Delivering Media at Scale: The Fast Data Perspective

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Lightbend

Ideas adapted from this report

lightbend.com/fast-data-platform

2nd edition coming in October!

What We'll Discuss

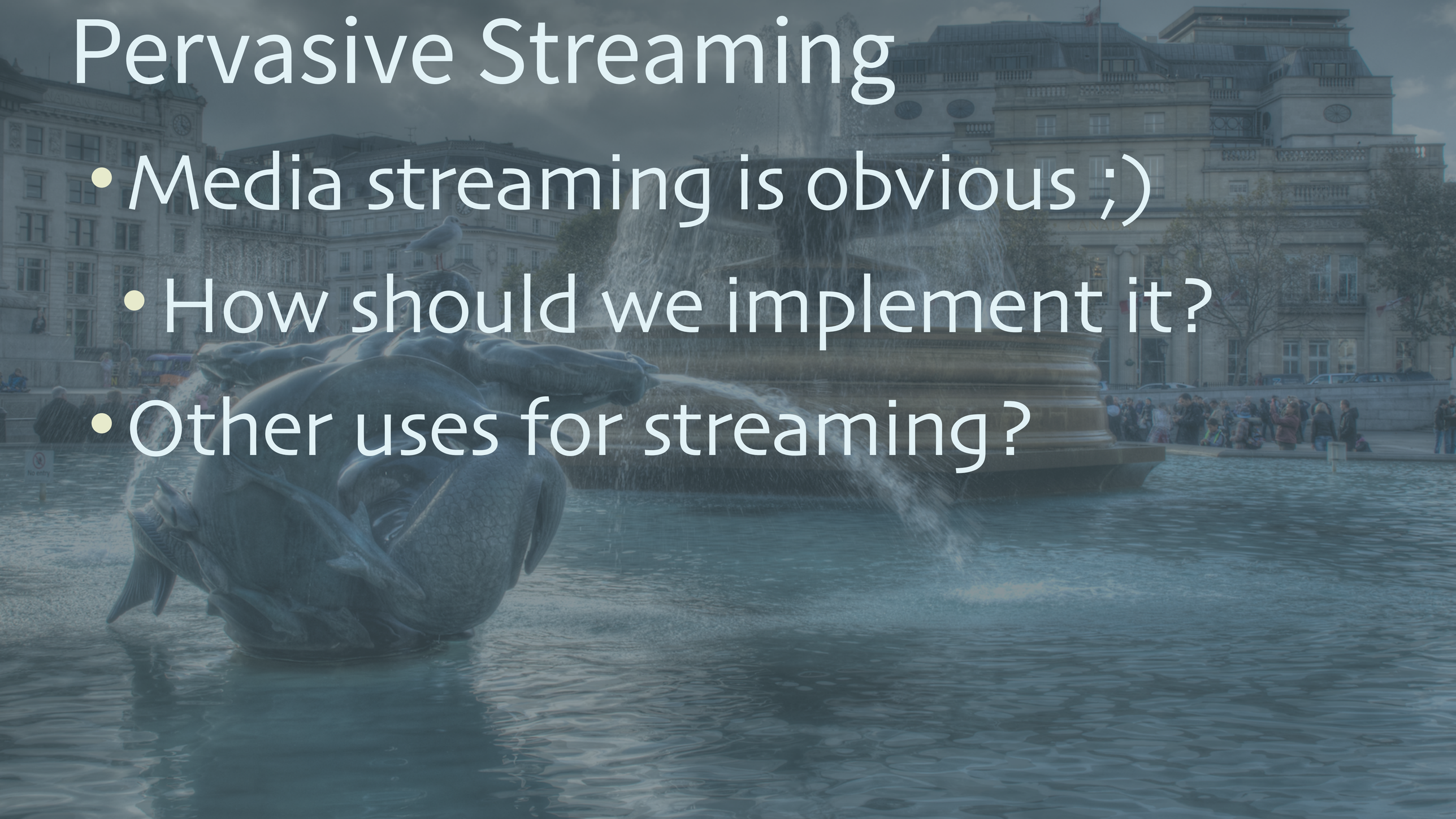
What We'll Discuss

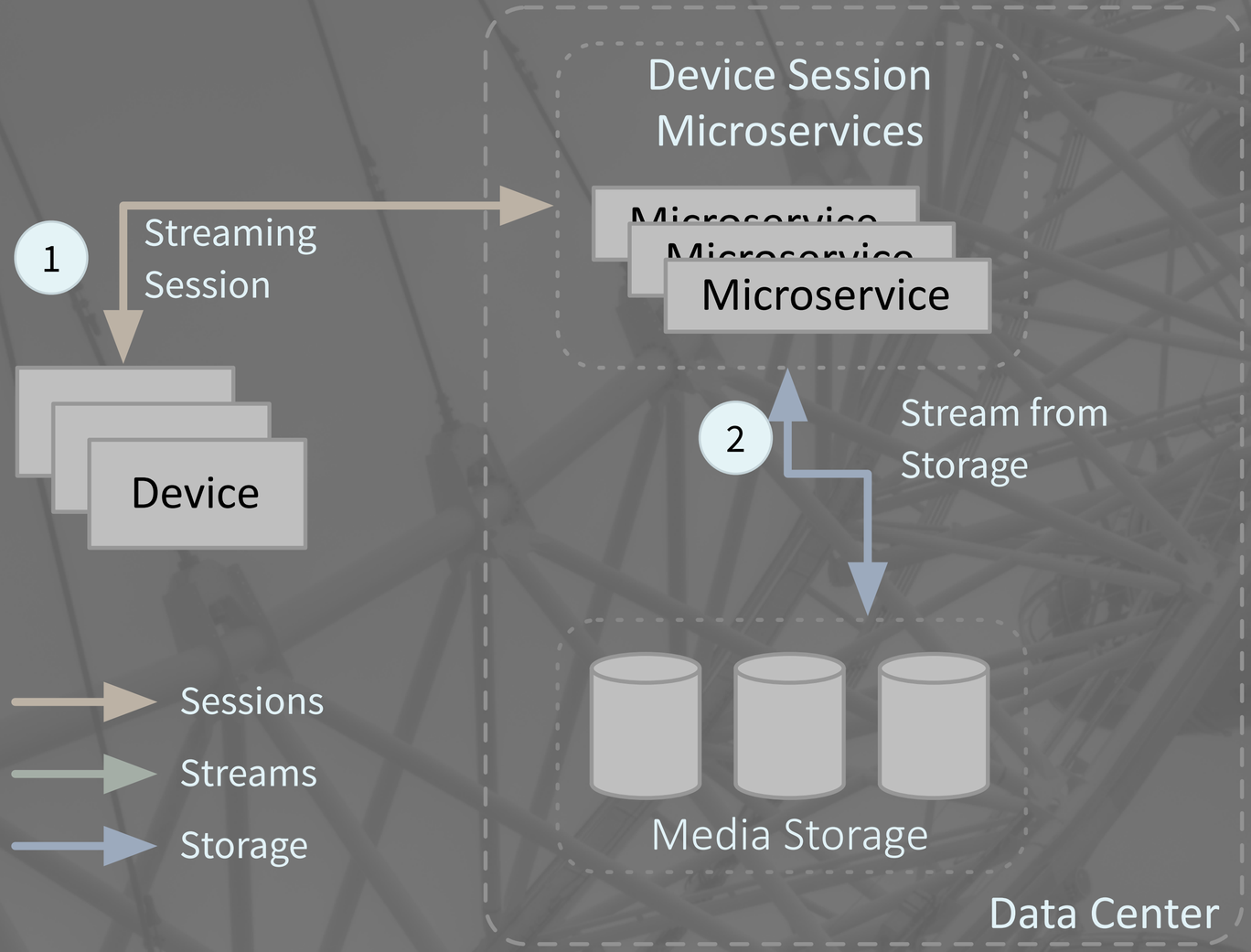
- Pervasive streaming? Why now?
- Technology choices
- How this changes your organization

Pervasive Streaming

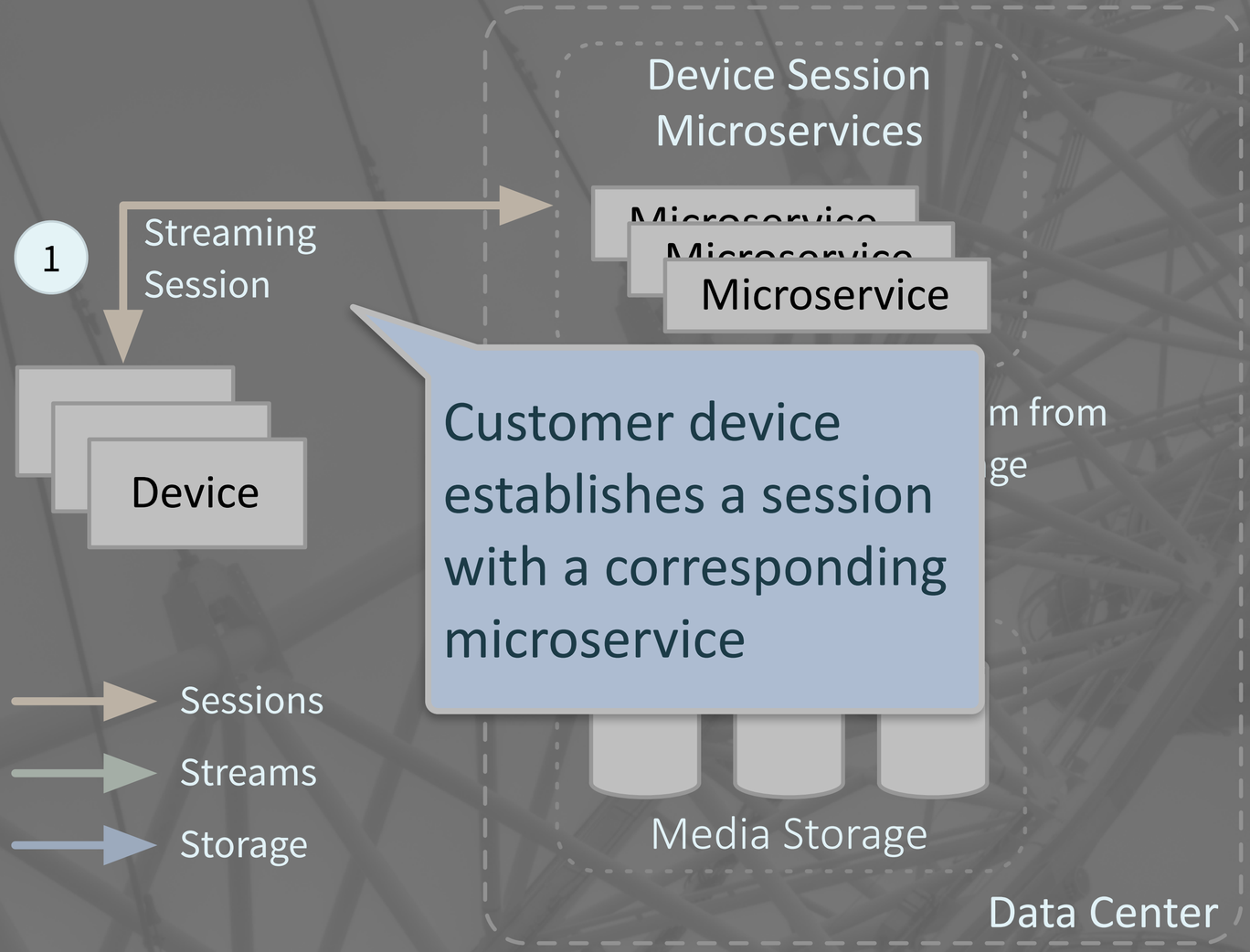
Pervasive Streaming

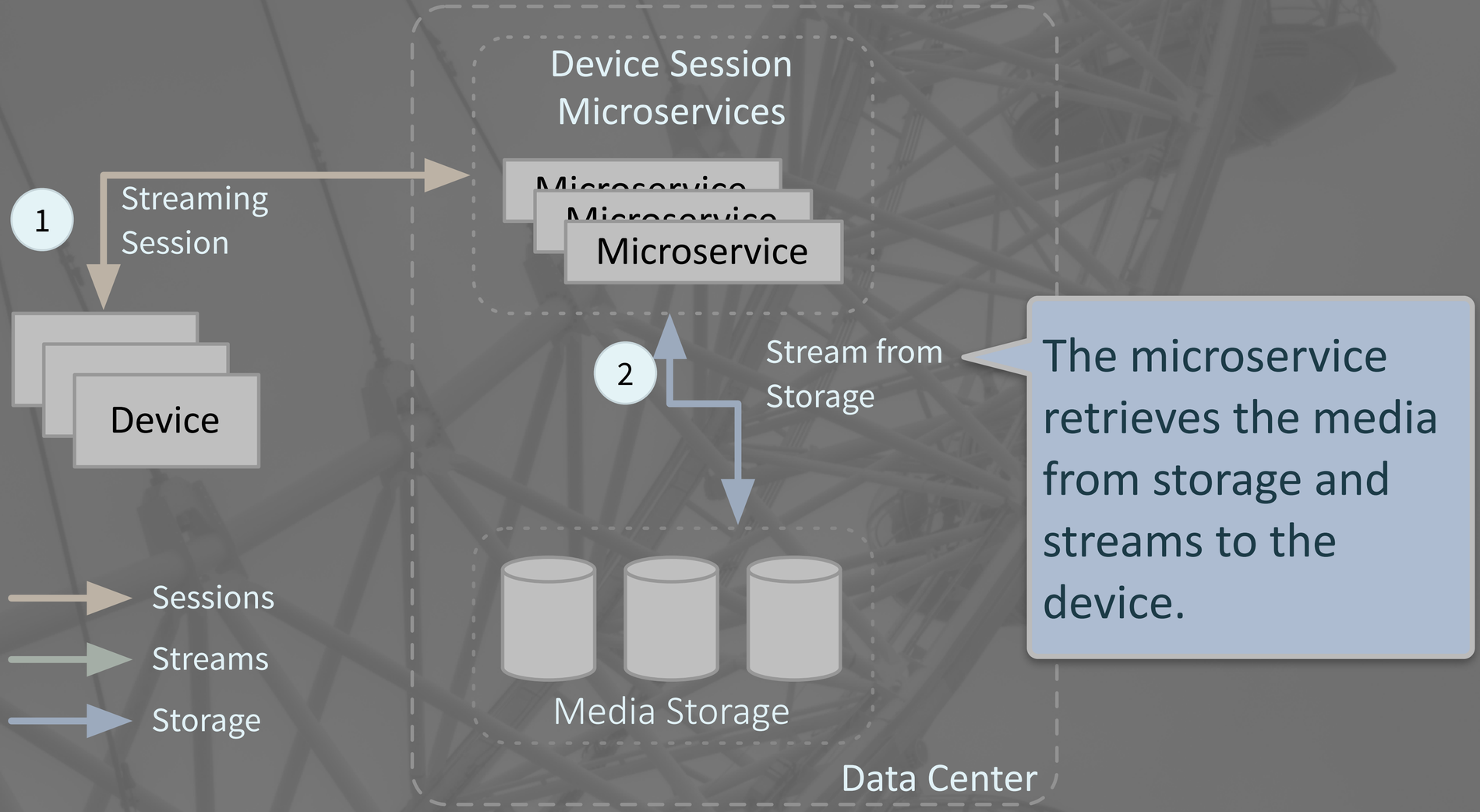
- Media streaming is obvious ;)
  - How should we implement it?
- Other uses for streaming?

