying, filtering, and search in app with preconfigured access to AWS data sources
- Enterprise security and fine-grained access control



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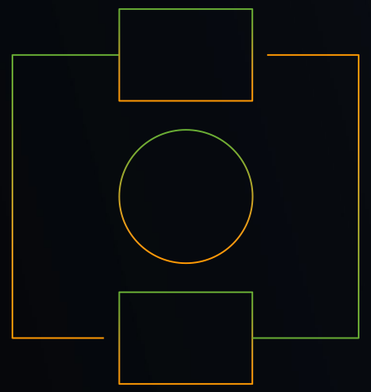
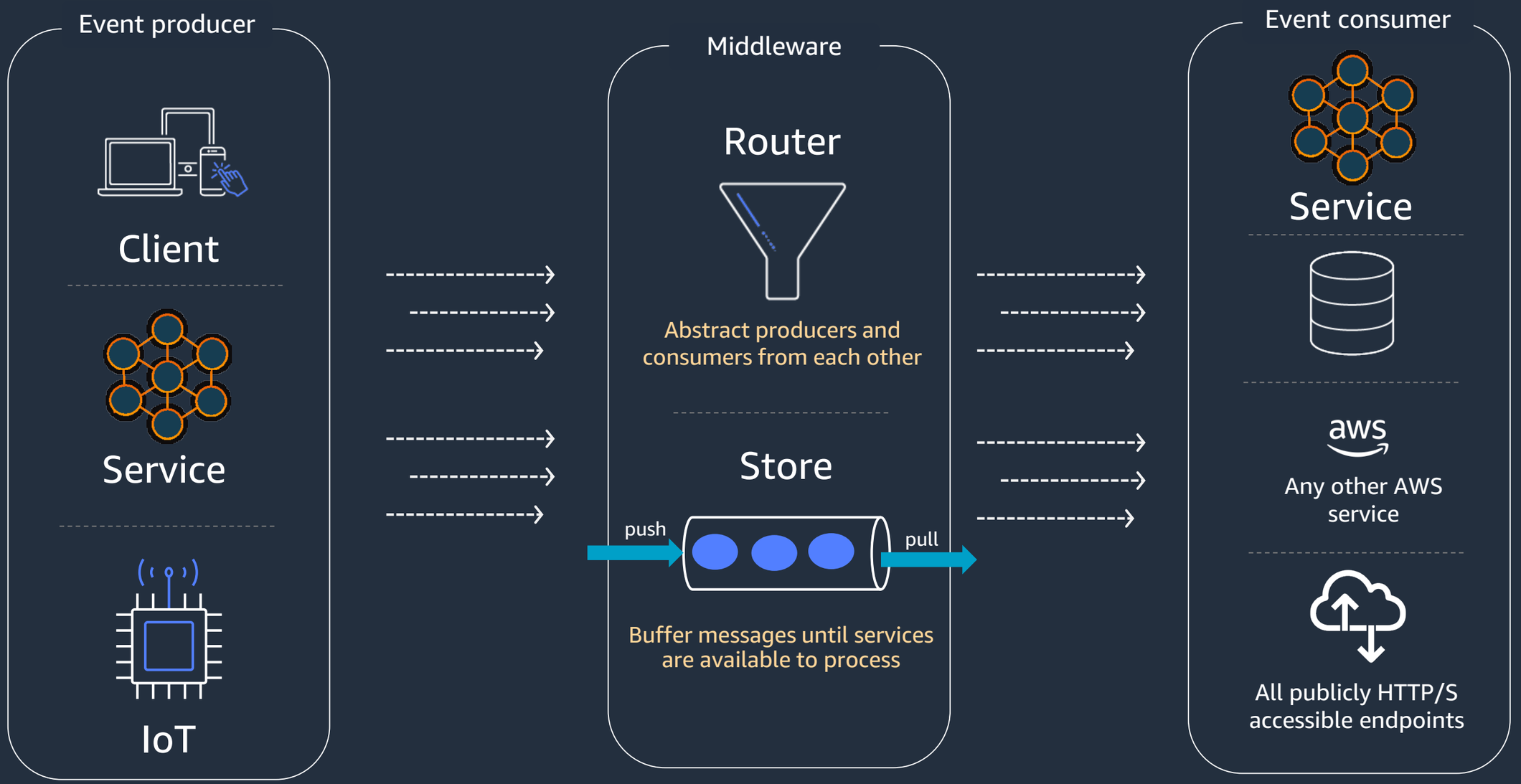


Events are the connective tissue of modern applications

Event-driven architecture



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It’s not just about computing & infrastructure!

