

Mobilaris and PI Integration

BARRICK

Agenda

- About Barrick Gold
- Background - Mobilaris
- How the PI System was Applied
- Implementation Details
- How Individual Product Capabilities Solved Your Business Challenge
- Results Obtained and Business Impact
- Conclusion

BARRICK

- Gold mining business with operations and projects in 15 countries.
- Barrick Nevada is an integrated gold mining operation that combines the Cortez and Goldstrike properties in Nevada, employing a total of 3,000 employees and 800 contractors.



Background

- Installations in three UG mines in US and one UG in Canada
- Cortez Underground Mining and Mobilaris
 - Real-Time Visualization of the Underground Mine
 - True Digitalization of the Data
 - Real-Time Monitoring
 - Real-Time Localization

How It Works

- Runs on a PC or a tablet through a web browser such as Chrome and Firefox.
- Integrates with the mine's wireless WiFi network.
- Equipment that lacks their own power source can be positioned with mass-localization.

Mass Localization

The Mobilaris Mass Localization allows cost-efficient tracking of masses of equipment.

By attaching tags (RFID tags are roughly 1 – 10 USD each) on these objects and then mounting an active RFID antenna on few of the vehicles that passes most tunnels in the mine regularly or using site's WIFI, we can indirectly get the position of these objects as the vehicle passes the tagged objects.

ID	d0:b5:c2:bd:6a:bb
VENDOR	Mobilaris
POSITION	8702.88/11330.14/1570.22
POSITION TYPE	WIFI
LAST HEARD	2/26/19 10:25 AM
AGE	9s
ZONE CHANGED	1m 2s
ACCESS POINT	USACHUGMRP01
ACCESS POINT MAC	a0:e0:af:41:67:90
SIGNAL STRENGTH	-64 dB



Emergency Support

- Allows the user to make proper decisions during emergency situations or evacuation.
- Sending initial emergency message
- Locating unsafe personnel
- Checking the status of the rescue chambers

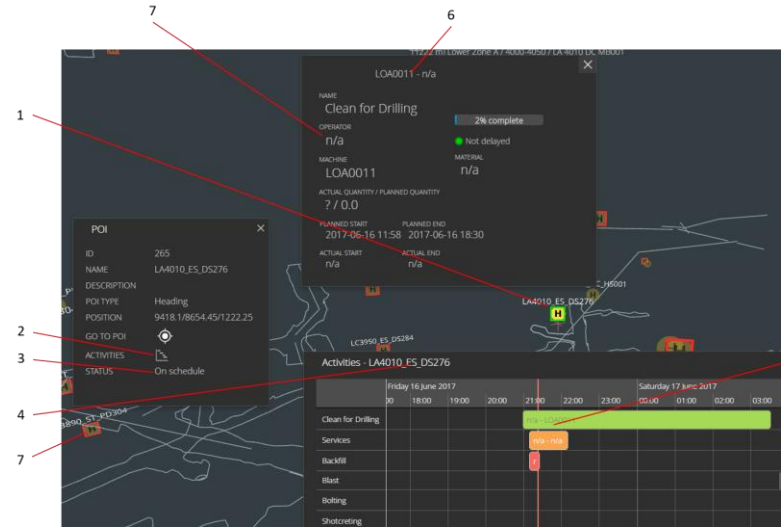
The screenshot displays an emergency support application interface. At the top, there is a navigation bar with a back arrow, a red emergency icon, and a status bar showing "[283 m] Under jord / Level -300-200 / AP69" and "4062/10214-283". Below the navigation bar is a search bar labeled "Rescue chambers" with a magnifying glass icon. Underneath the search bar is a text prompt: "Select rescue chamber to show personnel and their distance from the rescue chamber. Rescue chambers inside emergency area:". Below this is a table with the following columns: Name, Description, Level, Personnel / Max in chamber, Go to, and Search Nearby. The table contains 13 rows of data for various rescue chambers. To the right of the table is a map showing a green location marker for "RK 5 S274 : 0/8". At the bottom of the screen is a red emergency bar with a timer "02:03:47", the word "EMERGENCY!", a "Show emergency area" button, a status indicator "All personnel: 0", and buttons for "Safe: 0", "Unsafe: 0", and "Acknowledge".

