AWS re:Invent

NOV. 29 – DEC. 3, 2021 | LAS VEGAS, NV

NET318

Building resilient and low-latency gaming architectures on AWS

David Heidt (he/him)
Sr. Game Tech Solutions Architect
AWS

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Agenda

Challenges of globally distributed gaming workloads

Global optimization and availability with AWS services

DDoS resiliency and mitigation for gaming workloads

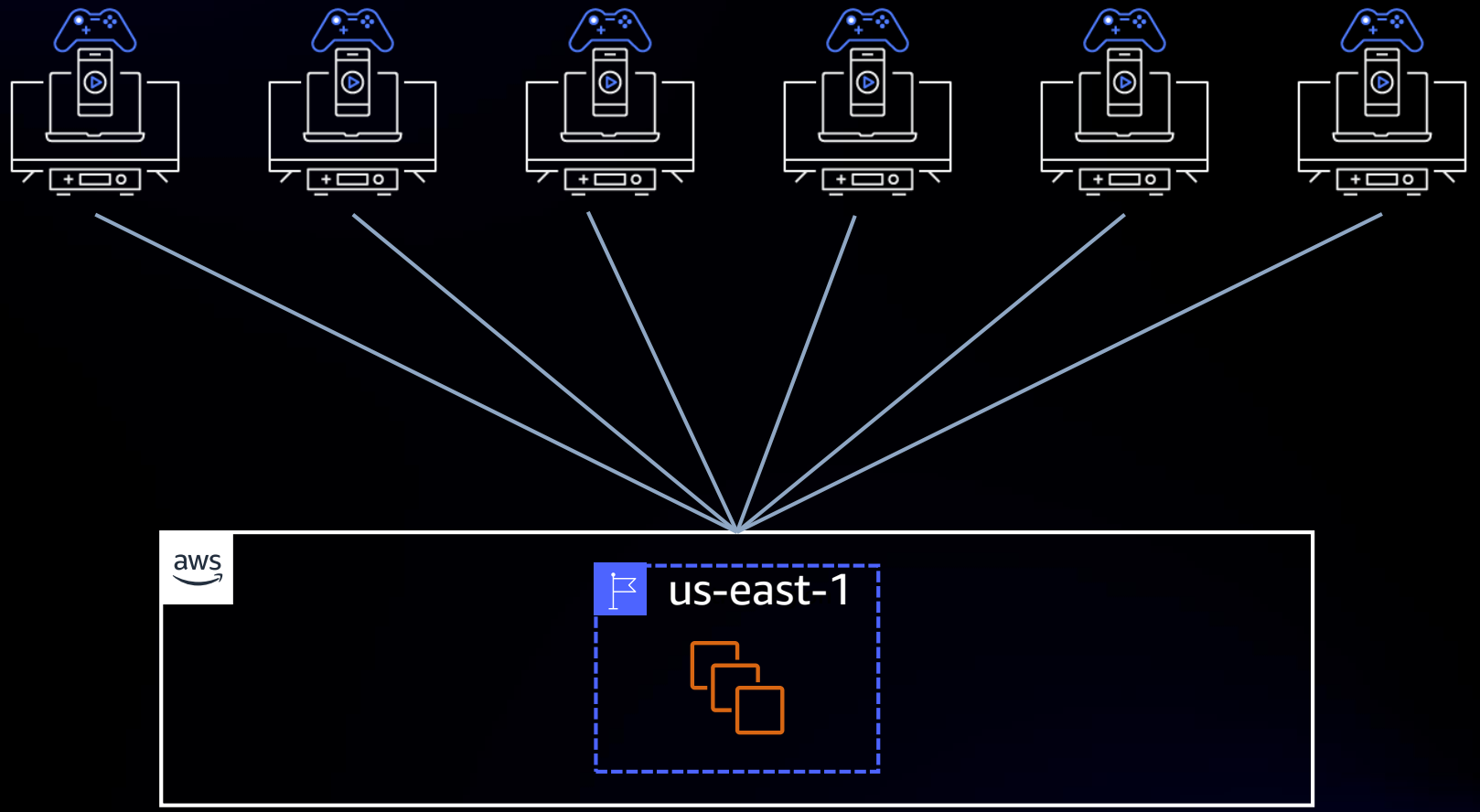
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Challenges of distributed workloads

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Challenges of distributed workloads

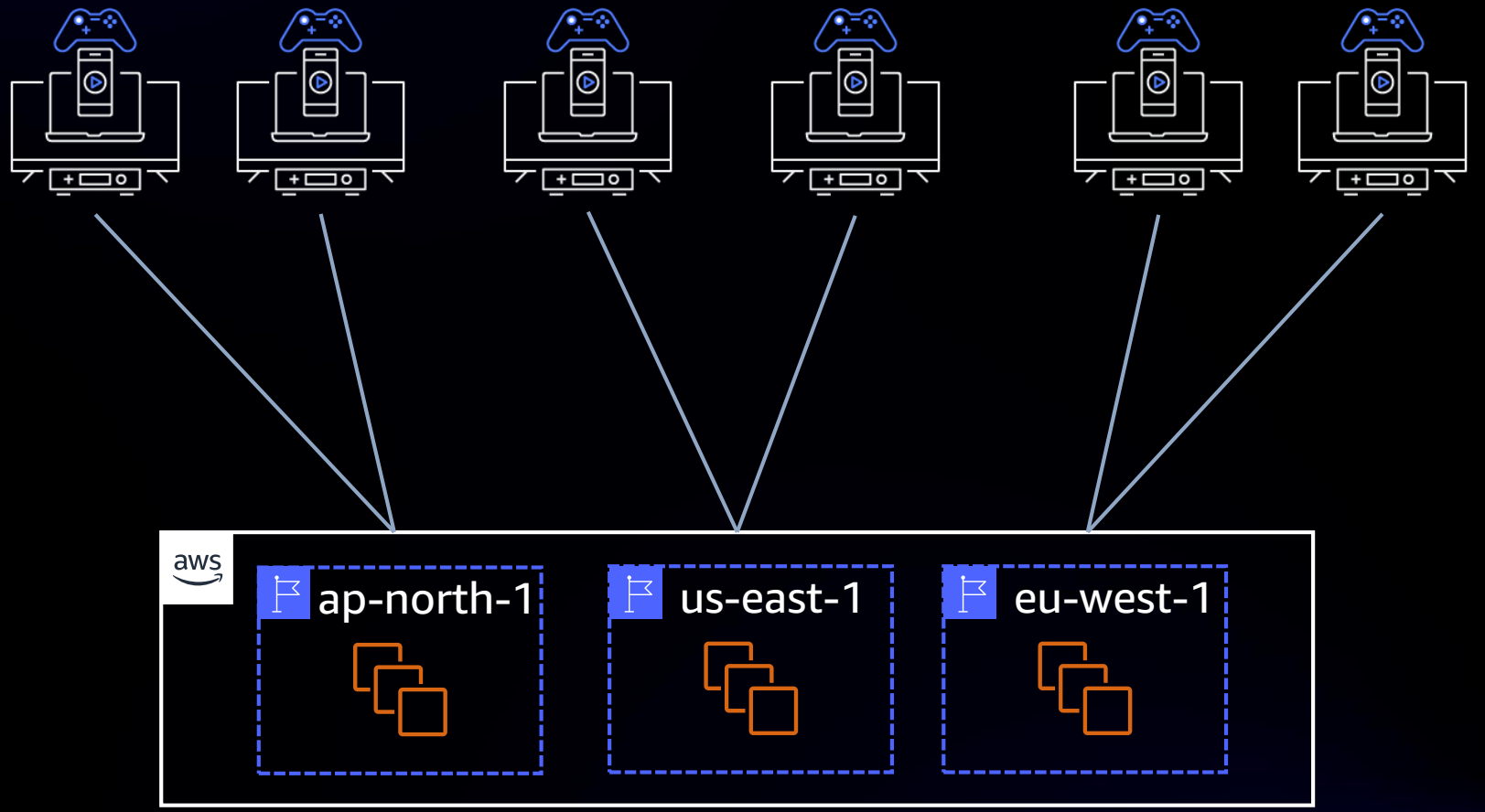
SINGLE-REGION DEPLOYMENT



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Challenges of distributed workloads

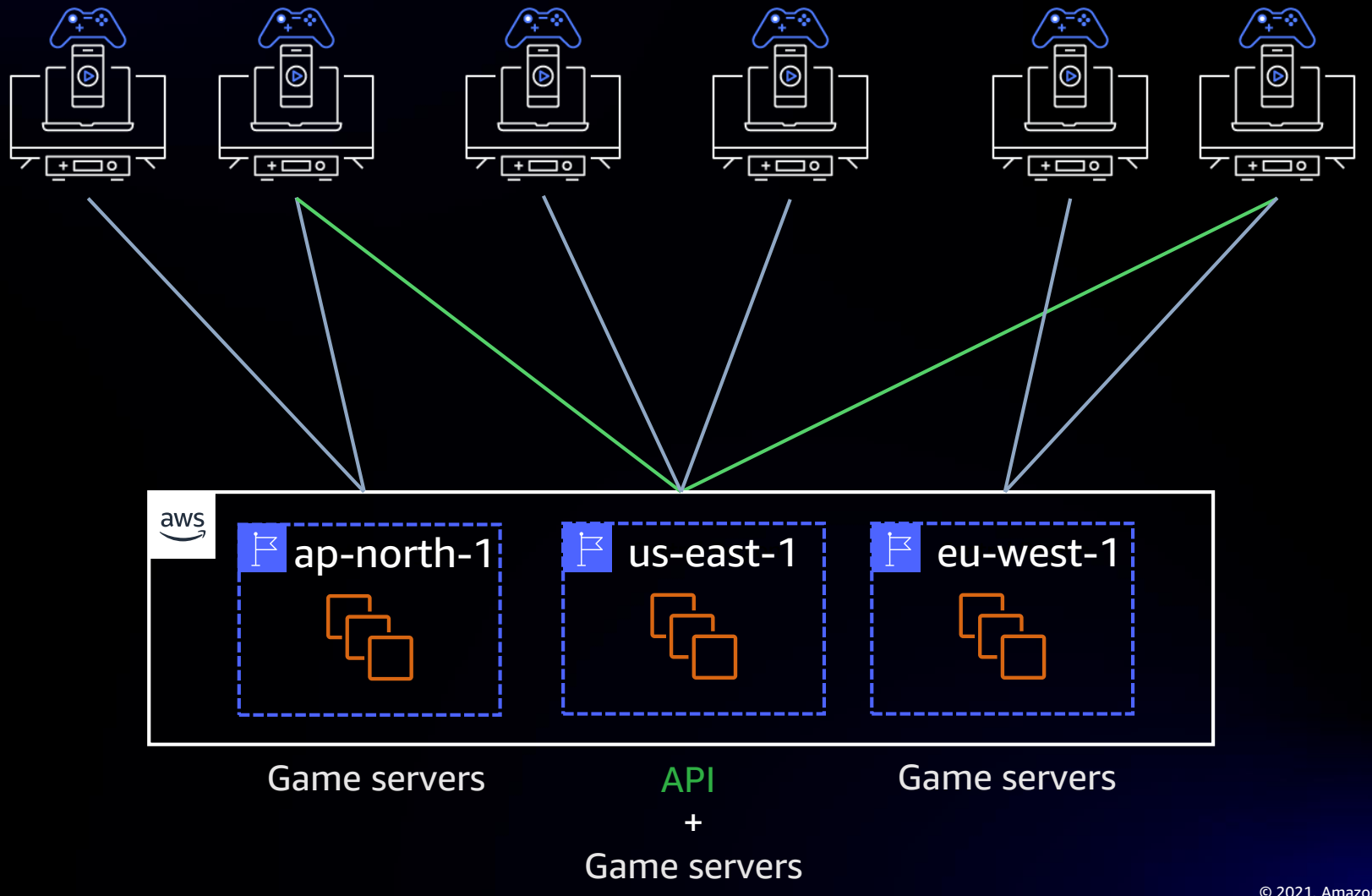
MULTI-REGION DEPLOYMENT



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Challenges of distributed workloads

STRATEGIC DEPLOYMENT

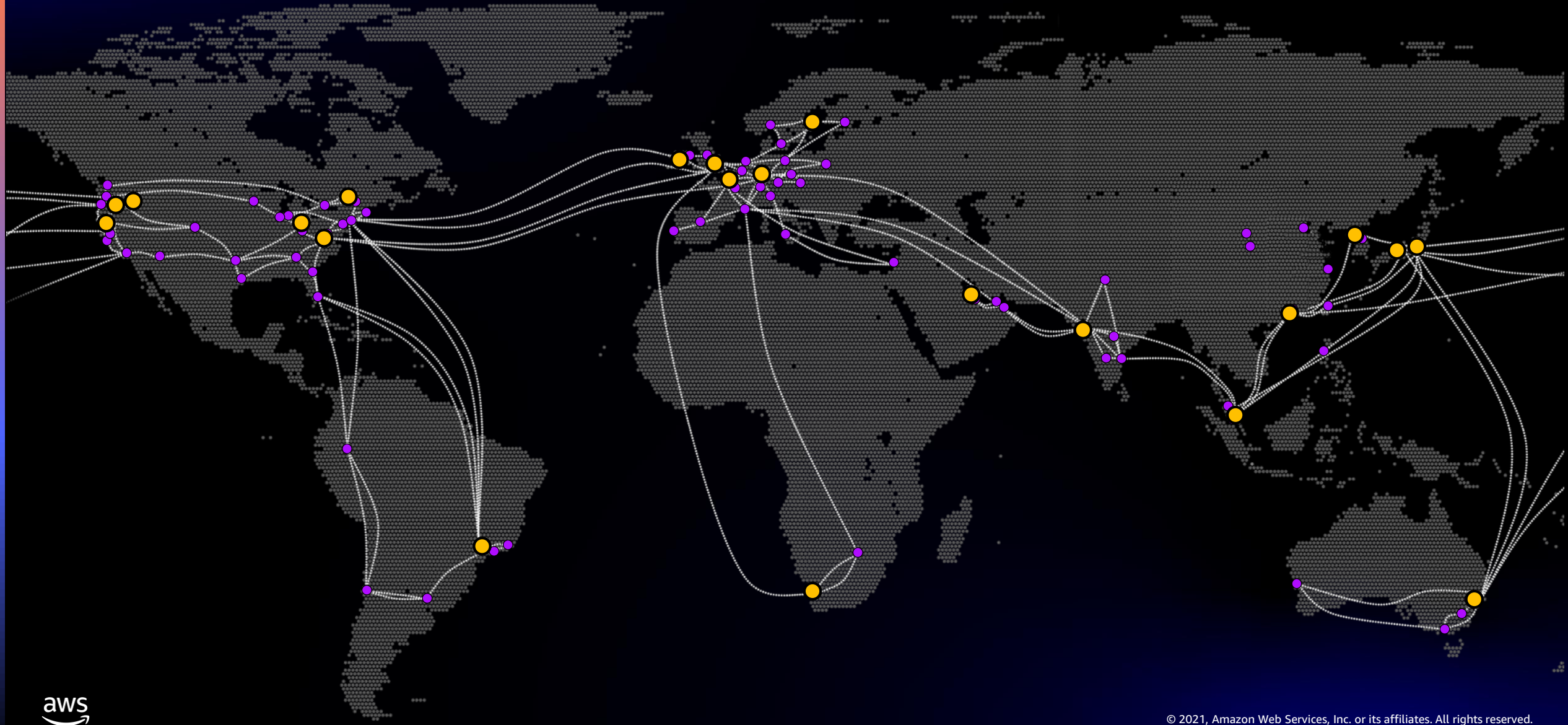


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Global availability and optimization