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Data model and store

Relational

Referential integrity, ACID transactions, schema-on-write

Common Use Cases: Lift and shift, ERP, CRM, finance

AWS Service(s): **Amazon Aurora, Amazon RDS**

In-memory

Query by key with microsecond latency

Common Use Cases: Leaderboards, real-time analytics, caching

AWS Service(s): **Amazon ElastiCache**

Key-value

High throughput, low-latency reads and writes, endless scale

Common Use Cases: Real-time bidding, shopping cart, social, product catalog, customer preferences

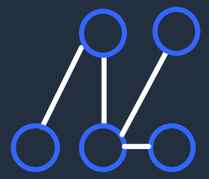
AWS Service(s): **Amazon DynamoDB**

Document

Store documents and quickly access querying on any attribute

Common Use Cases: Content management, personalization, mobile

AWS Service(s): **Amazon DocumentDB**



Graph

Quickly and easily create and navigate relationships between data

Common Use Cases: Fraud detection, social networking, recommendation engine

AWS Service(s): **Amazon Neptune**

Time-series

Collect, store, and process data sequenced by time

Common Use Cases: IoT applications, event tracking

AWS Service(s): **Amazon Timestream**

Ledger

Complete, immutable, and verifiable history of all changes to application data

Common Use Cases: Systems of record, supply chain, health care, registrations, financial

AWS Service(s): **Amazon QLDB**

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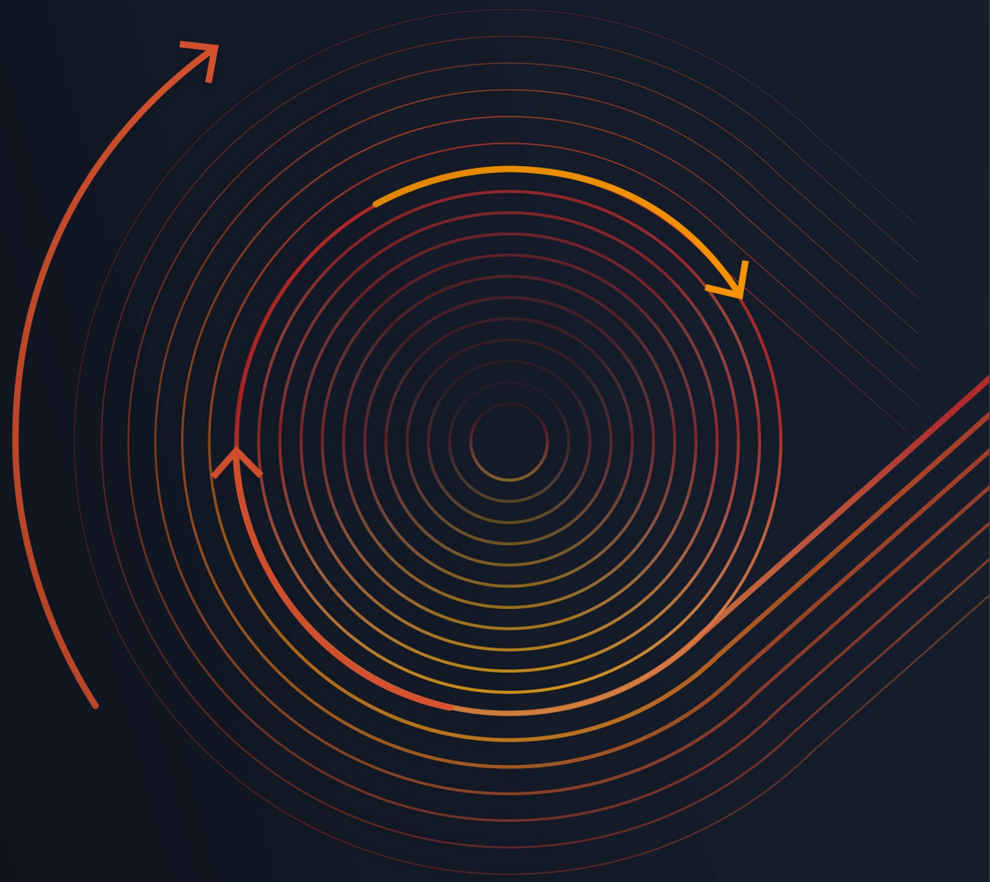
Changes to the operational model



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Isn’t all of this very hard now that we have lots of pieces to operate?

