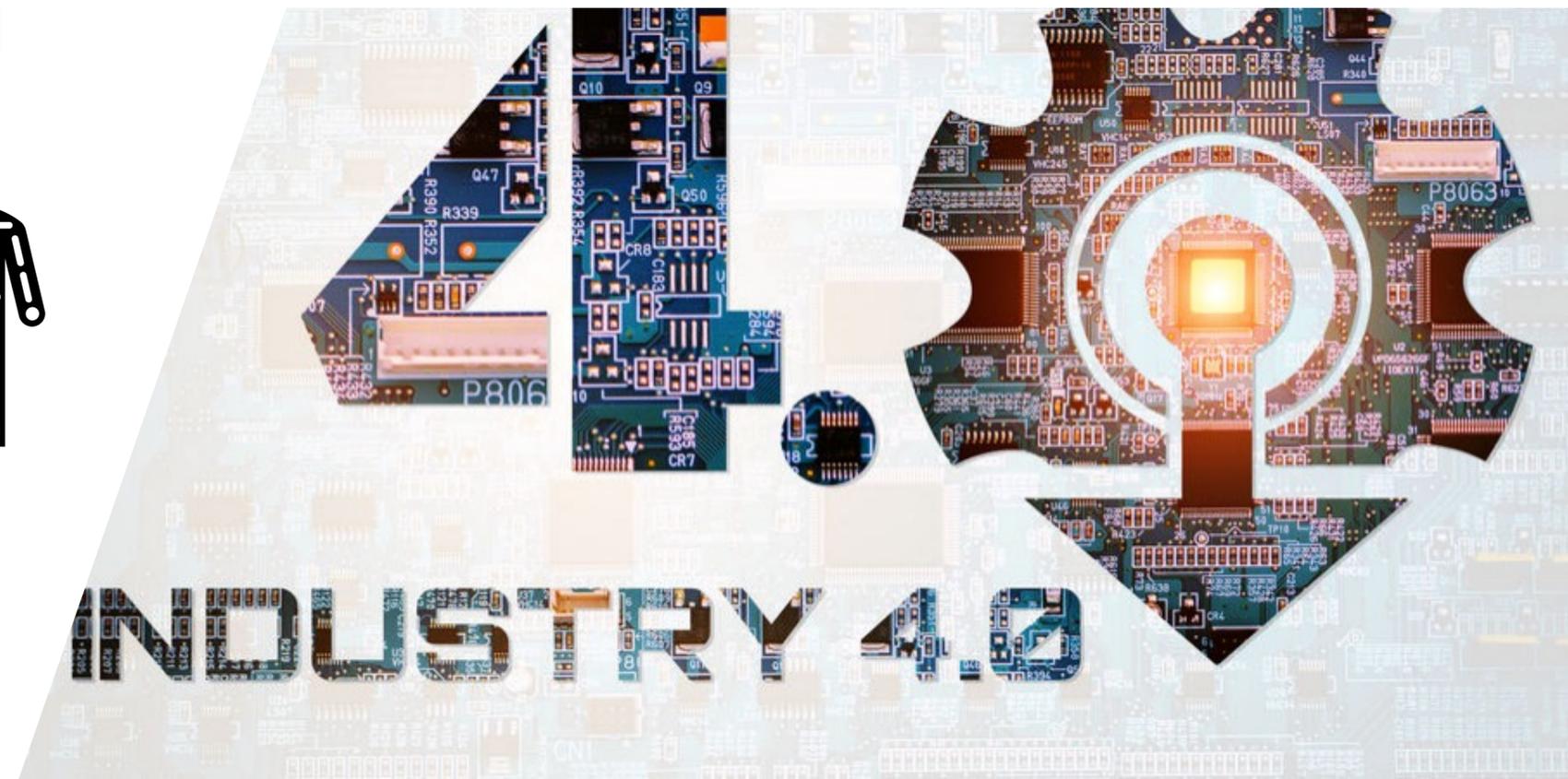
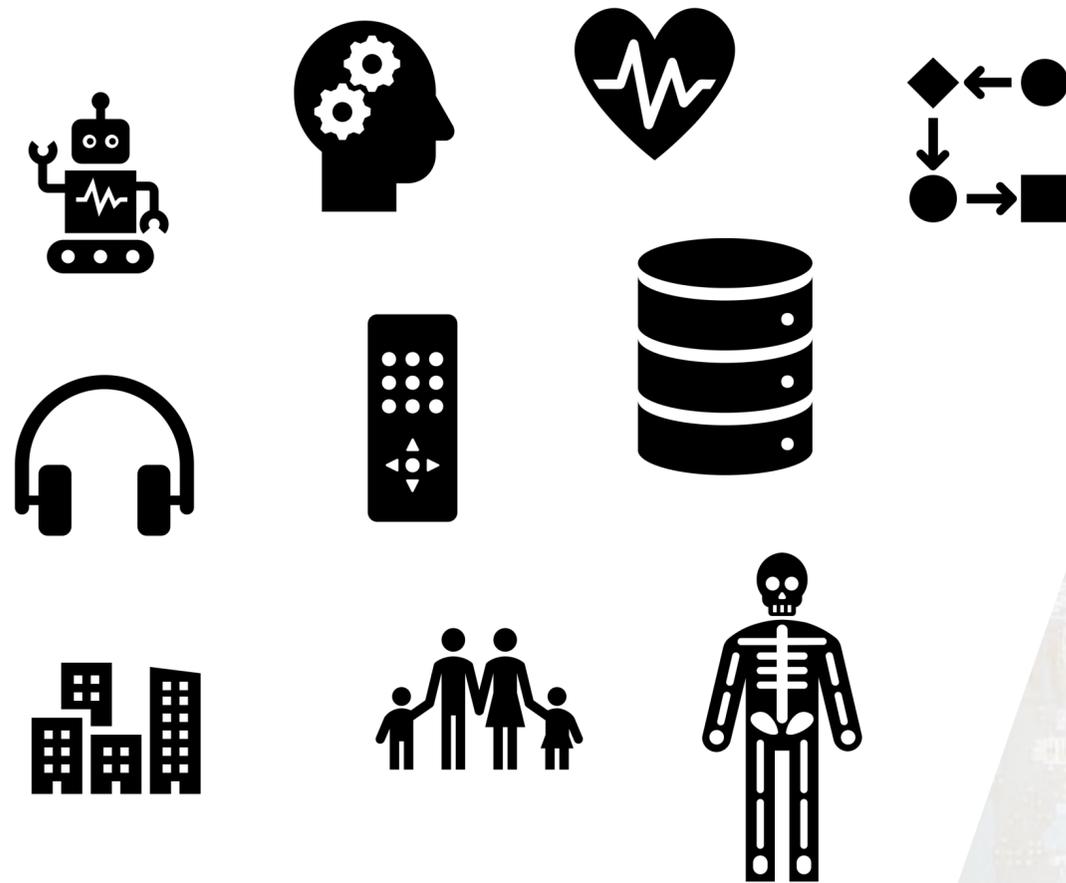
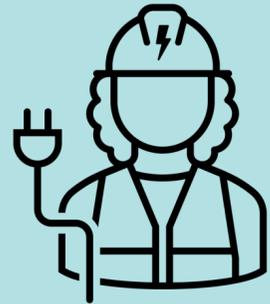


kafka for Industrial IoT



Real-time Data beats **Slow Data**.

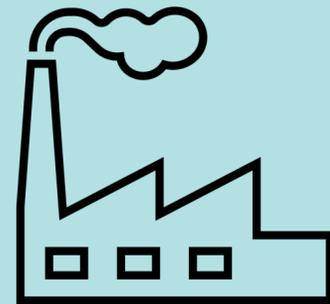


Manufacturing

Sensor diagnostics

MES/ERP Integration

Reporting



Edge Computing

Condition Monitoring

Predictive
Maintenance

Quality Assurance



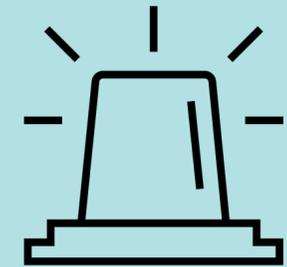
Logistics

Supply Chain

Inventory
management

Track & Trace

Context-specific
routing



Cybersecurity

Threat detection

Intrusion detection

Incident response

Military decisions



This is a fundamental paradigm shift...



Cloud-Native

Future of the
datacenter

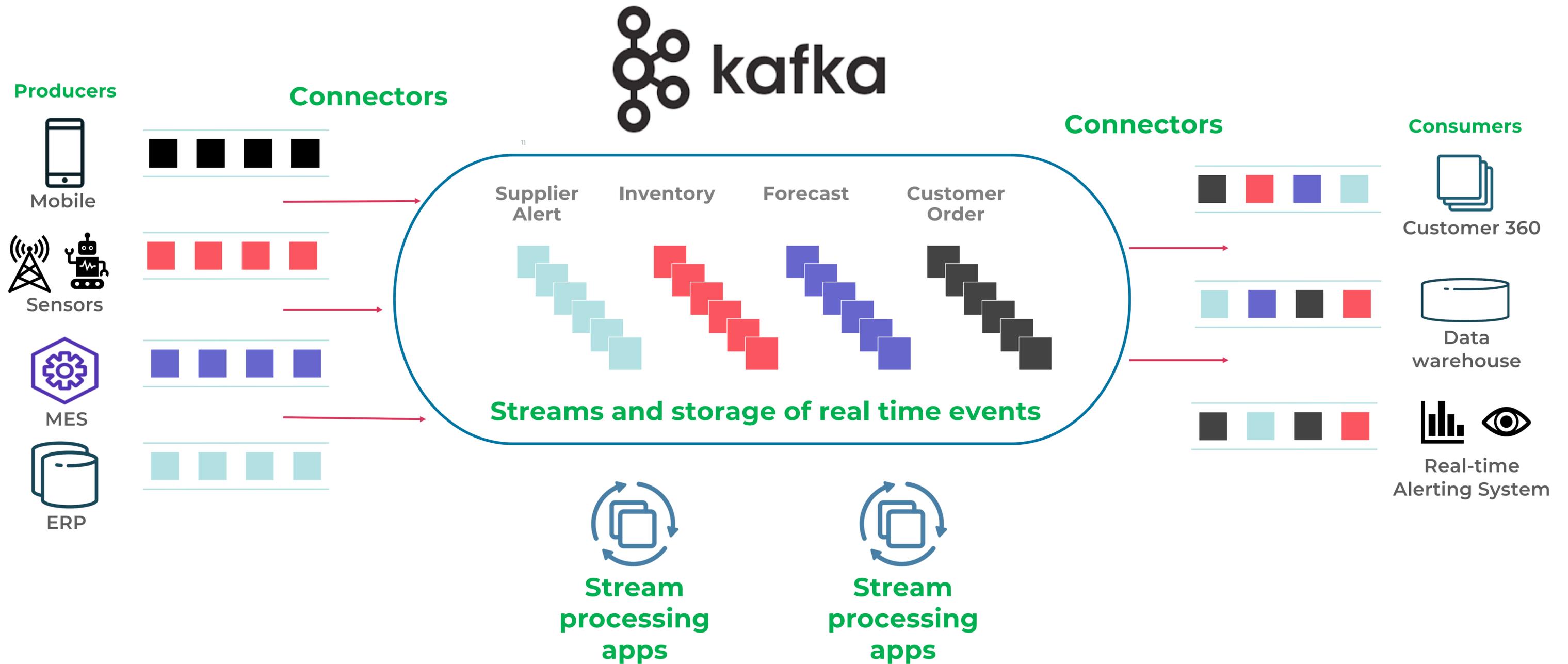
Infrastructure
as code

Data Streaming

Future of data

Data in motion
as continuous
streams of events

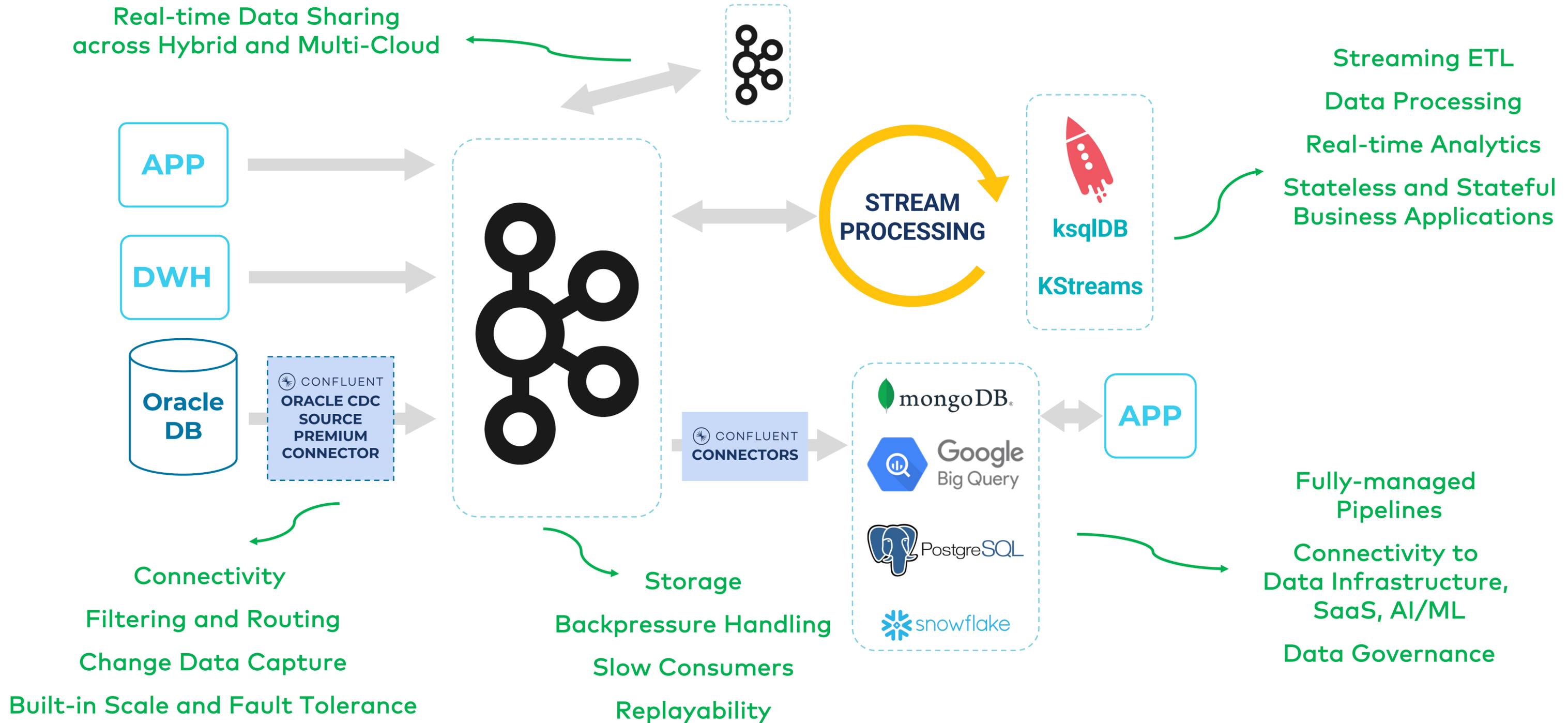
Apache Kafka is the Platform for Data in Motion



Kafka is a cloud-native streaming middleware!