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

The AWS global infrastructure



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

L3 and L4 optimization

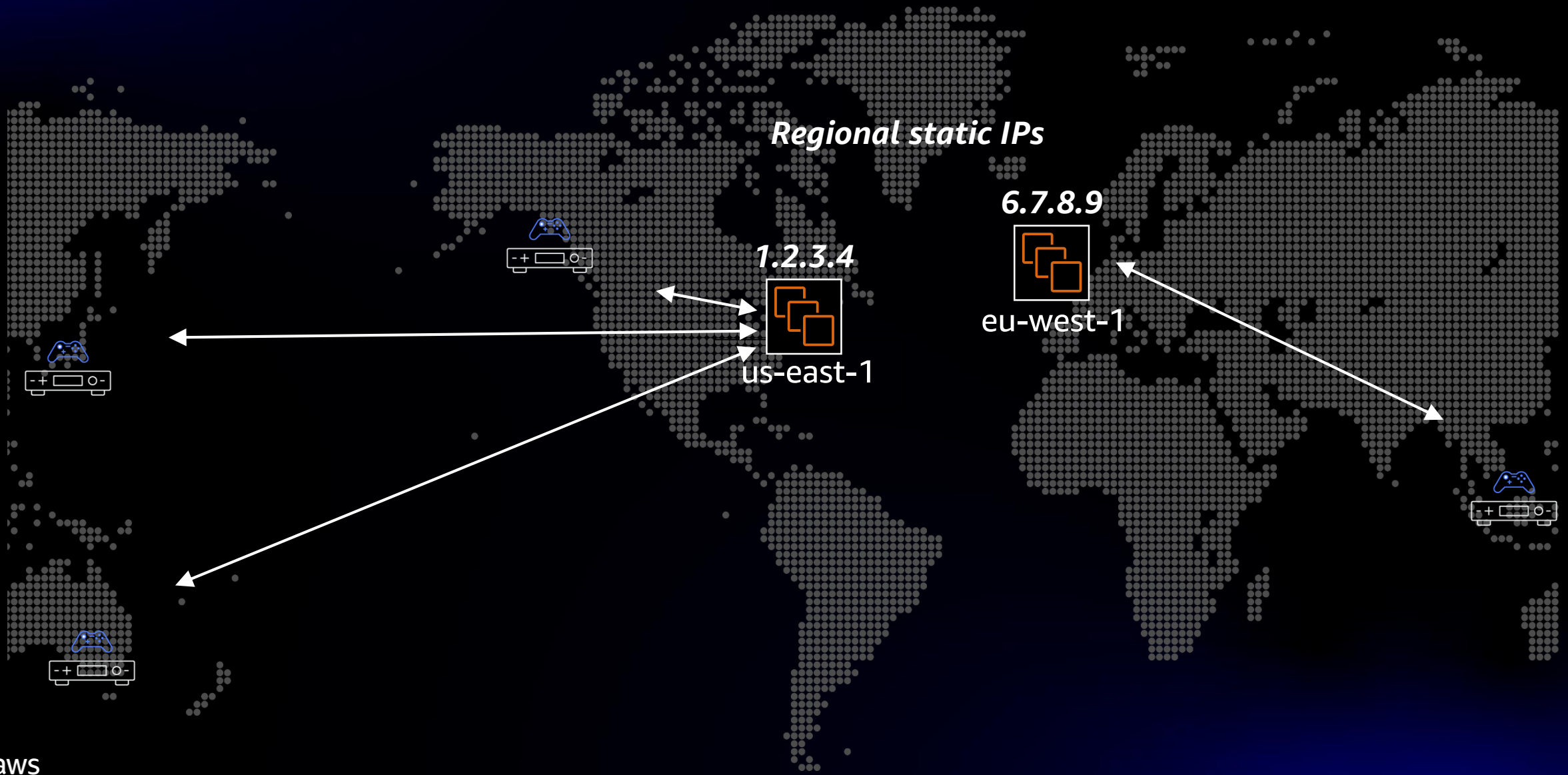


Use the **performance** and **stability** of the **AWS global infrastructure** with TCP/UDP workloads

AWS Global Accelerator

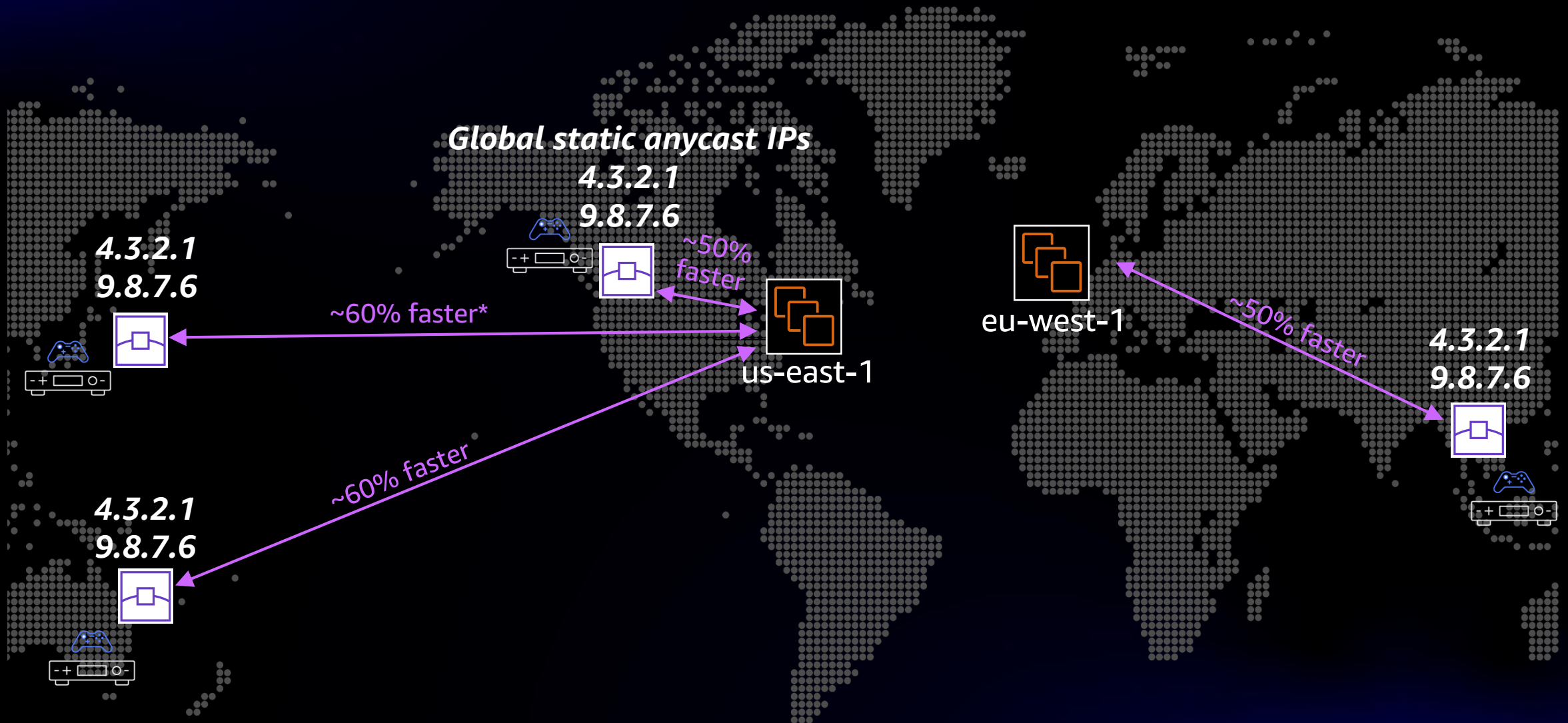
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Without Global Accelerator



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

With Global Accelerator



*p50 time to download a 100 KB object; third-party real-user measurements

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Performance

First byte latency (FBL)

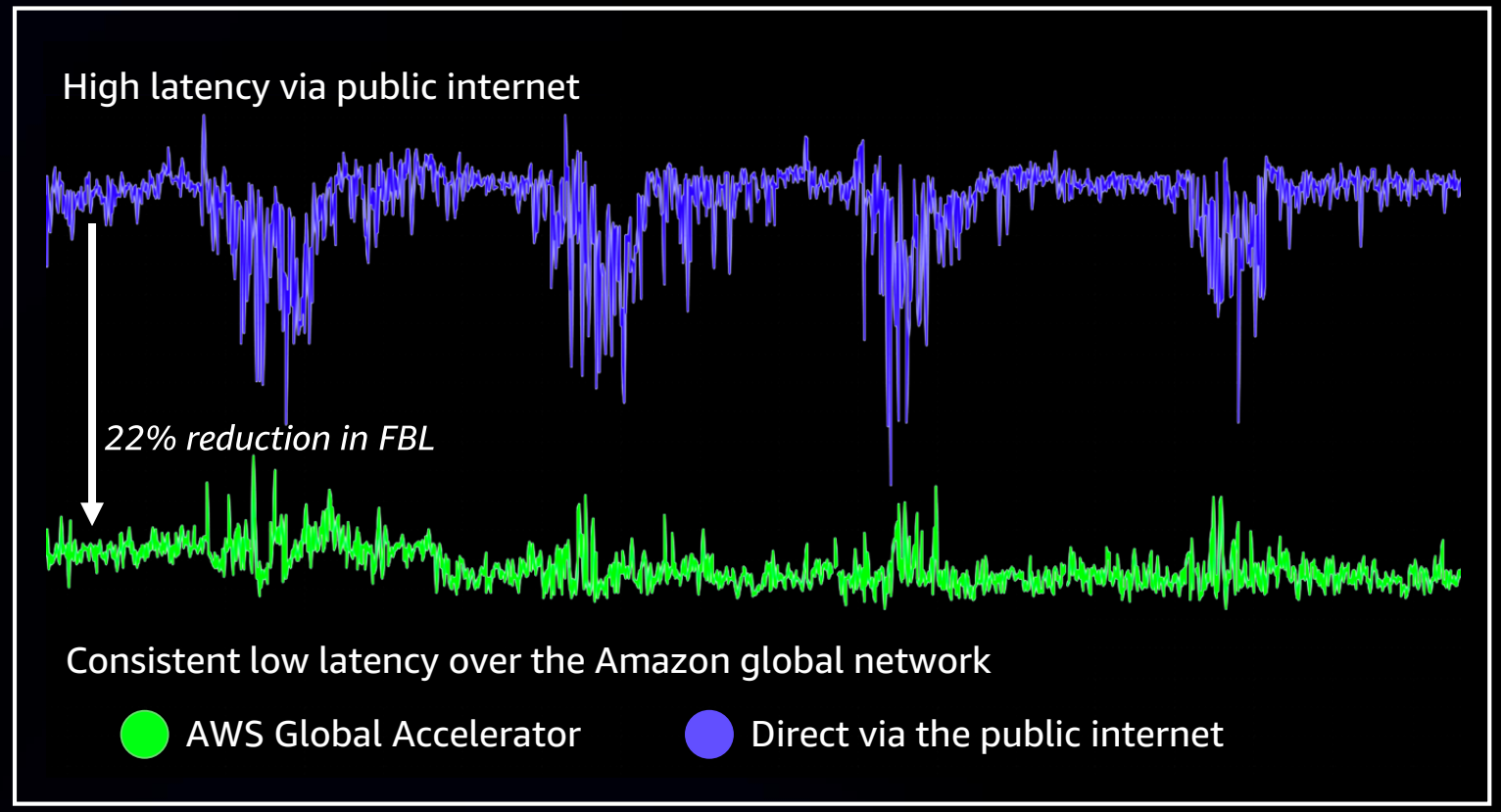
- Up to 49% better than direct *across continents*
- Up to 34% *within a continent*

Throughput

- Up to 60% better than direct *across continents*
- Up to 40% *within a continent*

Jitter

- Up to 58% better than direct *across continents*
- Up to 8% *within a continent*



Third-party real-user measurement (p90) from users in Singapore to Ireland Region

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Case study: JoyCity

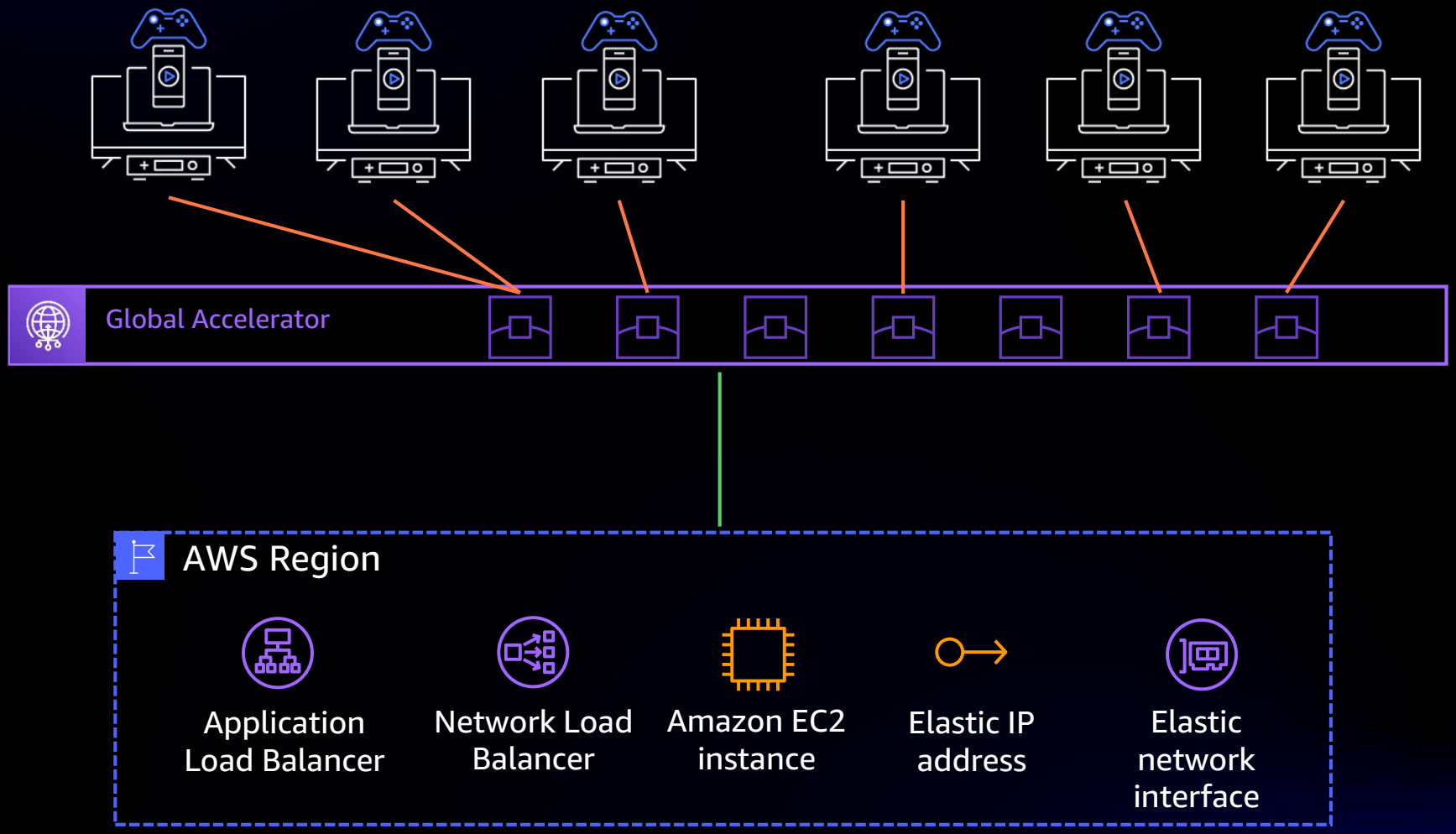
"AWS Global Accelerator dropped the number of network timeouts by 8 times in some countries."

