

AWS re:Invent

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ANT341

How Riot Games processes 20 TB of analytics data daily on AWS

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AWS



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Agenda

Riot Games introduction

A tale of four architectures

- Scaling telemetry for League of Legends
- Preparing for our next games
- Fixing the plane mid-flight
- One event bus to rule them all

What's next



LEAGUE OF
LEGENDS

LEAGUE OF
LEGENDS
WILD RIFT

LEGENDS OF
RUNETERRA

TEAMFIGHT
TACTICS

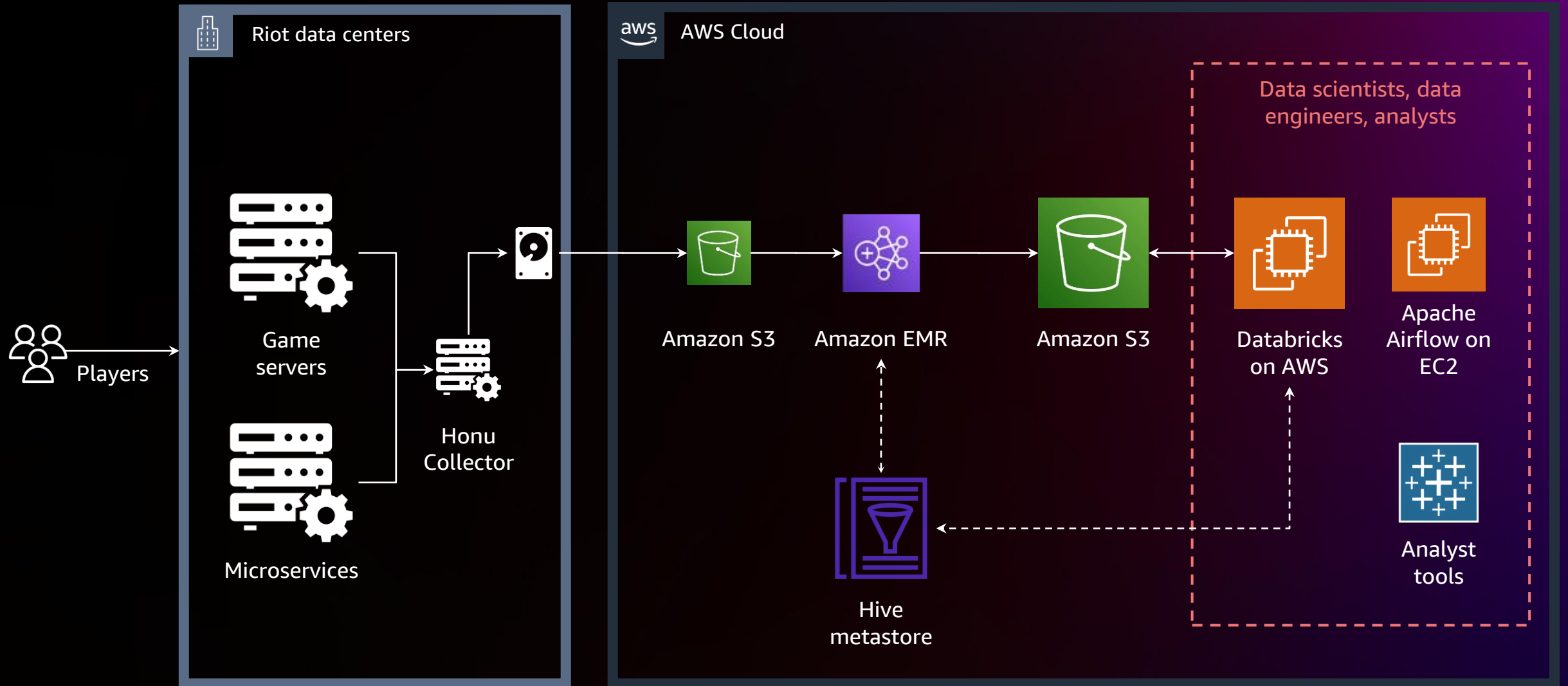


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Scaling telemetry for League of Legends

Initial architecture – Honu



Challenges

01

Schemaless – engineers send a message containing string key, value pairs

02

Lossy

03

Many small files



```
1 - {  
2   "app": "legs",  
3   "assists": "[{"currentAccountId": 0, "championId": 26}]",  
4   "gameId": "111111",  
5   "gameStatActor": "",  
6   "gameStatName": "",  
7   "gameStatTeam": "",  
8   "gameStatValue": "",  
9   "itemActor": "",  
10  "itemId": "",  
11  "killType": "",  
12  "killer": "{ \"currentAccountId\" : 123456, \"championId\" : 11}",  
13  "killerTeamId": "",  
14  "legsVersionId": "0.329",  
15  "level": "",  
16  "levelUpActor": "",  
17  "millisSinceGameStart": "1009432",  
18  "monsterSubtype": "",  
19  "monsterVictim": "",  
20  "pauseRealTimestamp": "",  
21  "platformId": "NA1",  
22  "processedTimestamp": "1525180484955",  
23  "skillLevelUpActor": "",  
24  "skillLevelUpSlot": "",  
25  "skillLevelUpType": "",  
26  "type": "CHAMPION_KILL",  
27  "victim": "{ \"currentAccountId\" : 0, \"championId\" : 89}",  
28  "wardActor": "",  
29  "wardType": "",  
30  "xPos": "4951",  
31  "zPos": "13187"  
}
```


