Vale's Remote Operations Centre

Importance of Near Real Time Telemetry

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Agenda

1. About Vale

2. Problem Summary

3. What is iROC?

4. What is OpSIGHT?
   - Use Case / Business Benefit
   - OpSIGHT potential at iROC

5. Vale's Telemetry Architecture
   - Call to Action

6. Data Streams, Why Now?

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About Vale

We exist to improve life and transform the future

- With a mission to transform natural resources into prosperity and sustainable development, Vale is a global mining company with headquarters in Brazil. We are leaders in the production of iron ore and the second largest producer of nickel.

- Vale plays a large role in your everyday life and in the world around you. We are proud to teach you more about our Canadian operations and invite you to explore the site and learn more about our work.

- Base Metals Operations main products are Nickel, Copper & Cobalt.

- Nickel and Cobalt are in high demand to support batteries for electric vehicles.
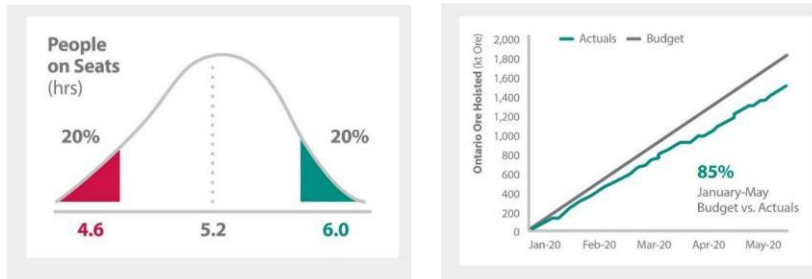

Nickel

Cobalt

Problem Summary

Challenge

Solution

Benefits

Vale's requirement to monitor and course correct production operations holistically is driving the demand for accurate and up to date reporting of operational data.

1. A new reporting solution, OpSIGHT, built on PI AF & PI Vision.

2. Negotiations with OEM vendors of mobile equipment (LHDs, Drill, Trucks, etc.) to provide live data streams for the equipment telemetry

- Reduced Safety Risk
- Reduced Costs
- Increased Production
  - NR Case 15M

iROC: unlocking our mines productivity potential.

Mining Today

North Atlantic Operations continues to invest in **new methods** and **new technologies** that will **transform our business** – **improving our productivity** and strengthening our reputation for leadership.
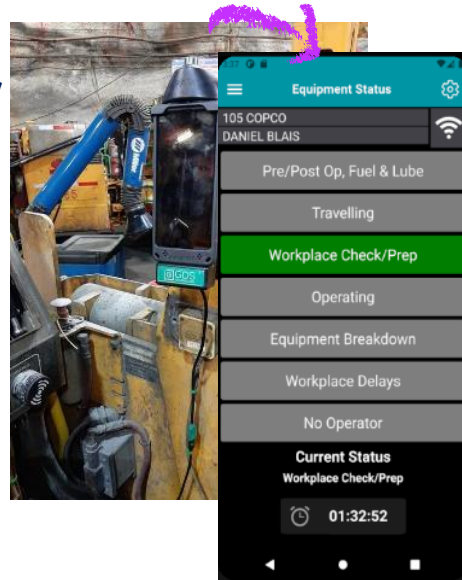

Vision

At the forefront of our commitment to innovation and adaptability is the new North Atlantic Integrated Remote Operations Centre – or **iROC** – a **state-of-the-art facility** located at our North Atlantic Operations Centre in Sudbury, Ontario.

Technology

A team has been assigned to **deliver key solutions to remove these roadblocks through** the implementation of **new technology** that will provide**:**

- Equipment Location;
- Underground connectivity;
- Equipment Telemetry;
- Equipment Delay;
- U/G to iROC radio connectivity.

Results

Overall Effectiveness
Increased utilization & availability of equip. by minimizing non-value-add work.

Supervisor Focus
24/7 support. Provides active problem solving & data driven recommendations. Removes non-value-add work.

Operational Process
Cont. improv. through: granular & reliable Data. Improv. predict. & reliability

Safety & Emergency Procedures
Improv. response time. 24/7 seismicity monitoring.