AWS operational responsibility models

On-premises | Cloud

Compute	Virtual machine	Amazon EC2	AWS Elastic Beanstalk		AWS Fargate	AWS Lambda
Databases	MySQL	MySQL on Amazon EC2	Amazon RDS for MySQL	Amazon RDS	Amazon Aurora	Amazon DynamoDB
Storage	Storage					Amazon Simple Storage Service (Amazon S3)
Messaging	ESBs		Amazon MQ	Amazon Kinesis		Amazon EventBridge/ Amazon SQS/Amazon SNS
Analytics	Hadoop	Hadoop on EC2	Amazon EMR	Amazon Elasticsearch Service		Amazon Athena

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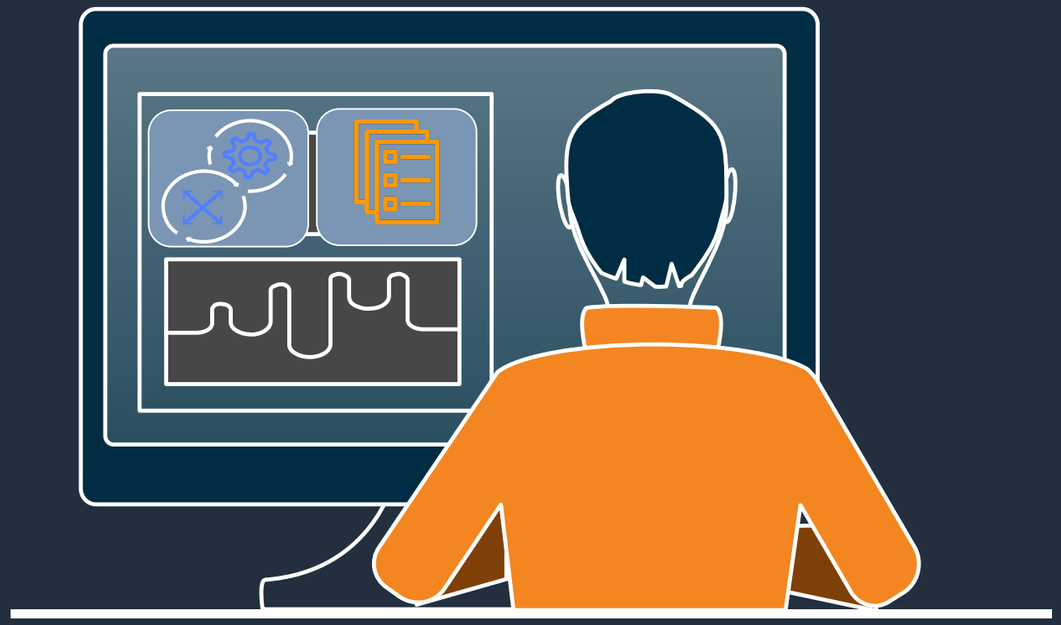
Comparison of operational responsibility - Compute

	AWS manages	Customer manages
AWS Lambda Serverless functions	• Data source integrations • Physical hardware, software, networking, and facilities • Provisioning	• Application code
AWS Fargate Serverless containers	• Container orchestration, provisioning • Cluster scaling • Physical hardware, host OS/kernel, networking, and facilities	• Application code • Data source integrations • Security config and updates, network config, management tasks
Amazon ECS/Amazon EKS Container-management as a service	• Container orchestration control plane • Physical hardware software, networking, and facilities	• Application code • Data source integrations • Work clusters • Security config and updates, network config, firewall, management tasks
Amazon EC2 Infrastructure-as-a-Service	• Physical hardware software, networking, and facilities	• Application code • Data source integrations • Scaling • Security config and updates, network config, management tasks • Provisioning, managing scaling and patching of servers

Application should guide infrastructure

AWS Lambda

AWS Fargate



Serverless is an operational model that spans many different categories of services