Challenges

01

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29  "wardType": "",  
30  "xPos": "4951",  
31  "zPos": "13187"  
32 }
```

Challenges

01

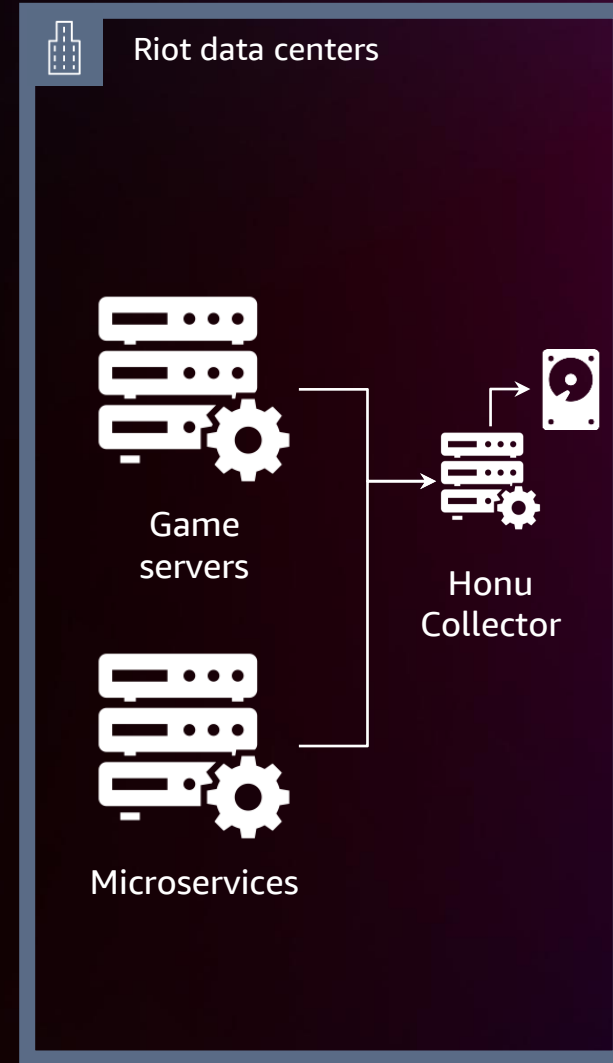
Schemaless – engineers send a message containing string key, value pairs

02

Lossy – rather than falling over and failing to capture any data, we throw data on the floor

03

Many small files



Challenges

01

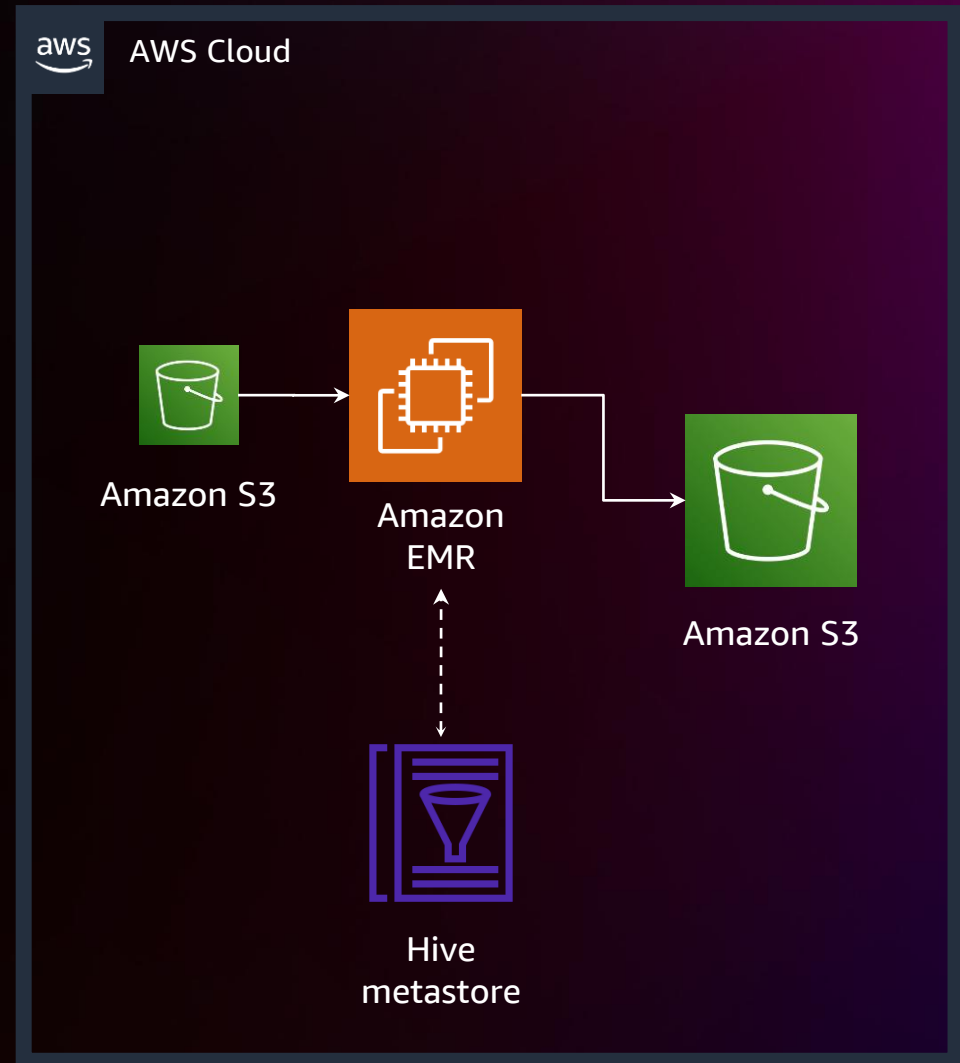
Schemaless – engineers send a message containing string key, value pairs

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Lossy – rather than falling over and failing to capture any data, we throw data on the floor

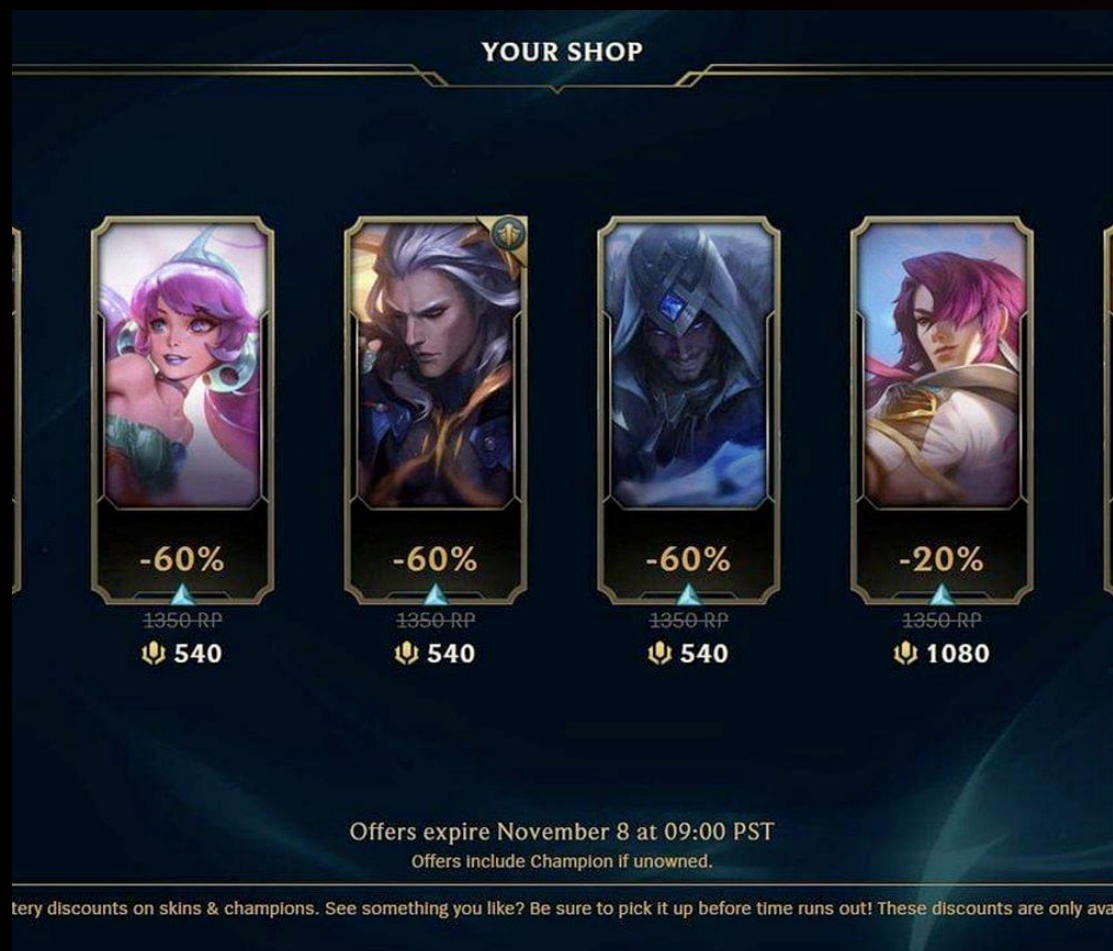
03

Many small files – we are uploading files from all Regions we are deployed and relying on a downstream aggregator



Player value

Your shop



Analyst insights

Popularity of ADCs

Patch 7.16

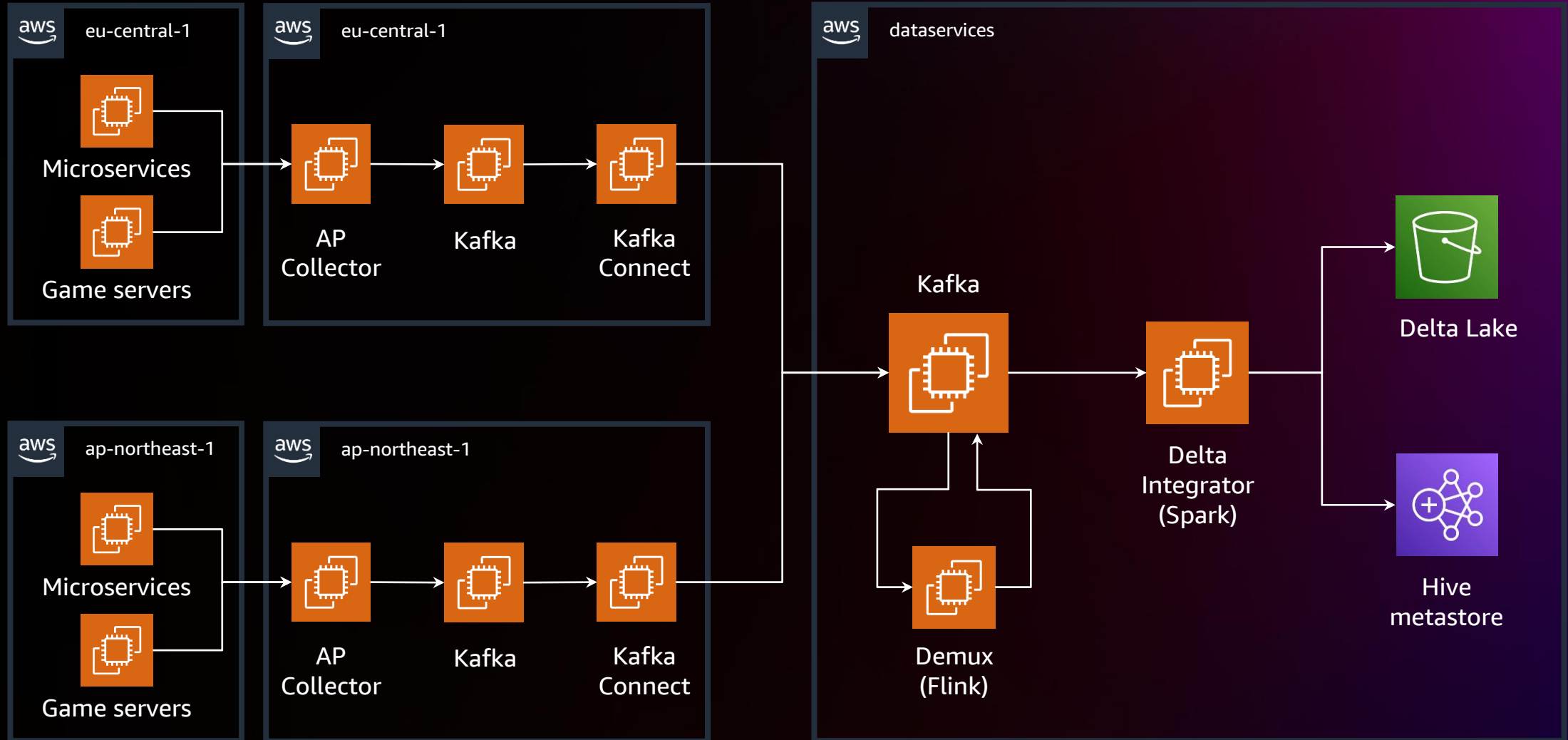


Source: <https://nexus.leagueoflegends.com/en-us/2017/11/champ-popularity-mixing-math-art/>

Analytics Platform (AP)



Architecture diagram



Features

01

Schema – leverage JSON schema for definition telemetry payloads and validation

02

Regional collection

03

Streaming

