
AVEVAWORLD
PARIS

How CONNECT data services Enables Analytics in Mining

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Michael Bigras

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AGNICO EAGLE

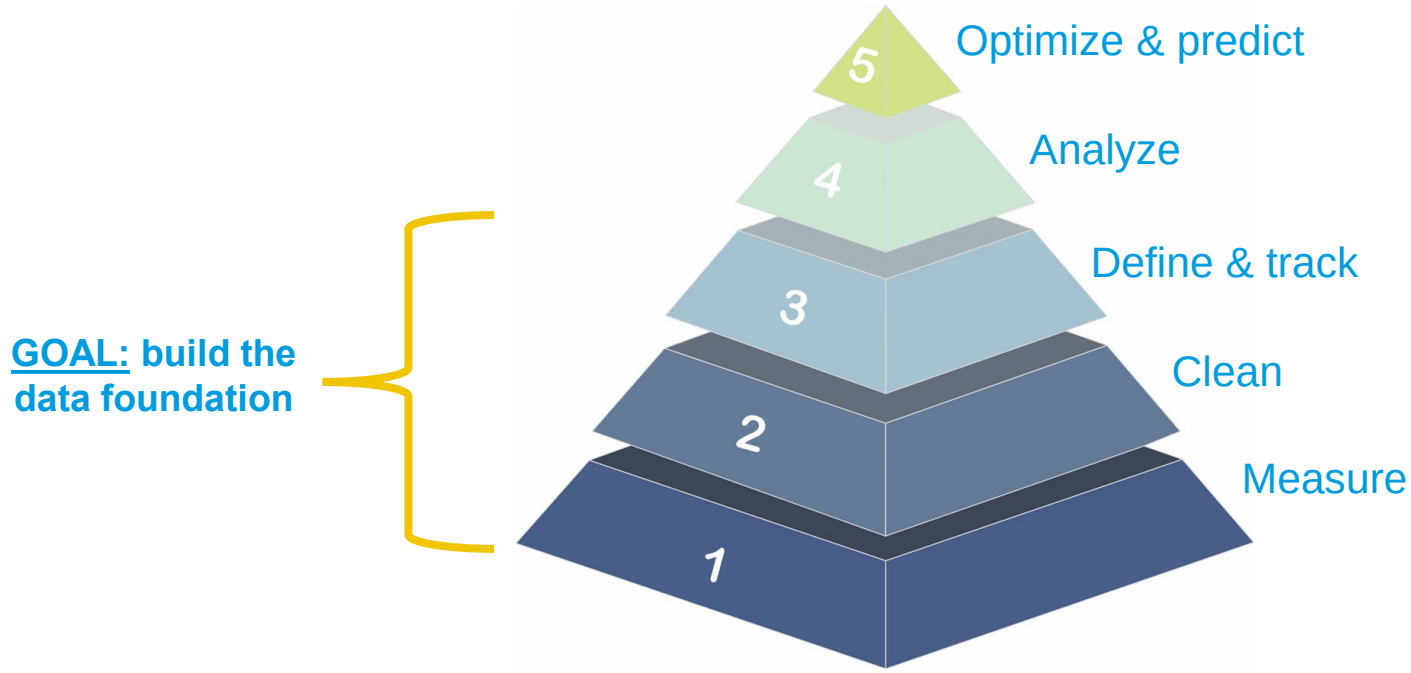






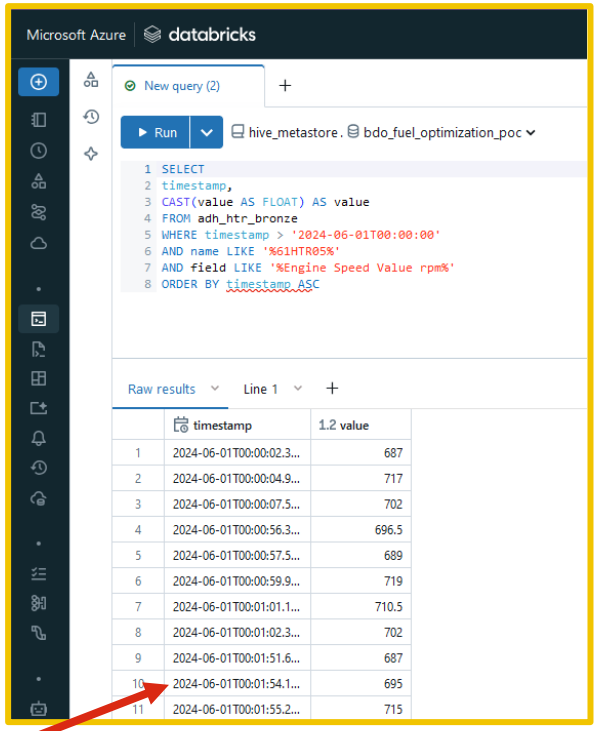

AGENDA

- The business challenge
- Overview of Agnico Eagle Mine's digital transformation
- Analytics opportunities
- Lighthouse program
- Integrated Operations Center
- Conclusions



