Stateless Kafka Brokers

Overview of architectures available in this space

2023

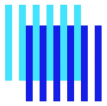
2025

WarpStream

StreamNative

ursa

AutoMQ



Bufstream

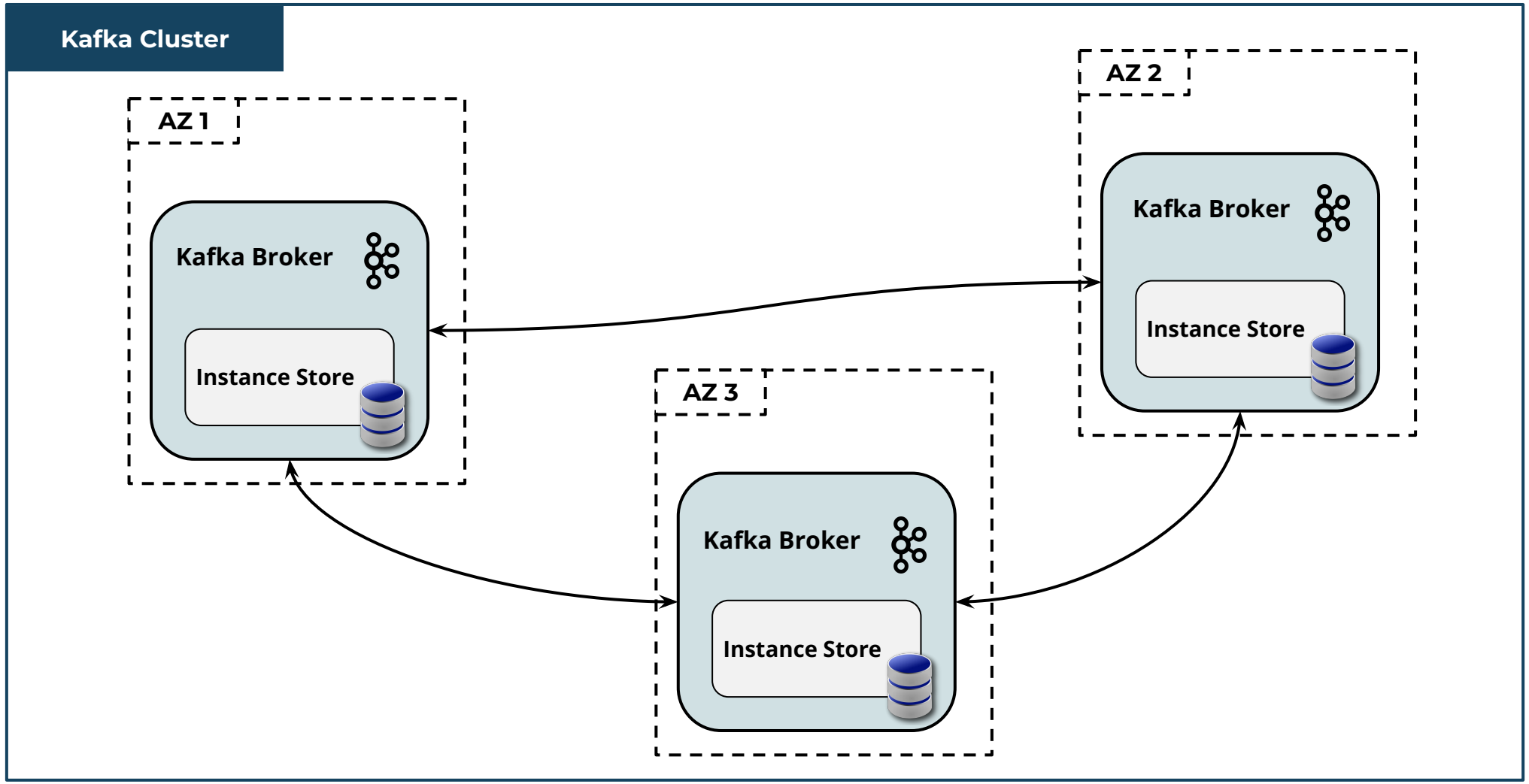
tansu

Inkless

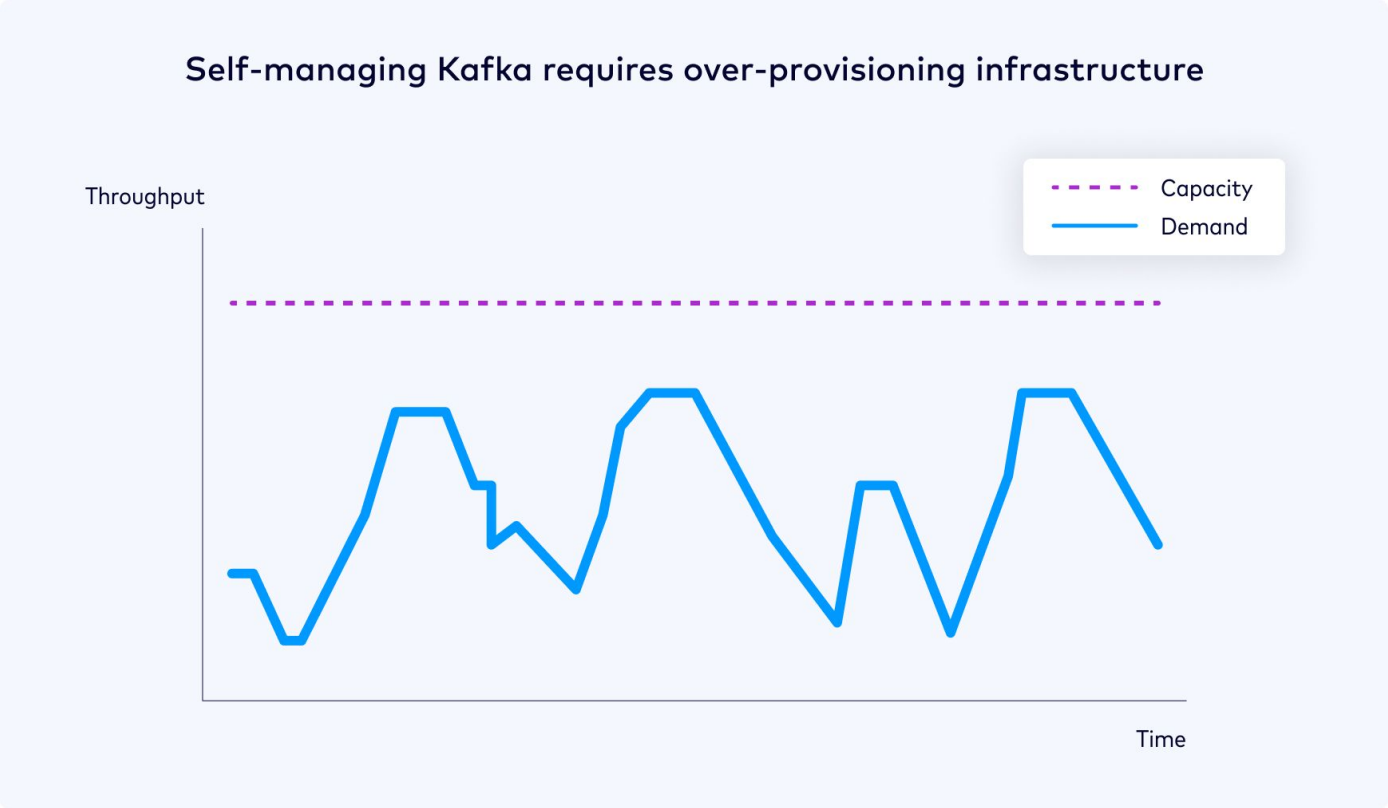
CONFLUENT

Freight Clusters

Kafka Highly Available cluster setup



Lack of elasticity means overprovisioning



Source: Confluent

https://www.confluent.io/blog/understanding-and-optimizing-your-kafka-costs-part-1-infrastructure/

Chapter 1:

Apache Kafka with Tiered Storage

How does Tiered Storage work?

block storage

How does Tiered Storage work?