SanAh Kang
Platform Team Leader, NDREAM
(parent company of JoyCity)



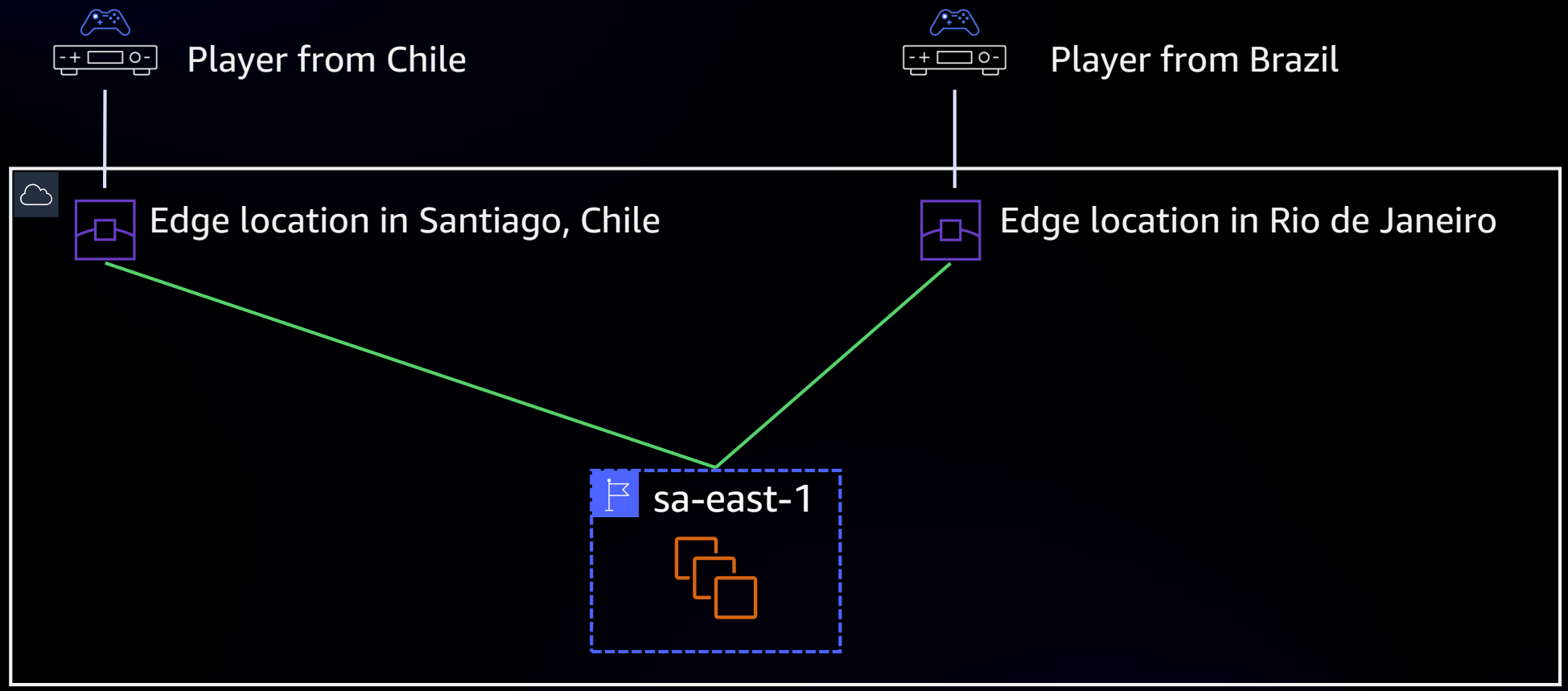
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Single-Region deployment with global reach



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

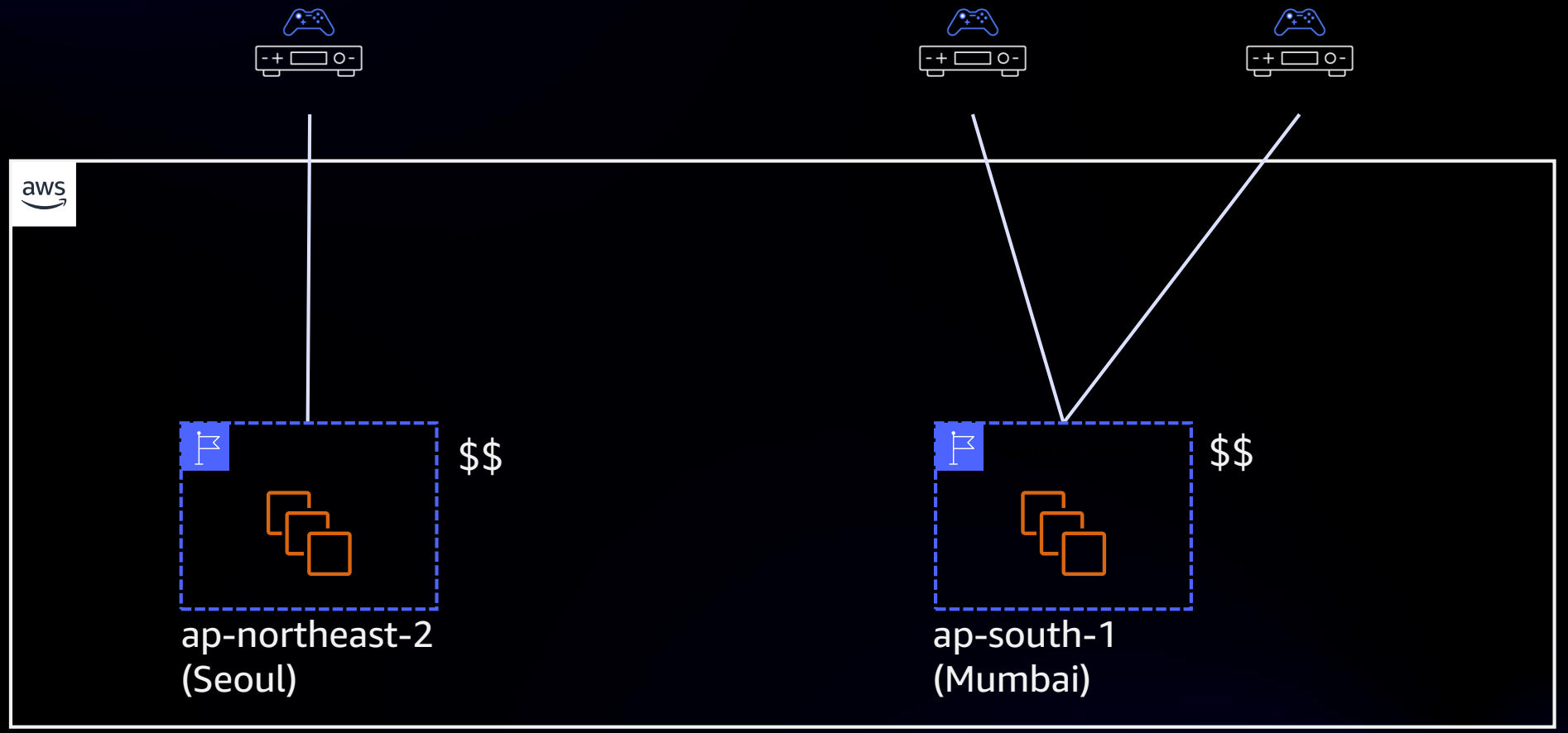
Connect players within a geographic Region



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Simplify multi-Region deployments

WITHOUT AWS GLOBAL ACCELERATOR

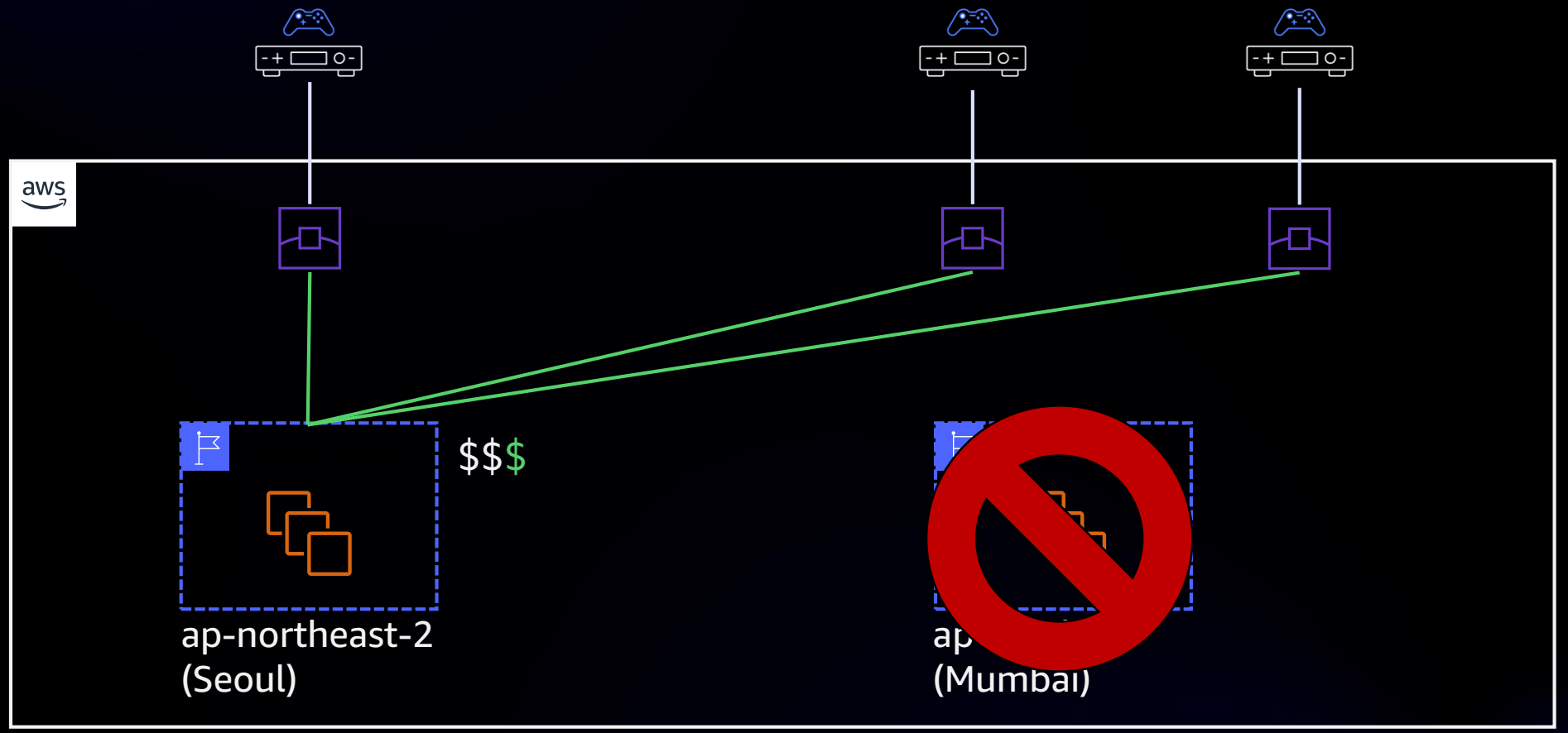


Total cost: $$$$

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Simplify multi-Region deployments