THE BUSINESS CHALLENGE

- Many analytics opportunities are limited by data access challenges
- Discussed with AVEVA to seamlessly integrate industrial asset data with other relational data
- Initiated a Lighthouse engagement for direct integration between CONNECT data services and Azure Databricks
- The new feature will allow direct Databricks Unity Catalog access to a pre-materialized copy of a CONNECT data services data view



CONNECT data services data here

Company Overview

- Agnico Eagle Mines
- Digital Transformation group

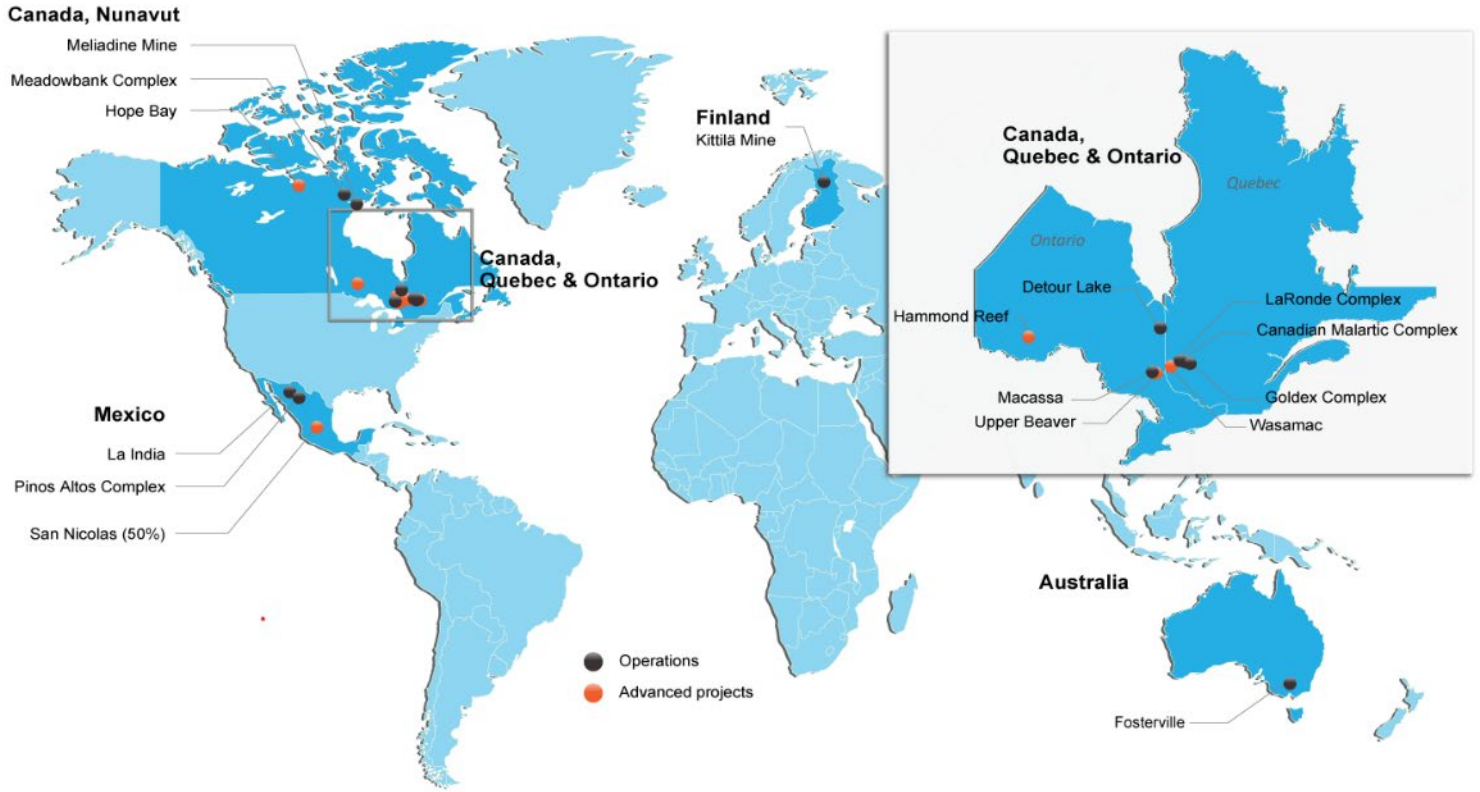
High-Quality Portfolio

ESG Stewardship

Generating Superior Long-Term Returns to Shareholders

AGNICO EAGLE MINES OVERVIEW

- Third largest gold producer in the world (2023 Global Gold Production: 3.44 Moz)
- 11 operating mines in Canada, Australia, Finland and Mexico
- 16,000+ global workforce