Compute


AWS Lambda


AWS Fargate

Data stores


Amazon S3


Amazon Aurora Serverless


Amazon DynamoDB

Integration


Amazon API Gateway


Amazon SQS


Amazon SNS


AWS Step Functions


AWS AppSync


Amazon EventBridge

https://aws.amazon.com/serverless/

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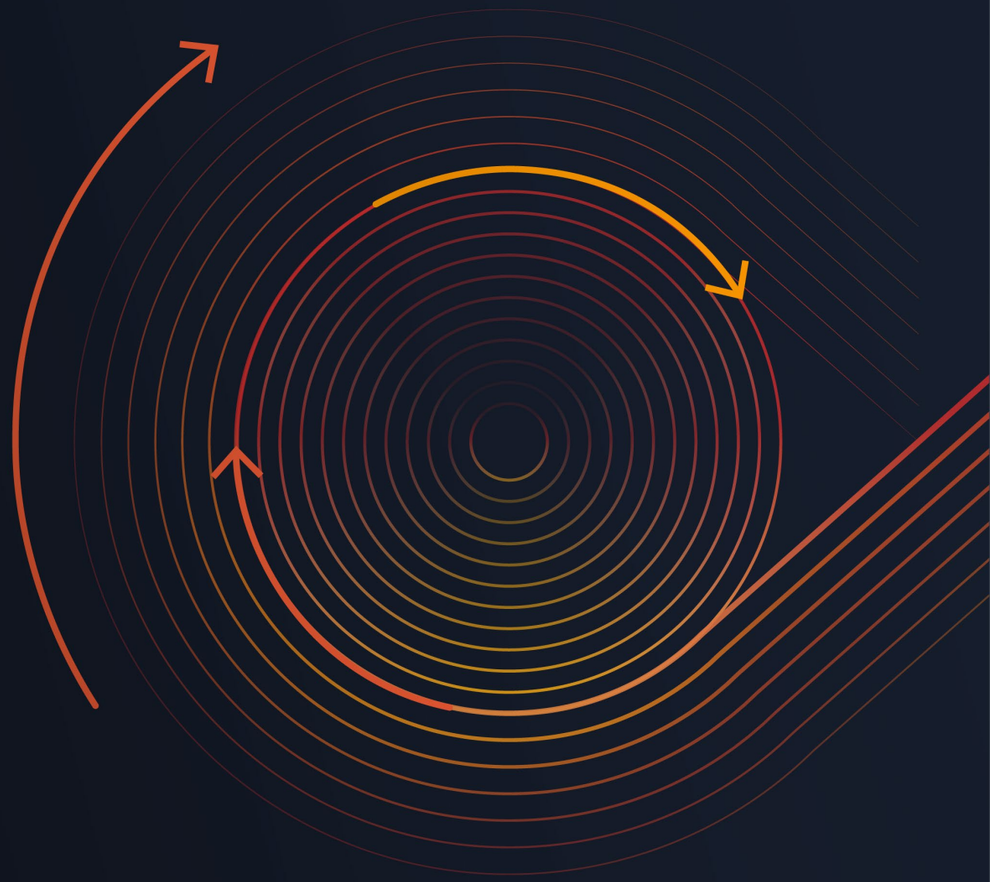
Accelerating developer productivity

As you move up the layers of simplicity at AWS, your team goes faster

Changes to the delivery of software



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How do I develop and deploy code in a serverless microservices architecture?