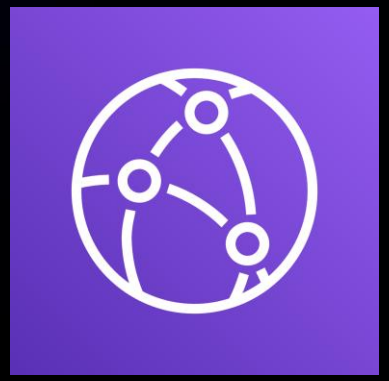
WITH AWS GLOBAL ACCELERATOR



Total cost: $$$

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

HTTP workloads

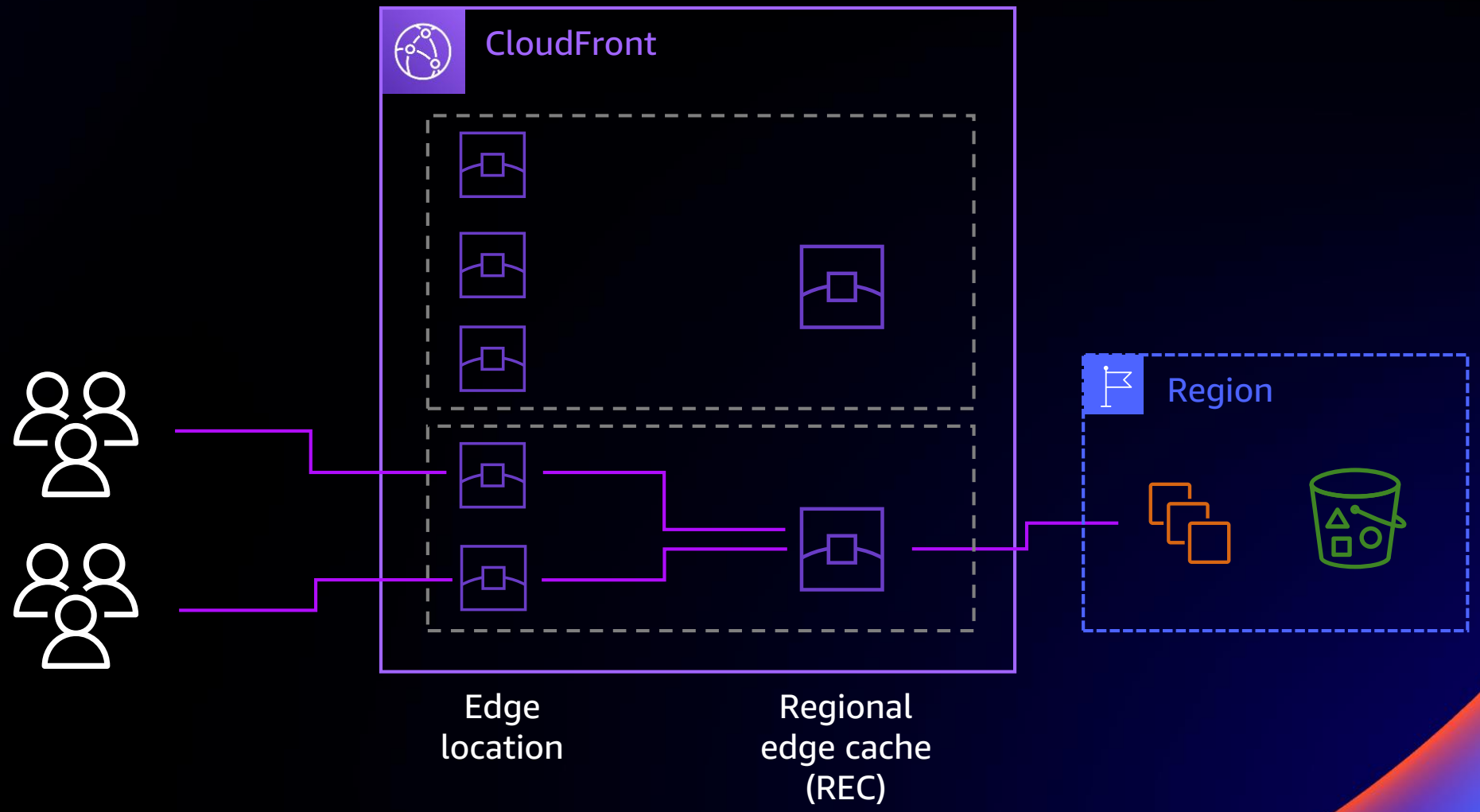


Reliable **content delivery** and **global API acceleration**

Amazon CloudFront

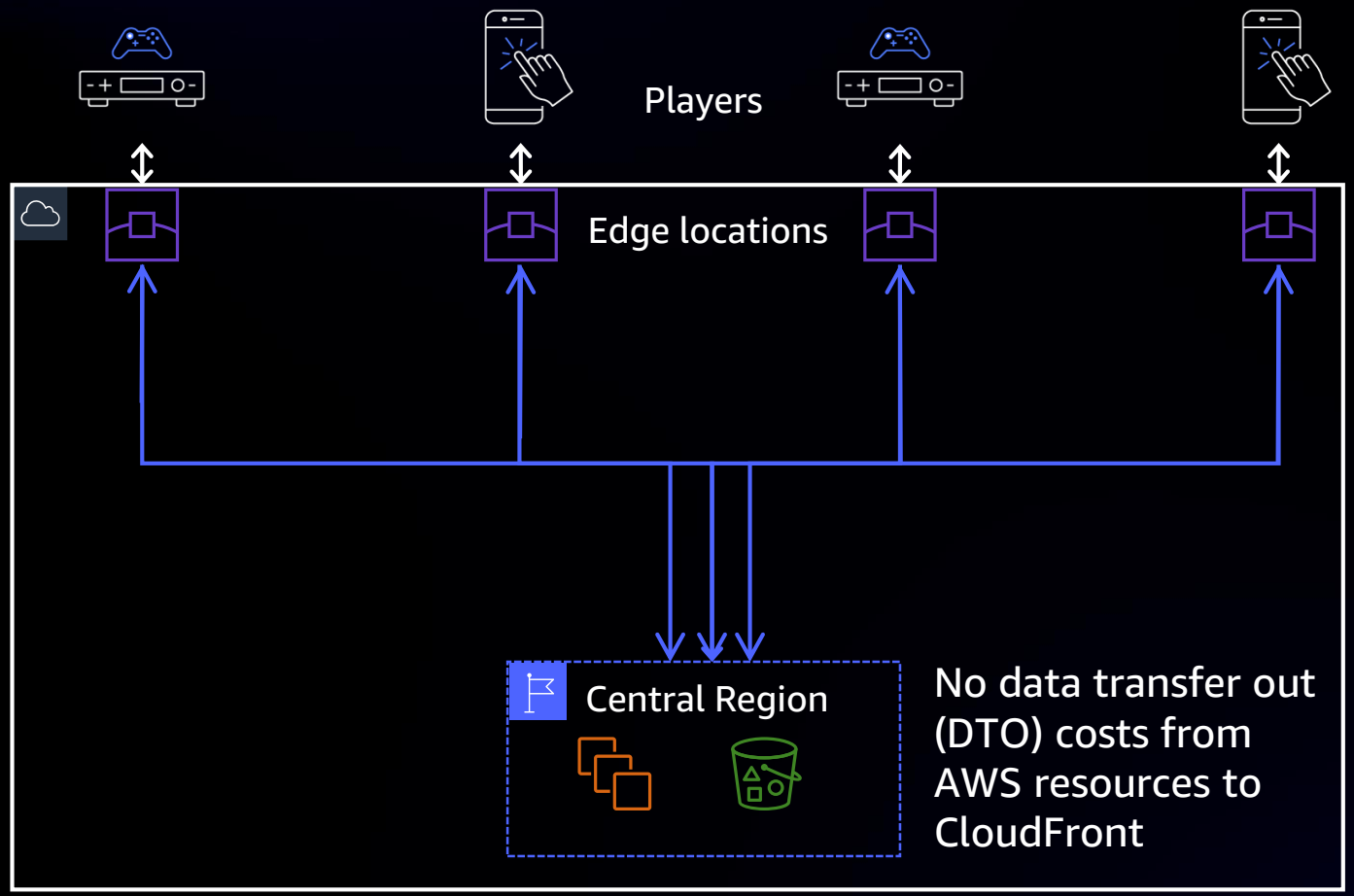
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

The architecture of CloudFront



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Content delivery with CloudFront



Use cases

- Binaries (patches and DLCs)
- Resource packs
- On-demand assets
- Video streaming
- Immutable content

Benefits

- Reduce costs
- Offload origin capacity
- Handle spikes
- Globally consistent performance

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Case study: Social Quantum

"By moving the Content Delivery Network to AWS, we reduced those costs by 80 percent. That was our first major move to AWS and clearly it was a good one."

Ivan Kondratev
CIO, Social Quantum

Social Quantum

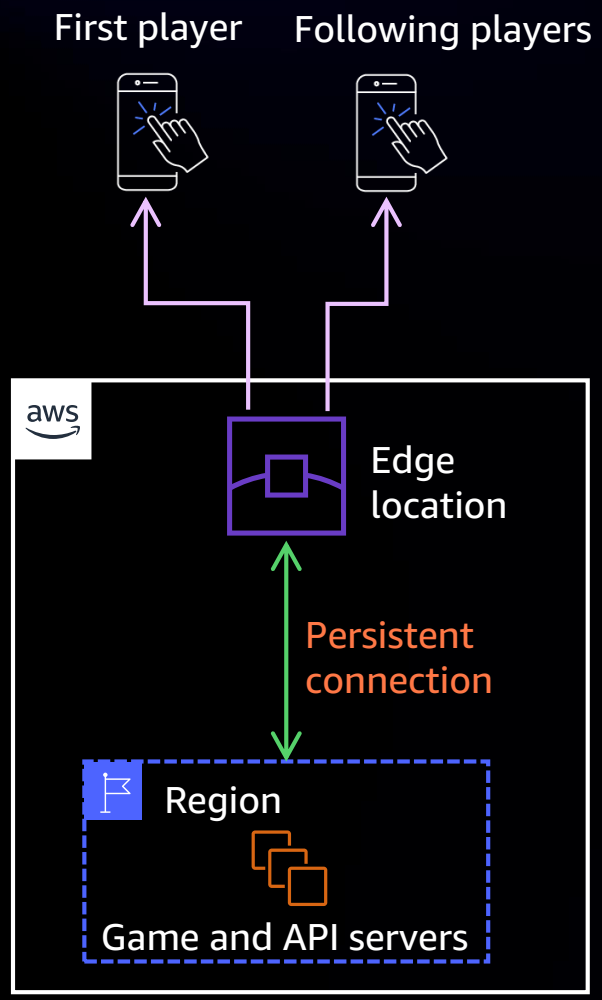


aws

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Accelerate dynamic workloads

HTTP GAME SERVERS AND BACKENDS



Exemplary round-trip times

All requests:
TCP handshake: 10 ms
HTTP request: 10 ms

First request:
TCP handshake: 80 ms
HTTP request: 80 ms

Following request:
~~TCP handshake: 80 ms~~
HTTP request: 80 ms

Global dynamic content acceleration

Players benefit from the AWS global network

Additionally, players may **reuse** the **persistent connection** and experience a much **faster round-trip** time!

aws

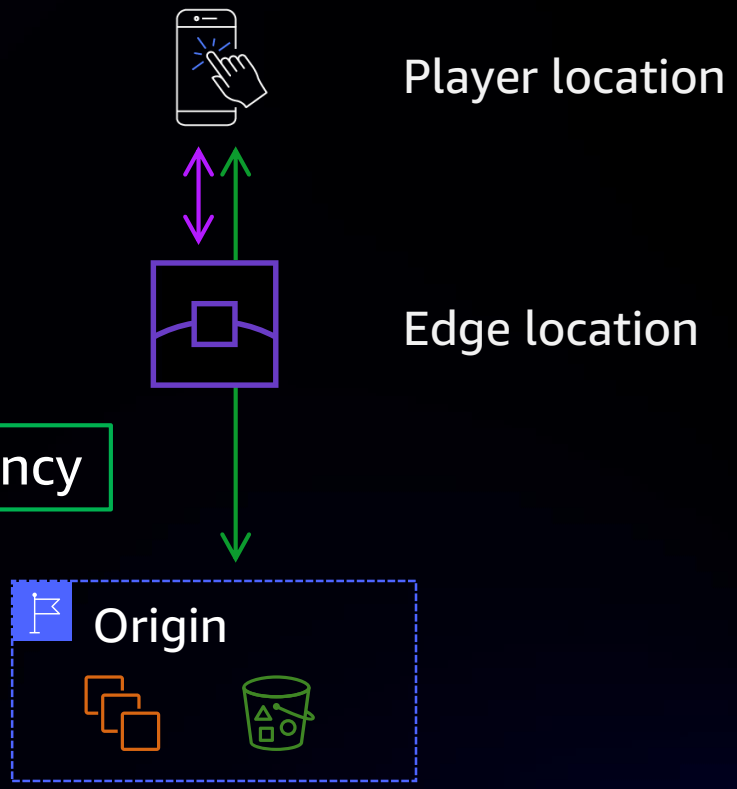
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Caching for the win!

HIGHER CACHE HIT RATIO LEADS TO FASTER ROUND-TRIP TIMES FOR PLAYERS

80% delivered with low latency

20% delivered with acceptable latency



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Caching for the win!

EXAMPLE: RPG API

Player

- Name: N00bKn1ght ★
- HP: 4 ★
- LVL: 1 ★

NPC

- Name: ShadowDragon IV ★
- HP: 5000 ★
- LVL: 53 ★
- Drops: DarkCrystalCataclyst, Potato ★

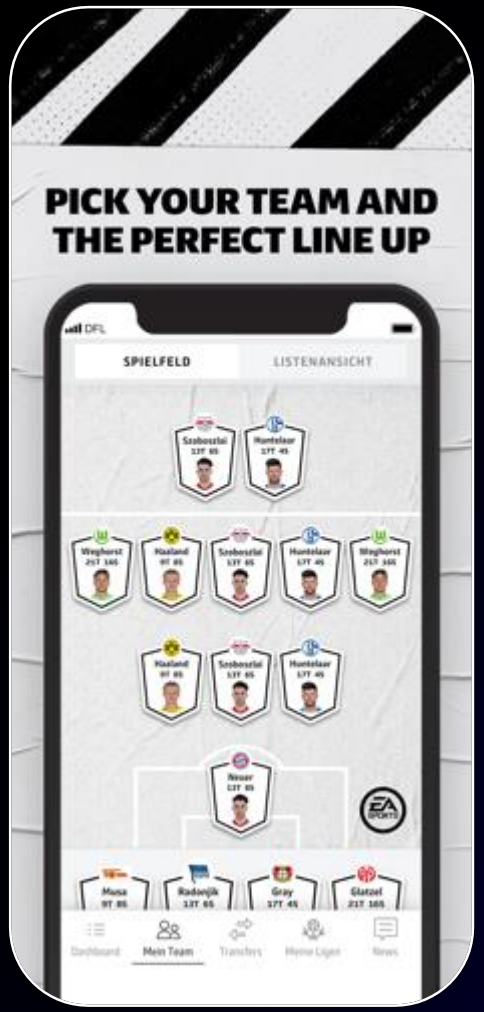
★ Cache-control: public, max-age=86400
★ Cache-control: public, max-age=120
★ Cache-control: no-store

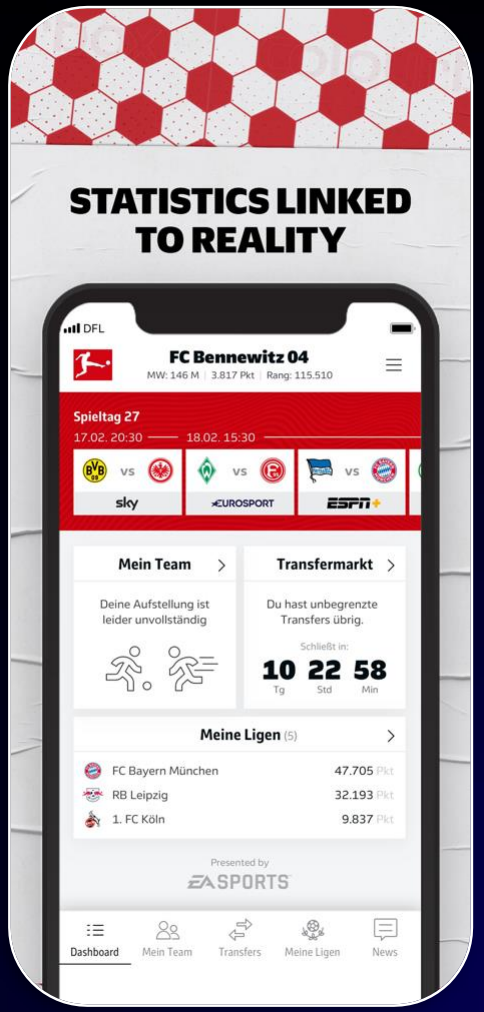


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Case study: DFL Fantasy Manager





