riskified tech;

Let's Make Your CFO Happy;

## A Practical Guide for

# Kafka Cost Reduction

# The Elephant In The Room

**What are we paying for?**

Running a self-hosted Kafka deployment

**Where and how can we cut costs?**

Tips, tricks, and KIPs

**Develop an economic mindset**

It’s part of our role

# Elad Leev

## Data Engineer at Riskified

#DistributedSystems #DataStreams

#Scalability

#Kafka #ConfluentCommunityCatalyst

@eladleev

What We Do

# Riskified

# Riskified by the Numbers

**750+**

Global team, nearly 50%
in **engineering & analytics**

**180+**

Countries across
the globe

**50+**

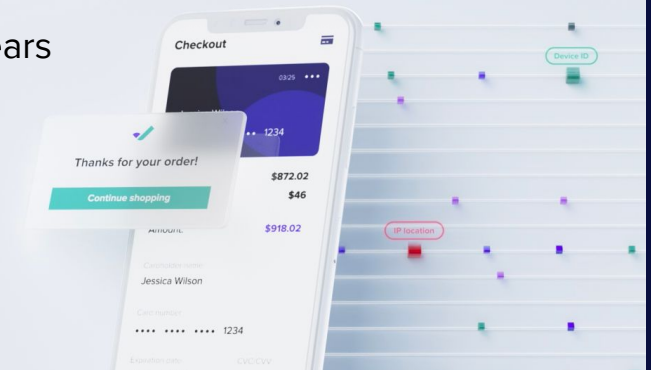
Publicly held companies
among our clients

**$89B**

Online volume (GMV)
reviewed in 2021

**98%+**

Client retention*
for the past 2 years




*Annual dollar retention

As of March 2022

ticketmaster

macy's

PRADA

wish

wayfair

lastminute.com

REVOLVE

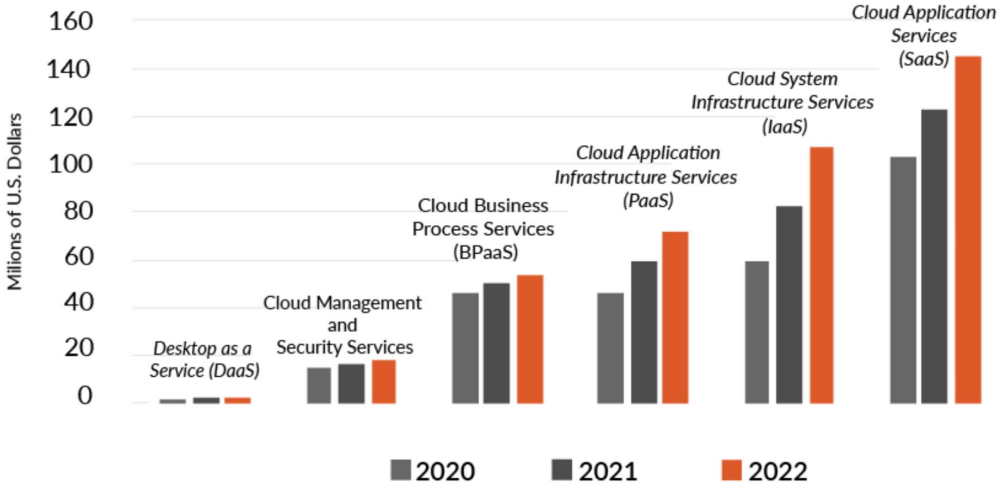
FINISH LINE

# Let’s dive in!

# According to Gartner Forecasts

The worldwide end-user spending on public cloud services is forecast to grow by **20%** in 2022 to a total of **$397 billion**.

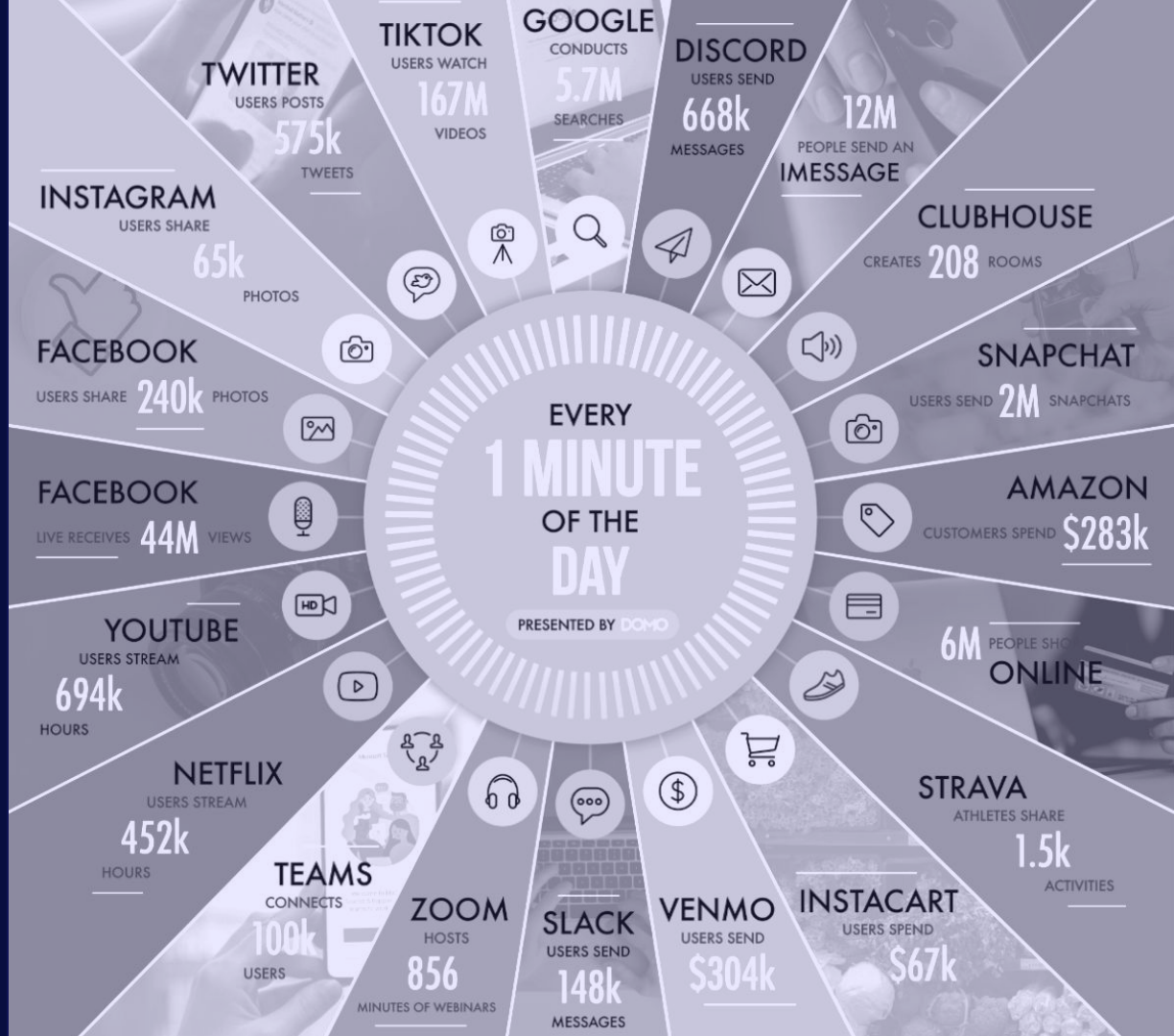
## Worldwide Public Cloud Services End-User Spending Forecast




Source: Gartner (April 2021)

# Data Never Sleeps

According to Statista, the total amount of data consumed globally in 2021 was **79 Zettabytes**.



More than

# 80%

of all Fortune 100 companies trust, and use Kafka.

10 OUT OF 10

MANUFACTURING

7 OUT OF 10

BANKS

10 OUT OF 10

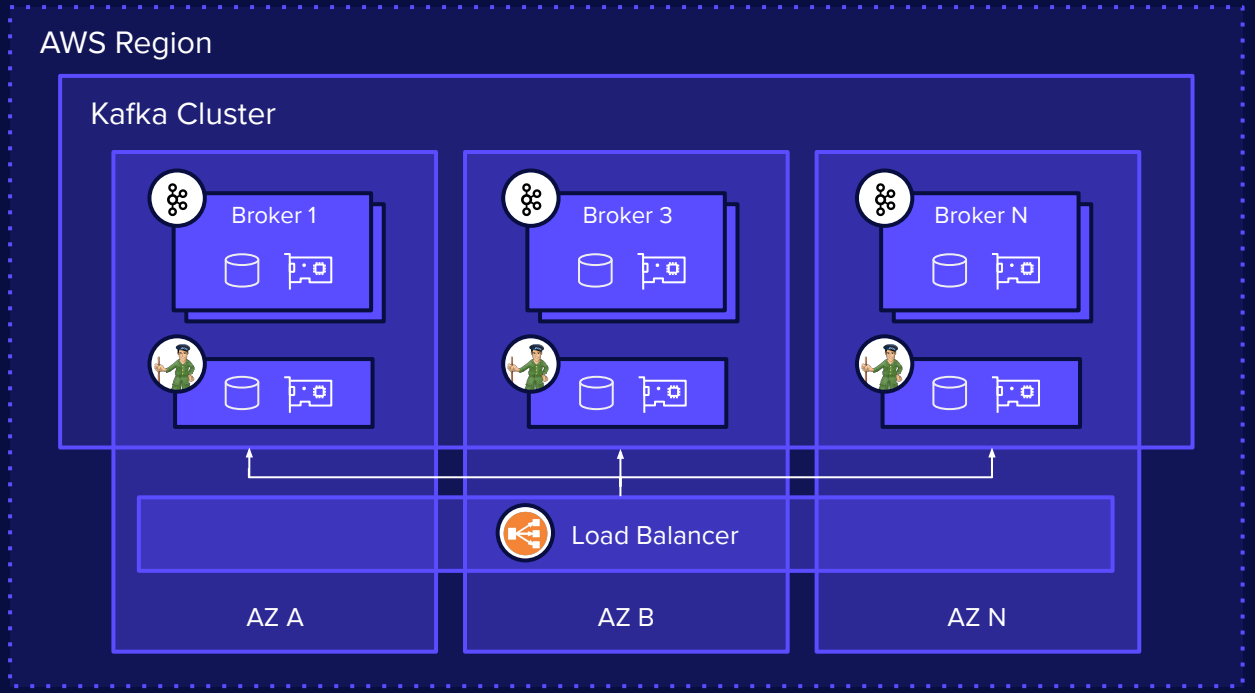
INSURANCE

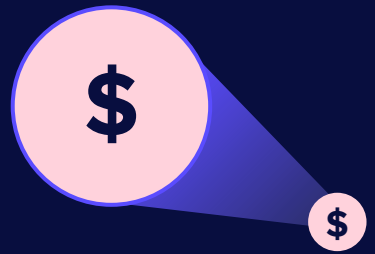
8 OUT OF 10

TELECOM

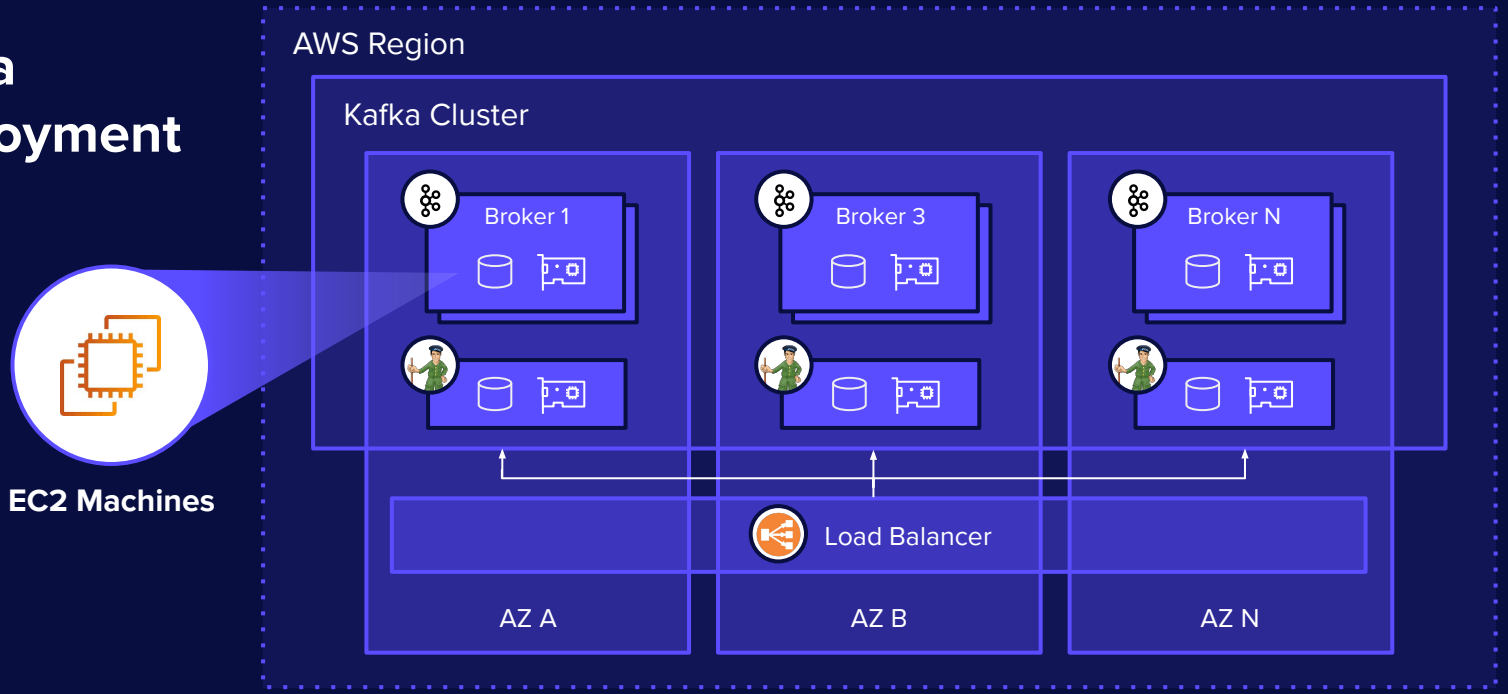
# What are we paying for?