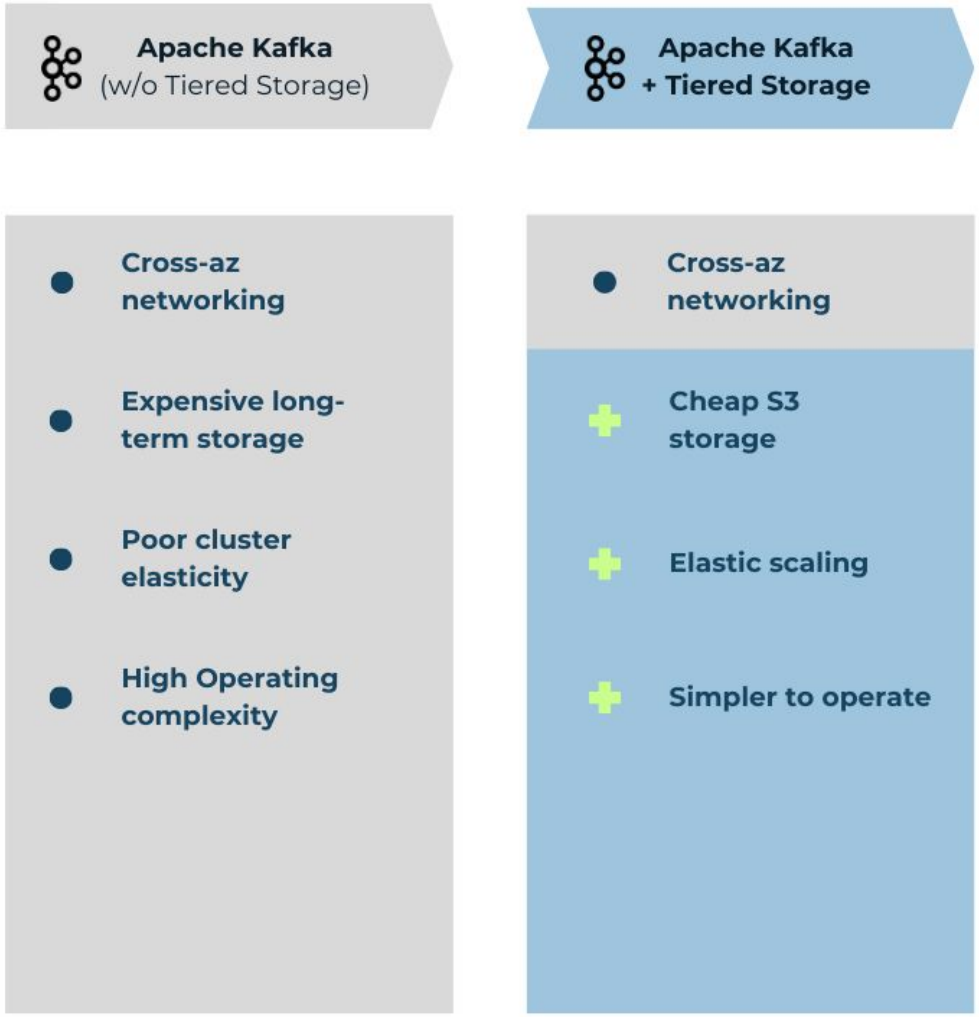
block storage

11 12

object storage

1 2 3 4 5 6 7 8 9 10 11

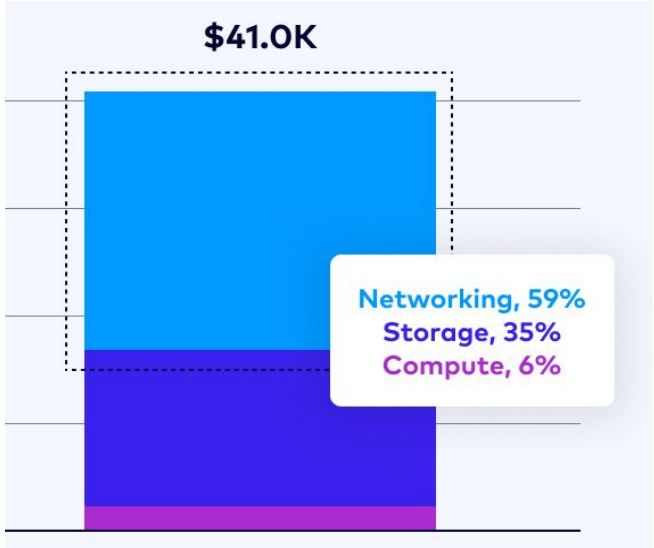
What's "wrong" with kafka?



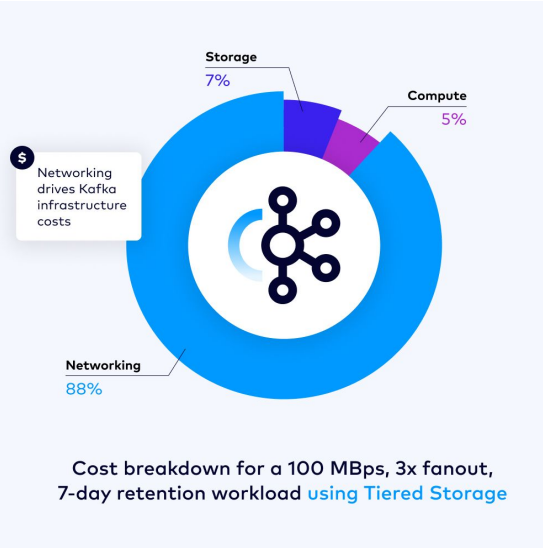
Where are Kafka's costs?

Cool article by **Confluent** on infrastructure costs of a relatable benchmark

- 100 MBps writes
- 300 MBps reads
- 7 day retention
- **fetch-from-follower not enabled**



