Guidance for Near Real-Time Airline Operational Data Hub on AWS

This architecture diagram illustrates how to effectively support a near real-time Operational Data Hub for Airlines on AWS. It shows the key components and their interactions, providing an overview of the architecture's structure and functionality. This slide shows Steps 1-11.

Example Data Sources

- **Flight Operations:** Aircraft telemetry, flight plans, ATC communications, gate assignments, runway conditions, etc.

- **Crew Operations:** Crew schedules, duty times, rest periods, certifications, etc.

- **Passenger Operations:** Booking data, check-in, boarding, loyalty programs, baggage tracking, etc.

- **Maintenance:** Aircraft health monitoring, maintenance schedules, spare parts inventory, repair history, etc.

- **Airport Operations:** Gate availability, fueling, catering, etc.

- **External Data:** Weather data, air traffic control (ATC) feeds, Notices to Airmen (NOTAMs), third-party flight tracking, etc.
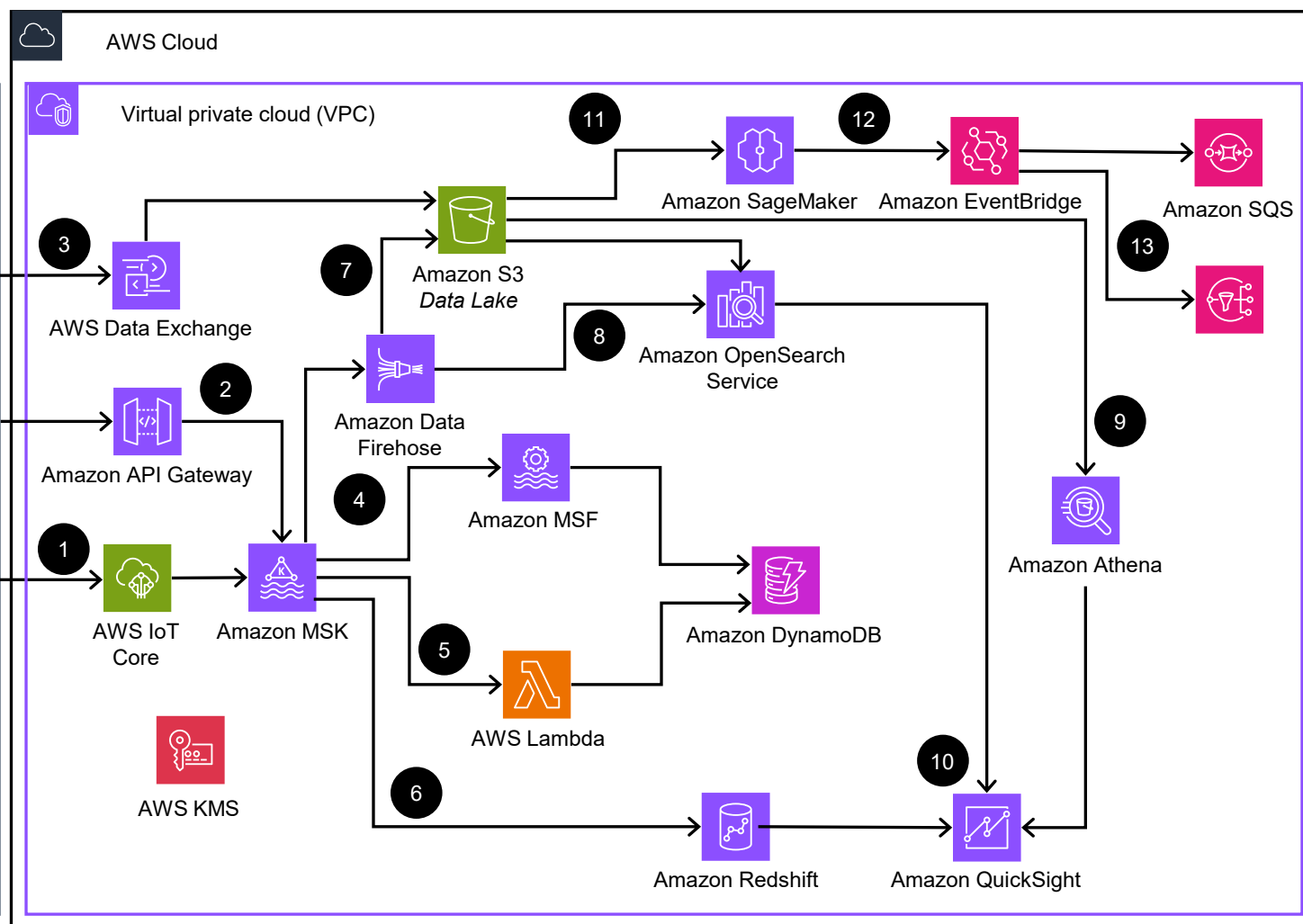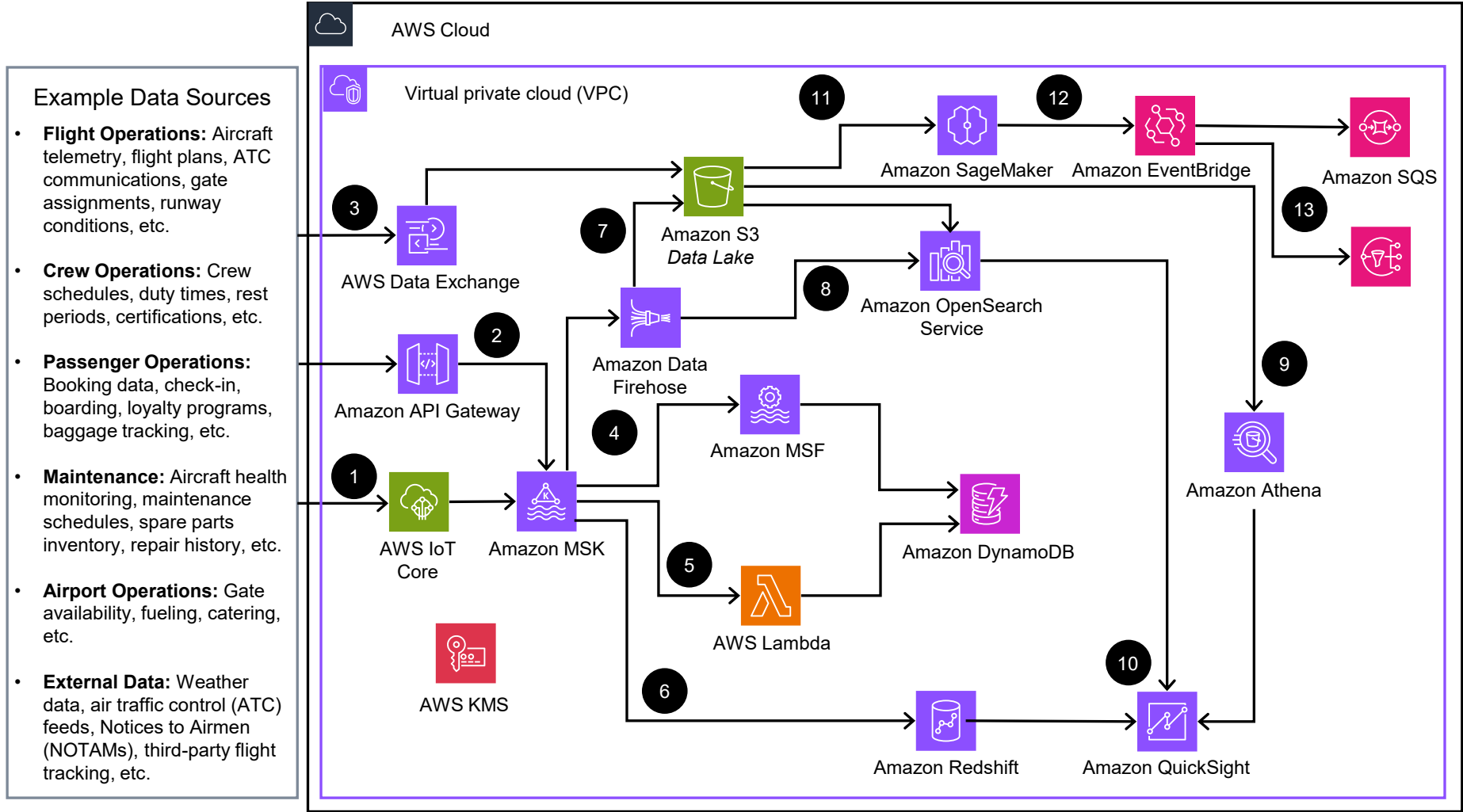
1 **AWS IoT Core** ingests data from sensors (Flight, Airport, Baggage, and Maintenance System.)