+15 – 30% Mines' Productivity Uplift

iROC: Integrated Remote Operations Centre

iROC Workspace Configuration

iROC Workspace Configuration

- ✓ 24/7 Operation with On-Site Tech Support during Pilot and Launch.
- ✓ Establishing Management Operating System has been one of the Pilot Priorities.
- ✓ 2 Business Data and Reporting Specialists onboarded.

Seismicity Monitoring:

Real time monitoring of active seismic regions with geophones.

Mobile Equip. Status:

Real time TUM data Telemetry Status / Productivity.

Shift Schedule/ Line-Up:

Current assigned job tasks at beginning of shift for each operator, equipment and location.

Reporting & Analysis:

Shift/ Daily performance and variance.

Location Awareness:

Real time monitoring of equipment and people locations.

Radio/ Phone:

Real time communication with Mine Operations

Telemetry:

Equipment information to monitor the asset health and productivity

Cameras:

Identification of potentially hazardous conditions via live feeds

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OpSIGHT

The "Check Engine" light for your Process

Digitalize Operation Units

Digitalizing operational plant units to build controllable event frames. Gathering real-time event data and monitor process control

Capture Trouble states

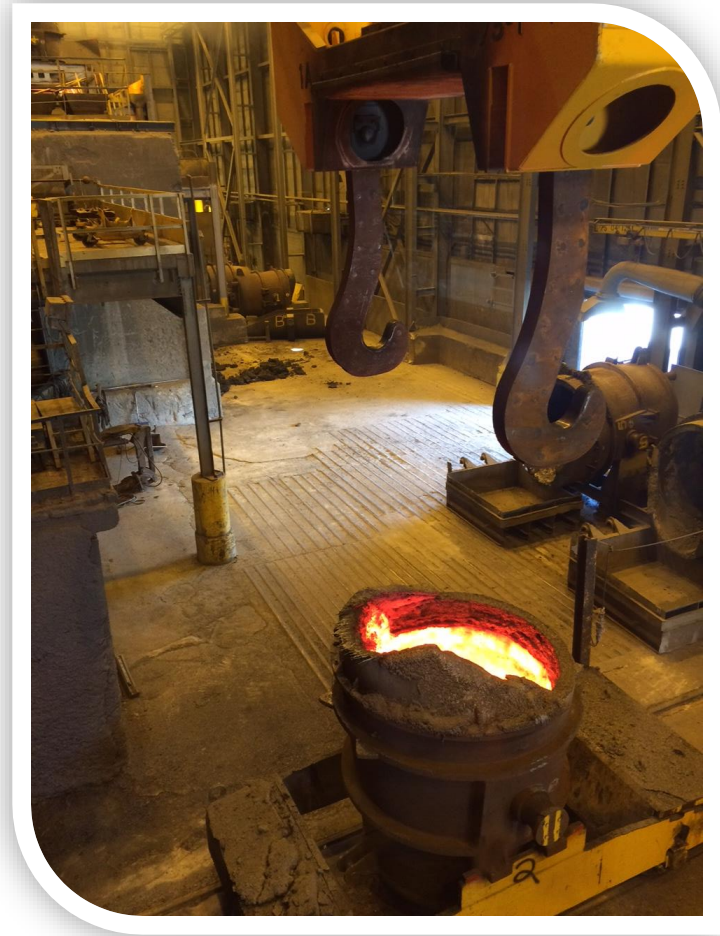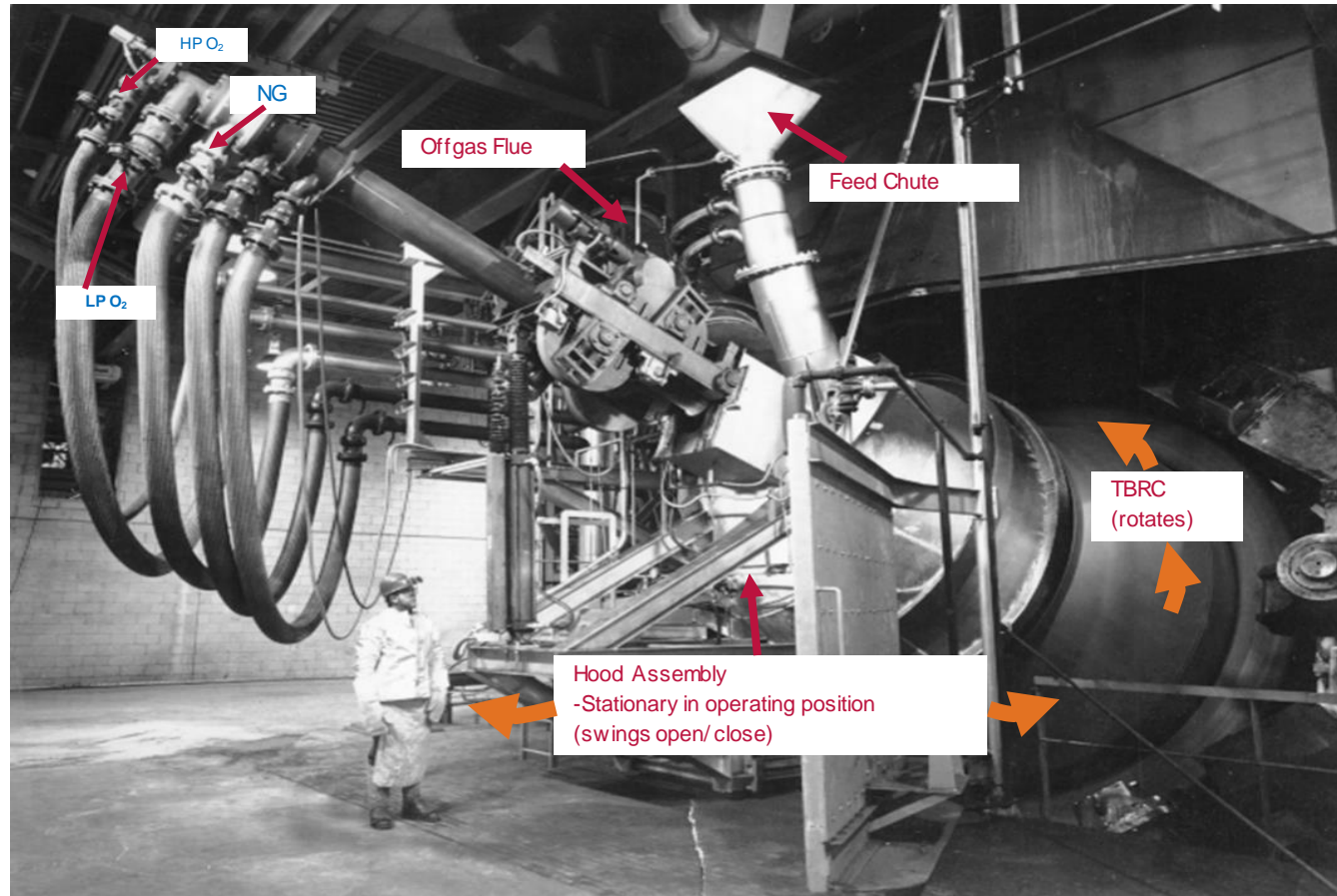Define trouble events based on the historically known sub-optimal efficiency across operational units