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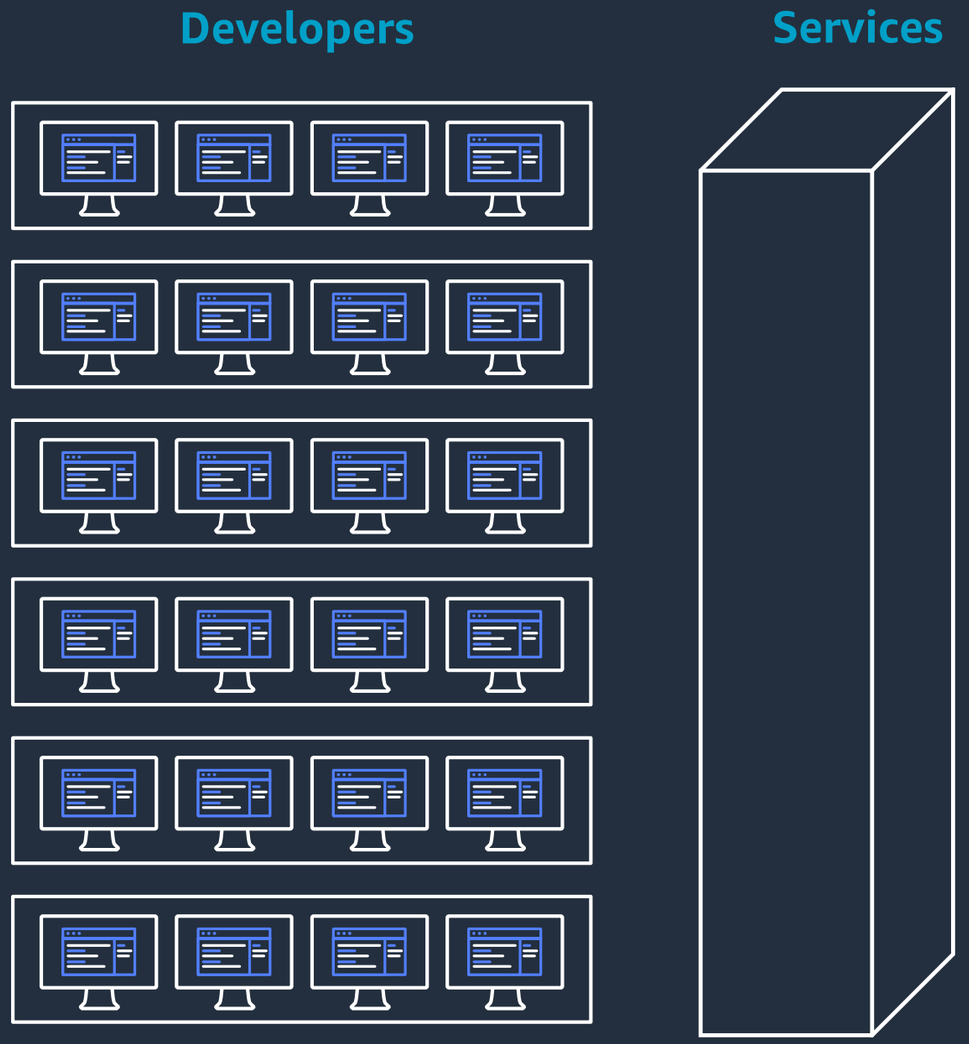
Monolith development lifecycle



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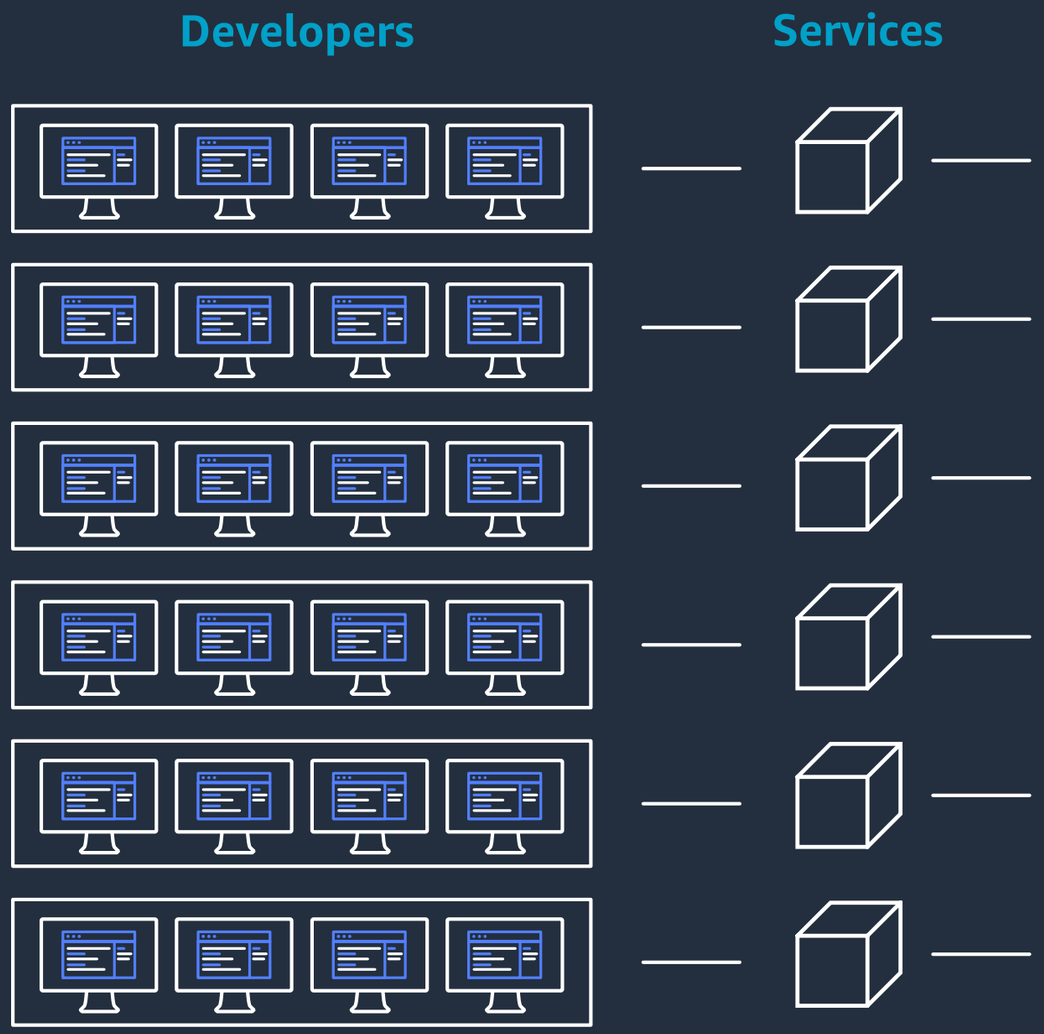
Microservice development lifecycle



