A Culture of the Possible

Continental RESOURCES

Completions Real Time Streaming Application

Friday November 30, 2017

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50 YEARS OF EXPLORATION DISCOVERIES

Real Time Streaming Application – Overview

Completions Operations Problem Statement

- Build a mobile or desktop application that can be used on field sites by Devon's Person in Charge (PIC) to improve operational decisions or behaviors, during hydraulic fracturing by streaming real-time treatment data

Decisions and Behaviors to Influence

- Better decisions on when to stop a stage
- Better decisions on optimal pump rate to minimize cost

High Level Impact

- Comparing current treating pressure to casing burst pressure
- Monitoring net treating pressure (screenout leading indicator)
- Predicting stage pump time remaining (cost savings measure)

Real Time Streaming Application – Solution / Benefits

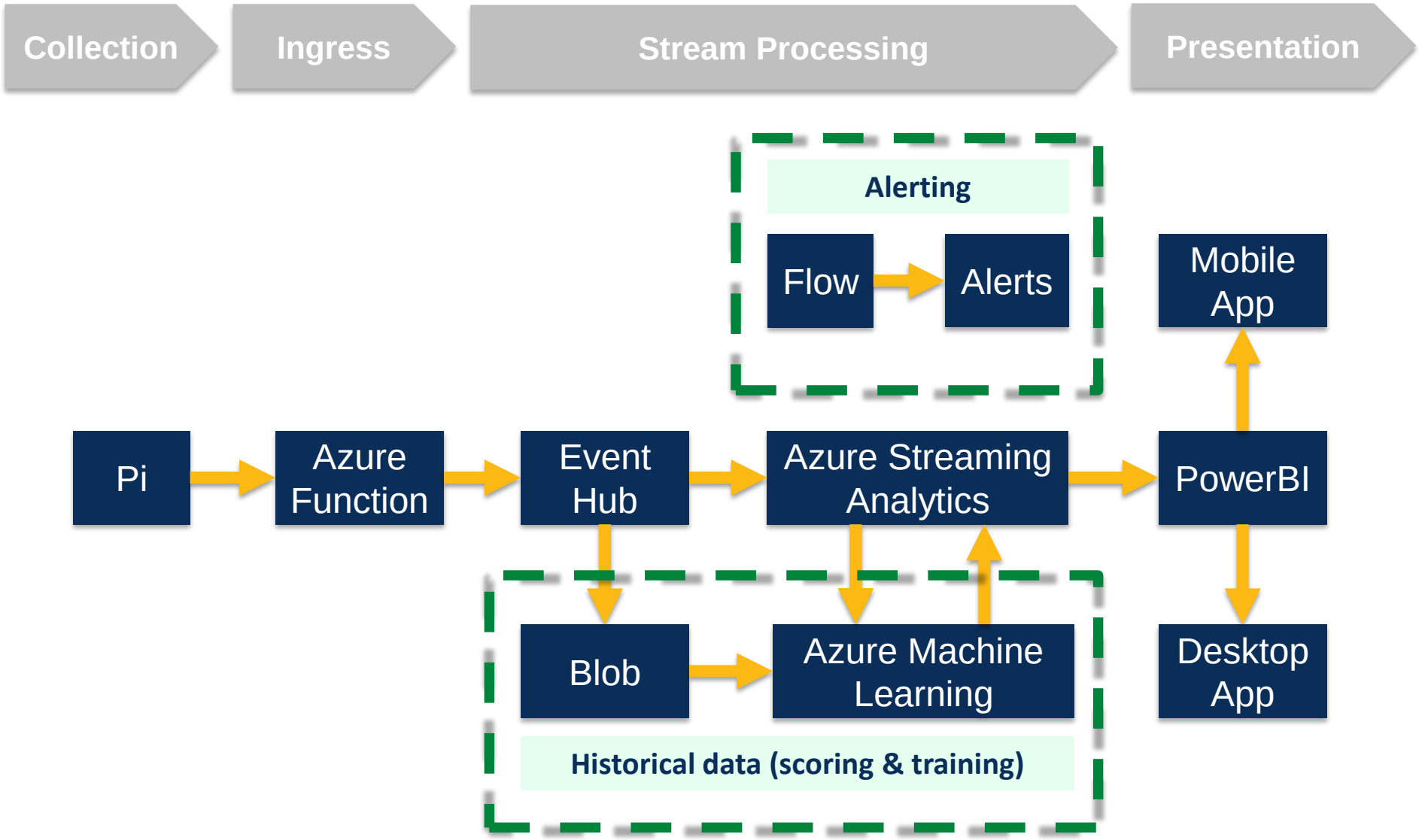
Current

- Ability to **stream and visualize second by second** real-time treatment data via desktop and mobile application
- Apply **KPI analytics "on-the-fly"** at field sites, offices or anywhere
- Allows **user customization** of dashboard
- **Scalable solution** applied to multiple simultaneous treatment jobs
- **"Easy To Read"** visuals