# Kafka Deployment

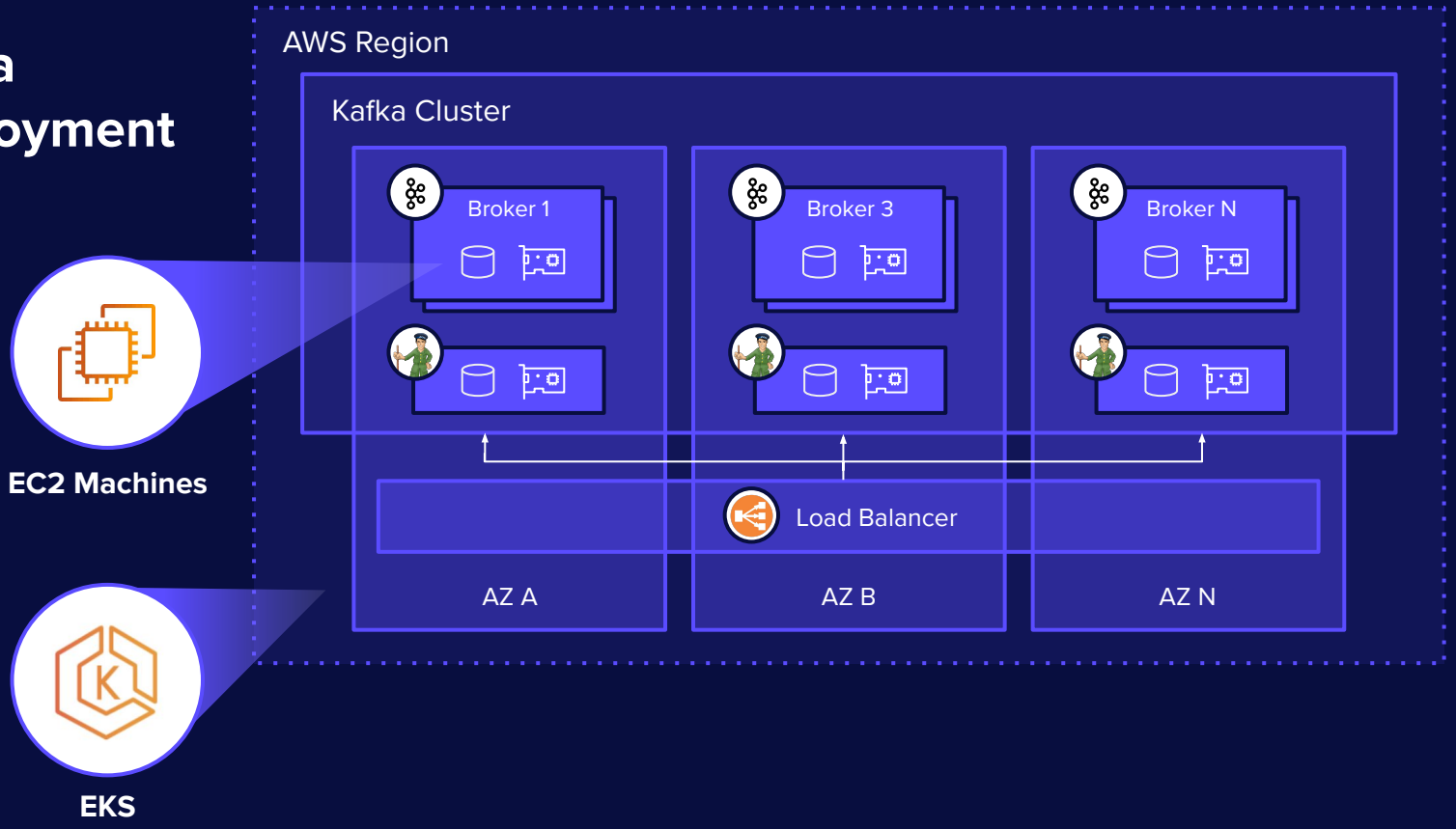


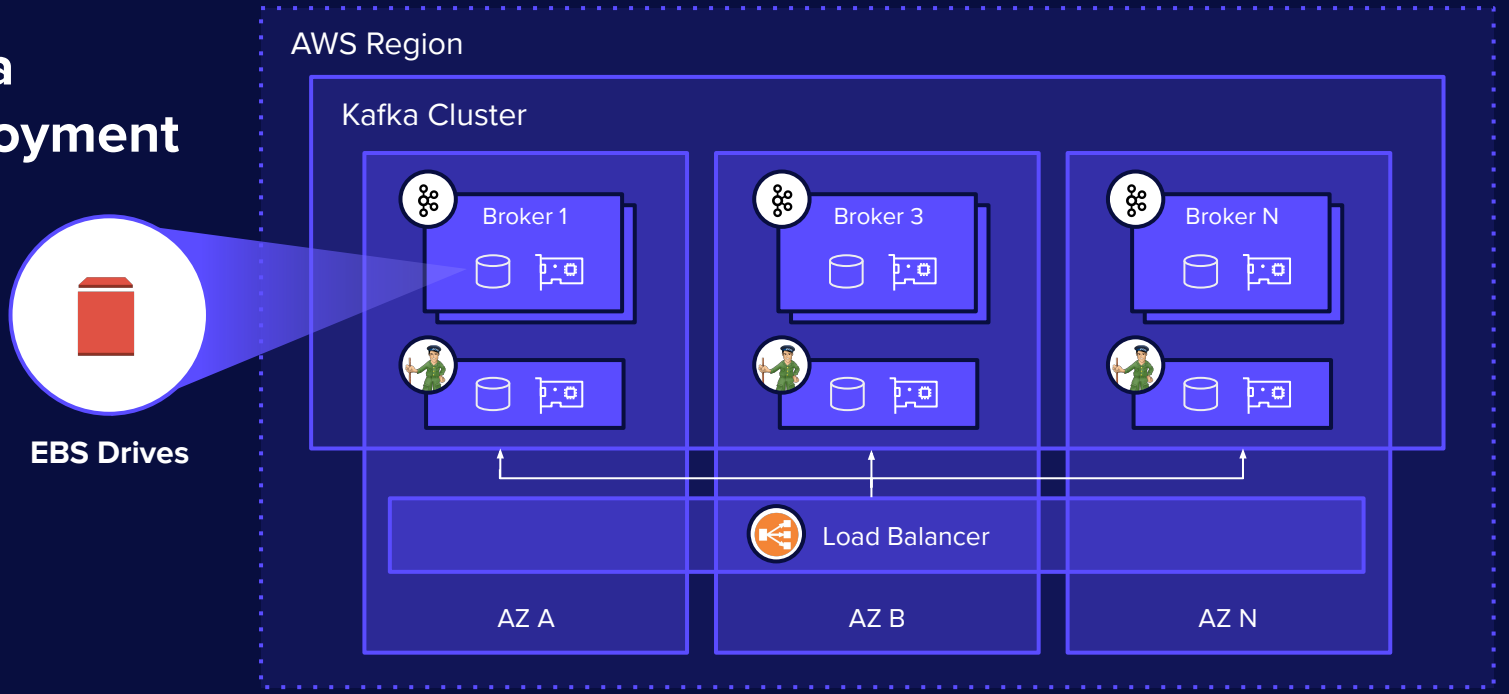
# Kafka Deployment




# Kafka Deployment

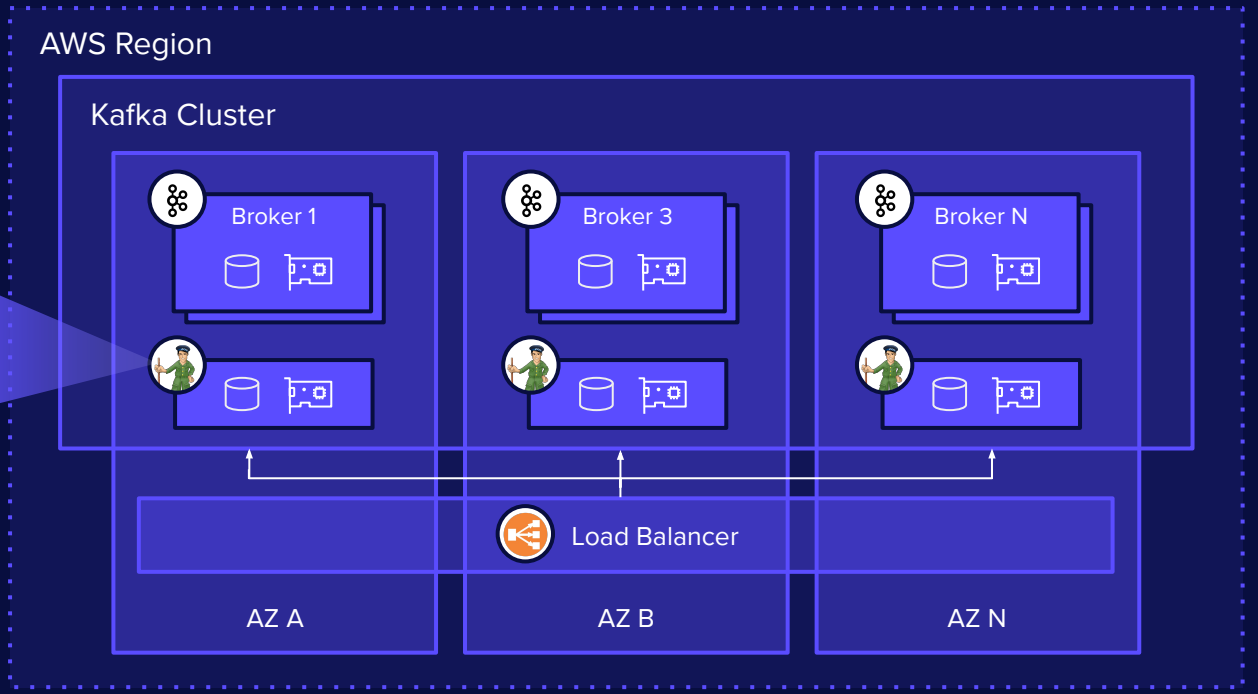



# Kafka Deployment

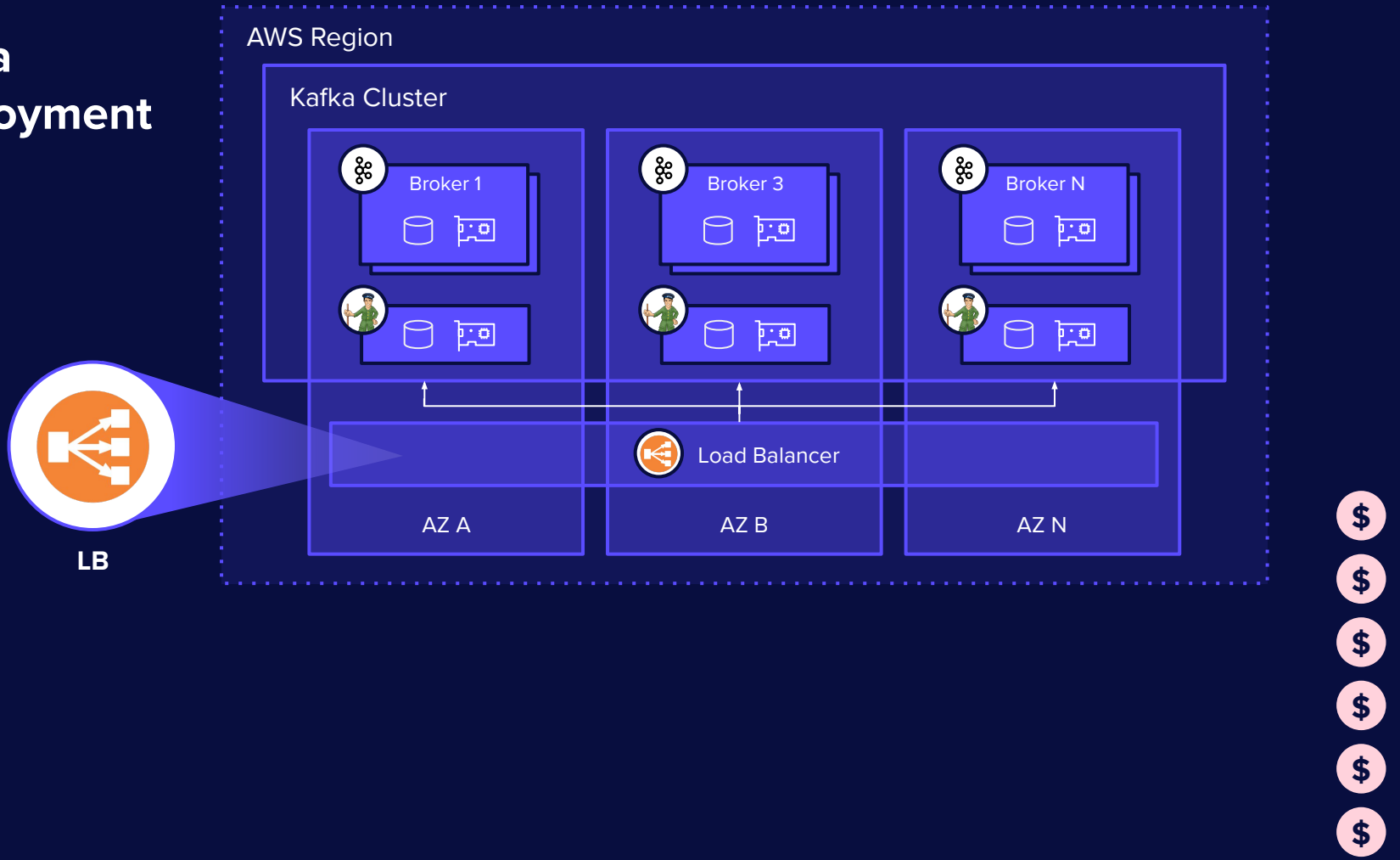


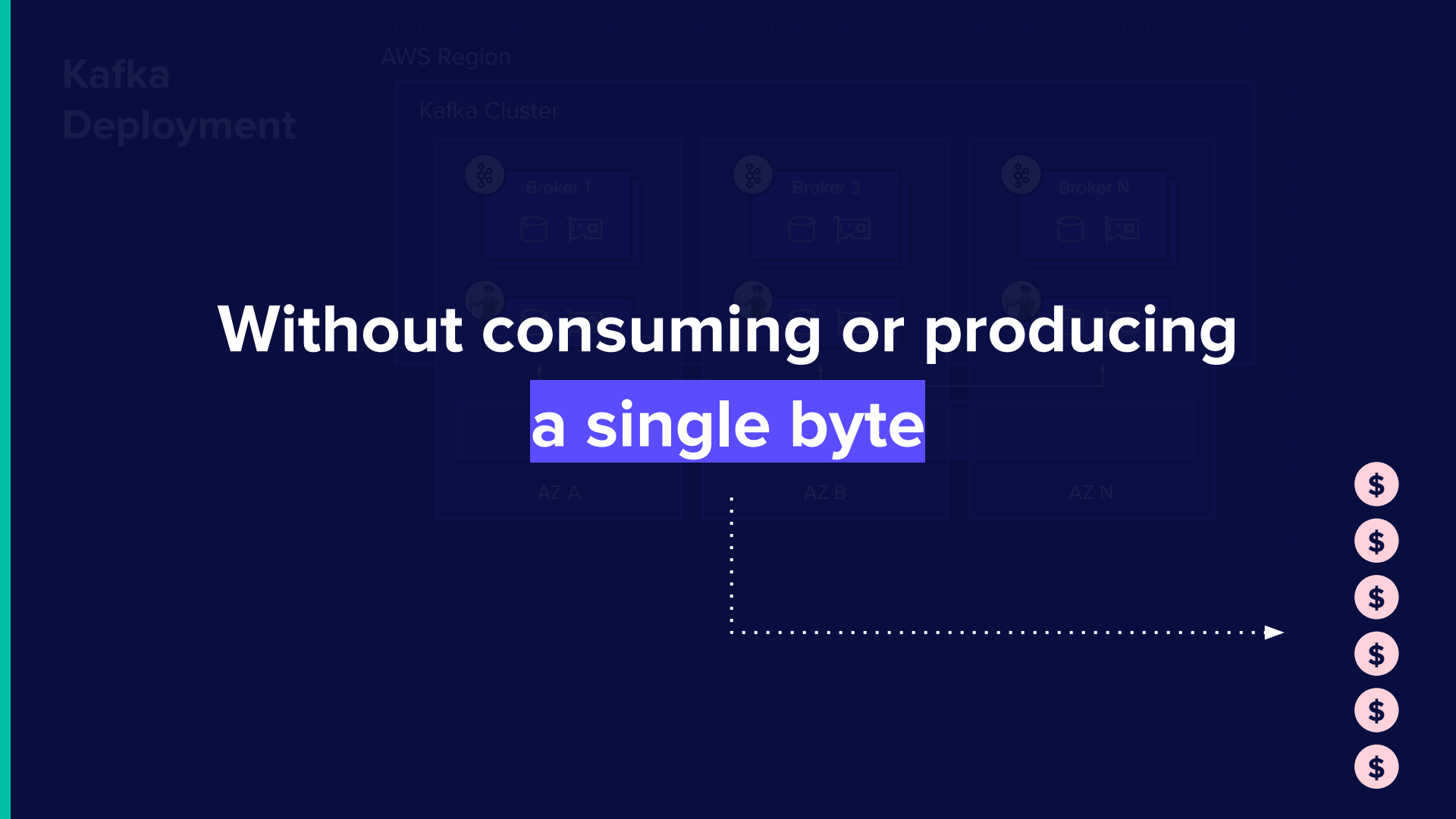