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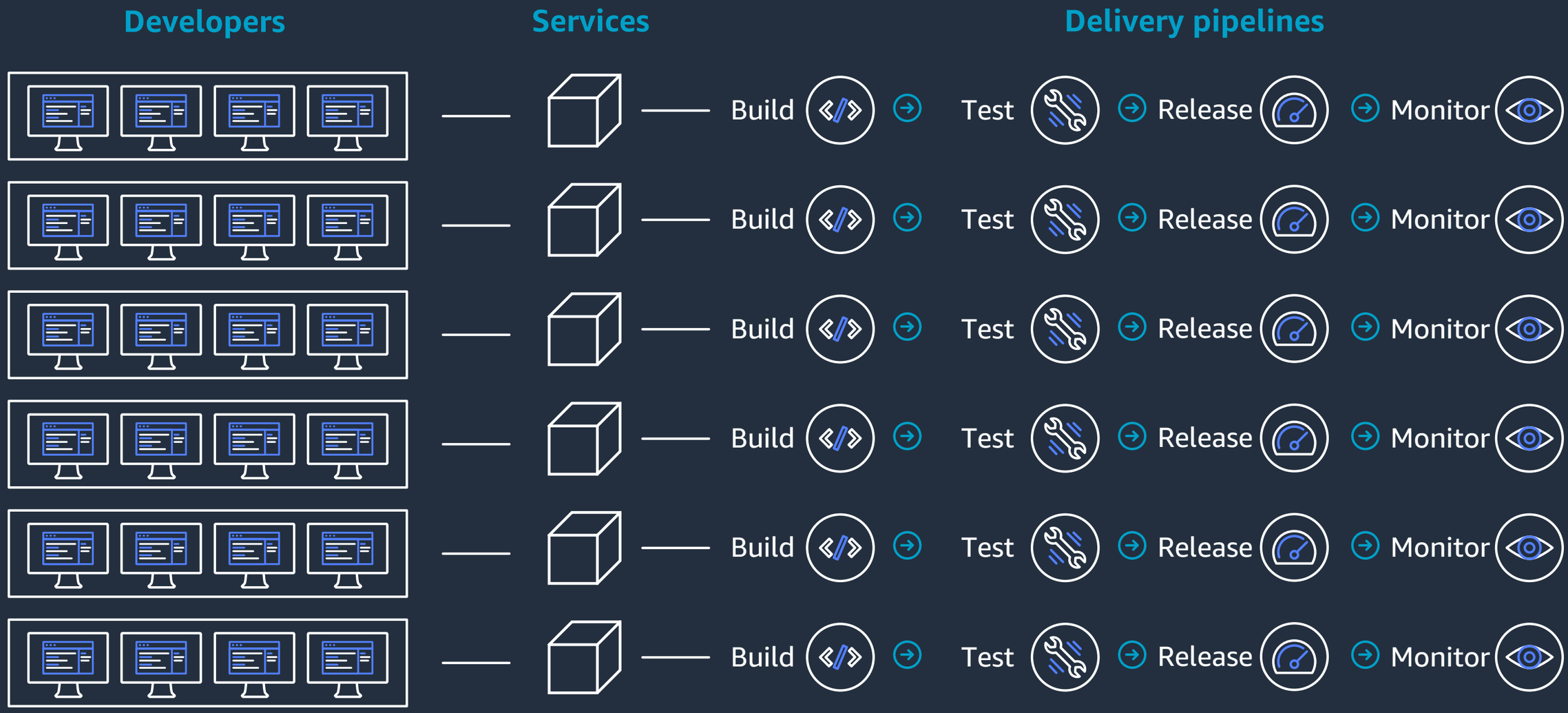
Microservice development lifecycle