Trigger actions based on Insights

Recommend suitable actions to provide frontline users a list of actions to mitigate the trouble state

Project Context – Vale Nickel Refinery TBRC's

HP O₂

NG

LP O₂

Offgas Flue

Feed Chute

TBRC (rotates)

Hood Assembly
-Stationary in operating position (swings open/close)

OpSIGHT Benefits

- Traditionally small Loss of containment events were frequent which became normalized in the operation.

- Multiple significant loss of containment over many years with the latest in Sept 2019 caused serious equipment damage resulting in 2 weeks production loss and safety concerns.
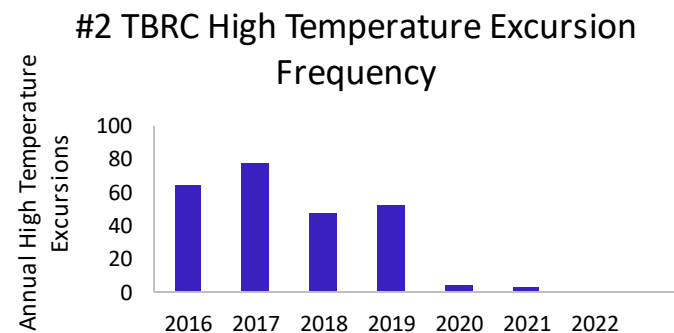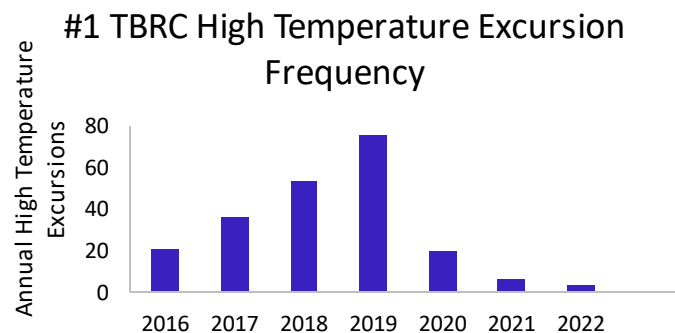

Door Blocked Shut   Natural Gas Line Intact   Extent of LOC

- Vale's Risk assessment team mandated that there should be no loss of containment.

- Due to the High Impact Risk of the TBRC operation and reoccurring incidents of converter "Loss Of Containment", a solution was needed to address this serious problem.

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Results

- Creation of Solution to reduce "Loss Of Containment" by providing
  - innovative level of operator guidance for operating
  - troubleshooting the TBRC's.

- To date, zero LOC's have occurred since 2020 resulting in reduced exposure

- Satisfied the Risk assessment team's mandate of zero loss of containment

- Improved control resulting in a reduction of temperature excursions since 2020 to date. 2022 January to April recorded 3 high temperature events, in comparison to 68 during the same timespan in 2019.

#1 TBRC High Temperature Excursion Frequency

#2 TBRC High Temperature Excursion Frequency

Cost Case Study: September 2019 LOC

- LOC's vary greatly in terms of scale.

- September 2019 data is provided here as an example of the potential costs of an LOC.

- It resulted in over 10 days of downtime for repairs resulting in additional costs of approximately $350,000, and $15,000,000 in lost production.

Component	Cost
Maintenance Costs	$200,000
Investigation Costs	$150,000
Lost Production	$15,000,000

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OpSIGHT & iROC

OpSIGHT is currently used for Surface Plants
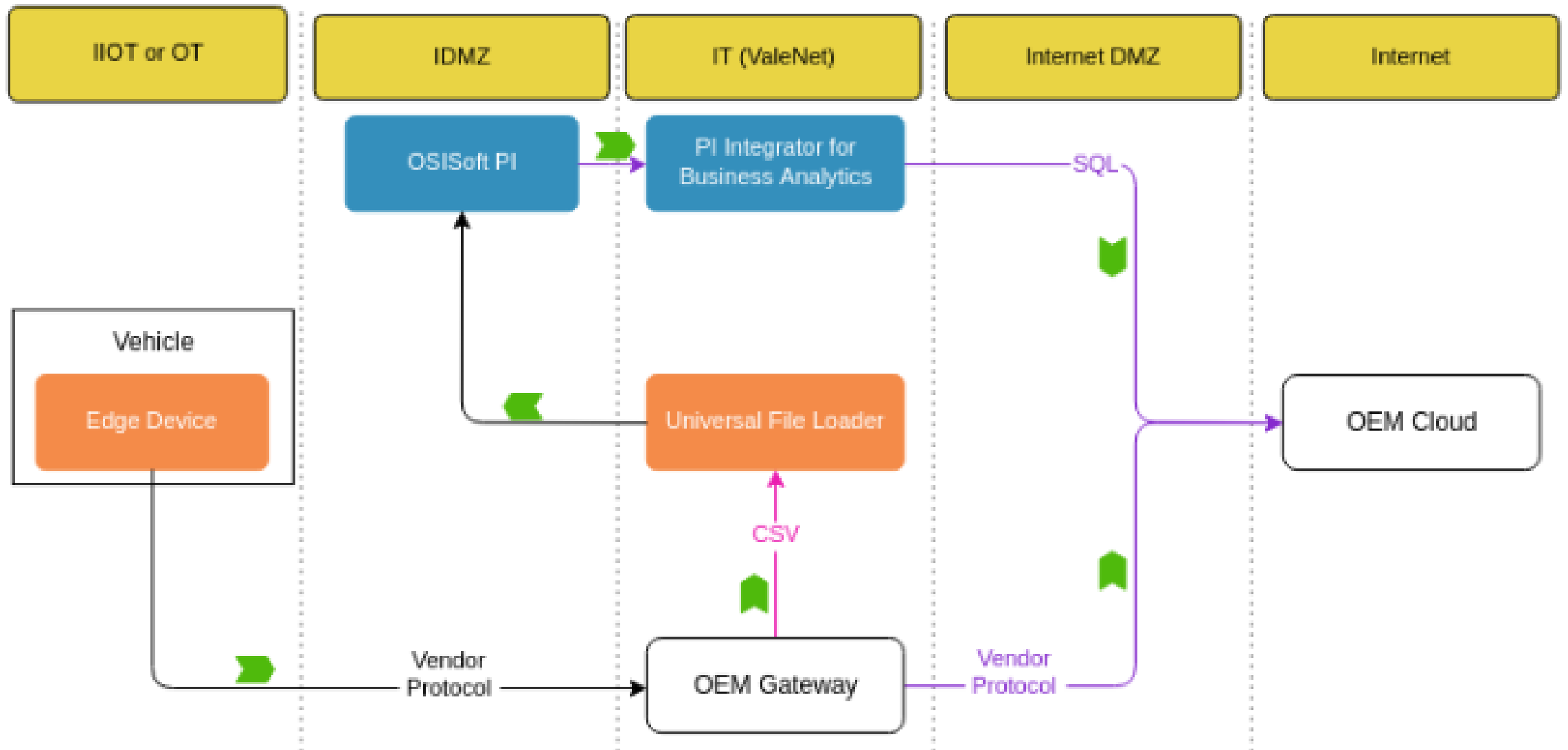OpSIGHT for Mines is currently being assessed for fit

