TransCanada's Journey to Advanced Analytics

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Forward-Looking Information and Non-GAAP Measures

This presentation includes certain forward looking information, including future oriented financial information or financial outlook, which is intended to help current and potential investors understand management's assessment of our future plans and financial outlook, and our future prospects overall. Statements that are forward-looking are based on certain assumptions and on what we know and expect today and generally include words like anticipate, expect, believe, may, will, should, estimate or other similar words.

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Agenda

- TransCanada at a Glance
- Our Journey with the PI System
- Building a Foundation for Data Analytics
- Leveraging our Analytics Foundation
- Evolving to Advanced Analytics with AWS Machine Learning
- Perspectives, Best Practices, & Lessons Learned
- Future of Advanced Analytics at TransCanada

TransCanada Corporation (TSX/NYSE: TRP)

One of North America's Largest Natural Gas Pipeline Networks

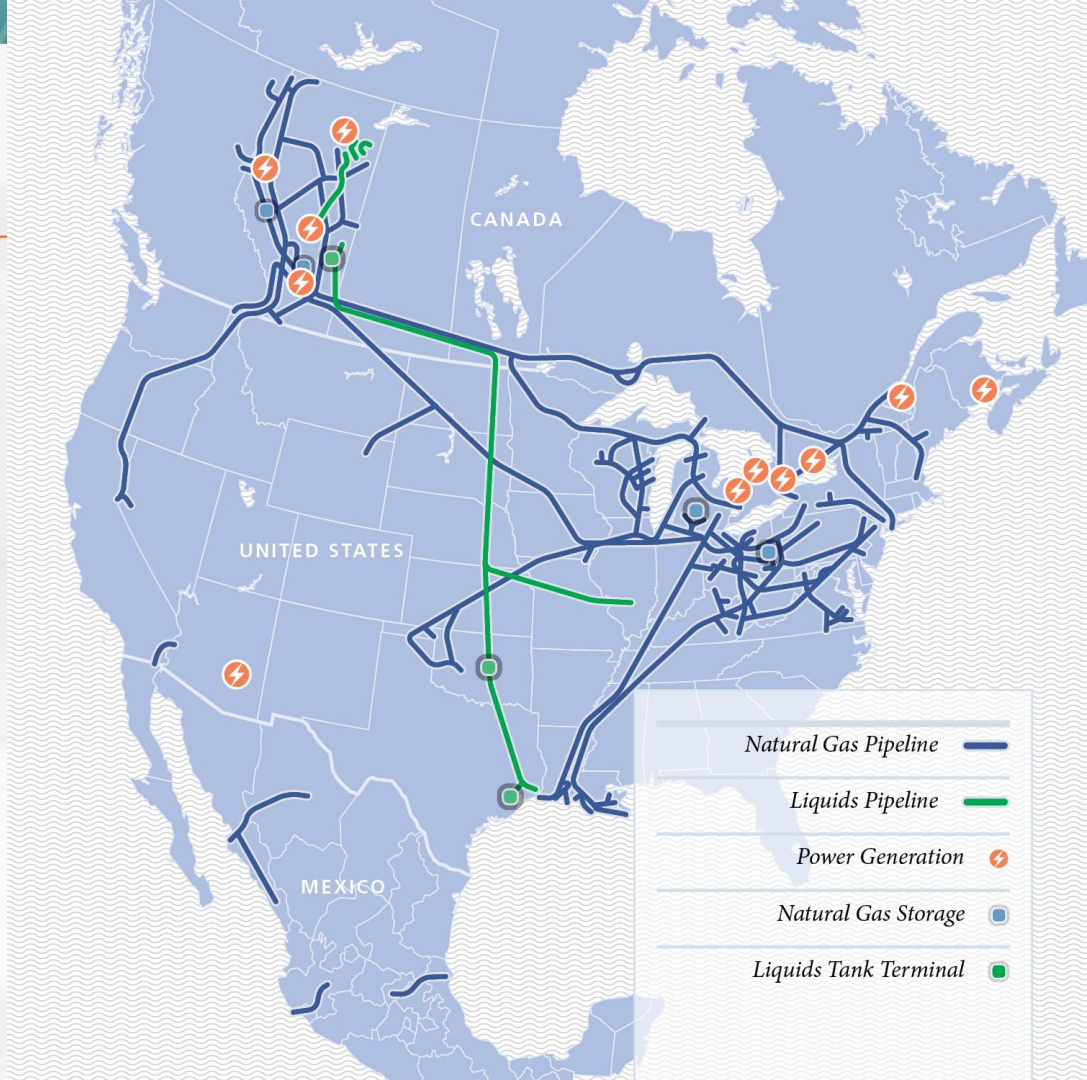
- Operate 91,900 km (57,100 mi.) of pipelines
- Transport ~25 per cent of continental demand
- Over 650 Bcf of gas storage capacity