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Pipeline per team

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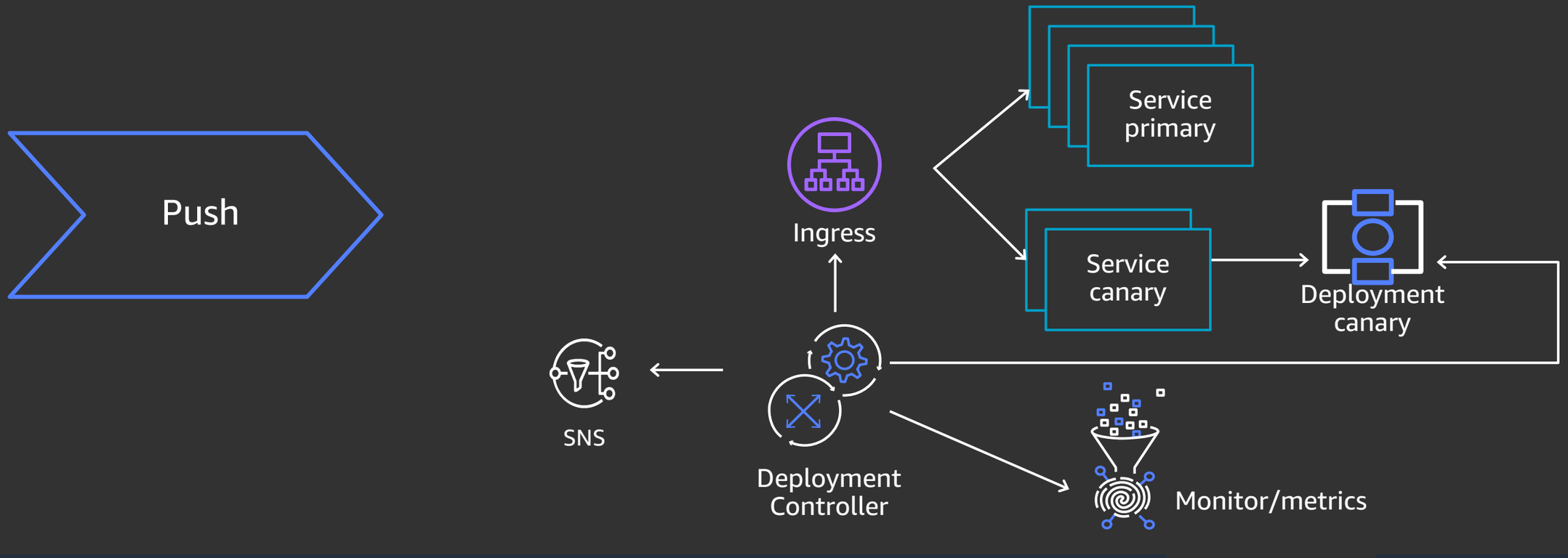
Automated deployment



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Infrastructure and application

Cloud resources and application

Common code review process

Deployed as a package

Recent : SAM start right

1

Pick a serverless quick start

Scheduled Job
(Amazon CloudWatch -> AWS Lambda)

