Tiger Analytics

Microsoft

Delivering Real-Time Operational Insights for PTP with a Modern Azure Lakehouse Platform

CASE STUDY

Executive Summary

Pelabuhan Tanjung Pelepas Sdn Bhd (PTP), Malaysia's premier transshipment port, required a transformational overhaul of its data ecosystem. Faced with fragmented information across more than 10 operational systems and increasing data volumes, PTP faced delayed, error-prone reporting and a absence of real-time insights. To overcome these challenges, PTP partnered with Tiger Analytics to deploy a unified data platform built on Microsoft Azure. This new solution consolidated structured and unstructured data into a single, scalable repository using the latest features in Azure Databricks Lakehouse platform while enabling real-time analytics and interactive reporting through Power BI. The transformation has not only accelerated operational reporting but also laid a strong foundation for future AI and machine learning (ML) initiatives.

Business Challenges

The fragmentation of data across multiple systems had a significant impact across key functions at PTP such as operations, productivity, maintenance, and finance. Some of these were:

Need for integration across 10+ operational source systems and a 17% year – over-year increase in data volume.

Capturing and managing intermediate data states during updates and inserts.

Generating real-time operational reports

Developing machine learning (ML) and business intelligence (BI) use cases.

Delay in report generation due to reliance on macros-enabled Excel, where complex calculations take over an hour to process, leading to potential manual errors.

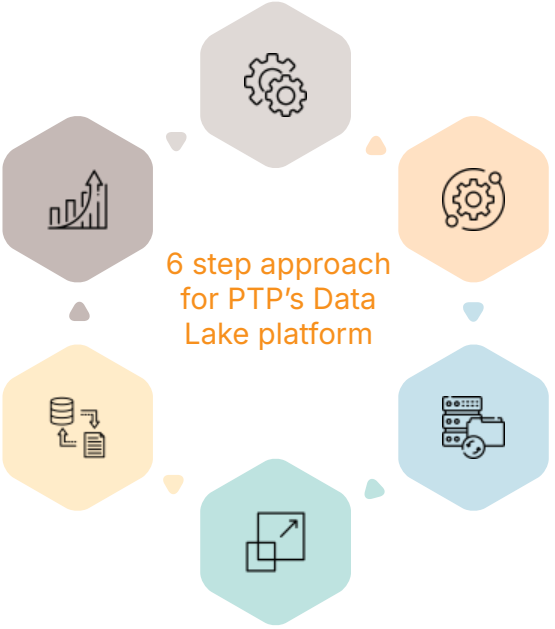
Reliance on manual judgement to estimate and adjust the number of prime movers required for Quay Cranes, resulting in discrepancies between reported and actual performance.

Solution Approach

To address the business need, a Data Lake and Analytics platform was chosen as the best solution. This next-generation solution would centralize PTP's data - both structured and unstructured - into a single, unified interface. We adopted a **six-step approach** in implementing this Data Lake platform.

Event Driven Processing:
Continuous event ingestion/processing from Terminal OS using Azure Event Hub and Databricks Workflows

ML Pipelines-based Performance Forecasting: Past metrics, scenarios captured to train models in Databricks for real time performance analytics



Data Capture and Transmission: Employed Debezium connectors, APIs, file systems, SharePoint to capture and send both real-time and batch data

Data Orchestration and Transformation: Utilized Azure Data Factory to manage data flows and Azure Databricks to apply business logic and prepare data for Power BI

Data Organization: Applied a Medallion architecture to organize data into raw, cleaned, and business-level formats

Scheduling and Scalability:
Leveraged Azure Databricks workflows for near real-time job scheduling and execution, delivering a scalable and reliable solution for timely data updates

Technical Architecture

The solution's architecture is underpinned by several key Azure services.