2 **Amazon Managed Streaming for Apache Kafka (Amazon MSK)** ingests high-volume, real-time data from all operational systems through **Amazon API Gateway**.

3 Subscribe to third-party data products like weather forecasts or global flight tracking with **AWS Data Exchange**.

4 **Amazon Managed Service for Apache Flink (MSF)** provides stateful, highly scalable stream processing for immediate operational insights.

5 **AWS Lambda** performs event driven processing for tasks like storing telemetry data or baggage tracking data in **Amazon DynamoDB**.

6 Store structured and semi-structured data on **Amazon Redshift** for complex analytical queries, historical trend analysis, and large-scale reporting.

7 **Amazon Data Firehose** performs ETL and delivers data to **Amazon Simple Storage Service (Amazon S3)** Data Lake, which stores all ingested data in its original, immutable format and stores processed, cleaned, and enriched data optimized for analytics and ML training. **AWS Key Management Service** ensures data encryption at rest and in transit.

8 **Amazon OpenSearch Service** provides powerful search and visualization capabilities for operational data.

9 **Amazon Athena** provides a serverless query service to analyze data in **Amazon S3** using standard SQL.

10 **Amazon QuickSight** provides actionable insights to operations teams.

11 **Amazon Sagemaker** develops, deploys, and manages ML models for various operational and business use cases.

AWS Reference Architecture

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12   **Amazon EventBridge** automates complex responses to real-time events.

13   **Amazon Simple Notification Service (Amazon SNS)** and **Amazon Simple Queue Service (Amazon SQS)** ensure timely communication of critical events and reliable message delivery for actions.

AWS Reference Architecture