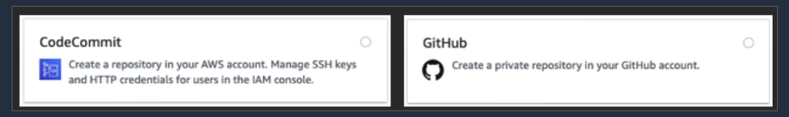
Queue Processing
(SQS ->AWS Lambda)

File Processing
(Amazon S3 -> AWS Lambda)

API backend
(Amazon API Gateway -> AWS Lambda)

2

Configure your application's repository



3

Get a complete deployment pipeline

Serverless application

Automated deployment pipeline

AWS SAM

Source → Build → Deploy

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Best practices

Decompose for agility
(microservices, 2 pizza teams)

Automate everything

Standardized tools

Belts and suspenders
(governance, templates, DevSecOps)

Infrastructure as Code

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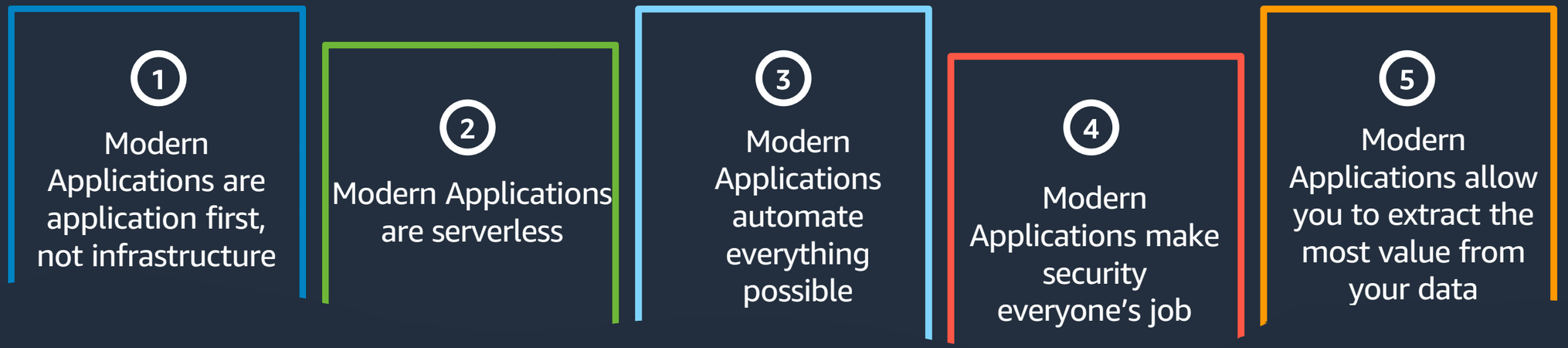
Five pillars of Modern Applications



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Deliver innovation

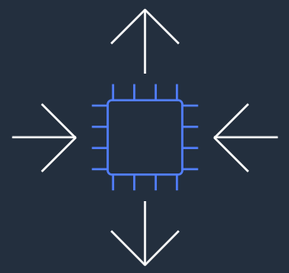
Agility

"We relied on AWS Lambda to get our platform on the market in under four weeks. Within six months, we had scaled to 40,000 users without running a single server."

—A Cloud Guru

"We can have a commit roll into production in literally minutes—as well as provide a bunch of flexible routing options dynamically."

—Pinpoint



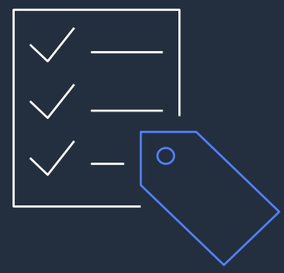
Elasticity

"Using Lambda-based serverless applications, Resnap can run multiple Machine Learning models on an average of 600 photos, which results in thousands of invocations and still generates a photo book within one minute."

—Resnap

"Our serverless-based approaches allow us to serve ads to audiences 60% faster than with instance-based approaches."

—Infinia Mobile



Total cost efficiency

"Our costs dropped by more than 25% and our monthly average time to complete data processing dropped to 7 seconds, making the process over 99% faster."

—Speed Shift Media

"Using AWS Lambda & AWS Step Functions, we cut customer onboarding times from 20 minutes to 30 seconds and their 'expected costs are $20 USD per 10,000 orders.'"

—Mercury

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[1] 451 Research, *Demystifying Cloud Transformation: Where Enterprises Should Start,* September 2019.

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