Backwaters: Security Streaming Platform

Comcast TPX Security Solutions Engineering (SSE)

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Agenda

- Apache Kafka Overview
- Intelligence Driven Security
- Methods of Receiving Logs
- Architecture of Backwaters: Security Streaming Platform
- How security utilizes Apache Kafka's API

Apache Kafka Overview

Apache Kafka is a distributed streaming platform which has three key capabilities:

- Publish and subscribe to streams of records, similar to a message queue
- Store streams of records in a fault-tolerant durable way
- Process streams of records as they occur

Kafka is generally used for two broad classes of applications:

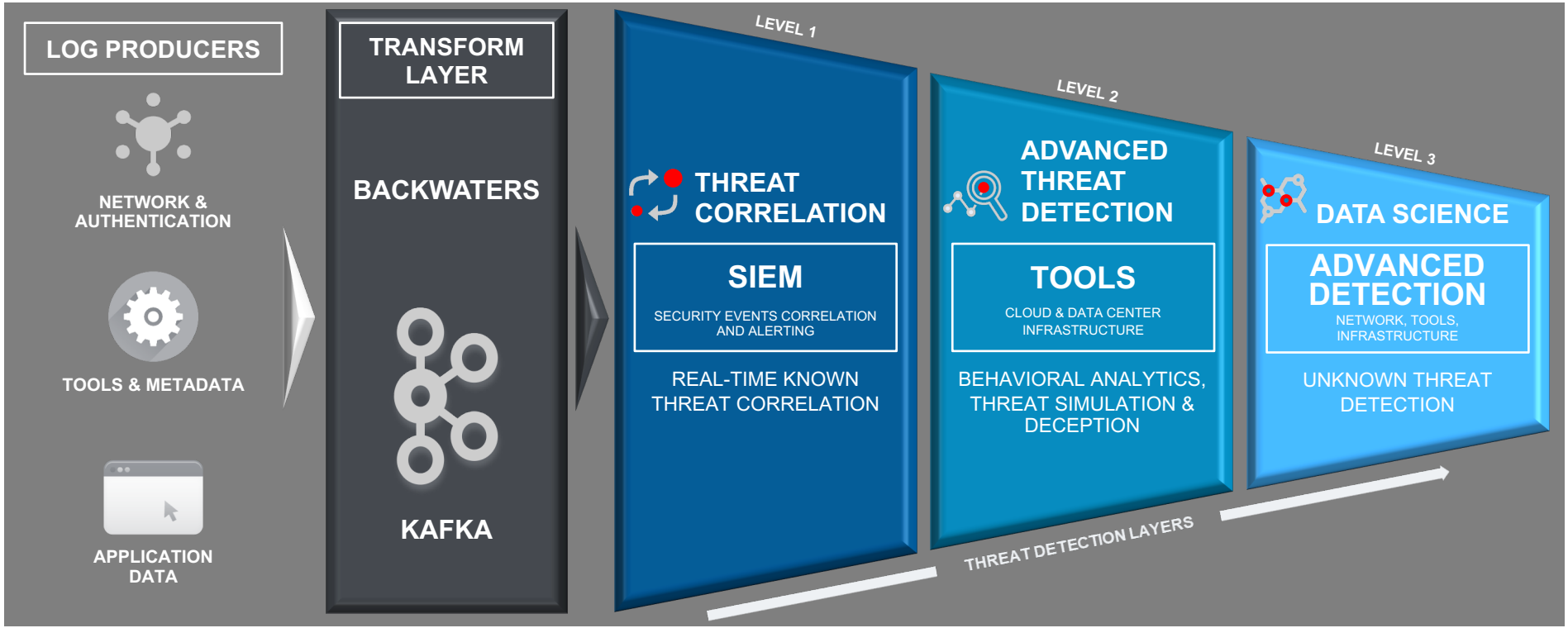
- Building real-time streaming data pipelines that reliably get data between systems or applications
- Building real-time streaming applications that transform or react to the streams of data

Kafka includes four core data-centric APIs:

