

aws INNOVATE

DATA EDITION

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Detecting power theft using smart meters data and Amazon OpenSearch Service in near real-time

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Agenda

- Introduction
- SMART meter and SMART grids experimental data
- Solution architecture demo
- Summary

Introduction

- Technical losses (TL) and non-technical losses (NTL) in electricity
 - TL losses occurring during the transportation of electricity.
 - NTL are losses due to billing delay and irregularities, energy theft, faulty energy meters, fraud, and unpaid bills.
- Magnitude of power theft problem
 - As per the Central Electricity Authority, over 27 pc of all power produced in India is either lost due to dissipation from wires or theft. That's about 261,130 gigawatt/hour of power annually- enough to light up New York for nearly two years.

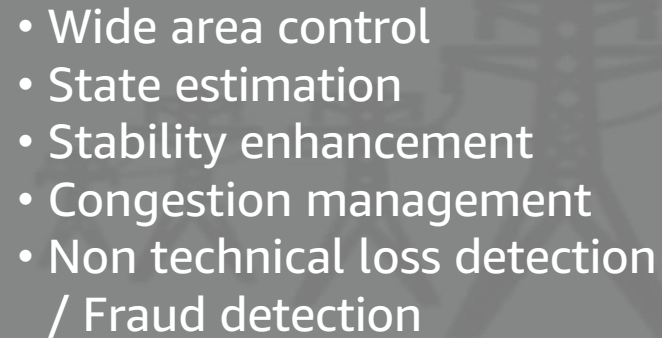
Smart meters and smart grids

- SMART meters and SMART grids
 - The smart grid is the evolving electric grid with advanced automation, control, IT and IoT systems that enables real-time monitoring and control of power flows from sources of generation to sources of consumption.
 - A smart meter is an electronic device that records consumption of electric energy in intervals of an hour or less and communicates that information at least daily back to the utility for monitoring and billing.
- Data explosion due to SMART meters
 - SMART meters are generating consumption data at the rate as fast as one reading per 15 minutes.
 - Thus approximately 3000 fold increase in the volume of data as compared to traditional meters resulting in a data explosion by smart meters.

Utilization of this data

- 
- Asset health analytics
 - Pricing forecasting
 - Risk analysis


Device Operators

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- Wide area control
 - State estimation
 - Stability enhancement
 - Congestion management
 - Non technical loss detection / Fraud detection

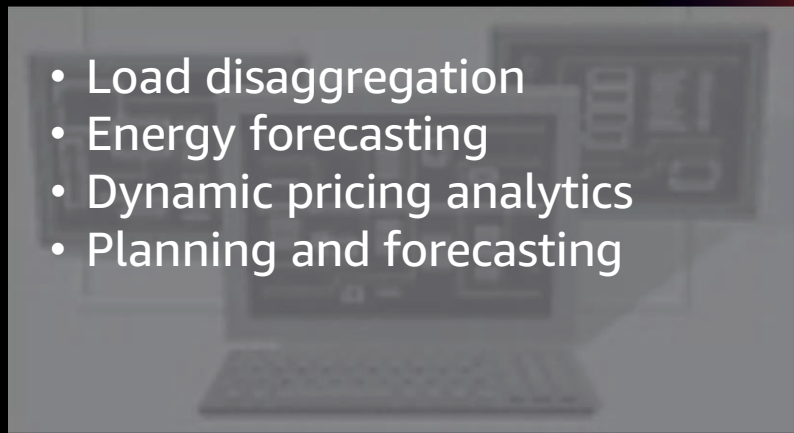
Transmission Operators

- 
- Demand forecasting for plant
 - Generation and planning

Generation

- 
- Customer behaviors
 - Demand response
 - Real-time energy management
 - Churn analysis

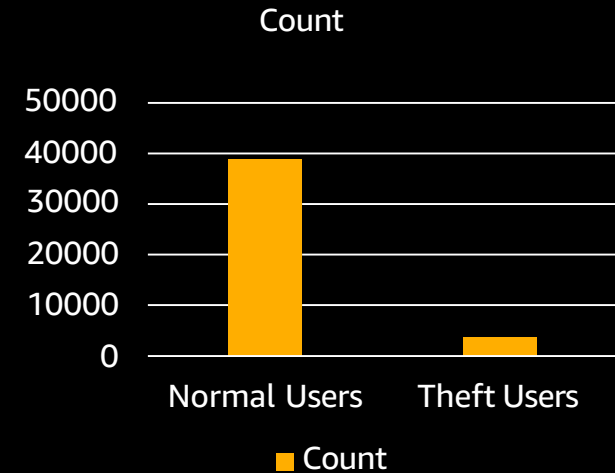
Customers

- 
- Load disaggregation
 - Energy forecasting
 - Dynamic pricing analytics
 - Planning and forecasting