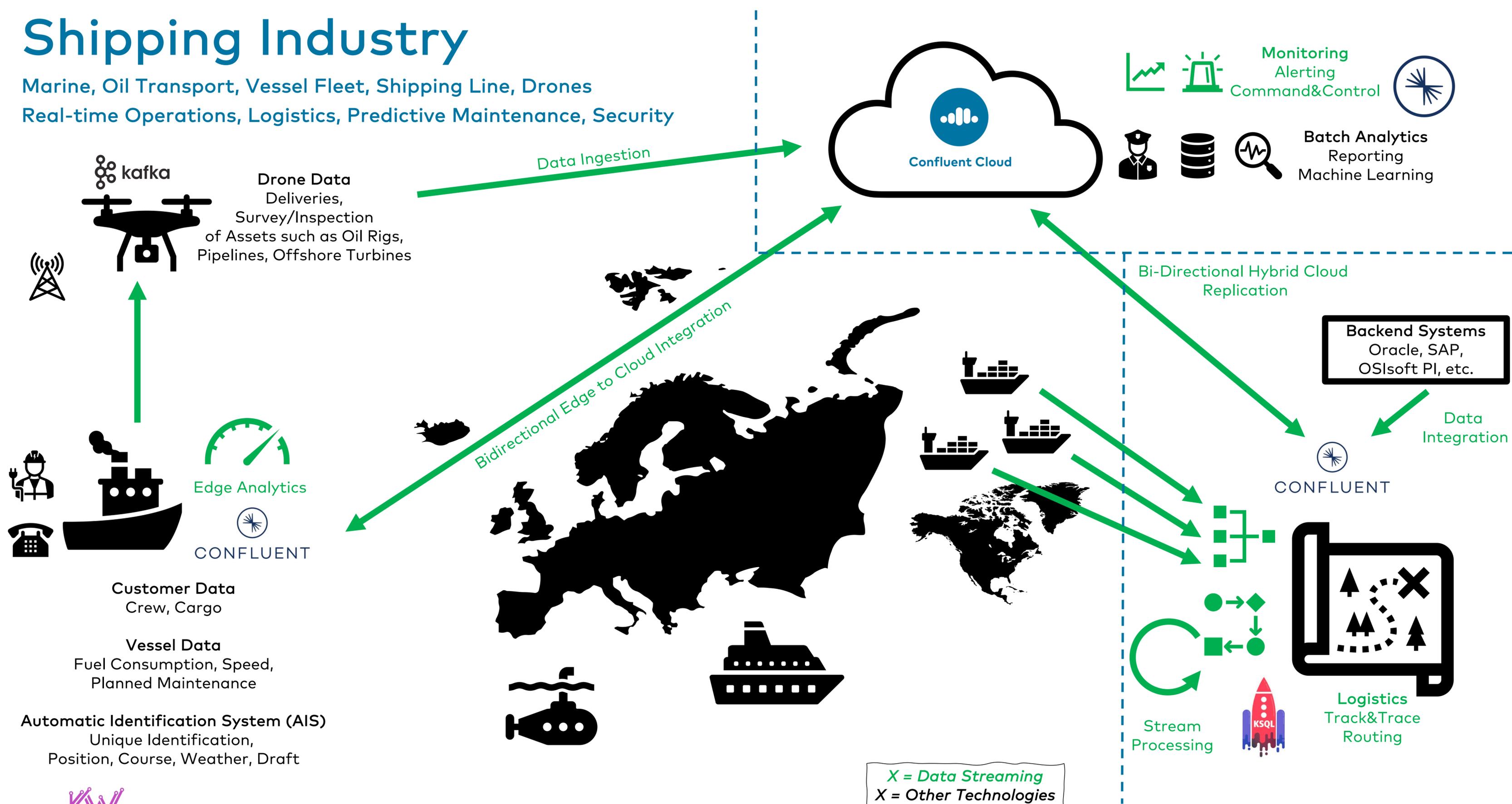


→ More than just data ingestion or message queue



Shipping Industry

Marine, Oil Transport, Vessel Fleet, Shipping Line, Drones
Real-time Operations, Logistics, Predictive Maintenance, Security





kafka is not an IoT Platform!



Device management
Unreliable networks
Connectivity beyond standards
Tens of thousands of connections
Embedded systems
...



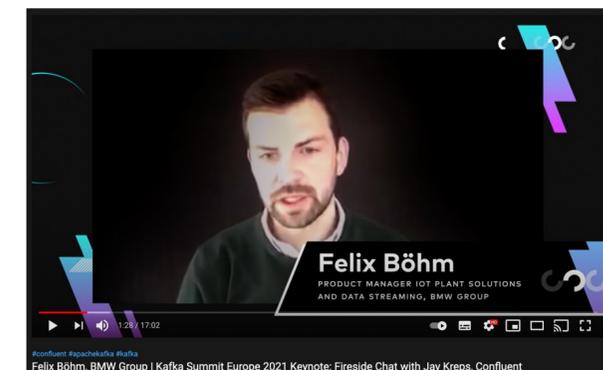
*Real-World
Use Cases*



Mission-critical workloads at the edge and in the cloud

- Why Kafka? **Decoupling. Transparency. Innovation.**
- Why Confluent? **Stability is key in manufacturing**
- Decoupling between logistics and production systems
- **Provide edge platform (self-managed) + Azure Cloud (fully-managed) + bidirectional integration**

- **Use case**
 - **Logistics and supply chain in global plants**
 - Right stock in place (physically and in ERP systems like SAP)
 - Just in time, just in sequence
 - Lot of critical applications



Jay Kreps, Confluent CEO
Felix Böhm, BMW Plant Digitalization and Cloud Transformation

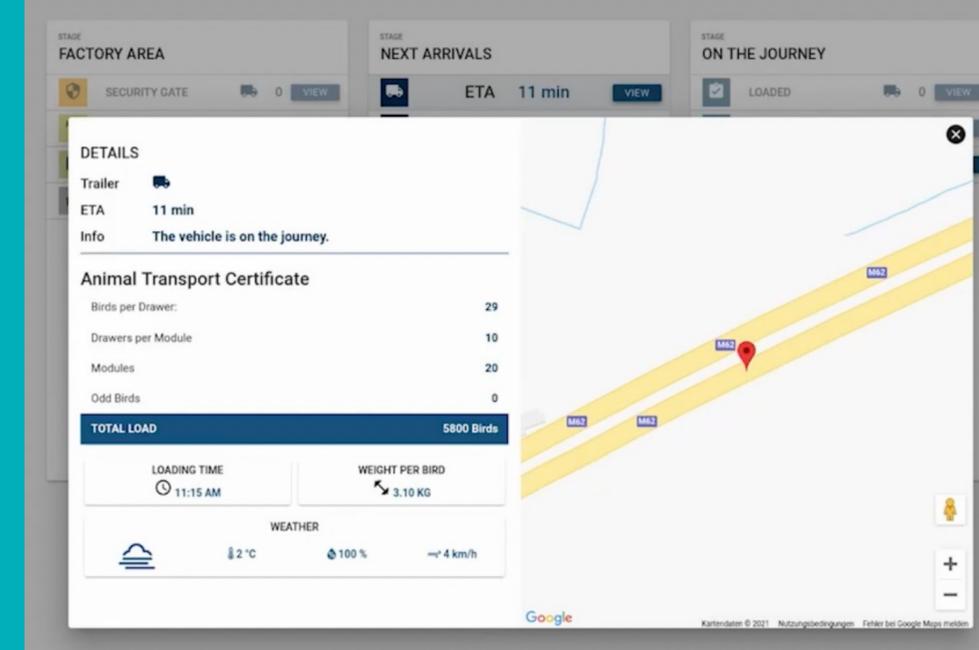
Keynote at Kafka Summit Eurpoe 2021:
<https://www.youtube.com/watch?v=3cG2ud7TRs4>



Food Value Chain

IoT-Based and Data-Driven

BAADER 

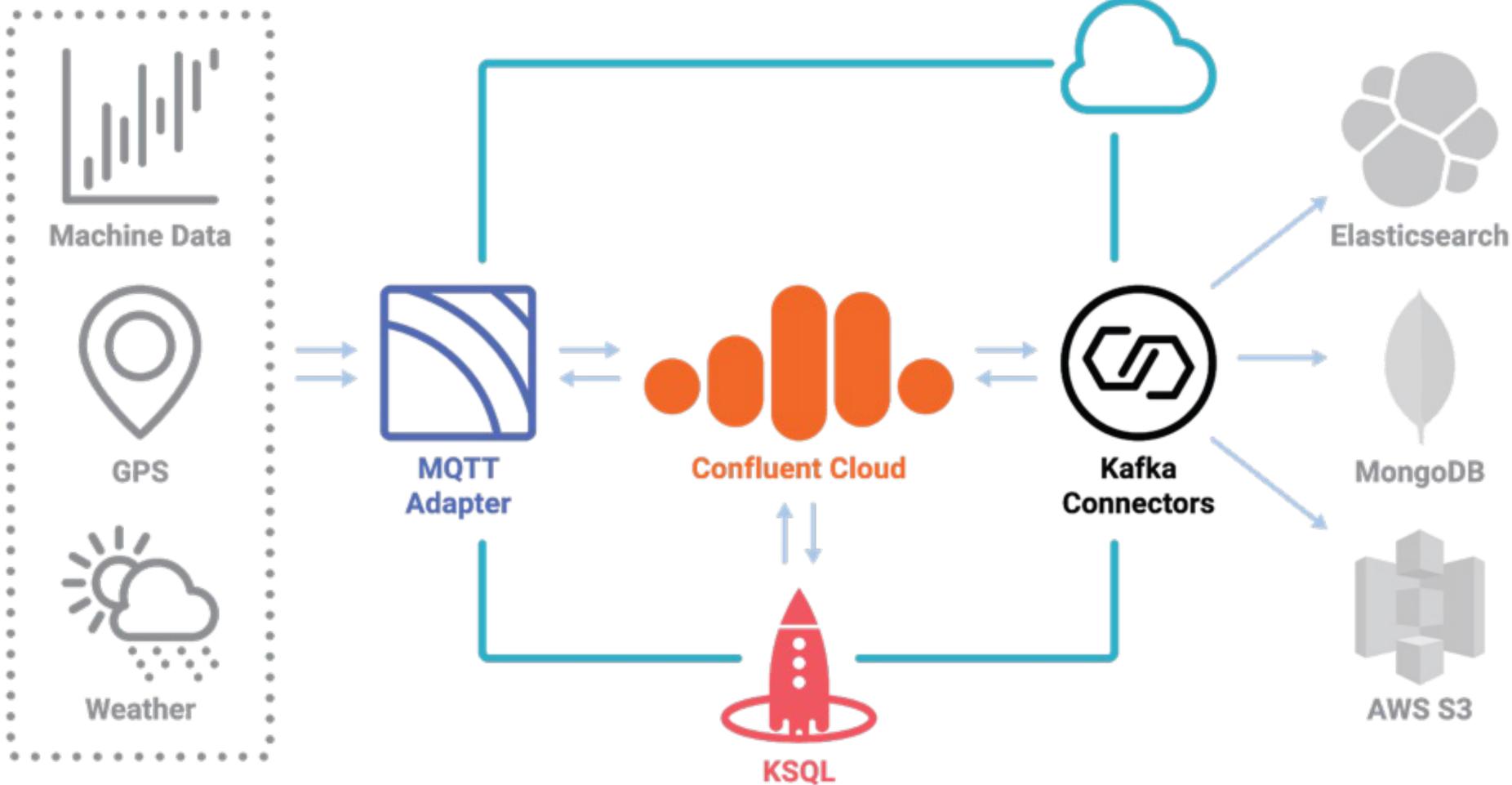


Single source of truth

across the food value chain
(in the factories, and across regions)

Business critical operations

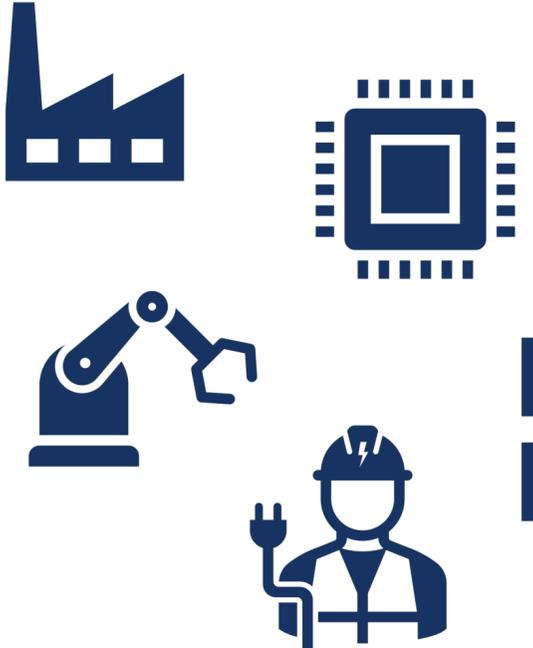
(tracking, calculations, alerts, ...)



