Implementing 250 million smart meters

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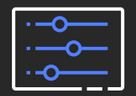
Agenda



Industry Perspective

Possible Approach / Architecture

Build DISCOM Data Warehouse on AWS

Emphasis in the utilities today

Customer engagement and insights

Reduce customer churn, improve customer satisfaction, and create new revenue streams

IT transformation

Improve agility, reduce costs, and enable innovation across the IT function and the rest of the business

OT transformation

Achieve the highest level of operational excellence in the face of increasing IoT data and intermittent renewable generation

Work and asset value management

Create more value from your existing physical assets and workforce through analytics and machine learning

Utilities IT/OT Systems Landscape

Consumer interactions

Commercial & Operations users

Fieldforce/ Technicians

Senior & Top Management

Customer Portal & Mobile App

Customer Service & Marketing

Energy Settlement

Workforce Management

Demand Response

Demand Forecasting

Enterprise Resource Planning – Materials, Procurement, Planning, Finance etc.

Customer Information System

Fraud Management

Energy Accounting

Geographical Information System

Enterprise Warehouse and BI

Enterprise Integration Platform

Active Directory

Meter Data Management

Distribution SCADA

Distribution Management System

Outage Management System

Legacy AMR Systems

Smart Meter Head End Systems

Network Management System

Security Systems – Firewall, IPS

SCADA Front End Processors

Communication network – RF/PLC/ OFC/ Cellular

Smart meters at consumer premise, distribution transformers, feeders

Transformers

Circuit Breakers

Sectionalizers & Reclosers

Grid operations devices at transformers, substations, switch yards

Architectural challenges

Scalability

Variety of systems

No of consumers

Reduce effort

Administration

Deployment

Application

Stateless

Break the monolith

Processing, aggregation

DW & analytics

Data

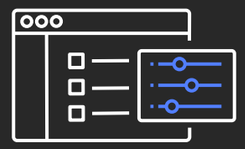
Collect and analyze huge amount of heterogeneous data

Integration

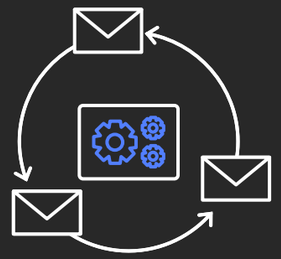
Legacy systems

Applications

Critical success factors for India implementation



Centralized planning & decentralized execution



Interoperability across solution providers

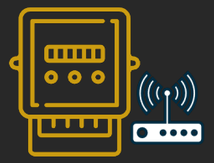
Heterogeneity and differences in maturity of different discoms

Smart Metering – Functional Architecture

Smart meters with inbuilt in comms module

PLC/RF communication

Aggregators/ Repeaters



Cellular communication

Smart meters with external comms module

- Reading schedules
- Meter Protocols
- Network Management
- Firmware/ Config management

Head-end System

1

- Scheduled meter data reads – daily, load profile
- On demand read requests
- commands – reconnect, disconnect, ping
- provisioning

Meter Data Management -Application and Visualization layer

- Transactions – viewing and editing
- Dashboards and Reporting
- Reading request management
- Command request management
- Meter read data validation rules
- Exception and editing rules Management
- Alarms and events management
- Meter Details – addition, replacement, removal

Meter Data Management - Data layer

- Reads storage – daily reads, interval
- Reads storage – daily reads, interval
- Meter master
- Account information