One of Canada's Largest Private Sector Power Generators

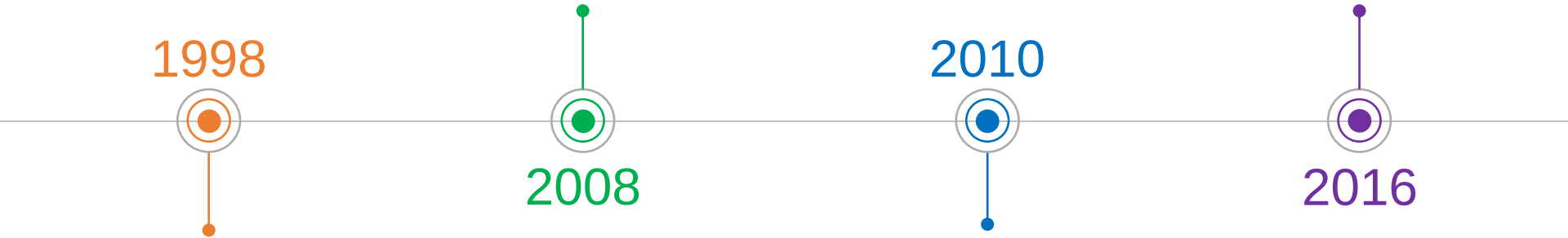
- 11 power facilities, approximately 6,600 MW
- Low-emissions portfolio includes nuclear and natural gas generation

Premier Liquids Pipeline System

- 4,900 km (3,000 mi.) of pipelines
- Keystone System transports ~20 per cent of Western Canadian exports
- Safely delivered more than 2 billion barrels of Canadian oil to U.S. markets



Our Journey with the PI System

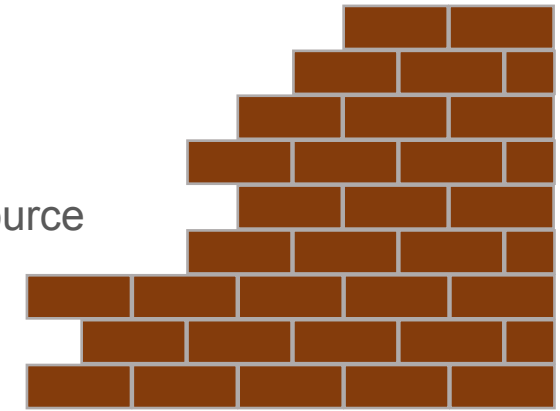


Building a Foundation for Data Analytics

- **Starting with the Basics**
  - Data Culture
  - OT Analytics
  - Self Serve, Human Analytics

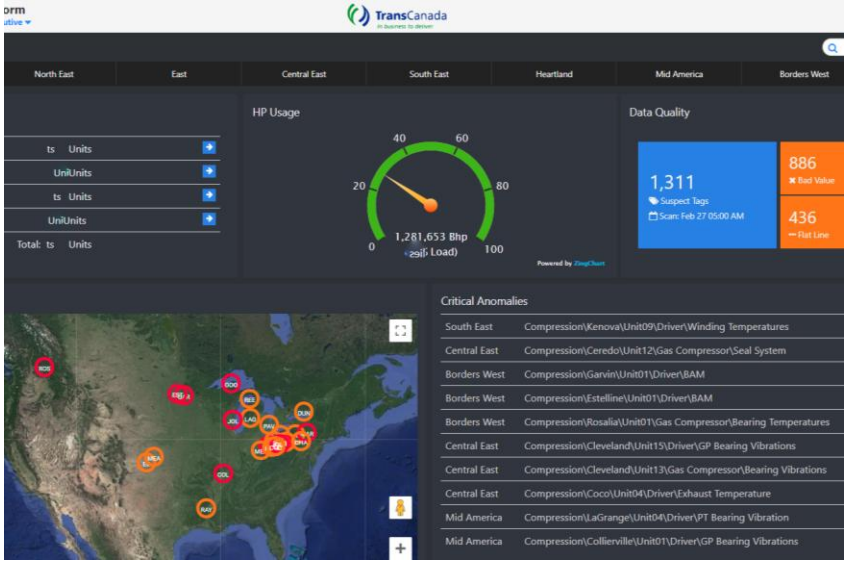
- **Understanding Data *as an Asset***
  - The world's most valuable resource
  - Create "pipelines" to collect, store and utilize that resource
  - Take advantage of AF, Vision to create value

- **Building Cross-functional Teams**
  - Subject Matter Experts
  - Engineers and Data Scientists