OpSIGHT is a strong contender because:
- Provides user friendly displays
- Real time data
- User managed inputs for AF logic
- Dashboards can be shared on large screens
- Ability to drill down and perform analytics
- Information can be shared with operators via radio verbally or smartphone reports
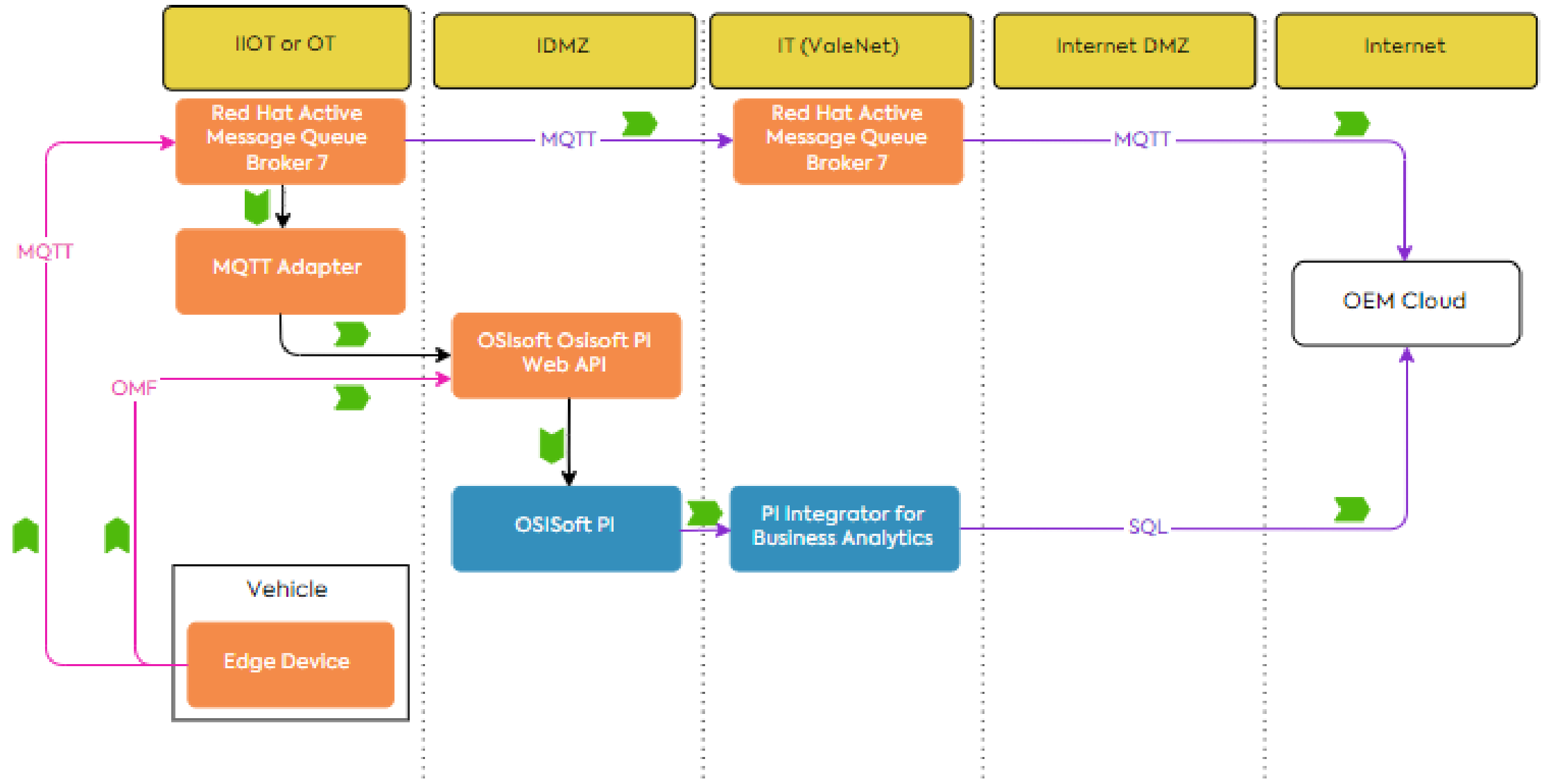- Course correction can be given via radio verbally or smartphone reports