<https://www.confluent.io/blog/creating-iot-based-data-driven-food-value-chain-with-confluent-cloud/>



Data Streaming as the Foundation of a Real-Time Supply Chain Control Tower



Machine Data
(OPC-UA)

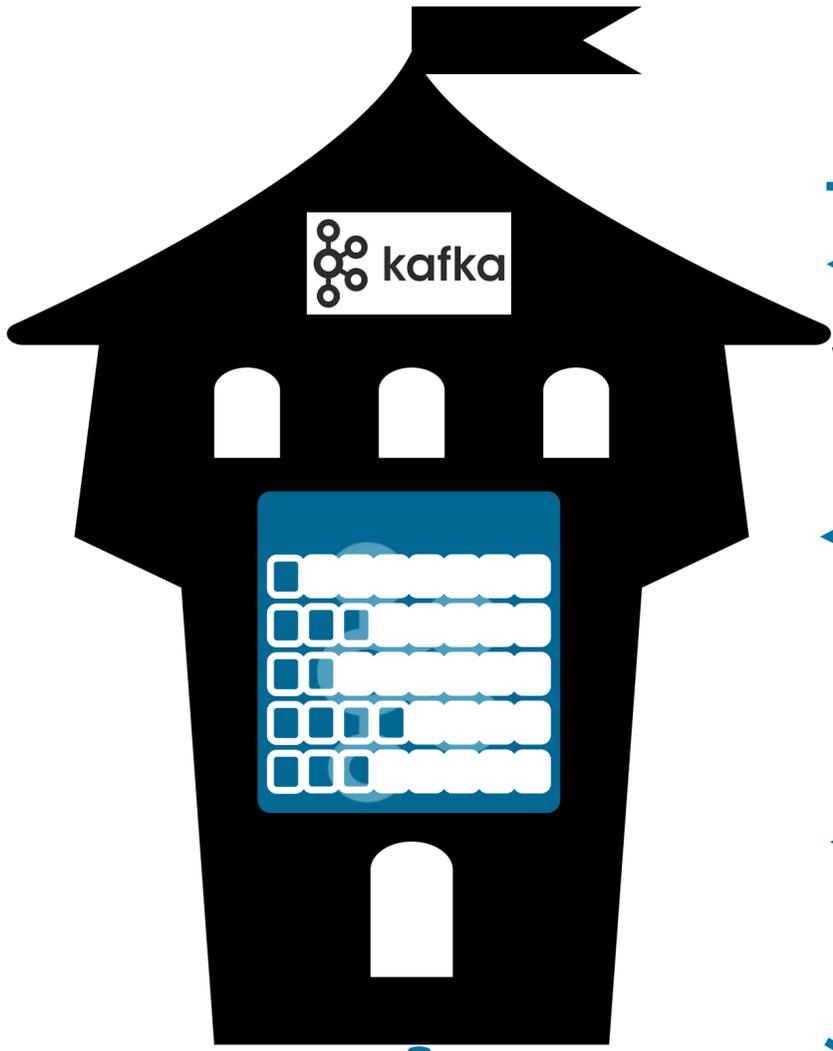


Ingest Sensor Data

1010
1010



Command & Control



Weather Predictions



Track & Trace



Order Management



Supply Information

Weather Service

External API
(REST / HTTP)

GPS

Location-based Service
(KSQL + MQTT)

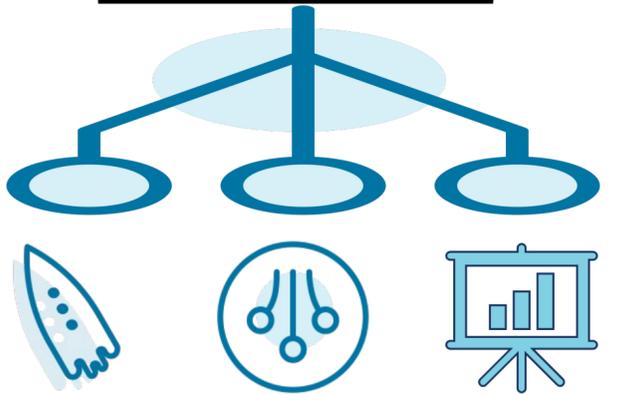
ERP / MES

SAP
(Kafka Connect)



B2B Forecasting

Demand Planning SaaS
(Proprietary API)



Data Consolidation

Streaming ETL
(Kafka Streams / KSQL)

- End-to-end visibility.
- Problem resolutions.
- Interaction with any API, interface, UI.
- Integration with anything; MES, ERP, B2B, CRM, Open API.
- All automated. In real-time. At scale. With decoupled domains.
- Edge or hybrid or cloud-only.

KAFKA AS A KEY ENABLER FOR IOT AT BOSCH POWER TOOLS



BOSCH



IoT@Bosch Power Tools Projects

- RefineMySite



- Bluehound



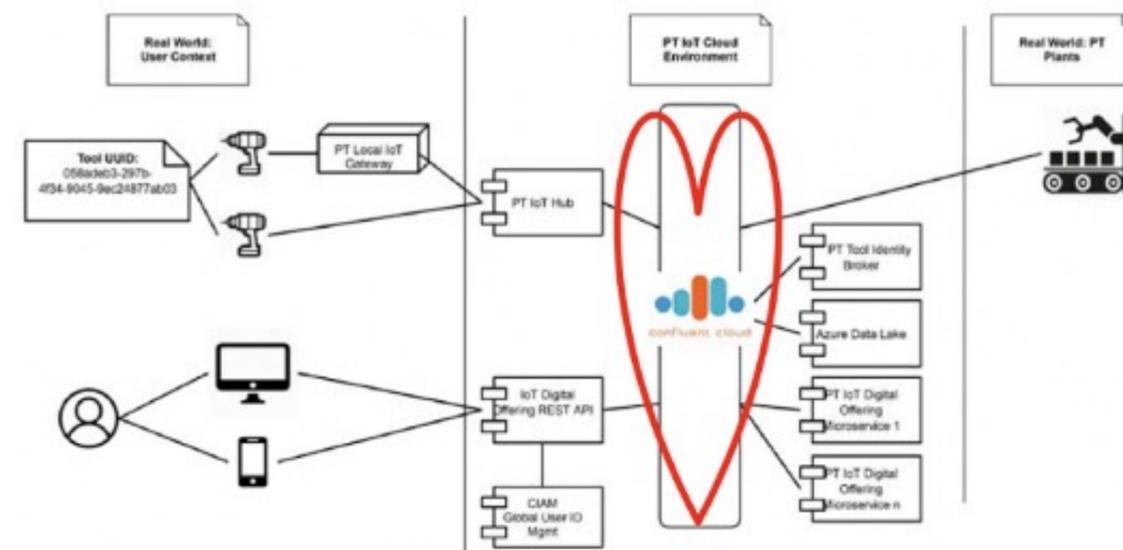
- Home and Garden App



- Field Data Connectivity



IoT@Bosch Power Tools Confluent Cloud at the Heart



Track, manage, and locate tools and other equipment anytime and anywhere from the warehouse to the jobsite

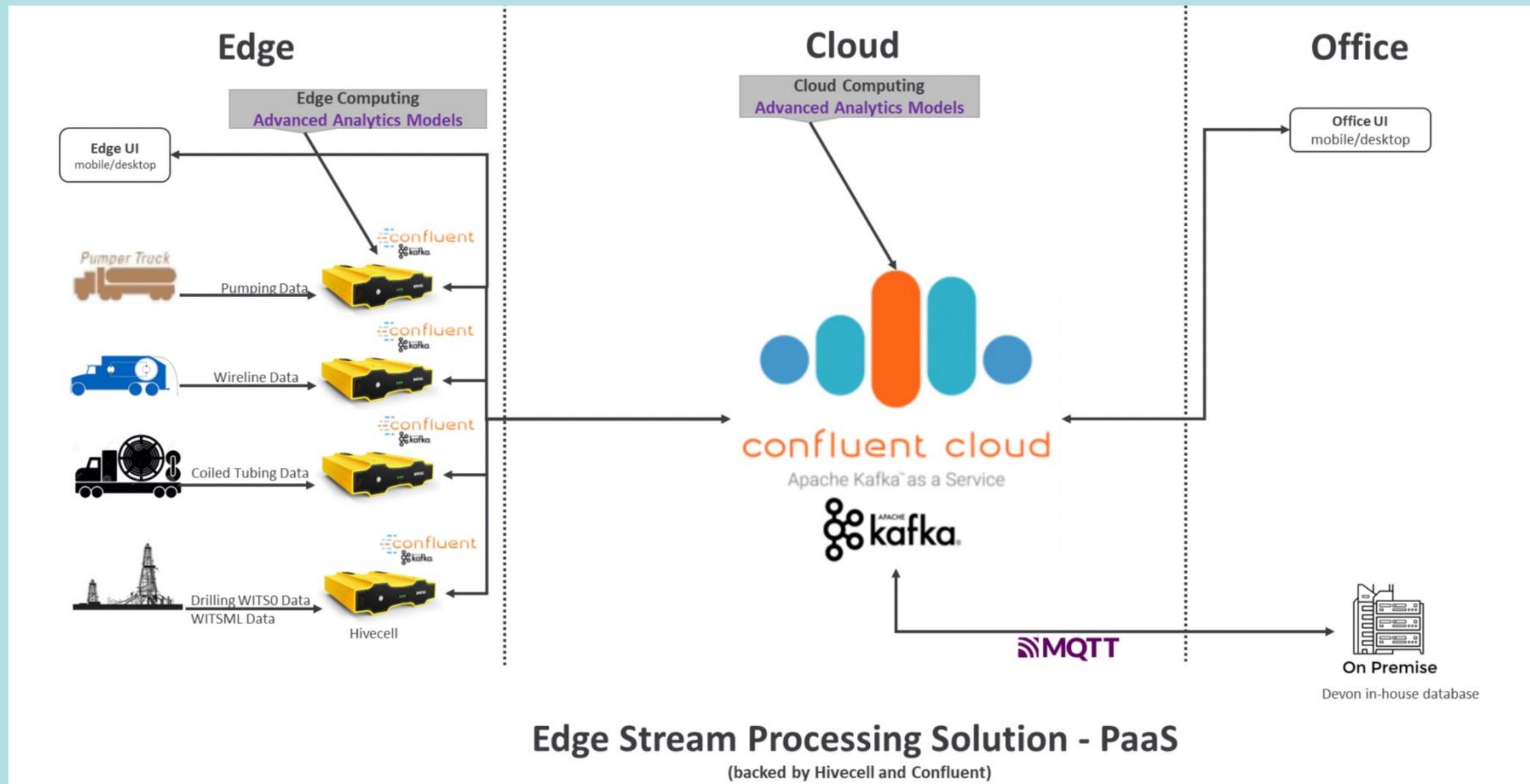
<https://www.confluent.io/customers/bosch/>
<https://events.confluent.io/online-talks/bosch-power-toolse-nables-real-time-analytics-on-iot-event-streams>



Devon Energy

Oil & Gas Industry

Improve drilling and well completion operations
Edge stream processing/analytics + closed-loop control ready
Vendor agnostic (pumping, wireline, coil, offset wells, drilling operations, producing wells)
Replication to the cloud in real-time at scale
Cloud agnostic (AWS, GCP, Azure)



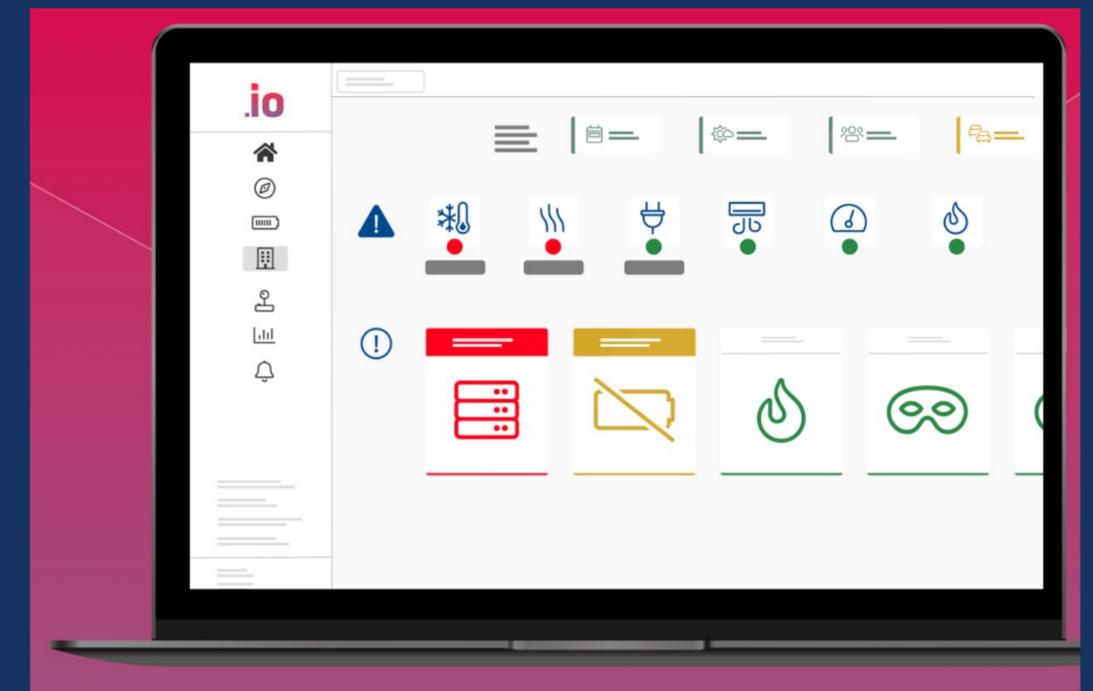
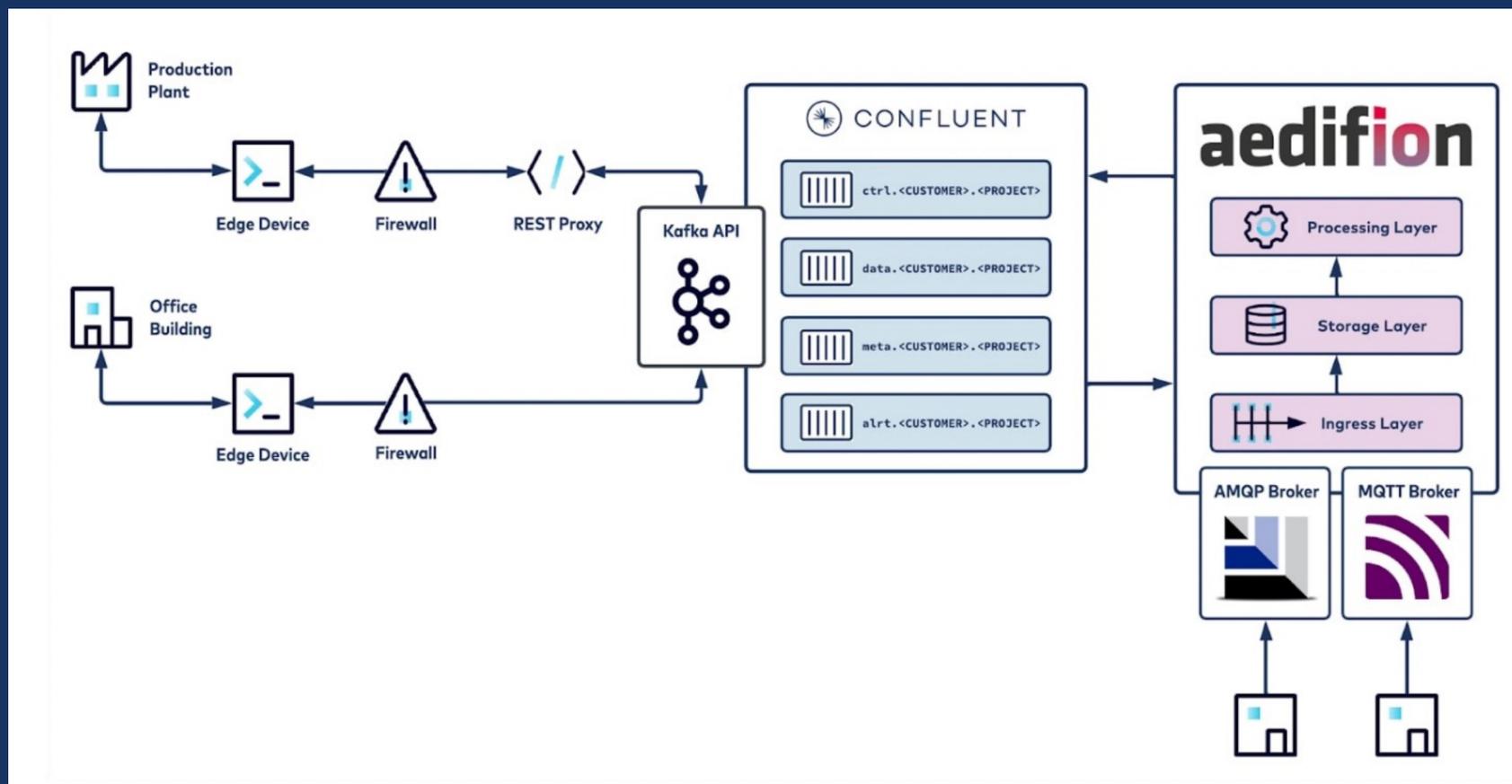
Source: Energy in Data - Powered by AAPG, SEG & SPE: energyindata.org