no tiered storage

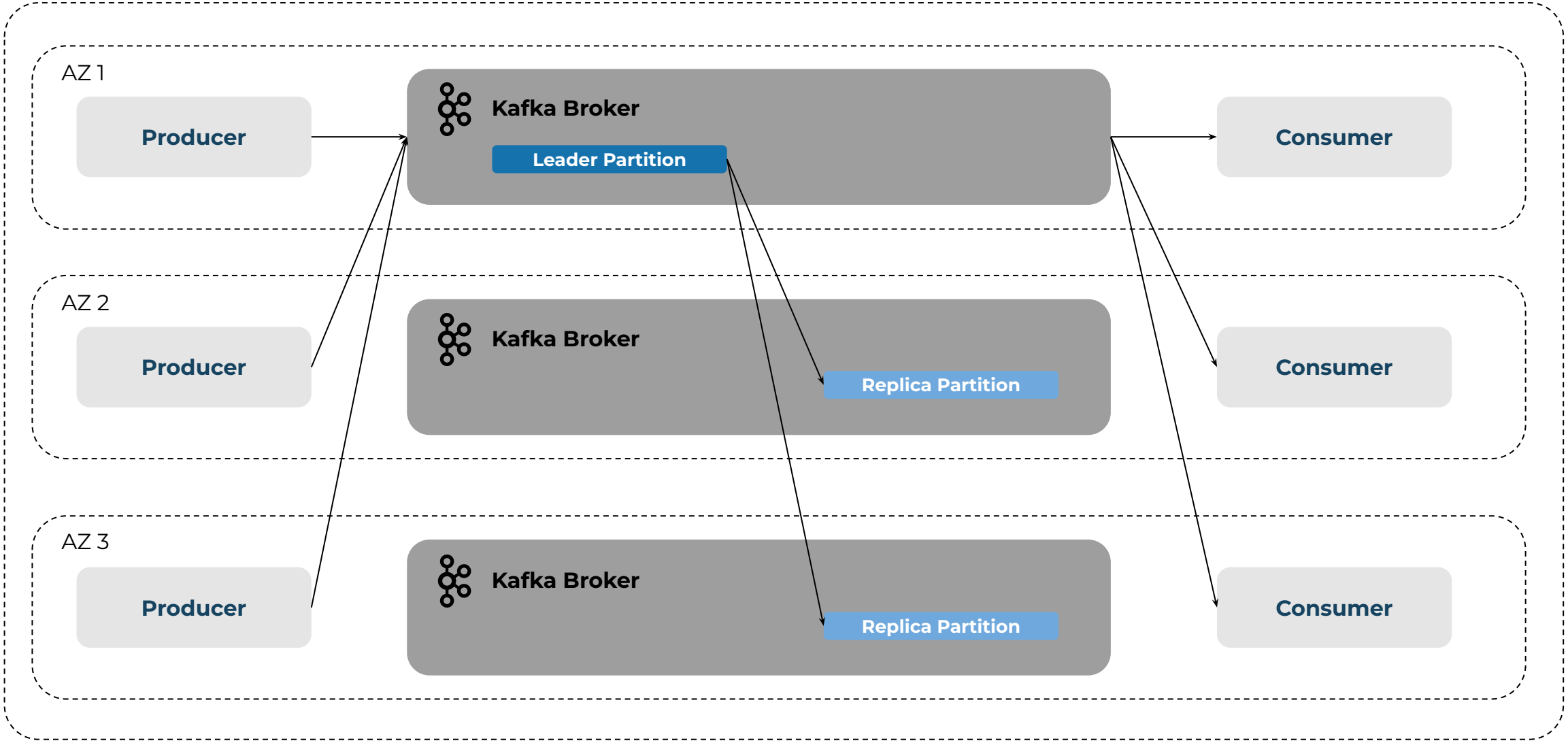


tiered storage

These are **direct costs only** of a straightforward benchmark

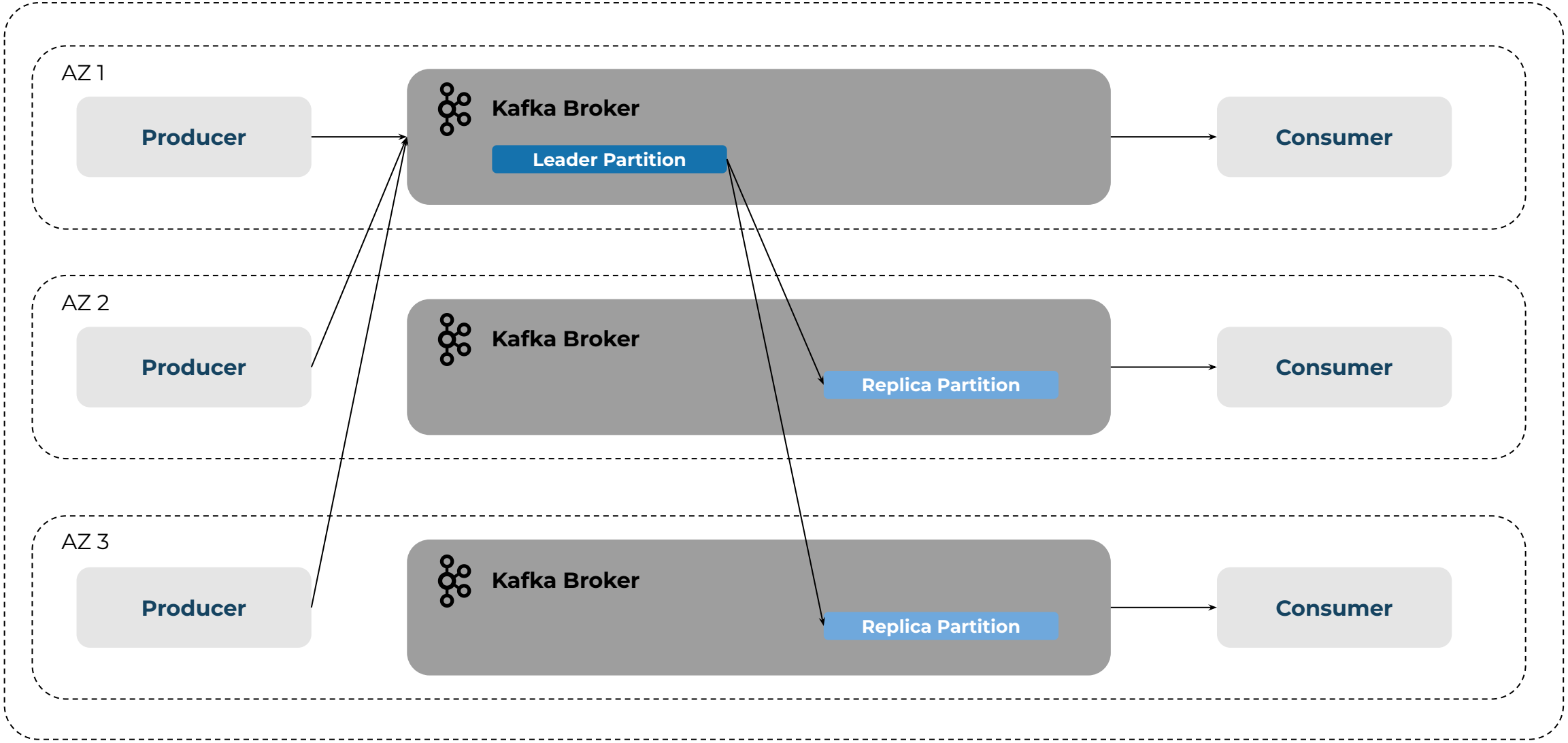
Source: Confluent
https://www.confluent.io/blog/understanding-and-optimizing-your-kafka-costs-part-1-infrastructure/