Energy Retailers

Experimental data & insights

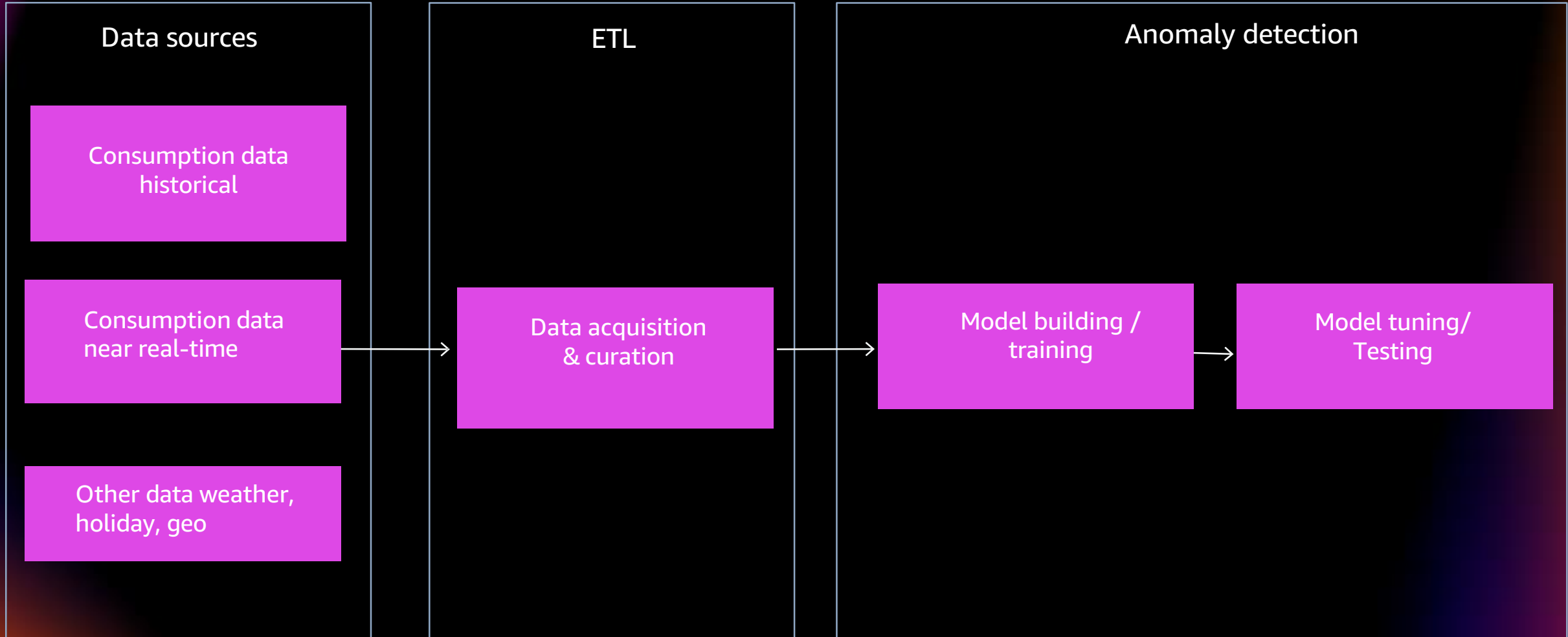
- Sample source data & insights
- SMART meter data
- Extrapolation of data