aedifion: Efficient Management of Real Estate



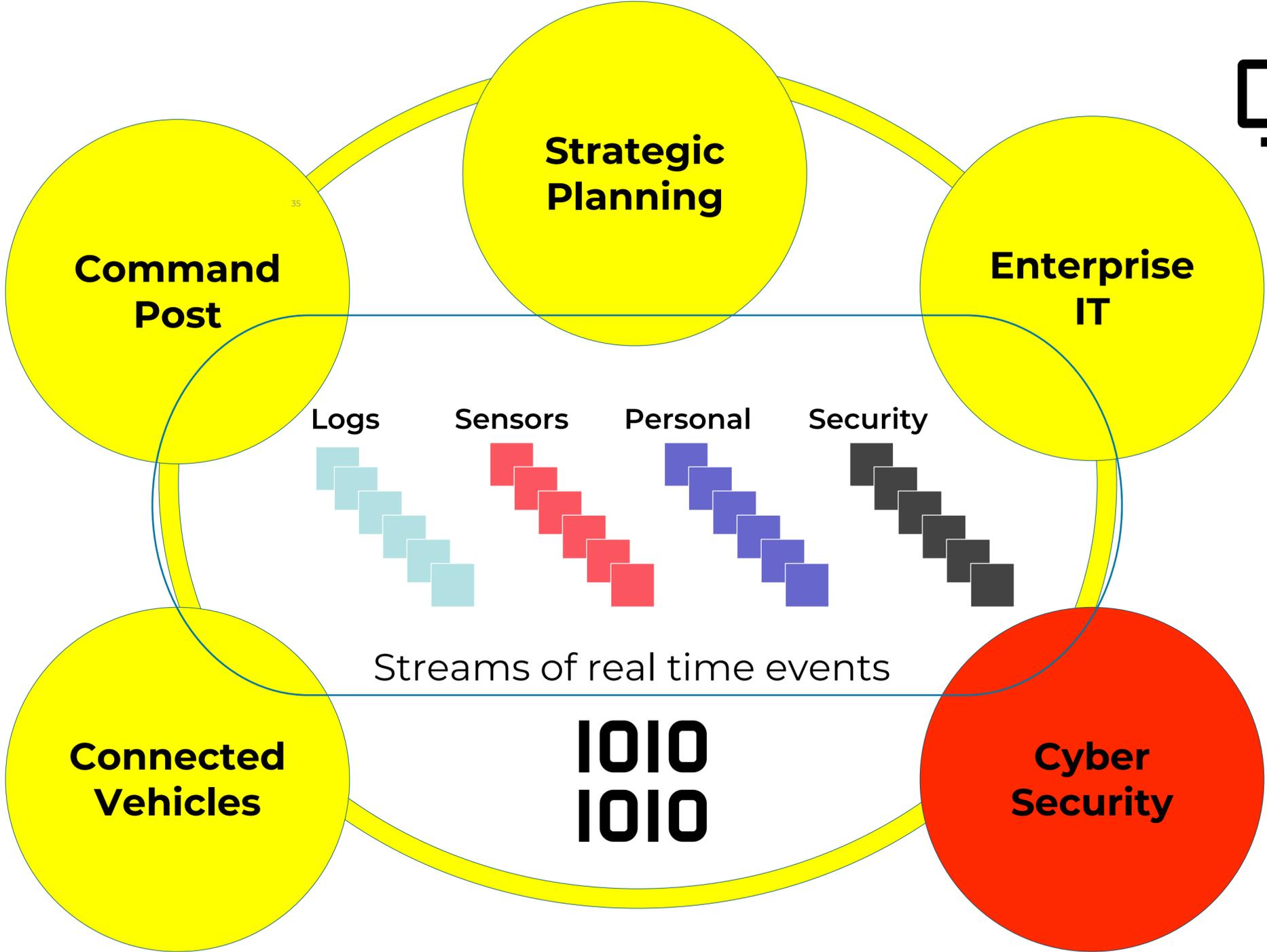
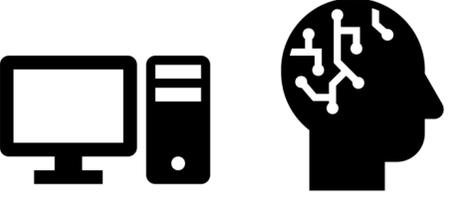
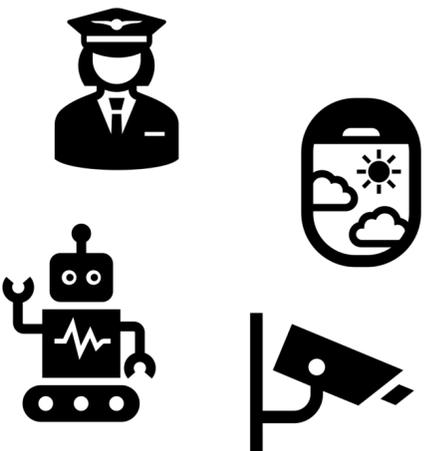
- Digital, data-driven monitoring, analytics and controls products
- Operate buildings better and meet Environmental, Social, and Corporate Governance (ESG) goals
- Secure connectivity and reliable data collection with Confluent Cloud
- Depreciated MQTT-based pipeline - Kafka serves as a reliable buffer between producers (Edge Devices) and consumers (backend microservices) smoothing over bursts and temporary application downtimes



<https://www.confluent.io/blog/smart-buildings-with-real-time-iot-analytics-using-confluent-at-aedifion>

Data in Motion

The Backbone for Defence

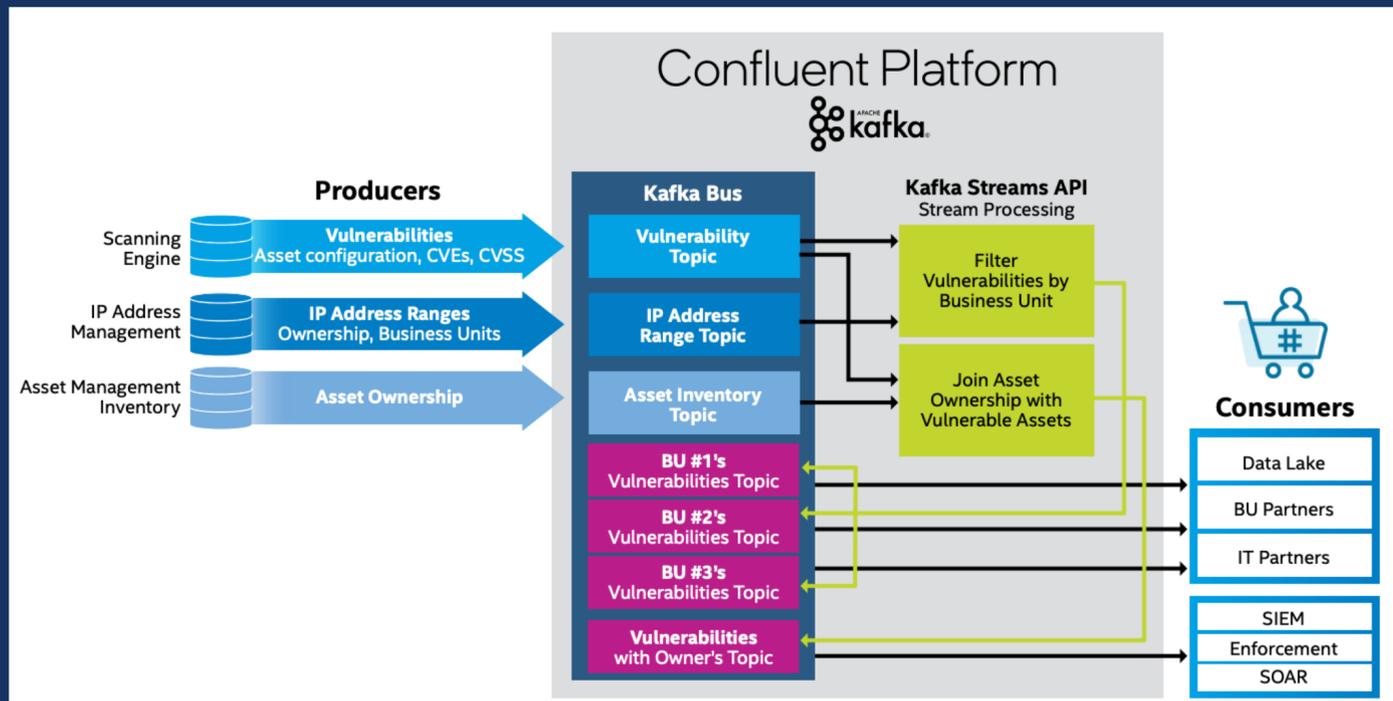
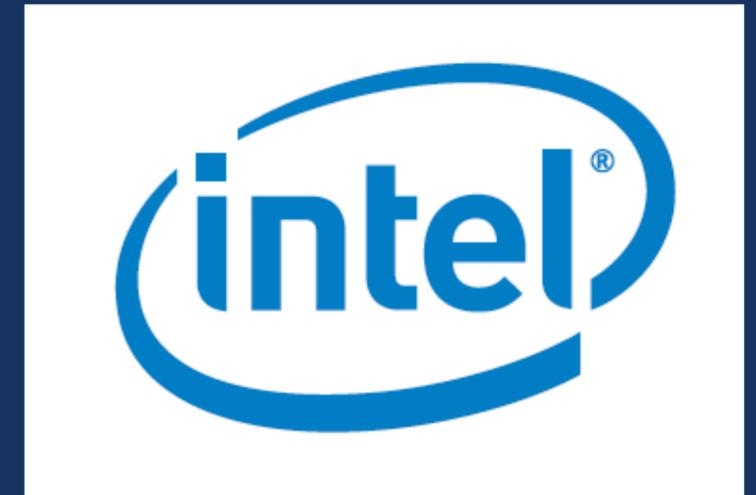
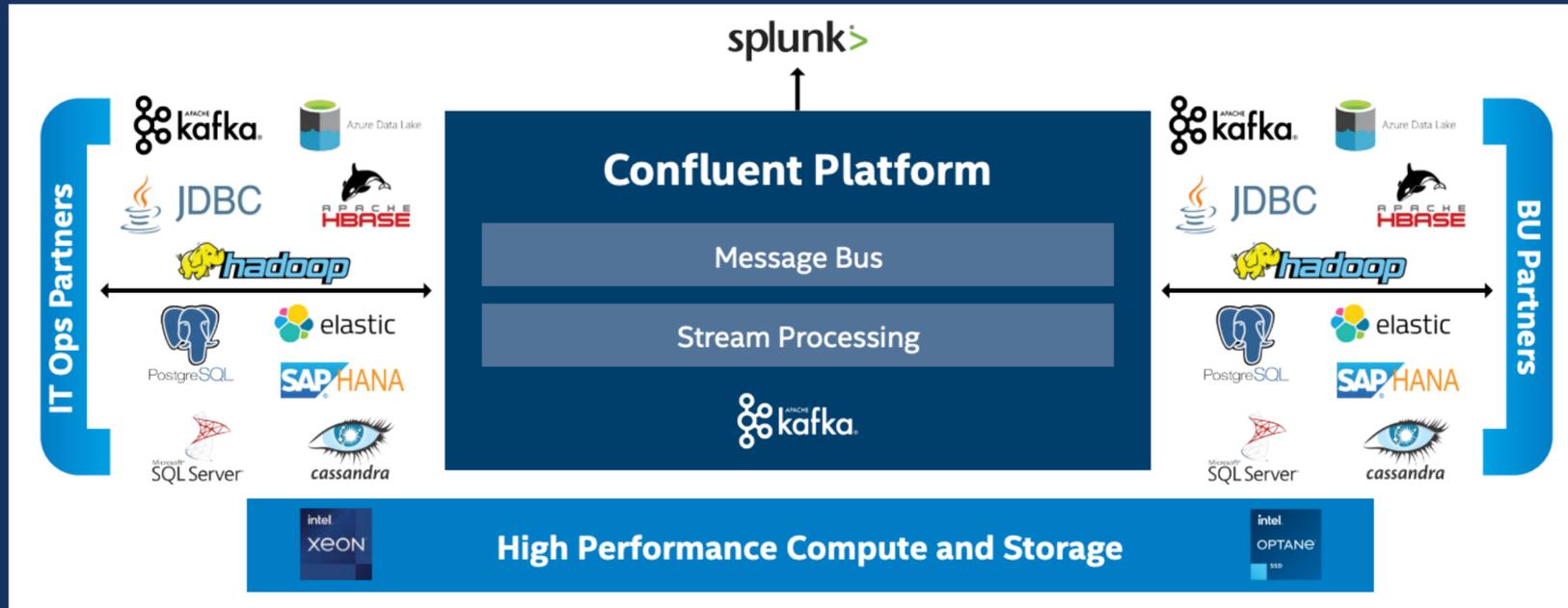


**Continuous
Data Correlation
Monitoring
Alerting
Proactive Actions**



Cyber Intelligence Platform

leveraging Kafka Connect, Kafka Streams, Multi-Region Clusters (MRC), and more...