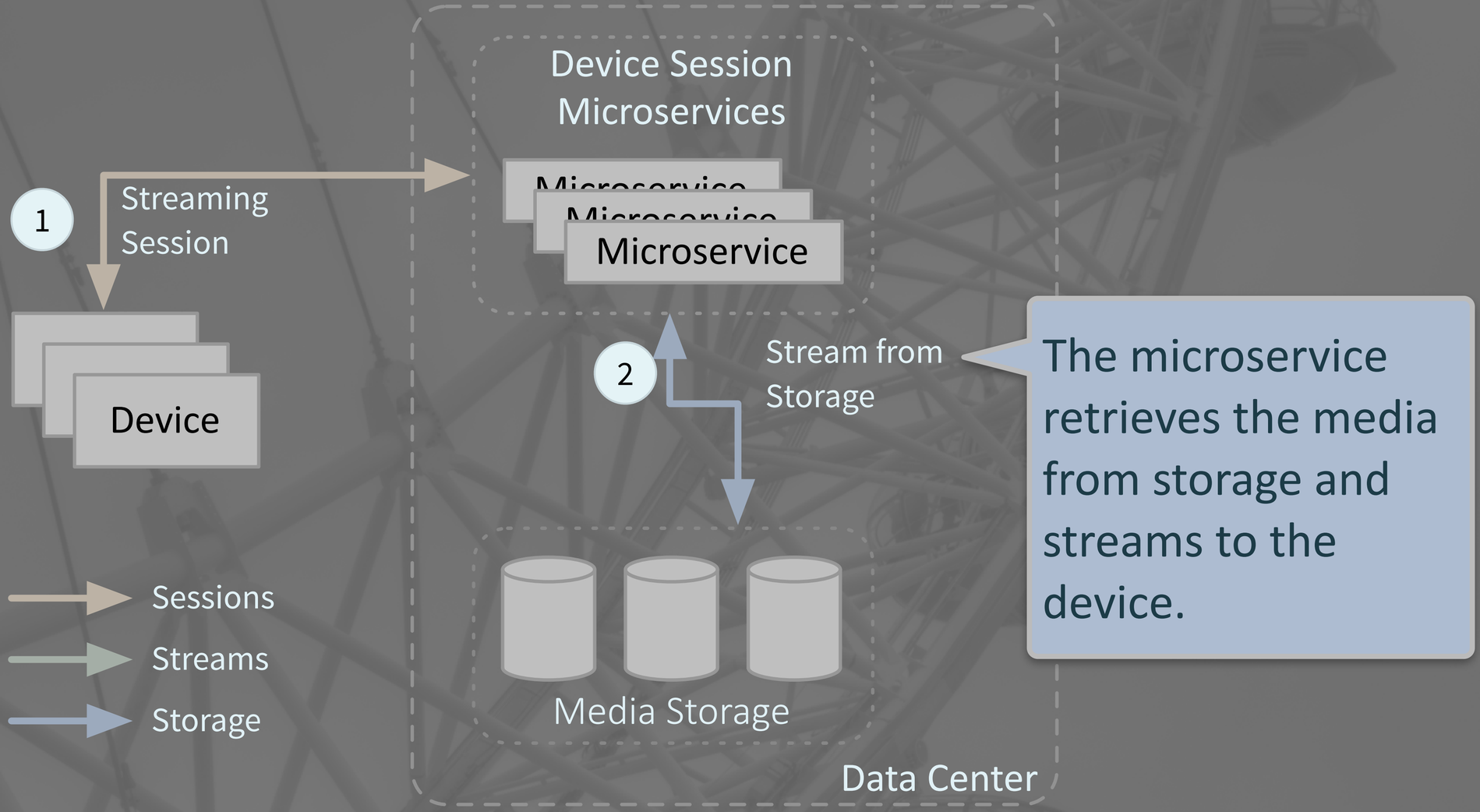




Media Streaming - V1

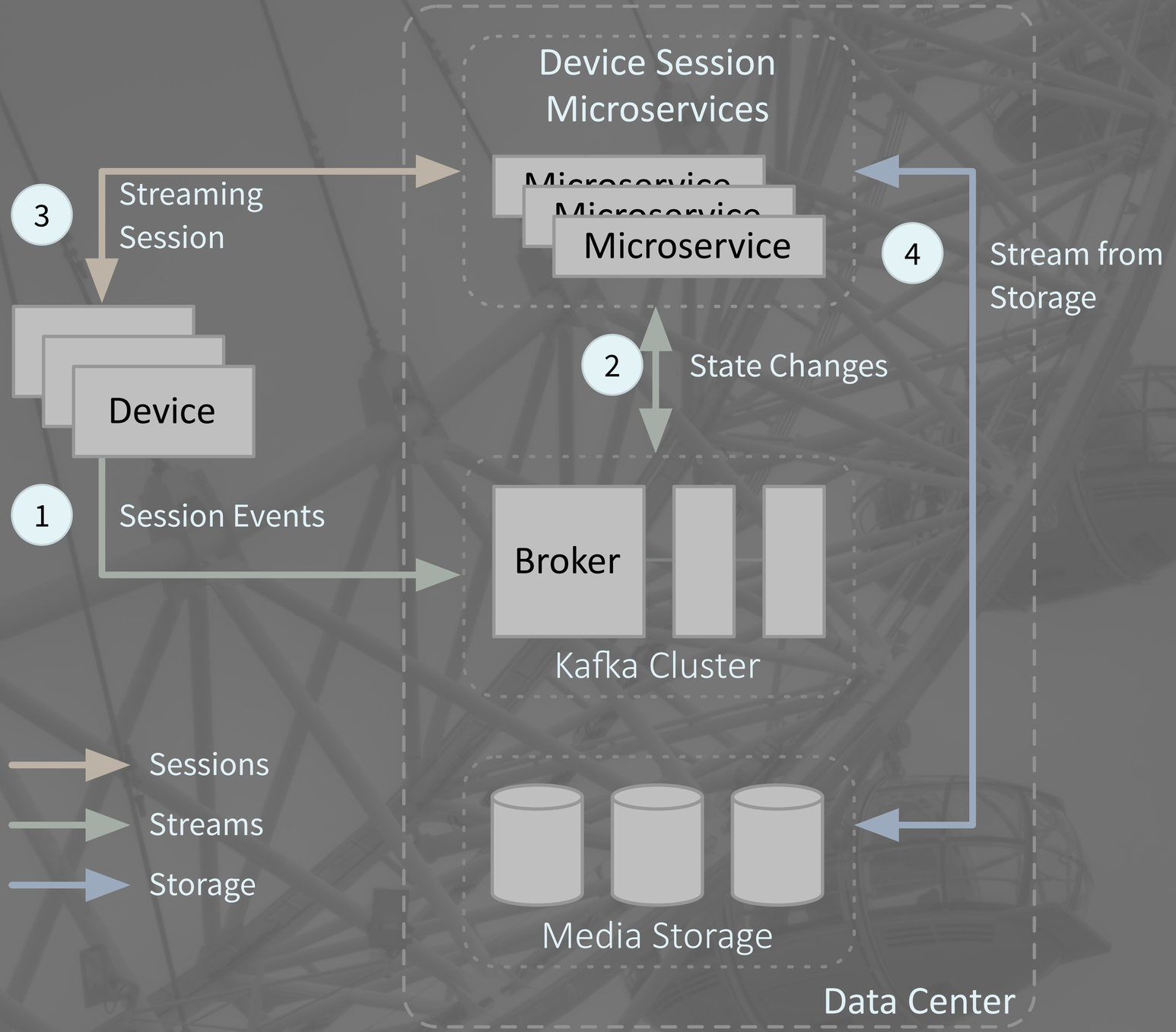

Device Session
Microservices
Microservice
Microservice
Microservice
1
Streaming
Session
Device
Customer device establishes a session with a corresponding microservice
m from
ge
Sessions
Streams
Storage
Media Storage
Data Center


Device Session Microservices
Microservice
Microservice
Microservice
1
Streaming Session
Device
2
Stream from Storage
Media Storage
Data Center
Sessions
Streams
Storage
The microservice retrieves the media from storage and streams to the device.

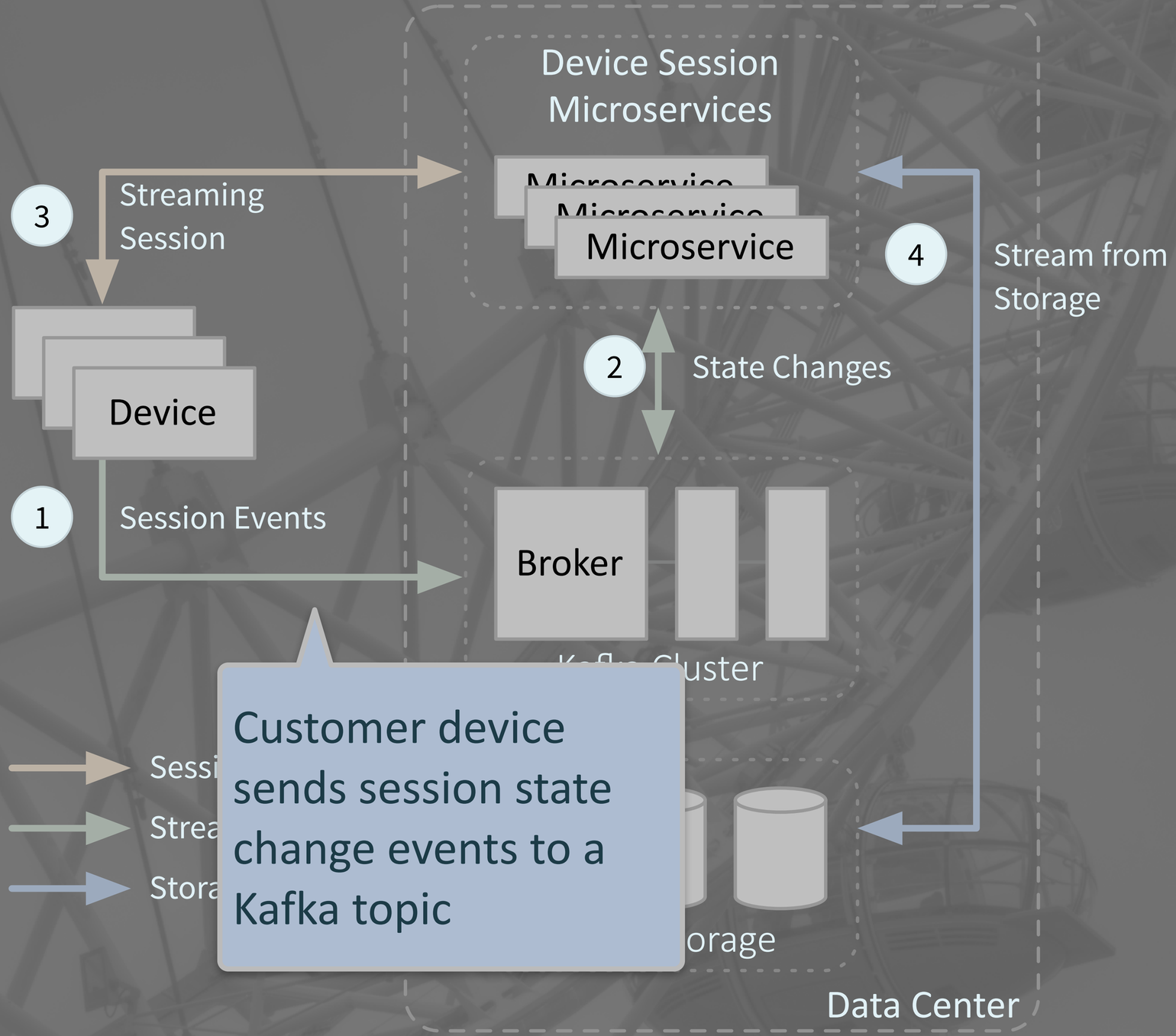

Device Session Microservices
Microservice
Microservice
Microservice
1
Streaming Session
Device
2
Stream from Storage
Media Storage
Data Center
Sessions
Streams
Storage
The microservice retrieves the media from storage and streams to the device.

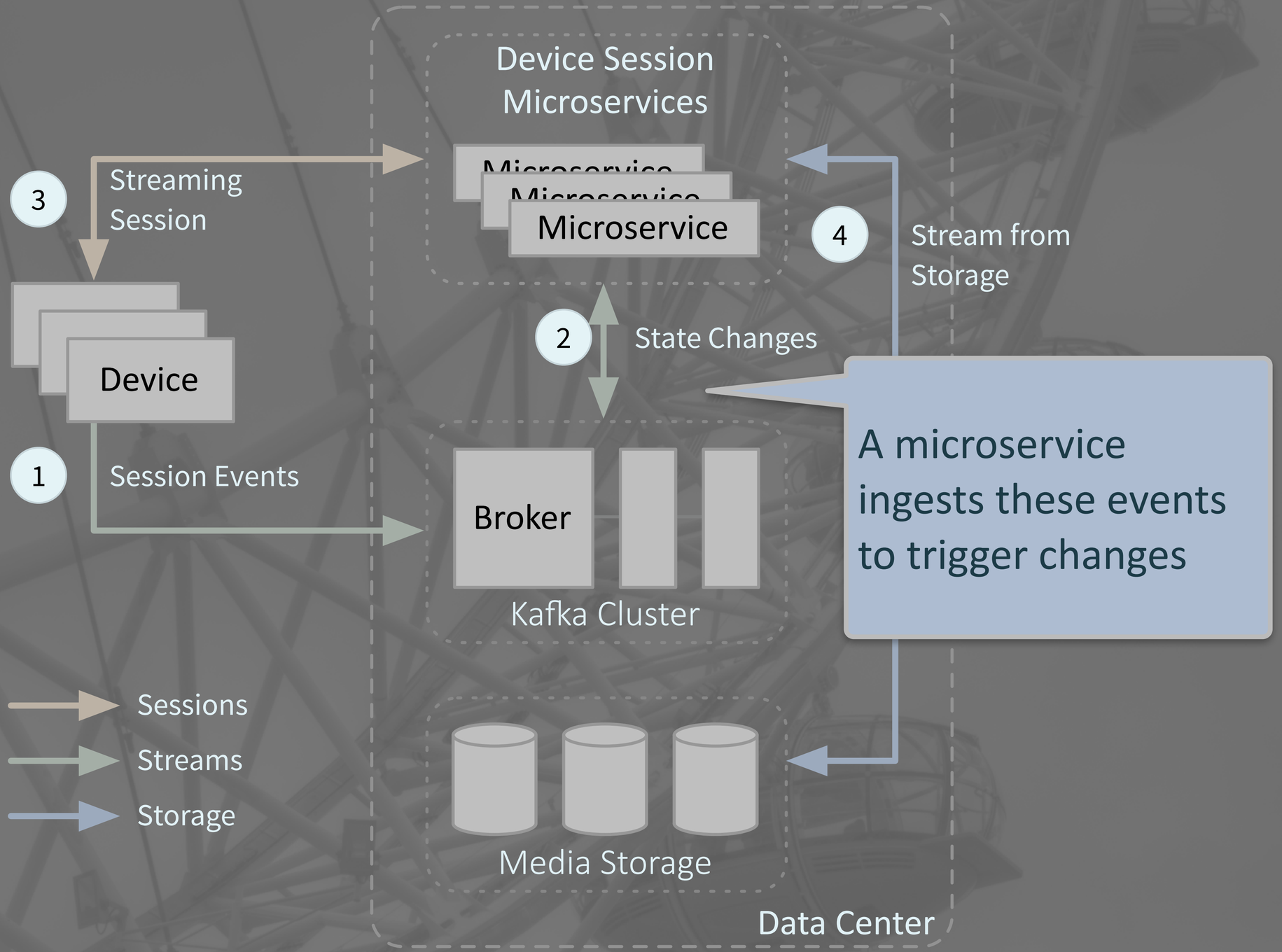
Challenges

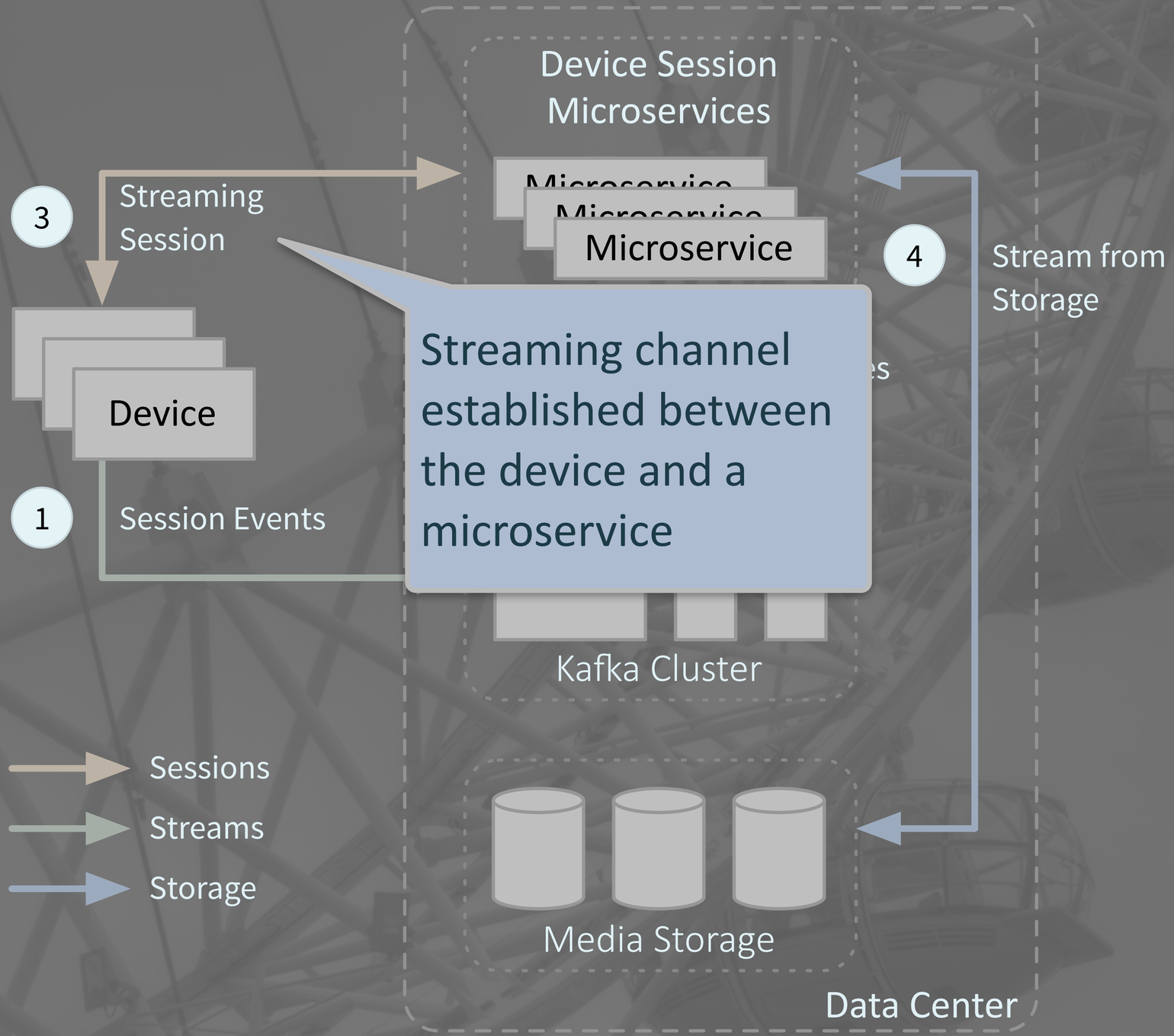
- Does this really scale to lots of devices?
- What if a connection or microservice dies?

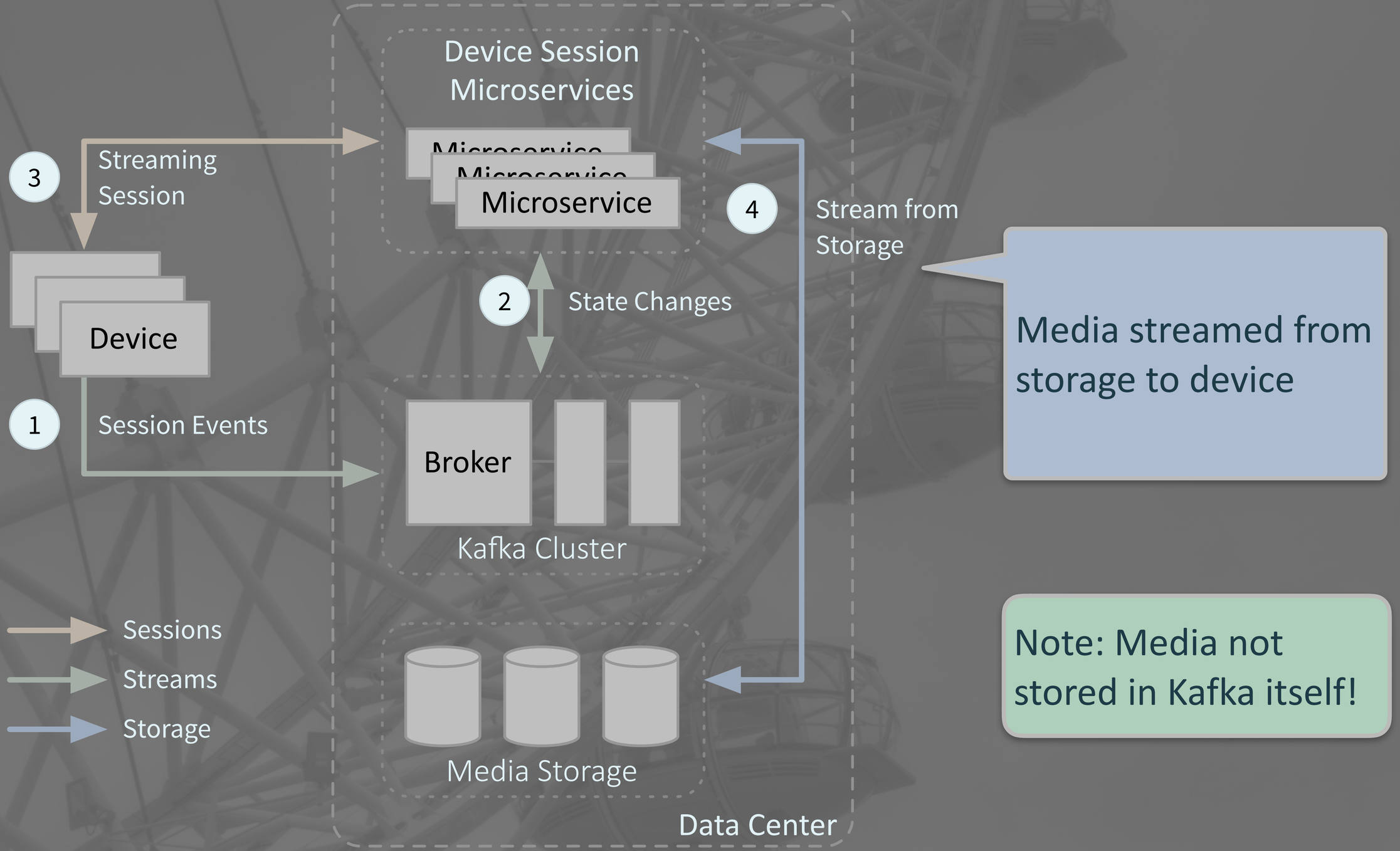


Media Streaming - V2


Device Session Microservices
Microservice
3
Streaming Session
4
Stream from Storage
2
State Changes
Device
1
Session Events
Broker
Customer device sends session state change events to a Kafka topic
Data Center


Device Session Microservices
Microservice
3
Streaming Session
4
Stream from Storage
Device
2
State Changes
1
Session Events
Broker
Kafka Cluster
A microservice ingests these events to trigger changes
Sessions
Streams
Storage
Media Storage
Data Center


Device Session Microservices
Microservice
Microservice
Microservice
3
Streaming Session
4
Stream from Storage
Device
1
Session Events
Streaming channel established between the device and a microservice
Kafka Cluster
Sessions
Streams
Storage
Media Storage
Data Center


Device Session Microservices
Microservice
3
Streaming Session
Device
1
Session Events
2
State Changes
Broker
Kafka Cluster
4
Stream from Storage
Media Storage
Data Center
Sessions
Streams
Storage
Media streamed from storage to device
Note: Media not stored in Kafka itself!