Name	Description	Level	Personnel / Max in chamber	Go to	Search Nearby
RK Matsal 400	Räddningskarr 400	397	7 / 30		
RK 15 N545	Räddningskarr 15	553	7 / 8		
RK 3 H320	Räddningskarr 3	317	7 / 6		
RK 1 H205	Räddningskarr 1	201	7 / 8		
RK 5 S274	Räddningskarr 5	272	7 / 8		
RK 8 N542	Räddningskarr 8	539	7 / 8		
RK 4 S517	Räddningskarr 4	517	7 / 8		
RK 6 S451	Räddningskarr 6	447	7 / 8		
RK 9 S553	Räddningskarr 9	551	7 / 8		
RK 2 S409	Räddningskarr 2	407	7 / 8		
RK 7 S382	Räddningskarr 7	378	7 / 8		

Visualization of Shift Activities

Supports different functions to monitor and track the production and operations scheduling.

- See which headings that currently have activities
- See the activity schedule for an active heading
- See which headings that are 'off-track' in terms of operations scheduling

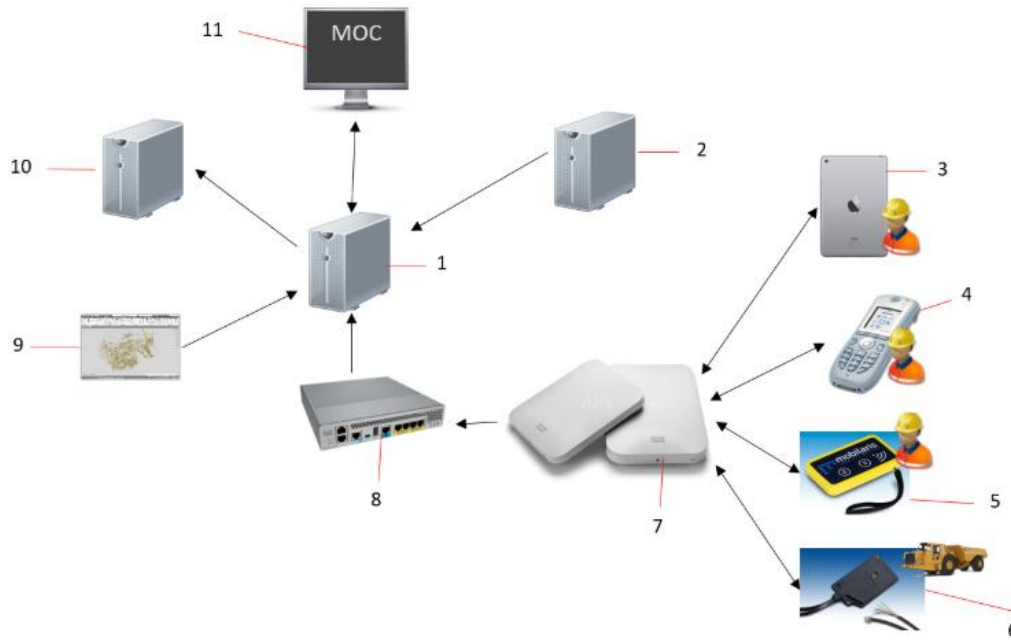


Our Challenge

- Improve on Ore Stockpile Management (Quantity and Quality)
- Access to All the Historic Data
- Create Custom Reports and Analytics
- Create Custom Events
- Create Custom Notifications
- Provide Connectivity Functionalities
- Provide Increased Reliability of the Data (data availability & quality)
- Ore/Waste Segregation Tracking

Implementation

System Implementation



1. Mining Intelligence™
2. Deswik
3. OPSTablet
4. ASCOM IP Phone
5. Person positioning tag
6. Vehicle positioning tag
7. Cisco Wi-fi AP
8. Cisco WLC
9. CAD application
10. Other application
11. Mining Operation Center (MOC)

PI Data Integration

- Connecting both systems via the PI Connector for UFL (REST Client), we capture the positioning data in real-time and efficiently store all historical data.
- Using Asset Framework, we added context ; using Asset Analytics, we generated actionable events for idle or down equipment.