Transforming Intel's Security Posture with Innovations in Data Intelligence

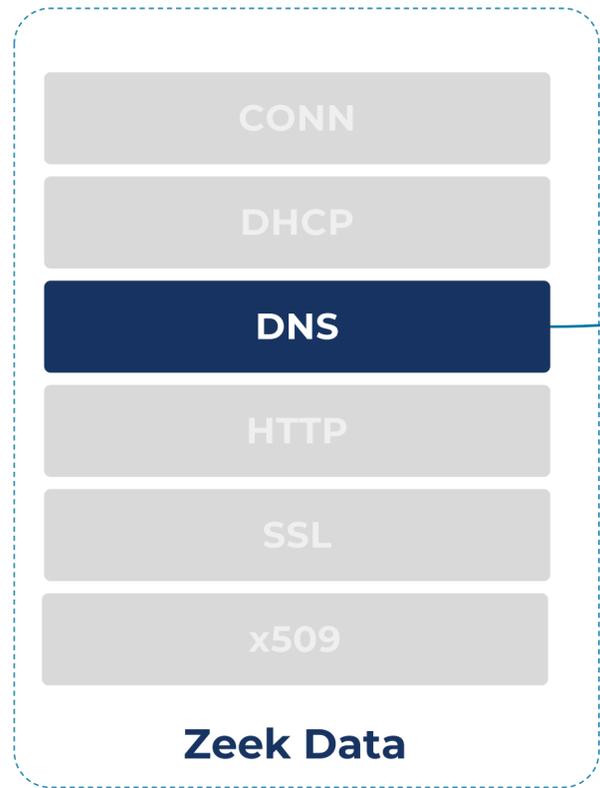
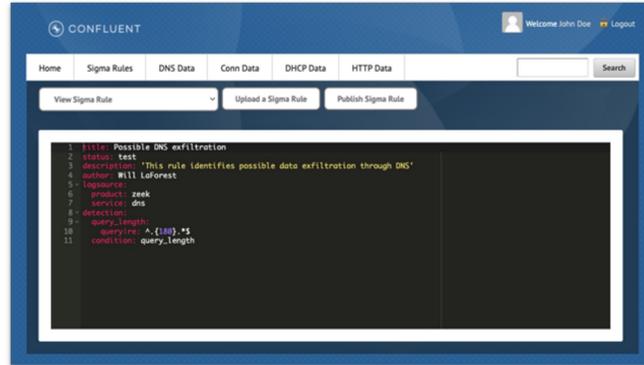
Intel's new Cyber Intelligence Platform provides a context-rich environment that provides value across our entire Information Security organization. It has transformed how Information Security works with a data advantage.

<https://www.intel.com/content/www/us/en/it-management/intel-it-best-practices/modern-scalable-cyber-intelligence-platform-kafka.html>

Confluent Sigma

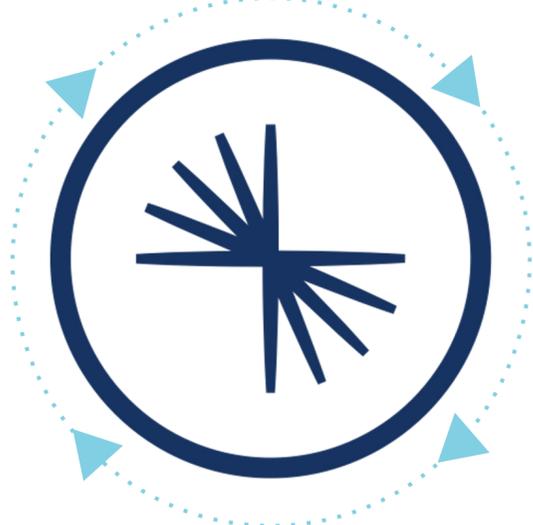


Sigma Rule Editor



sigma rules topic

dns topic



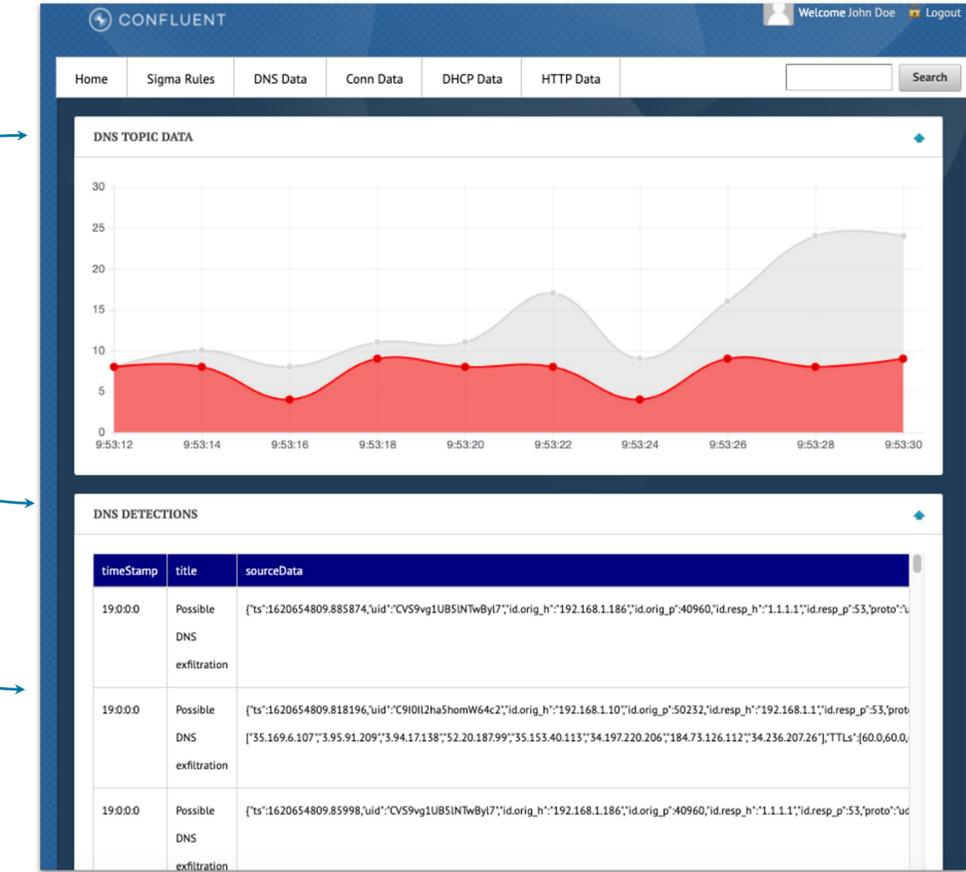
dns detections topic

sigma rules cache

rule parsing, filtering, aggregation, windowing

Sigma Stream Processors

Zeek Data and Detections Viewer

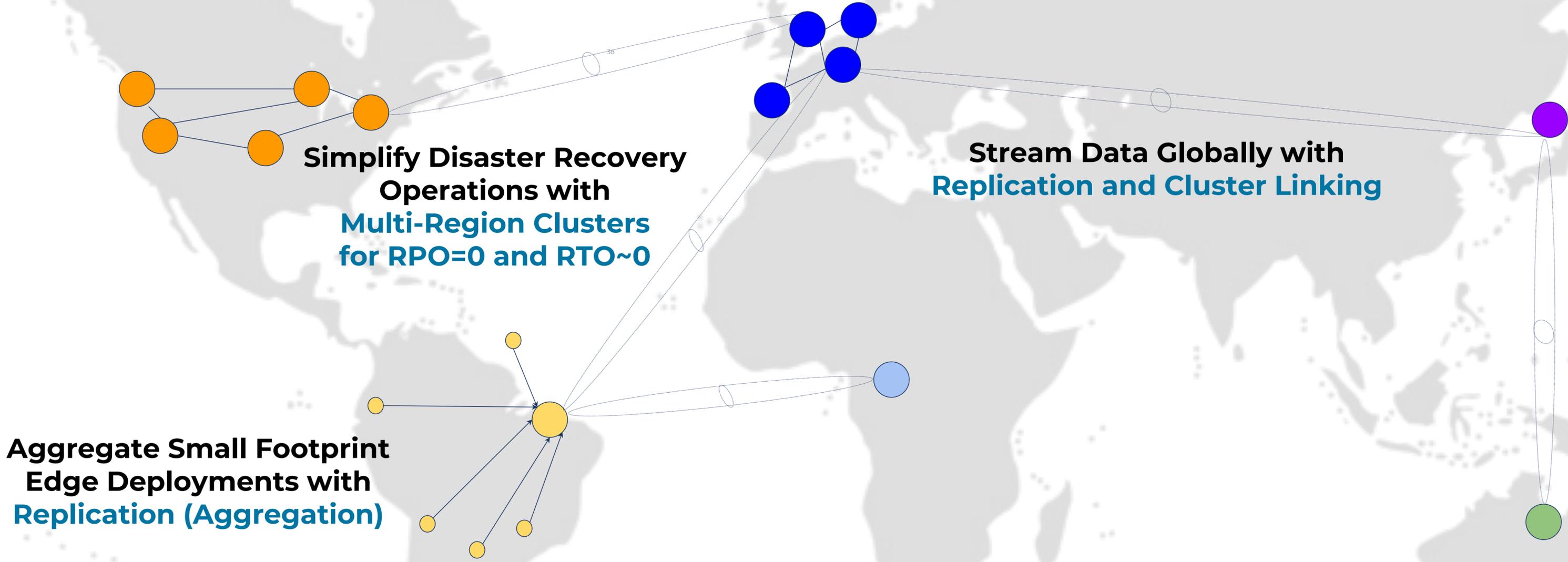


Global Data Streaming



Streaming Replication between Kafka Clusters

Bridge to Databases, Data Lakes, Apps, APIs, SaaS



Aggregate Small Footprint Edge Deployments with Replication (Aggregation)

Simplify Disaster Recovery Operations with Multi-Region Clusters for RPO=0 and RTO~0

Stream Data Globally with Replication and Cluster Linking

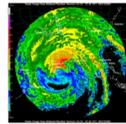
Smarter Soldiers at the Edge



Command Post running Confluent Platform aggregating information from Squires and other sensor data



Weather



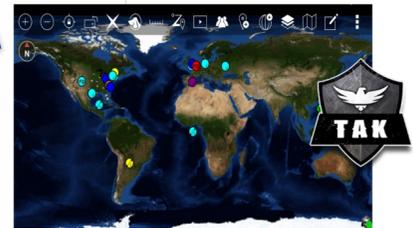
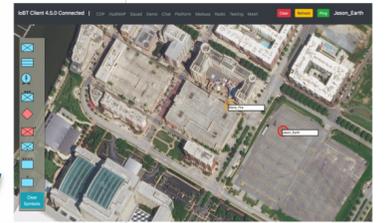
Personnel



Logistics



Targets



Enhanced Situational Awareness

Sensor data published to Command Post when connected to network



Confluent Platform (Single Broker)