Cross-AZ networking in 2019



Cross-AZ networking in 2025

Fetch from follower and **rack-aware partition assignor** more or less solved the issue of consumer-side AZ traffic



Cross-AZ networking in 2025

Pricing differs among cloud vendors

0.02 $/GB

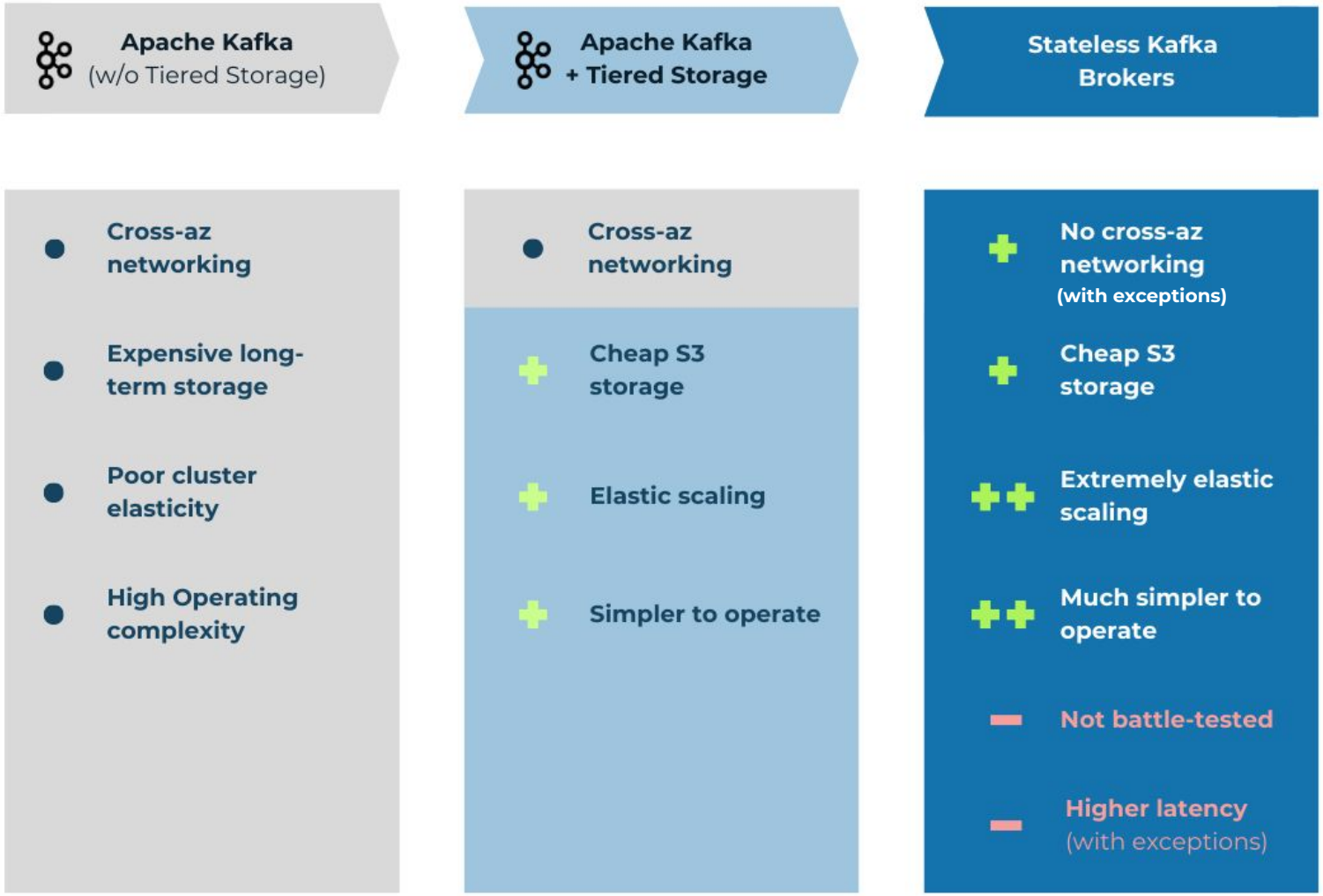
0.01 $/GB

0 $/GB

Chapter 2:

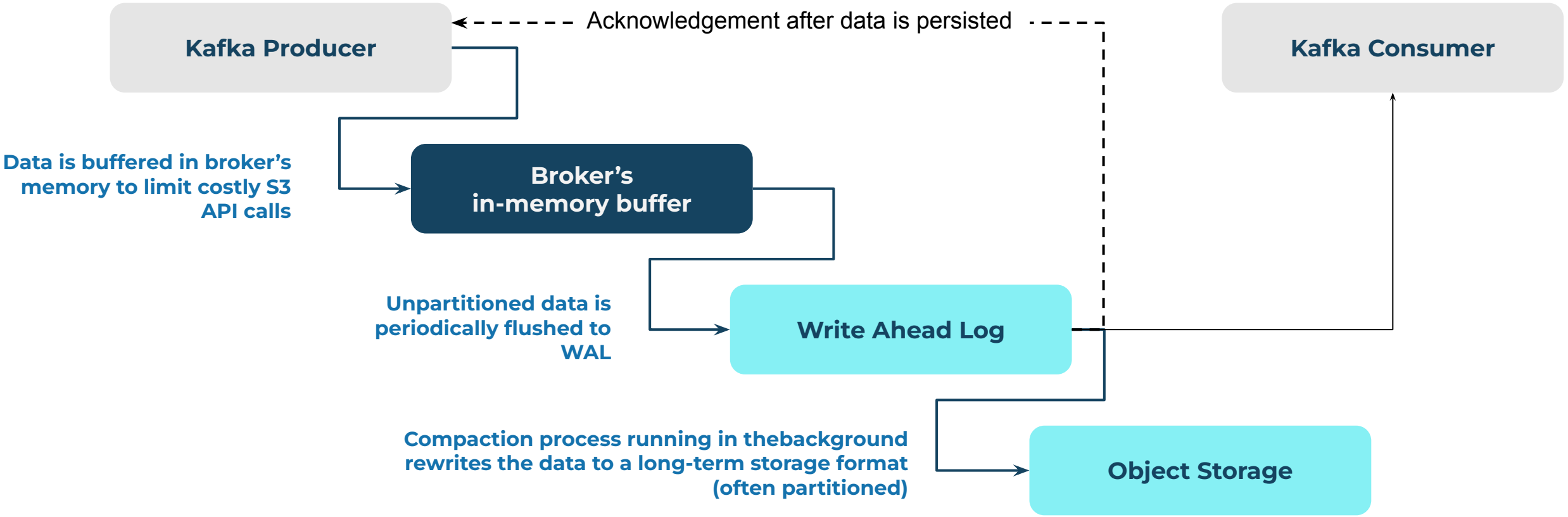
Stateless Kafka brokers

What's "wrong" with kafka?



What do they share?

Generic Stateless Kafka data flow



What do they share?