Next Steps for OpSIGHT

- Add data points outside of PI
- Include more PI Vision Symbols
- Investigate new reporting requirements
- Investigate integration with MineRP and Short Interval Control Systems

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HLD - Telemetry Legacy

HLD – Telemetry Future Vision

Current Status and OEM Adoption

Caterpillar: Is the early adopter in live data streams. Caterpillar equipment telemetry is available to PI analytics withing seconds. We benchmark other vendors against their performance.

MacLean: Has been receptive to our architecture and has delivered a solution using Edge Data Store OMF. We are currently in the testing phase.

2 Other Vendors: Have made commitments but have yet to confirm the technology stack or date for availability.

Our Procurement team have added a Data Stream requirement clause to the RFQ / RFP Process.

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Vale's Offer and Request – Call to Action

Offer: Take our ideas and our High Level Design and make it your own.
- Get your vehicle telemetry integrated into PI with your Production data.
- Take advantage of the Business Benefit that will be available once you have this core data available in near real time.

Request: Ask your Vehicle Vendors / OEMs to support OMF or MQTT.
- In this way, we can encourage the vendors to change with the voice of many companies instead of one.

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Data Streams, Why Now?

- Aveva releasing their High Availability MQTT adaptor
- Better network options on Surface and Underground
- Remote Operations Centres are demanding more visibility
  - Objective: Increase Production
- Continued growth in Short Interval Control for underground
  - Real time edge data is a requirement of SIC
  - Objective: Increase Production by early course correction
- Vehicle Telemetry should be matched with Tracking Data and Operator feedback to reap more Business Value
- Edge resources have the compute and storage capabilities for both:
  - Store and Forward
  - Live Data Streams
- AI models can use the near real time streams to identify equipment problems, prescriptive maintenance, operator training, production predictions, etc.
  - Tire Wear model using Tire Pressure and Equipment Load
- Real time telemetry importance increases for remote and autonomous vehicles

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"Now I find that the computer stuff I struggled with or didn't understand isn't so bad. I've got someone in my corner, happy to help with anything that can make my job easier, which allows me to spend more time in the field with my employees coaching them, teaching them tricks to make their jobs easier and ultimately ensuring they are working safe. Using iROC and getting familiar with the technology has been a big win for me as a supervisor, and for my team."

Coleman Mine Supervisor

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Questions?

Please wait for the microphone.

State your name and company.

Please remember to...

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Thank you!

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