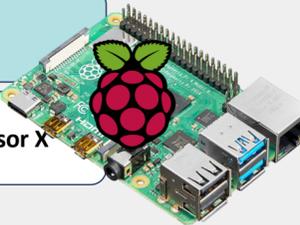


MQTT

Sensor A

Sensor B

Sensor X

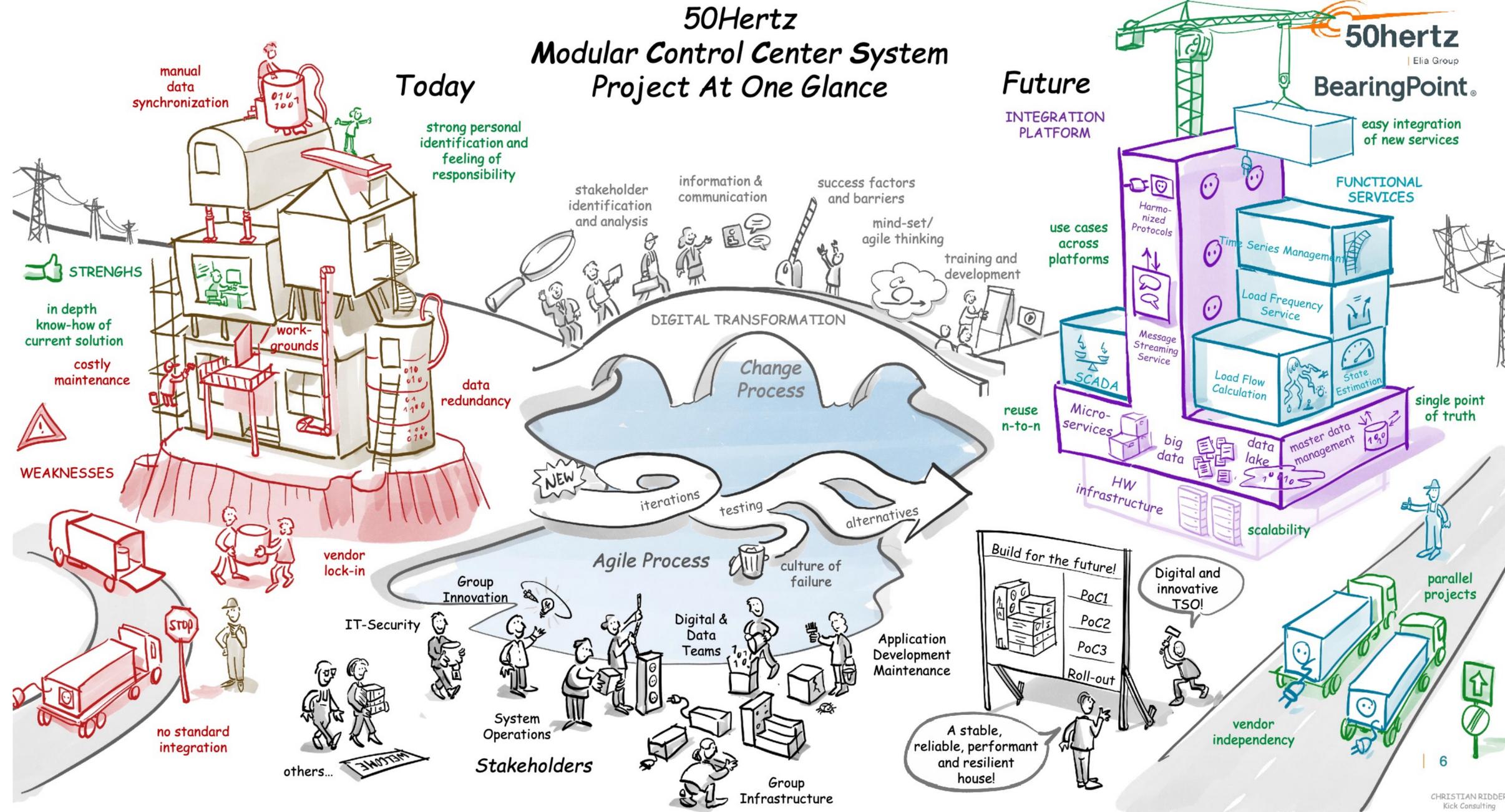


Confluent Platform deployed on a small computer and leveraging Cluster Linking to publish sensor data to Command Post in a DDIL environment.



50hertz – Modular Control Center System

Transmission system operators for electricity in Germany

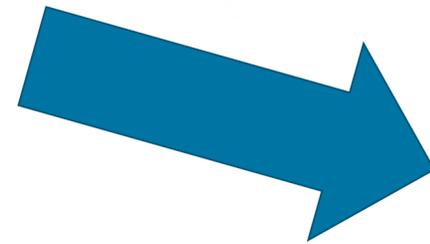
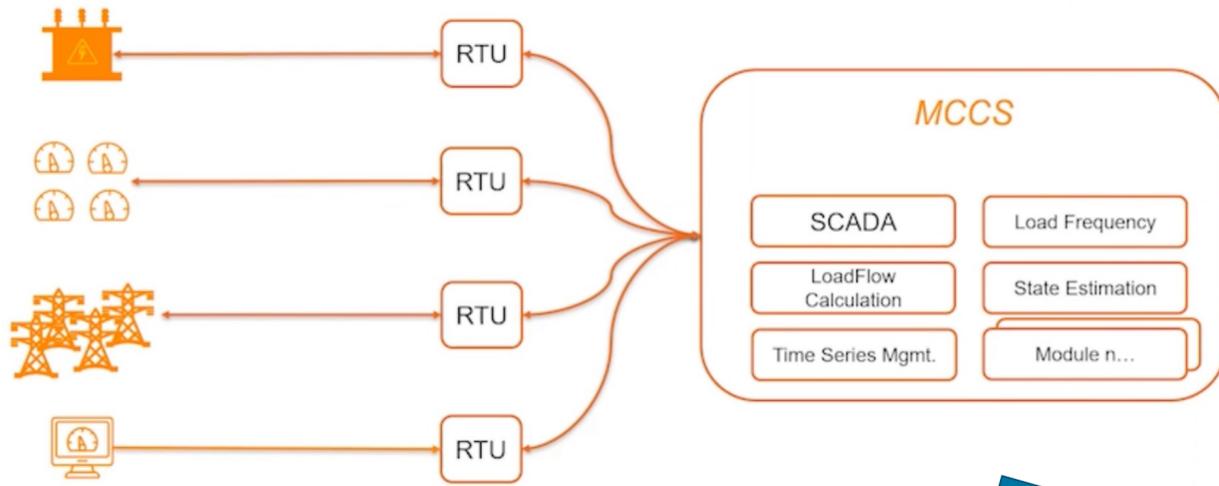


<https://events.confluent.io/datainmotiontour20211>

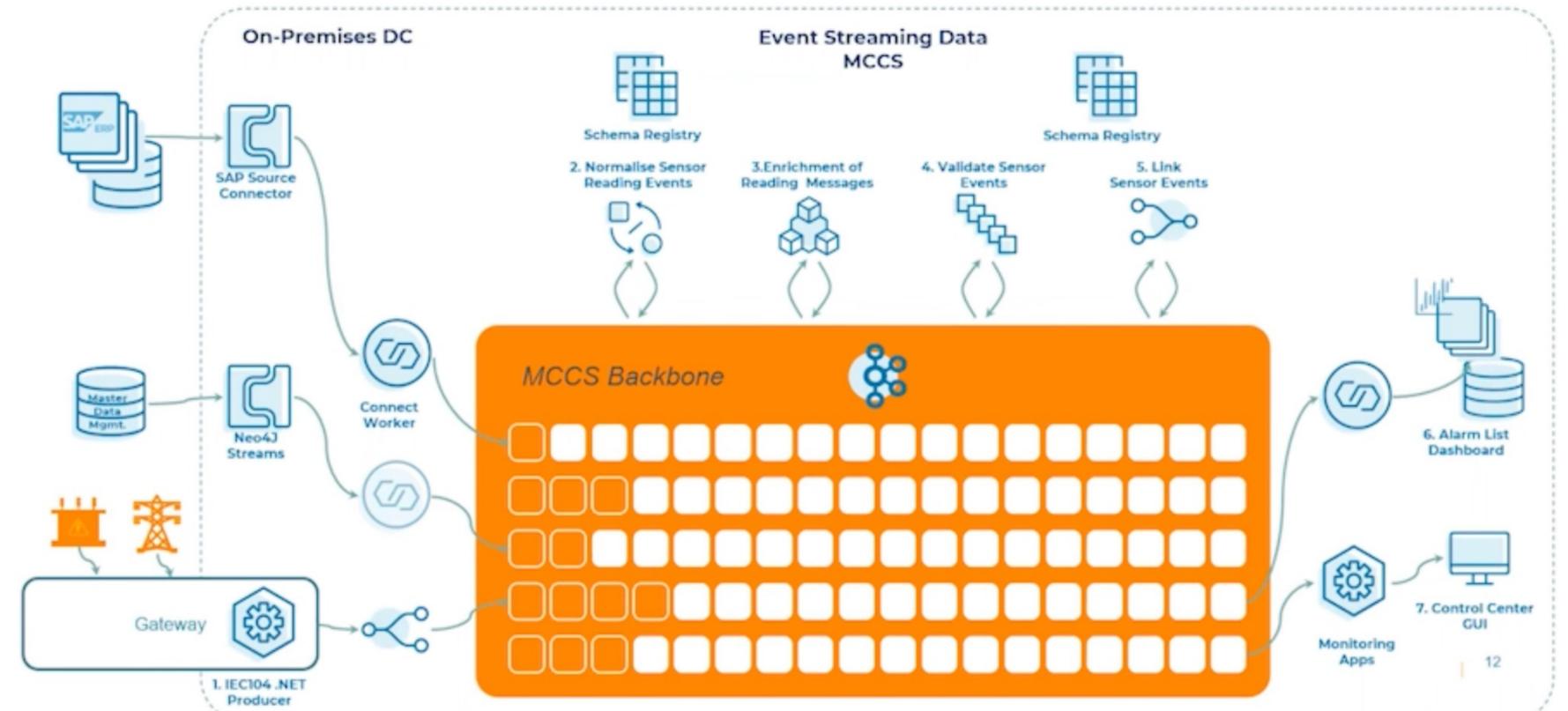
50hertz – Modular Control Center System



Cloud-native 24/7 SCADA system built with Confluent
 Developed in the cloud, deployed in safety-critical edge environments
 Unidirectional hardware gateway for replication into the cloud



Event Streaming Architecture for Control Center



50Hertz power grid

50Hertz Control Center



Supervisory
Control

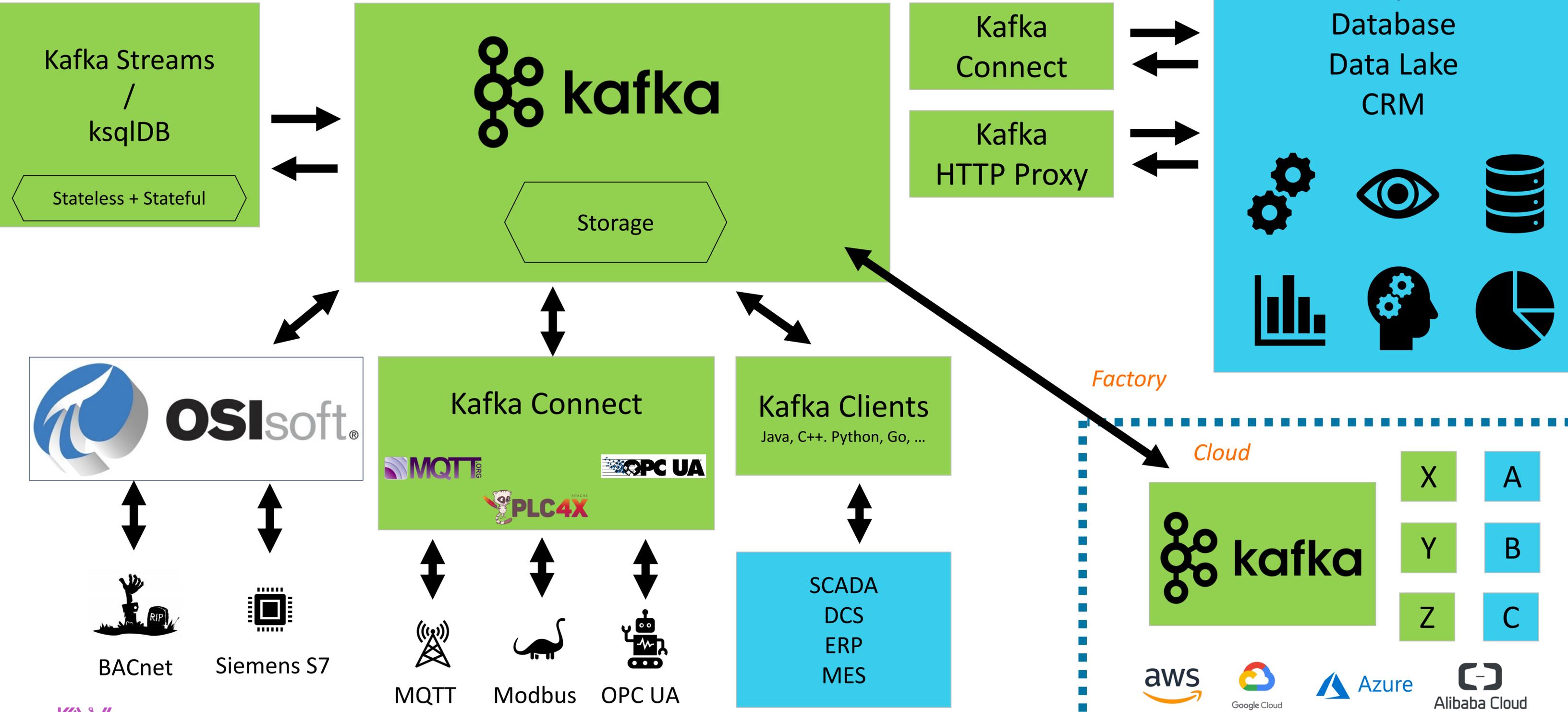


<https://events.confluent.io/datainmotiontour20211>

Kafka as Open and Scalable Data Historian

Continuous real time data ingestion, processing and monitoring 24/7 at scale

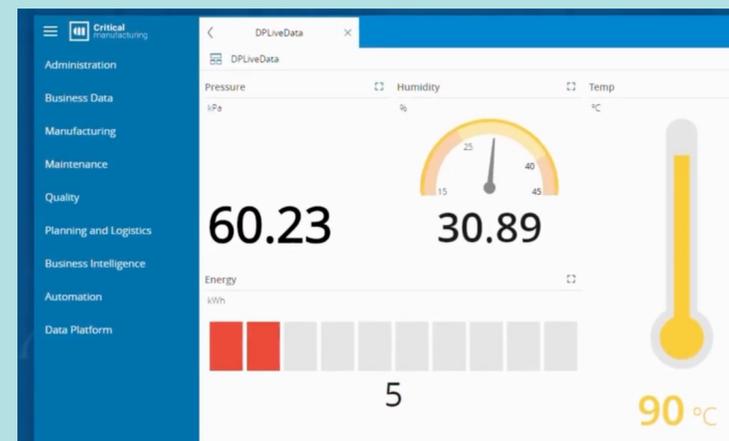
Integration | Storage | Processing | Access | Cloud | Security



Critical Manufacturing – Cloud-native MES



- Combines MES transaction workloads and big data IoT analytics
- Ingest, store, process, transform and analyze data in real-time (from IoT interfaces, ERP, MES, etc.)
- Durable, distributed and highly scalable unified analytics platform for large scale online or offline data processing
- Truly decoupled and flexible container-based architecture



Severstal

Predictive Maintenance and Quality Assurance at the Shop Floor

Real Time Streaming Machine Learning with Kafka



SEVERSTAL

Reducing Downtime with Real-Time Streaming Data



Severstal is among Russia's largest integrated steel and mining companies, producing more than 11 million metric tons of steel and close to \$8B in revenue annually. The company's key performance indicators—including revenue, profitability and dividend payouts—all improved last year, in part due to Severstal's strategy of defensive growth, which is focused on increasing earnings via enhanced efficiency and product quality rather than increased scale of production. To further solidify its position as a global leader in value creation, the company has embarked on the next phase of this strategy, a digital transformation in which resources are invested in big data, the Internet of Things, predictive maintenance and machine learning initiatives.