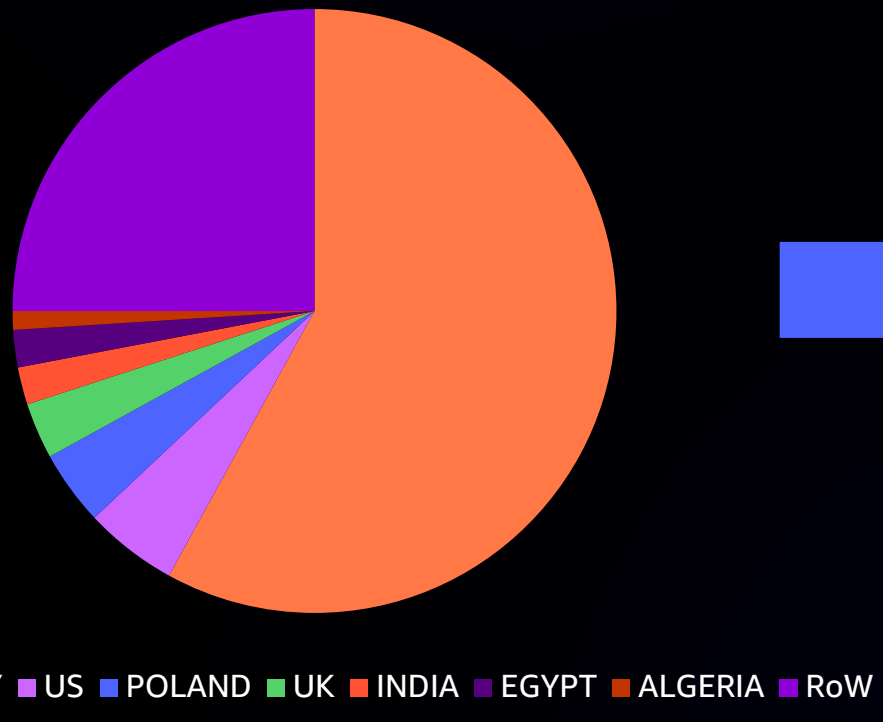


© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

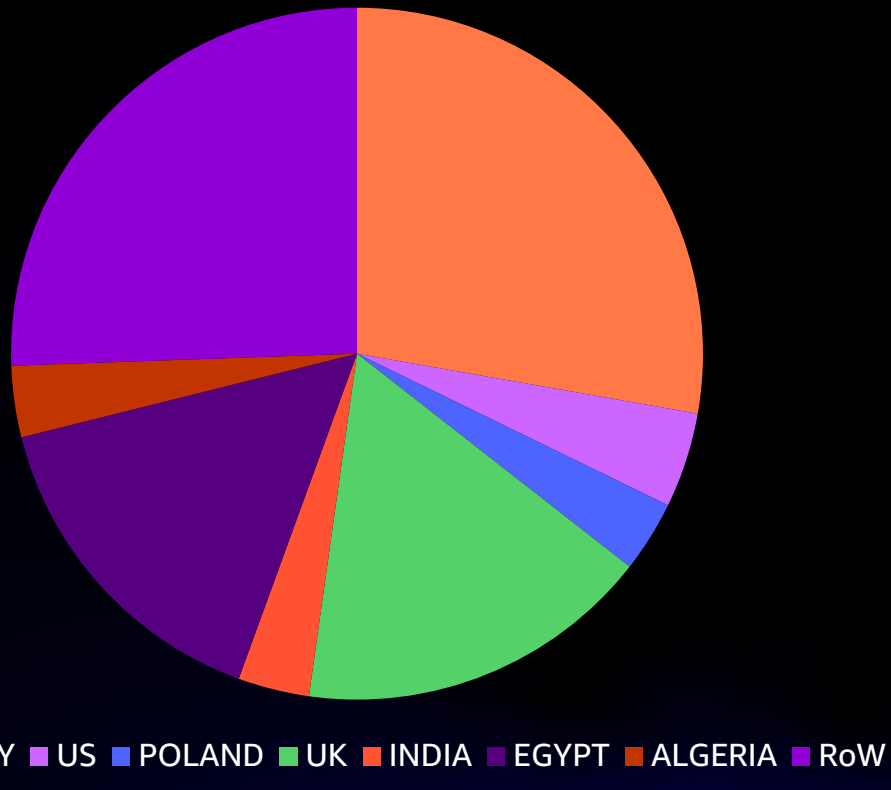
DFL Fantasy Manager

CHANGE OF GEOGRAPHICAL PLAYER DISTRIBUTION

First half of 2020



Second half of 2020



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

“By leveraging Amazon CloudFront, we were able to dramatically reduce application load times by **62%** in a matter of days – meaning **happier users** of the app and **greater fan engagement** with the Bundesliga as a result.”



Alexander Altenhofen

Director Product & Technology, DFL Digital Sports GmbH

aws

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

DNS



Use broad and rich **DNS** capabilities

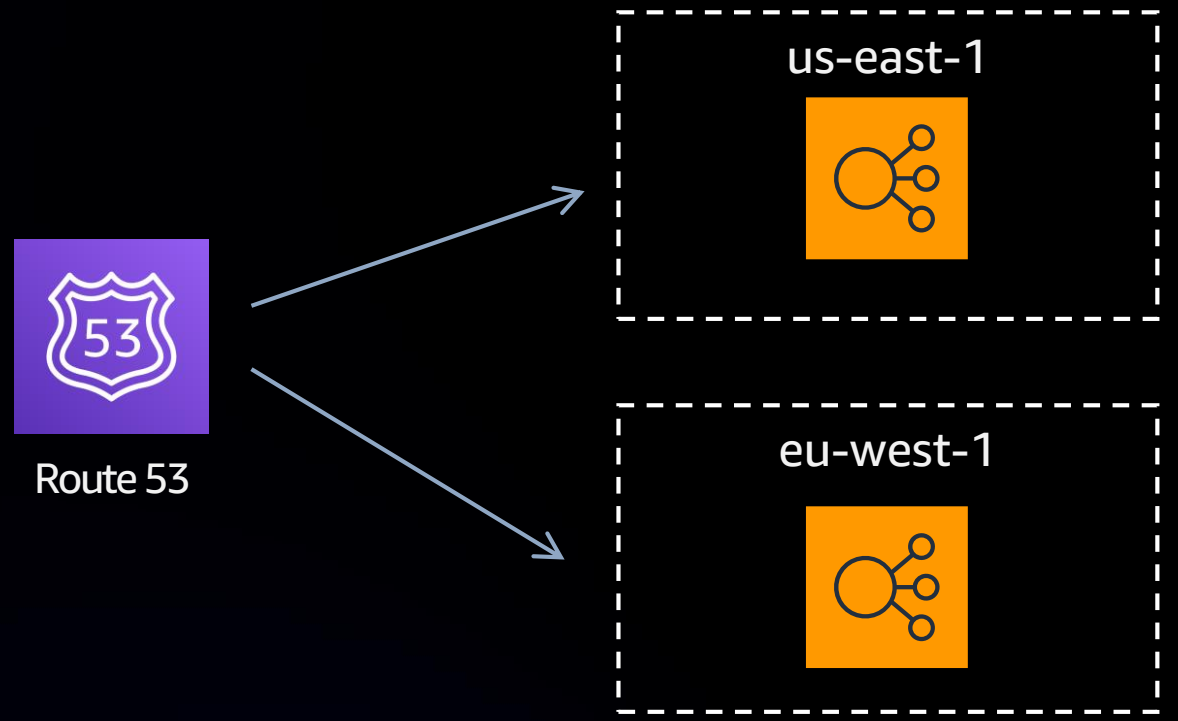
Amazon Route 53

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Routing policies

FINE-GRAINED CONTROL OF ROUTE 53 QUERY RESPONSES

- Simple
- Weighted round robin
- **Least latency**
- Failover routing
- **Geolocation**
- Geoproximity
- Multivalue answer

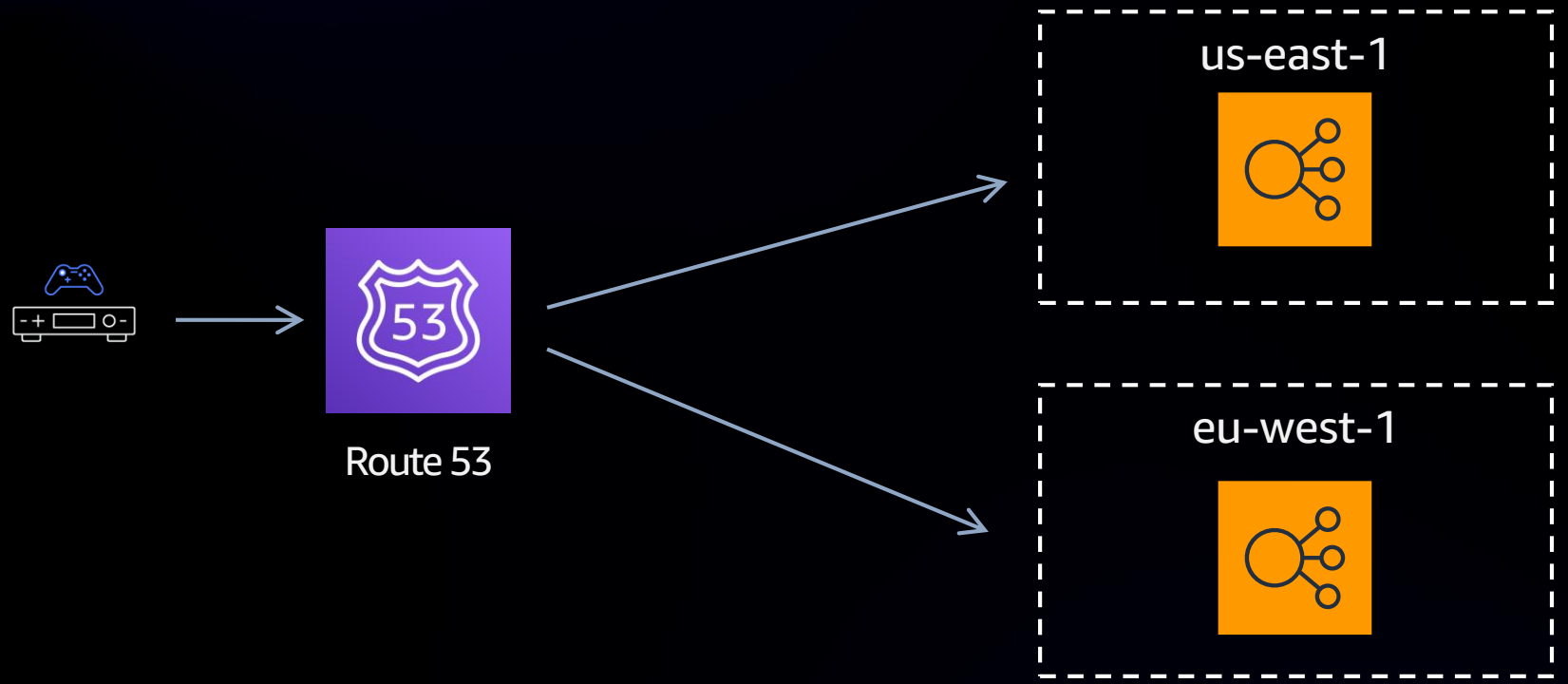


aws

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Routing policies

LEAST LATENCY

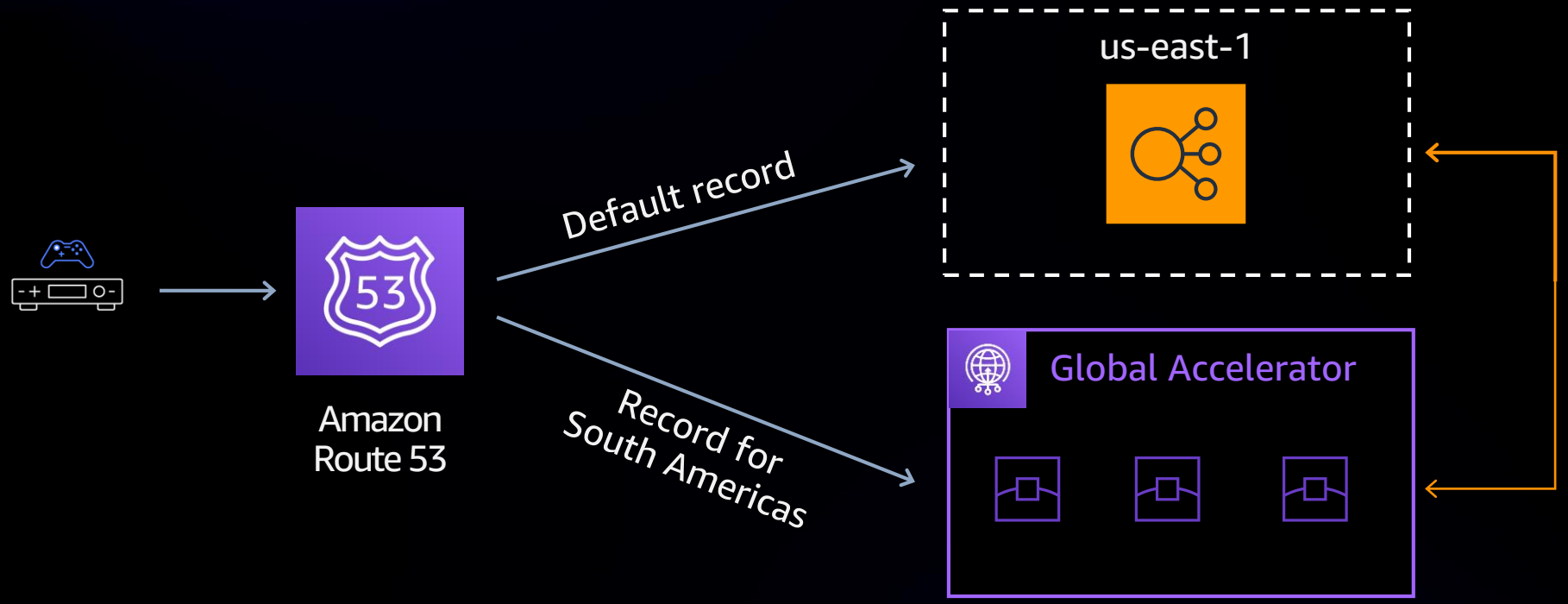


1. Route 53 looks up latency from the client network to AWS Regions
2. Route 53 returns record with least latency

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Routing policies

GEOLOCATION COMBINED WITH AWS GLOBAL ACCELERATOR



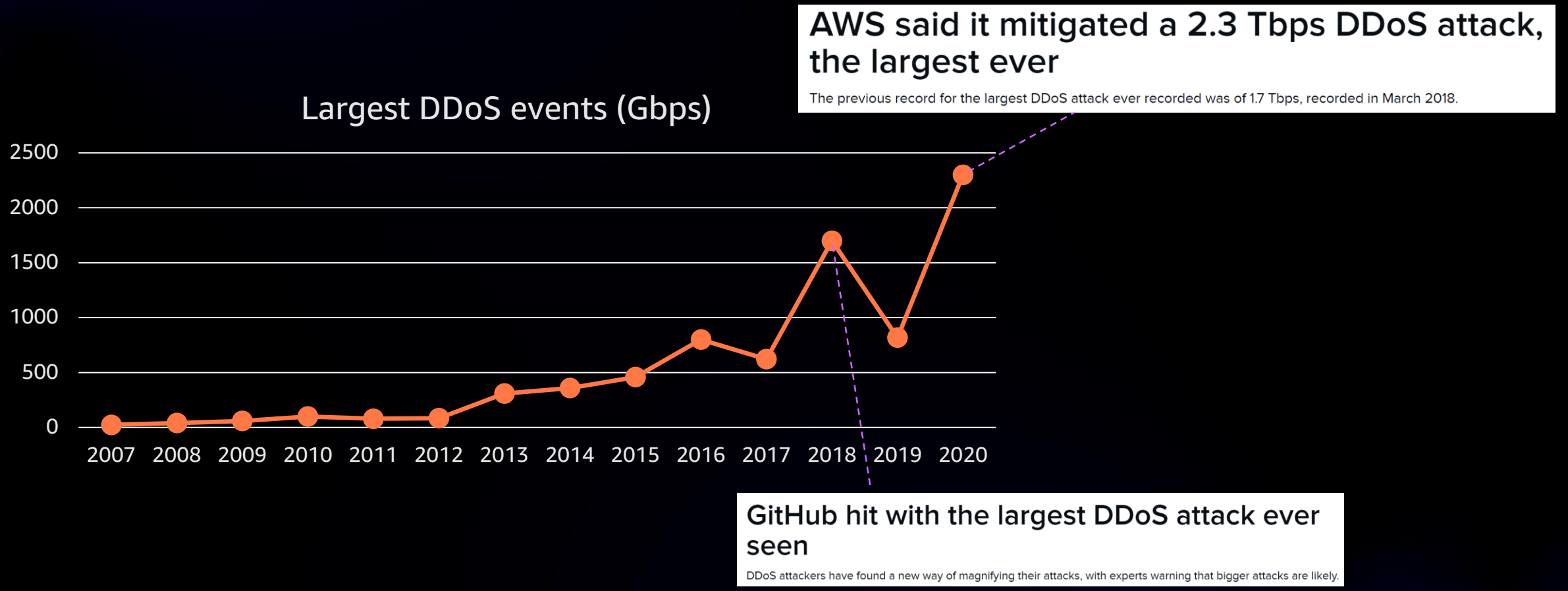
1. Route 53 looks up the client IP in its GEO-IP List
2. Route 53 returns record with best match for the GEO