PI Connector for UFL

- REST Client functionality
- JsonGetValue function allows for easy data parsing/mapping

```
[MSG]
MSG(1).NAME="Data"

[Data]
Data.FILTER=C1=="*"

FOREACH (JsonGetItem(__MESSAGE, "[ ]")) DO

    assetid = JsonGetValue(__ITEM, "assetId")
    TimestampMilliseconds = JsonGetValue(__ITEM, "timestamp")

    TimestampSeconds = ToString(TimestampMilliseconds / 1000)

    Timestamp = TimestampSeconds

    'COMMENT' PRINT(CONCAT(TimestampSeconds + ", " + ToString(Timestamp)))

    PosX = JsonGetValue(__ITEM, "posX")
    StoreEvent( CONCAT("Model Name: ", assetid, "_PosX"), , Timestamp, PosX )

    PosY = JsonGetValue(__ITEM, "posY")
    StoreEvent( CONCAT("Model Name: ", assetid, "_PosY"), , Timestamp, PosY )

    PosZ = JsonGetValue(__ITEM, "posZ")
    StoreEvent( CONCAT("Model Name: ", assetid, "_PosZ"), , Timestamp, PosZ )

    apMacAddr = JsonGetValue(__ITEM, "apMacAddr")
    StoreEvent( CONCAT("Model Name: ", assetid, "_apMacAddr"), , Timestamp, apMacAddr )

ENDFOR
```

Asset Framework

The screenshot displays the PI System Explorer interface for an asset named '0003'. The left-hand pane shows a hierarchical tree structure of elements, including categories like 'CORTEX', 'UNDERGROUND', 'MOBILE EQUIPMENT', and 'AD30'. The main window shows a table of data points for the selected asset, organized into several categories:

- Category: <None>**
 - Downtime
 - Hourly Stops
 - Hourly Stops - Time
 - Hourly Total
 - Hourly Total - Fix
 - Stopped Status
 - Total Moves - Hourly
 - Truck Status
 - Utilization
- Category: Analytics**
 - Movement Detected
 - Time Since Last Movement
- Category: Asset Data**
 - Asset Id
 - Description
 - Name
 - Type
- Category: Positioning**
 - apiMacAddr
 - PosX
 - PosY
 - PosZ

The table columns are 'Name', 'Value', 'Time Stamp', and 'Description'. The interface also includes a menu bar (File, Search, View, Go, Tools, Help), a toolbar with options like 'Database', 'Query Date', 'Check In', 'Refresh', and 'New Element', and a search bar for elements.

Asset Analytics

The screenshot displays the PI System Explorer interface. On the left, a tree view shows the hierarchy of assets, including 'CORTEZ', 'OPEN PIT', 'PROCESS', 'UNDERGROUND', 'FIXED PLANT', 'MOBILARIS - PEOPLE', 'MOBILE EQUIPMENT', 'BOLTERS', 'DRILL & BLAST', 'GRADERS', 'HAUL TRUCK', and 'TANK FARM'. The 'HAUL TRUCK' folder is expanded, showing various truck IDs like AD30, 0003, 0004, 0005, 0006, 0007, 0009, 0010, 0011, 0012, 0013, 0014, 0015, 0016, 3001, 3002, 4501, 4501a, 4502a, AD45B, LOADERS, MINEERS, SPINMAC, SUPPORT EQUIP, and TRACTOR.

The main window shows the configuration for element '0003'. The 'General' tab is active, displaying a table of variables:

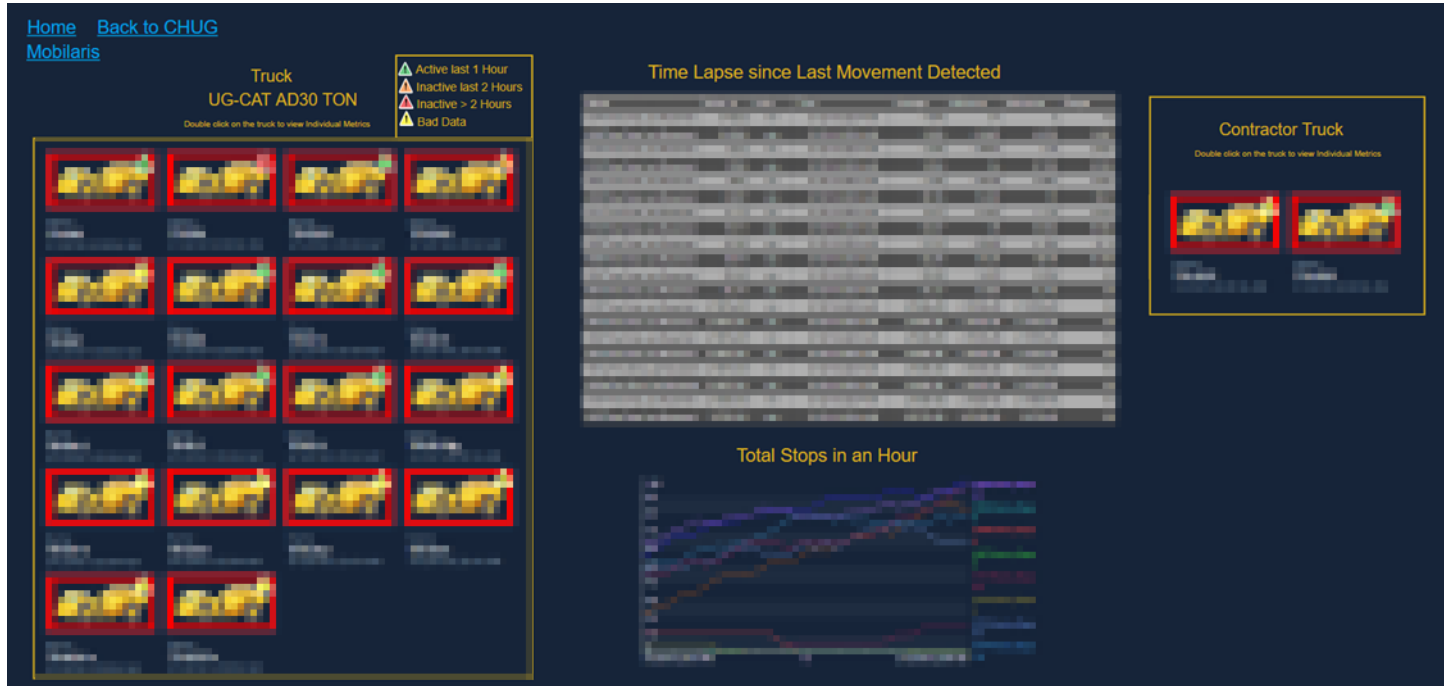
Name	Backfilling
f99 Downtime	✓
f99 For Fleet Mgmt Use	✓
f99 Hourly Stats	✓
f99 Status	✓
Truck Stopped	✓

Below the table, the 'Add a new variable' section contains the following configuration:

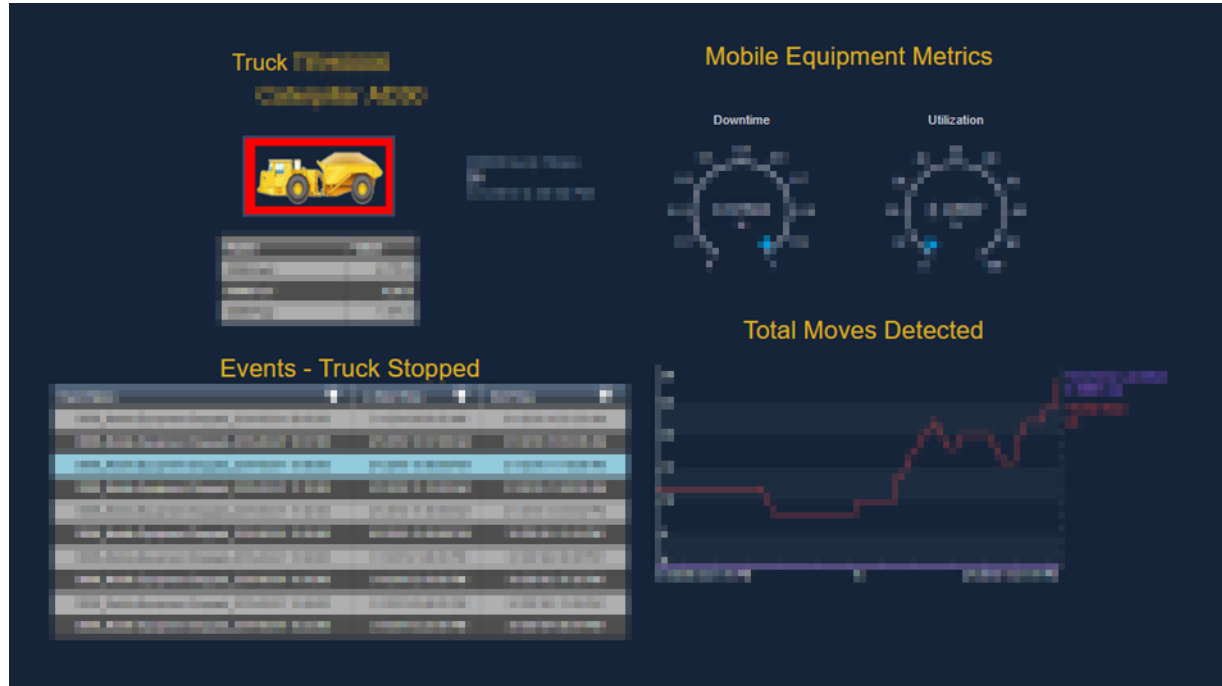
Name	Expression	Output Attribute
Stopped	<code>if PrevVal('PosX','')<>TagVal('PosX','') and HasChanged('PosX','')="True" and 'PosX'<>0</code>	Truck Status
StoppedStatus	<code>if Stopped=1 then NoOutput() else 1</code>	Stopped Status
Count	<code>NumOfChanges('Truck Status','*-1h','')</code>	Hourly Stops
Variable1	<code>if 'Hourly Stops'>0 then TagTot('Hourly Stops','*-1h','') else 0</code>	Hourly Stops - Time

At the bottom, the 'Scheduling' section is set to 'Event-Triggered' and 'Trigger on Any Input'. A status indicator at the bottom right shows 'Connected to the PI Analysis Service'.