Advantages

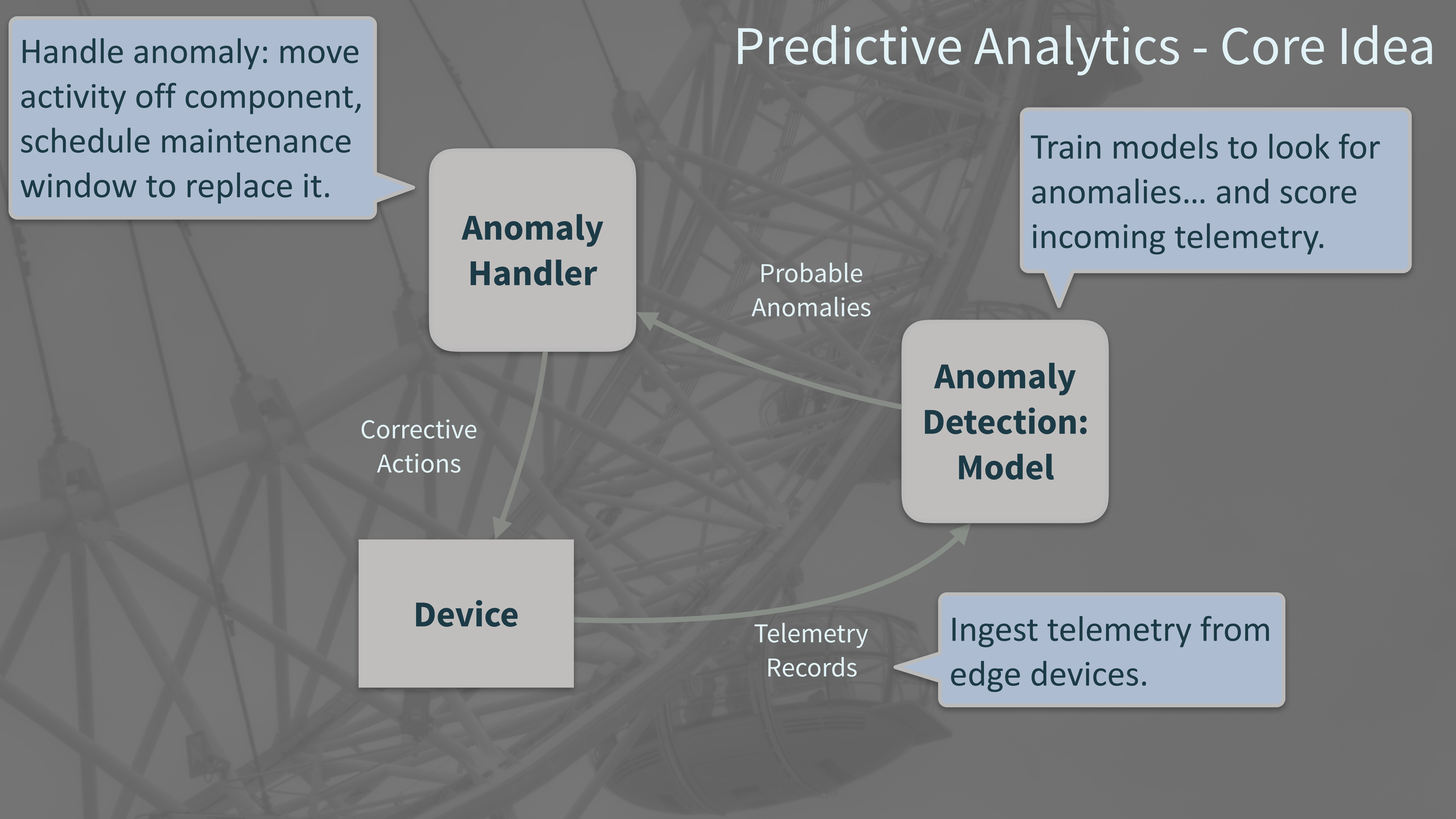
- Fully asynchronous - no blocking REST…
- Recover from outages with “management” microservice that reads the same Kafka

Other Uses for Streaming

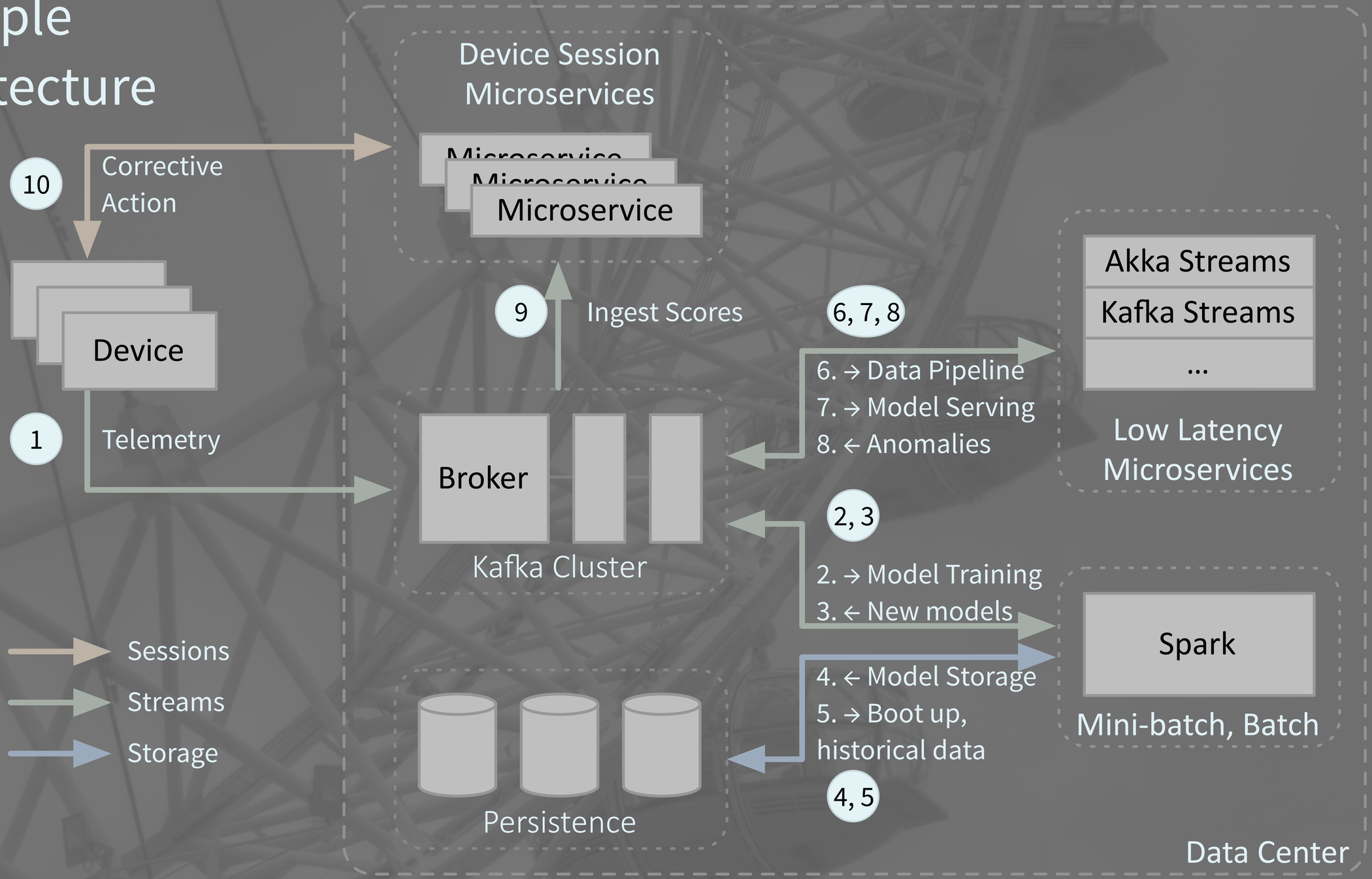
Predictive Analytics

- ML models applied to device telemetry to detect anomalies
- Preemptive maintenance prevents potential failures that would impact users

Predictive Analytics - Core Idea



Example Architecture



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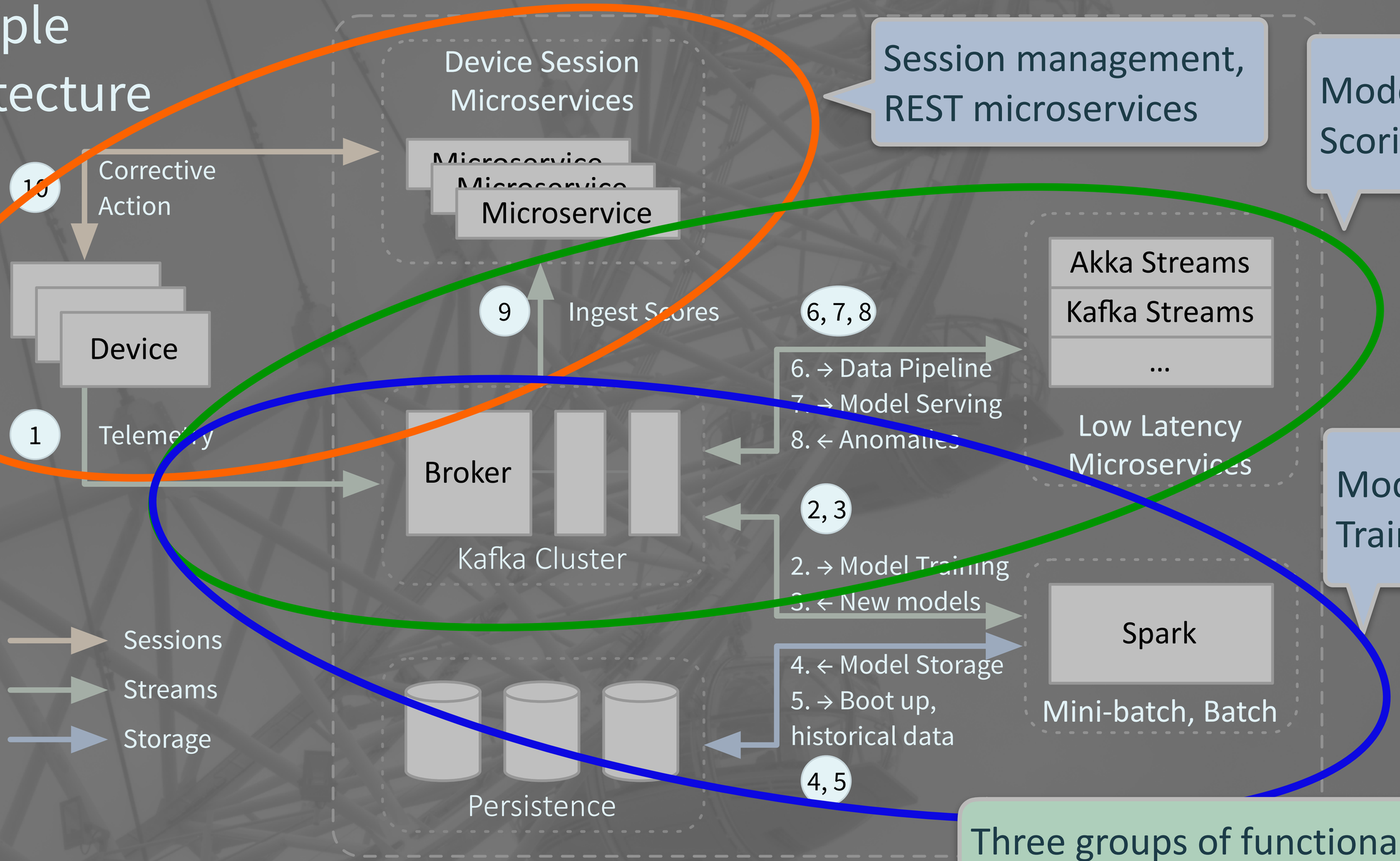

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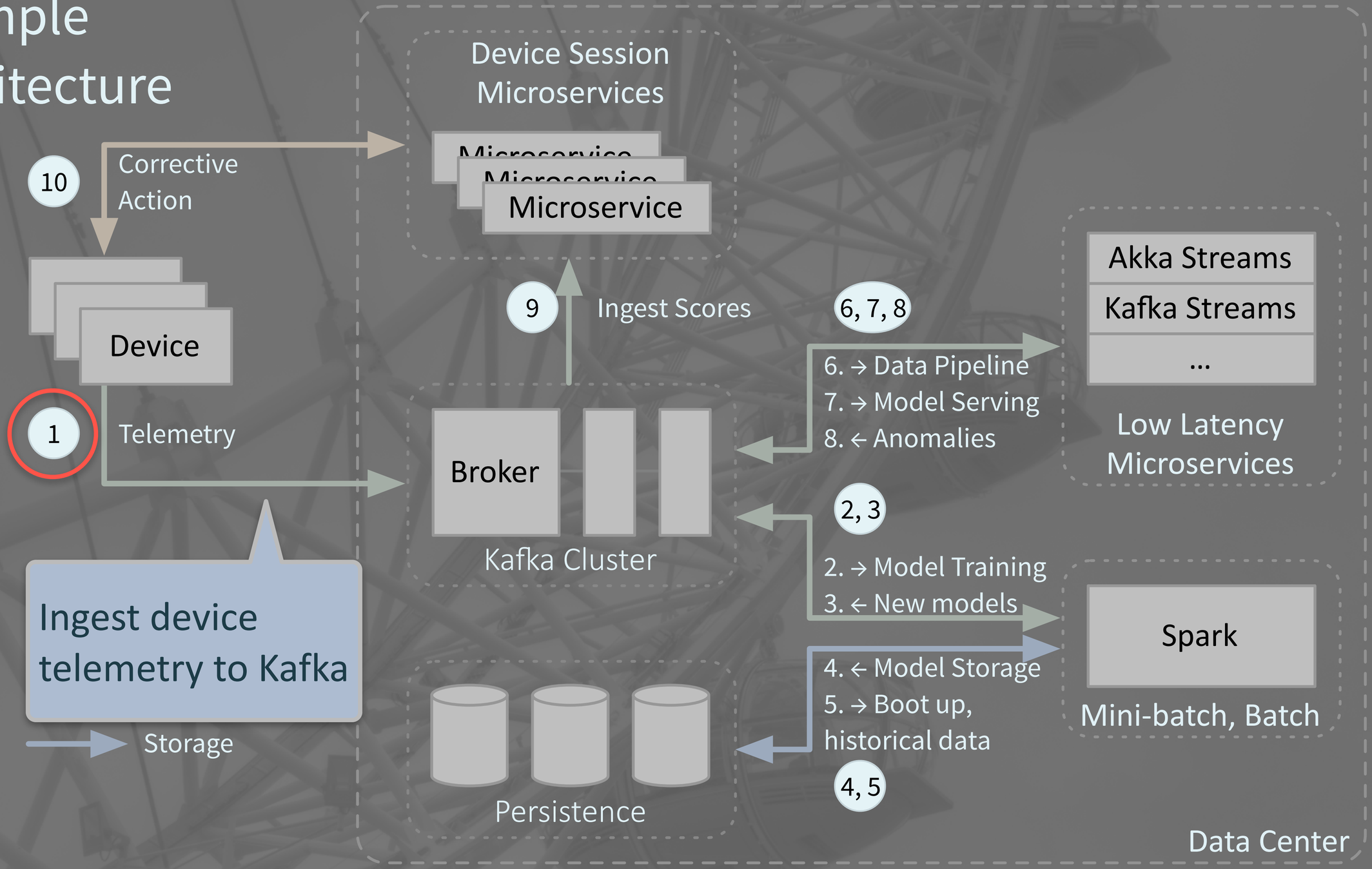

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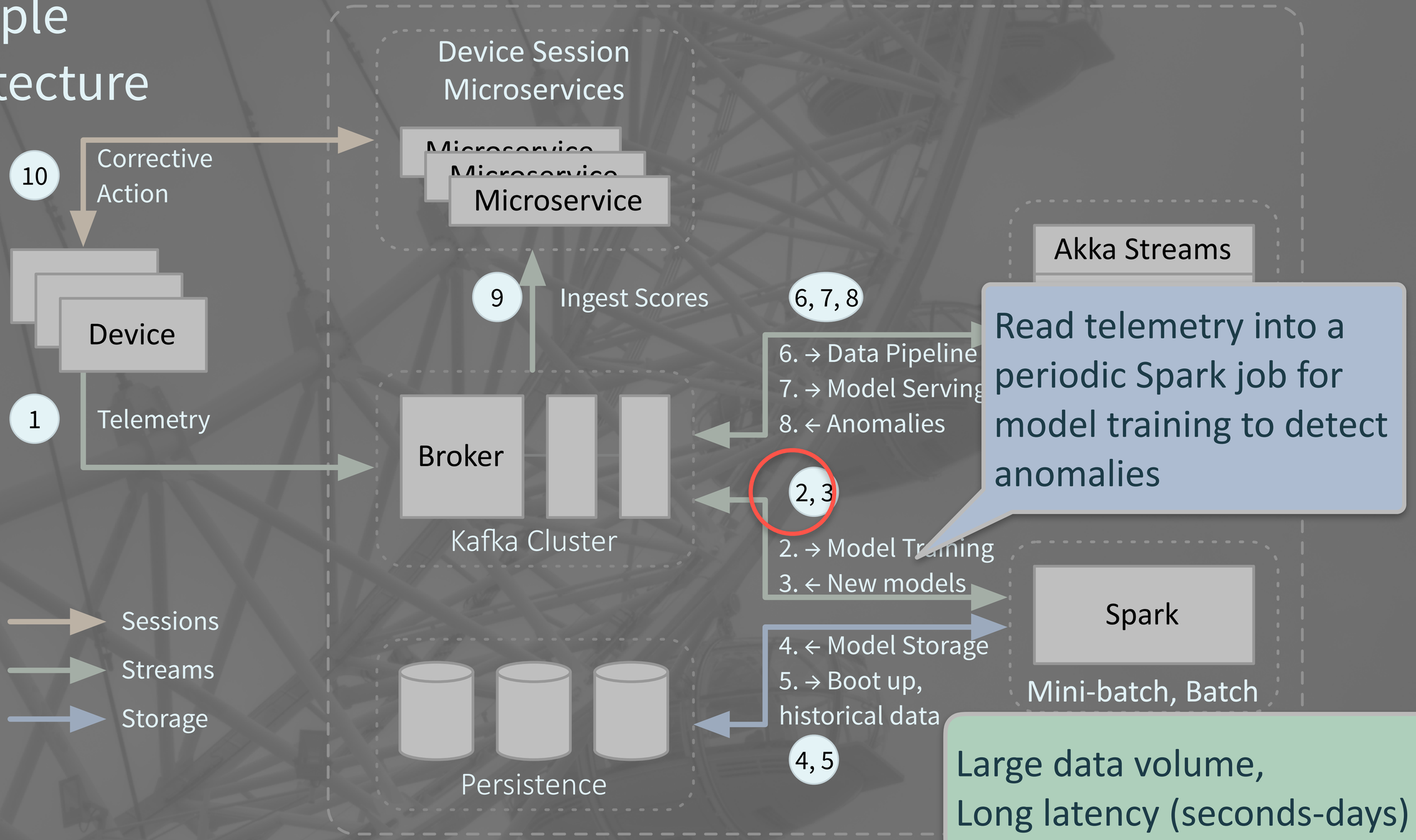