# Kafka Deployment

ZooKeepers

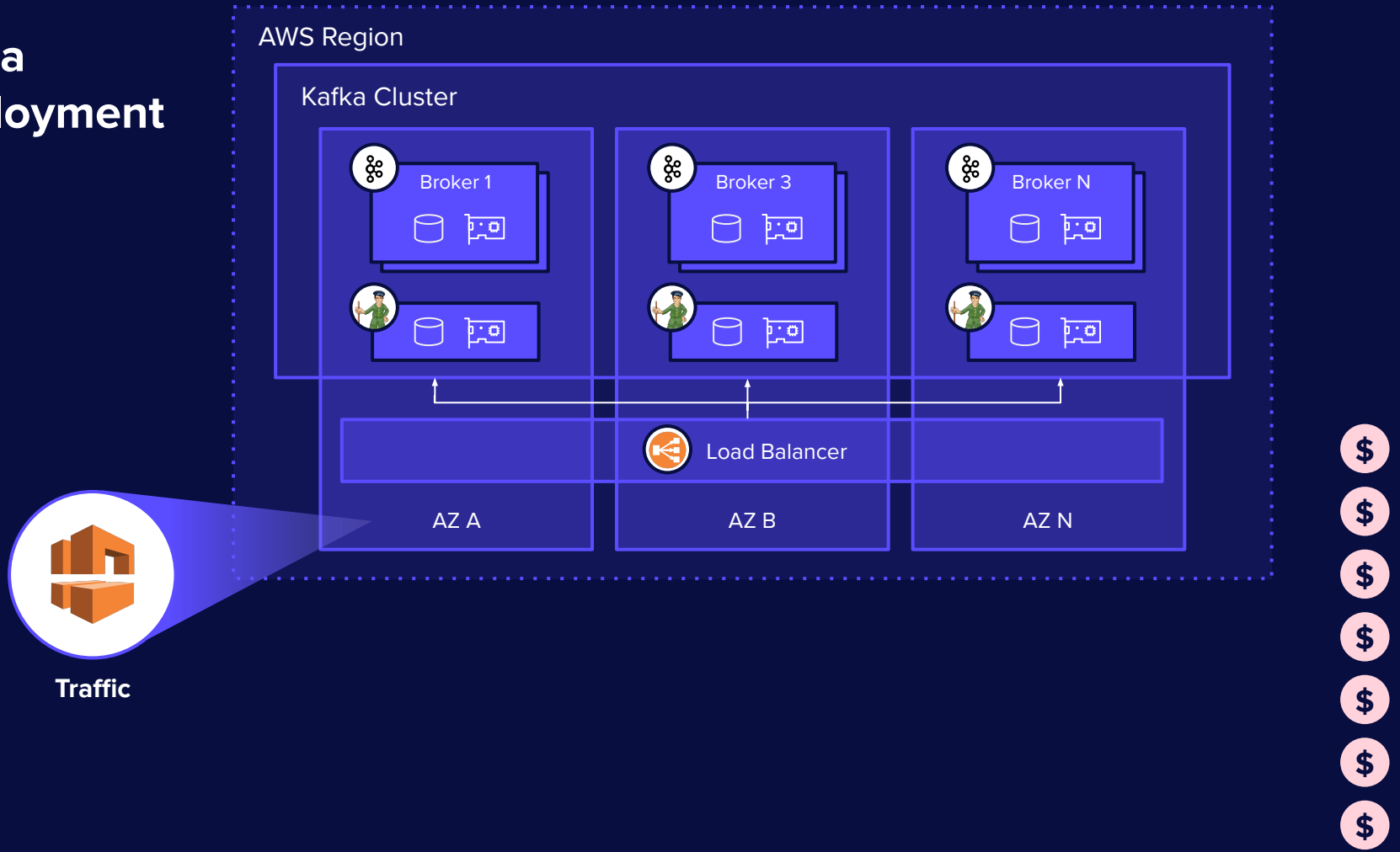



# Kafka Deployment

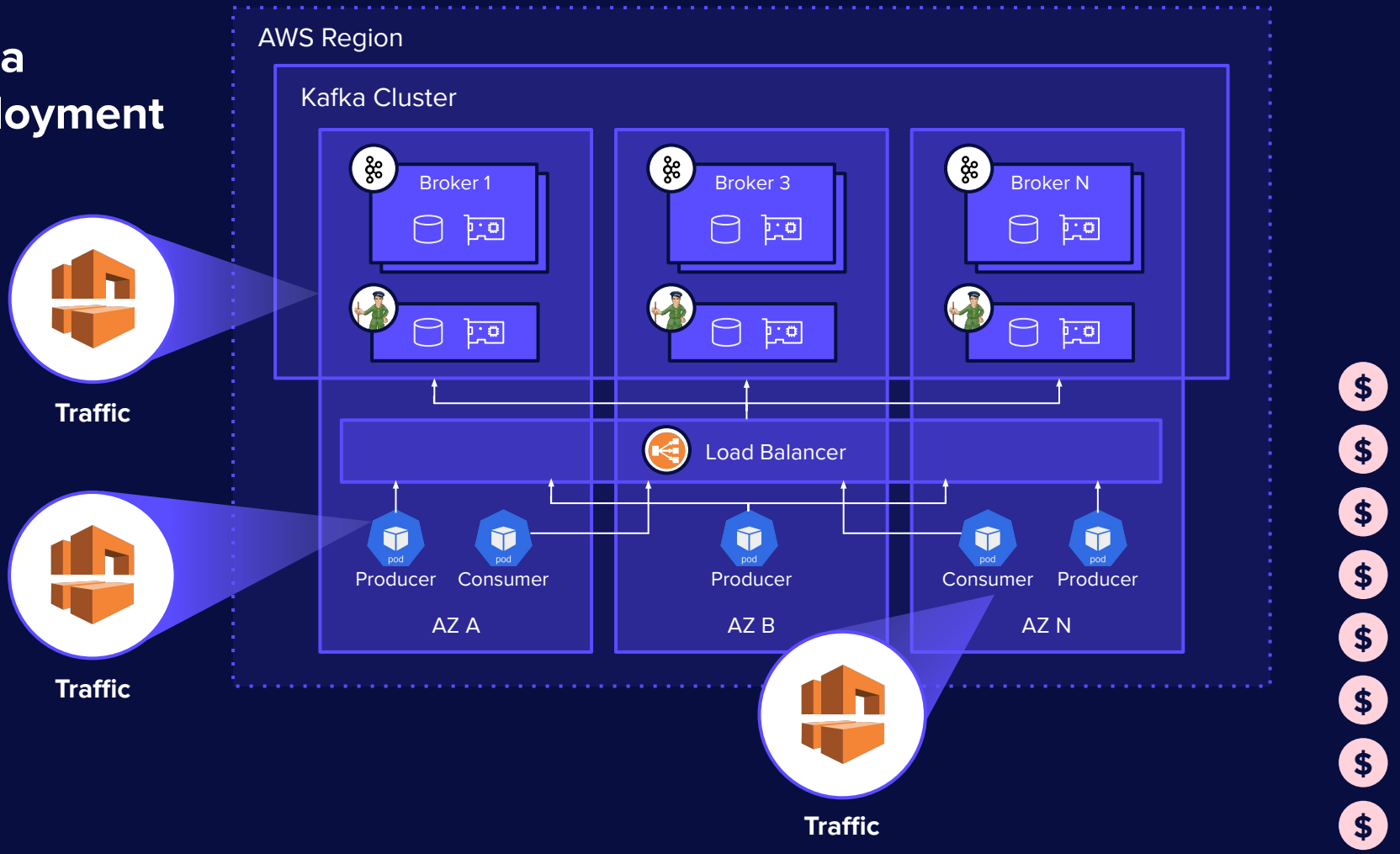



Kafka
Deployment
AWS Region
Kafka Cluster
Broker 1
Broker 3
Broker N
AZ A
AZ B
AZ N
Without consuming or producing
a single byte
$
$
$
$
$
$