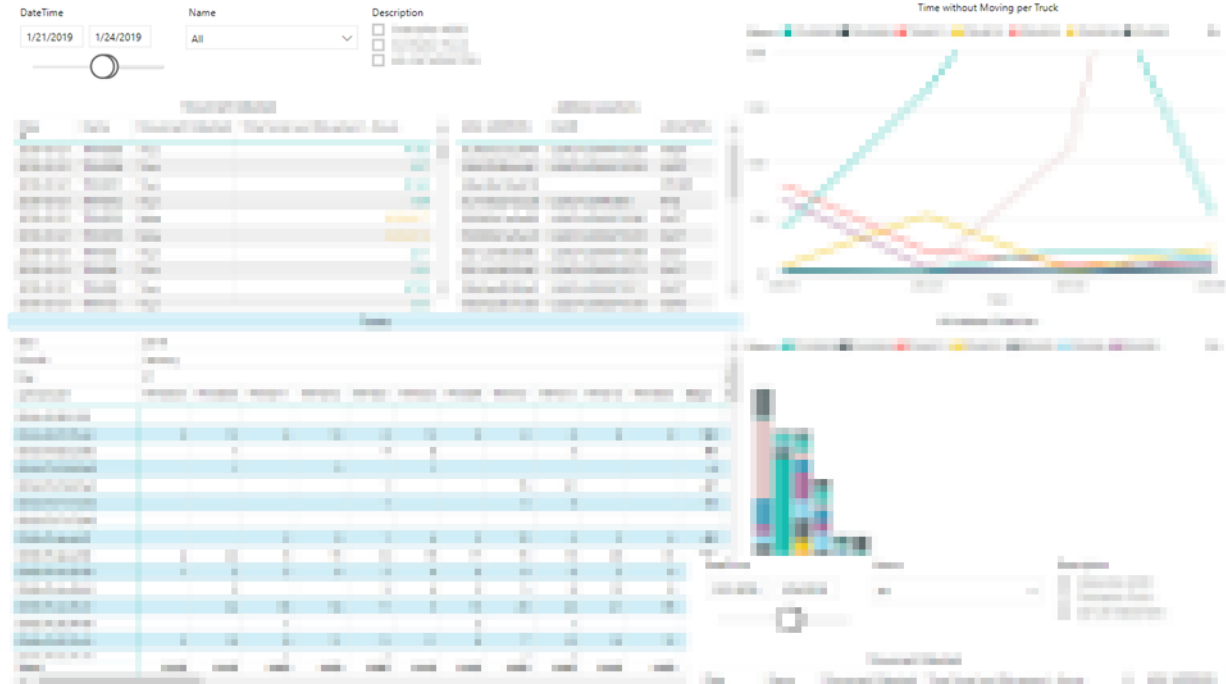
PI Vision



PI Vision



Power BI



Results

Benefits

Efficiency

- Real-Time Visualization - With Mobilaris in an Underground Mine, you see everything because you are connected to everything and everyone. Together with the knowledge of the shift plan, the operations' personnel can take the right decisions faster than before and keep up the face utilization.

Benefits

Efficiency

- Emergency Support - Allows the user to make proper decisions during emergency situations or evacuation.
- Integration of Shift Activities – Ability to monitor and track the production and operations scheduling in real-time.

Benefits

Efficiency

- Localization of assets (equipment and personnel) in real-time.
- Blasting Support - Maintains count of all personnel and marks as safe or unsafe depending on their location.

Benefits

Availability of the Data – PI Integration

- Ability for custom reporting, event triggering, notifications, and analytics.
- Increased Accessibility of the data going as far back in the historian as needed by the operations.

Benefits

Availability of the Data – PI Integration

- Ability to monitor connection status and trigger alarms as needed
- Ability to generate and provide historical reports of Asset Movement
- Ability to acquire positioning data for all assets

Benefits

Availability of the Data – PI Integration

- Ability to assist in Accident or Incident Investigations
- Provides connectivity functionalities by allowing to join and/or blend data from other source systems (geology, planning, asset work order management, etc.) into a common reporting tool

Conclusions

Barrick

Mobilaris and PI Integration

CHALLENGE

Create Custom Analytics and Reports using the data Mobilaris was generating

- Using existing technologies, massive amounts of equipment can be tracked in a cost-efficient way
- Data must be available, accessible, and reliable at all time
- Data must have no historian limit

SOLUTION

Integrate Mobilaris with PI

- Connecting both systems via PI Connector for UFL
- Using Power BI for visual analytics
- PI Vision for Real-Time reporting and Custom Visuals

RESULTS

Efficiency
Availability of the Data

- Ability to make the right decisions faster
- Ability to access the data from any device, at any time, and create as many custom reports as needed
- Time saving underground emergency evacuation
- Shift Operations' Visualization
- Mass Localization

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Questions?

Please wait for
the **microphone**

State your
name & company



Please remember

TO DOWNLOAD
APP, SEARCH
OSISOFT



謝謝 KEA LEBOHA
 TAPADH LEIBH 고맙습니다
 БАЯРЛАЛАА MISAOTRA ANAO
 DZIĘKUJĘ CI NGIYABONGA TEŞEKKÜR EDERIM GRACIES OBRIGADO شكرا SALAMAT
 DANKON TANK TAPADH LEAT SALAMAT
 KÖSZÖNÖM DANKIE TERIMA KASIH GRACIES
 СПАСИБО
 ПАКМЕТ СІЗГЕ
 GO RAIBH MAITH AGAT
 БЛАГОДАРЯ GRACIAS MAHADSANID
 ТИ БЛАГОДАРАМ
 TAK DANKE MAHADSANID
 RAHMAT MERCI
 HATUR NUHUN
 GRAZZI ПАККА ПЕР PAXMAT САГА
 FАLEMINDERIT
 CẢM ƠN BẠN
 WAZVIITA
 TI БЛАГОДАРАМ СИПОС
 EΥΧΑΡΙΣΤΩ GRATIAS TIBI
 AČIŮ SALAMAT MAHALO IĀ 'ŌE TAKK SKALDU HA
 ありがとうございます
 SIPAS JI WERE TERIMA KASIH
 UA TSAUG RAU KOJ
 TI БЛАГОДАРАМ СИПОС
 MULŢUMESC
 HVALA FААFETAИ
 ESKERRIK ASKO
 HVALA ХВАЛА ВАМ
 TEŞEKKÜR EDERIM
 GRAZIE
 DI OU MÈSI
 ĎAKUJEM
 MATUR NUWUN

