MS Awards
4Arrows, UMK mine
Microsoft Azure – Internet of Things

A mining contractor in the Northern Cape, South Africa needed to keep the wheels turning on their business, but their tire bill stopped them in their tracks.

Moving heavy and earth

For the past ten years, 4Arrows, a contract mining company, has loaded, hauled and crushed in excess of 3.5 million tons of waste and ROM on a monthly basis at the United Manganese of Kalahari (UMK) mine in the John Taolo Gaetsewe District Municipality, Northern Cape. That's a lot of heavy cargo across rocky, treacherous terrain – it's tough on tires, and tougher on drivers who rely on a few inches of rubber to keep them safely on the road. But the real damage was to their operational spend.

Each mine has approximately 30 dump trucks, each with six tires, and each of those tires costs R250,000. Replacing a full set of tires costs R1.5m—and that's for one vehicle. But, the tires were only lasting *half* of their typical lifespan. Through their engineering analysis, 4Arrows deduced that over 60% of their tire degradation was because of overinflation. Incorrect tire pressure resulted in a bill of over R10 m per month on tires alone.

What if 4Arrows could have real time over and under inflation data insights with alerts that could result in action being taken to address the problem sooner rather than later? And ultimately reduce significant tire degradation? As well as that overinflated bill?

Pumping up their performance

4Arrows needed a solution that maximised their tires' life, ensured their drivers' safety, and significantly reduced their monthly tire expenses.

"Microsoft Azure for us was a no brainer. The workbench, the suite of IoT and other services could be wrapped together easily, consumed easily, and spun up into business value. Microsoft Azure IoT was our ultimate decision."

Dave Martin, Strategy and Innovation Director for Dimension Data's Intelligent Workplace Business

The team ran a pilot in the form of a proof of concept at the mine, using two Trip 7s—large rigid dump trucks—each with six tires. Full tire component visibility, leveraging the benefits of IoT, and fully supported by Microsoft Azure.

A mobile application was set up, created and configured to track and trace the assets and in-field execution, recording all incidental data.

Tire pressure management is only one key component to maximise tire life, so additional components were included: tire installation recording, tracking and monitoring, tire rotation, temperature, tread depth measurement, impact on the tire, and tire end of life.

"In each of the dump trucks, we used an Intel gateway because, in many ways, within the Microsoft Azure ecosystem, they've been the perfect gateway for us to leverage. It's allowed us to gather the appropriate data at the Edge, bring it into the IoT hub in the public cloud, and then leverage the other pass services to treat that data correctly."

Dave Martin, Strategy and Innovation Director for Dimension Data's Intelligent Workplace Business

The main interface is a web interface/portal running on Azure storage as a single page API-driven web interface. This is authenticated using Azure B2C for security.

Tire pressure management sensors were installed (imported from Europe – Pressure Pro, best of class sensors), which were connected to a Dell 3000 gateway, which communicated the temperature and pressure of the tires every 10 minutes into IoT technology. The data is then aggregated with the data from the mobile app, which enables client rich insights and management intervention at critical stages.

Keeping on track

Real time monitoring on the tires alerts when a tire is both over- or underinflated. The system flows into an alert structure that summons a team of workers to go out and inflate or deflate the tires based on the recordings.

The data is visualised in graphs and is very straightforward

The tech functions both on and offline. Mines are known for their harsh conditions, and devices are easy targets for loose stones, falling rocks, and bumping metal. The devices are kept ticking in these conditions, even when offline, out of comms, and in a vehicle.

The system picks up potholes and areas of impact based on the vibrations. At a point of impact or point of alert, the location is tagged with GPS coordinates, tire pressure, and accelerometer data, which is sent via email, Microsoft Teams or text message. It's also shown on a web portal on a map with a pin and visualizes what went wrong and the relevant details.

This solution can also be used on older vehicles, which can cut down on wastage (as it makes an older vehicle smart).

Accelerating change, shifting perceptions

"When those devices were first installed, there were some concerns—hold on what is this device doing here? Is this device a 'Big Brother' to watch me and threaten me with my job or is this the new world of automation that is going to make my job redundant? Unfortunately, we actually saw some of the devices damaged in the early days of deployment."

Marco?, 4Arrows

Because of this lack of trust and understanding, all stakeholders, in particular the drivers, as part of the ecosystem, were part of a change management program. For the drivers, the IoT devices means greater peace of mind on the road—better safety, more preventative measures, and constant 24/7 monitoring. It's made their jobs better and safer, an additional outcome that reaps ongoing dividends.

"New technology need not be the enemy. It can actually be my companion if it means we can succeed together. So we found that despite a complex technology project, there has to be respect to the people component - make sure that everybody and all stakeholders in the ecosystem see value in coming together to unlock the potential."

Marco?, 4Arrows

Where the rubber meets the road

Analysis of the data proved that by quickly reacting to the tire's exceeding their threshold or running under- or over-inflated, wear and tear on the tires is saved as the in-field team is alerted to attend to the tires immediately.

The tire lifespan increased by 20%, saving the client R2m per month— and that was within three months with only two trucks.

This was also the first solution to be able to process and maintain pit data on and off connection (while offline). By utilising the IoT Edge capability, data is processed, analysed and outputted in the actual pit while the vehicle is offline.

Moving on…

The entire 54 rigid dump truck fleet will be included as part of the ongoing pilot.

"Microsoft Azure was the most complete suite of capabilities that was readily available, not just for what we've had to do for the proof of concept, but what we've laid out as a road map to where we're taking this platform going forward. We are very excited around the other Azure capabilities we're working towards."

Dave Martin, Strategy and Innovation Director for Dimension Data's Intelligent Workplace Business

The solution is also being expanded, by leveraging the same technology, to assist with hydraulic oil management, load cycle optimisation and production management.

By extending data gathered, things like accelerometer sensors can look at acceleration and good driver behaviour. They're also useful to detect things like potholes in the mine, and if there's a tire blow out, it can detect the GPS location, and the quality of the roads can be upgraded to ensure less tire pressure degradation.

More than just tires

But this technology can also be expanded to other verticals, like healthcare, logistics, manufacturing and retail.

"The exciting part with Microsoft Azure is around rapid deployment and cost effective solutions that we're able to rollout, on a cost effective basis. The size of the opportunity is overwhelming."

Dave Martin, Strategy and Innovation Director for Dimension Data's Intelligent Workplace Business