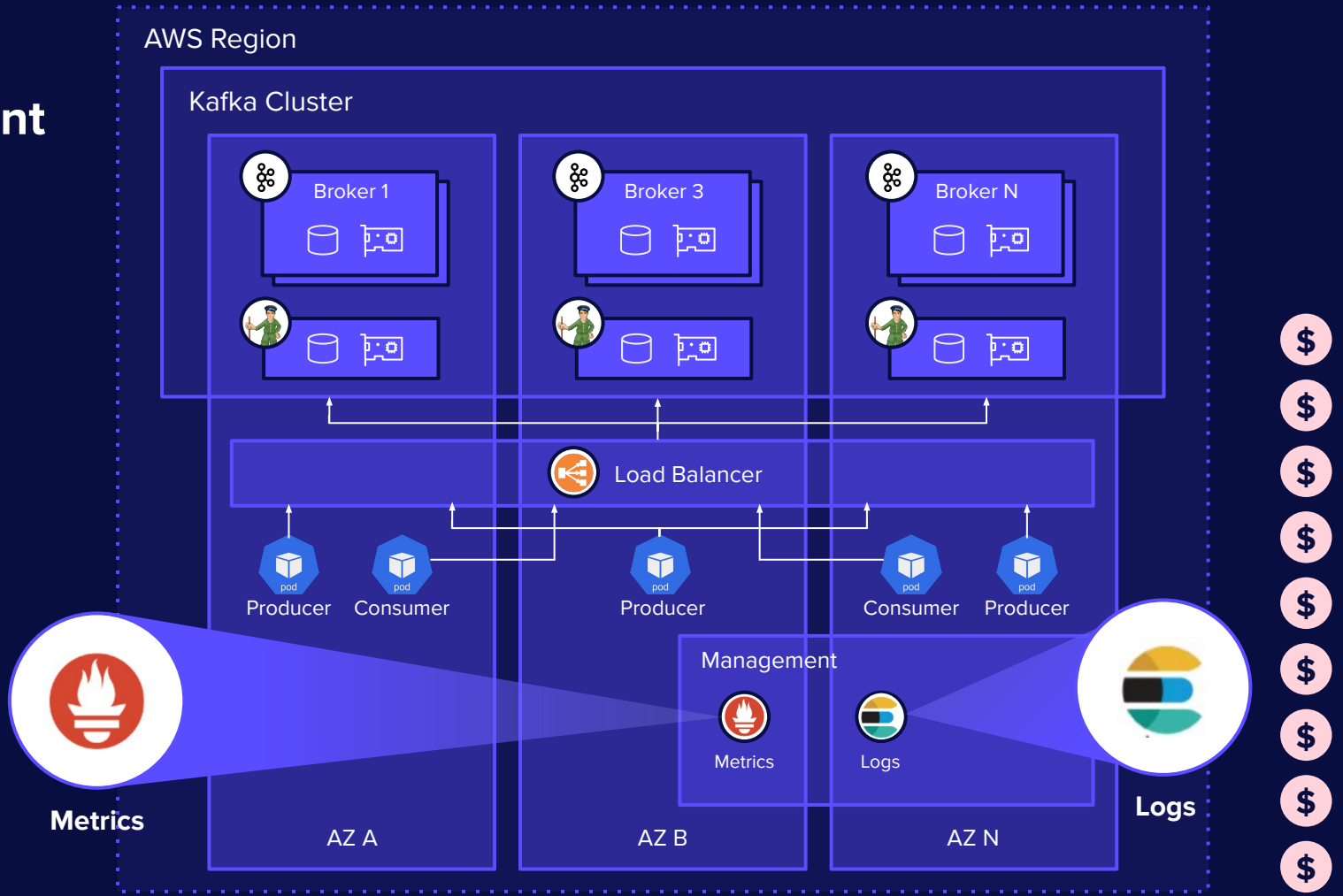
# Kafka Deployment



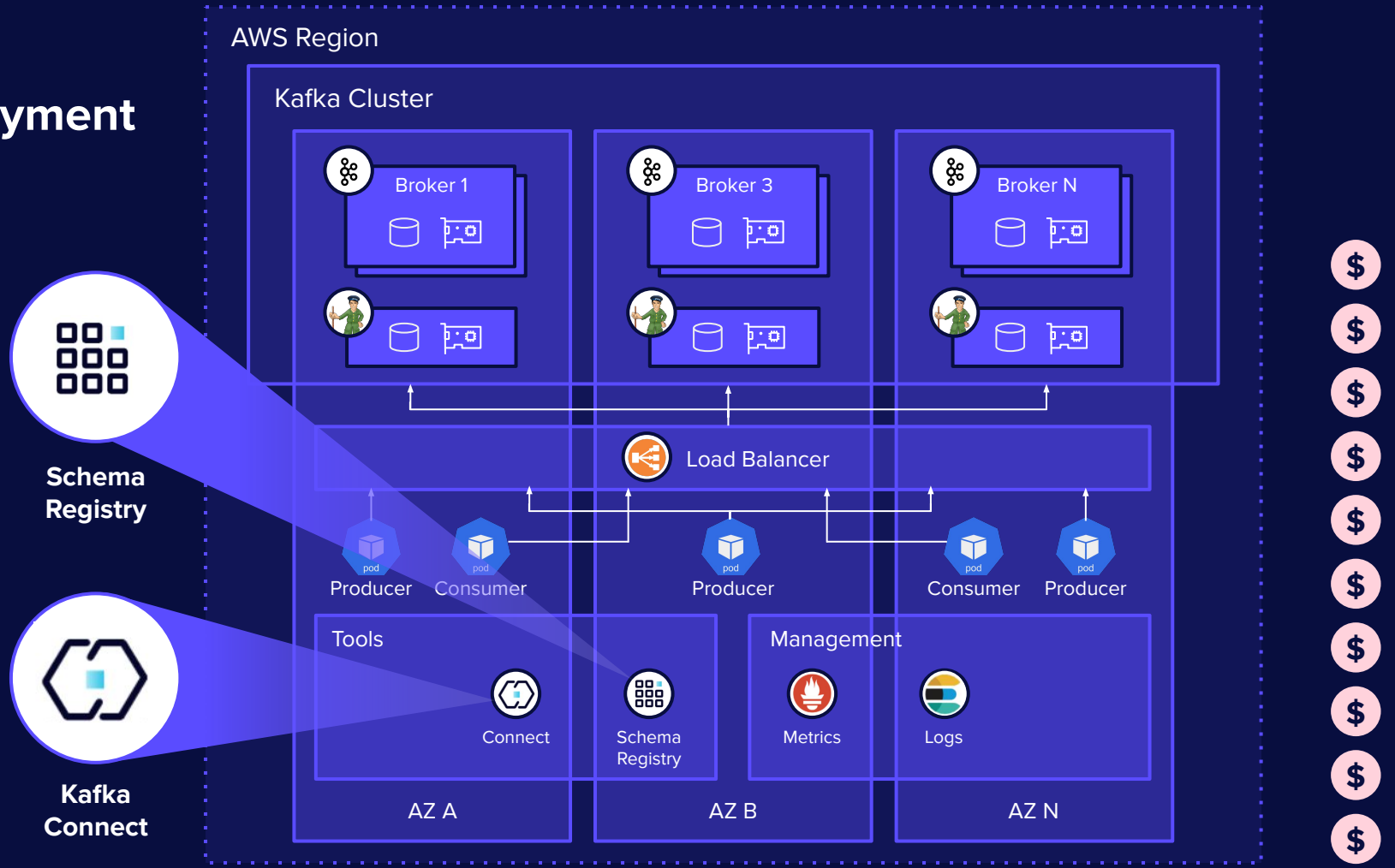
# Kafka Deployment



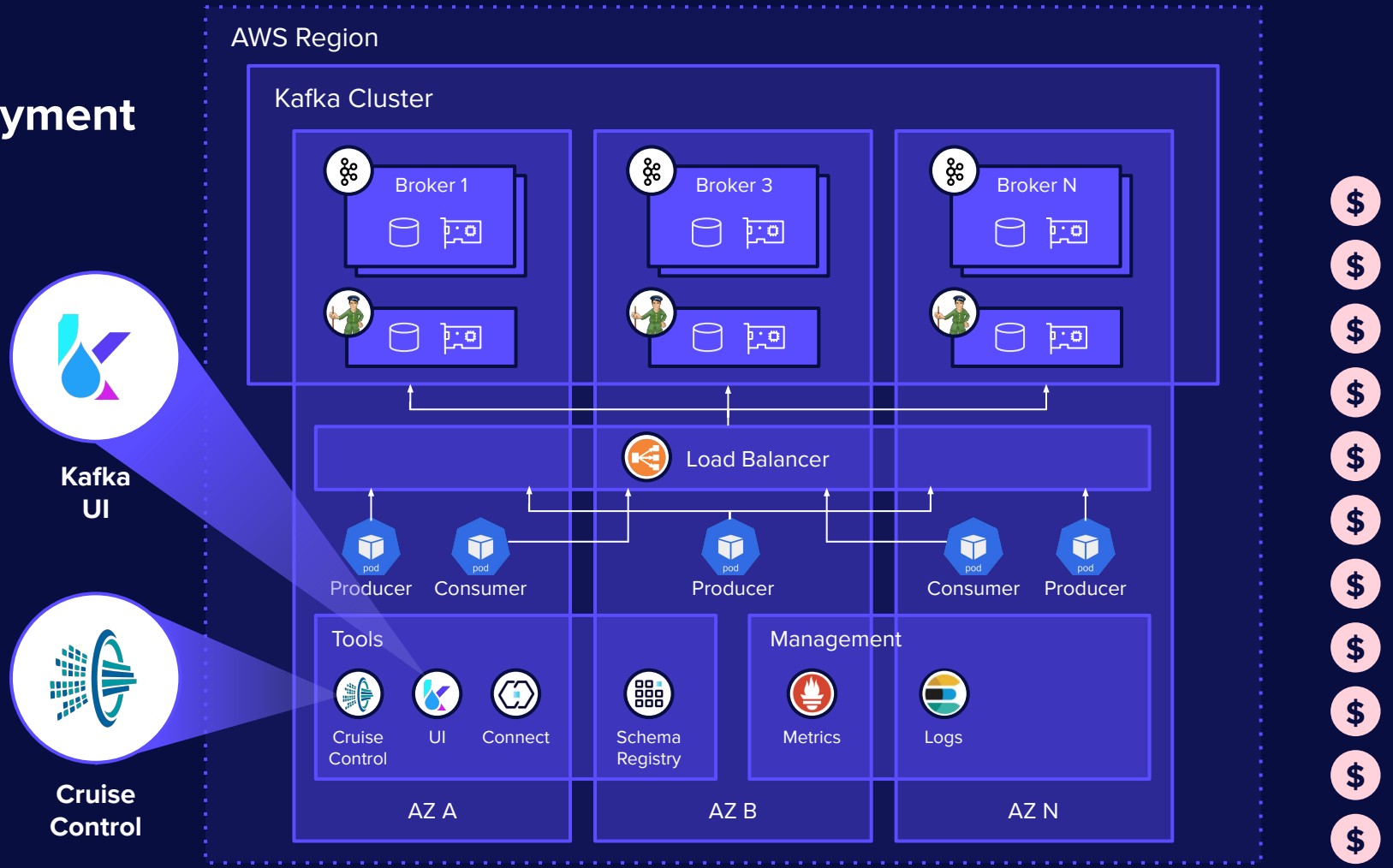
# Kafka Deployment



# Kafka Deployment



# Kafka Deployment



# Kafka Deployment


- Multi Region
- Persist to S3
- Mirror Maker
- Domain Separation


LOONEY TUNES

# Cost Factors

# What can we do?

01 **Instance type**

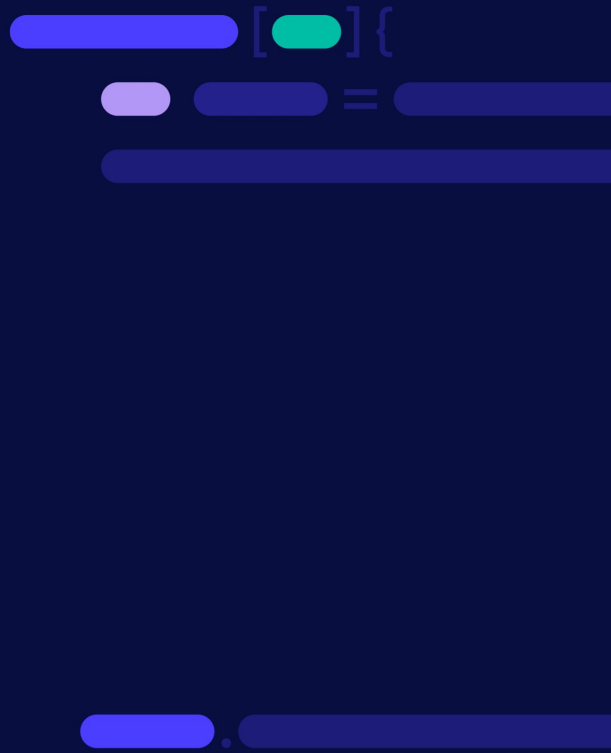
02 **Compression**

03 **Fetch from replica**

04 **Cluster balance**

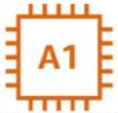
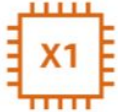
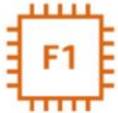
05 **Client configuration fine tune**

06 **Tiered storage**



# Are you using the right instance type?

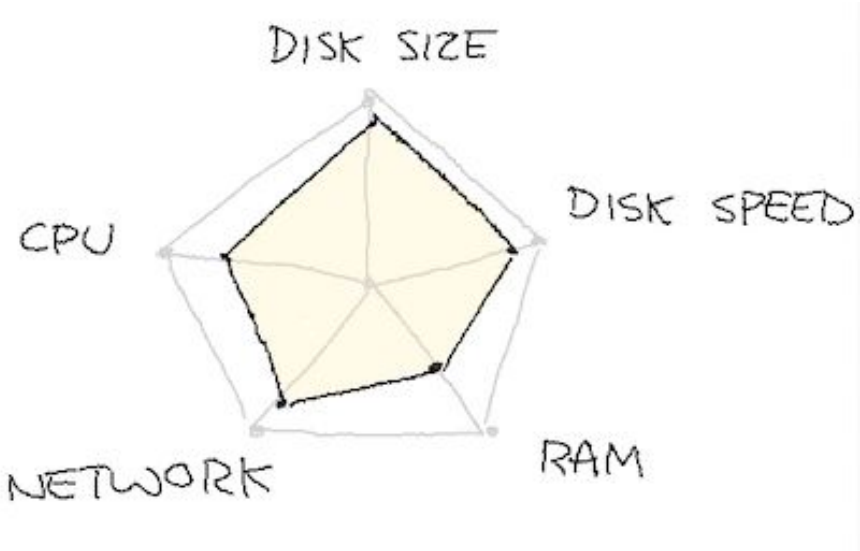
A quick Google search will suggest the **R5**, **D2**, **C5** combined with **GP2/3** or **IO2** storage as the broad recommendation.

| General Purpose | Compute Optimised | Memory Optimised | Accelerated Computing | Storage Optimised |
|---|---|---|---|---|
|  ARM based core and custom silicon |  Compute - CPU intensive apps and DBs |  RAM - Memory intensive apps and DB's |  Processing optimised- Machine Learning |  High Disk Throughput - Big data clusters |
|  Tiny - Web servers and small DBs | |  Xtreme RAM - For SAP/Spark |  Graphics Intensive - Video and streaming |  IOPS - NoSQL DBs |
|  Main - App servers and general purpose | |  High Compute and High Memory - Gaming |  Field Programmable - Hardware acceleration |  Dense Storage - Data Warehousing |

# Are you using the right instance type?

Everything is a trade-off.