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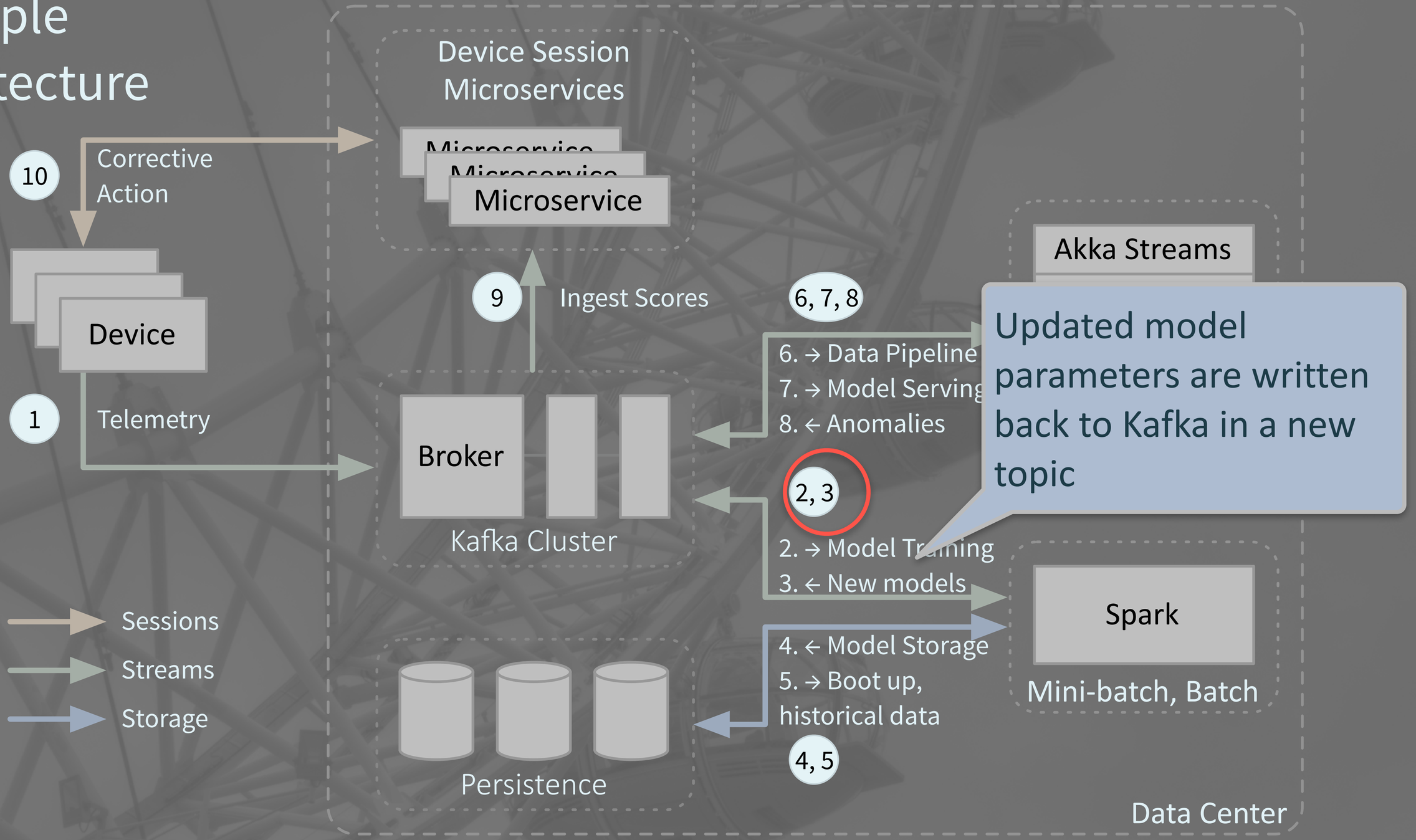

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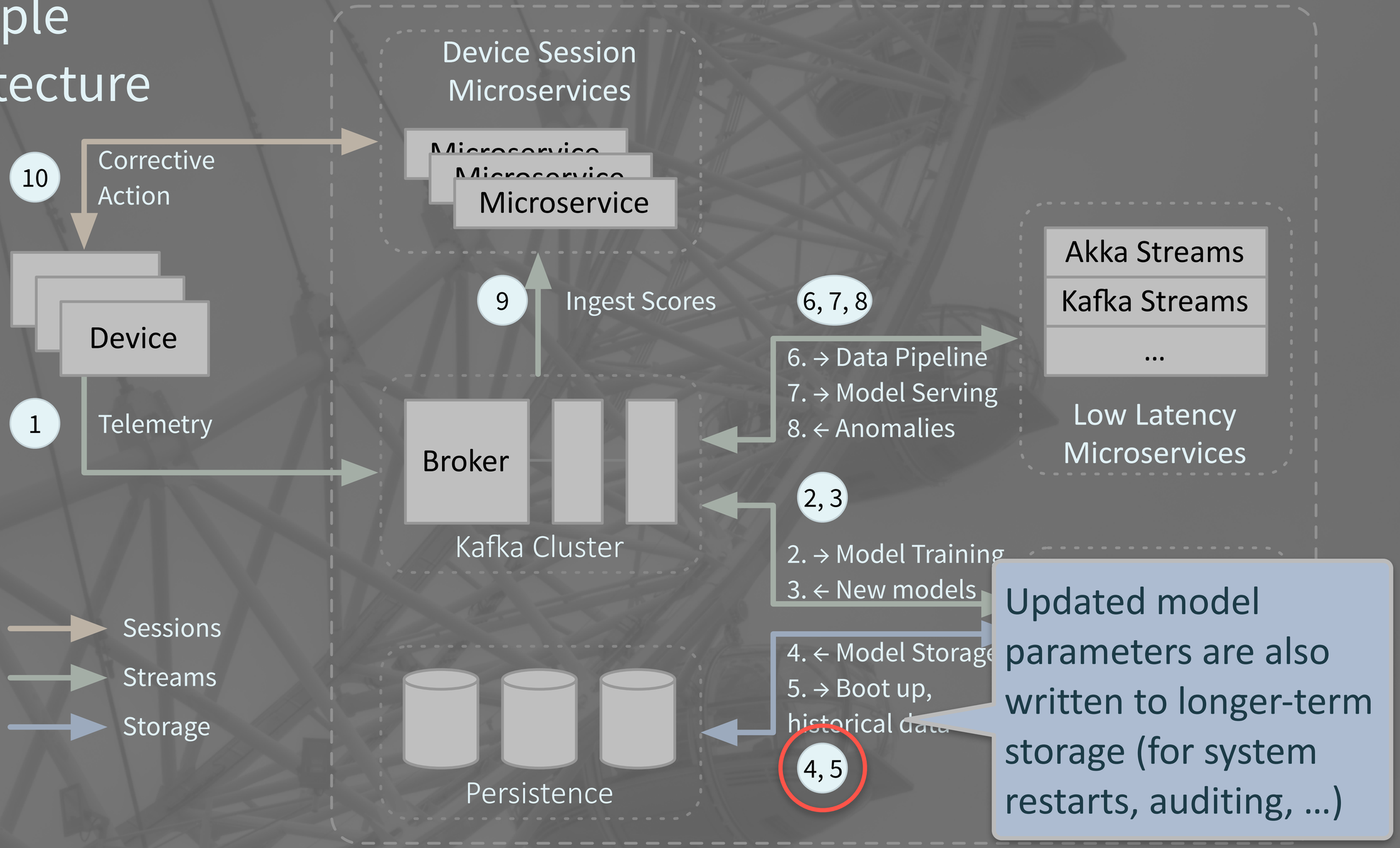
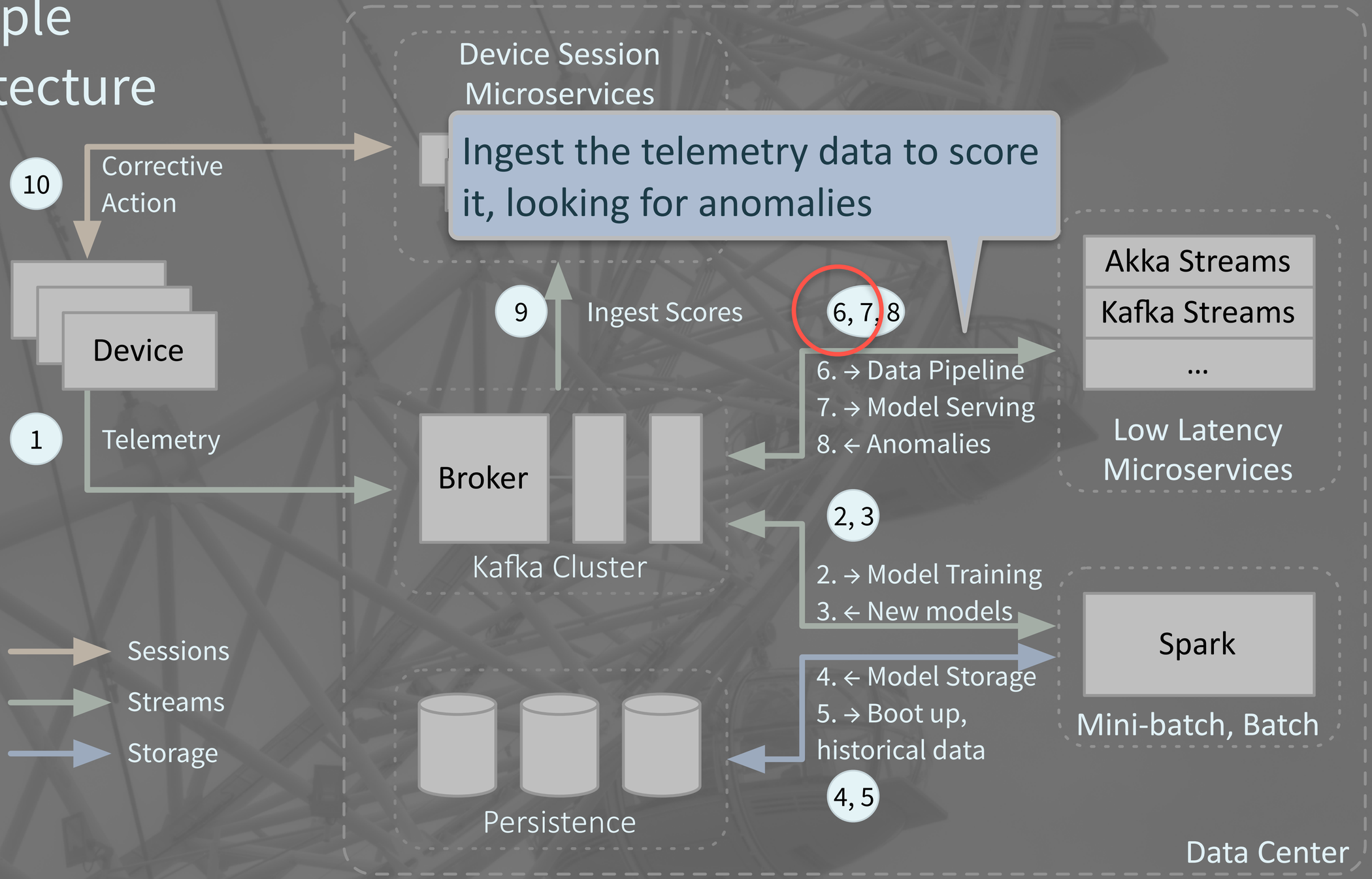


Example Architecture



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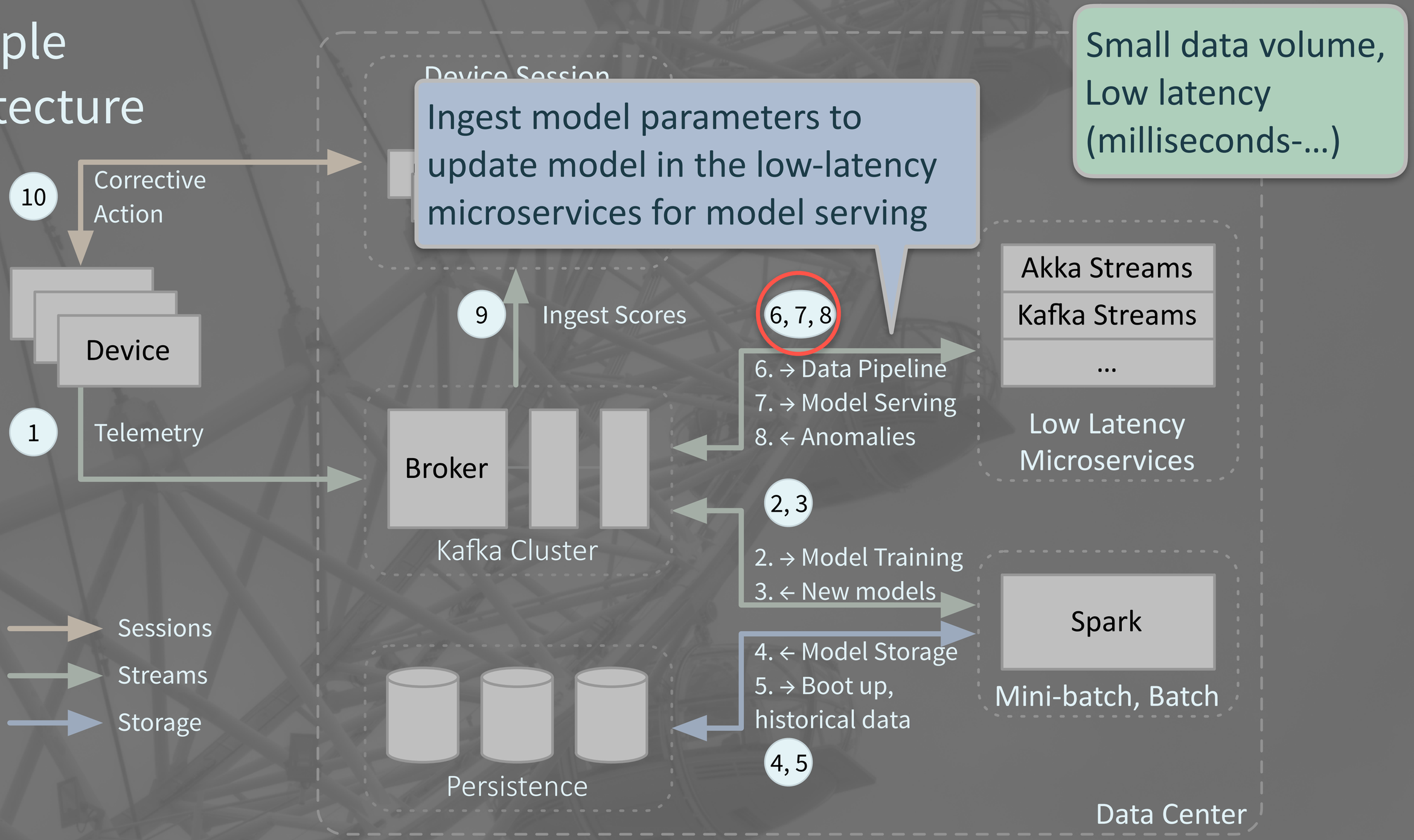

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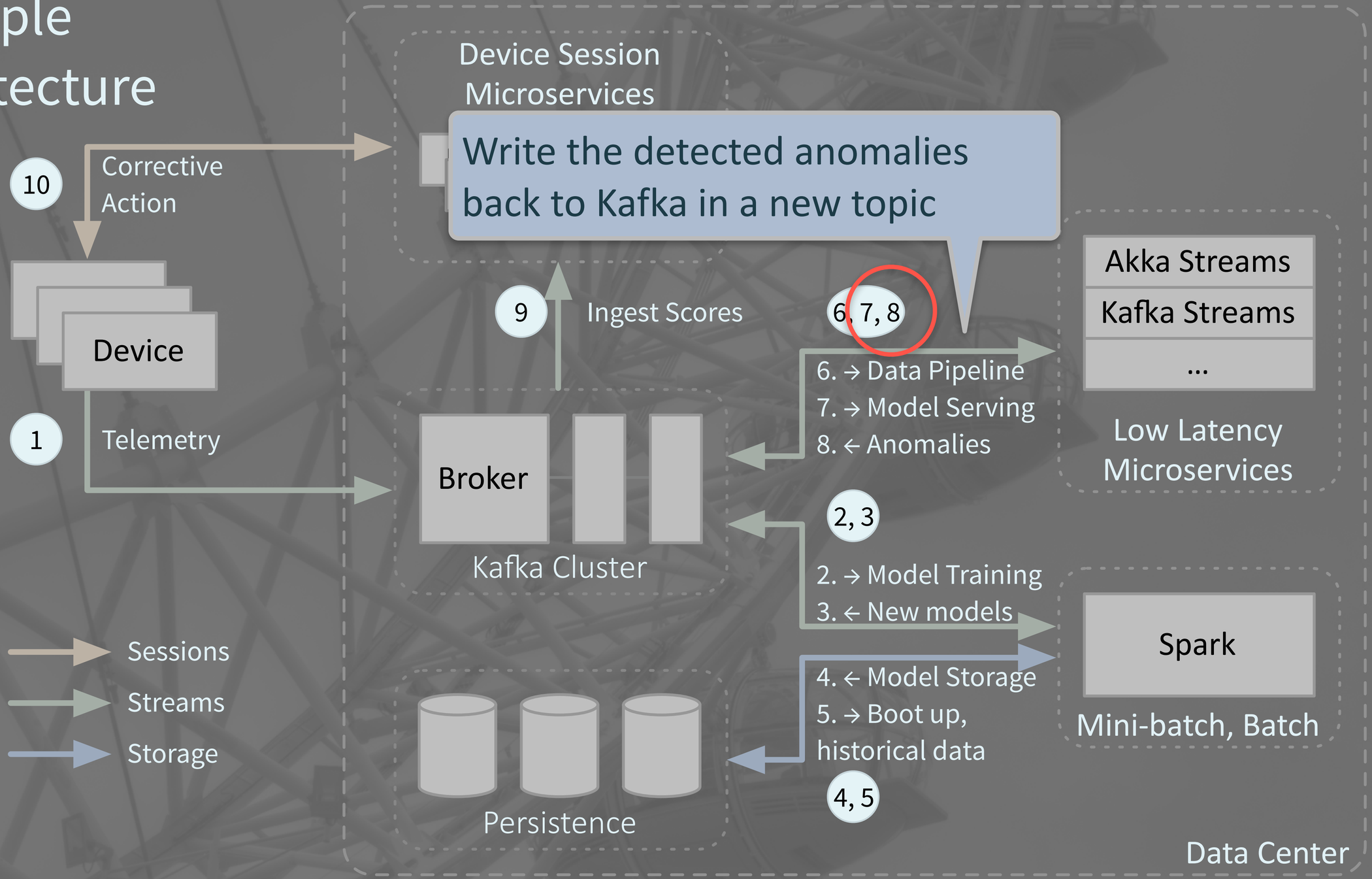