Integration Layer

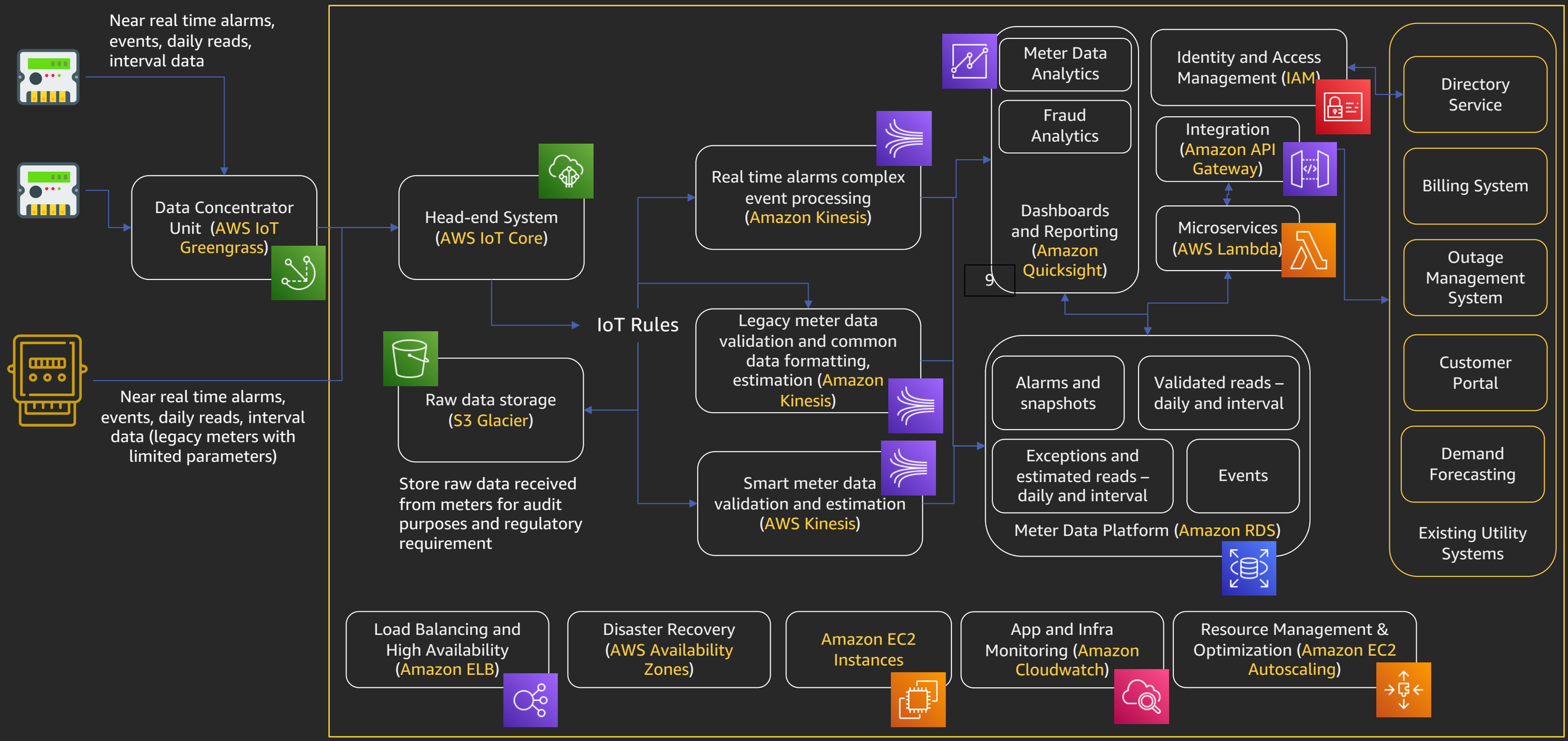
2

- Billing and customer care
- Customer Portal
- Outage Management
- Fraud Management

2

- Account and asset information
- Billing read requests and offcycle read requests
- reconnect and disconnection requests
- Load profile Usage history on customer portal
- outage and restoration alarms for outage identification
- tamper alarms and events for fraud management

Meter Data Platform Built on AWS



Enel Is Already Doing This

Key Drivers of IoT based implementation to gather smart metering data:

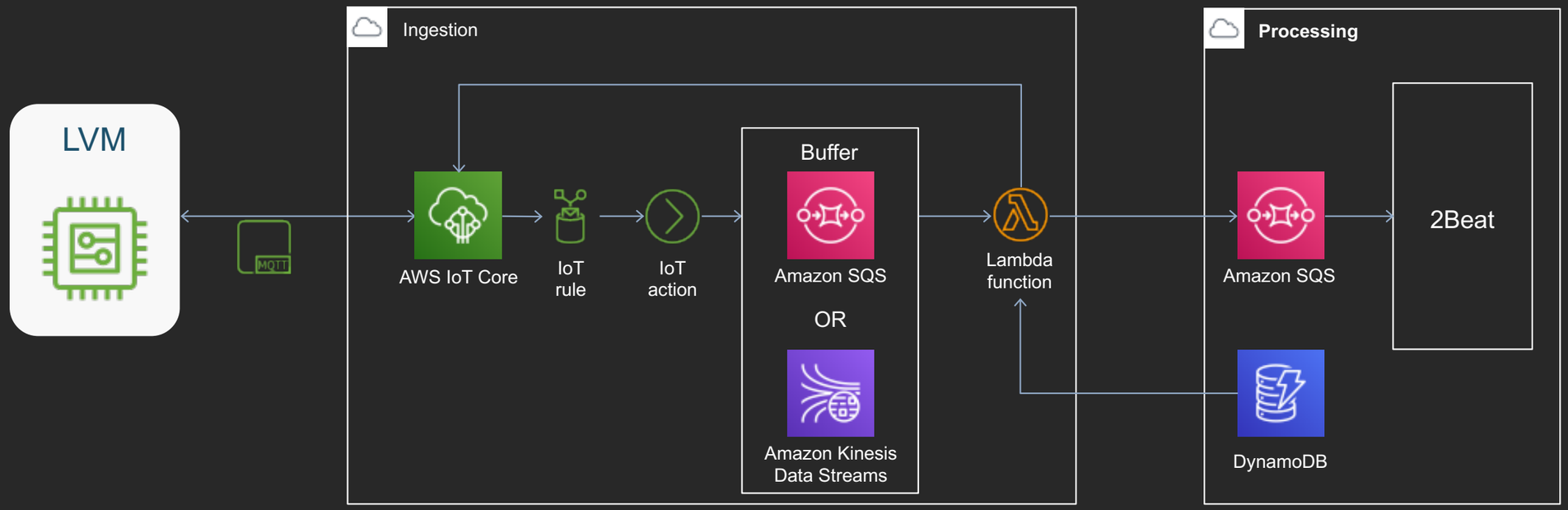
- Technical
  - Data resolution: 1 sample / 15 min
  - Scalability: 32M meters, 380k gateways, 150M files per day
- Business
  - Meter data collection: 95% within 24 h
  - Customer Contract Change KPI: 94% within 4h