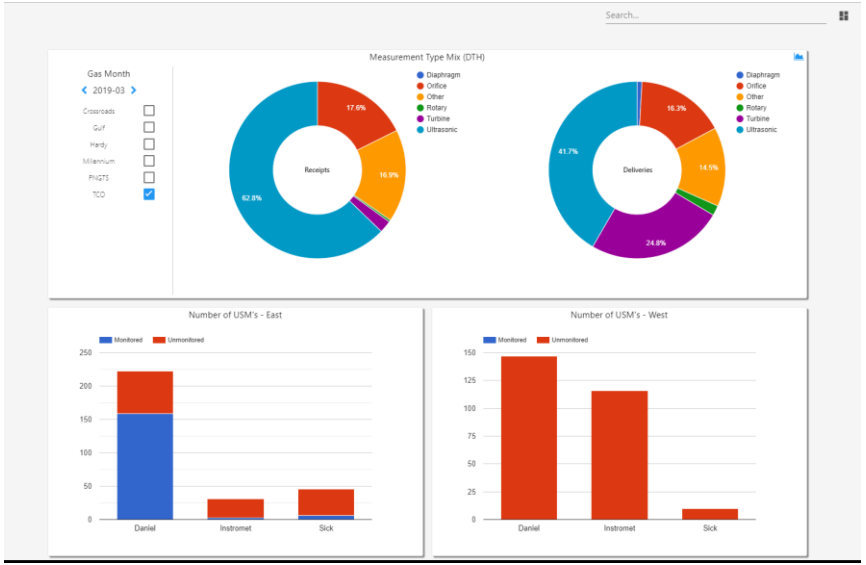


Leveraging our Analytics Foundation

Reliability Analysis Platform



Measurement Insights & Analytics



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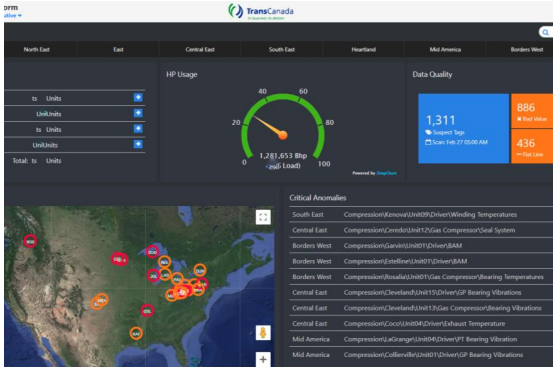
RELIABILITY ANALYSIS PLATFORM



CHALLENGE

Manage and take action on anomalies identified by AF analyses and document findings

- Prioritization of anomalies
- Anomaly Management
- Take advantage of statistical models
- Document Findings
- Improve asset implementation time in AF

SOLUTION

Redesign AF using modular approach and develop a custom platform to augment PI Asset Framework

- Modular AF redesign
- Developed web platform to manage anomalies and findings
- Ability to train and retrain statistical models

RESULTS

- Over 100% increase in findings from AF redesign
- 2018: over 250 corrective actions taken
- Significantly reduced time to implement assets

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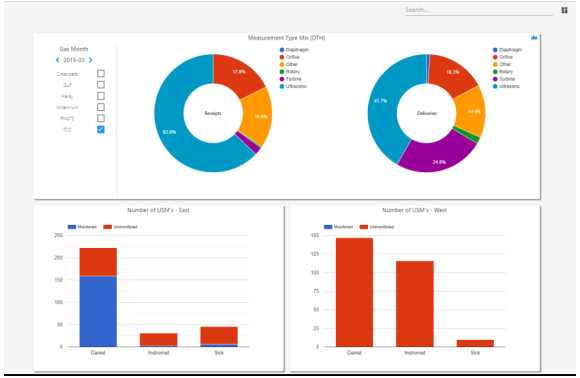
MEASUREMENT INSIGHTS & ANALYTICS



CHALLENGE

Get more value out of our PI System by expanding beyond Compression assets and into Gas Measurement

- Improve measurement accuracy
- Provide insights into measurement equipment health
- Take advantage of PI Vision

SOLUTION

Create a new AF structure and asset templates for full measurement system.

- Building existing knowledge into analyses
- Custom event frame and finding management
- Adding new measurement assets into existing Vision platform

RESULTS

Improved measurement health and problem discovery time significantly reduced.

- Able to more readily pinpoint when problems begin
- Measurement data in PI more easily consumable by business users
- Centralized equipment diagnostic data interpretation

Evolving to Advanced Analytics with AWS

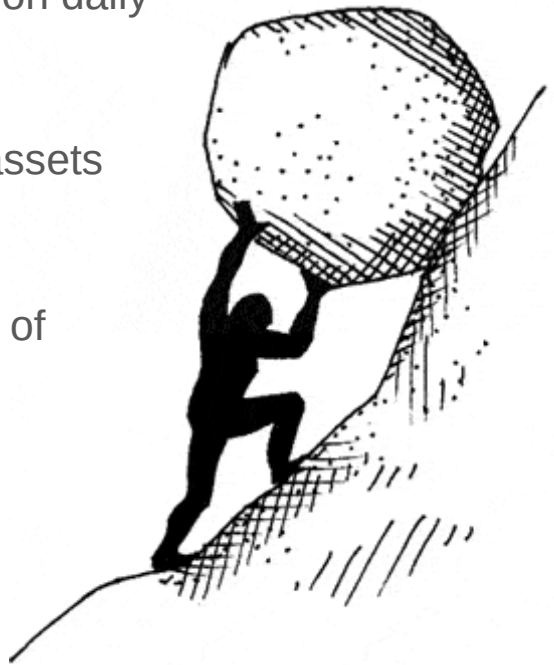
Gas Day Forecasting

- Challenge
- Objectives
- Navigating the Sea of Data
- Feeding the Machine
- PI Integrator for Business Analytics Demo
- Automating the Demand Forecast
- Consuming the Results
- What else?