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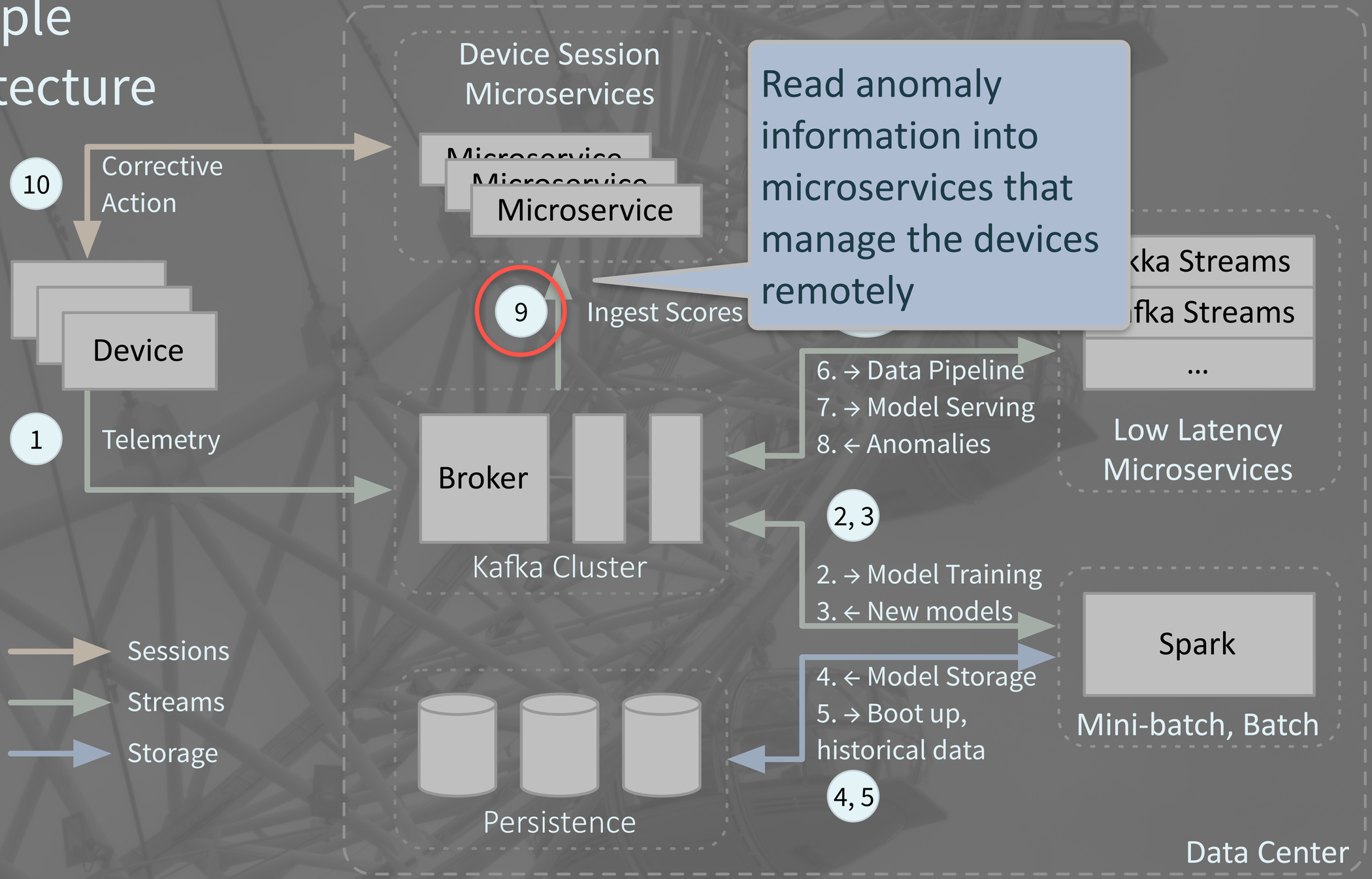
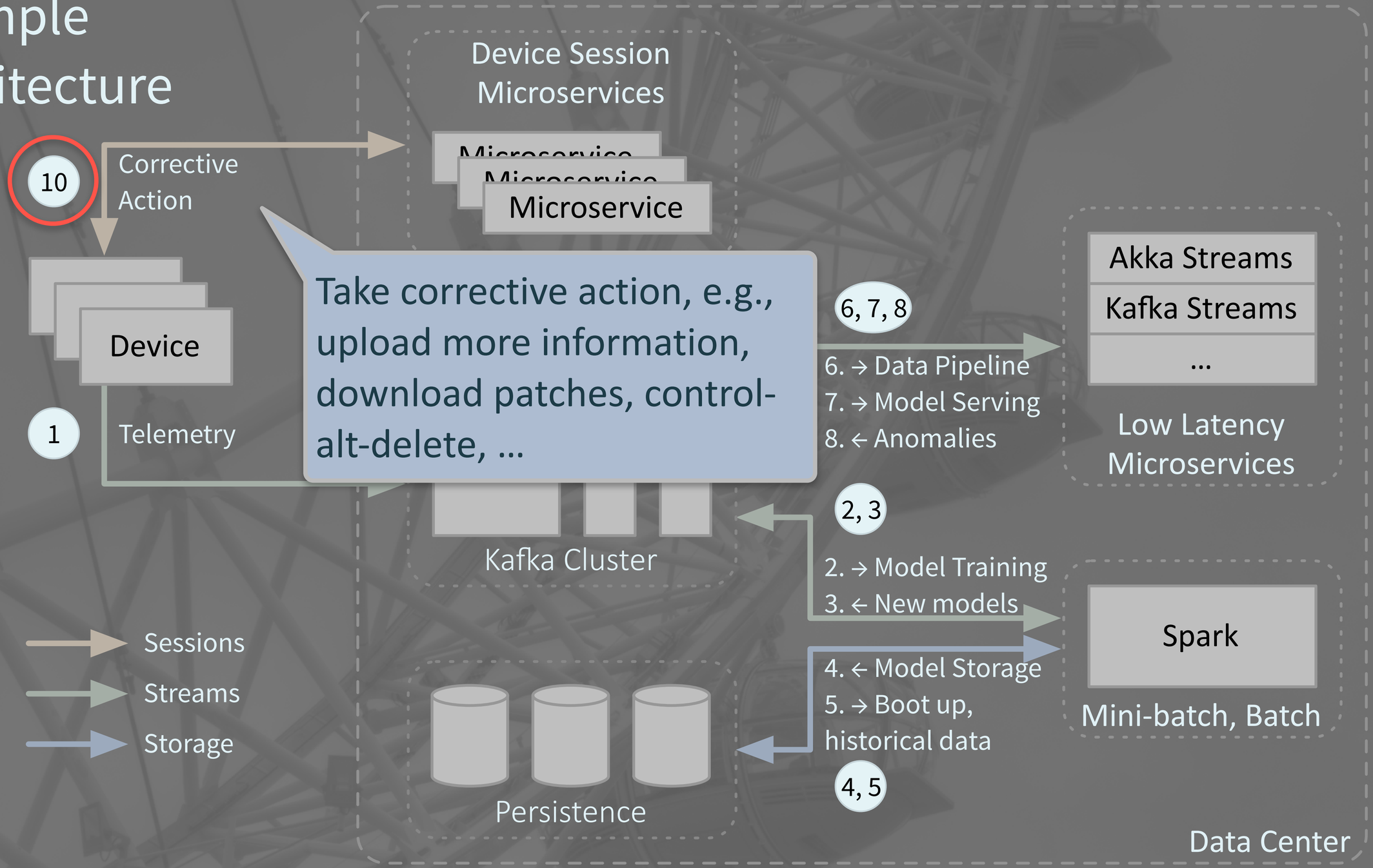


Example Architecture



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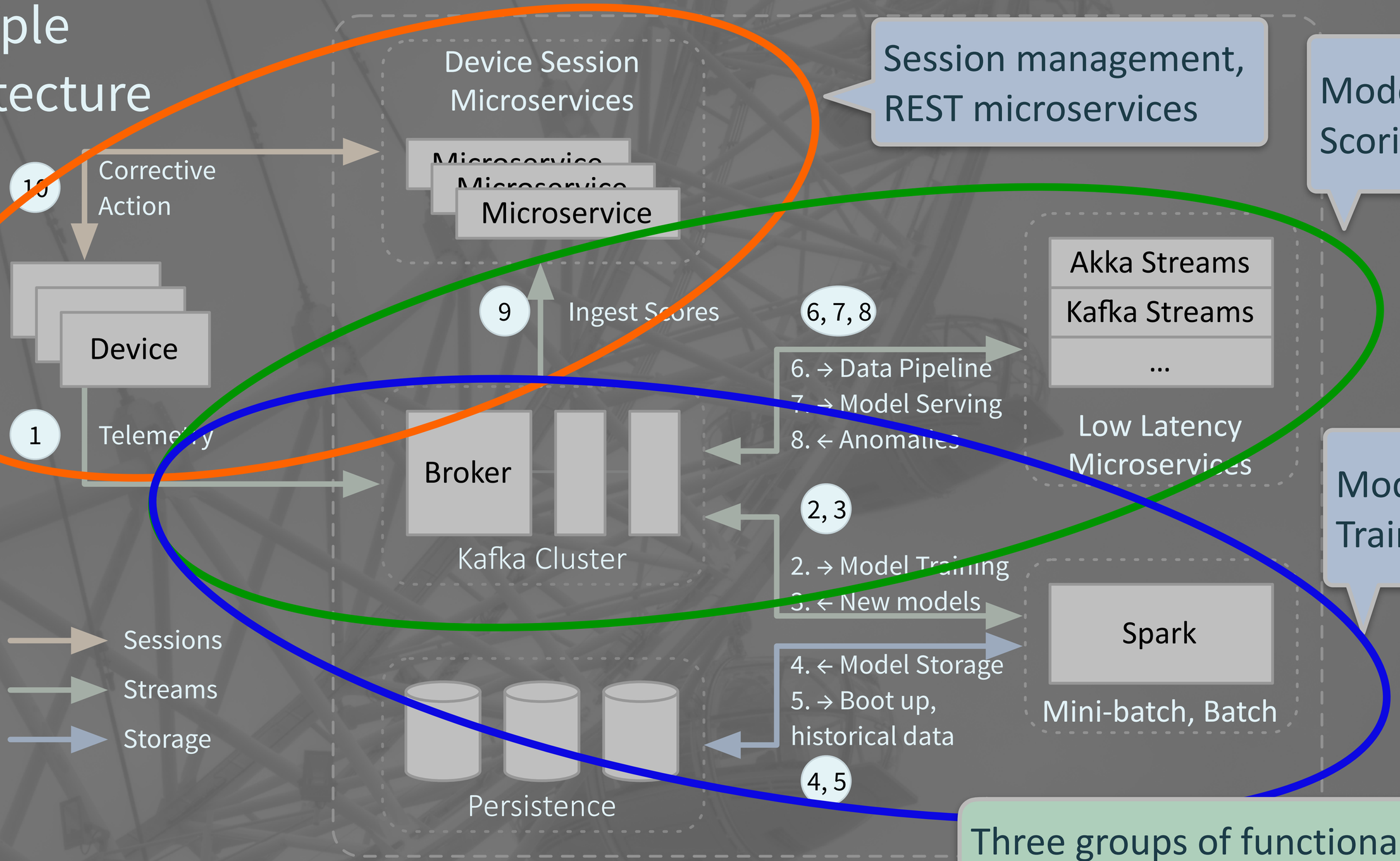

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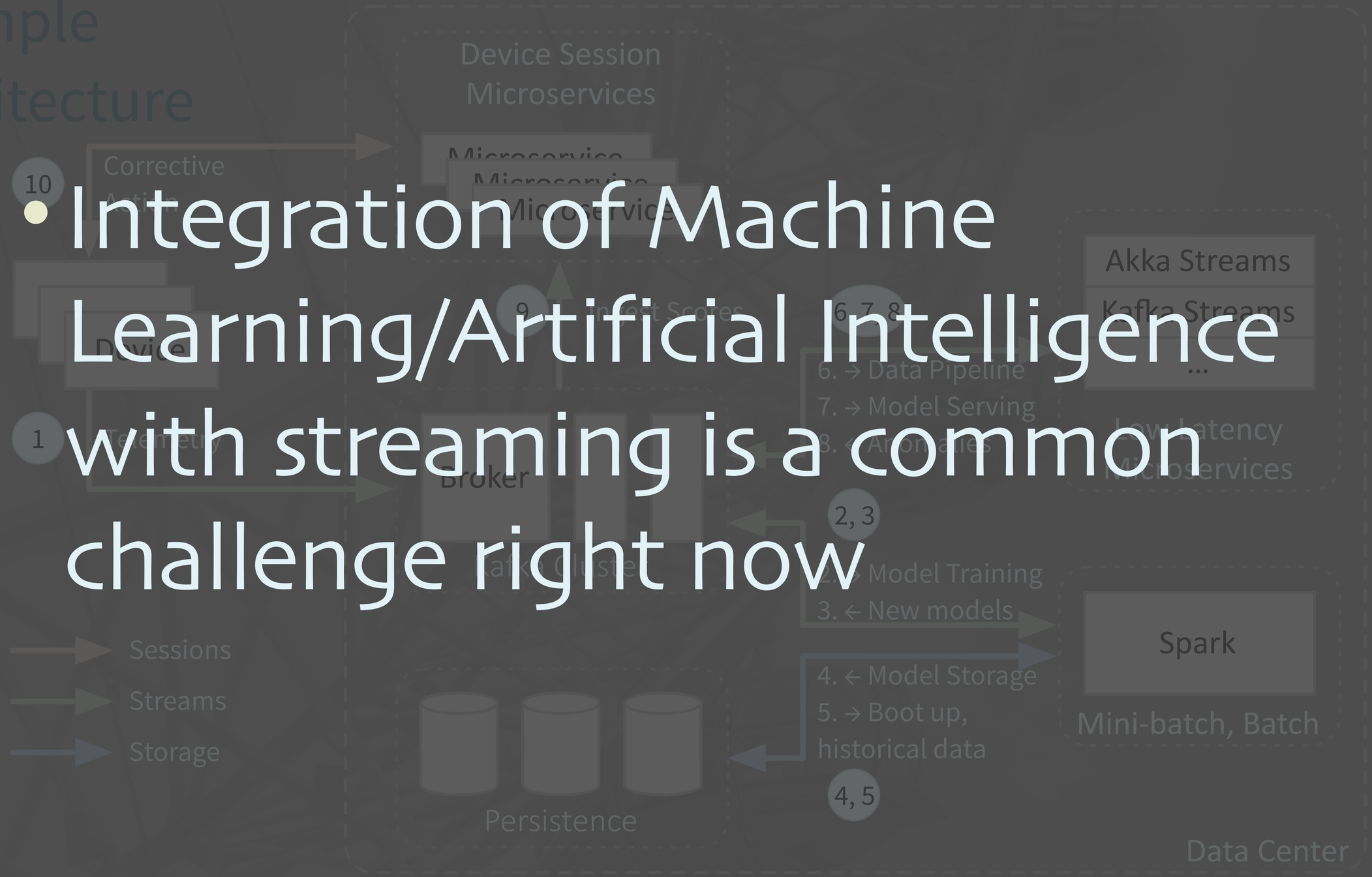
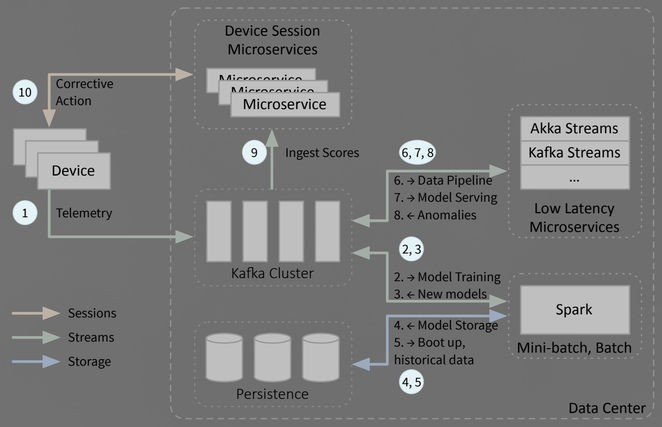


- Integration of Machine Learning/Artificial Intelligence with streaming is a common challenge right now

Challenges

- Network overhead for telemetry ingestion too high?
- Model serving latency too long?
- Datacenter unavailable?
- Idea: Serve models on the device!