Multinational utility company headquartered in Italy

- 64+ million consumers
- 35 countries

Clearly defined Cloud roadmap:

- Cloud-First strategy (2015 – 2016)
- Cloud-Only strategy (2017 – 2018)
- Serverless & IoT (2017-2018)
- AI/ML (2020-2020)



Global Power & Utilities

Customers and Partners

aws

Smart meter use cases for a data driven utility

End-users

Consumption profiles for end-user

Increase awareness

Retailers

Enabling value added services

Enhanced fraud detection

Flexible rates

Network operators

Advanced diagnostic

Predictive maintenance

Network monitoring

Smart meters and machine learning

With smart meters data in your data lake, you can leverage ML

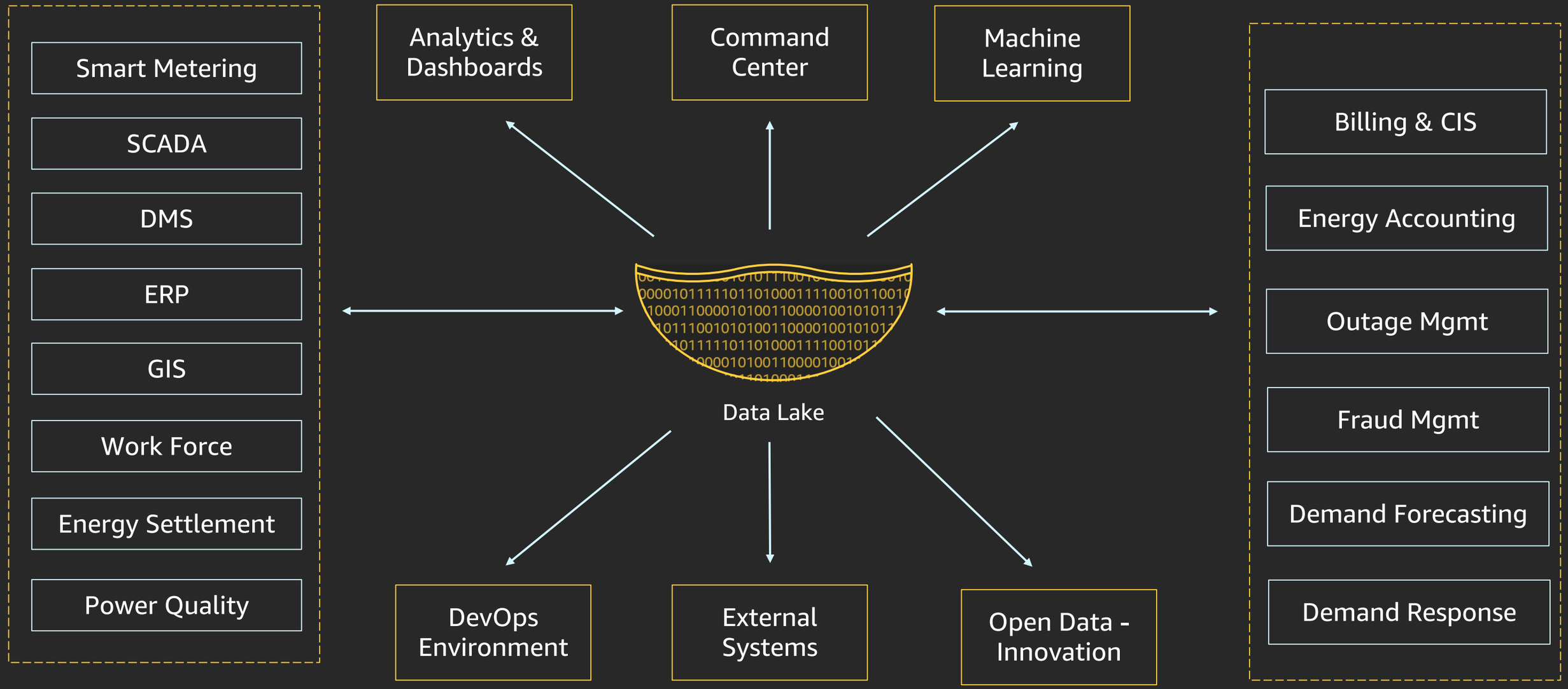
Main use cases:

Predictive maintenance

Consumption profiles and forecasting

Anomaly detection

Multiple DISCOM Solutions – Common Data Lake



Defining the data lake

Centralized repository that allows structured and unstructured data to be stored at any scale

Used for all use cases including machine learning, real-time streaming analytics, data discovery, and business intelligence

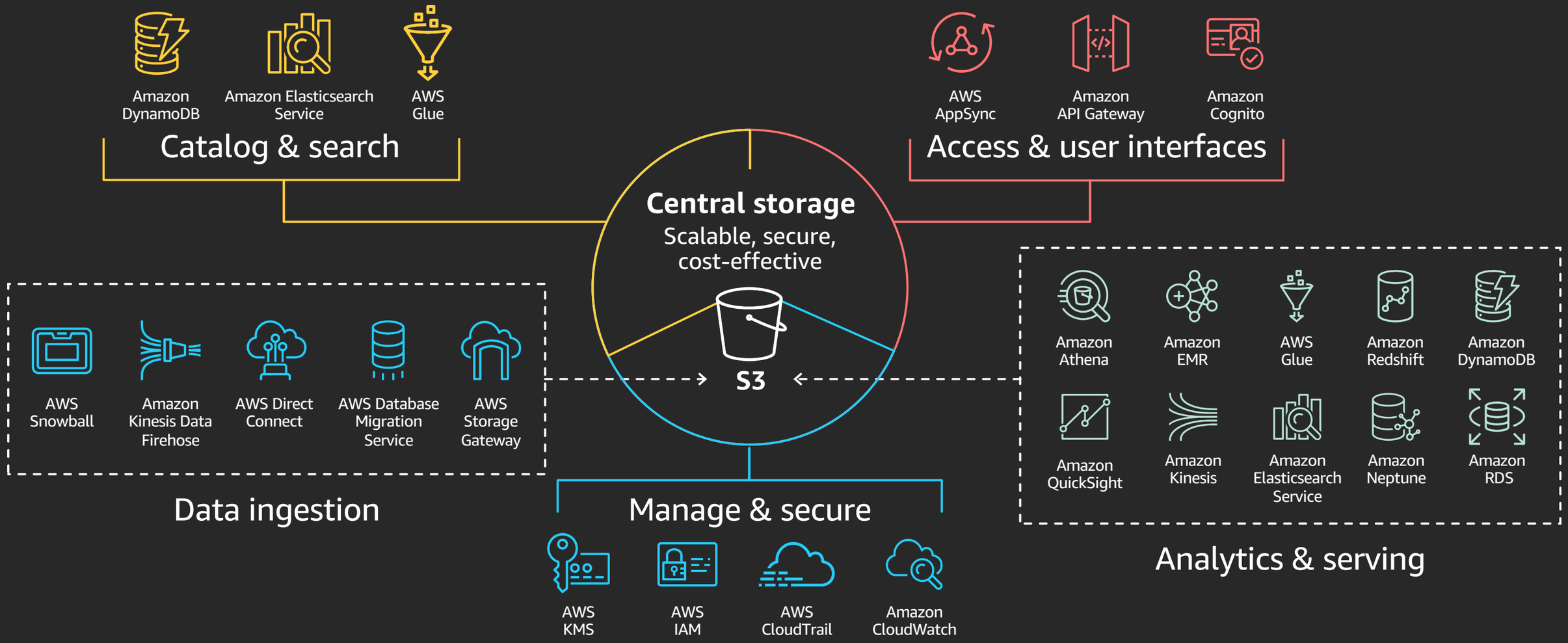
Data is stored as-is without having to first structure the data

Support rapid ingestion transformation and consumption of data

Other key attributes

- Decouple storage and compute
- Support protection and security rules
- Designed for low-cost storage
- Schema on read

Data lake on AWS



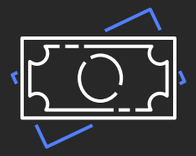
Benefits of building a data lake on AWS

Security & compliance: Encrypt highly sensitive data and enable controls for data access, auditability, and lineage

Scalability: Amazon S3 data lakes and transient Amazon EMR clusters provide flexibility to meet changing regulatory requirements

Agility: Decoupling storage and compute enable flexibility and cost-effective analytics without moving data from the data lake

Innovation: Governed data sets with clear lineage provides the foundation for application of AWS analytics and machine learning services



Cost-efficiency: Pay-as-you-go pricing for compute, storage, and analytics

Thank you!

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