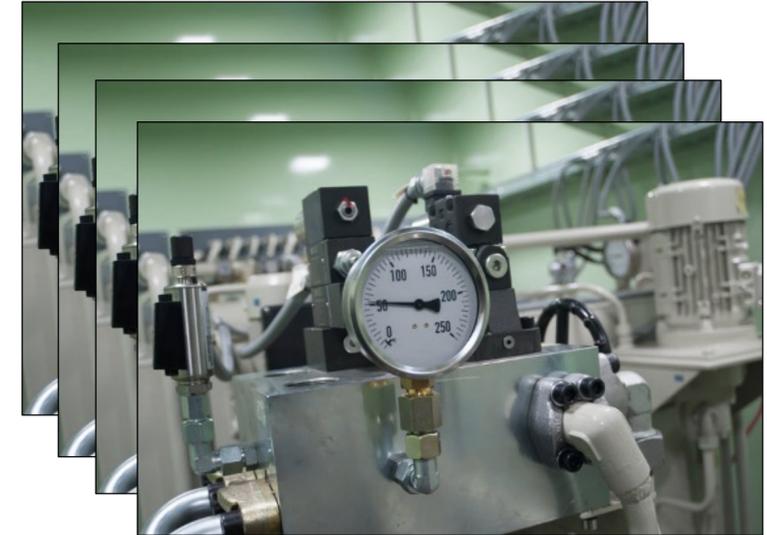
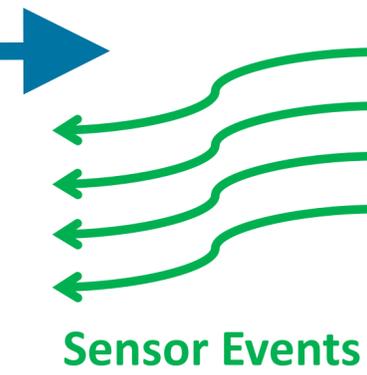
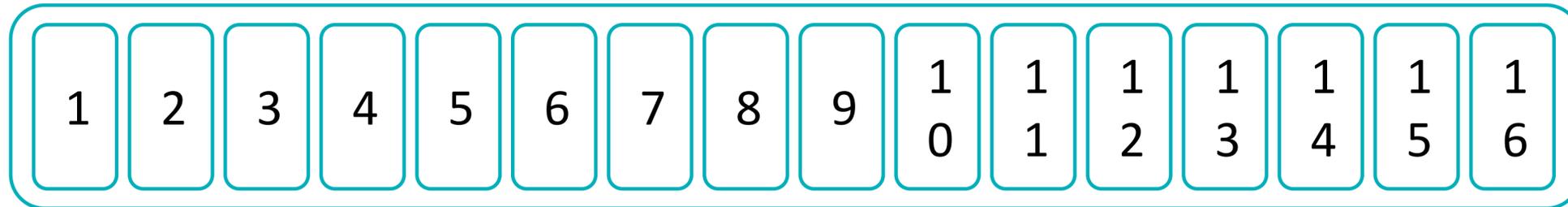


Condition Monitoring and Predictive Maintenance

Stateless and stateful stream processing for real-time data correlation with Kafka-native tools (Kafka Streams / ksqlDB)



Time

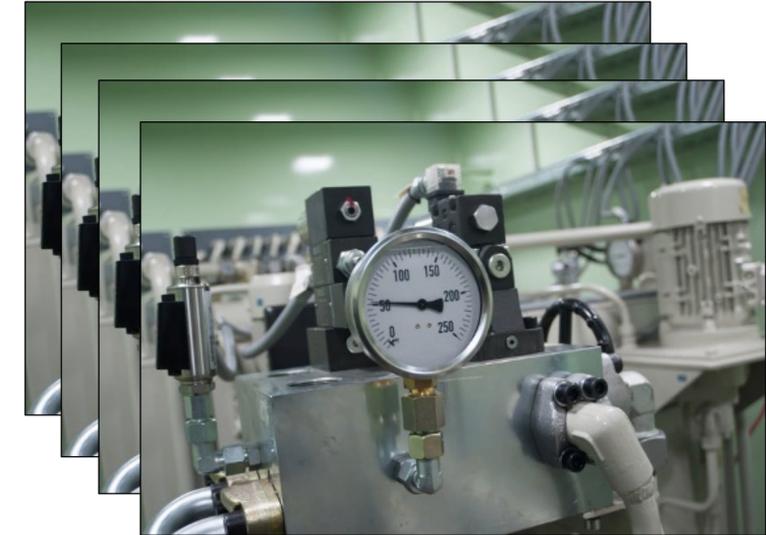
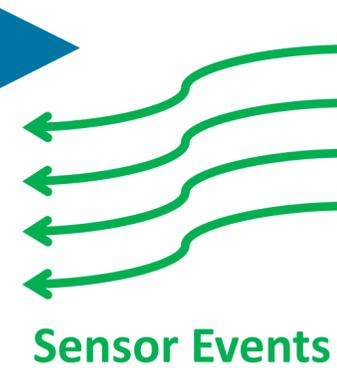
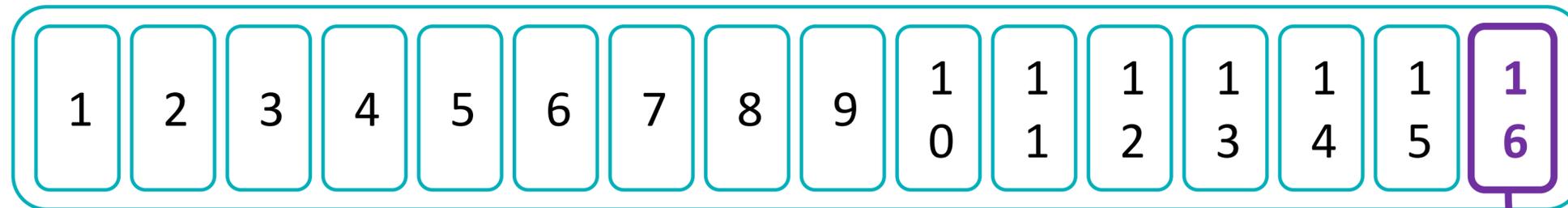


Condition Monitoring and Predictive Maintenance

Stateless and stateful stream processing for real-time data correlation with Kafka-native tools (Kafka Streams / ksqlDB)



Time



```
builder
  .stream("temperature-sensor")
  .filter((key, sensor-data) ->
    sensor-data.temperature > 100)
  .to("temperature-spikes");
```



Stateless Filter Above-Threshold Events

Condition Monitoring
(Temperature Spikes)

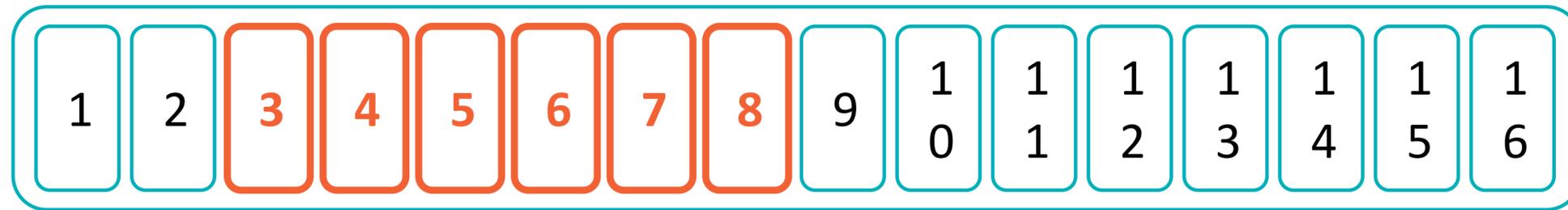


Condition Monitoring and Predictive Maintenance

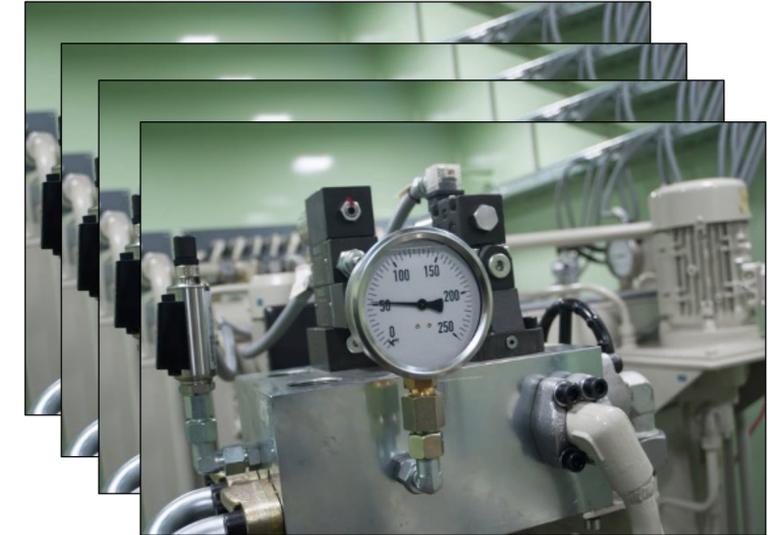
Stateless and stateful stream processing for real-time data correlation with Kafka-native tools (Kafka Streams / ksqlDB)



Time



Sensor Events



Predictive Maintenance

(Continuous Anomaly Detection)

```
CREATE TABLE anomaly_detection AS
SELECT temperature_spike_id, COUNT(*) AS total_spikes,
AVG(temperature) AS avg_temperature
FROM sensor-data
WINDOW TUMBLING (SIZE 1 HOUR)
GROUP BY temperature_spike_id
EMIT CHANGES;
```

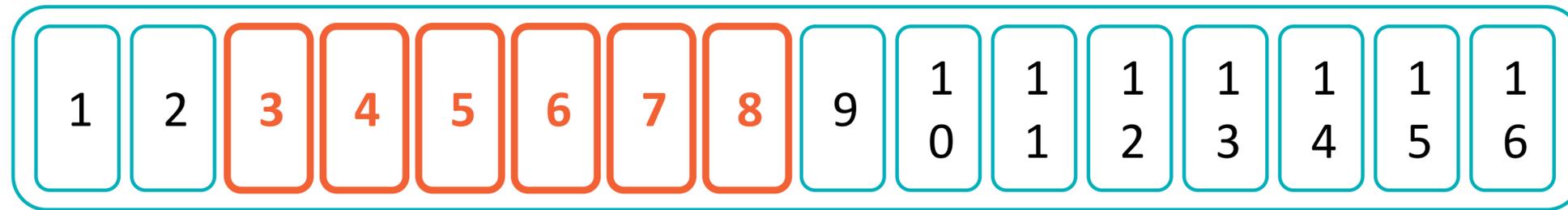


Condition Monitoring and Predictive Maintenance

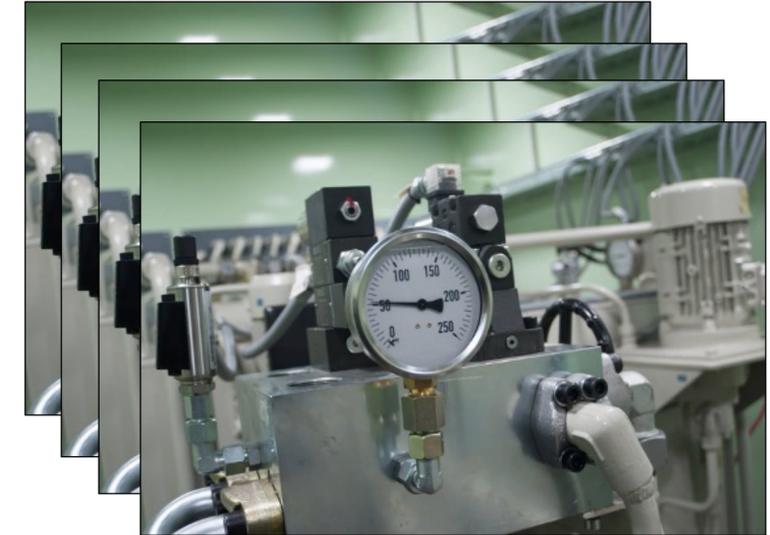
Stateless and stateful stream processing for real-time data correlation with Kafka-native tools (Kafka Streams / ksqlDB)



Time



Sensor Events



TensorFlow
Real-time Machine Learning

Predictive Maintenance

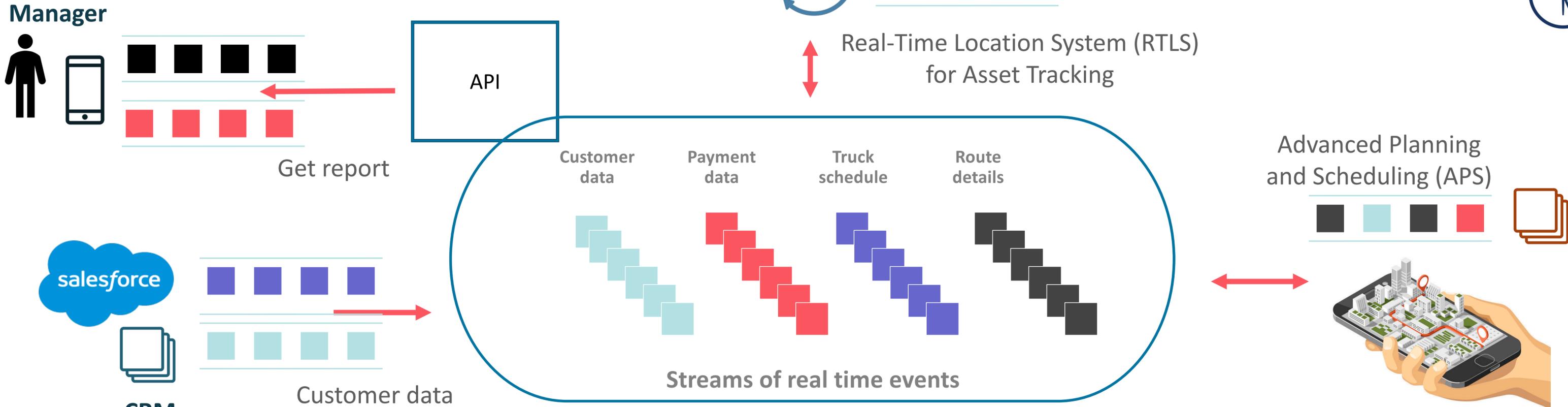
(Continuous Anomaly Detection)

```
CREATE STREAM anomaly_detection AS  
SELECT sensor_id, detect_anomaly(sensor_values)  
FROM machine;
```