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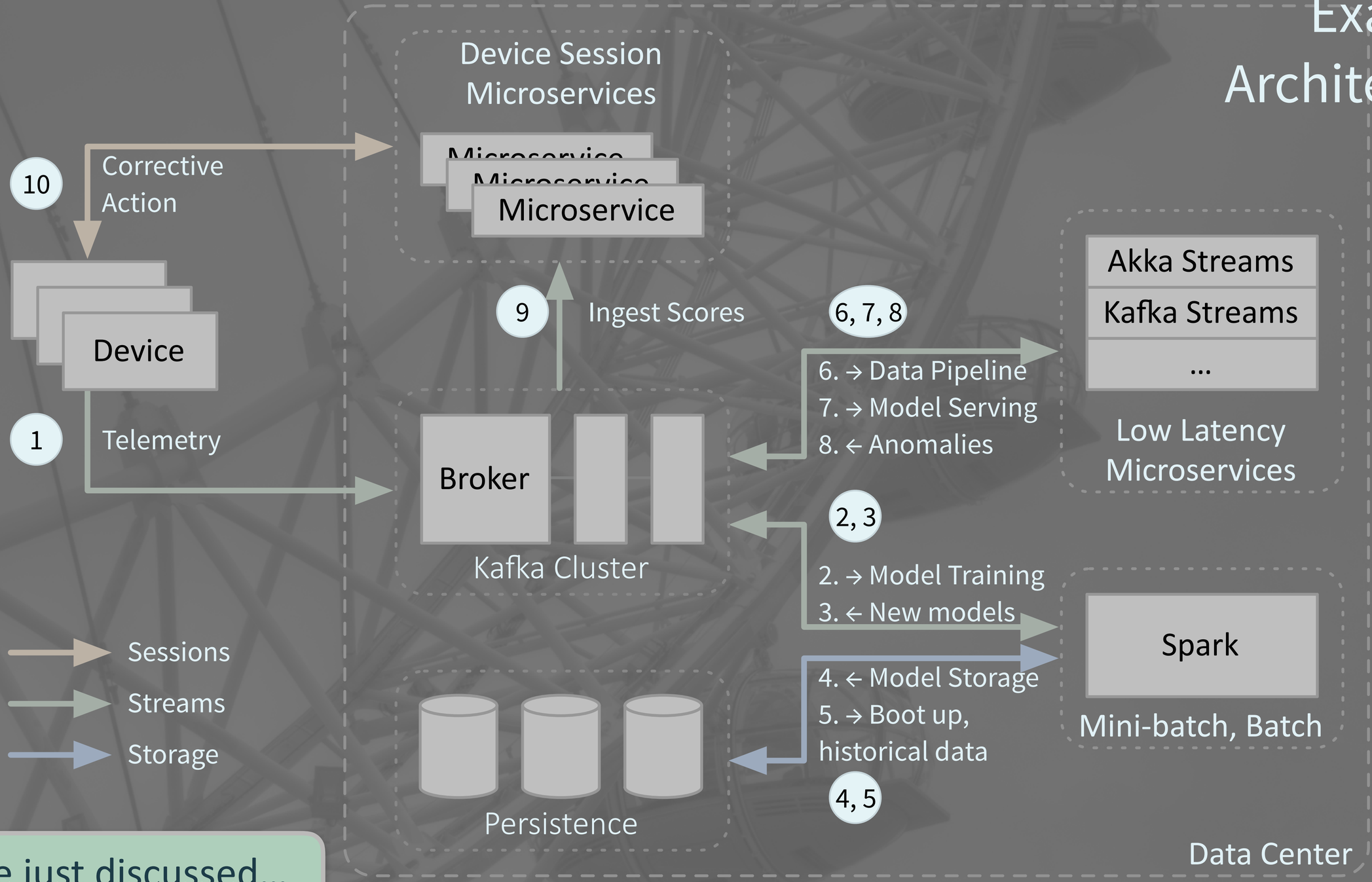
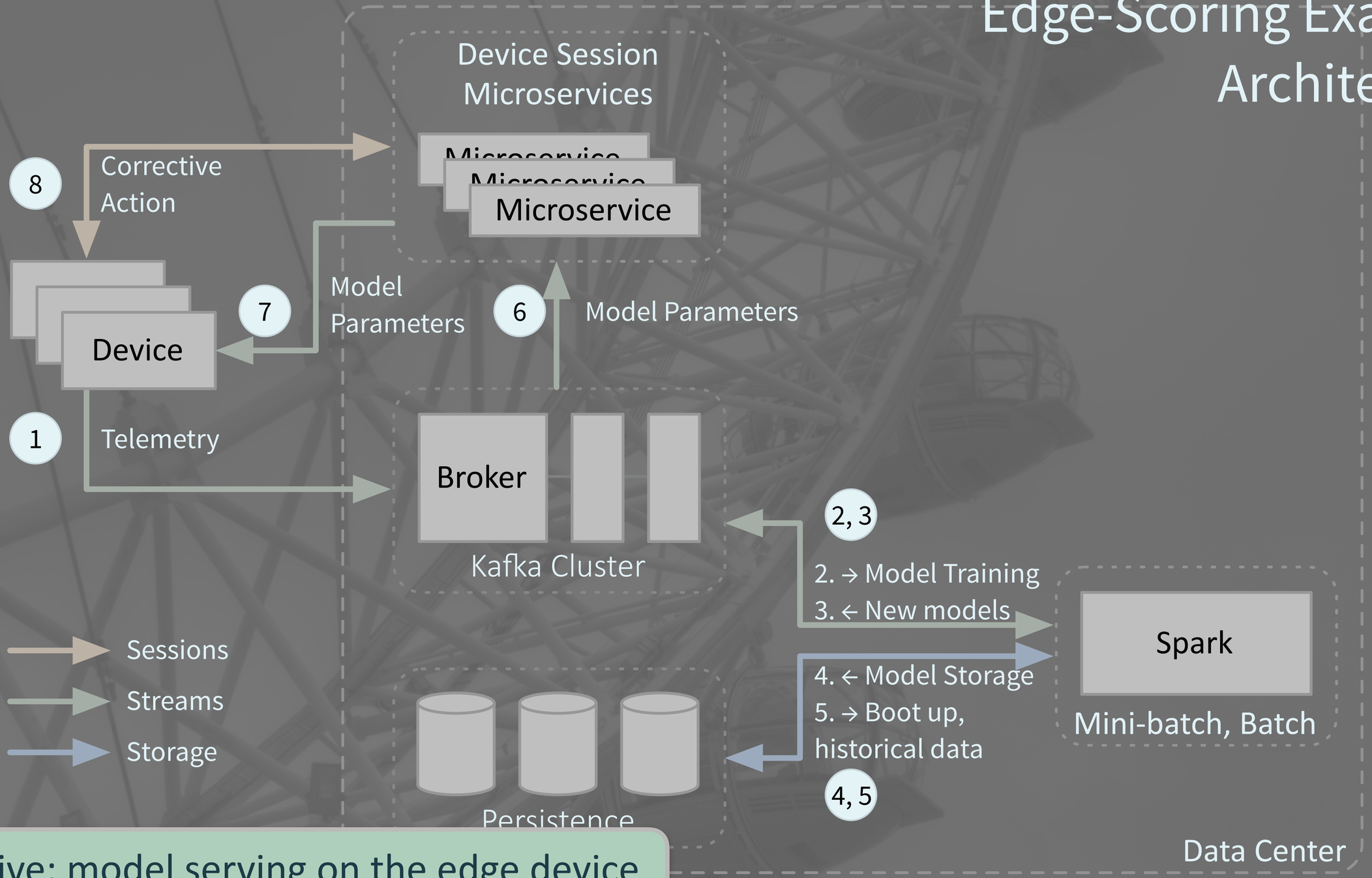


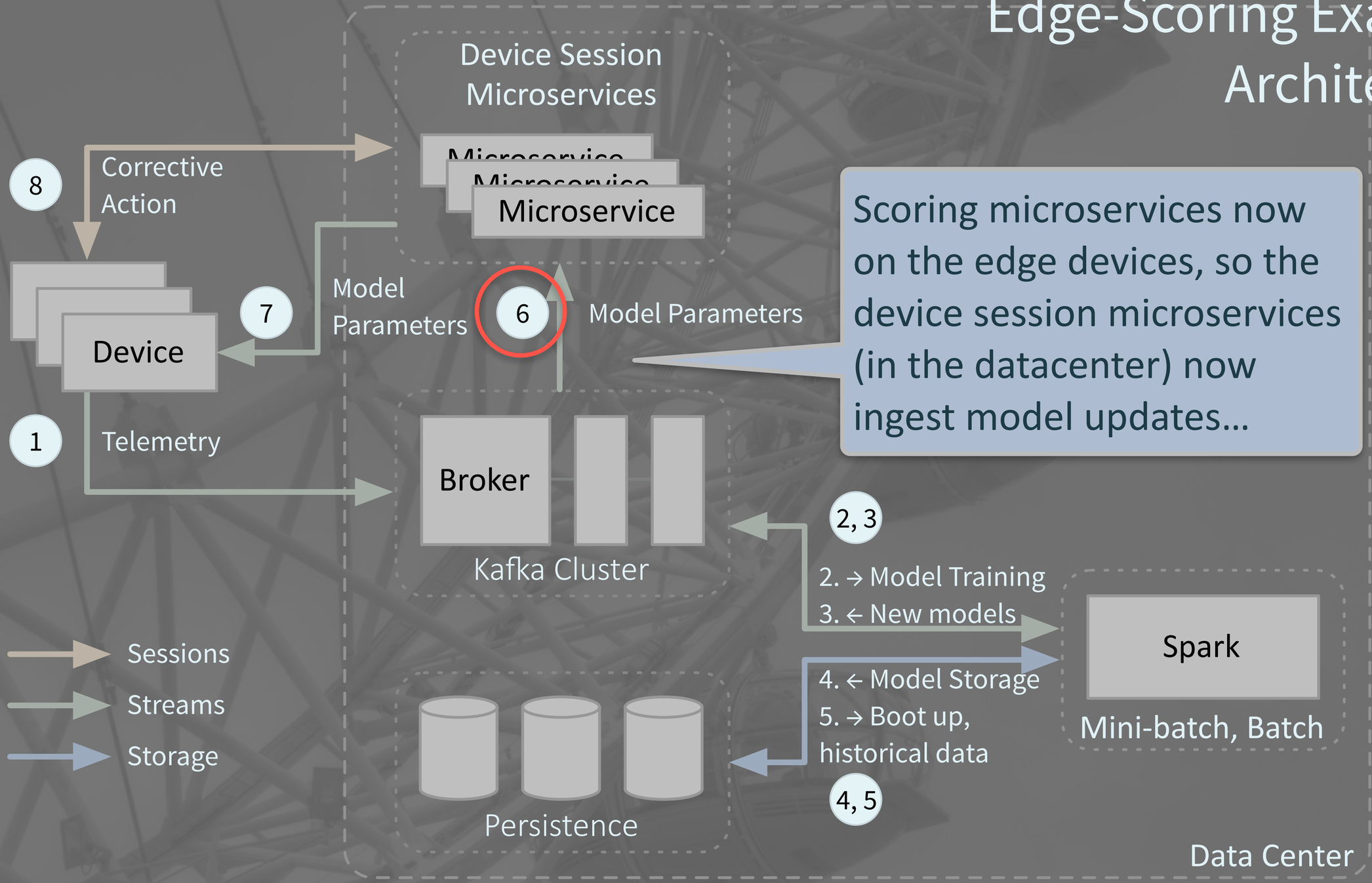
What we just discussed...

Edge-Scoring Example Architecture



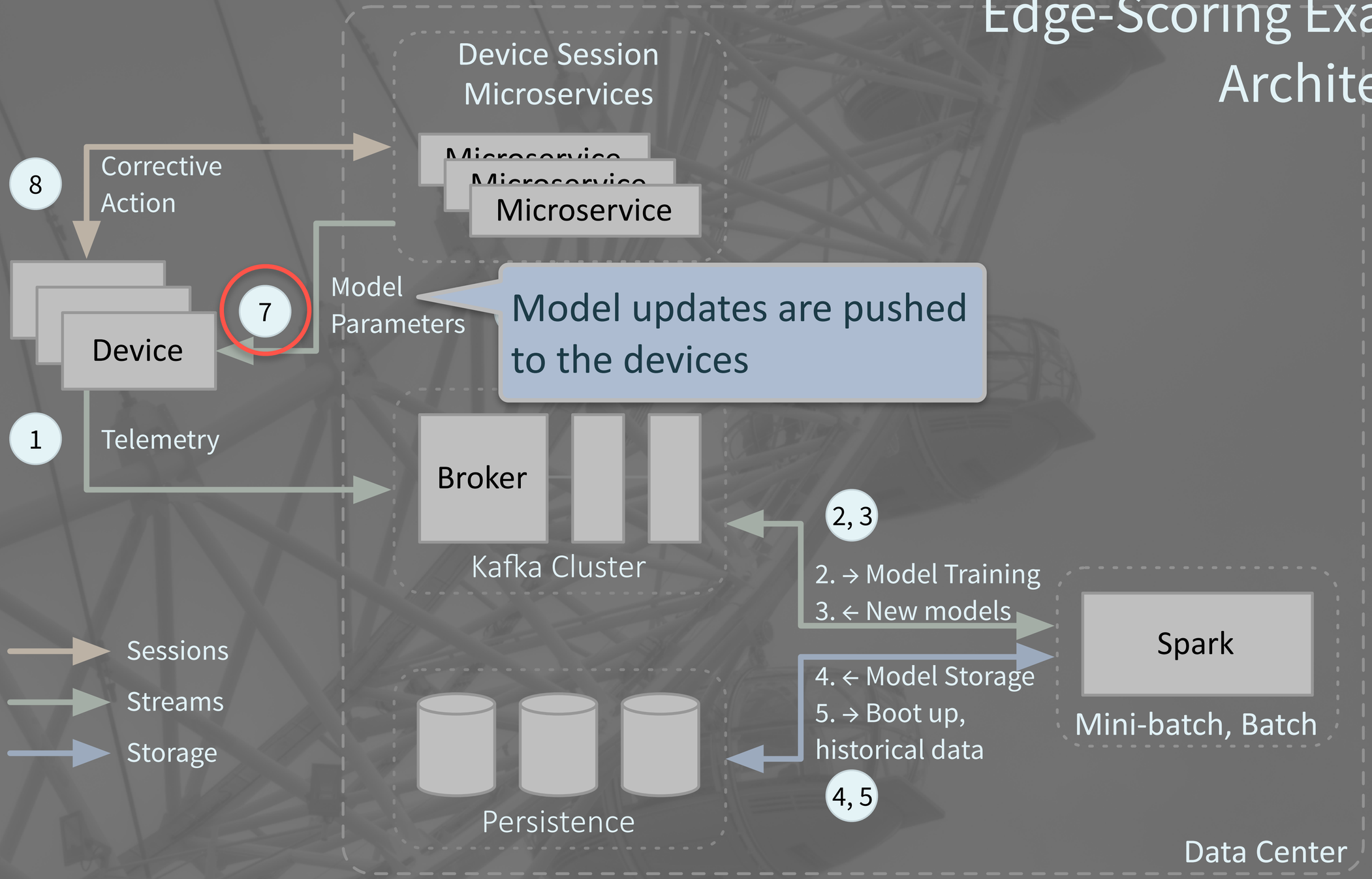
Alternative: model serving on the edge device

Edge-Scoring Example Architecture



Scoring microservices now on the edge devices, so the device session microservices (in the datacenter) now ingest model updates…

Edge-Scoring Example Architecture



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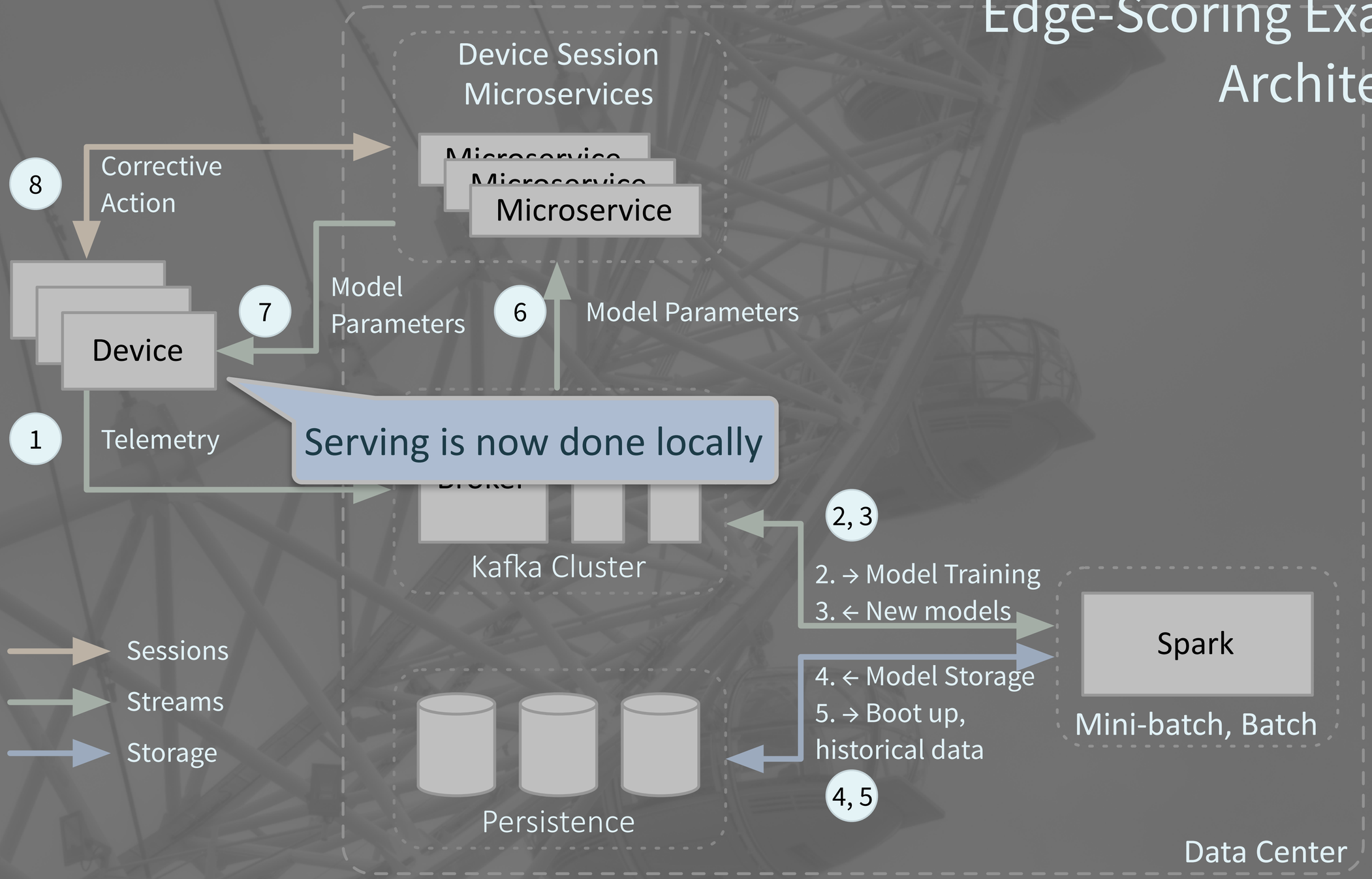

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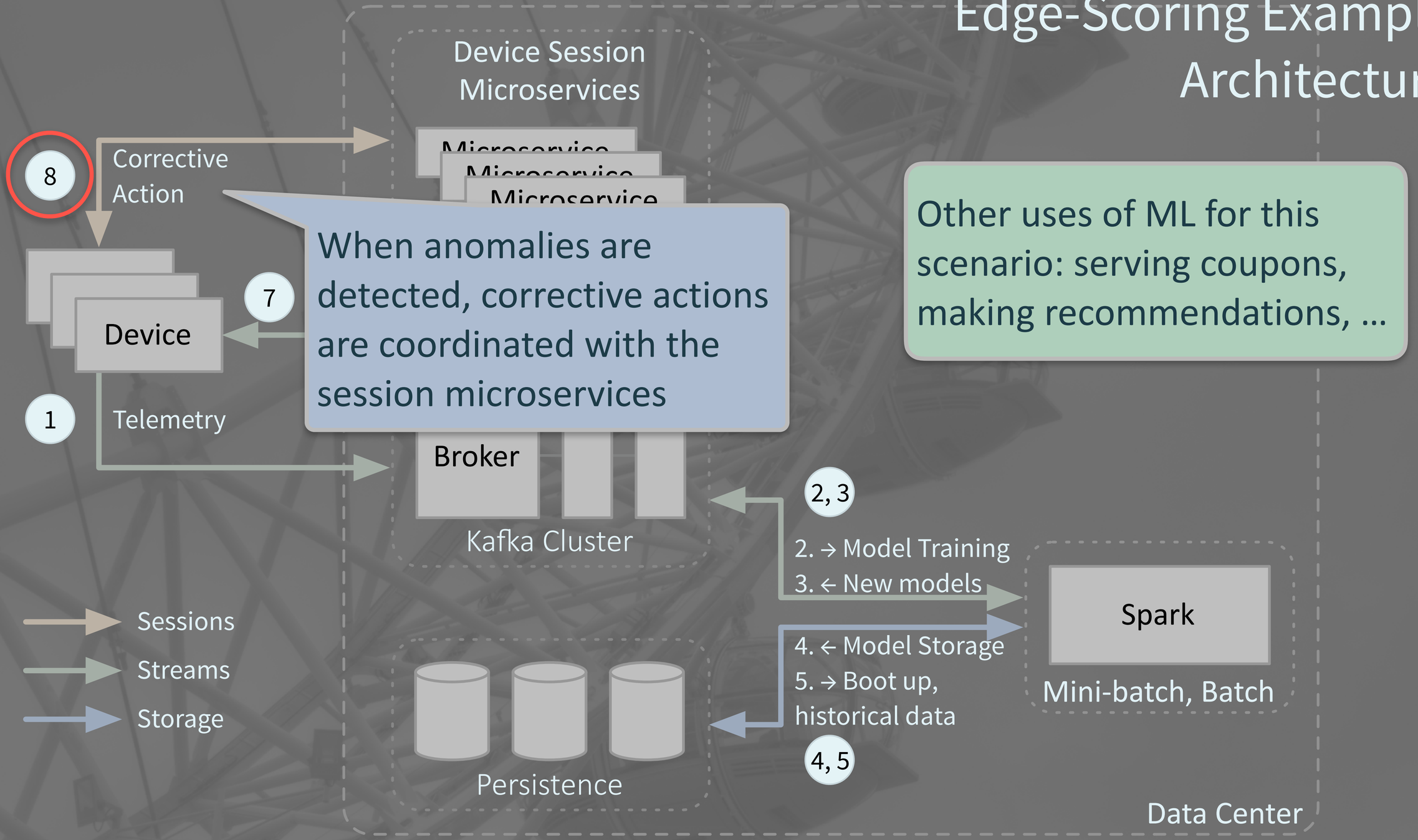