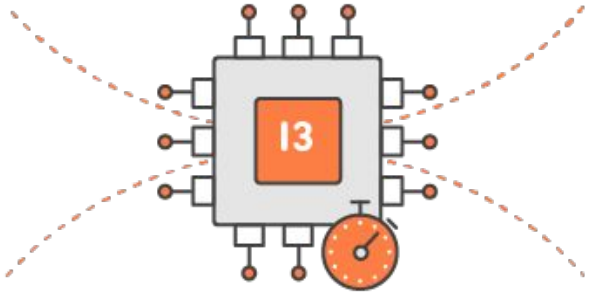
Choose wisely based on your needs: Time-to-recover, Storage-to-dollar ratio, network throughput, EBS downfalls.

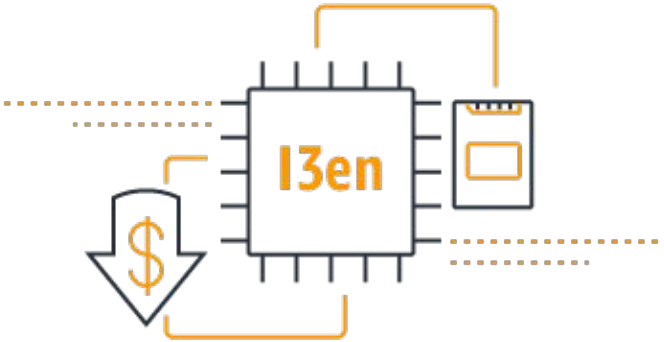



Source: Liz Fong-Jones, Honeycomb.io

# i3 and i3en for High-performance Kafka Deployments

Despite the operational overhead of ephemeral drives.



# i3en provides great storage-to-dollar ratio

Suitable for I/O intensive deployments in which the limiting factor is storage capacity.

| | Storage size per core | price per core | price per TB of data |
|---|---|---|---|
| i3.16xlarge | 480GB | $ 880.50 / year | $ 1,857.96 / year |
| i3.metal | 426GB | $ 773.78 / year | $ 1,857.06 / year |
| i3en.24xlarge | 1.2TB | $ 1,258.43 / yea | $ 1,006.75 / year |

| Benchmark | i3.16xlarge (ops) | i3en.24xlarge (ops) | difference |
|---|---|---|---|
| cache | 1.59 | 2.25 | 41.51% |
| cpu | 221.21 | 302.40 | 36.70% |
| dentry | 23,578.10 | 29,544.91 | 25.31% |
| icache | 399.97 | 449.88 | 12.48% |
| matrix | 4,219.04 | 4,133.63 | -2.02% |
| memcpy | 567.87 | 381.34 | -32.85% |
| qsort | 8.82 | 10.63 | 20.52% |
| timer | 119,784.59 | 136,156.85 | 13.67% |
| tsc | 847,677.39 | 983,544.69 | 16.03% |

Source: ScyllaDB

# Are you using the right instance types?

- Is your cluster saturated? On what conditions?
- What is the limiting factor?
- Are EBS drives the right decision?
- Do the cluster needs changed over time?

01 Instance type

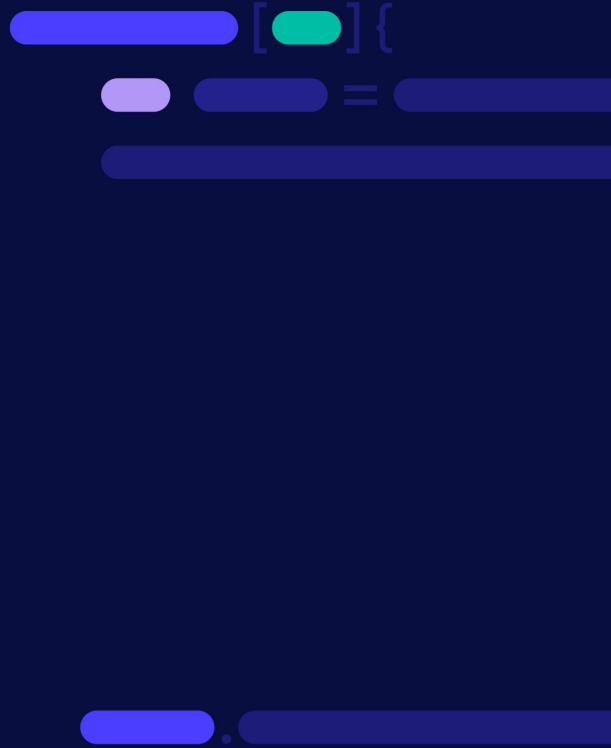
02 **Compression**

03 Fetch from replica

04 Cluster balance

05 Client configuration fine tune

06 Tiered storage



# Change compression type

You can choose between GZIP, LZ4, Snappy, and since KIP-110 - **ZSTD**.

**compression.type**

The compression type for all data generated by the producer. The default is none (i.e. no compression). Valid values are `none`, `gzip`, `snappy`, `lz4`, or `zstd`. Compression is of full batches of data, so the efficacy of batching will also impact the compression ratio (more batching means better compression).

| | |
|---|---|
| **Type:** | string |
| **Default:** | none |
| **Valid Values:** | |
| **Importance:** | high |

Pages / Index / Kafka Improvement Proposals

## KIP-110: Add Codec for ZStandard Compression

Created by Dongjin Lee, last modified on Nov 18, 2018

- Status
- Motivation
- Proposed Changes
- Compatibility, Deprecation, and Migration Plan
- Rejected Alternatives
  - A. Support ZStandard to the old clients which can understand v0, v1 messages only.
  - B. Bump the API version and support only v2-available clients
    - B.1. INVALID_REQUEST (42)
    - B.2. CORRUPT_MESSAGE (2)
    - B.3 UNSUPPORTED_FOR_MESSAGE_FORMAT (43)
- Related issues
  - Whether to use existing library or not
  - License

# Zstandard

Compression algorithm
by ~~Facebook~~ *Meta*
It aims for a smaller and
faster data compression.

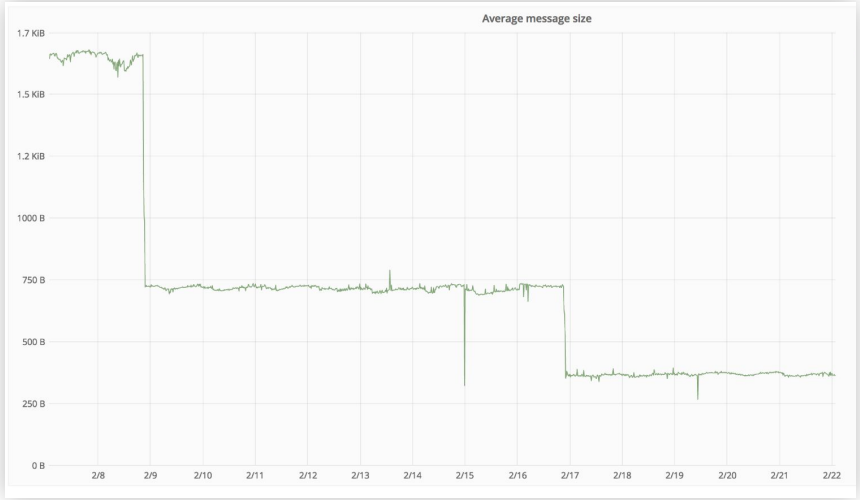
| Compressor name | Ratio | Compression | Decompress. |
|---|---|---|---|
| **zstd 1.4.5 -1** | 2.884 | 500 MB/s | 1660 MB/s |
| zlib 1.2.11 -1 | 2.743 | 90 MB/s | 400 MB/s |
| brotli 1.0.7 -0 | 2.703 | 400 MB/s | 450 MB/s |
| **zstd 1.4.5 --fast=1** | 2.434 | 570 MB/s | 2200 MB/s |
| **zstd 1.4.5 --fast=3** | 2.312 | 640 MB/s | 2300 MB/s |
| quicklz 1.5.0 -1 | 2.238 | 560 MB/s | 710 MB/s |
| **zstd 1.4.5 --fast=5** | 2.178 | 700 MB/s | 2420 MB/s |
| lzo1x 2.10 -1 | 2.106 | 690 MB/s | 820 MB/s |
| lz4 1.9.2 | 2.101 | 740 MB/s | 4530 MB/s |
| lzf 3.6 -1 | 2.077 | 410 MB/s | 860 MB/s |
| snappy 1.1.8 | 2.073 | 560 MB/s | 1790 MB/s |

# Real world examples

Using Zstd, Shopify was able to get a 4.28x compression ratio compared to Snappy's 2.5x.

Average Message Size

Bytes


shopify

CLOUDFLARE

“

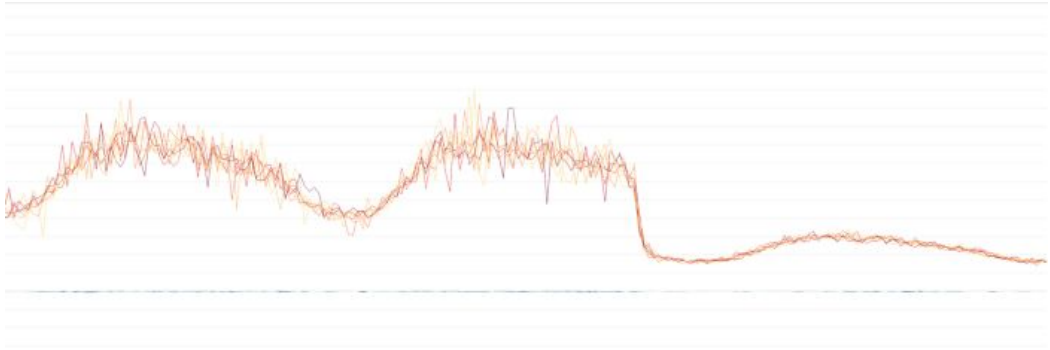
After switching to Zstandard, our bandwidth usage decreased **by 3x!**

This saves us tens of thousands of dollars per month in data transfer costs just from the processing pipeline alone.

With these great results we immediately began deploying Zstandard to other systems in our architecture for further cost savings.

”

Amplitude



**Bandwidth usage**

# KIP-390: Support Compression Level

Zstd Level 1 produces **32.7% more** messages per second than Zstd Level 3.