Evolving to Advanced Analytics with AWS

Challenge

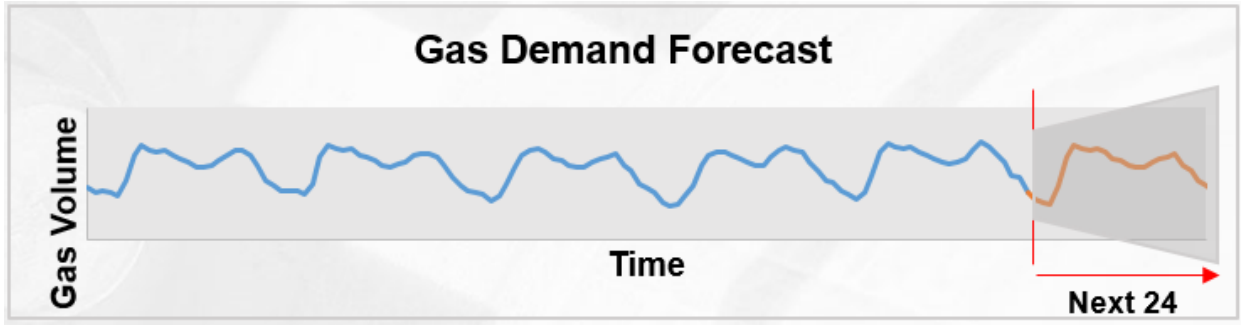
- Commercial operating decisions are currently made based on daily demand forecast.
- More accurate forecasting provides for optimal use of our assets and more flexibility for our customers.
- Current method of forecasting does not take full advantage of historical measurement, weather and load demand data.
- Scalable model to support full system load



Evolving to Advanced Analytics with AWS

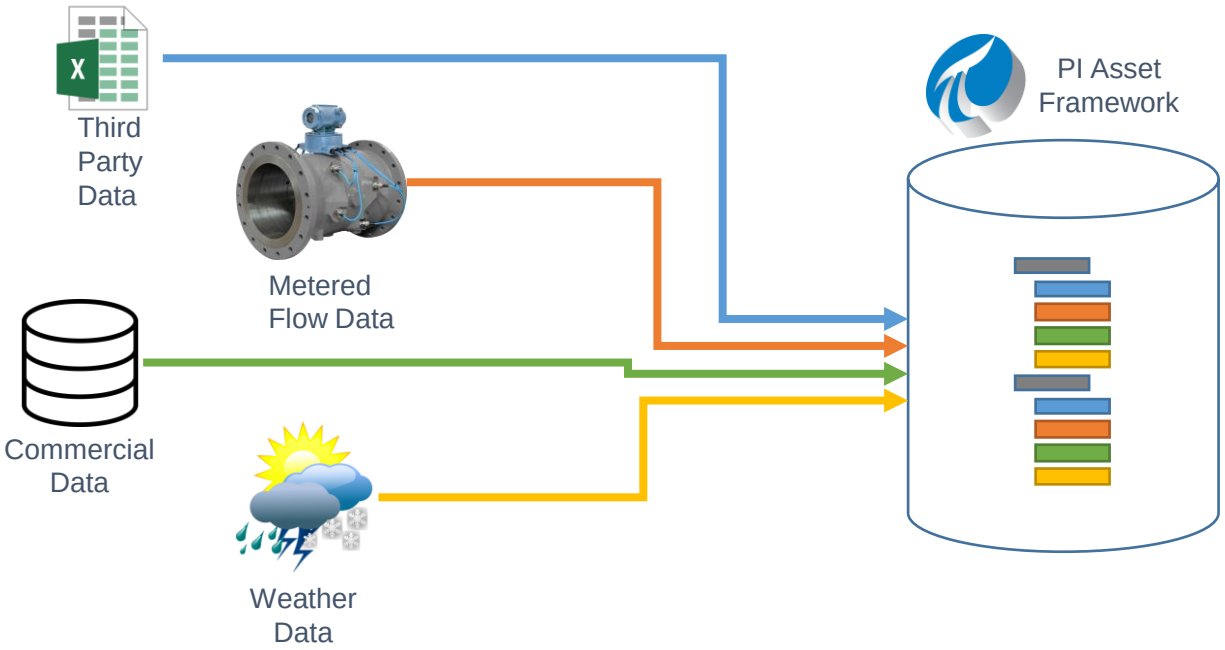
Objectives

- Fully utilize our data to produce more accurate forecasts by modeling system performance against historic conditions.
- Utilize AWS to minimize up-front investment and on-going costs.
- Leverage key technology partnerships to prove out the concept in rapid fire fashion. Fail Fast, Succeed Faster.