```
{
  $schema: "resource:///metaschemas/event",
  title: "Instance of Forge game",
  description: "One per running forge game instance/process.",
  owner: "central.rdp.platform",
  - properties: {
    - gameVersion: {
      $ref: "resource:///forge/entities/gameVersion"
    },
    - gameSessionId: {
      $ref: "resource:///forge/types/sessionId"
    },
    - playerInfo: {
      $ref: "resource:///forge/entities/playerInfo"
    },
    - achievementUnlocked: {
      $ref: "resource:///forge/types/achievement"
    },
    - unlockDate: {
      $ref: "resource:///riot/types/rfc0460Timestamp"
    },
    - metadata: {
      $ref: "resource:///rtp/entities/metadata"
    }
  },
  - required: [
    "gameVersion",
    "gameSessionId",
    "playerInfo",
    "achievementUnlocked",
    "unlockDate",
    "metadata"
  ],
  additionalProperties: false
}
```

Features

01

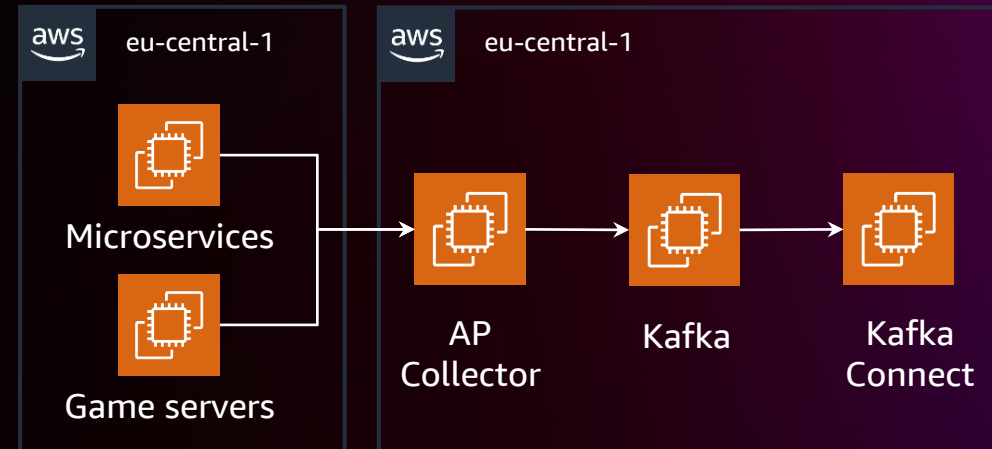
Schema – leverage JSON schema for definition telemetry payloads and validation

02

Regional collection – writing directly to Kafka in Region and replicating centrally

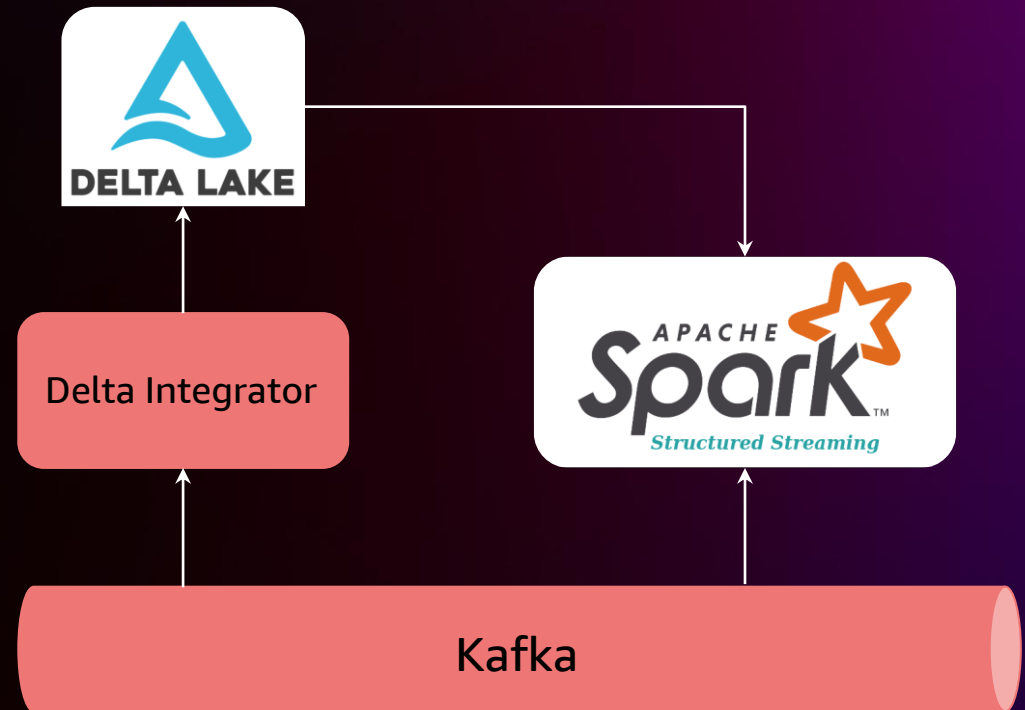
03

Streaming



Features