DIGITAL TRANSFORMATION GROUP

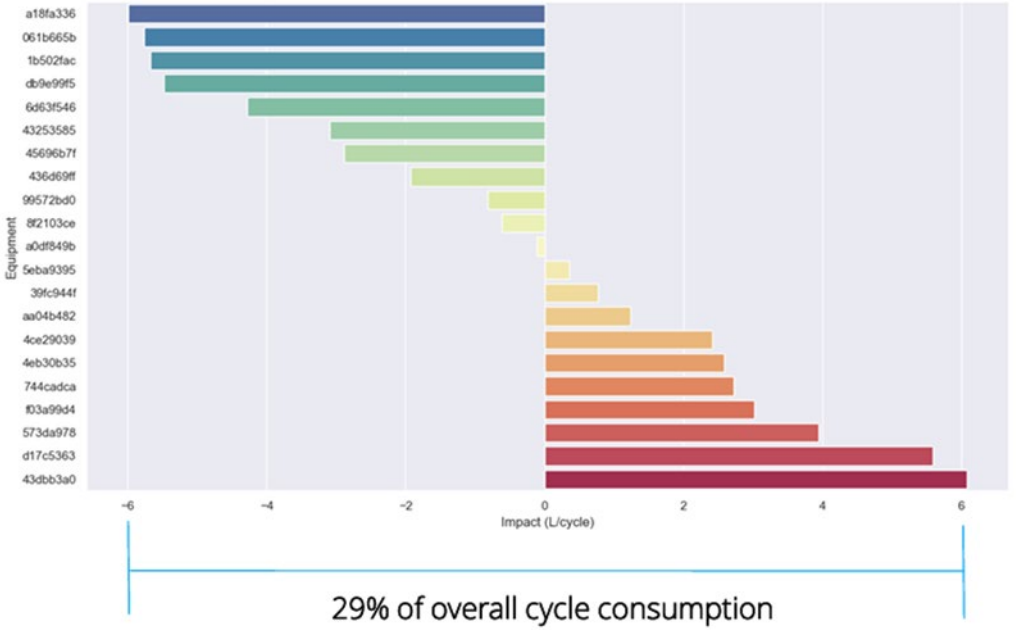
- Established in 2022
- Provide guidance for data integration and analytics
- AEM Data Academy
- Strategies for Data Quality & Integrity
- BI reporting support and enablement
- Integrated Operations Centers in Abitibi and Ontario
- Build internal Data Science capabilities

Michael Bigras
OT Automation Specialist

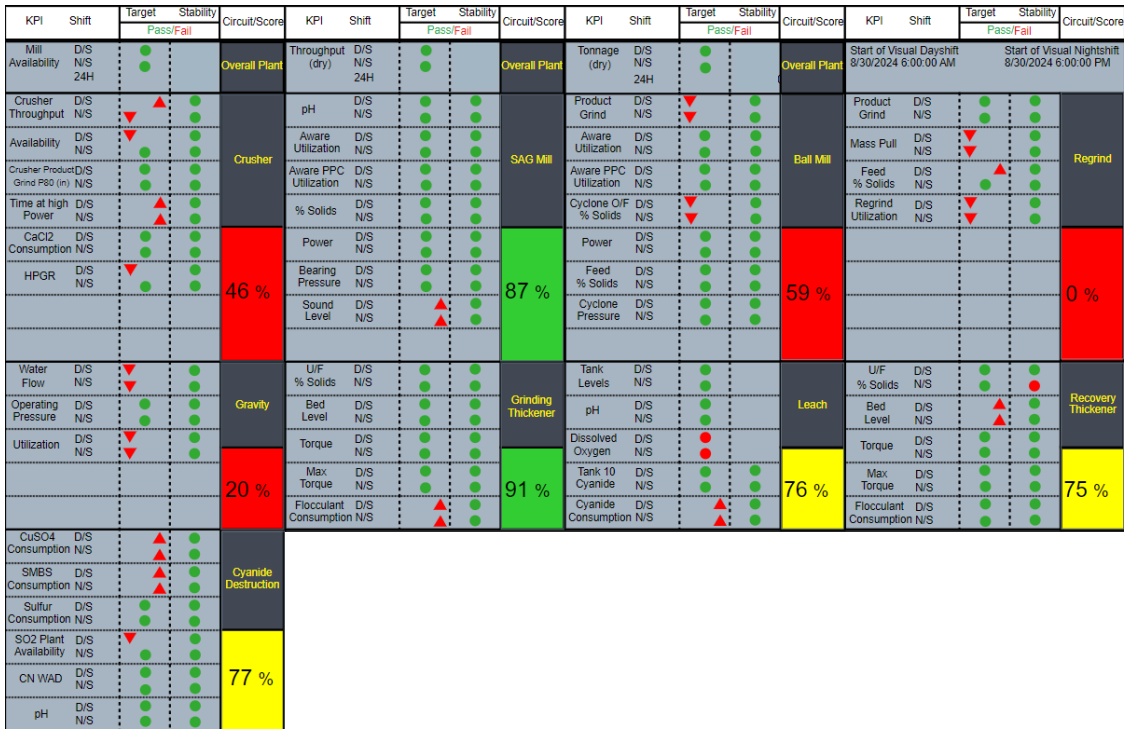
Karl Leetmaa
Metallurgy Subject Matter Expert

Analytics Opportunities

Haul truck analytics



Process KPI dashboard



ANALYTICS PROJECTS OVERVIEW

- ***AVEVA and Databricks integration using CONNECT data services will lower the technical knowledge barriers***

- Several ongoing projects would benefit from easier access to time-series equipment and process data:

  - **Paste backfill:** integrate plant batch data with lab results to better manage batch quality through automated reporting

  - **Haul truck analytics:** integrate machine data with logistics and maintenance data to optimize haul routes and asset health