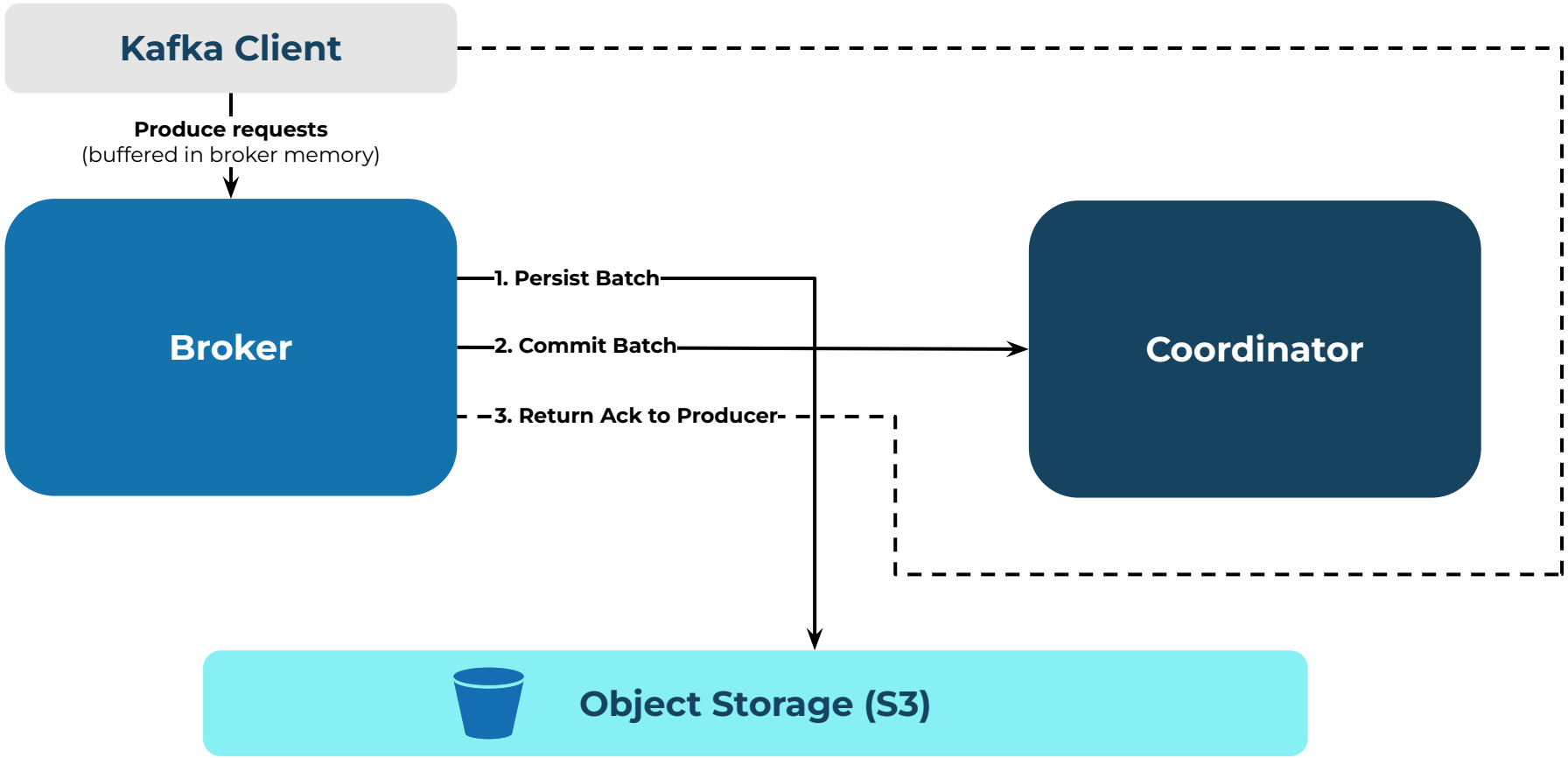
Popular features

- Broker-side schema validation
- Native Iceberg integration
- Schema registry included in binaries
- Multi-region active-active clusters
- Easy to migrate (easy to deploy drop-in replacements)

kentra

Coordinator based approach