Evolving to Advanced Analytics with AWS

Navigating the Sea of Data



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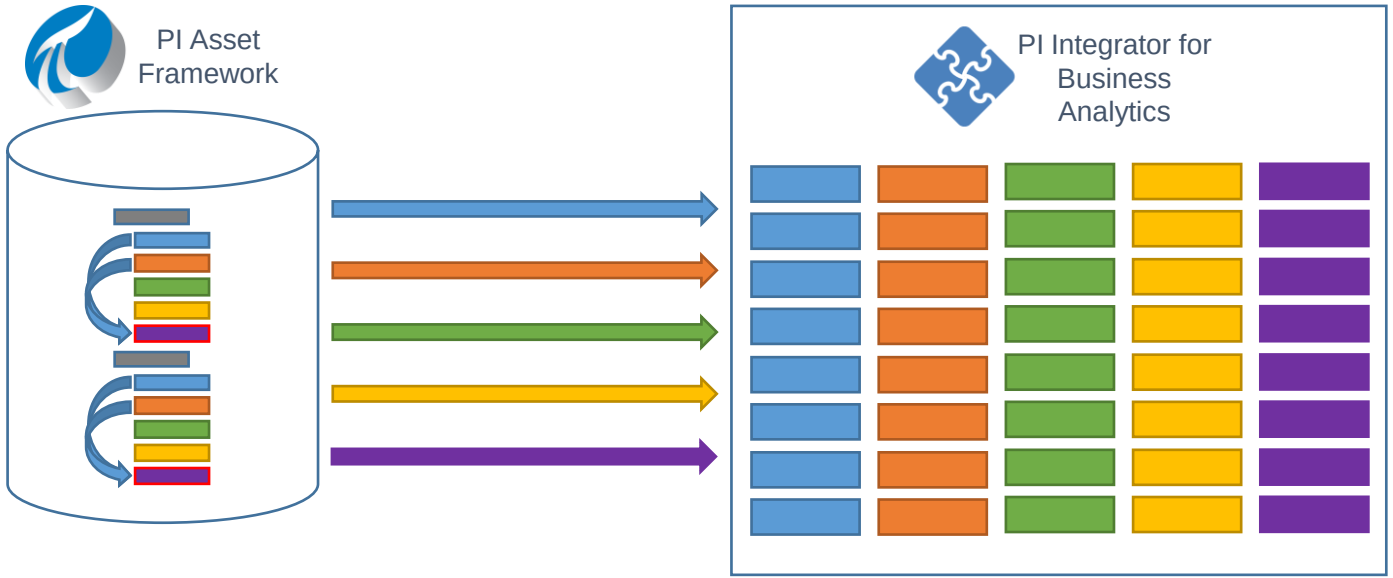
Navigating the Sea of Data