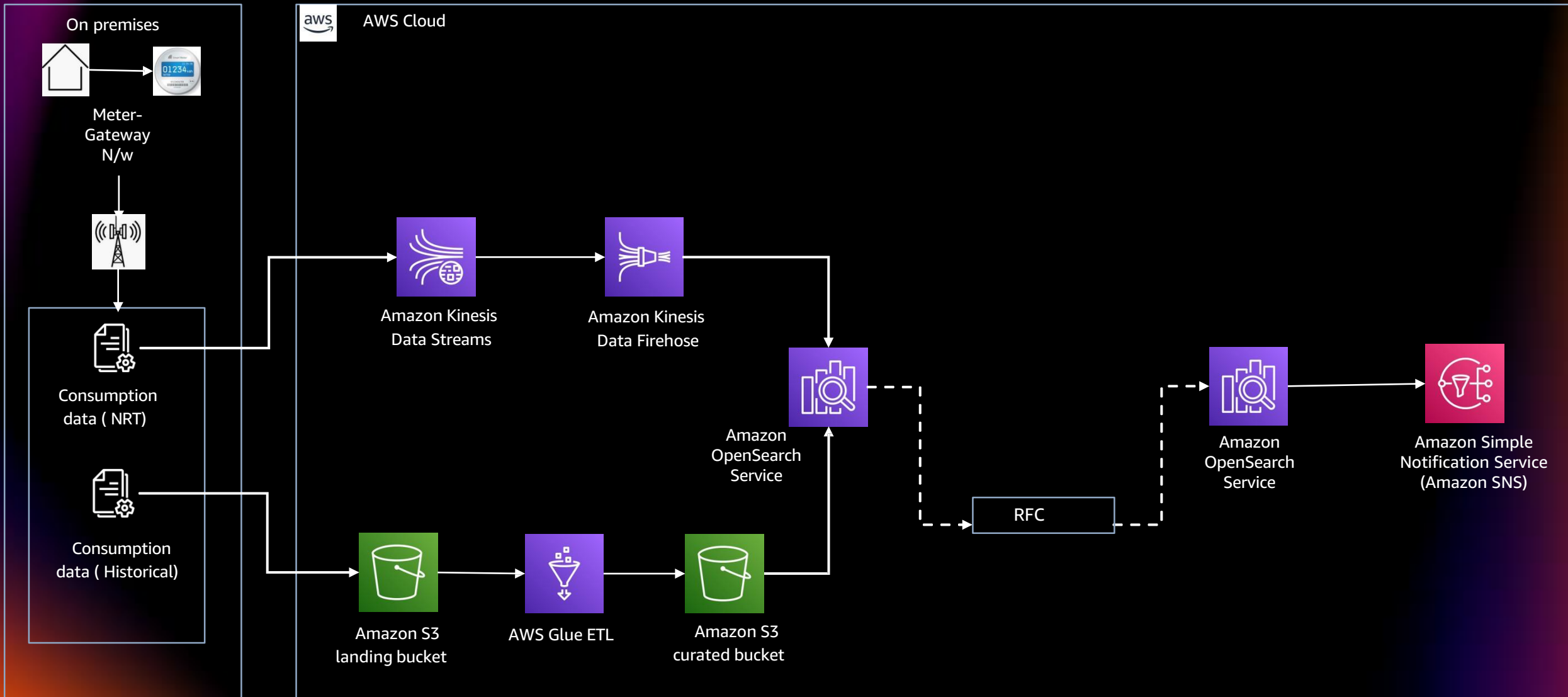
Power theft detection – Approaches

- Manual inspection
- State of the art infrastructure setup
- Deep learning based approaches

Solution architecture – Block diagram



Detailed solution architecture



Demo

What can still be done

- Data imbalance
 - In the real world, the number of theft samples are less as compared to the benign samples, which leads to data imbalance issue. The models will be biased regarding the majority class.
- Augmenting the source data
 - Consumption of the power is driven by other factors such as weather, geo-location data
 - Considering these factors will help to improve the accuracy.
- Using algorithms other than RFC (eg. XG Boost, NN etc)

Summary and key takeaways

- Amazon OpenSearch simplifies and accelerates the model lifecycle (development, training, tuning, HPO etc.) resulting in saving efforts and costs.
- Accurate and real-time theft detection can help to save the costs for the business.
- To build an efficient power supply system, preventing non-technical losses is key.

Resources

- Amazon OpenSearch [Developer Guide](#)
- Getting started with Amazon OpenSearch [Developer Guide](#)
- Amazon Kinesis [Developer Guide](#)

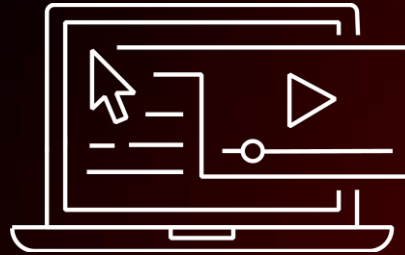
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Thank you!