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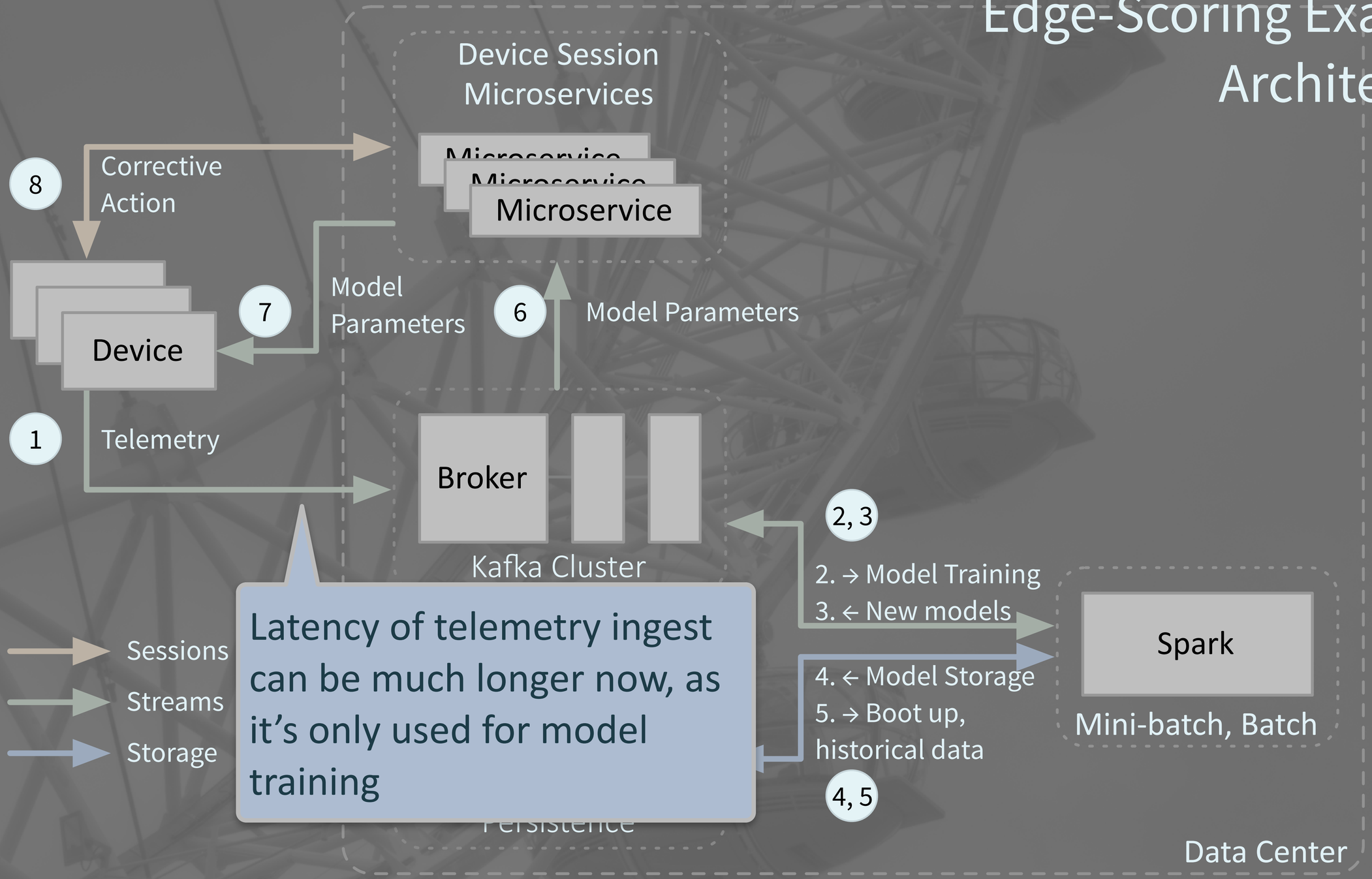

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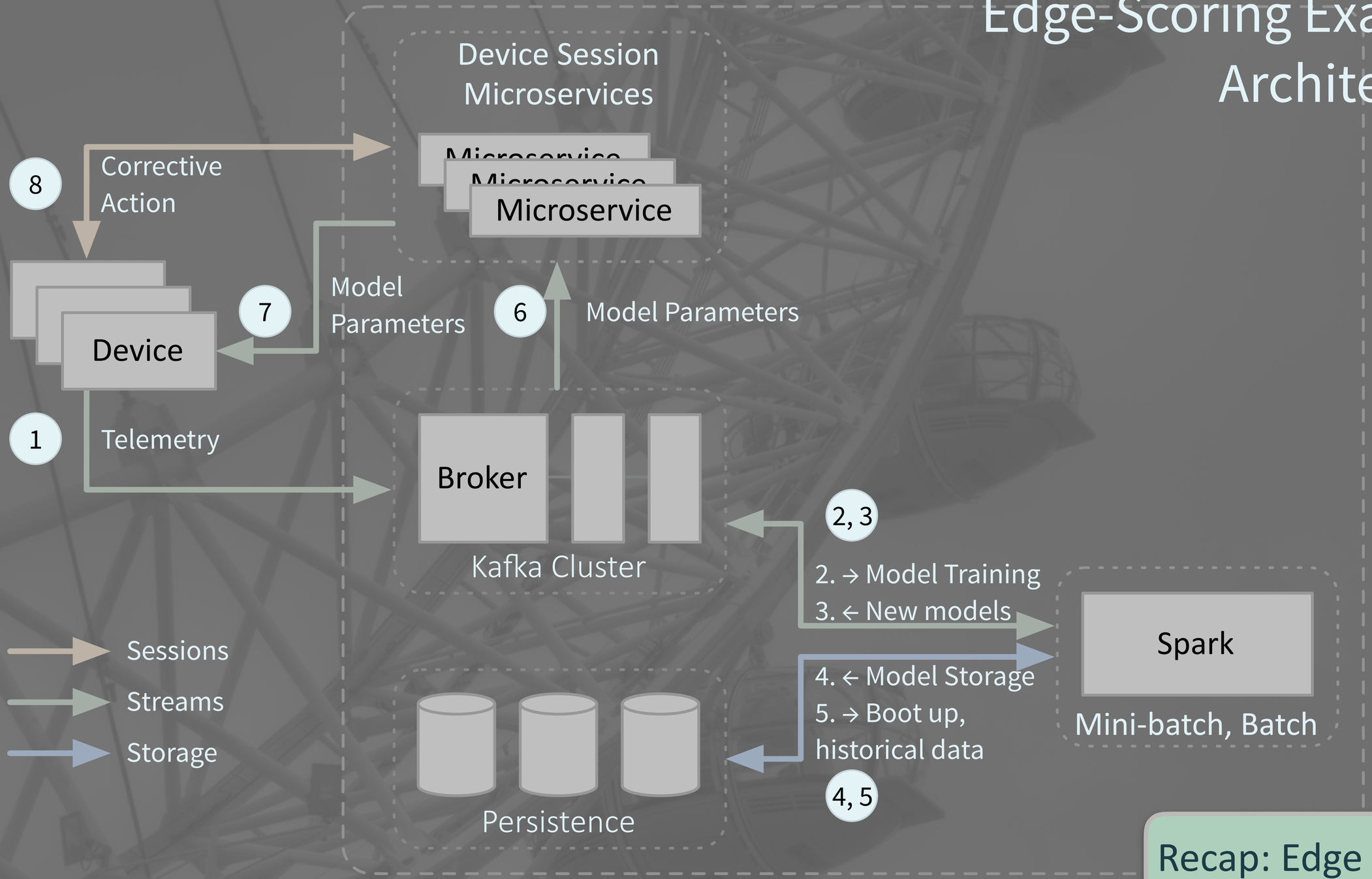
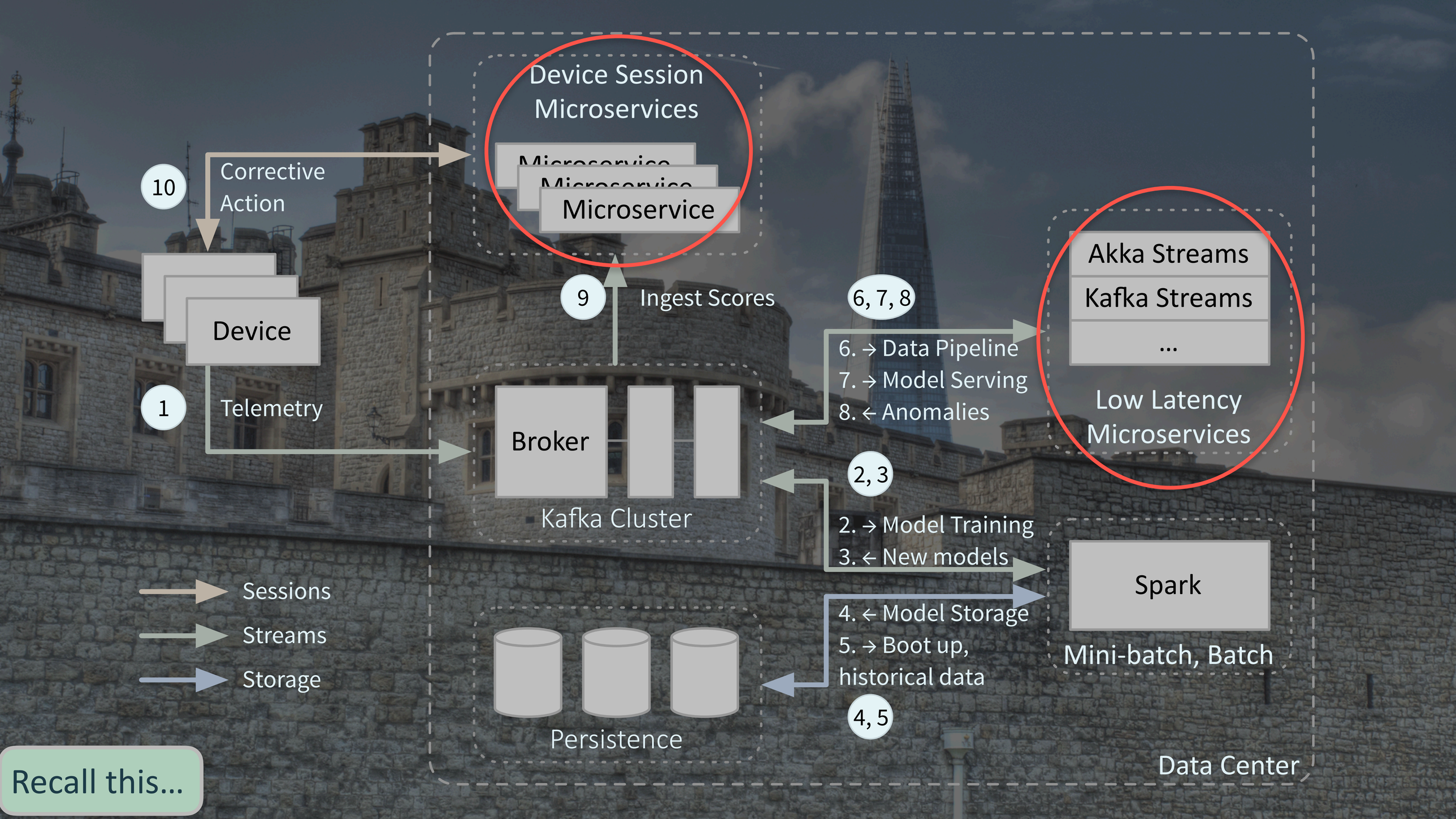


Recap: Edge Serving

More Challenges…

More Challenges…

How do you keep all this healthy for months and months??


Device Session Microservices
Microservice
10
Corrective Action
Device
1
Telemetry
9
Ingest Scores
Broker
Kafka Cluster
6, 7, 8
6. → Data Pipeline
7. → Model Serving
8. ← Anomalies
Akka Streams
Kafka Streams
...
Low Latency Microservices
2, 3
2. → Model Training
3. ← New models
4. ← Model Storage
5. → Boot up, historical data
4, 5
Spark
Mini-batch, Batch
Persistence
Sessions
Streams
Storage
Data Center
Recall this...

Why Microservices in Fast Data?

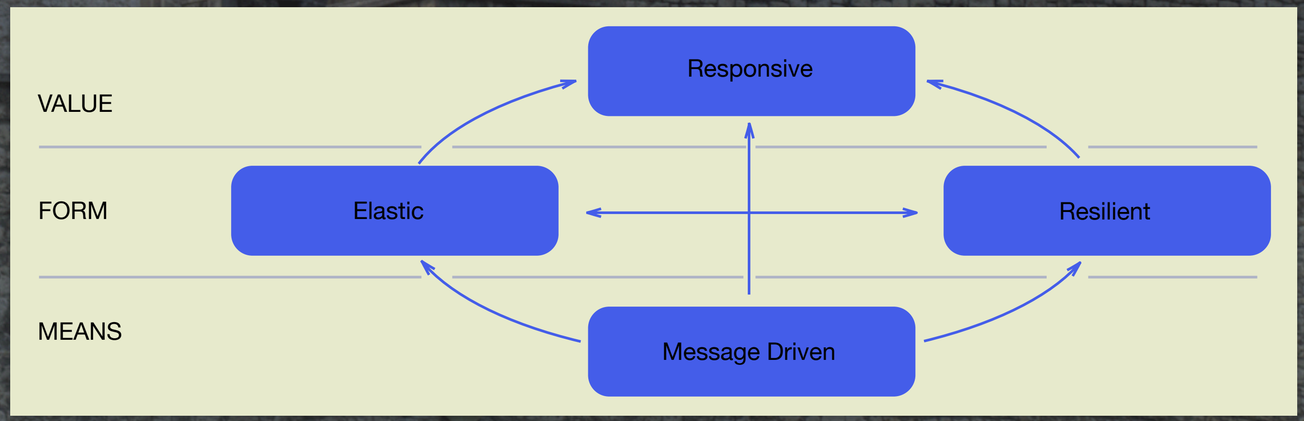
1. The trend is to run everything in big clusters using Kubernetes or Mesos
   - In the cloud or on-premise

Why Microservices in Fast Data?

2. If streaming gives you information faster…
   - … you'll want quick access to it in your other services!

Why Microservices in Fast Data?

3. Streaming raises the bar on data services
   - Compared to batch services, long-running streaming services must be more:
     - Scalable
     - Resilient
     - Flexible



https://www.reactivemanifesto.org/

Why Microservices in Fast Data?

4. This leads to our last major point…

Organizational Impact

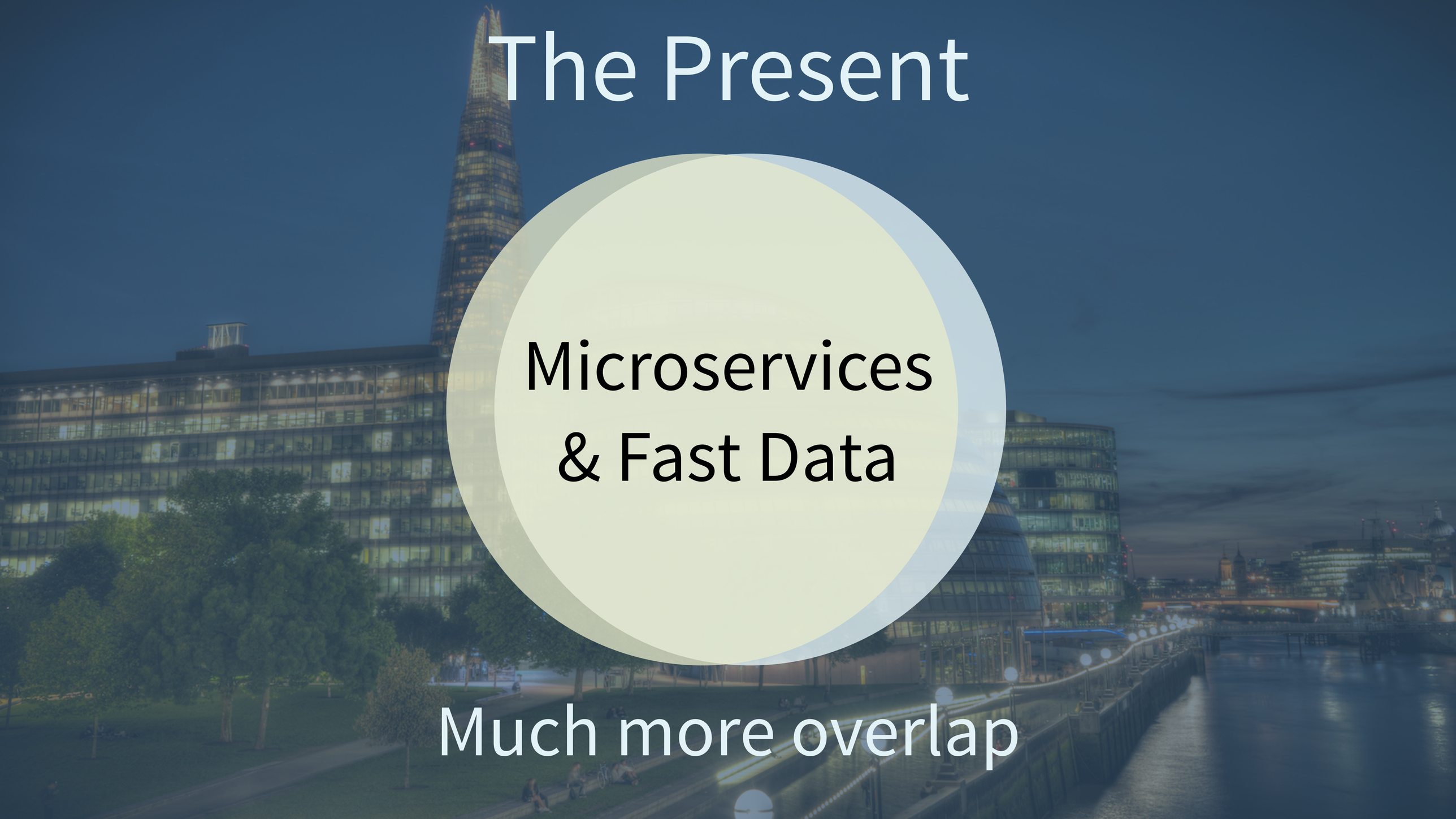
Organizational Impact

- Data scientists have to understand production issues
- Data engineers have to become good at highly-available microservices
- Microservice engineers have to become good at data

The Past

Some overlap in concerns, architecture

The Present



Much more overlap

The Future?