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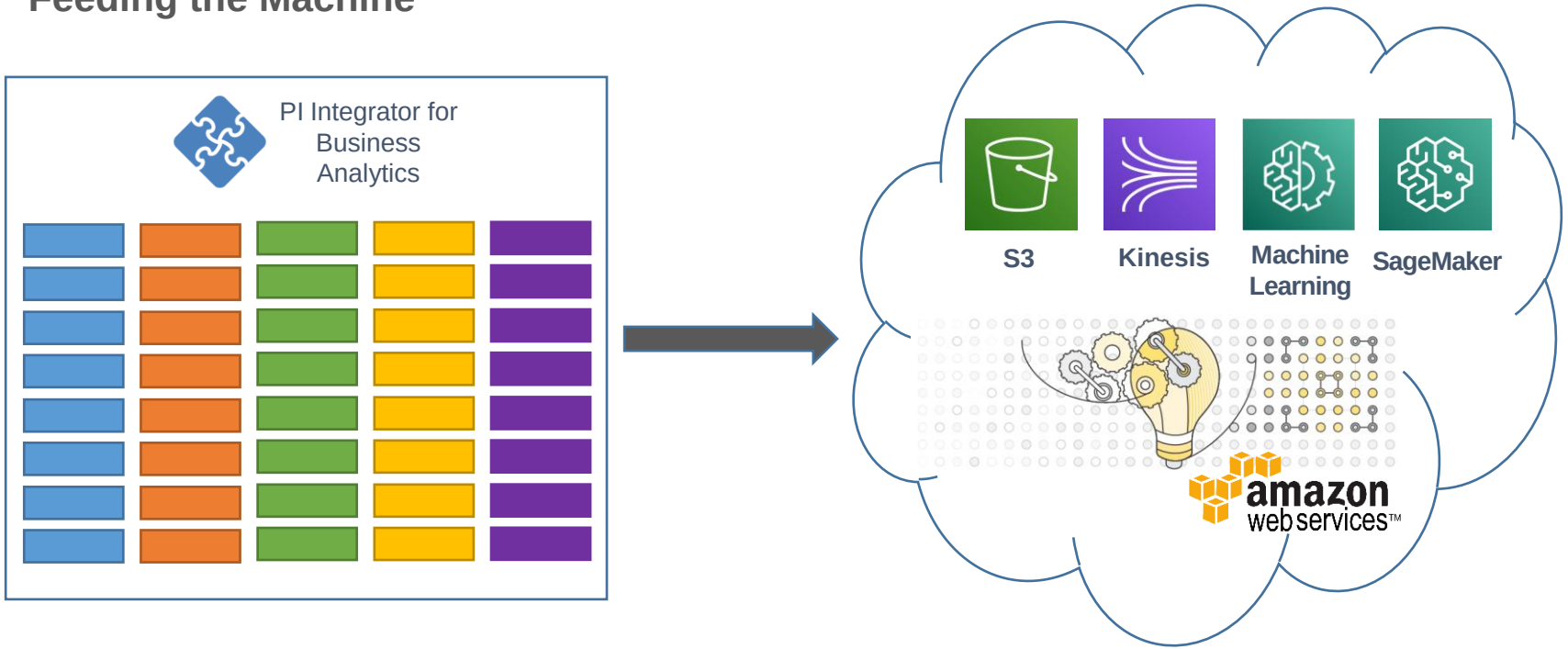
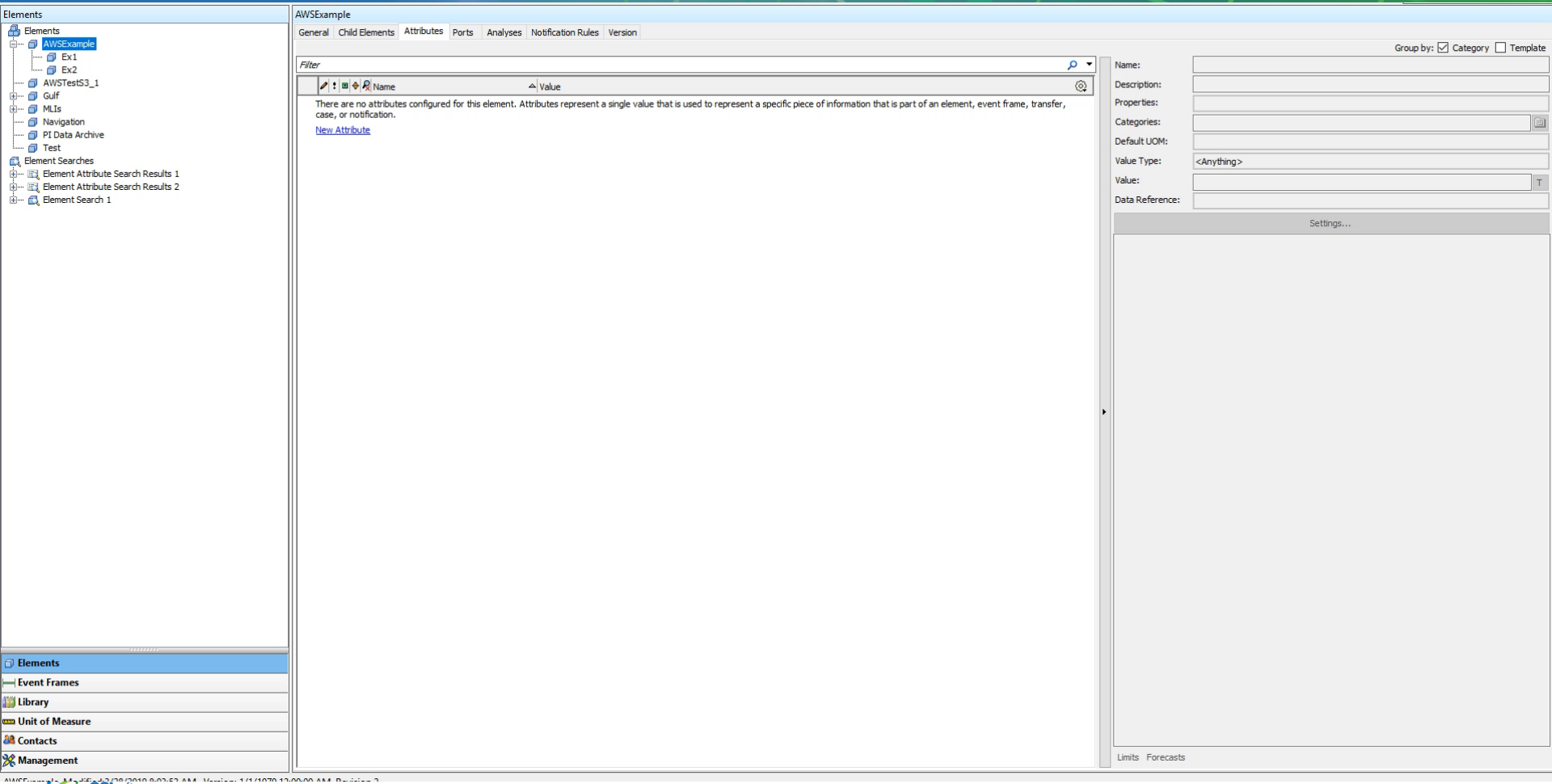
Feeding the Machine