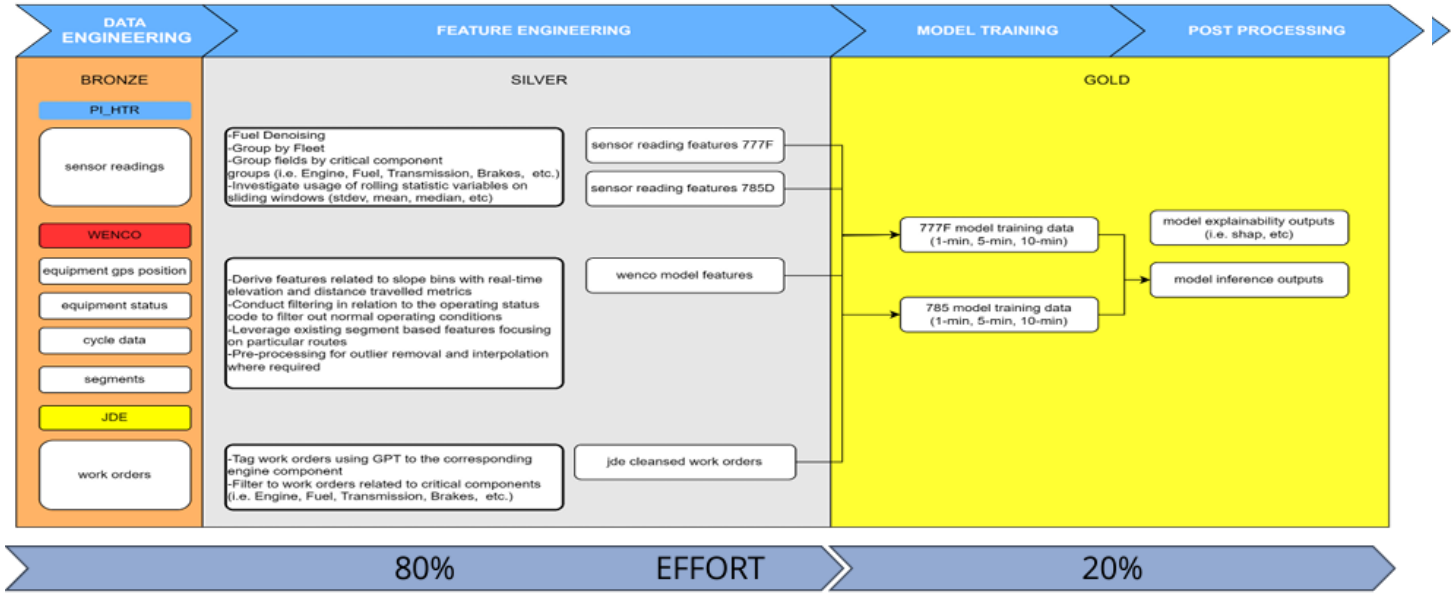
  - **Energy mapping:** Expand visibility of electrical and fuel data for mine sites, sustainability, finance and corporate

  - **Improved BI reporting:** integrate instrumentation data and operational data into common tables for analytics and reporting. Ex: tonnage from trucks and hoists (PI System) combined with mine underground short-term planning systems

  - **Process plant KPI dashboard:** instrument data combined with assay results and operator manual verifications for analytics related to process and asset efficiency

HAUL TRUCK ANALYTICS OPPORTUNITY

- **The opportunity -** Operational data at one of the Nunavut mine sites has created a mobile fleet analytics opportunity
  - Increase availability of production haul trucks (improve asset health)
  - Reduce energy intensity and CO_2 emissions
  - Optimize route/haul road



- Two approaches with similar objectives:
  - Vendor solution (site initiative)
  - Data science consulting engagement

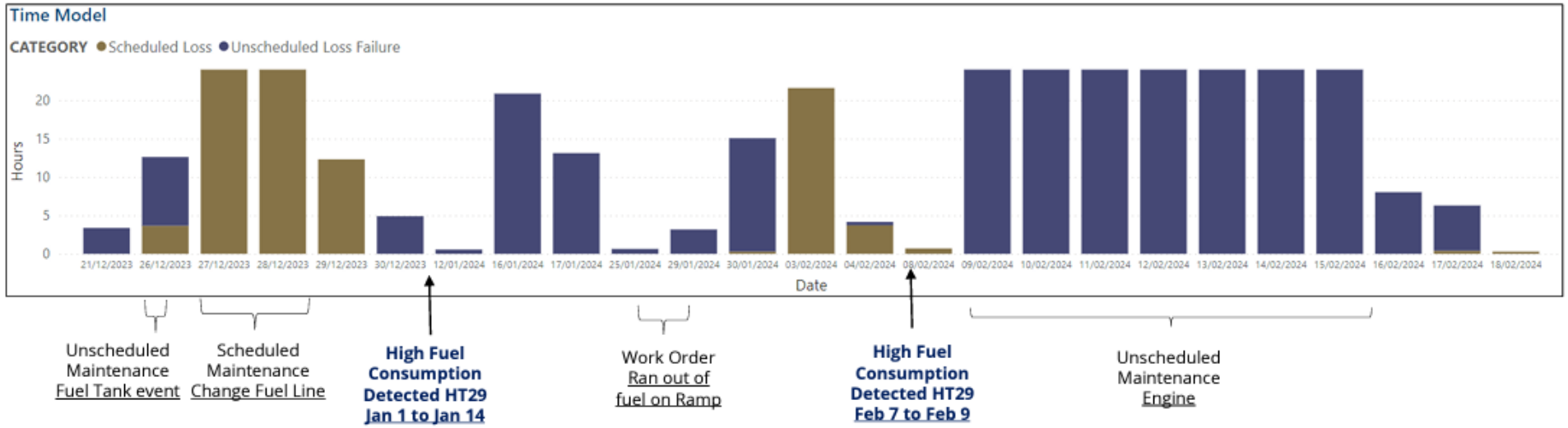
- Requires high frequency data from many streams
  - Many API calls and careful optimization before writing to Databricks data warehouse
  - Initial call required 8 - 9 days per month of data & contained gaps
  - Optimized API call: 1 month of data on 28 trucks took 1 – 2 days
  - Data quality is a big challenge