- 01 **Schema** – leverage JSON schema for definition telemetry payloads and validation
- 02 **Regional collection** – writing directly to Kafka in Region and replicating centrally
- 03 **Streaming** – we are able to write and deploy streaming jobs far more easily



Challenges

01

Firehose – all events are published to the same firehose topic, which means in-Region processing still difficult

02

Cost

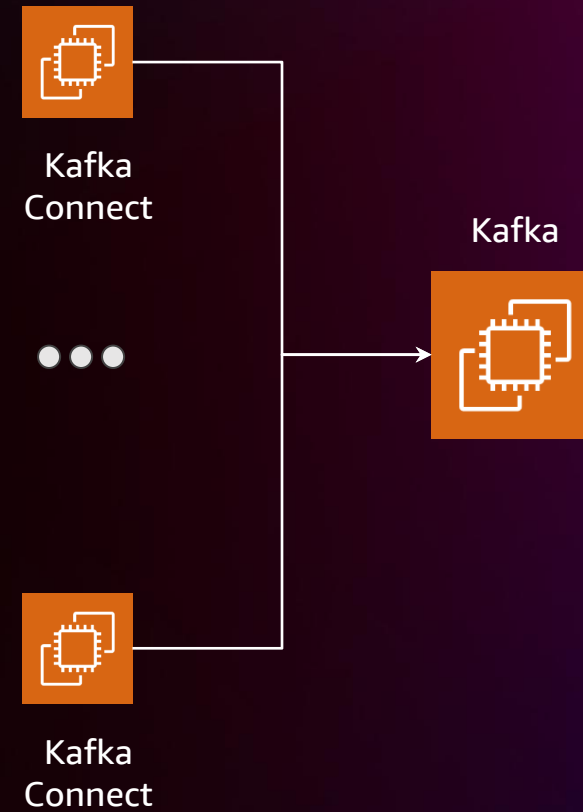
03

Validation



Challenges

- 01 **Firehose** – all events are published to the same firehose topic which means in-Region processing still difficult
- 02 **Cost** – replicating all data centrally just to write to Amazon S3 carries a high overhead
- 03 **Validation**



Challenges

01

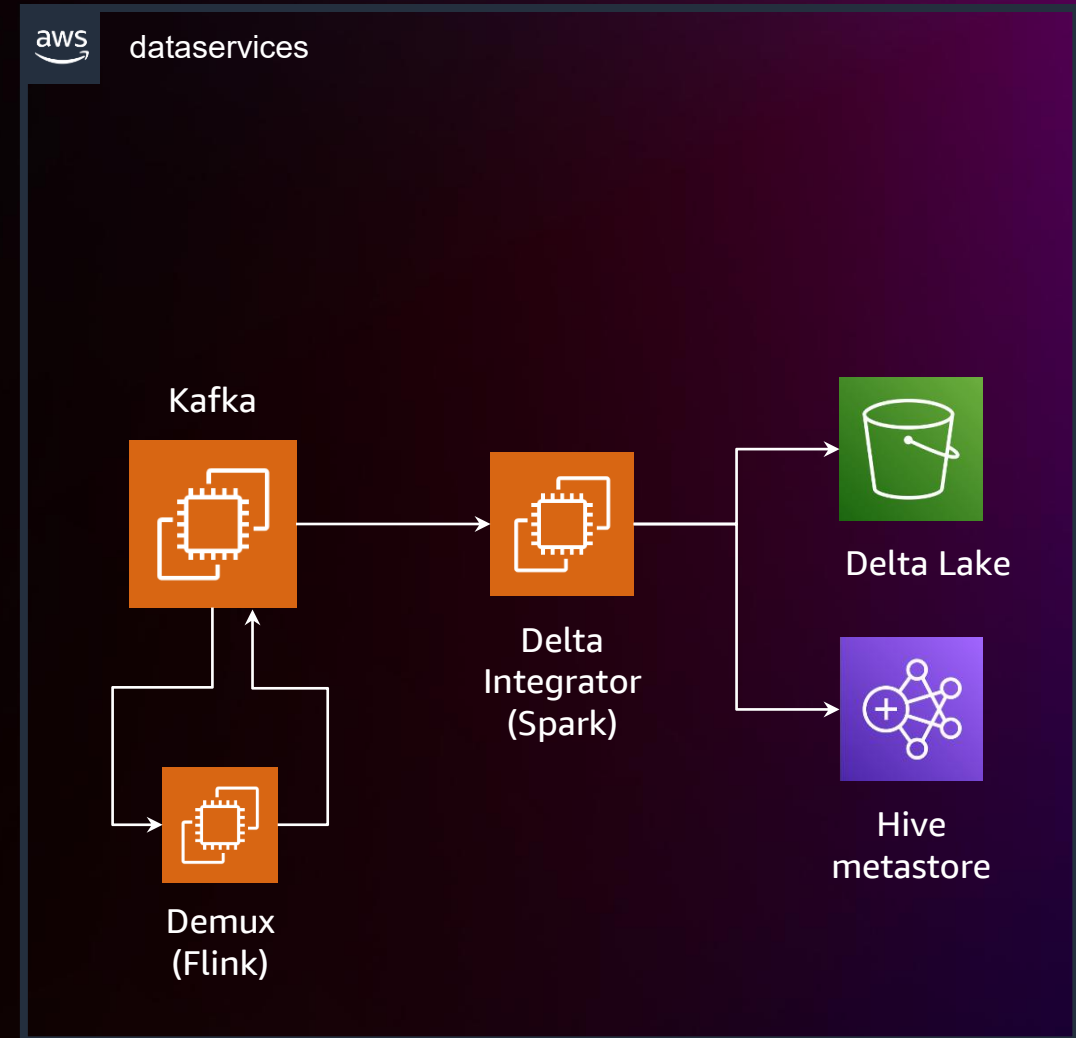
Firehose – all events are published to the same firehose topic which means in-Region processing still difficult

02

Cost – replicating all data centrally just to write to Amazon S3 carries a high overhead

03

Validation – late in the pipeline; often teams will not know they sent bad data as validation occurs far later and lands in a dead-letter queue