TensorFlow model embedded in User Defined Function (UDF)



Event Streaming in Hybrid Industrial IoT



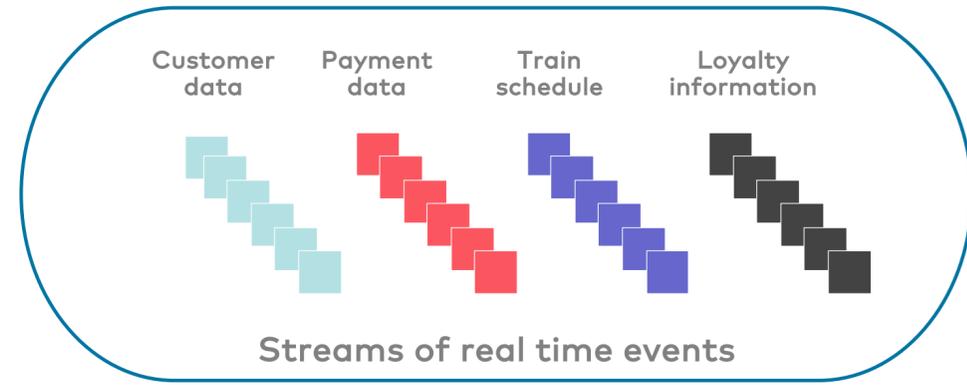
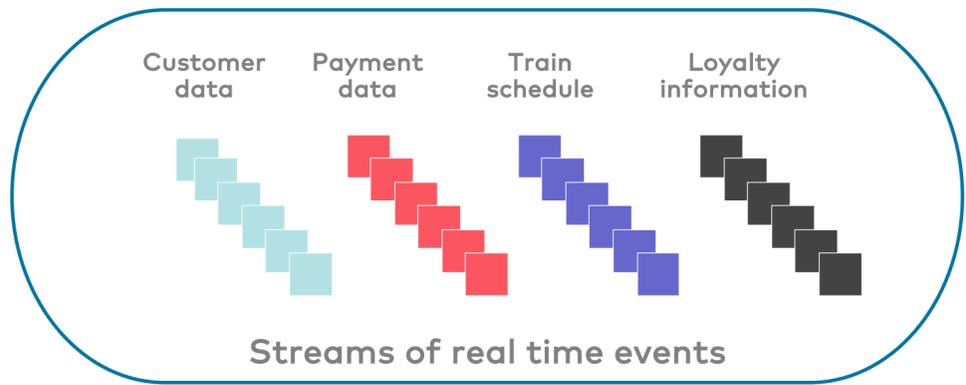
Public Cloud VPC

Campus 5G

Telco Carrier 5G

Smart Factory

Edge Computing



CONFLUENT

CONFLUENT

aws Wavelength

KAI WAEHNER

@KaiWaehner

kai-waehner.de

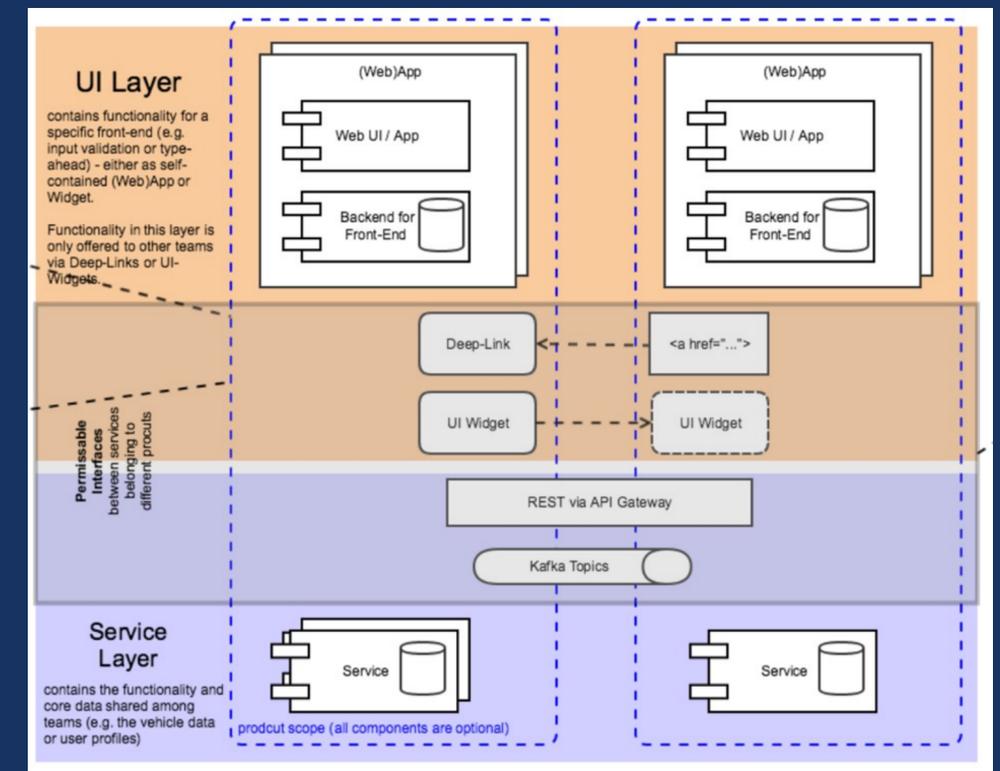
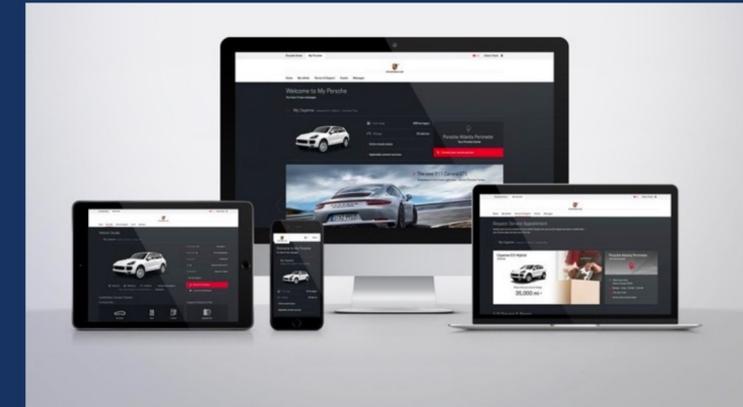
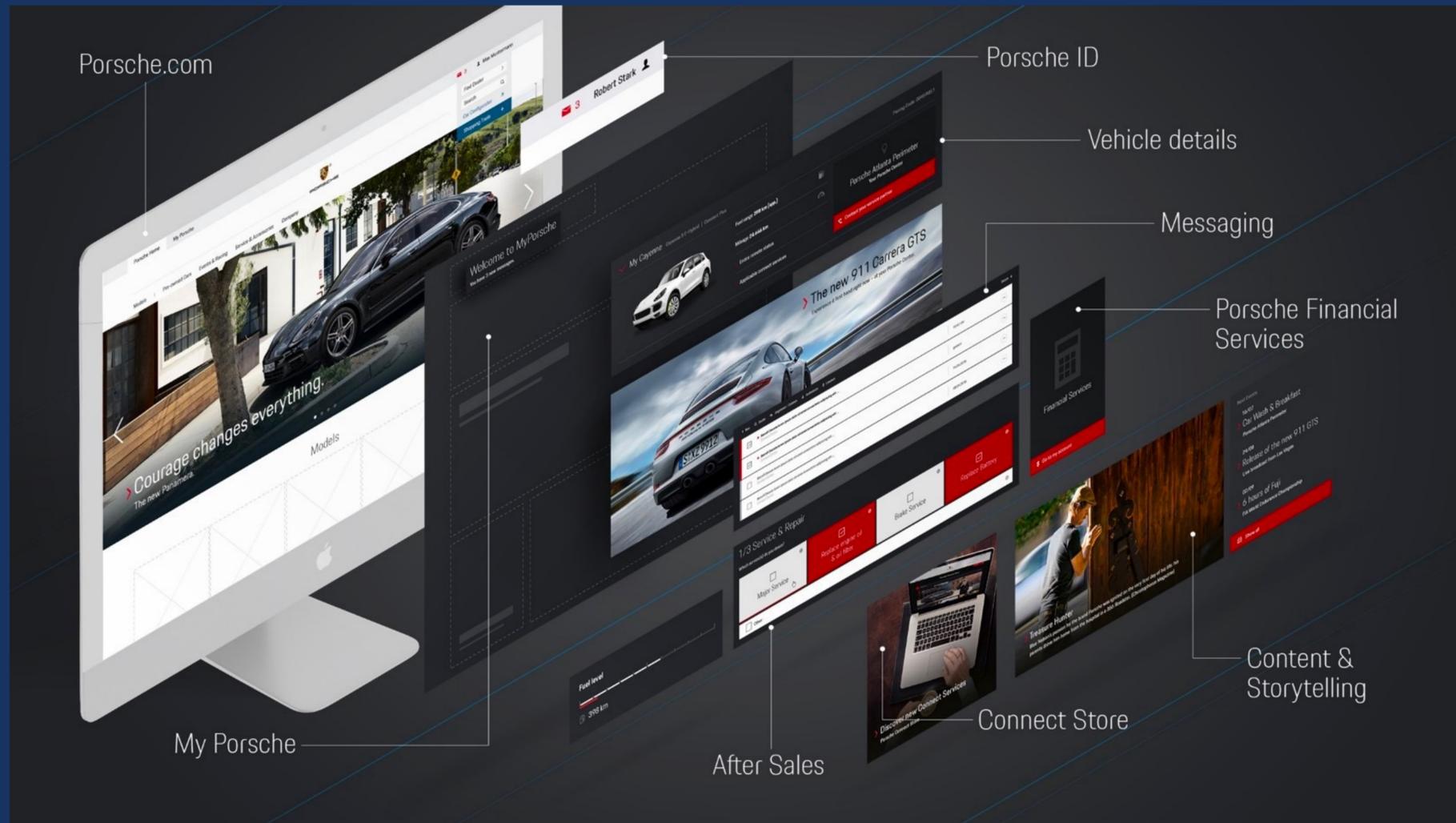
Data in Motion for the Industrial IoT



'My Porsche'



A digital service platform for customers, fans, and enthusiasts



Why Confluent

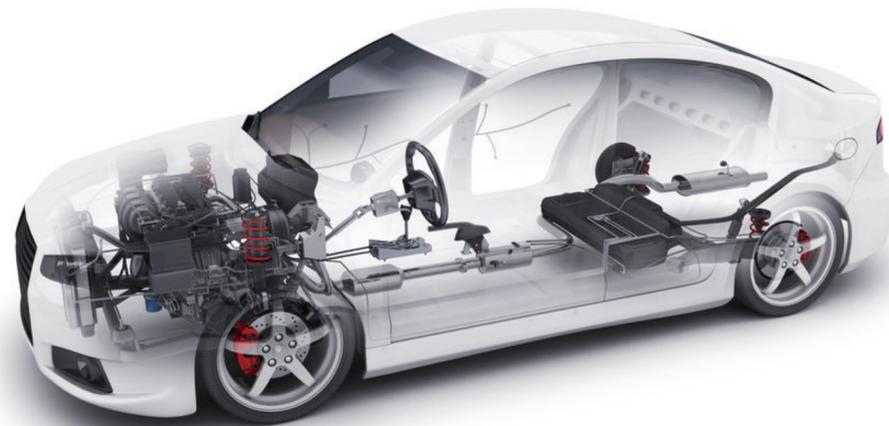
Confluent completes Apache Kafka. Cloud-native. Everywhere.



Car Engine

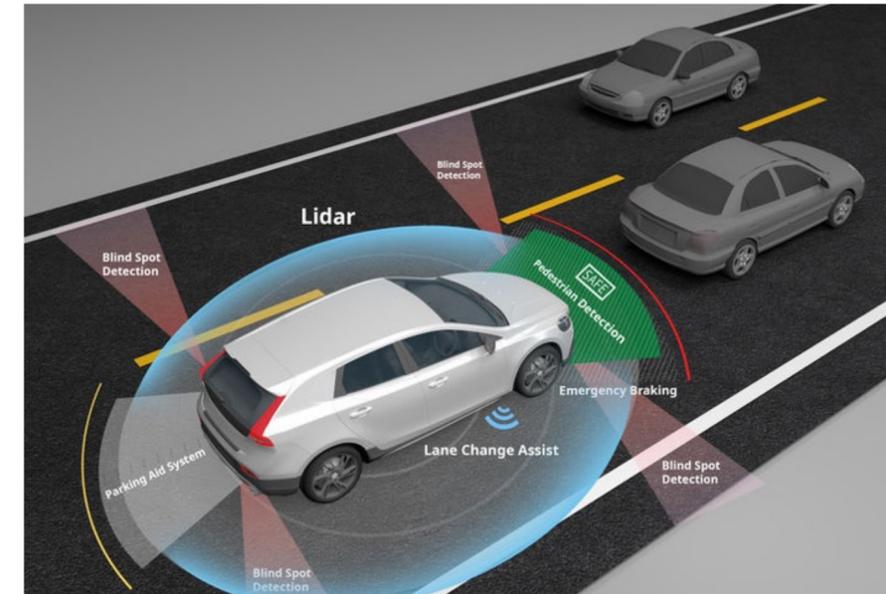


Car



CONFLUENT

Self-driving Car



Confluent Cloud





Questions? Feedback?
Let's connect!

Kai Waehner

Field CTO

kai.waehner@confluent.io
confluent.io
kai-waehner.de
@KaiWaehner
linkedin.com/in/kaiwaehner