HAUL TRUCK ANALYTICS IN HOUSE PLATFORM RESULTS

- Exploratory data analysis showed that fuel consumption monitoring can be used for early anomaly detection

- Development of fuel consumption rate Machine Learning (ML) models as proof of concept. Contributing factors:
  - High boost pressure & air filter differential are correlated to high fuel consumption

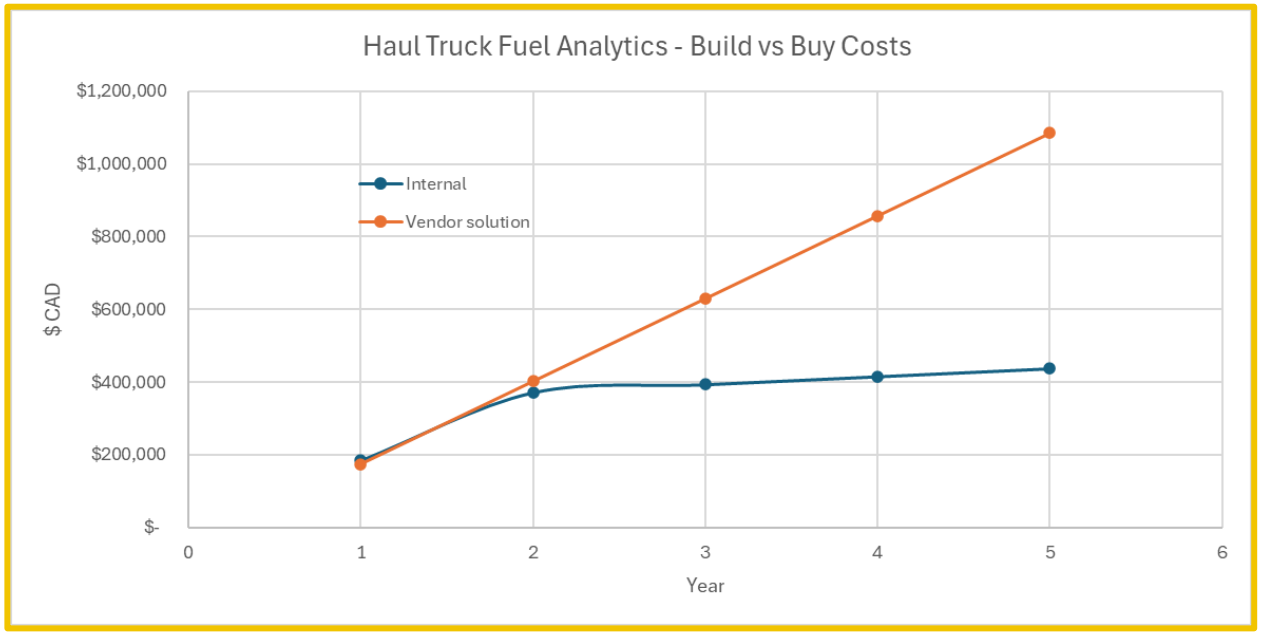
- Data science enablement partner provided a roadmap to operationalization:
  - Data engineering & architecture updates
  - ML model improvements
  - Deployment and monitoring according to MLOps best practices



HAUL TRUCK ANALYTICS BUILD VS BUY

- Vendor solution
  - **PROs:** Quick time to value, hands-off approach, facilitates collaboration with maintenance / operations
  - **CONs:** rely on supplier platform / black box, higher costs, 1 dimensional analysis could lead to false conclusions

- Data science enablement firm
  - **PROs:** Development of internal expertise, retain intellectual property, identify additional opportunities, cost scalability
  - **CONs:** Longer time to value, requires additional internal resources



Lighthouse Program

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MINING, METALS & MINERALS | CANADA

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Integrating CONNECT data services and Databricks should improve haul truck analytics

Challenge

- Lack of integration between data sets limits the opportunity for haul truck analytics related to asset health, operator performance and lowering emissions
- Secure data integration needs to be easier and faster
- Creating a scalable data infrastructure across OT and IT is an enabler

Solution

- Deploy an end-to-end solution, from operational data using AVEVA PI System to the cloud via CONNECT data services, efficiently enabling use cases within Databricks.