Future State

- Real-time **KPIs lookback** with offset well treatment data (select well of choice for comparison)
- **Overlay offset treatment plot** "on-the-fly" with current real time data to compare against successful "treatment signature"
- Utilizing Machine Learning to score historical data to develop **predictive screenout model**
- Ability to apply treatment changes "on-the-fly" to **optimize well completion**

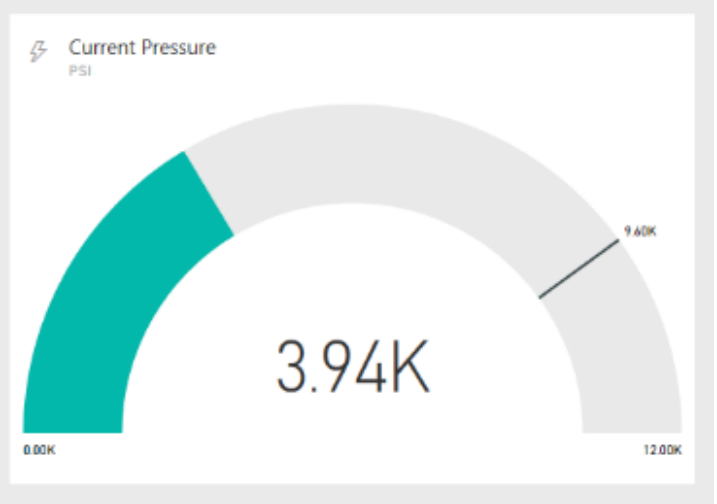
Real Time Streaming Application – Data Architecture



Dashboard Widget #1 – Current Treating Pressure KPI

Methodology

- 80% of max casing burst pressure (~10k psi)
- Visual of pressure tolerances (median & max)



Business Impact

- Visualization monitoring “critical” pressure value
- Better decision for PIC to drop rate, flush well to prevent screenout (reduce friction pressure) or end stage

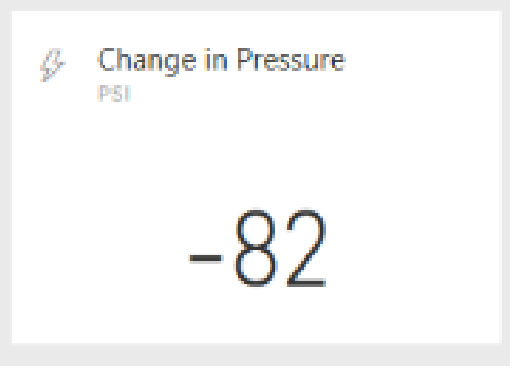
Future Enhancements

- Develop pressure threshold bounds through machine learning predictions (historical offset datasets)

Dashboard Widget #2 – Net Treating Pressure KPI

Methodology

- $\Delta P = P_{current} - P_{average}$[1]



Business Impact

- Leading indicator of potential screenout
- Provide PIC with “easy to read” visualization of pressure trends

Future Enhancements

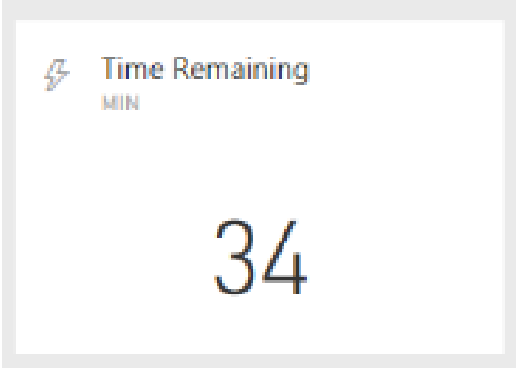
- Expand to incorporate visual KPI for rate of change of ΔP to further support leading indicator

[1]$P_{average}$ = Rolling 10 Sec Average

Dashboard Widget #3 – Estimated Stage Pump Time Remaining KPI

Methodology

- Known user inputs
  - Planned Stage Total Proppant, Fluid & Rate
- $Estimated\ Time\ Remaining = \frac{Remaining\ Slurry}{Planned\ Slurry\ Rate}$