DEMO

PI Business Integrator



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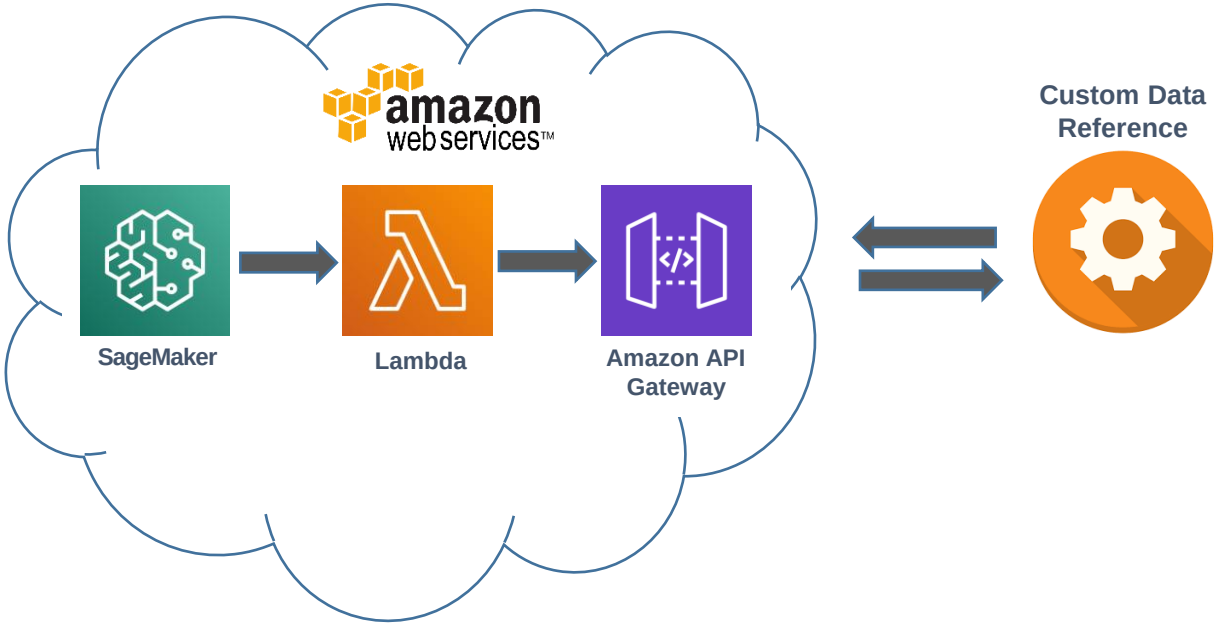
Automating the Demand Forecast



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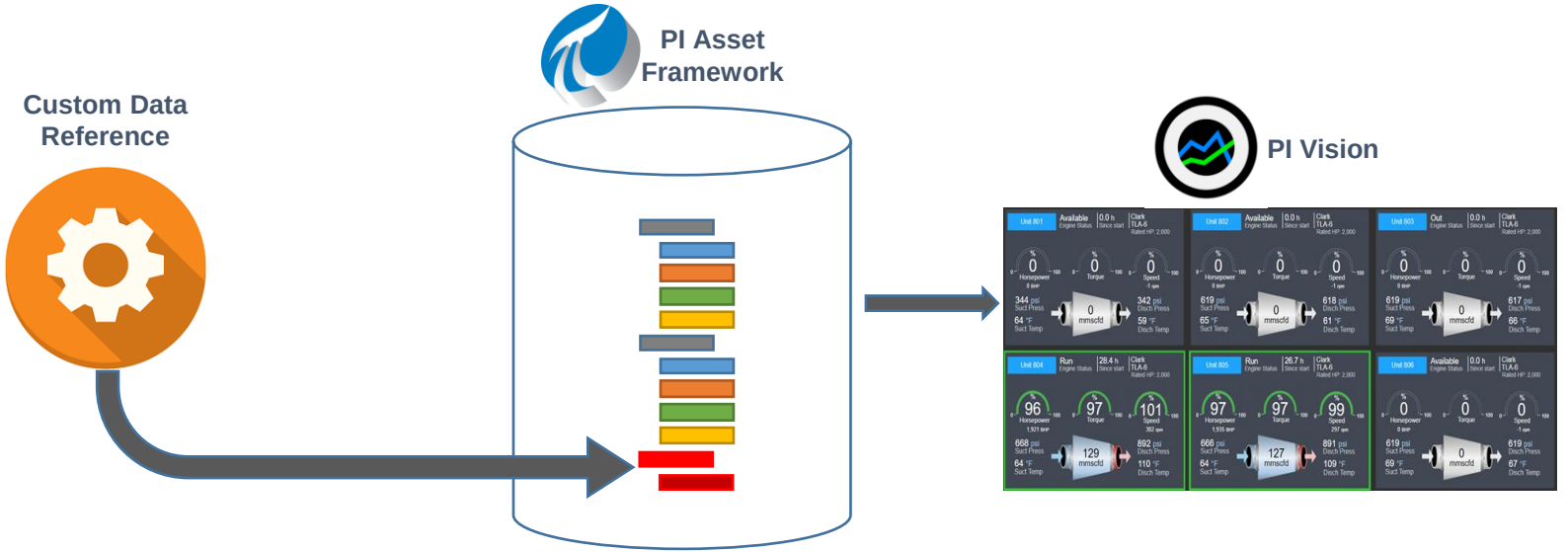
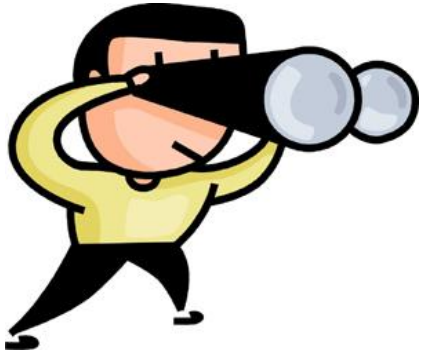
Consuming the Results