Results

- Framework to operationalize solutions involving time series data and other relational data sets
- Internal development of analytical and predictive models that will scale to multiple sites
- Potential for 3% truck efficiency and 1% operator lower costs with improved asset health and lower carbon emissions

“Leveraging CONNECT data services to seamlessly query time series data in the Databricks environment will open the door to many use cases where disparate data sets exist ”

Karl Leetmaa, Metallurgy Subject Matter Expert, Agnico Eagle Mines

Learn more

AVEVA

LIGHTHOUSE OBJECTIVES

Agnico Eagle is participating in a Lighthouse agreement to test an upcoming Databricks integration to:

- Improve efficiency with tighter UI and platform integrations
- Enable the ability to preserve metadata (ex: PI System asset framework)
- Create the ability to directly catalog and query PI System data in Unity Catalog
- Improve the speed and reliability of large data transfers between platforms

Current scope for the fuel analytics project is limited to one of the Nunavut sites - with efficiencies gained through the PI System / Databricks integration the analytics can be scaled to other mining operations

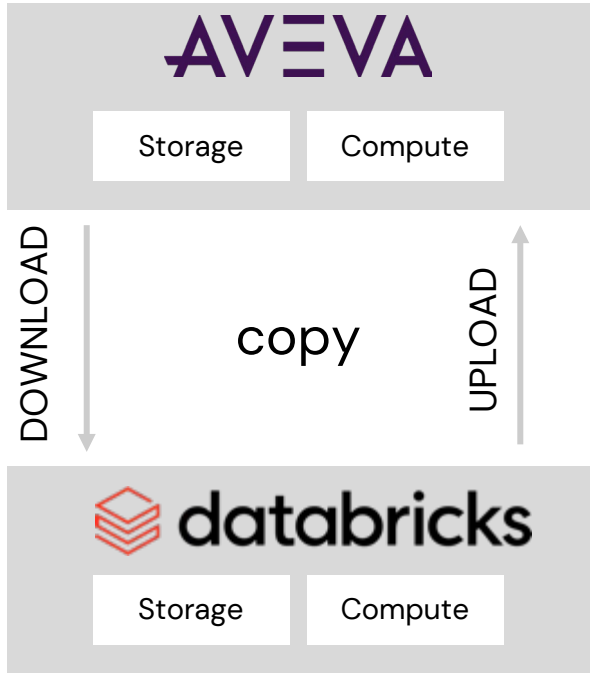
This includes sites with separate PI System servers, where CONNECT data services will greatly simplify the onboarding

AVEVA AND DATABRICKS INTEGRATION

AVEVA + databricks

Past:

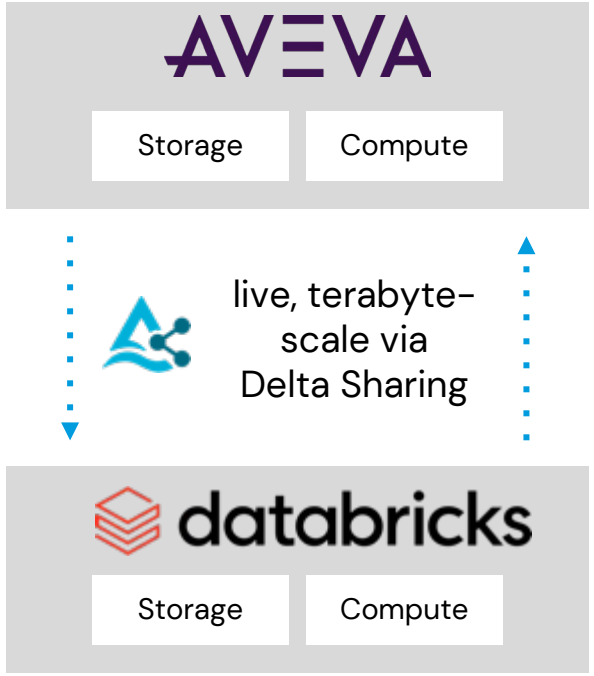
Sidecar



Customers responsible for reliable, performant data ingestion pipelines (or buy 3rd party tools that don't scale)

Future:

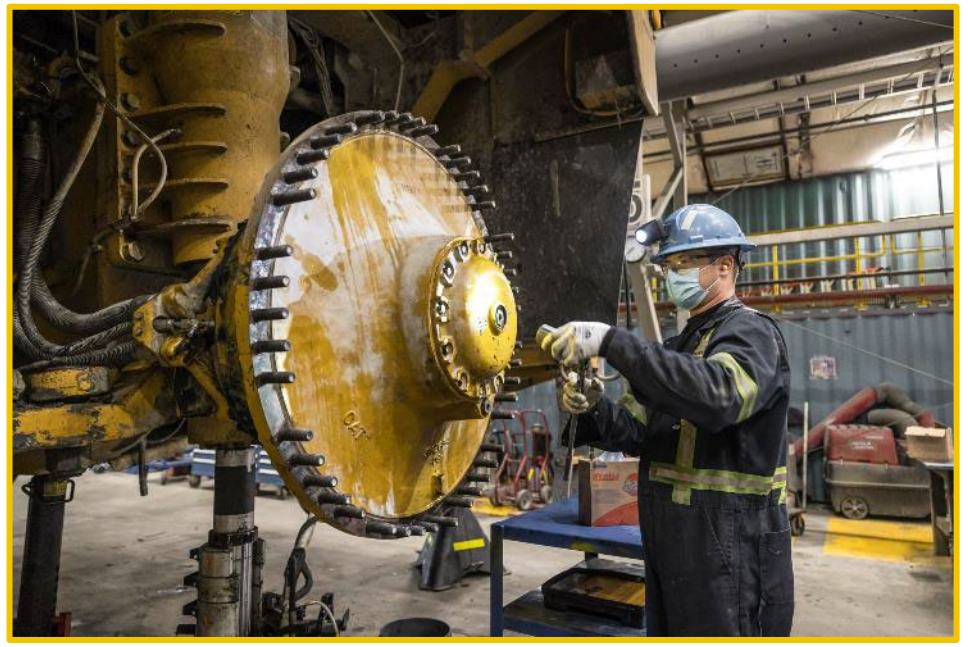
Live Integration



Authoritative, high quality, contextualized live sharing of data between OT and IT environments

EVOLUTION OF THE LIGHTHOUSE

- Databricks interoperability was initially not available for testing
- Focus was to optimize the existing data handling scripts
- More than ***3x increase*** in total transfer speed when compared with the original solution
- Obtaining data from CONNECT data services still requires some manual tasks and project specific optimization



LIGHTHOUSE – EXPLORATORY WORK

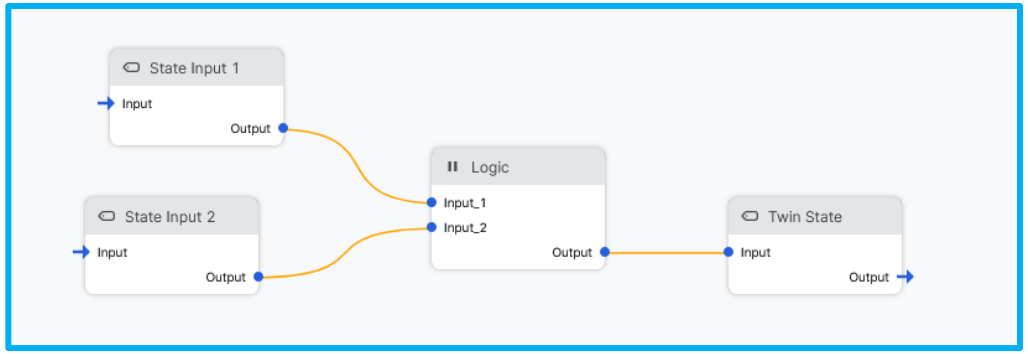
During transfer script optimization, additional AVEVA CONNECT data services products were tested

AVEVA Industrial AI assistant is part of the CONNECT Visualization product

- Simple ‘chat’ style AI assistant to query data services data and events
- Access to on demand analytics and raw data using natural language
- Could be used to find high value but previously unknown data relationships

Testing of the Advanced Analytics platform

- Simple drag and drop low-code interface to create stream-based analytics
- Fast and simple access to machine learning models and associated tools



To determine which assets with the prefix "viz_62-LRGRI" have the "Dayshift Result" property not between the "Target Minimum" and "Target Maximum" on 13 August 2024, we need to compare the values for each asset.

Asset: viz_62-LRGRI-PPAVAIL

- **Dayshift Result:** 90.4
- **Target Minimum:** 94.5
- **Target Maximum:** 100
- **Result:** Not between the Target Minimum and Target Maximum

Asset: viz_62-LRGRI-SAGDISPSOL

- **Dayshift Result:** 82.97
- **Target Minimum:** 75
- **Target Maximum:** 100
- **Result:** Between the Target Minimum and Target Maximum

Asset: viz_62-LRGRI-SAGDPRS

- **Dayshift Result:** 1312.43
- **Target Minimum:** 1350
- **Target Maximum:** 10000
- **Result:** Not between the Target Minimum and Target Maximum

Based on the provided data, the following assets with the prefix "viz_62-LRGRI" have the "Dayshift Result" property not between the "Target Minimum" and "Target Maximum" on 13 August 2024:

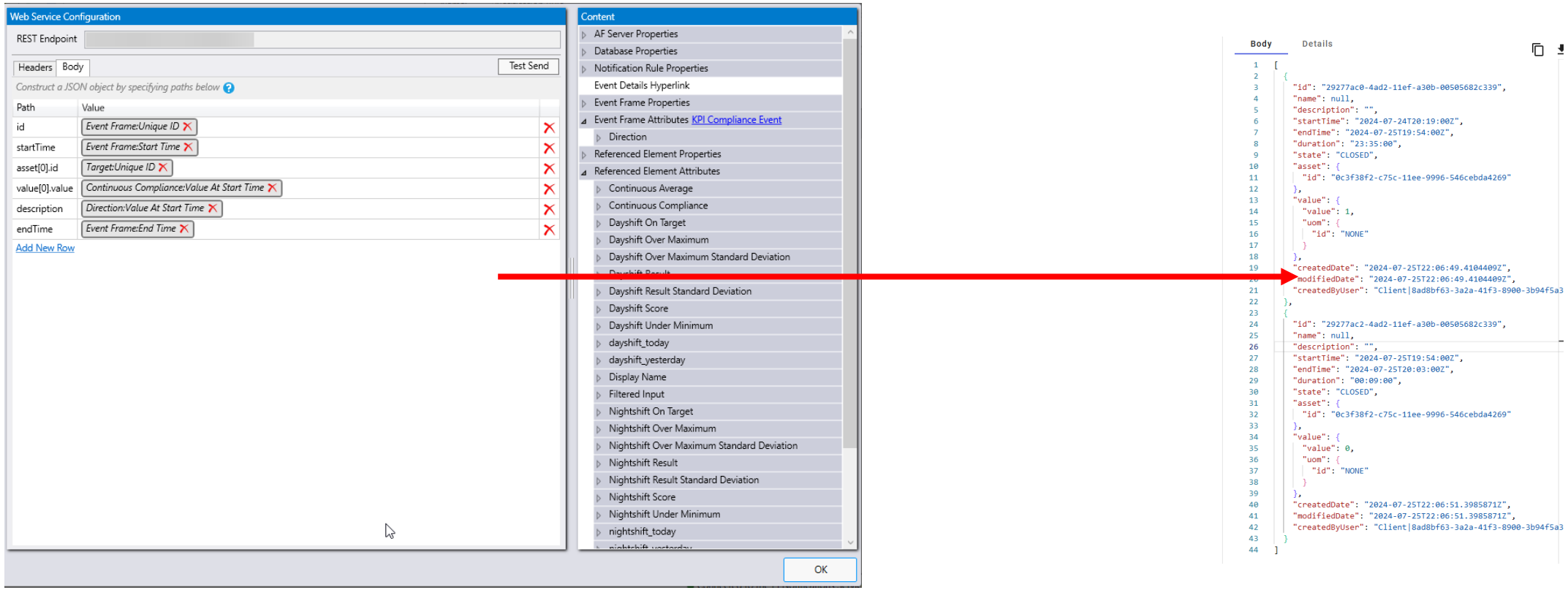
1. **viz_62-LRGRI-PPAVAIL**
2. **viz_62-LRGRI-SAGDPRS**

If you need further analysis or additional information, please let me know!

LIGHTHOUSE – DATAHUB EVENTS PROXY

As part of work with CONNECT data services visualization, discovered a need to send PI System Event Frame data to CONNECT data services.

Created an Azure web application to proxy PI System Asset Framework Event Notification REST API calls to Oauth authenticated calls to the CONNECT data services events endpoint



Integrated Operations Center

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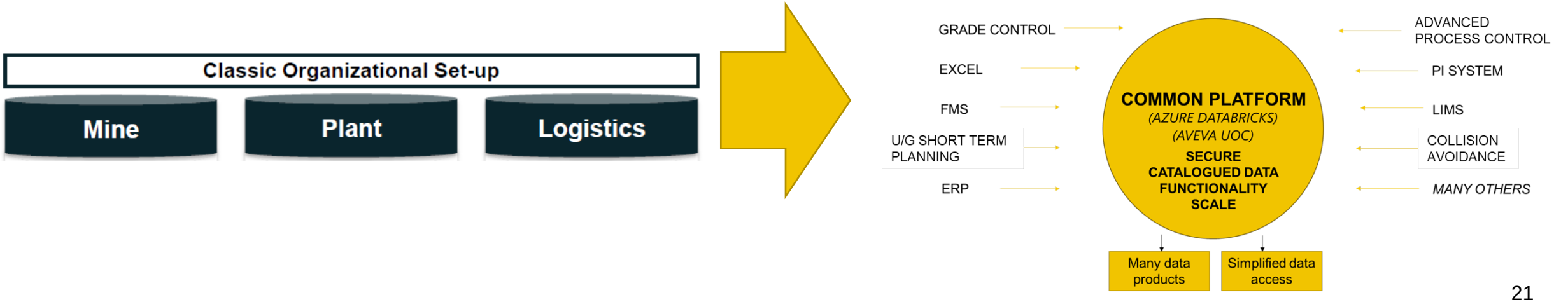
INTEGRATED OPERATIONS CENTER (IOC) CONCEPT

- Optimization tool to move away from operational silos and towards an integrated organization
- Based on the mining value chain: planning, development, drill & blast, mucking & hauling, blend management, processing
- Abitibi IOC will allow departments to **react faster** and **be more proactive**, while increasing **employee satisfaction** and acting as a **knowledge hub**
- The IOC is powered by AVEVA and Databricks



UNIFIED OPERATIONS CENTER VISUALIZATION DEVELOPMENT

- AVEVA Unified Operations Center proof of concept visualization

Conclusions

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CONCLUSIONS

- The Digital Transformation team has been developing the strategies and tools for the company since 2022
- Several ongoing digitalization initiatives have revealed areas for improvement: data quality & accessibility
- CONNECT data services allows easy integration of AVEVA PI System data into the Databricks environment to facilitate advanced analytics
- **Next steps:**
  - Implement data quality monitoring program on time series data – use AVEVA PI System templates
  - Incorporate the new functionality of CONNECT data services to improve access to time series data
  - Haul truck fuel model improvements and operationalization
- **Acknowledgements:**
  - Agnico Eagle Mines
  - AVEVA

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Questions?

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