Gzip Level 1 produces **56.4% more** than Gzip Level 6.

| | |
|---|---|
| Status: | IN PROGRESS |
| Resolution: | Unresolved |
| Fix Version/s: | 3.2.0 |

| codec | level | produced message / sec | latency (ms) | size (bytes) | description |
|---|---|---|---|---|---|
| none | | 2,739.50 | 205.34 | 5,659,454,754 | |
| gzip | 1 | 1,122.96 | 1,230.22 | 1,787,505,238 | min. level |
| gzip | 6 | 717.71 | 2,041.24 | 1,644,280,629 | default level |
| gzip | 9 | 608.54 | 2,413.66 | 1,643,517,758 | max. level |
| lz4 | 1 | 1,694.69 | 603.46 | 2,211,346,795 | min. level |
| lz4 | 9 | 1,199.93 | 878.85 | 2,184,022,257 | default level |
| lz4 | 17 | 495.34 | 2,110.55 | 2,178,643,665 | max. level |
| zstd | -5 | 7,653.45 | 156.88 | 1,997,500,892 | experimental level |
| zstd | 1 | 6,317.52 | 68.55 | 1,521,783,958 | |
| zstd | 3 | 4,760.54 | 286.79 | 1,494,620,615 | default level |
| zstd | 12 | 988.95 | 863.89 | 1,458,150,768 | |
| zstd | 18 | 85.20 | 2,017.92 | 1,492,015,424 | |

**29218 JSON files with an average size of 55.25kb**

```
compression.type=zstd
compression.level=1        # NEW: Compression level to be used.
```

01 Instance type

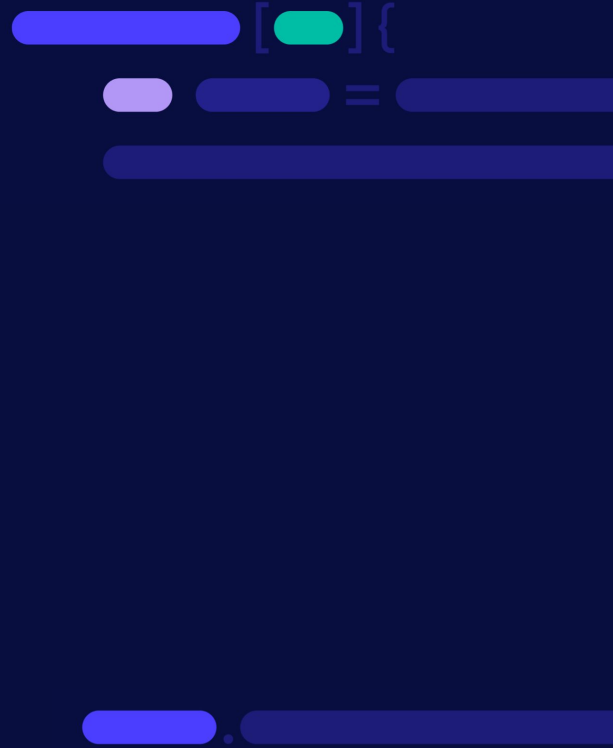
02 Compression

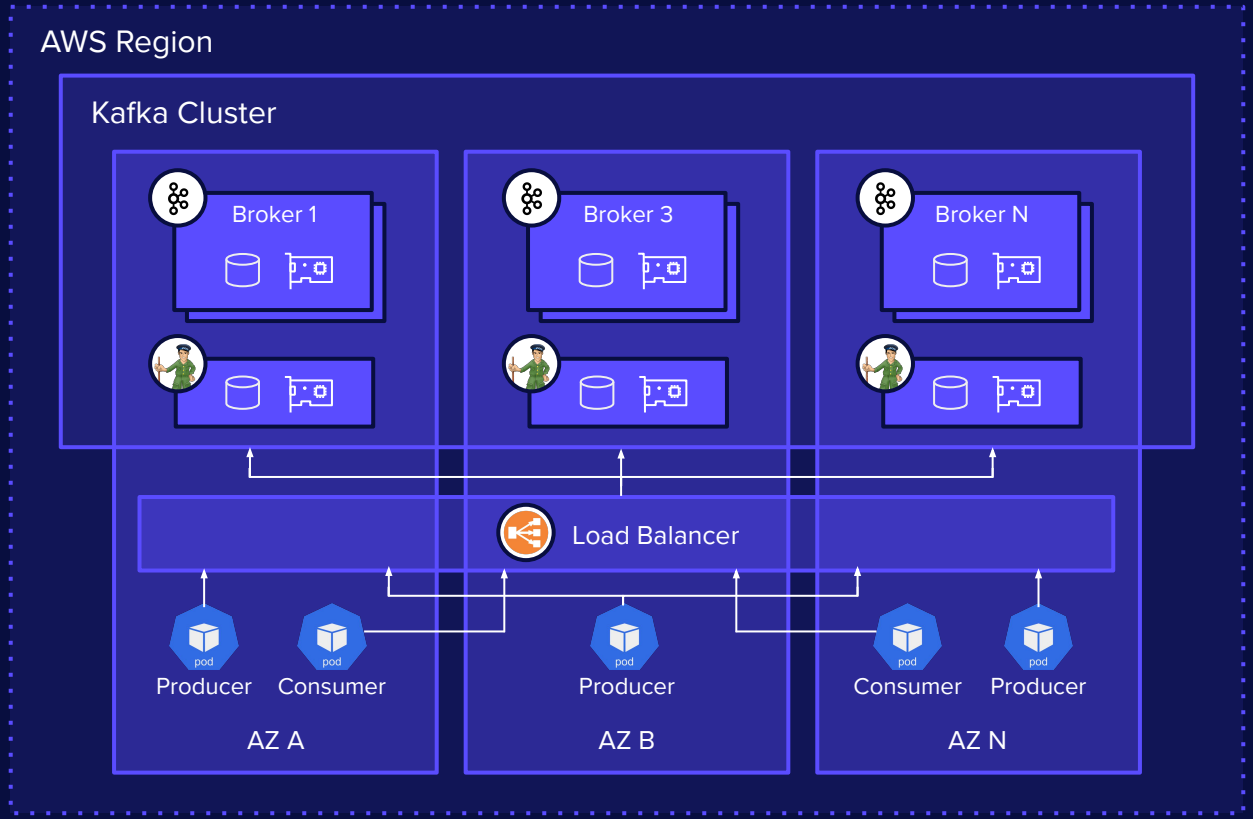
03 Fetch from replica

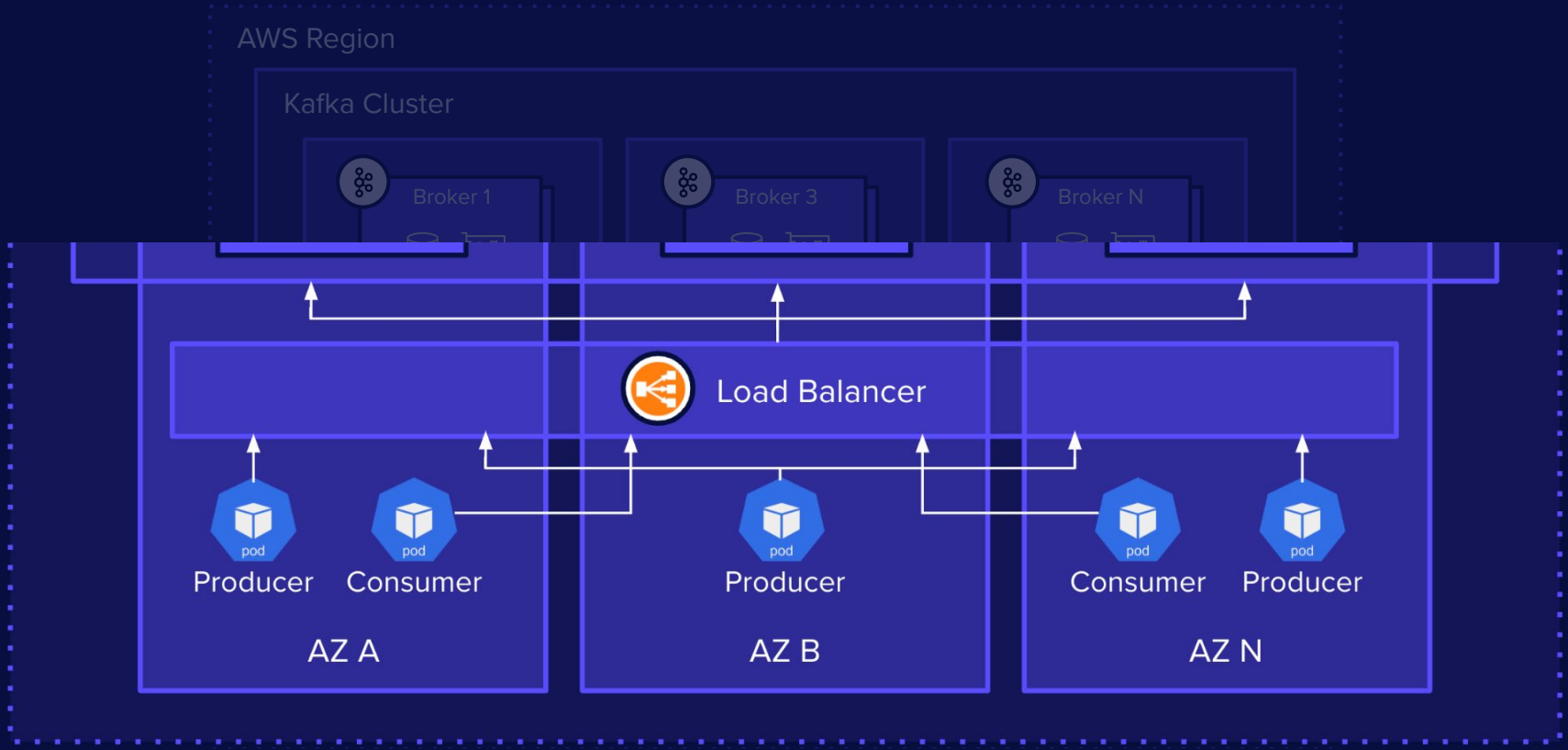
04 Cluster balance

05 Client configuration fine tune

06 Tiered storage




AWS Region
Kafka Cluster
Broker 1
Broker 3
Broker N
Load Balancer
pod
Producer
Consumer
Producer
Consumer
Producer
AZ A
AZ B
AZ N


AWS Region
Kafka Cluster
Broker 1
Broker 3
Broker N
Load Balancer
pod
Producer
pod
Consumer
pod
Producer
pod
Consumer
pod
Producer
AZ A
AZ B
AZ N

# KIP-392: Fetch from closest replica

Leverage locality in order to reduce expensive cross- AZ / cross-DC traffic costs.

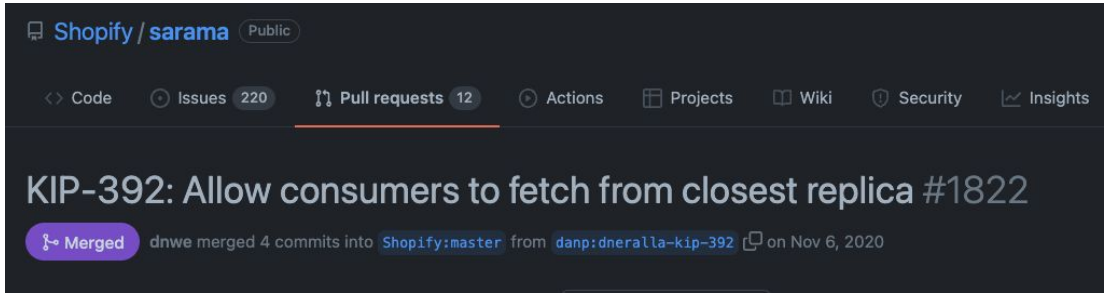
## KIP-392: Allow consumers to fetch from closest replica

Created by Jason Gustafson, last modified by Matthias J. Sax on Nov 05, 2019

# KIP-392: Fetch from closest replica

Rack awareness needs to be set. Support from the client is needed as well.

```
broker.rack="us-east-1a"
```



01 Instance type

02 Compression

03 Fetch from replica

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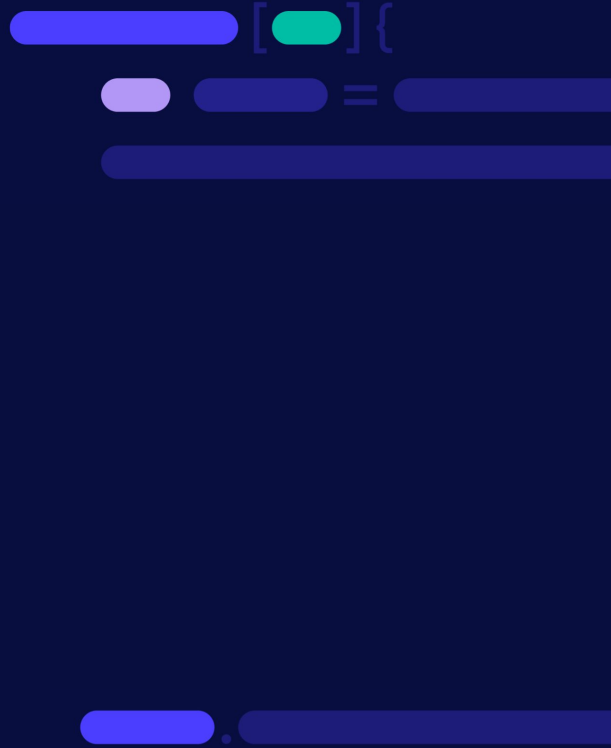
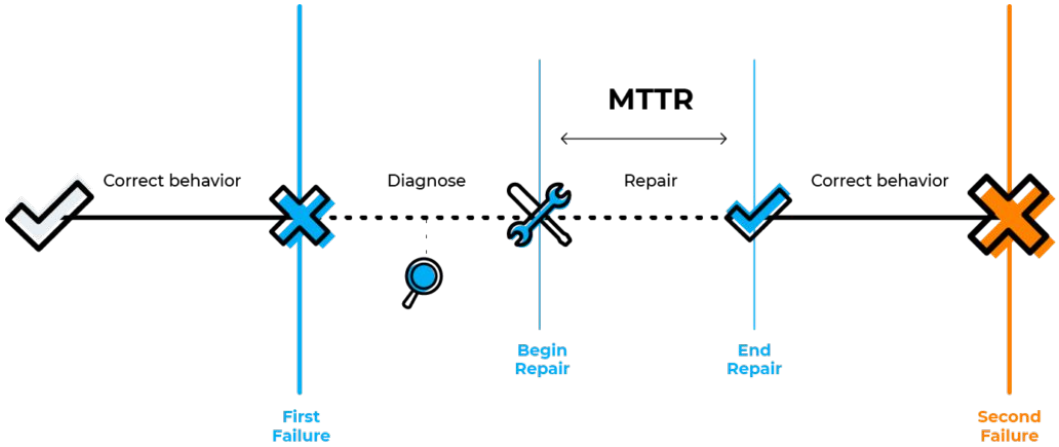


# Cluster imbalance

Might hurt cluster performance, lead to brokers skew, resource saturation, and as consequence - unnecessary capacity addition.