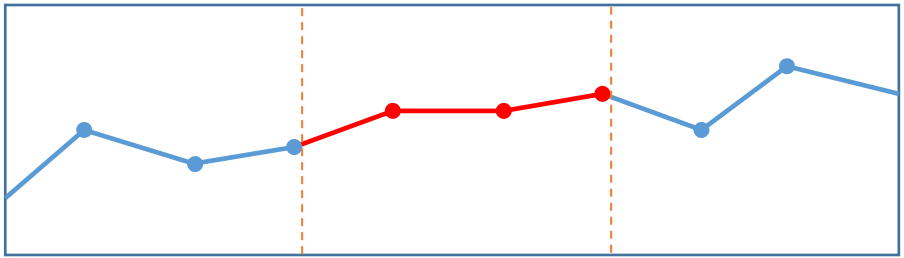
Evolving to Advanced Analytics with AWS

What else?

Lost and Unaccounted For Gas

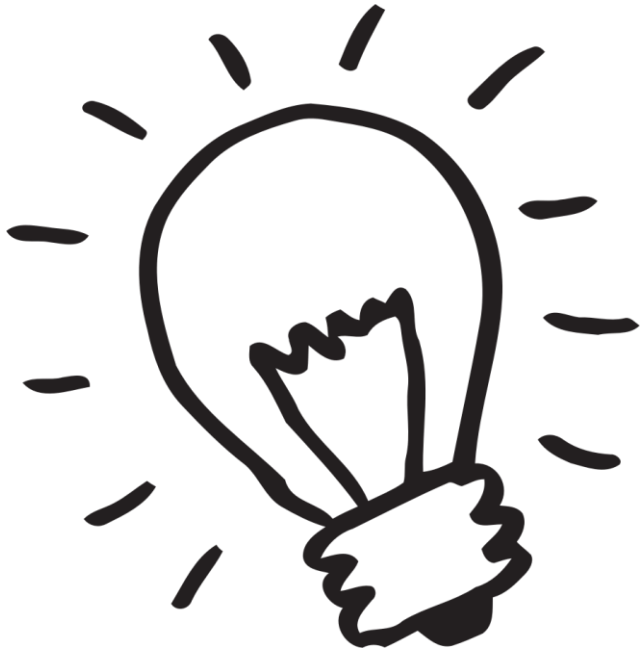


Gas Measurement Volume Estimation



Perspectives, Best Practices, & Lessons Learned

- **Layers of Analytics Approach**
  - Use tools already available
  - Enable self-serve analytics & visualization
  - Asset Framework, Vision
- **Data Quality**
  - Poor quality data is a damaged asset
  - Bad results reduce confidence
- **Feature Engineering**
  - Can be done in AF and historized
  - Increase the value of your asset
- **The Value of Experimentation**
  - Data Science is experimental
- **Be Agile**



Future of Analytics at TransCanada

- **Project Expansion**
  - Scale out all models
  - Fully automate training/evaluation
- **Predictive Modeling for Measurement**
  - Extension for MIA
  - Enhance anomaly detection by predicting flows
- **Making Advanced Analytics Accessible**
  - Joint prototype between RAP and MIA teams
  - Generic machine learning models
  - Management interface for data and model management
  - Leverage PI System and AWS

Summary

- **Build an Analytics Foundation**
  - Start simple
  - Data as an Asset
  - Cross-functional teams
- **Leverage the Foundation**
  - Build platforms with tools on hand
  - Enable users to create analytics and visualize data
- **Evolve with rapid prototyping**
  - Agile, Proof of Concept projects
  - Fail fast, succeed faster

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