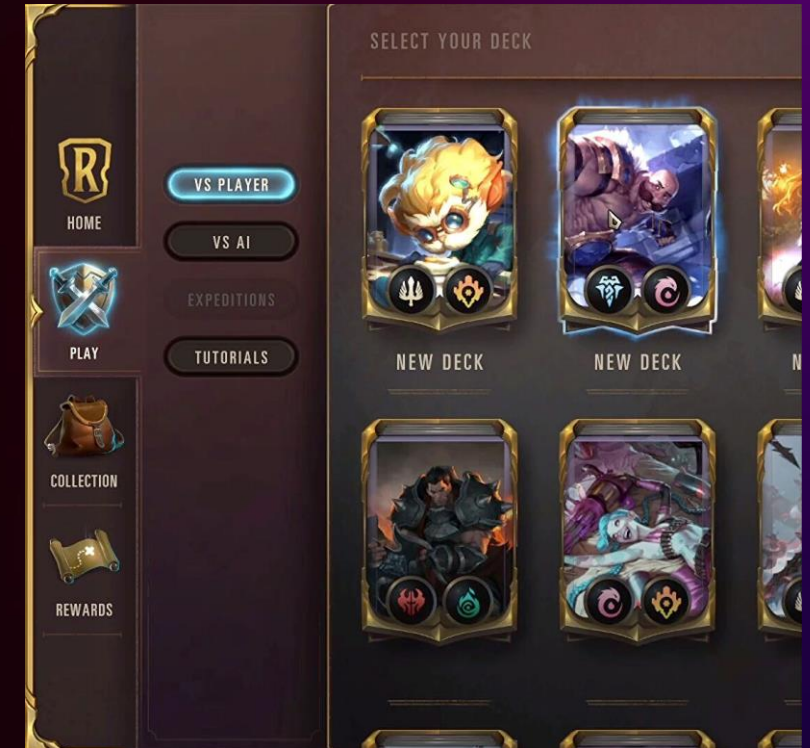
Player value

VALORANT Matchmaking

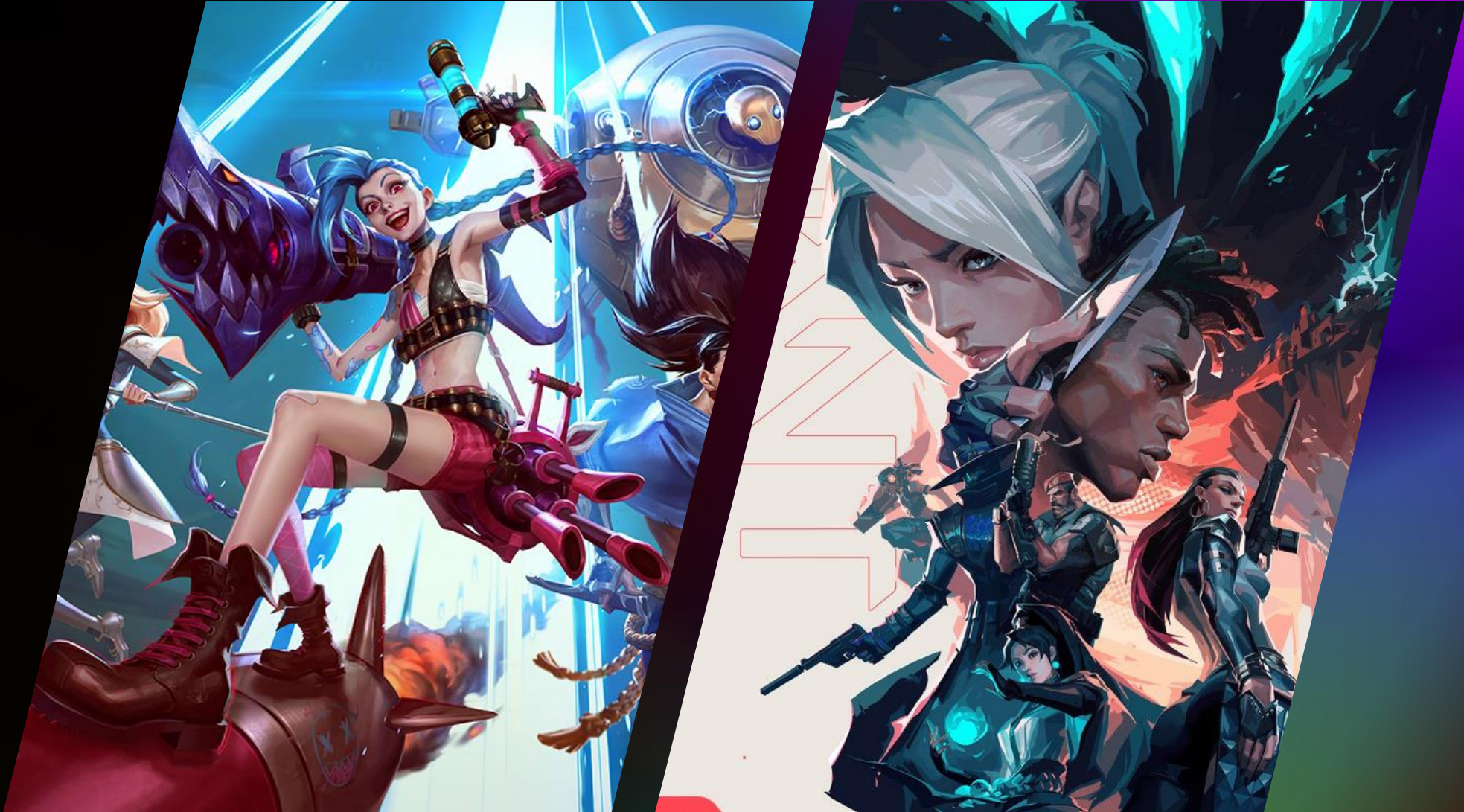


Twitch Beta Drops

Legends of Runeterra – metagame



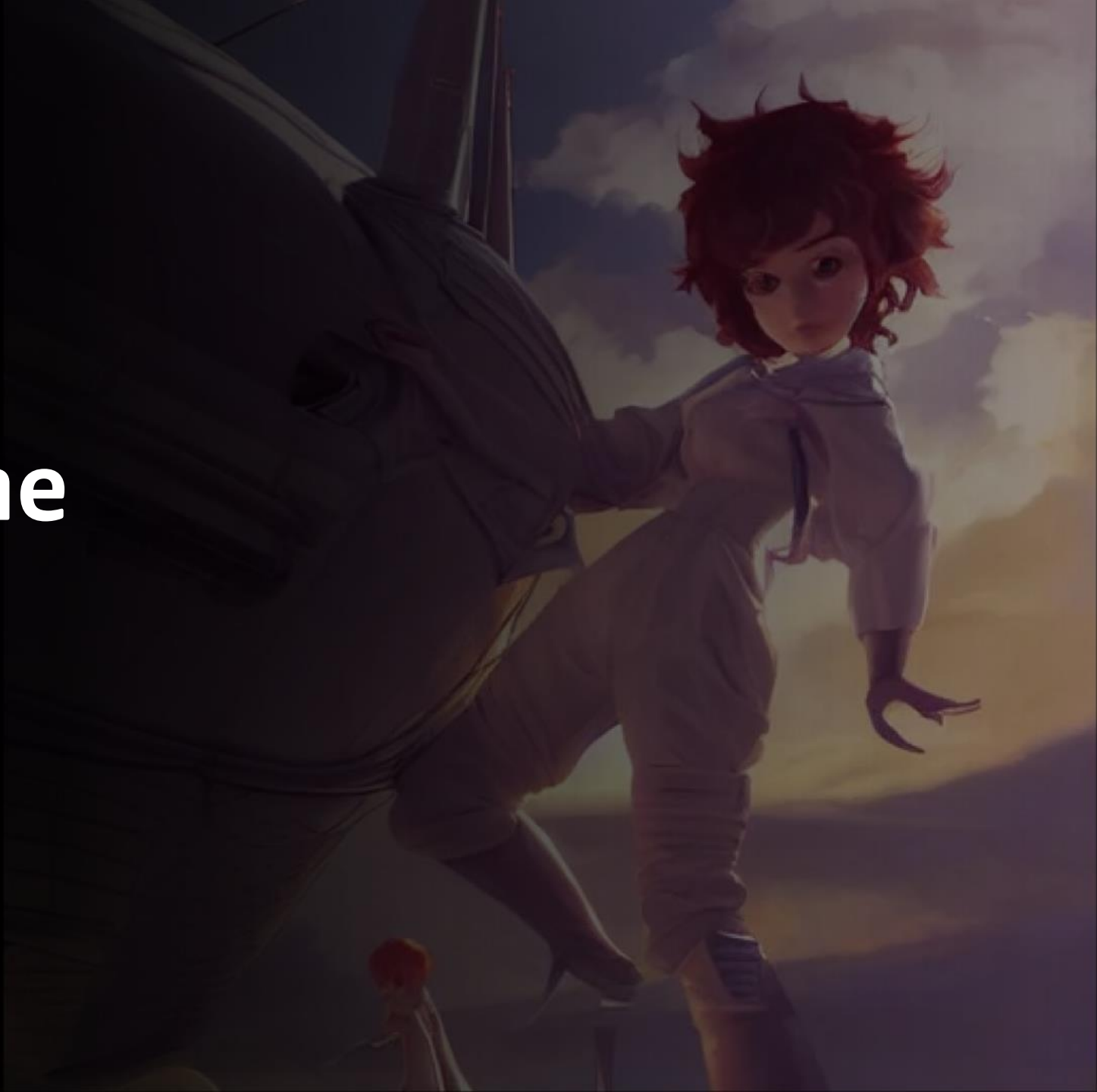
Two ingestion methods



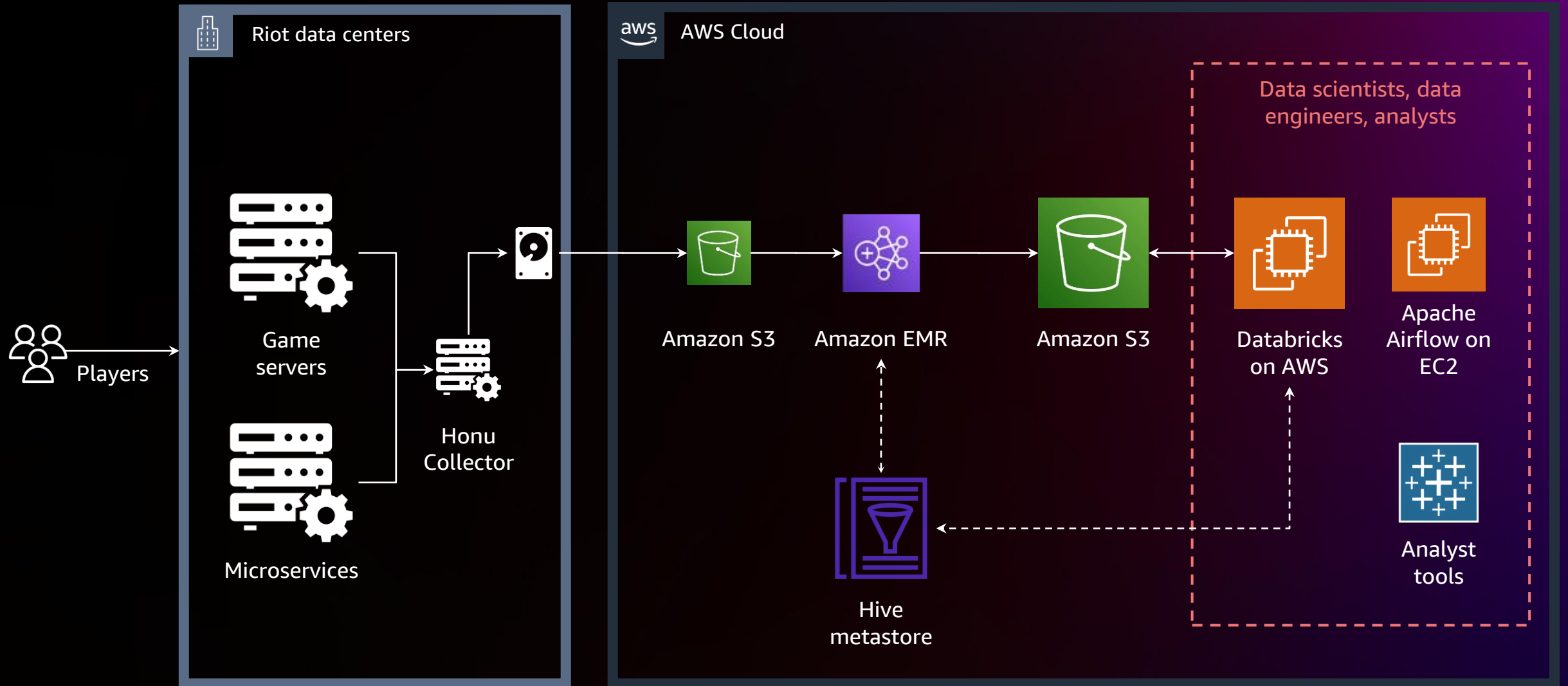
Fixing the plane mid-flight



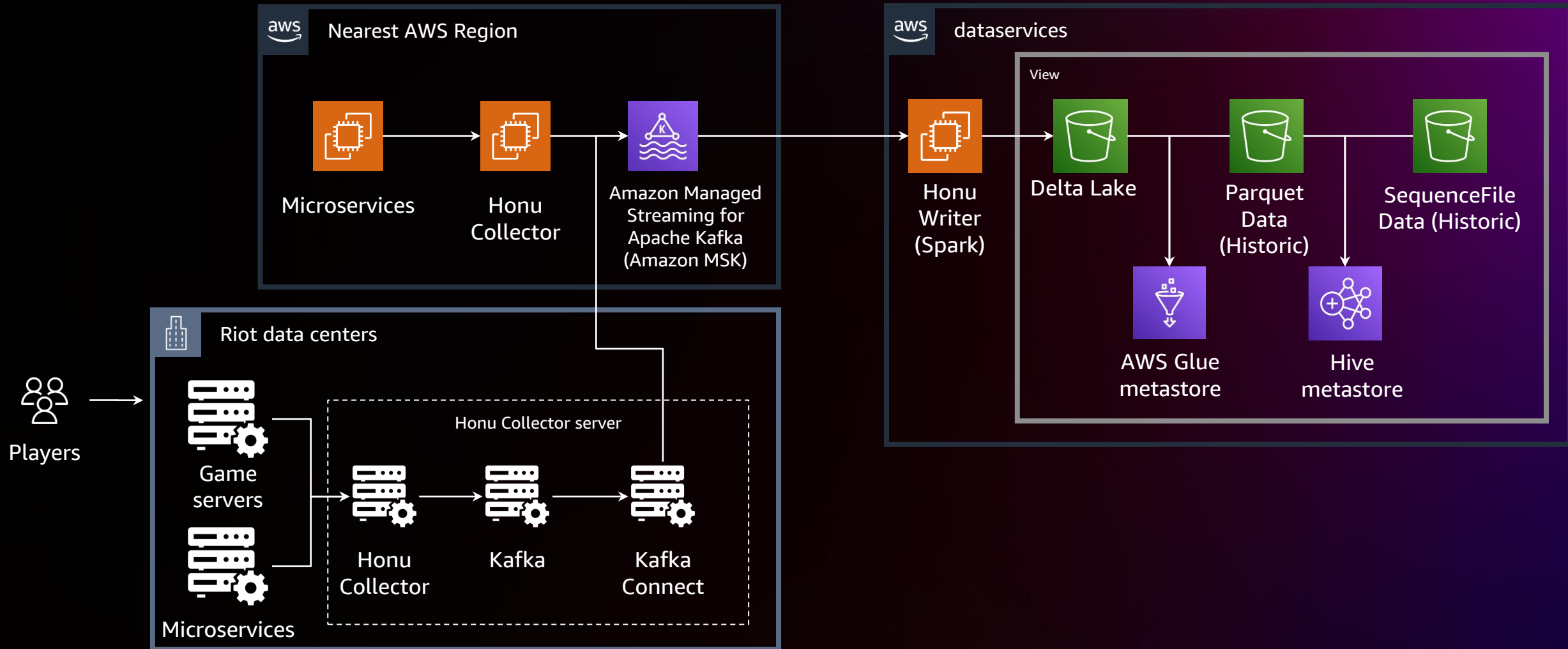
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Initial architecture – Honu



Revised architecture – Honu



Features

01

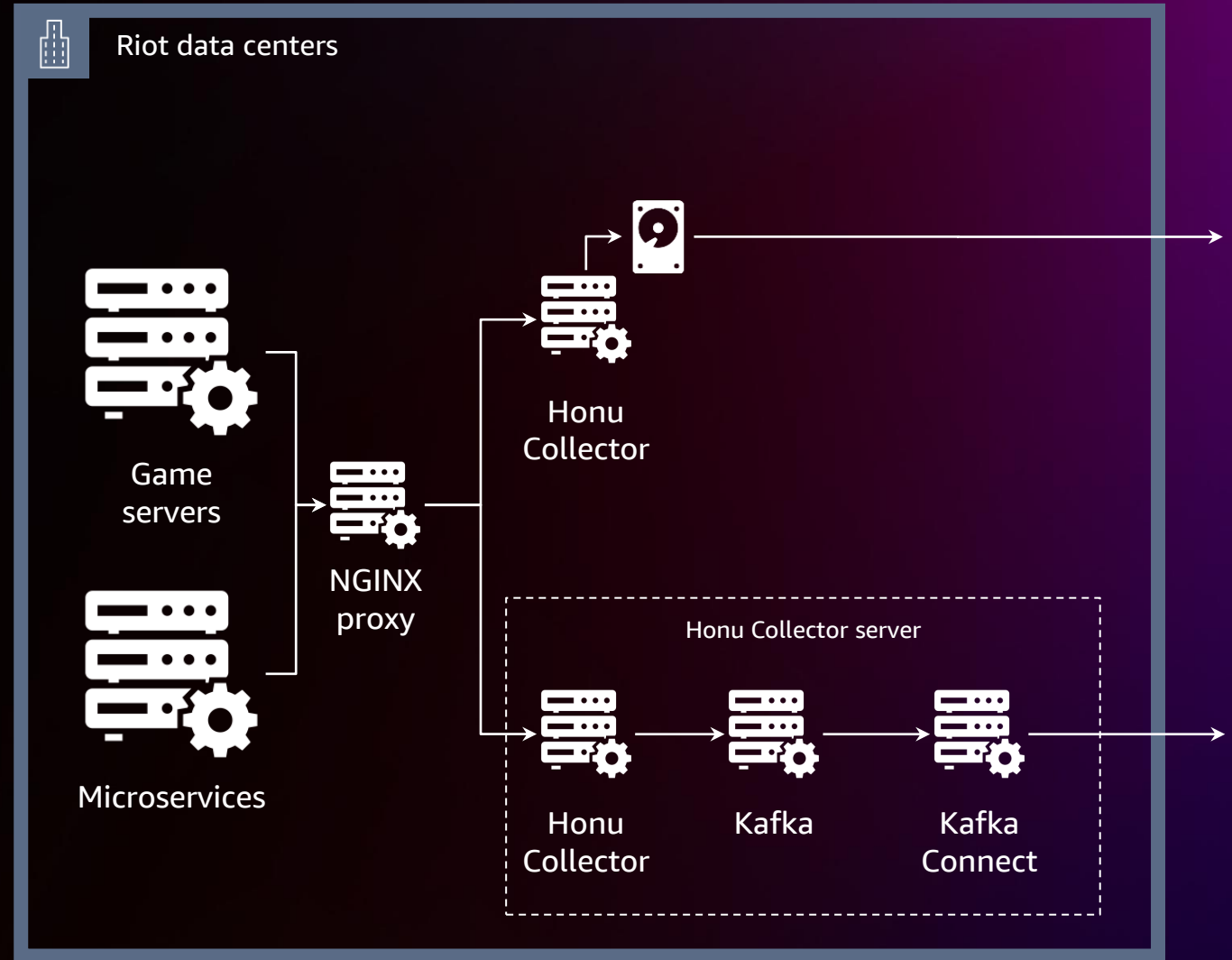
Zero downtime – swapped the underlying system without impacting players

02

Preserved Honu contract

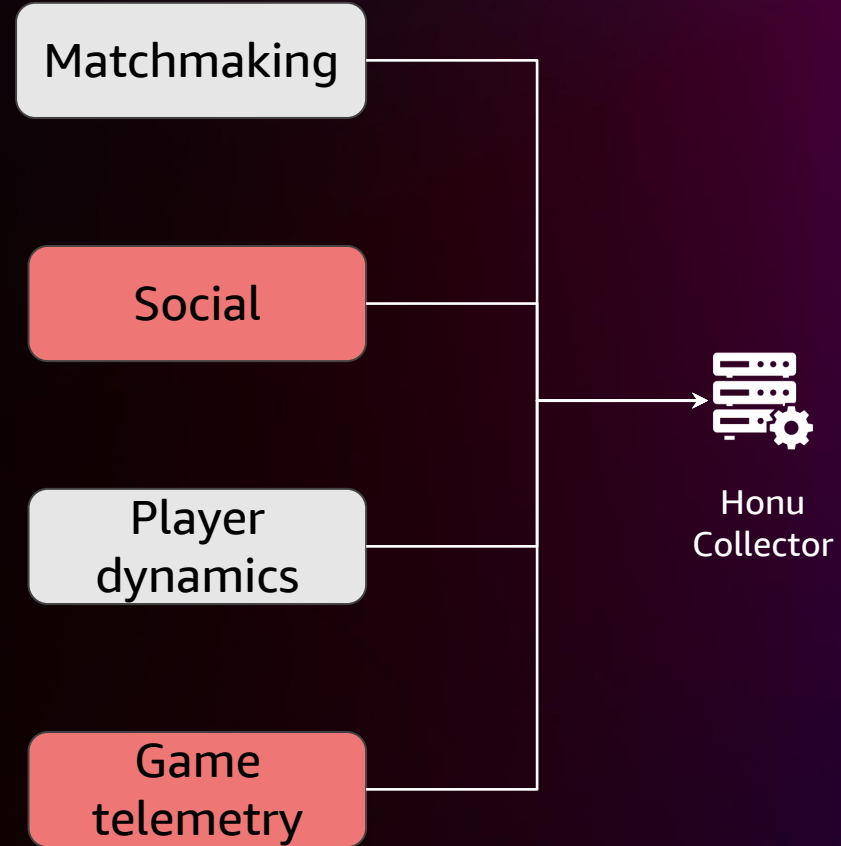
03

Performant



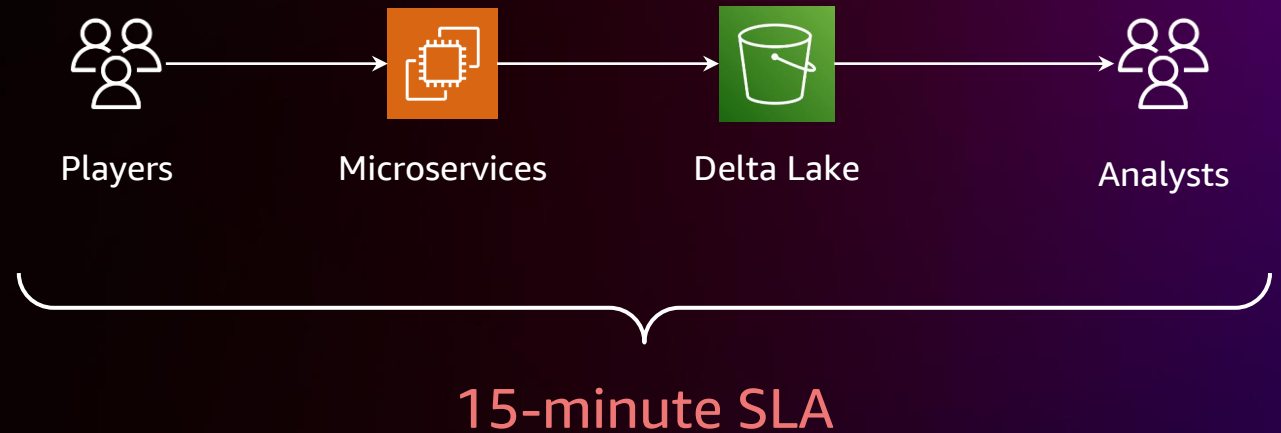
Features

- 01 **Zero downtime** – swapped the underlying system without impacting players
- 02 **Preserved Honu contract** – we did not need to change any services to move to a Kafka-based stack
- 03 **Performant**



Features

- 01 **Zero downtime** – swapped the underlying system without impacting players
- 02 **Preserved Honu contract** – we did not need to change any services to move to a Kafka-based stack