- Producer
- Consumer
- Streams
- Connector

Reference: *https://kafka.apache.org/documentation/#gettingStarted*

Intelligence Driven Security



Methods of Receiving Logs

Comcast Data Centers

Options:

- Kafka Producer
- Syslog Producer

Amazon Web Services Cloud

Options:

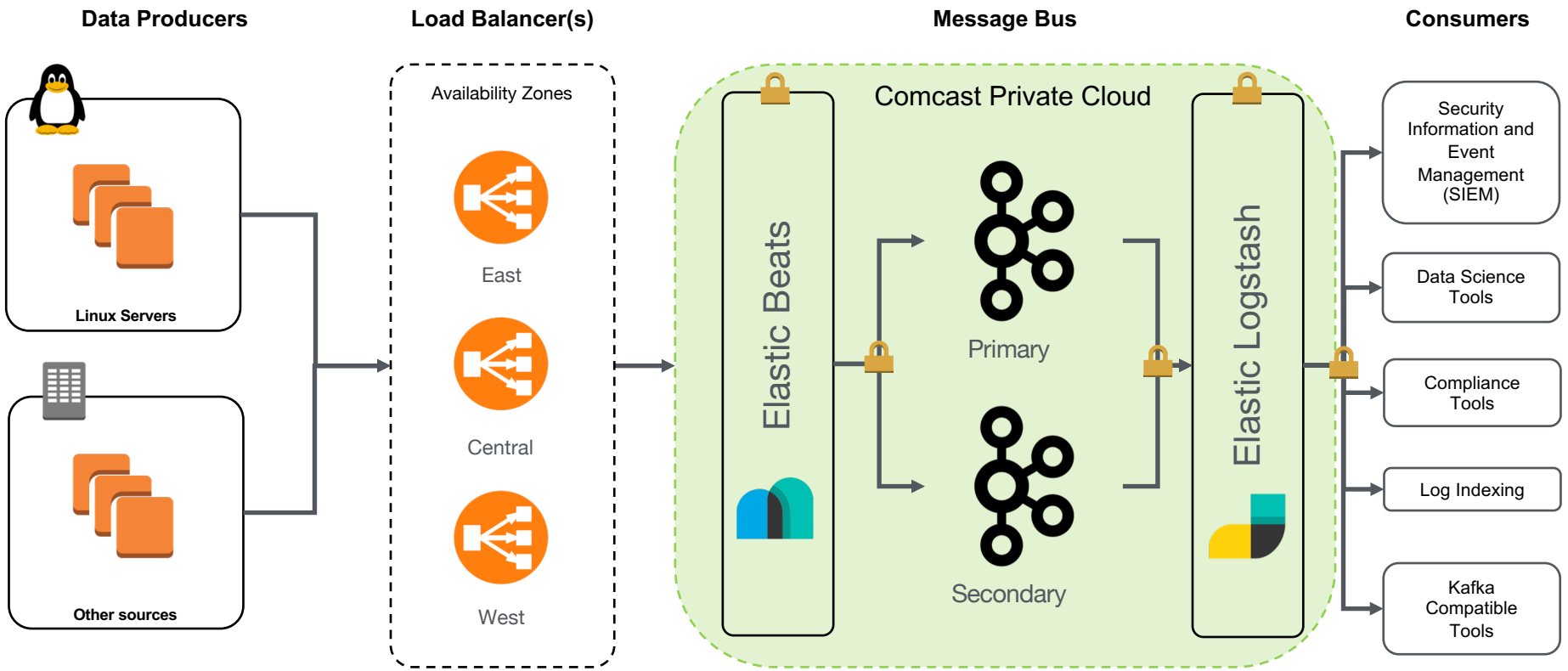
- EC2 Producer
- Lambda Producer

Microsoft Azure Cloud

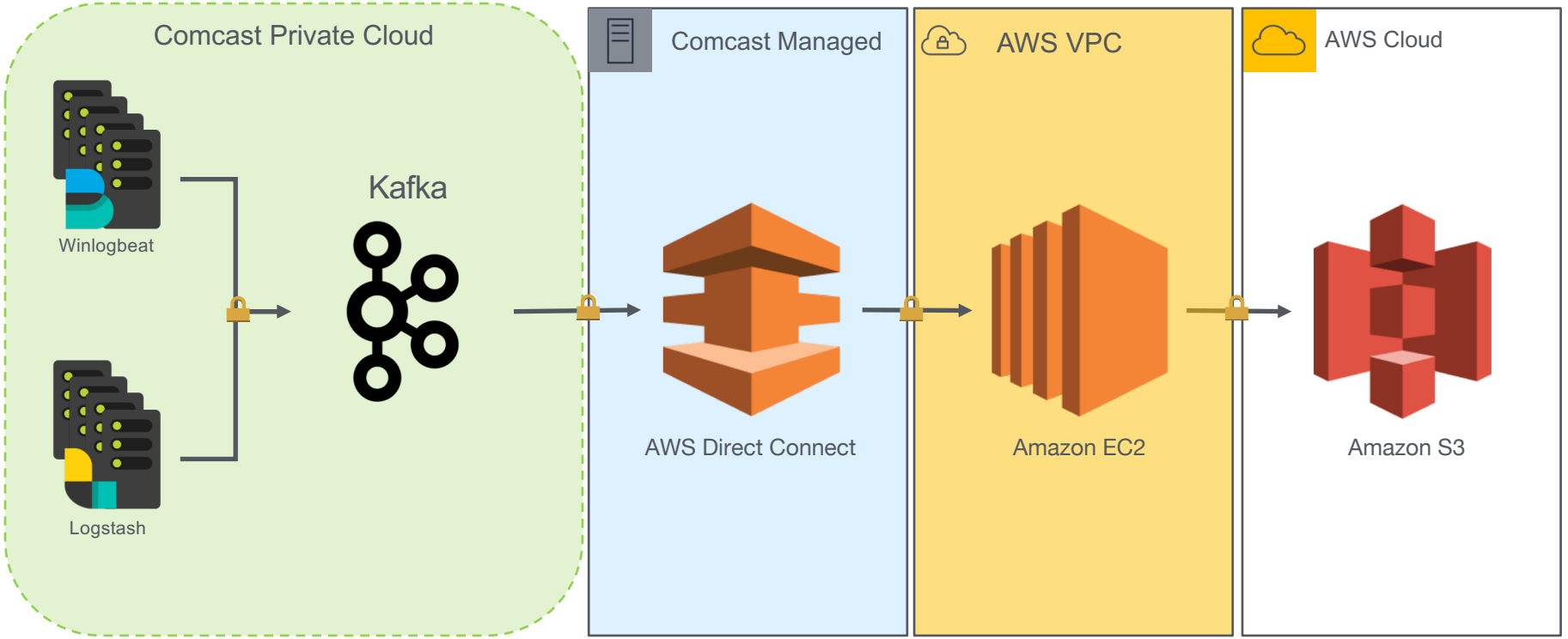
Options:

- Azure Functions Producer
- Azure VM Producer

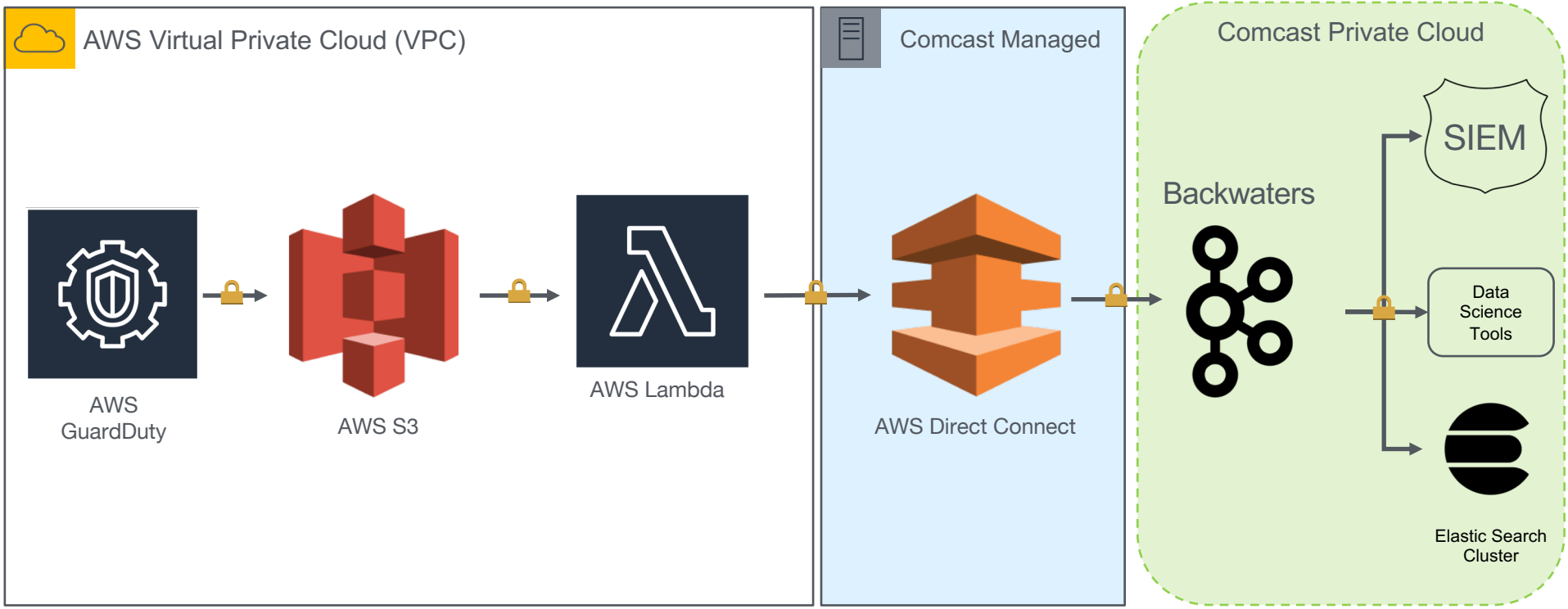
Syslog Ingest Path



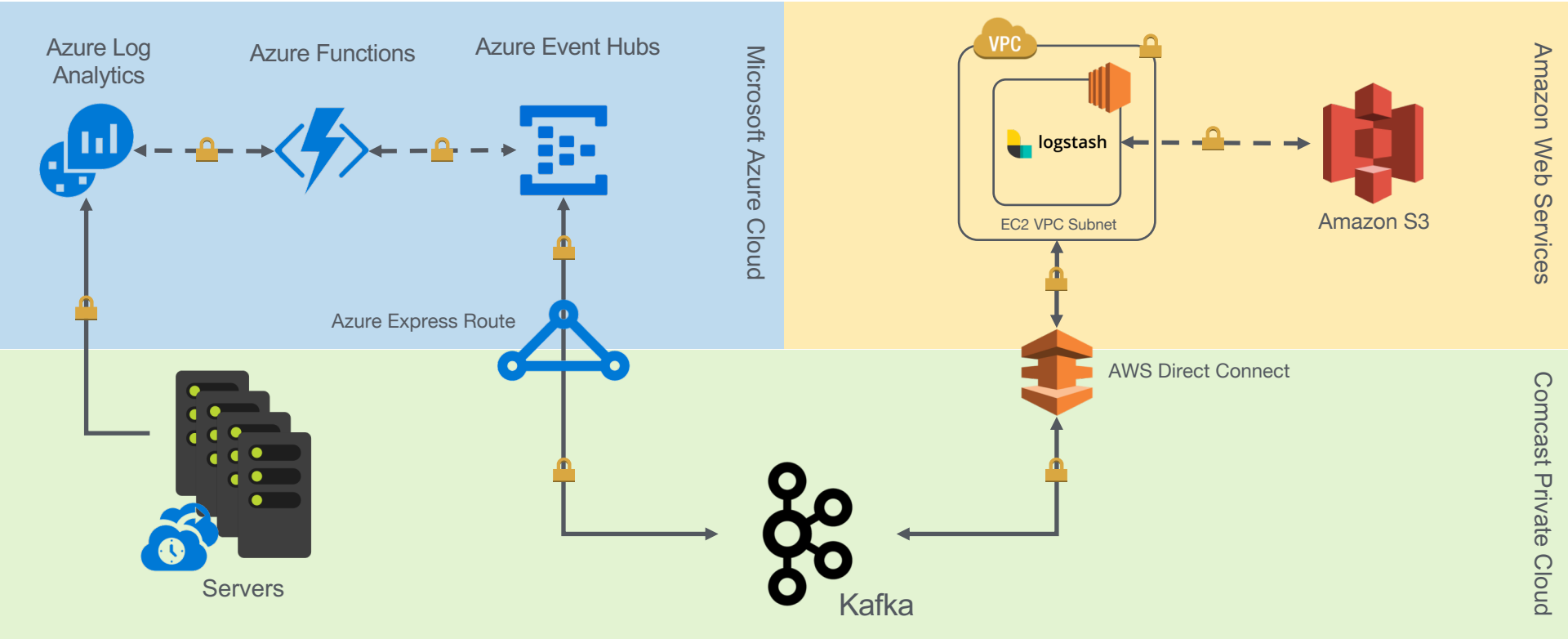
AWS Consumer Path



AWS Ingest Path



Backwaters Multi-Tenant Data Framework



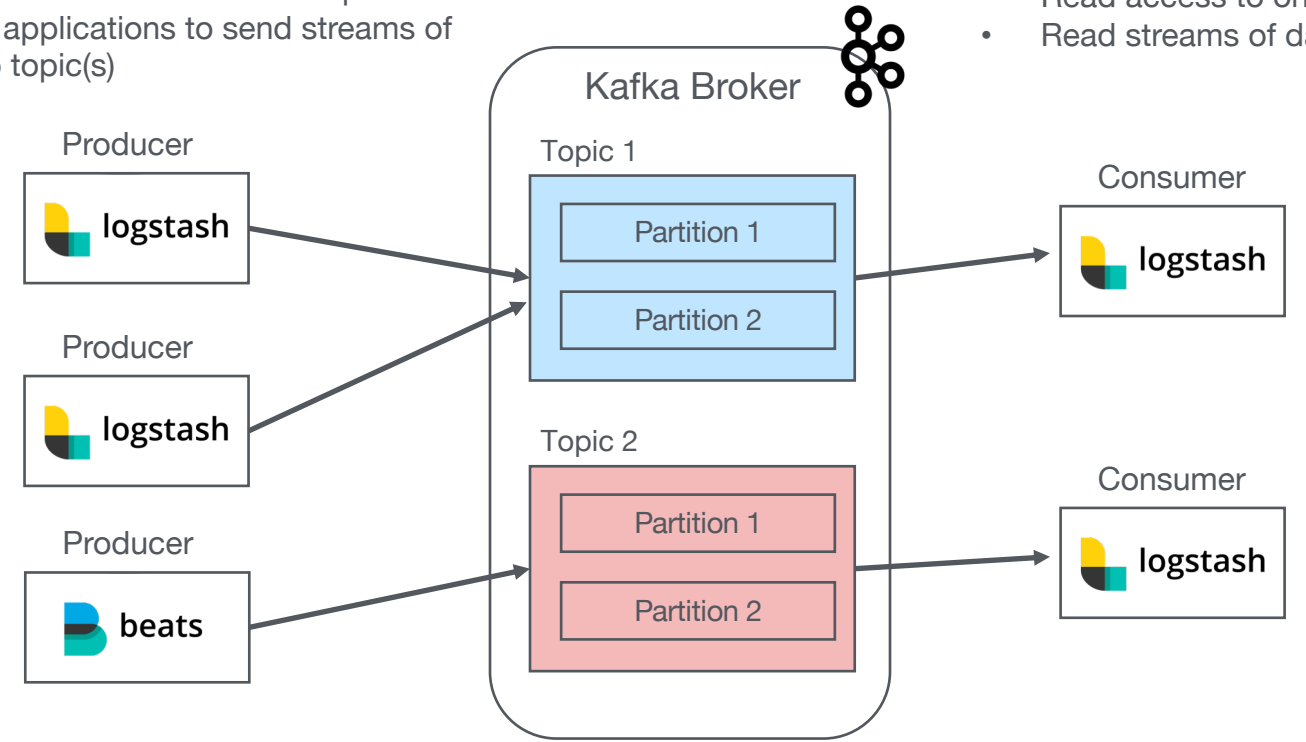
Apache Kafka's API

- The **Producer** API allows an application to publish a stream of records to one or more Kafka topics
- The **Consumer** API allows an application to subscribe to one or more topics and process the stream of records produced to them
- The **Streams** API allows an application to act as a *stream processor*, consuming an input stream from one or more topics and producing an output stream to one or more output topics, effectively transforming the input streams to output streams