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

DDoS resiliency and mitigation

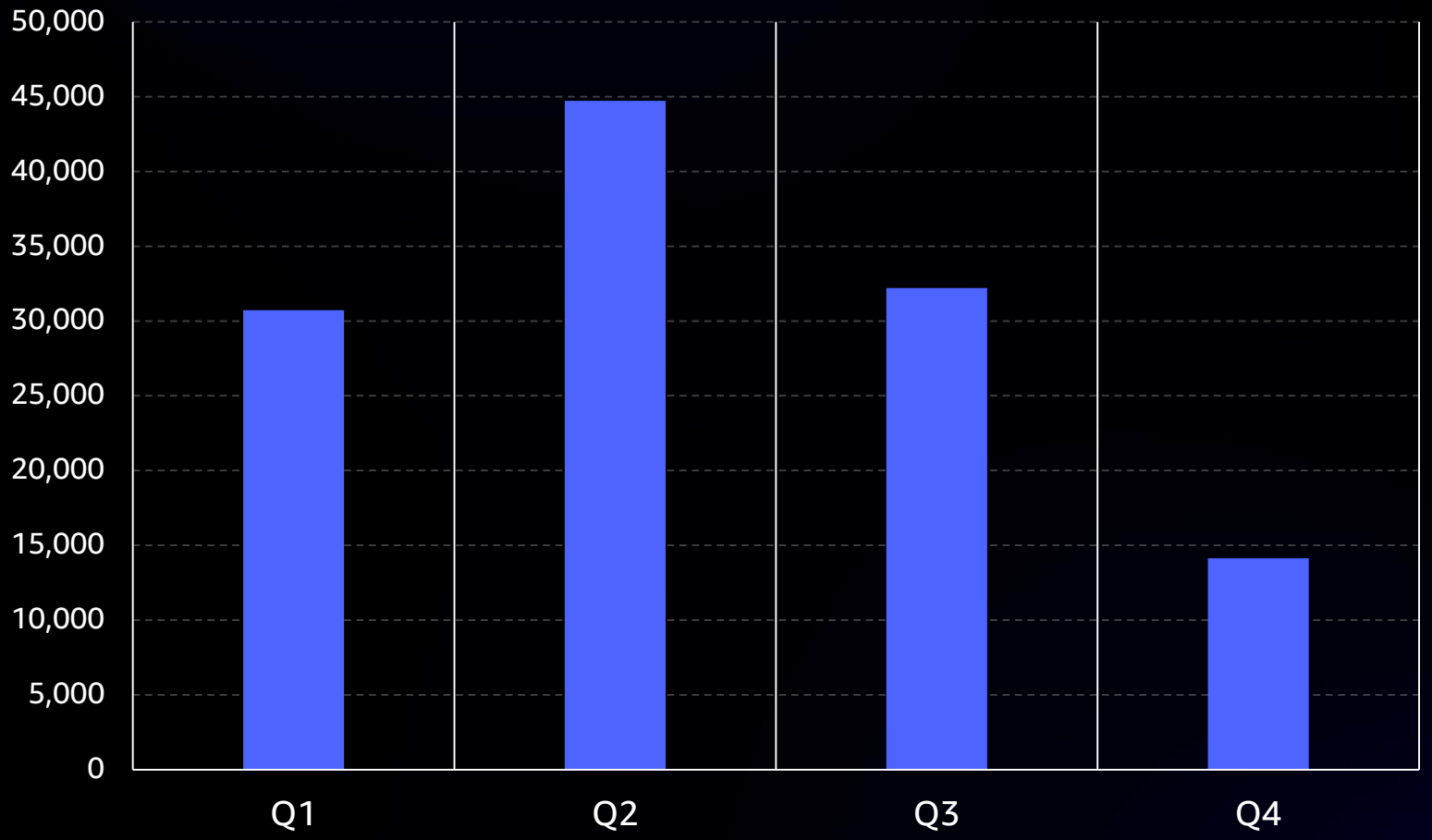
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

DDoS history



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

AWS Shield events for gaming in 2020



Most likely industry
to be targeted by DDoS

16%

of all 2020 events

Short events:
Less than 5 minutes

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

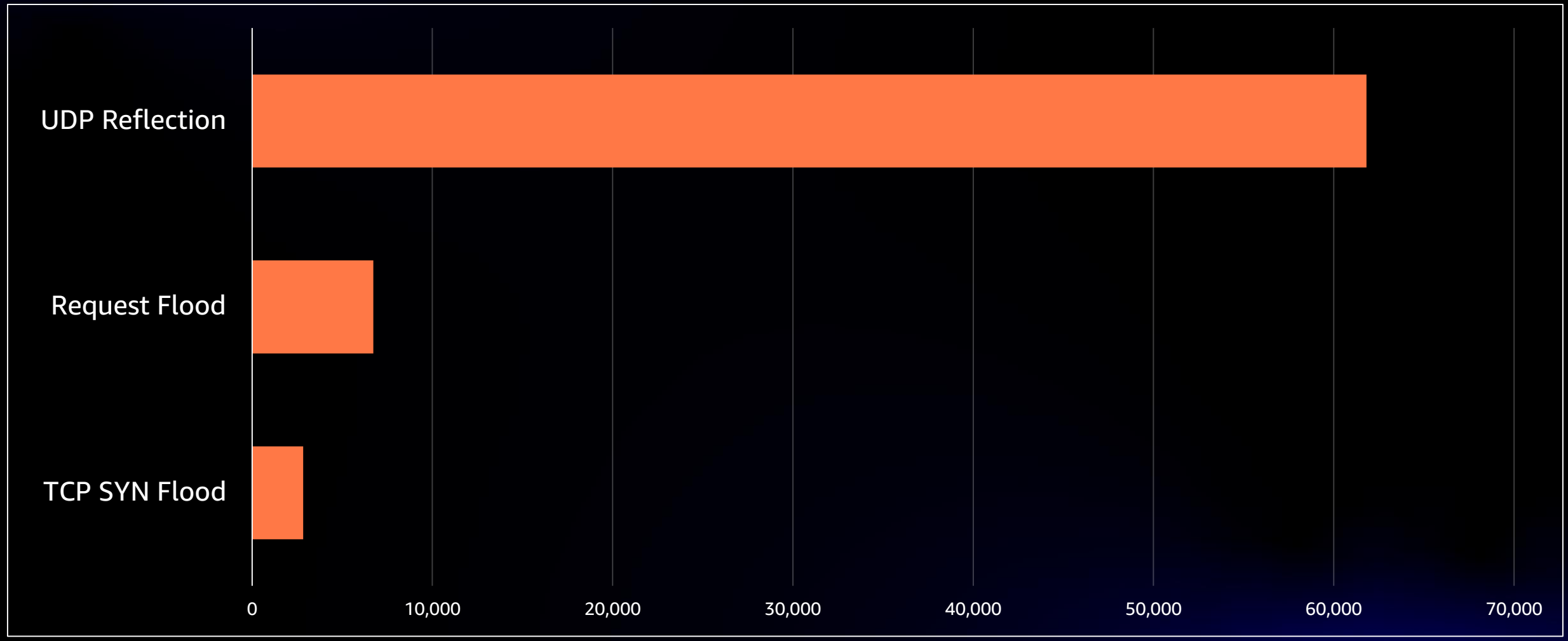
Different types of DDoS events

- Infrastructure DoS/DDoS
- Application DoS/DDoS



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

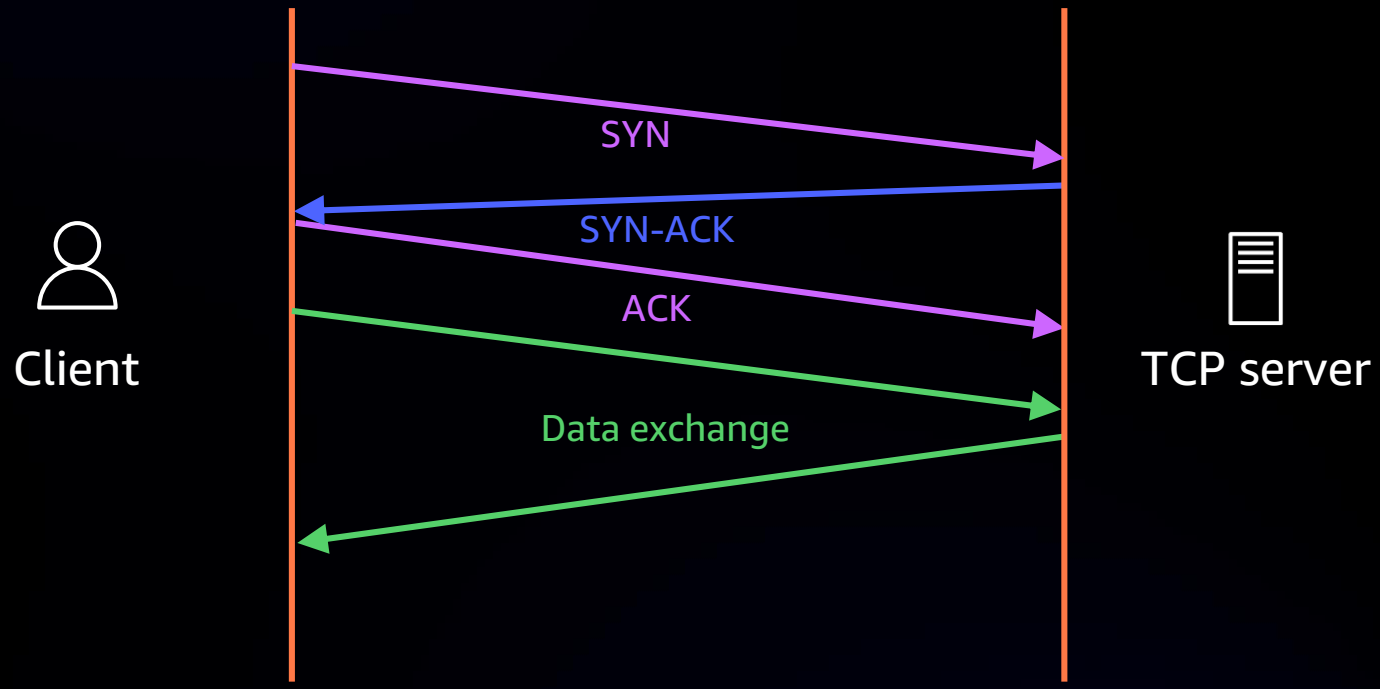
Top three attack vectors for gaming applications



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Breakout: TCP

USING REFLECTORS



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Breakout: UDP

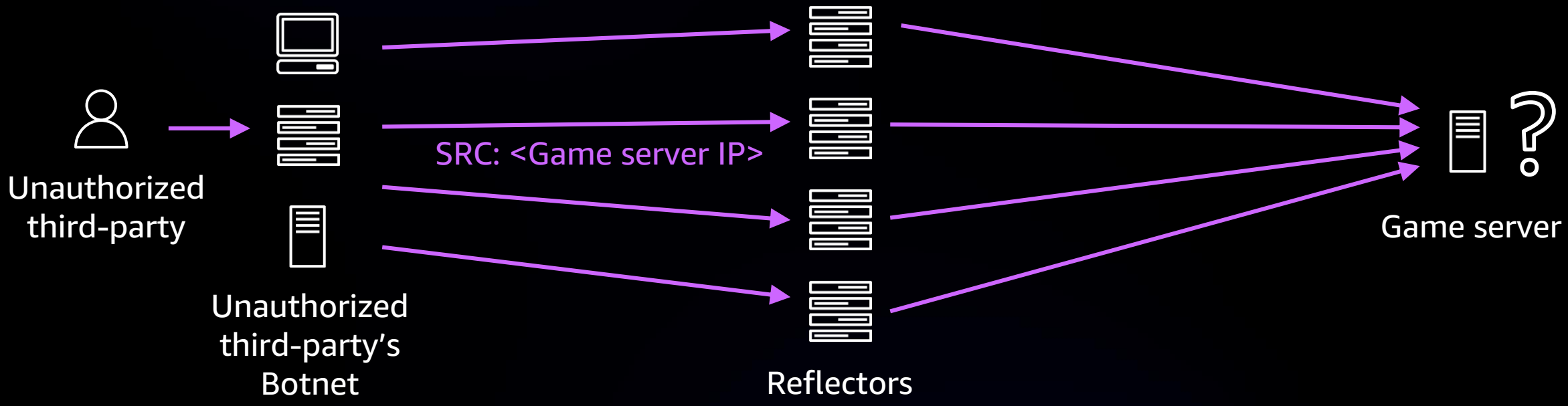
USING REFLECTORS



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Breakout: UDP reflection attack