- Leaderless - any client can read/write to any broker
- Batch contains records for all partitions
- Compaction process running in the background



Coordinator based approach

Who does it and how?

Freight Clusters

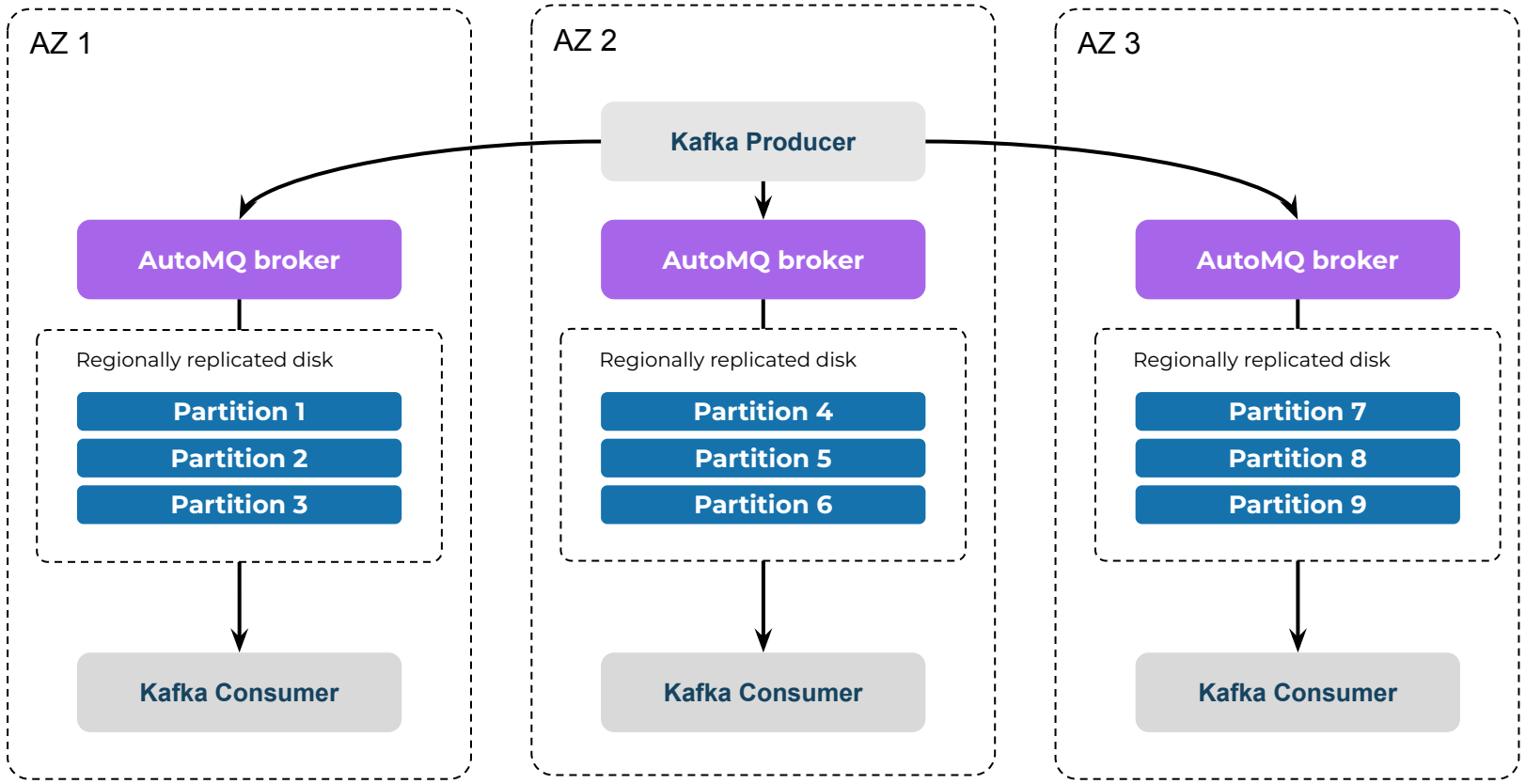
Diskless Kafka Topics in Apache Kafka?