- 03 **Performant** – processing times reduced to 15 minutes from a previous SLA of 6–12 hours





**How much data are
we processing?**

500,000 events per second

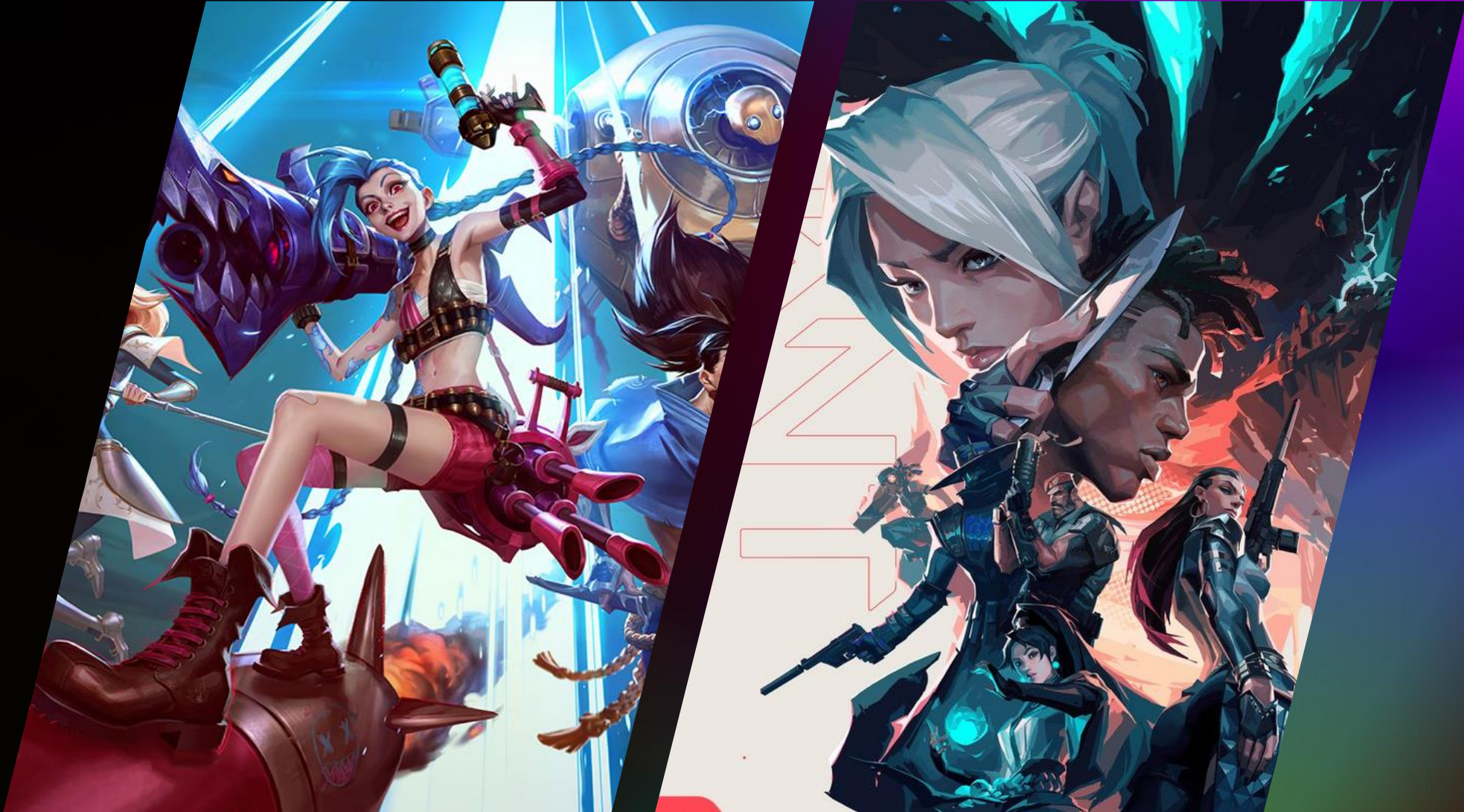
**75 TB of data every day
and growing**



Comparison

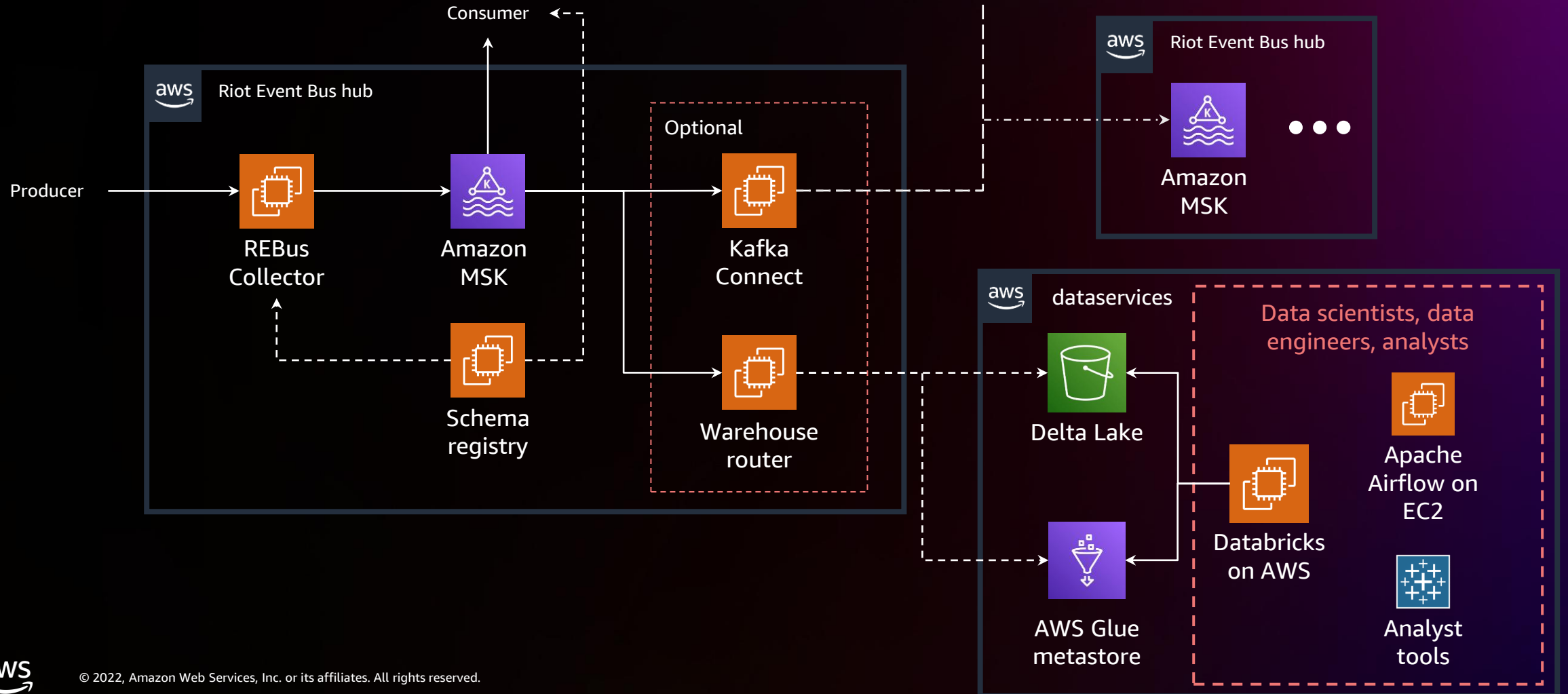
	 LEAGUE OF LEGENDS	 TEAMFIGHT TACTICS	 VALORANT	 LEGENDS OF RUNETERRA
Features	Honu		Analytics Platform	
Schema	✗		✓	
Kafka	✓		✓	
Unique topics	✗		✗	
Streaming	—		✓	
Regional processing	✗		✗	

Here we go again!



One event bus to rule them all

Riot Event Bus architecture (REBus)



Features

01

Service-to-service communication –
Riot-wide play for event-driven systems

02

Isolated resources

03

Granularity

LEAGUE^{OF}
LEGENDS

GameEndEvent

REBus
Collector

Kafka



Features

01

Service-to-service communication –
Riot-wide play for event-driven systems

02

Isolated resources – teams are
unable to take each other out

03

Granularity



Features

01

Service-to-service communication –
Riot-wide play for event-driven systems

02

Isolated resources – teams are
unable to take each other out

03

Granularity – deployed at any