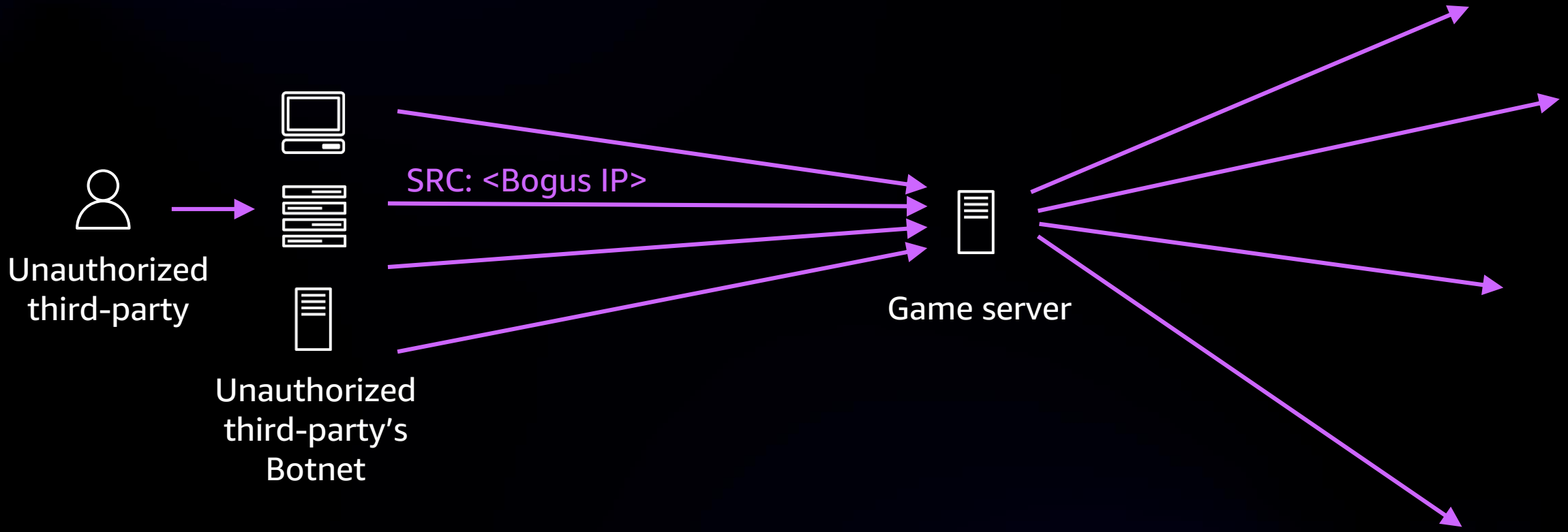
USING REFLECTORS



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Breakout: UDP reflection attack

TRIGGERING A PAYLOAD IN THE RESPONSE



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Business impact of DDoS events

- Infrastructure costs
- Operational ability
- Player experience
- Reputation
- Revenue



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

DDoS protection with AWS Shield



Protect your AWS resources from **DDoS** events

AWS Shield Advanced

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

AWS resources covered by Shield


CloudFront



Route 53

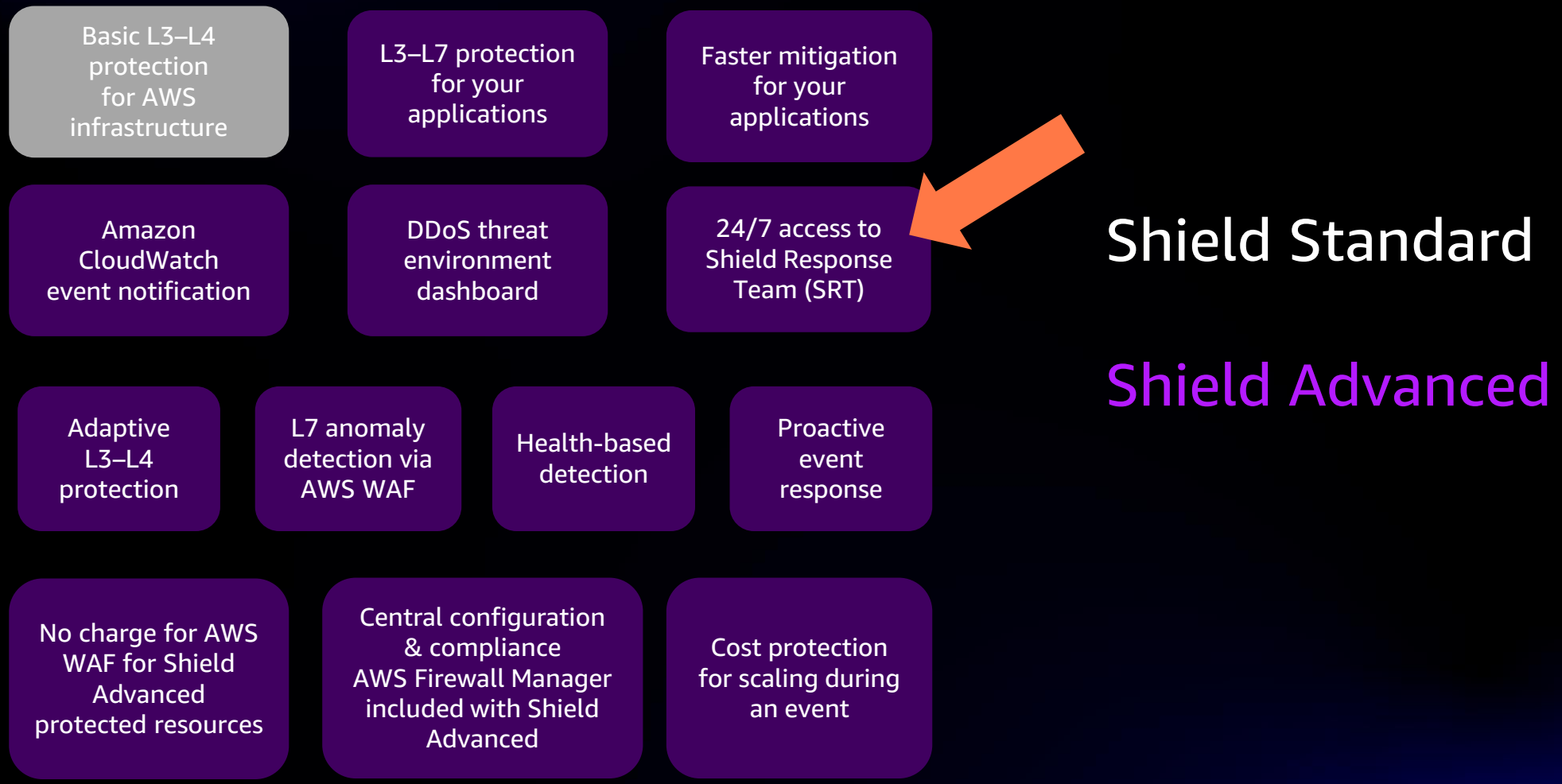

Elastic Load Balancing


Global Accelerator


Elastic IP address

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

What is Shield?



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Case study: Gaming web application

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Case study: Gaming web application

THE SITUATION

A gaming customer was experiencing a DDoS event

- Request counts, 5xx errors, and WAF requests all spiked
- Healthy resource count was dropping to zero
- Game connection URL, password reset, and forum support sites were all failing to load
- Customer contacted the Shield Response Team (SRT) for assistance

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Case study: Gaming web application

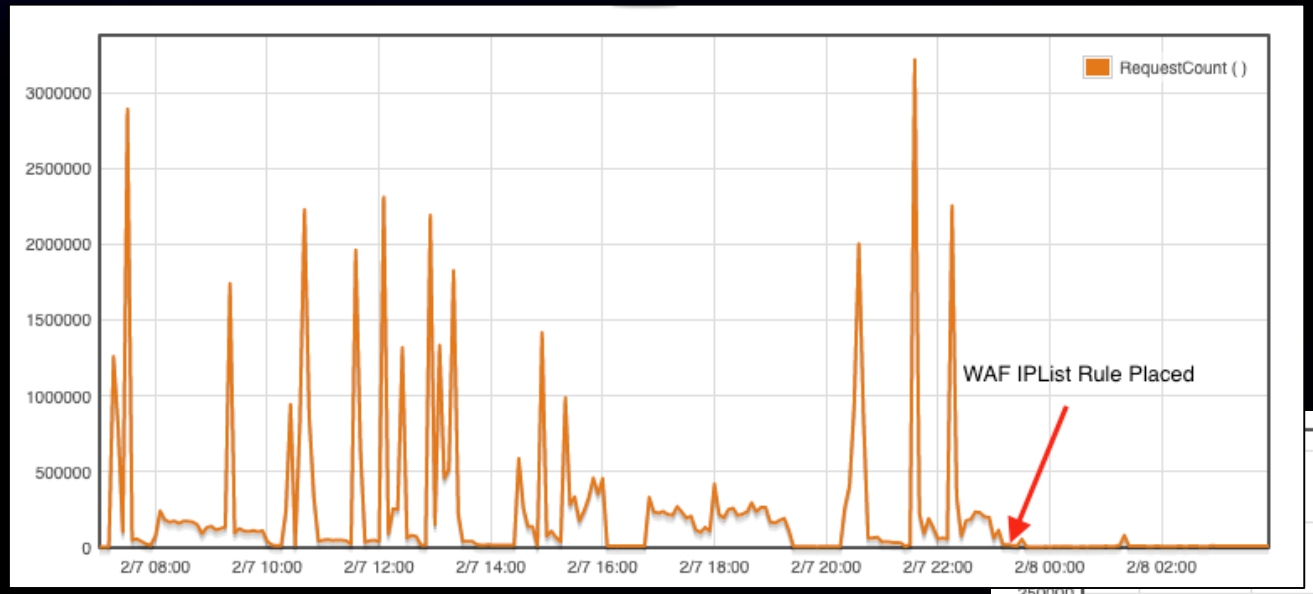
SRT ENGAGEMENT

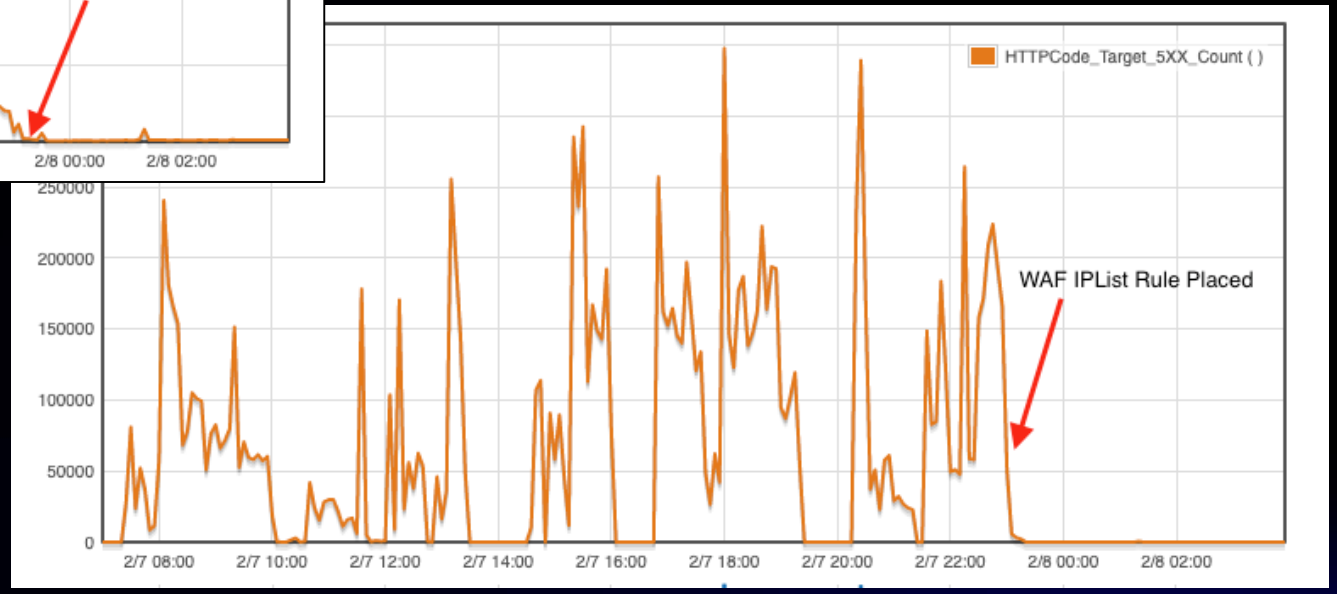
- Enabled WAF logging for the customer
- Ran WAF logs through our internal WAF log parser
- Identified 4K+ suspicious IPs
- Built a custom IP block list
- Created additional WAF rule to block requests with no cookie header
- Identified false positives then added allow list to allow post requests with no cookie

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Case study: Gaming web application

RESULTS





- Request count dropped to normal
- 5xx errors went to zero
- Operability restored

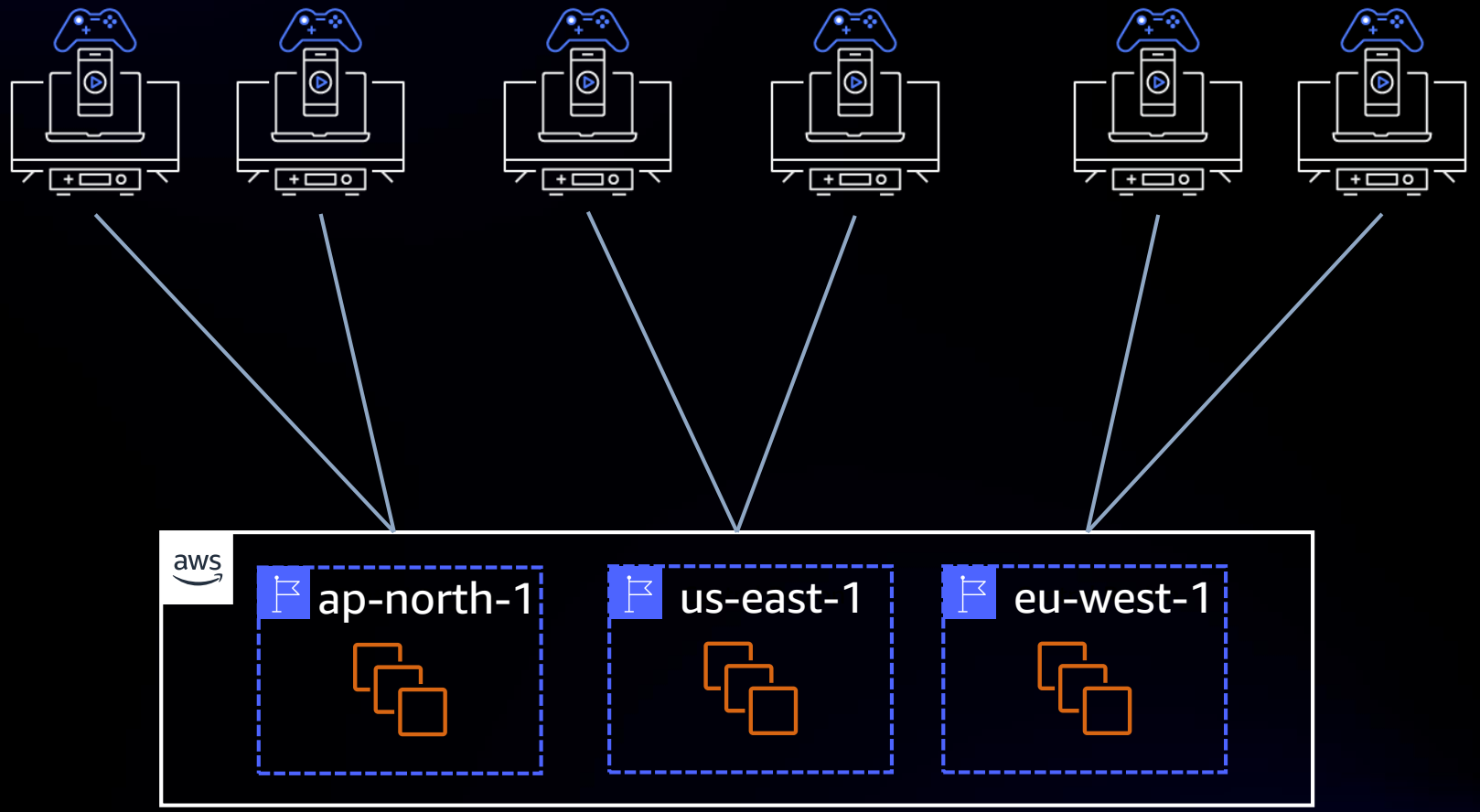
© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Case study: Real-time game servers