KIP-1150 in a nutshell

- **Leaderless approach**
- **Batch Coordinator** as a pluggable component with default implementation built as metadata topics using KRaft
- **KIP still under discussion**

AutoMQ with Regional Block Storage

(example: Azure ZRS managed disk)



AutoMQ is a Kafka fork (Kafka 3.9 right now) with rewrittend storage layer. Almost all of the code is open source, but this setup isn't.

AutoMQ Brokers are leaders for a partition with replication factor = 1

Data is synchronously replicated on the infrastructure level - in the case of AZ outage disk can be remounted in different AZ in ~30 seconds

Compaction process moves the data to S3 every few seconds

What’s open source?

AutoMQ

Inkless

tansu

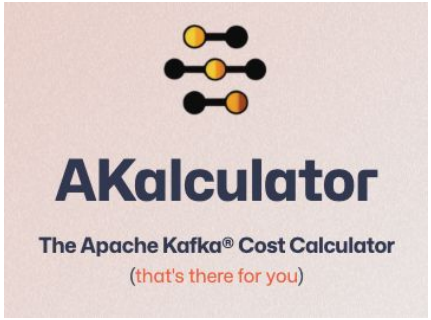
Chapter 3:

Cost and performance

Cost & latency comparison

Traffic I'm trying to normalize available data to:

- **1 GB/s write**
- **3 GB/s read**
- 4:1 compression ratio
- 7 days retention
- **Fetch from follower enabled**
- **AWS prices**



Sources:

- https://www.redpanda.com/blog/kafka-kraft-vs-redpanda-performance-2023
- https://www.confluent.io/blog/kafka-vs-kora-latency-comparison/
- https://2minutestreaming.com/tools/apache-kafka-calculator/
- https://www.warpstream.com/pricing
- https://buf.build/docs/bufstream/cost/#optimized-for-cloud-economics
- https://www.automq.com/blog/automq-performance-benchmark-on-azure
- https://www.automq.com/pricing

aws	**Kafka** w/o Tiered Storage	**Kafka with Tiered Storage**	**Warpstream** (ll = Low Latency variant)	**Bufstream**	**AutoMQ** Enterprise	**AutoMQ** Open Source
EC2 Instances	41 970	11 658	4 811	4 448	3 510	2 470
Networking	145 590	145 596	0	904	35 040	52 (ll: 35 040)
S3 API	-	-	4 620	4 508	1 101	6 670
Storage	52 623	17 931	13 900	13 900	13 900	13 900
Vendor fees	-	-	56 000	20 736	9 521	0
Monthly cost	**240 183**	**175 185**	**79 125** (~100k ll)	**42 625**	**61 201**	**23 092**
Monthly cost w/o networking	94 593	29 589	79 125	41 721	26 161	23 039
P50 E2E latency	**19 ms**	**19 ms**	**500 ms** (ll: 180ms)	**260 ms**	**9 ms**	**1.5 s** ll: 100-300ms
P99 E2E latency	**43 ms**	**43 ms**	**900 ms** (ll: 600ms)	**500 ms**	**40 ms**	**3.1 s**

What's most valuable to us?

Drastic reduction of cross-AZ networking traffic

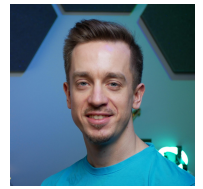
(very impactful unless you're on Azure)

Operational and architectural simplicity

Unlocking new markets for Kafka-compatible systems

Innovations in Data Streaming

Q & A?



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That’s all, folks!