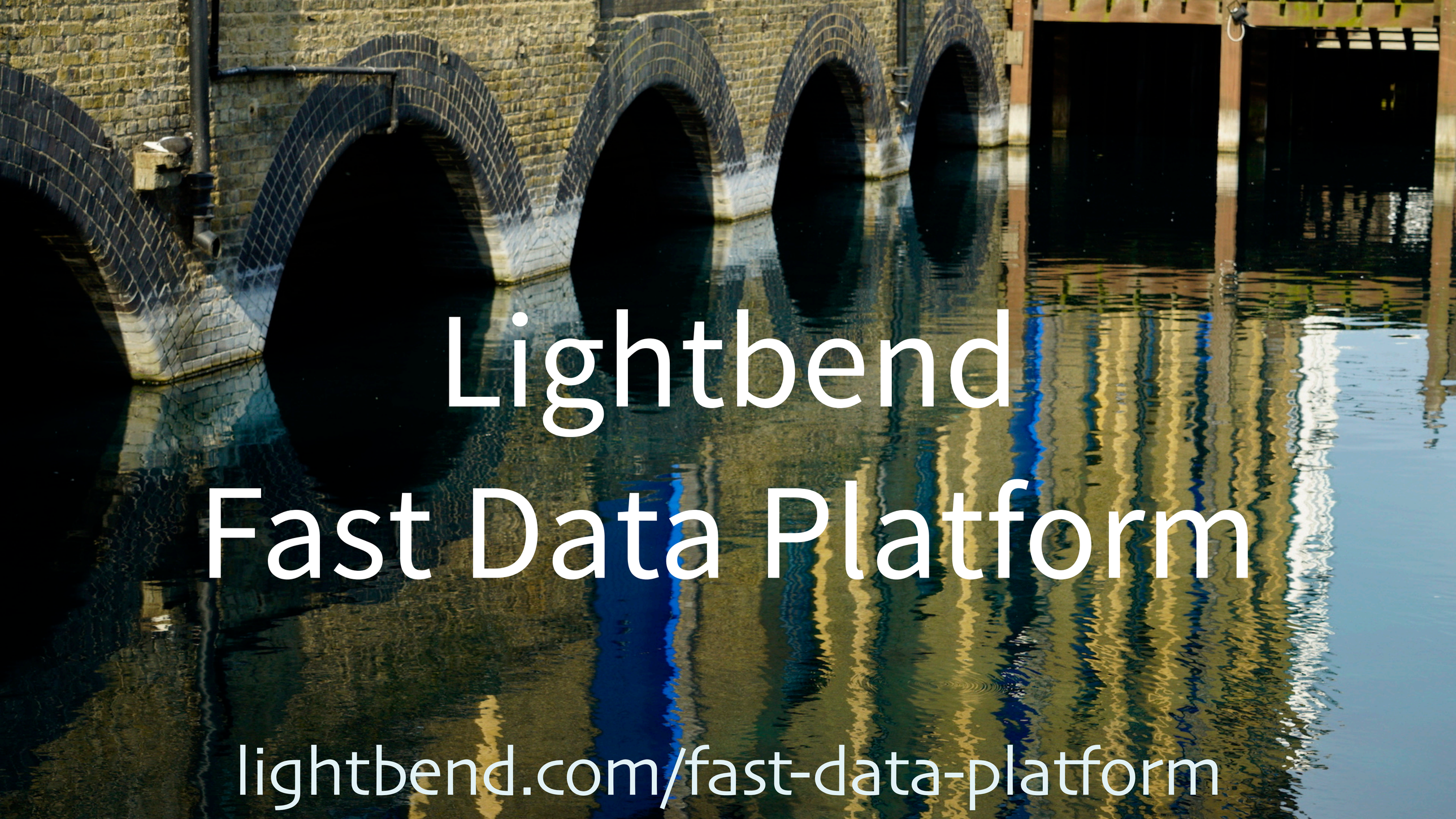
Why? Since streams process data incrementally, there is less need for large-scale tools like Spark, Flink

… and using microservices for everything simplifies development, deployment, and operations

Microservices *for* Fast Data

Unclear if this helps to integrate with the data science workflows we love.

Much more microservice focused?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Fast Data Platform
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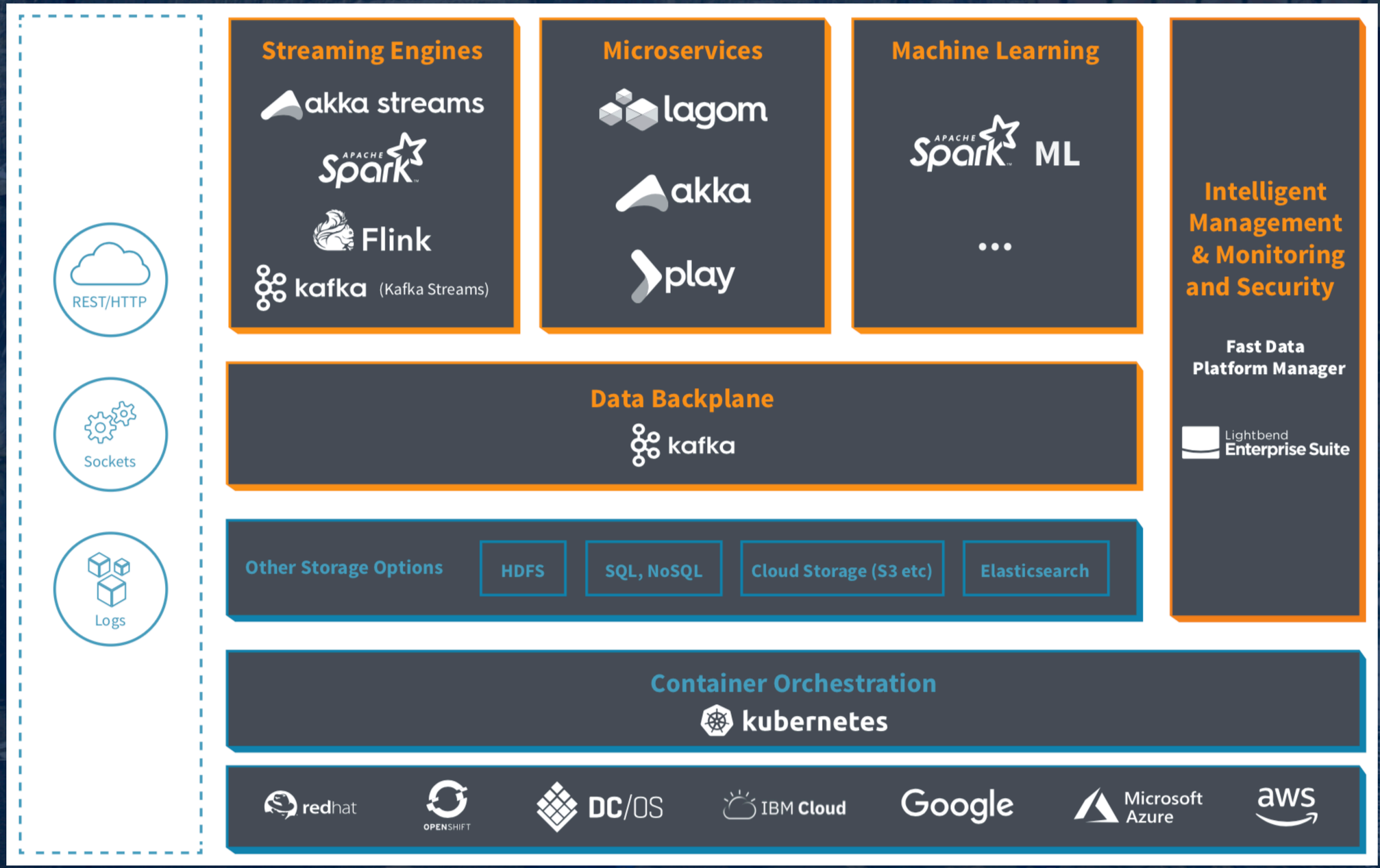

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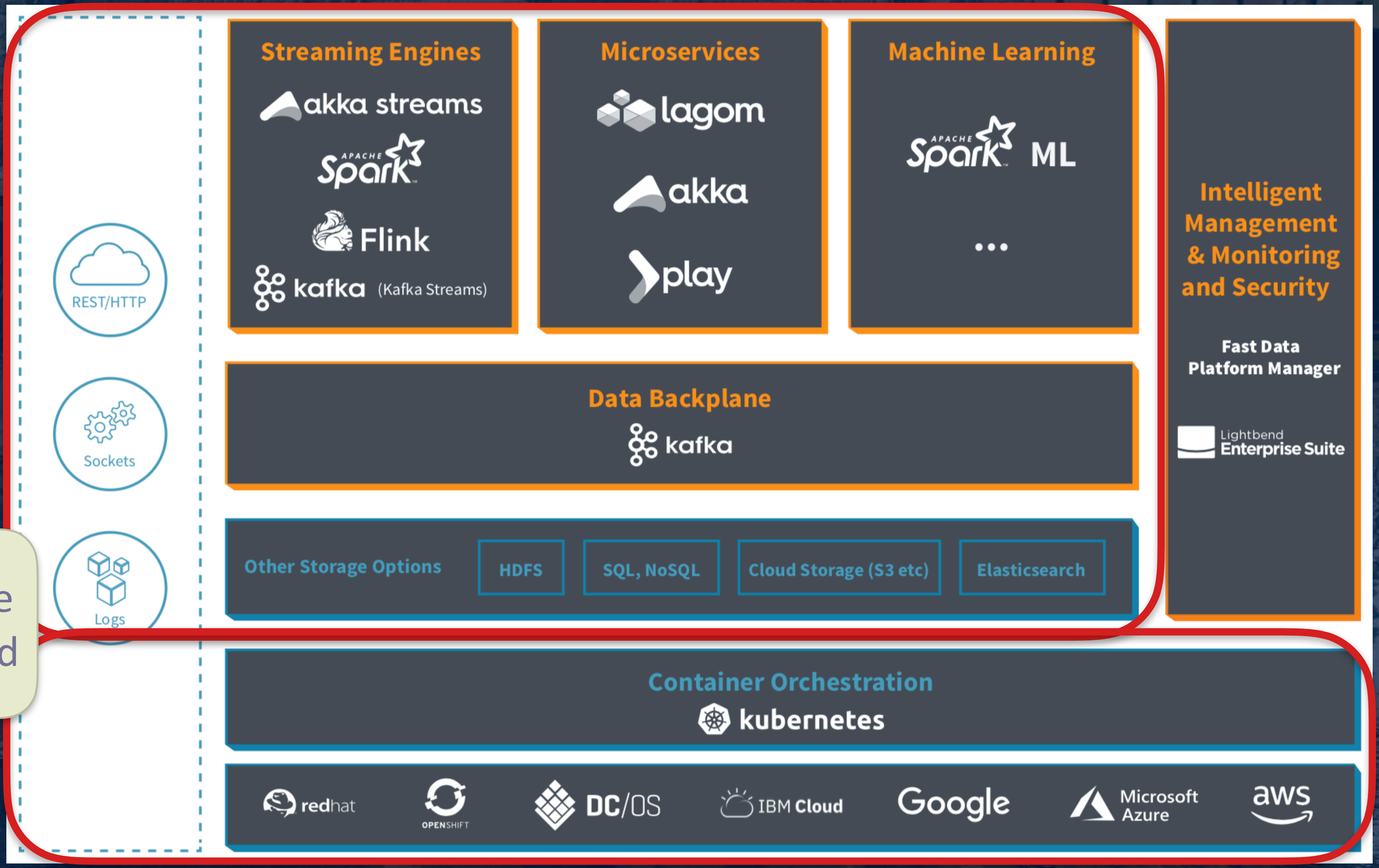

What we discussed

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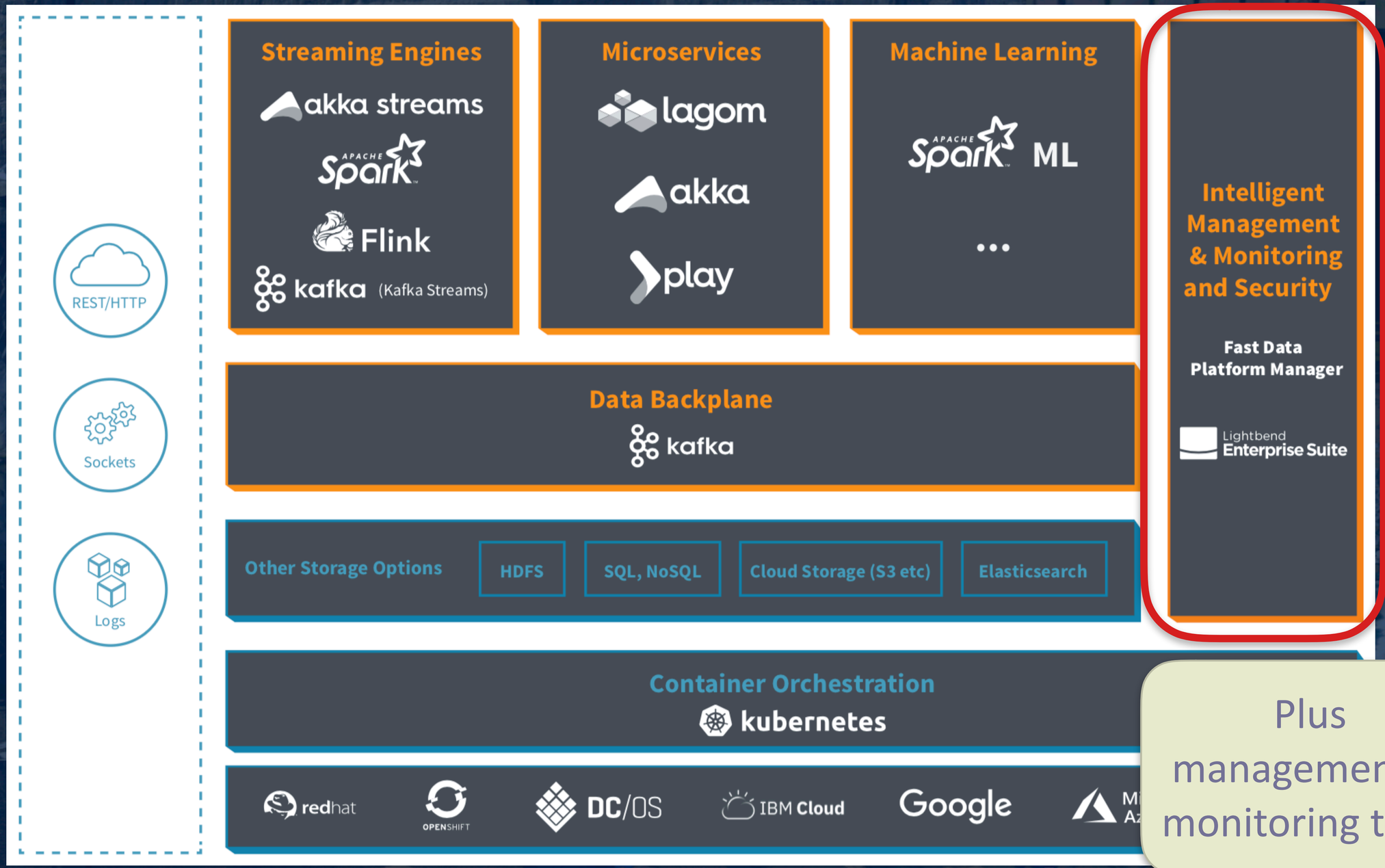

Plus management & monitoring tools

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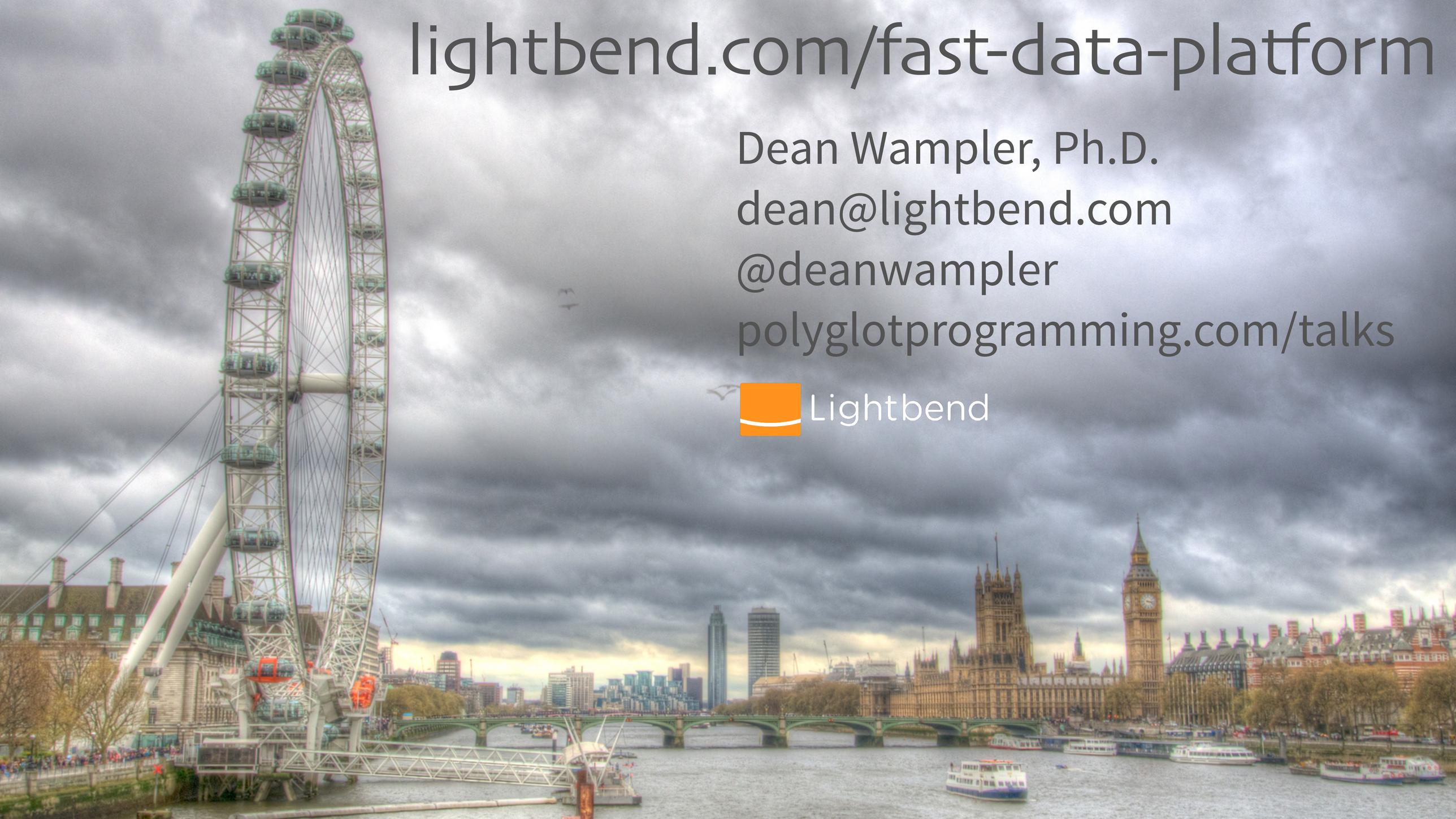

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