# Cluster imbalance

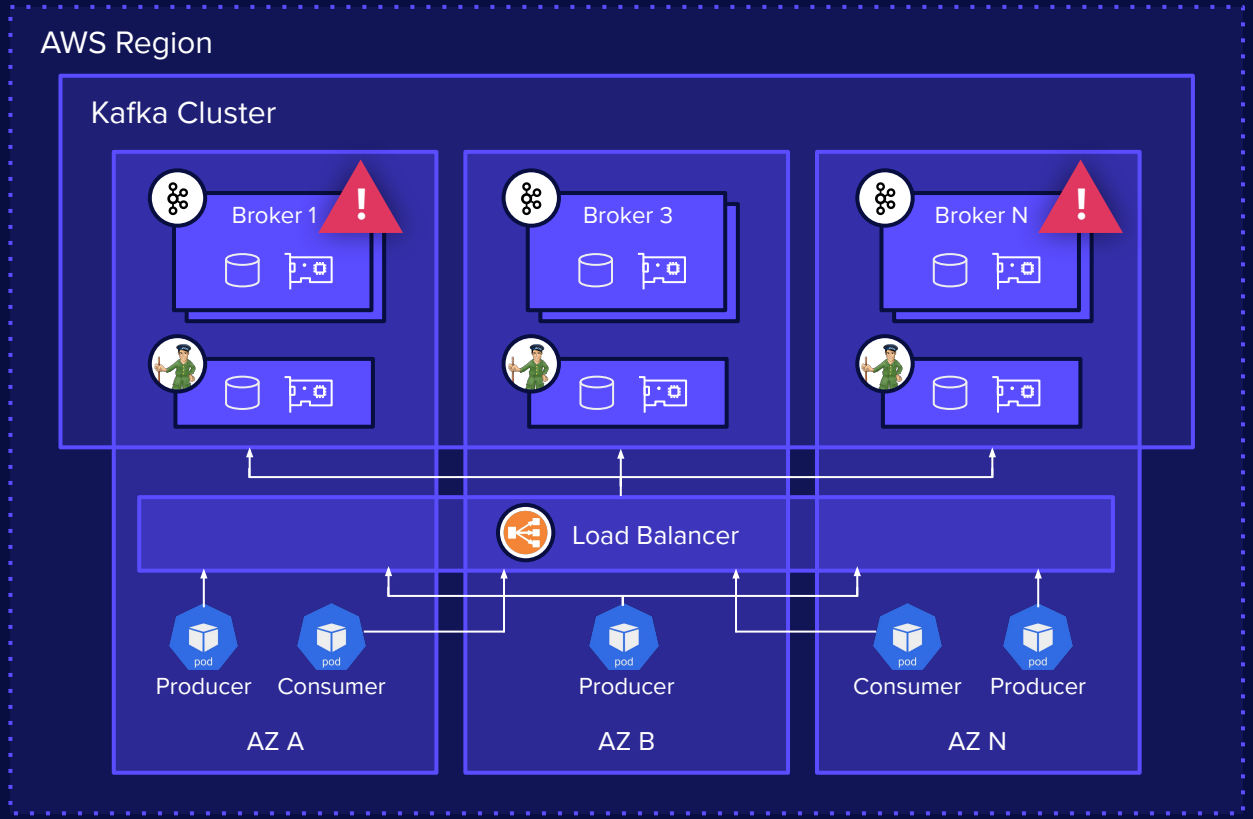
Overloaded brokers (more partitions, more segments) will suffer from higher MTTR.




Source: plutora.com

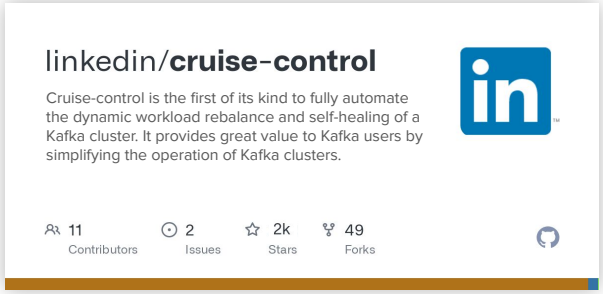
# Cluster imbalance

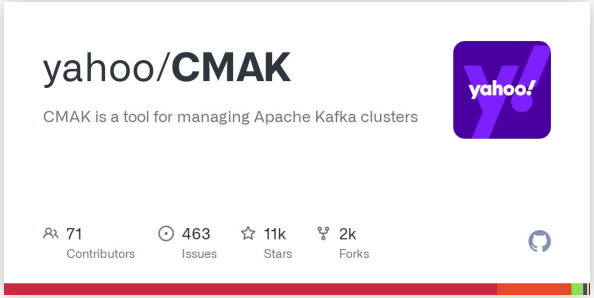
Long startup time exposes you to a higher risk of data loss in case of cascading failures.

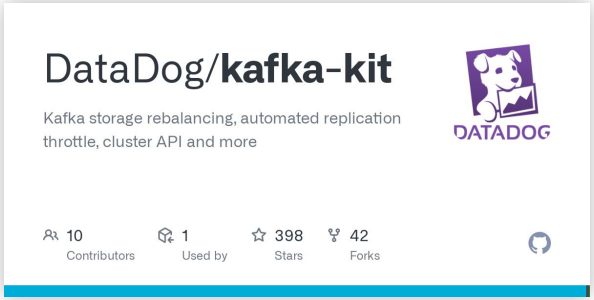


# Cluster imbalance

Relatively easy-to-do task using-
Cruise Control, CMAK, Kafka-Kit, and more.



01 Instance type

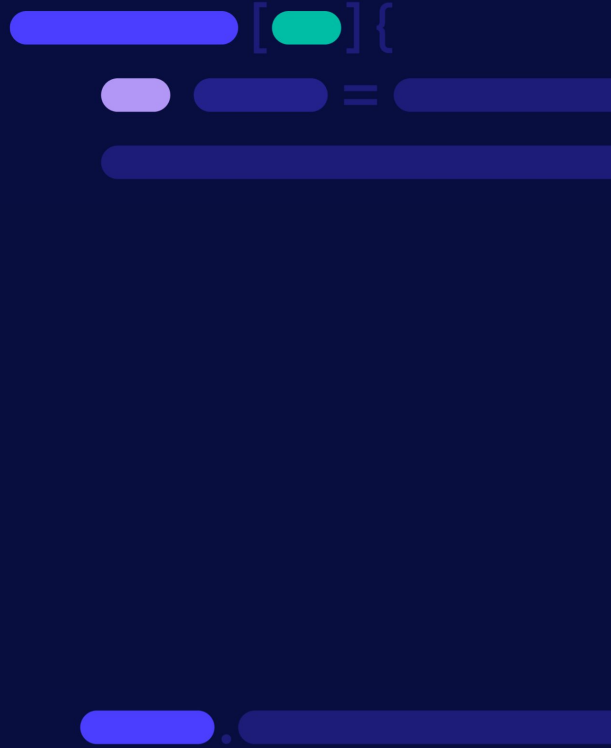
02 Compression

03 Fetch from replica

04 Cluster balance

05 Client configuration fine tune

06 Tiered storage

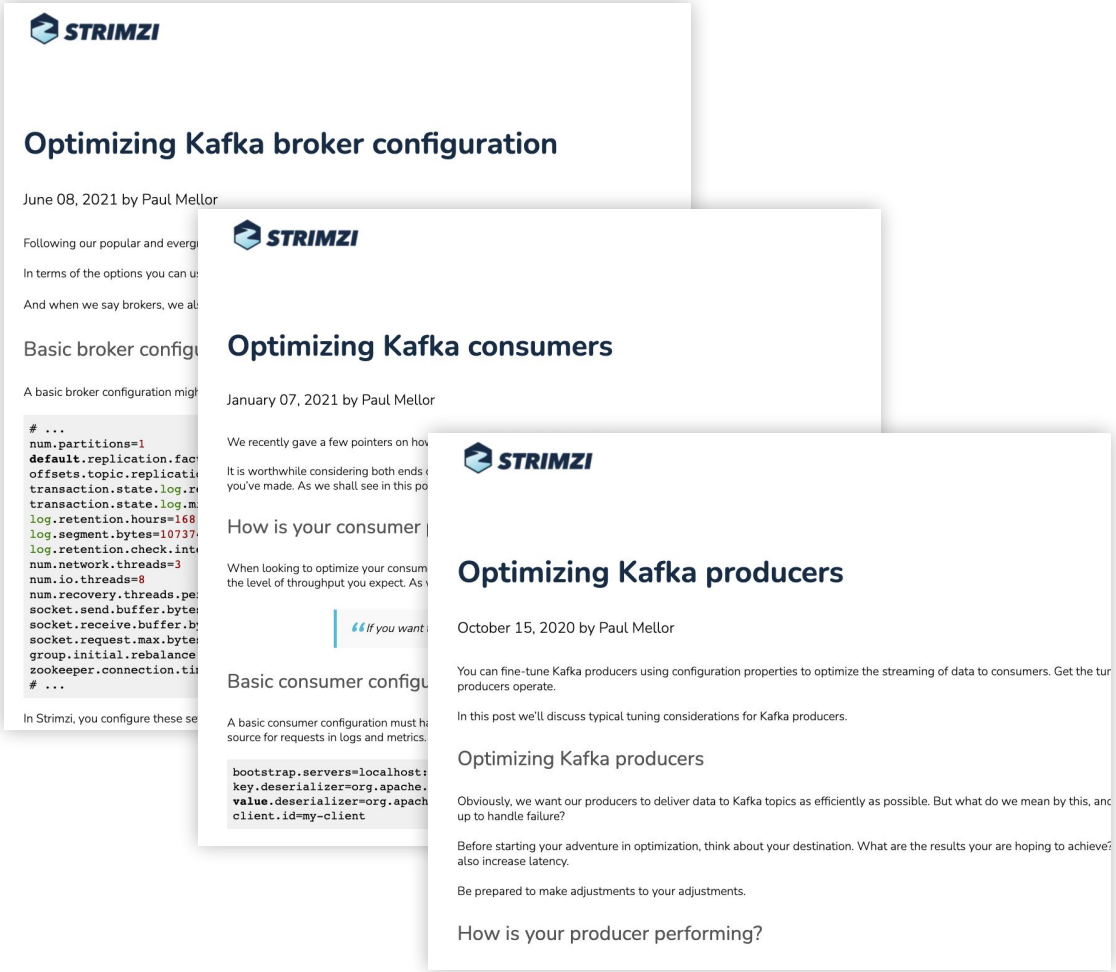


# Client Configurations

Deep dive into the client configurations knobs can dramatically affect the way your cluster works

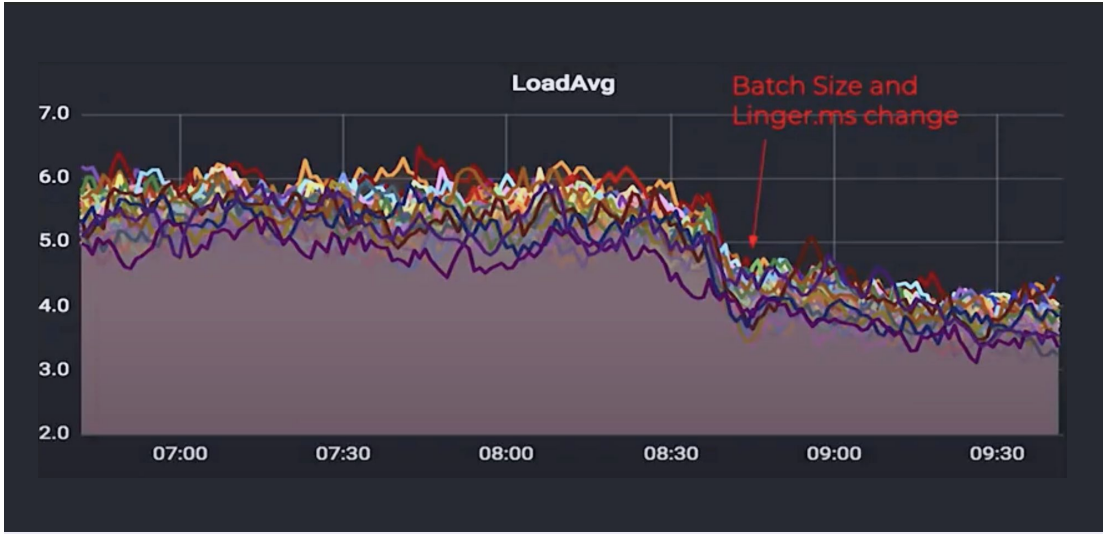

# Clients Configurations

Kafka just works out of the box. However to unlock its full potential - invest time in learning.



# Clients Configurations

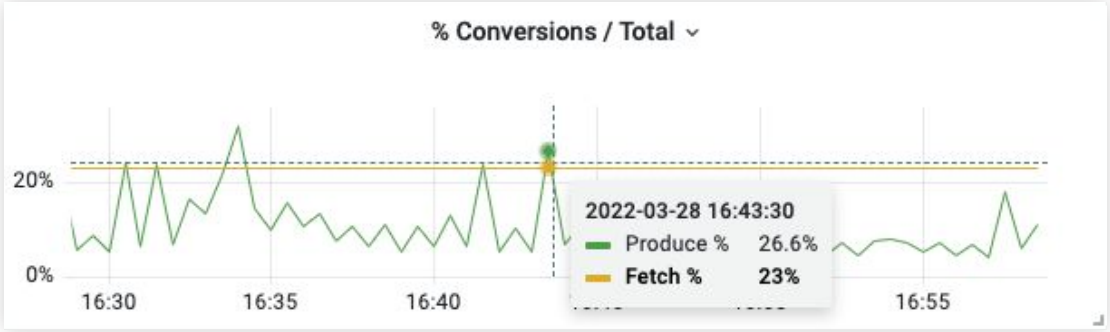
For example, changing your clients **batch.size** and **linger.ms** configurations can reduce your cluster resource utilization.