- The **Connector** API allows building and running reusable producers or consumers that connect Kafka topics to existing applications or data systems. For example, a connector to a relational database might capture every change to a table
- The **AdminClient** API allows managing and inspecting topics, brokers, and other Kafka objects

Apache Kafka Producer/Consumer API

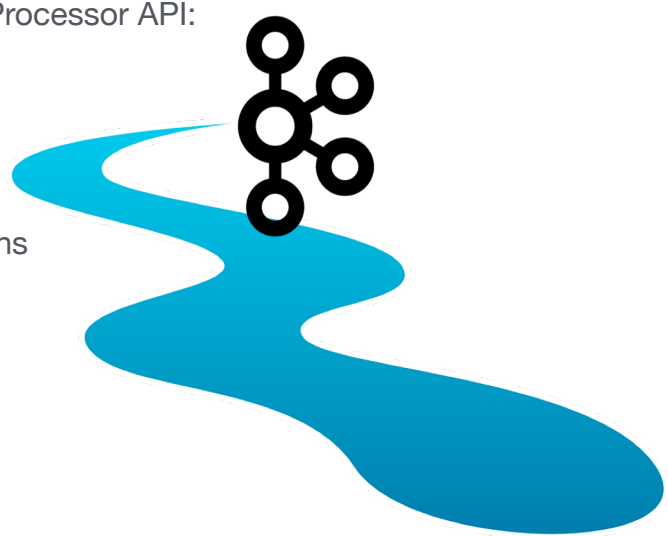
The Producer API:
- Write access to one or more topics
- Allows applications to send streams of data to topic(s)

The Consumer API:
- Read access to one or more topics
- Read streams of data from topic(s)



Apache Kafka Streams API

- High level abstraction language using Java's API
- Unbounded, continuous real-time flow of records
  - *You don't need to explicitly request new records, you just receive them*
- **Domain Specific Language (DSL)** is built on top of the Streams Processor API:
  - Built-in abstractions for streams and tables:
    - **Kstream**: append-only ledger (`INSERT` only)
    - **Ktable**: `UPSERT` changelog stream for one partition
    - **GlobalKTable**: `UPSERT` changelog stream for all partitions
  - Supports stateless and stateful transformations:
    - **Map**: unique keys to values
    - **Filter**: evaluate Boolean to retain or drop elements
    - **Aggregations** (e.g. count, reduce)
    - **Joins** (e.g. Inner, Left, Outer)
    - **Windowing** (e.g. *group records that have the same key*)



Kafka Streams API (Transform)