granularity; supports: Regions,
shards, set of services

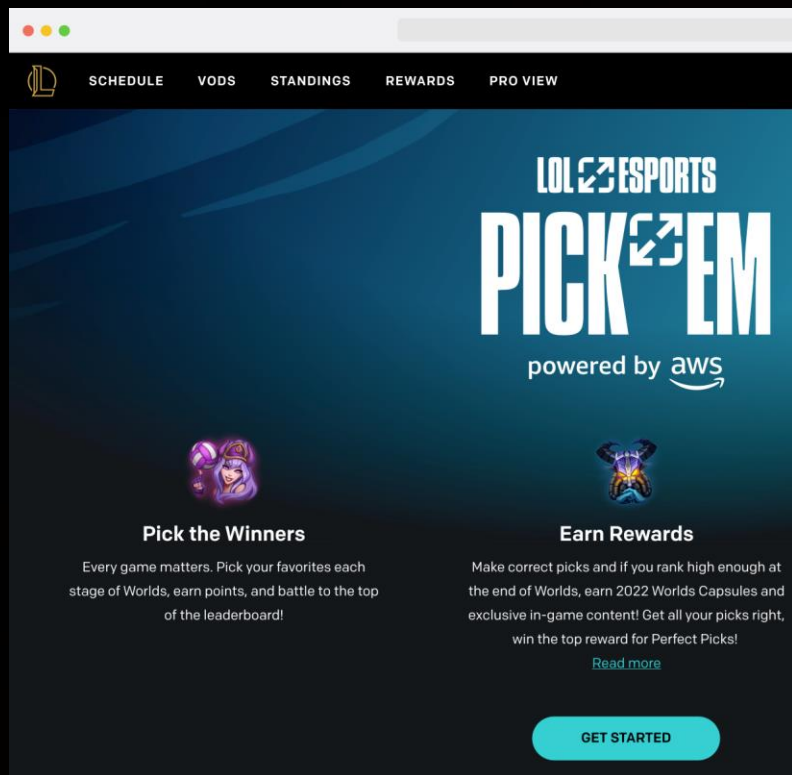


Comparison

	 	 	
Features	Honu	AP	Riot Event Bus
Schema	✗	✓	✓
Kafka	✓	✓	✓
Unique topics	✗	✗	✓
Streaming	—	✓	✓
Regional processing	✗	✗	✓

Player value

LoL Esports Pick'Em

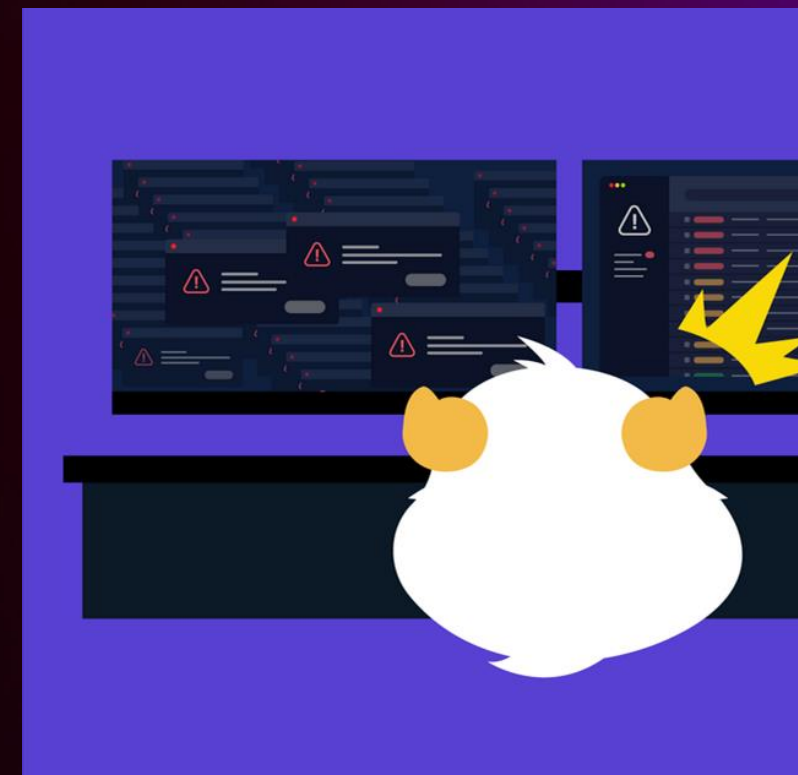


The screenshot shows the LoL Esports Pick'Em website. At the top, there's a navigation bar with links: SCHEDULE, VODS, STANDINGS, REWARDS, and PRO VIEW. The main header features the LoL Esports logo and the 'PICK'EM' title, with 'powered by aws' below it. The page is divided into two main sections: 'Pick the Winners' and 'Earn Rewards'. The 'Pick the Winners' section includes a small image of a champion and text explaining that users can earn points and battle for the top of the leaderboard. The 'Earn Rewards' section includes a small image of a champion and text explaining that users can earn 2022 Worlds Capsules and exclusive in-game content by making correct picks. A 'GET STARTED' button is located at the bottom right.



Enabling 2FA – rewards

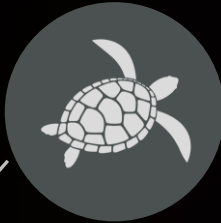
Central player dynamics



Recap