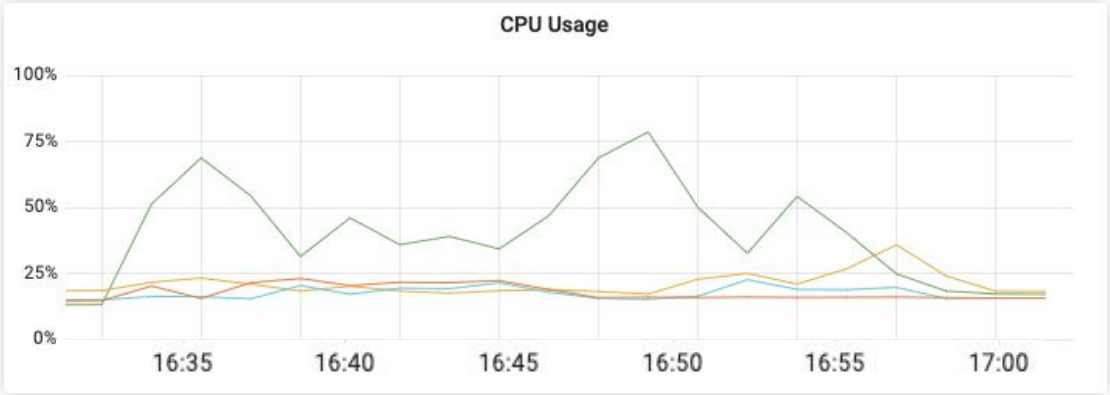


# Message Conversions

Message conversion introduces a processing overhead.

Upgrading clients can free up resources that were used unnecessarily for this task.



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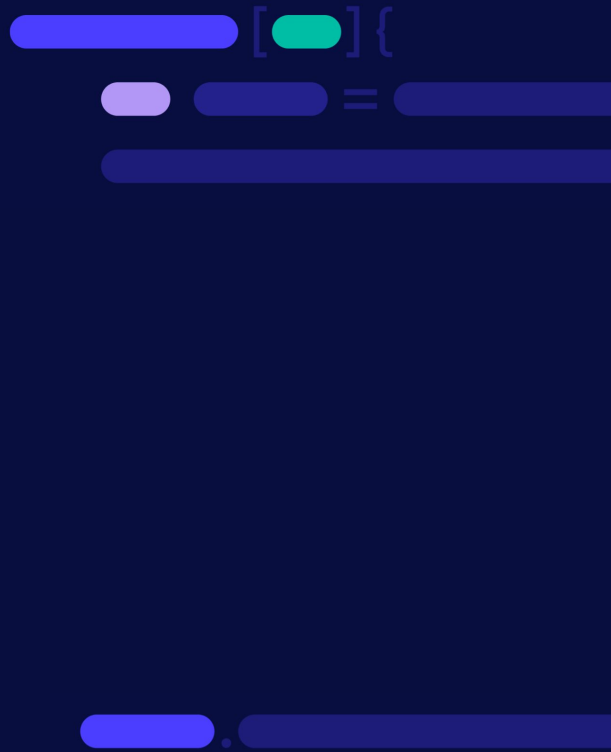


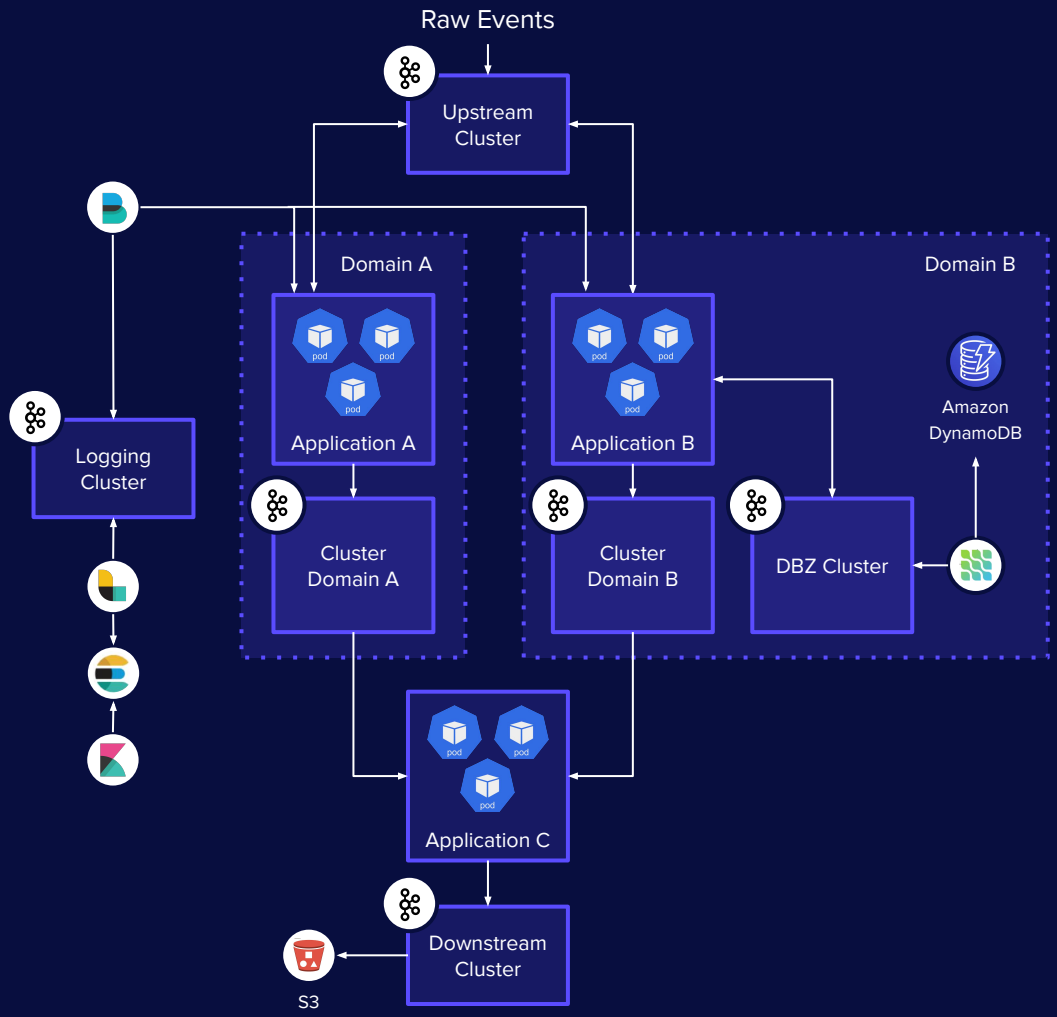
# The Cluster Storage

Kafka became the main entry point of all of the data in organizations, allowing clients to consume not only the recent events, but also older data based on the topic retention.

# Upstream Clusters

A common pattern is to split your cluster into smaller clusters based on business domains.

Using this method you can set a higher retention period on the upstream cluster for data recovery in case of a failure.



# Capacity addition

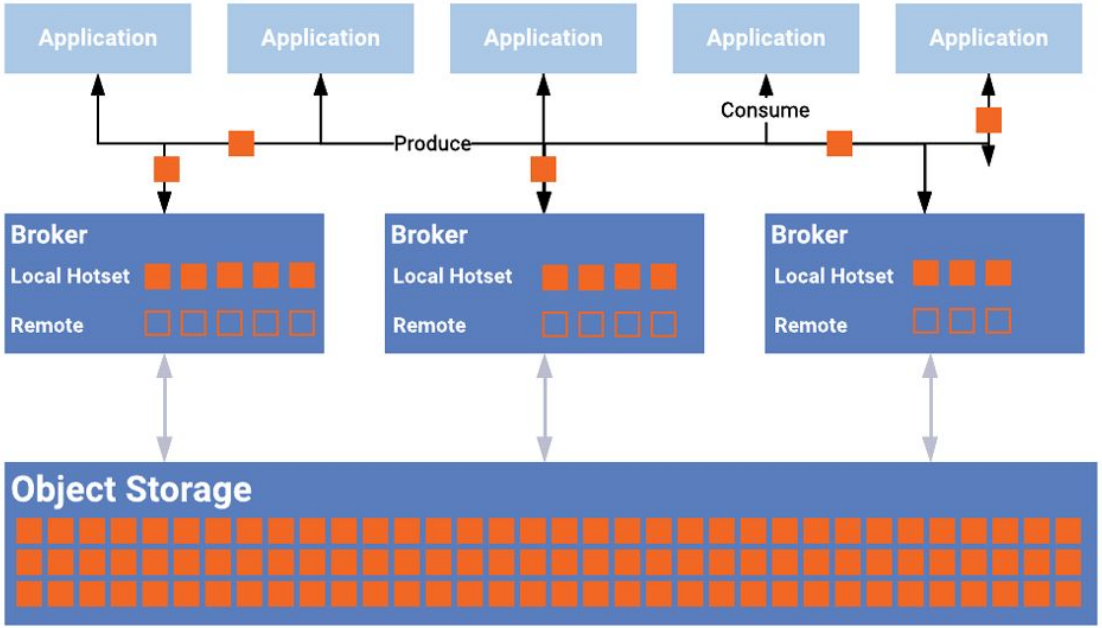
Both cases require you to add disk capacity to support growth.

High retention, justified by business needs, may lead to needless resource addition (memory and CPUs) to support storage capacity.

# KIP-405:
# Kafka Tiered Storage

Using Tiered Storage, Kafka clusters are configured with two tiers of storage: local and remote.

The new remote tier uses external object storage layers such as AWS S3 or HDFS.



# Kafka Tiered Storage

Tiered Storage is already available on Confluent Platform 6.0.0, and will be added to the Kafka 3.2 release.

## 01 Storage cost saving

~$0.08 per GB on gp3 Vs.
~$0.023 on S3

## 02 Accurate capacity planning

Mostly based on computing power, and not storage

## 03 Scaling storage

Independently from memory and CPUs

## 04 Remove unnecessary capacity

Remove capacity that has been added to support long-term retention

## 05 Faster broker startup

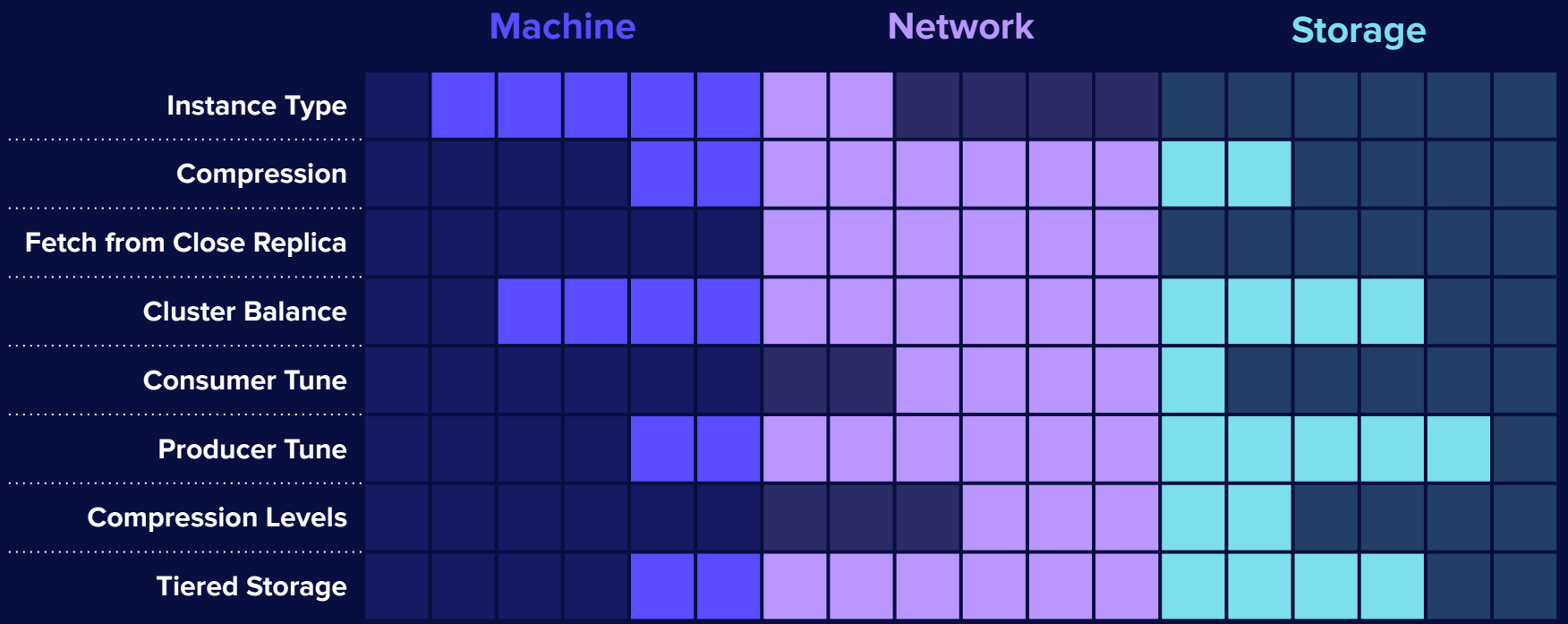
Loading local (and fewer) segments on broker startup

The

# TL;DL

(Too Long ; Didn't Listen)

# Cost Reduction Areas



riskified tech;

# Thank You For Your Time!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