Business Impact

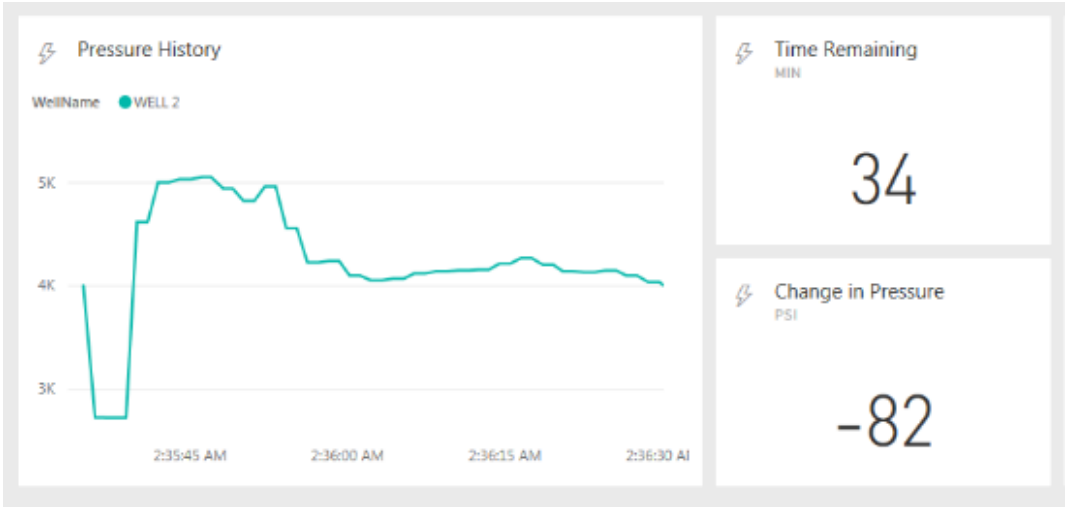
- Visualization to provide estimated time remaining based on planned job amounts
- Allows PIC to assess remaining stage time when encountering pressure control issues
- Optimization of time remaining (treatment parameters) results in cost savings

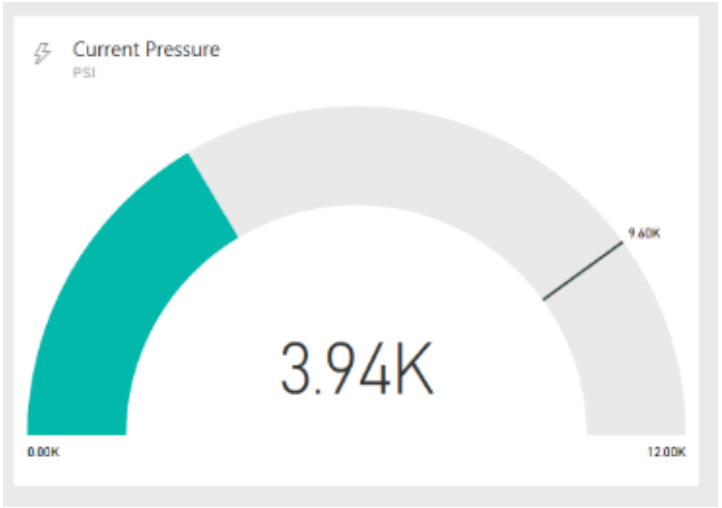
Future Enhancements

- Sensitivities of optimal time remaining based on incremental pump rate reduction

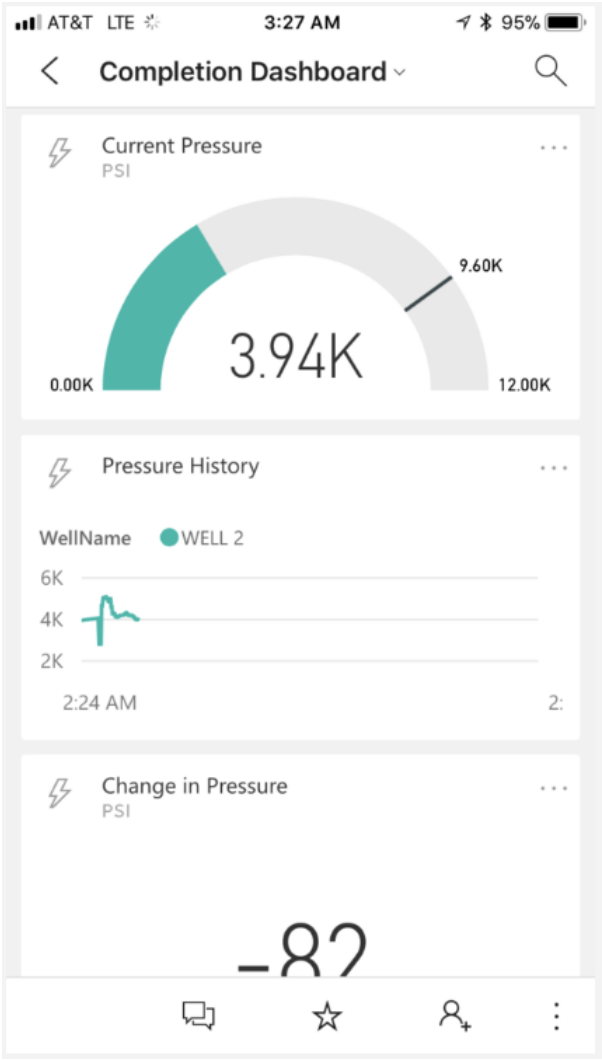
Field App for Fracturing Operations – Dashboard

Desktop





Mobile



https://vimeo.com/245341233