Ingestion pipelines

3 The number of ingestion pipelines we have running in production



Honu

Riot scales telemetry collection from all game servers and game services

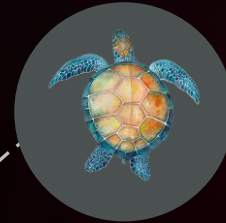
Analytics Platform

Can we increase our knowability and stability with ingestion



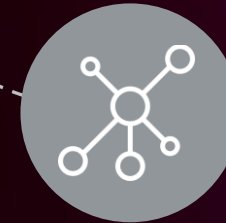
Honu on Amazon MSK

We upgraded our ability to ingest data from LoL, reducing query times from 6–12 hours to 15 minutes



REBus

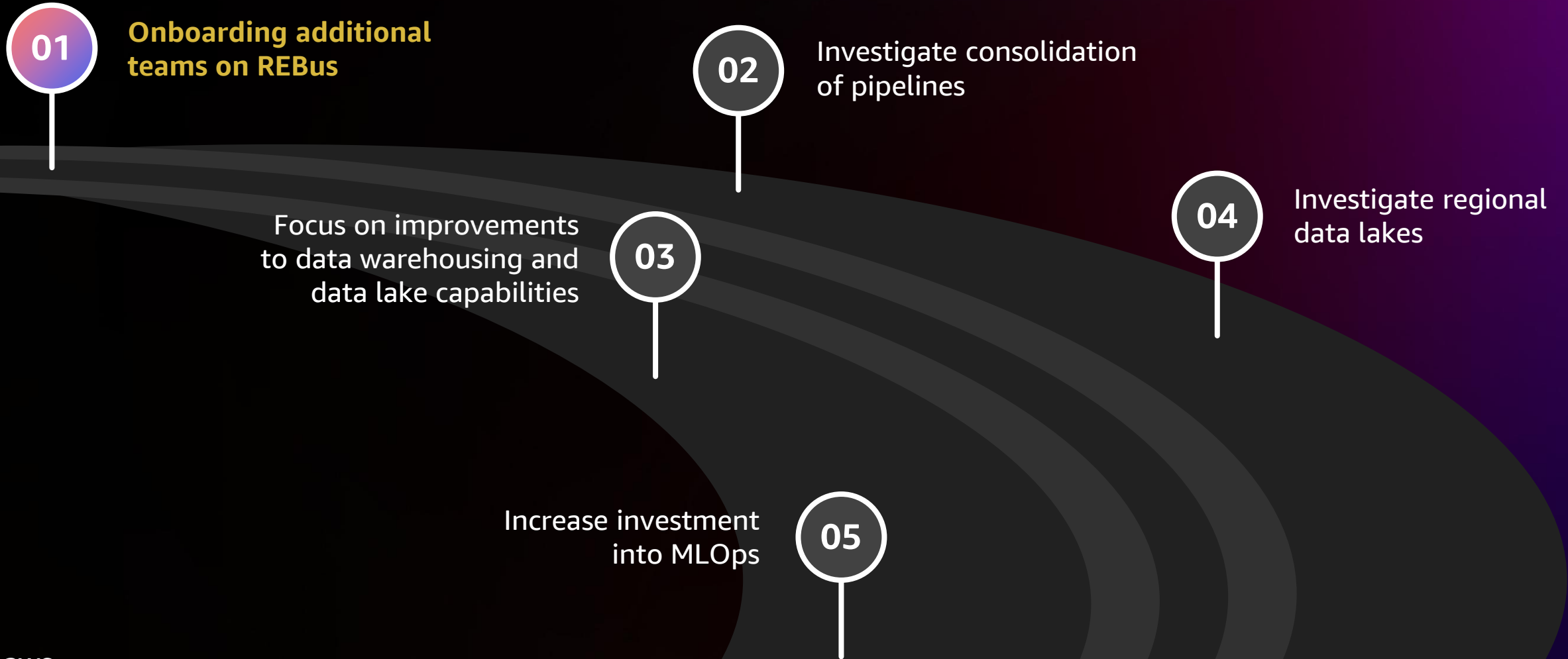
Unlock all event-driven system capabilities for Riot



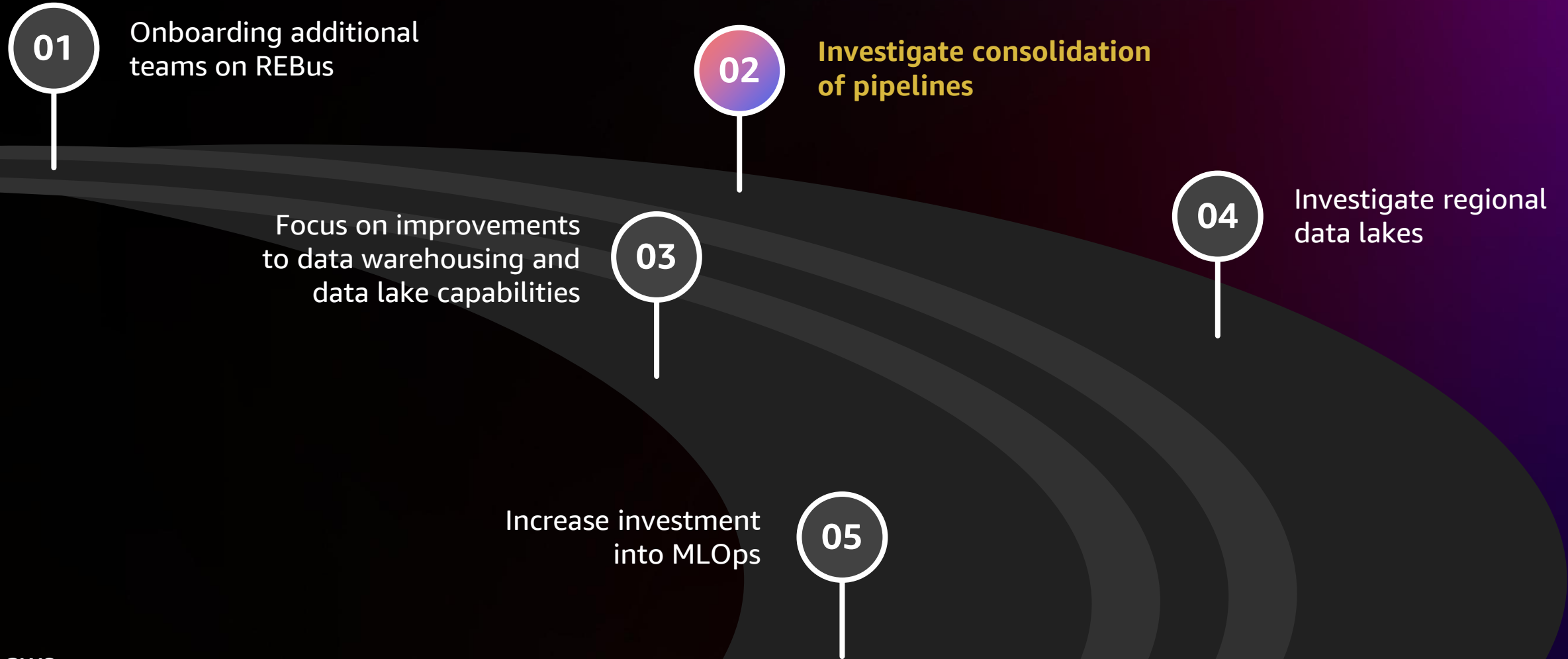
What's next?



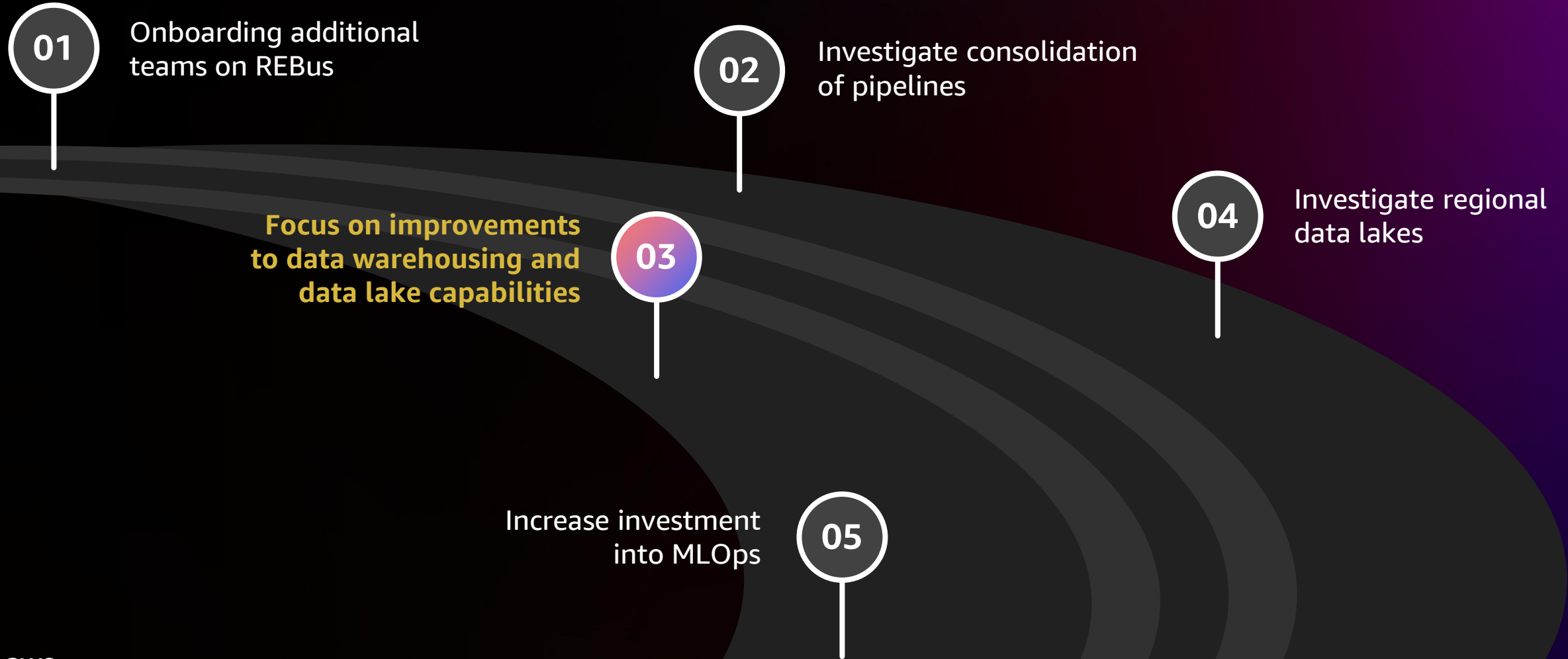
Roadmap



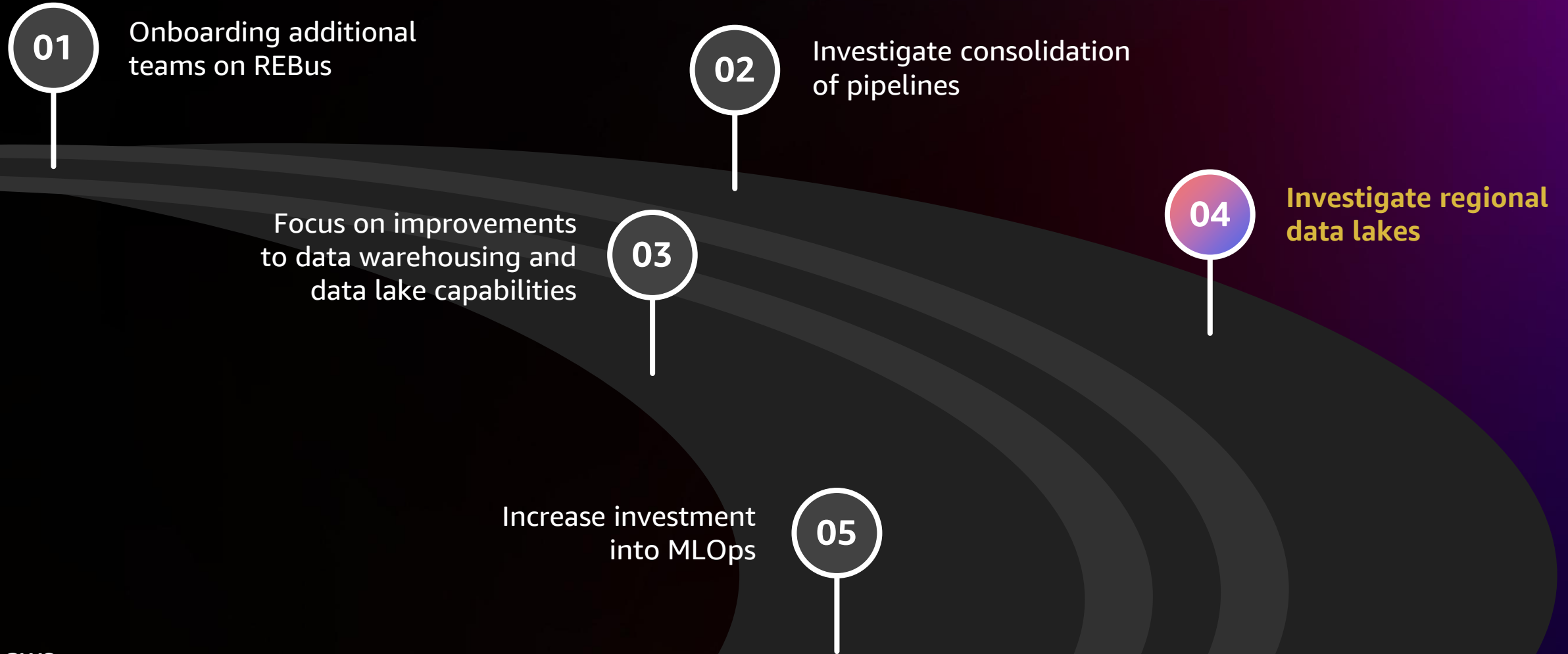
Roadmap



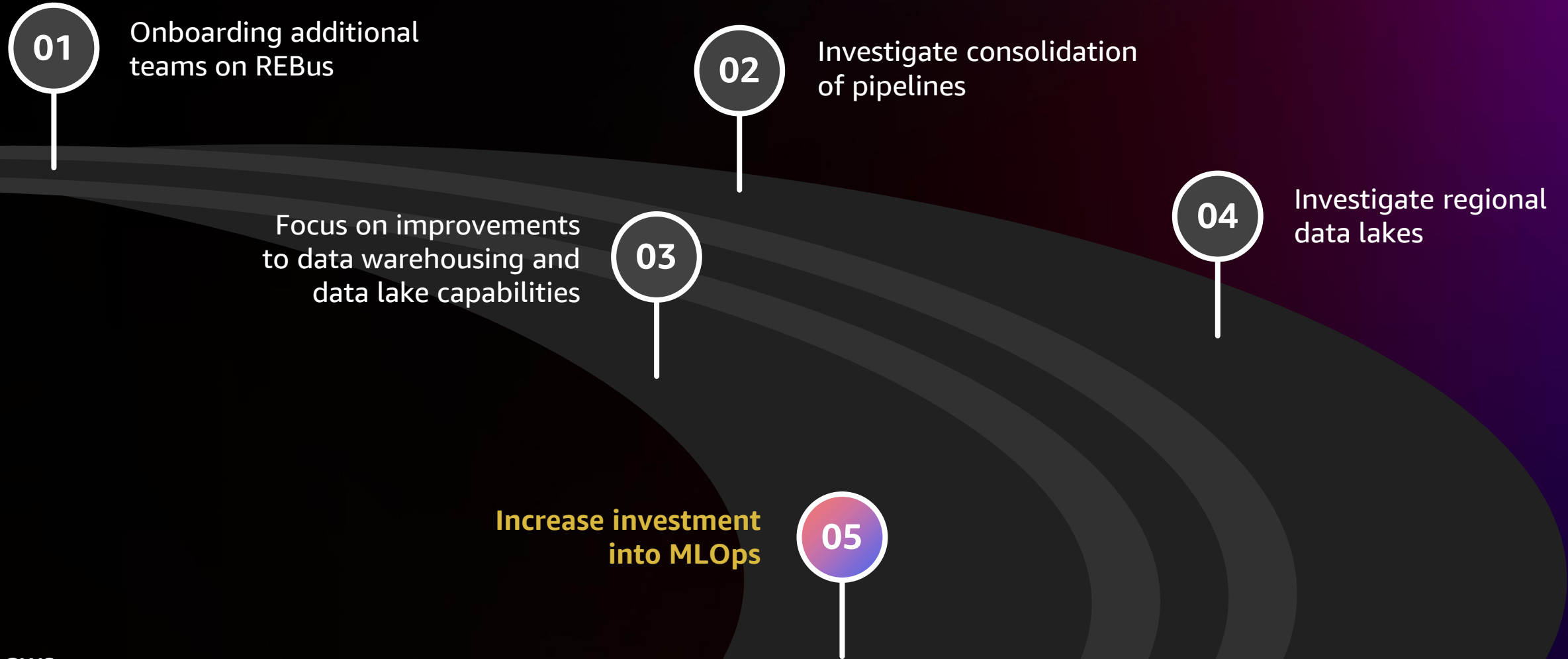
Roadmap



Roadmap

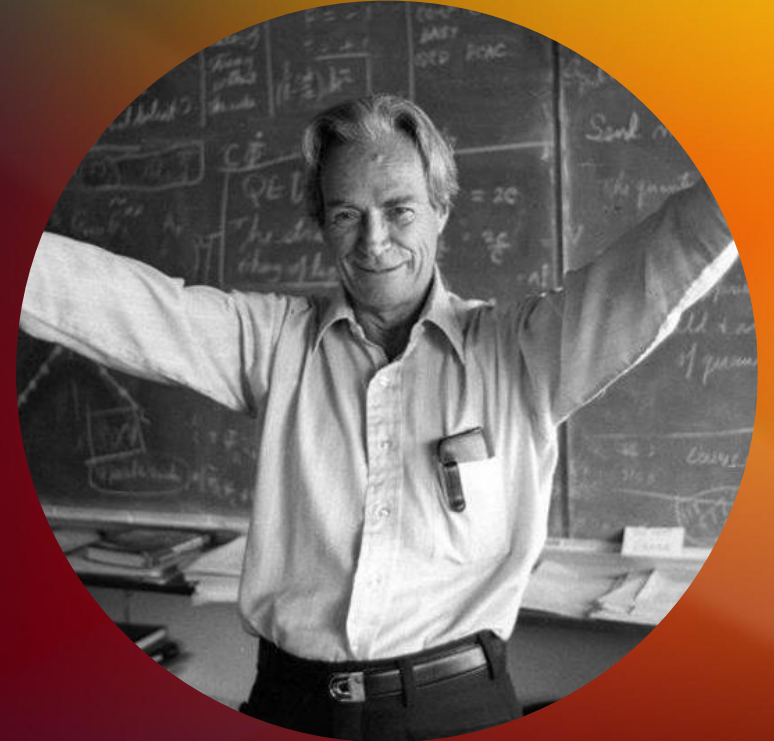


Roadmap



“Your intelligence cannot be measured by a number. It is defined by your willingness to learn, solve problems and try new things.”

Professor Richard Feynman



Thank you!

Wesley Kerr

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Karthik Kumar Odapally

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