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Case study: Real-time game servers

SCENARIO: MULTIPLAYER GAME ON AMAZON EC2

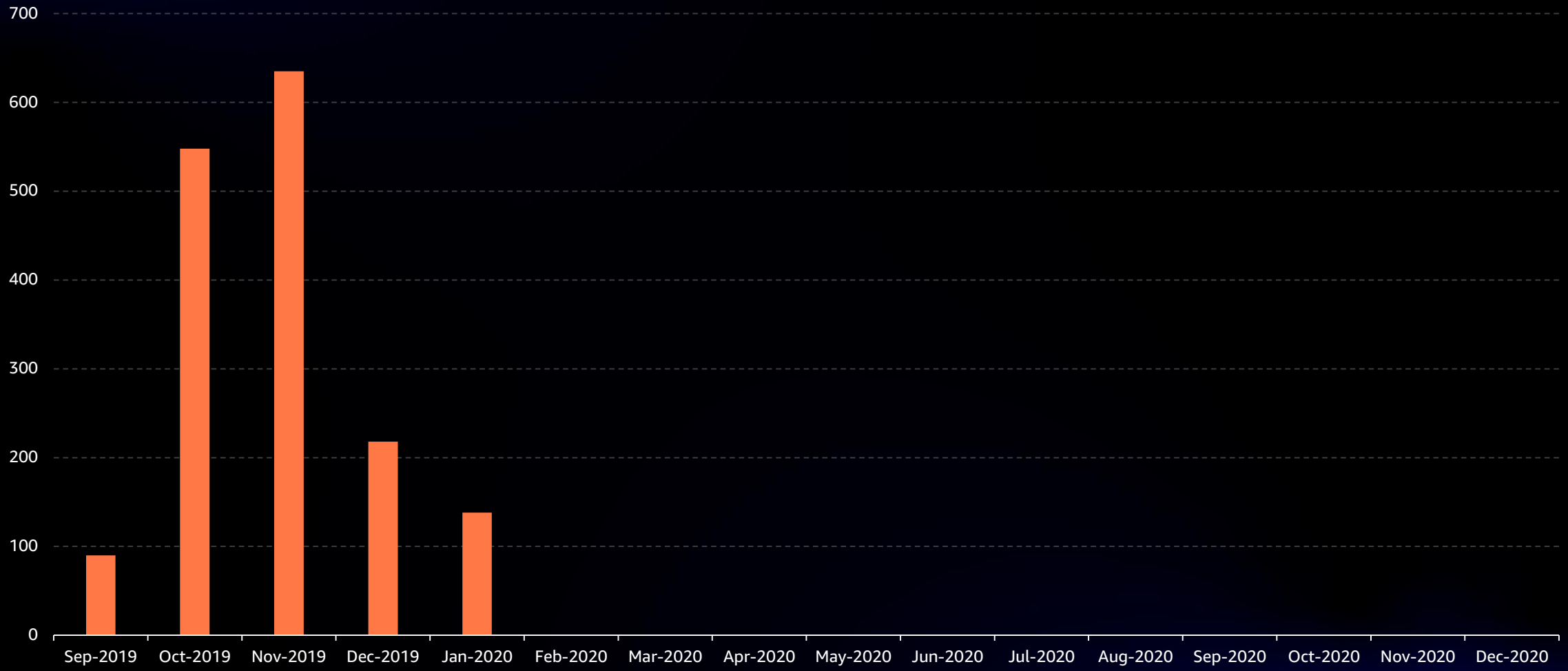


aws

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Case study: Real-time game servers

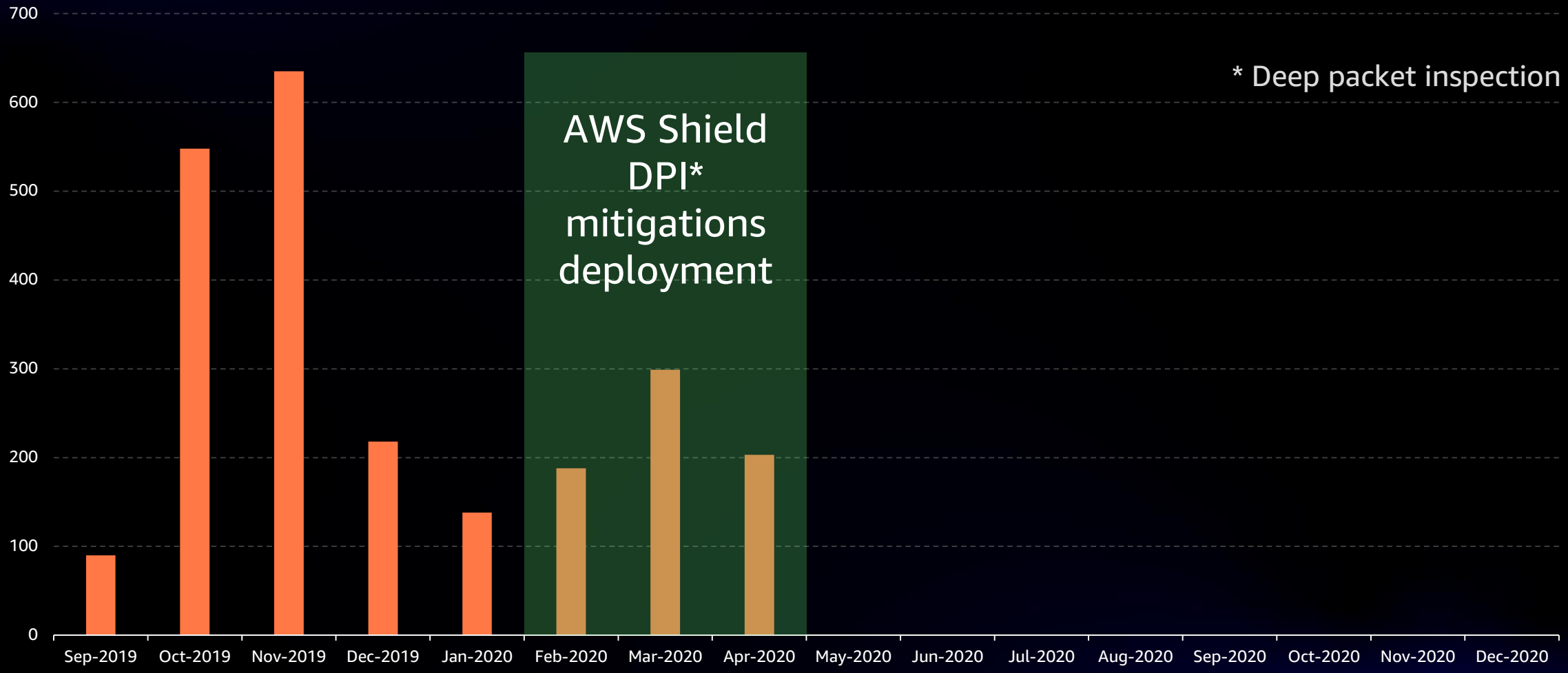
SITUATION



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Case study: Real-time game servers

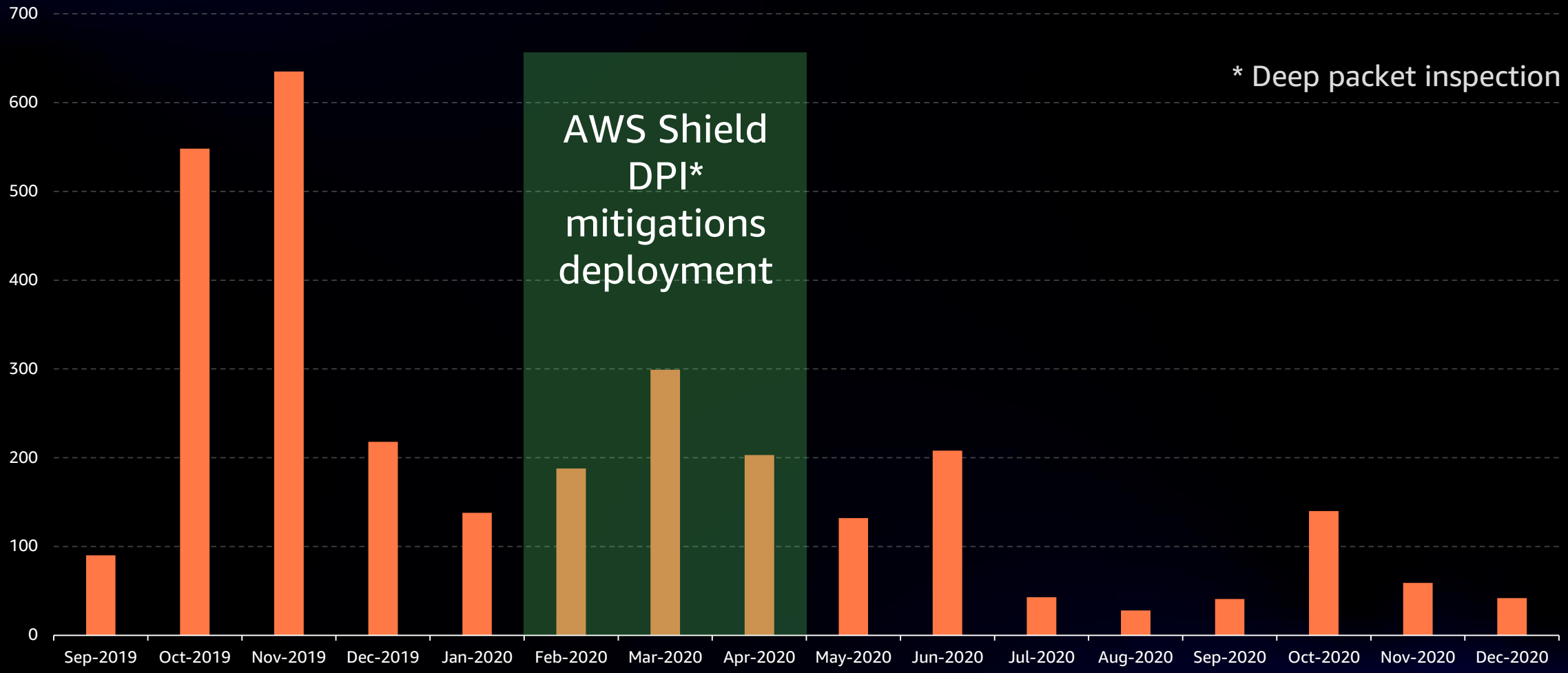
SRT ENGAGEMENT



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Case study: Real-time game servers

RESULTS



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Shield Advanced for gaming workloads

- Service endpoint needs to be a Shield-protected resource
- Don’t expect instant detection and mitigation for infrastructure DDoS or zero-day application DDoS events
- Custom, always-on mitigations can be established by the Shield Response Team (SRT)

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Protecting session-based game servers

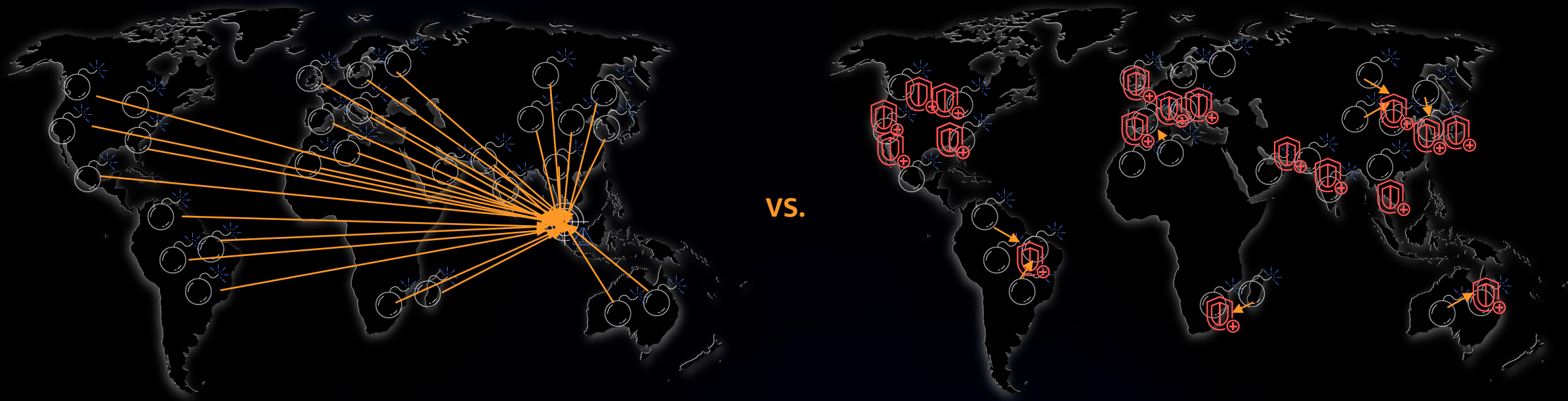
- Use host-based firewall to limit number and throughput of connections
- Use network access control lists (NACLs) in your VPC
- For recurring or distributed volumetric events, use Shield Advanced



aws

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Respond with a distributed defense



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Preparation is key

- Establish roles and processes around security
- Follow the AWS Well-Architected Framework
- Read AWS whitepapers for DDoS resiliency
- Work with your AWS Solutions Architect



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Resources

AWS Well-Architected Framework:
https://aws.amazon.com/architecture/well-architected/

AWS whitepaper on best practices for DDoS resiliency:
https://docs.aws.amazon.com/whitepapers/latest/aws-best-practices-ddos-resiliency/welcome.html

AWS Shield threat landscape review:
https://aws.amazon.com/blogs/security/aws-shield-threat-landscape-review-2020-year-in-review/

© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Thank you!

David Heidt

heidave@amazon.de
@davidsheidt



© 2021, Amazon Web Services, Inc. or its affiliates. All rights reserved.