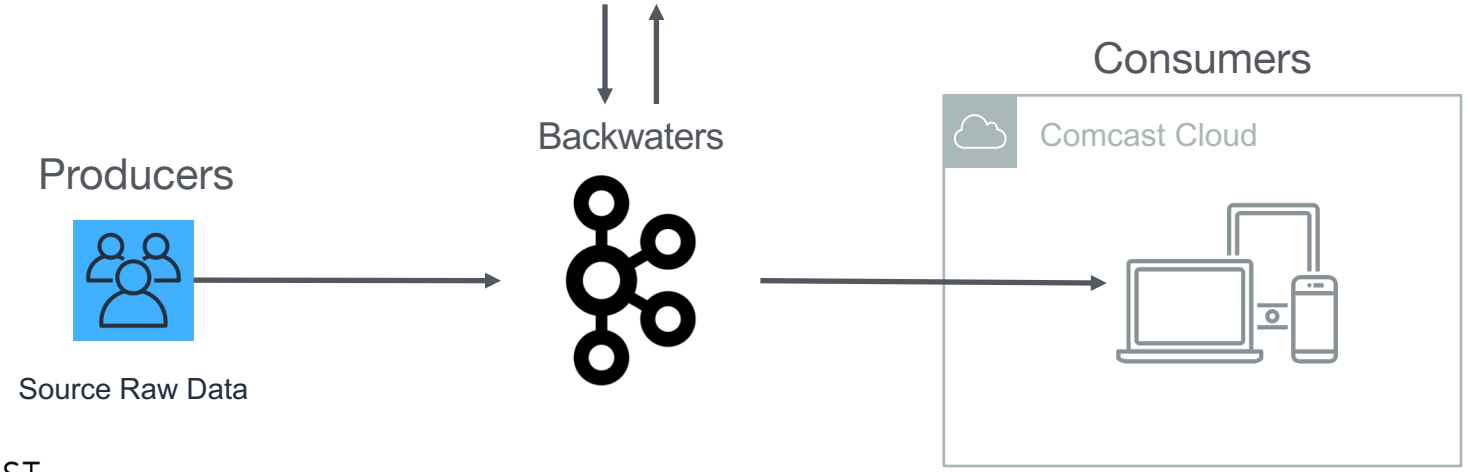
Kafka Streams app transform object(s) and write to new topic

Raw Topic

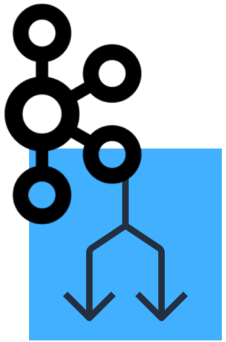
```
"2019-01-10 20:20:39"; \
"alice"; \
"Windows"; \
"Desktop"; \
"10.0.0.126"
```

Parsed Topic

```
{
  "timestamp": "2019-01-10 20:20:39",
  "username": "alice",
  "os": "Windows",
  "systemType": "Desktop",
  "ipAddress": "10.0.0.126"
}
```



Apache Kafka Connect API



- Connectors tool for scalably and reliably streaming data between Kafka and other systems
  - *Kafka Connect is intended to be run as a service*
- Kafka Connect currently supports two modes of execution:
  - **Standalone**: all work is performed in a single process (*Simplest*)
  - **Distributed**: handles automatic balancing of work, allows you to scale up (or down) dynamically
- **Core Concepts and APIs**:
  - Connectors come in two flavors (e.g. Pull or Push):
    - **SourceConnectors**: import data (e.g. `JDBCSourceConnector` would import relational database)
    - **SinkConnectors**: export data (e.g. `HDFSSinkConnector` export topic to an HDFS file)
  - Connectors are responsible for breaking jobs into a set of Tasks:
    - **SourceTask**: pull interface with two APIs, `commit` and `commitRecord`
    - **SinkTask**: push interface
  - REST API Layer:
    - View the status/configuration of connectors
    - Alter current behavior (e.g. change config or restart task

Kafka Connect API (SourceConnectors)

Kafka Streams app transform object(s) and write to new topic

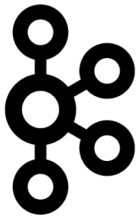
timestamp	user	os	type	ipAddress
2019-01-10 20:20:39	Alice	OSX	Desktop	10.0.0.126

Parsed Topic

```
{
  "timestamp": "2019-01-10 20:20:39",
  ”user": "alice",
  "os": "Windows",
  ”type": "Desktop",
  "ipAddress": "10.0.0.126"
}
```

Kafka Connect app performing
JDBC connection to database

Backwaters



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Questions?