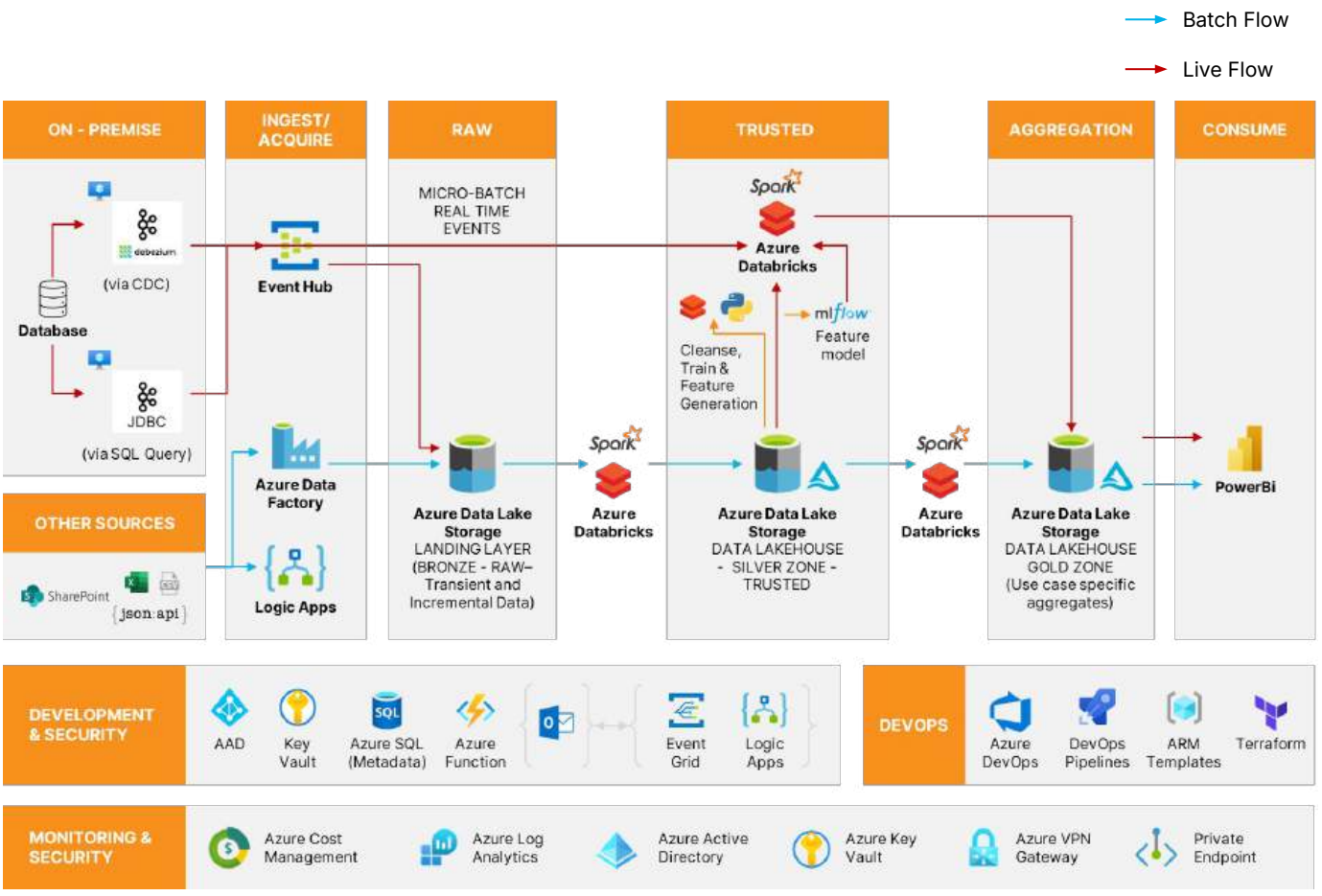
Azure Data Lake Storage serves as the central repository, hosting raw, cleansed, and business-ready data.

Data ingestion is managed by Azure Data Factory and Logic Apps, which ensure efficient and secure data transfer from multiple sources.

Real-time data streaming is facilitated by Azure Event Hub and Function Apps, which process incoming events with minimal latency.

Azure Databricks is employed for large-scale data processing and advanced analytics, while Power BI provides end-user access through interactive, real-time dashboards.

This architecture not only supports current operational needs but also offers the scalability required for future growth.



Business Outcomes

This solution delivered multiple tangible benefits for PTP.

01 The implementation of real-time reporting capabilities allowed the port to make quicker, data-driven decisions.

02 Automated workflows eliminated manual errors and reduced report generation time by over 90%, decreasing turnaround from several hours to under 30 minutes through auto-refresh capabilities.

03 Improved transparency of operational metrics led to better resource allocation and planning, especially in resource-intensive areas such as Prime Mover deployment, Yard Density Planning, and predicting the likelihood of delinquency among Terminal Equipment Operators.

04 Azure's scalable and secure infrastructure guaranteed that the platform could expand alongside the organization, paving the way for advanced analytics and predictive modeling initiatives in the future

Conclusion

By leveraging Microsoft Azure’s integrated cloud services, PTP has transformed its data landscape into a unified, real-time operational analytics platform.

The solution has eliminated data silos, reduced manual processing, and empowered the port with timely insights that drive better decision-making and operational efficiency. With the added potential for future enhancements in AI and ML, this platform stands as a testament to the power of Microsoft Azure in modernizing data ecosystems. Microsoft Azure’s robust, secure, and scalable cloud infrastructure continues to empower organizations like PTP to innovate, optimize, and lead in their respective industries.