

# From Automation to Autonomy: Building the Future of Mining Operations



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expanding human possibility®

# Today's operational technologies running mining is 15~20 years behind the technology curve

Operational technology evolved much slower in comparison to adjacent industries eg. Computer science & software engineer.

Most of the OT technologies – PLC, Historian, APC – were developed in the last century



# | Run-to-failure is draining agility, cost, and security

## Agility



Every layer of technical debt makes it harder to adopt new technology or respond to a market shift

The operation gets more rigid each year – locked into yesterday's architecture

Inability to adapt ore grades, market conditions, or regulatory requirements at speed

## Cost



Maintaining ageing, undocumented OT carries growing overhead – specialist skills, spares, workarounds

Each workaround adds to the debt, making the next change even more expensive

Integration re-done for every new project: the same cost, paid repeatedly

## Risk



Legacy OT is the soft underbelly of both operational and cybersecurity risk – unpatched, unsupported, exposed

Unlike IT debt: this risk sits at the layer closest to value creation

When OT lags, it costs tonnes – not just convenience

***And it all sits at the value-creation layer – OT is where the business actually makes its money***



**TODAY'S AUTOMATION  
RUN-TO-FAILURE**

Rigid monolithic systems

Raw signals without meaning

Unmanageable change risk

Tacit expert knowledge



**FUTURE'S AUTONOMY  
SELF-HEALING**

Rapid adapting to change

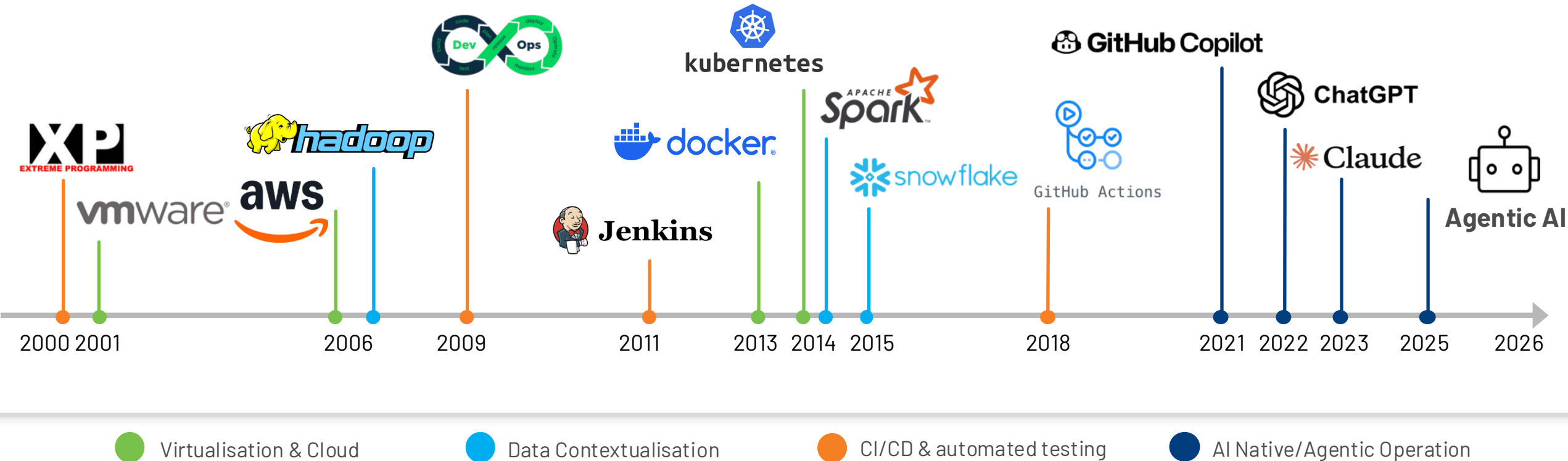
Data that explains itself

Fully tested and modelled risk

Democratised and institutional



# Software and IT went through a 30-year journey of automation, and it is now entering the **autonomous phase**



## ENABLER 1

Today control strategies are tightly coupled to the hardware it runs on.

# Software Defined Automation (SDA) breaks that coupling

Introducing agility to the business logic, control philosophy and user experience while maintaining hardware lifecycle at a slower pace to reduce change risks





## ENABLER 2

Most operational data carries no meaning on its own

# Contextualisation turn data into information

Automation era were developed on structured and time series data. To reach autonomous operation, we need to tap into unstructured data sources.

Data contextualisation is a practice that needs to be applied at multiple layers. It doesn't mean buying a single data platform

# Generative & agentic AI is expanding human possibility

The operational and process SMEs possess the “know-how” but lacks the ability to execution. With the power of GenAI, this barrier is collapsing and democratizing the ability to turn ideas into execution



## ENABLER 4

No change should reach production without being validated first

# Simulation and Emulation is the missing safety step

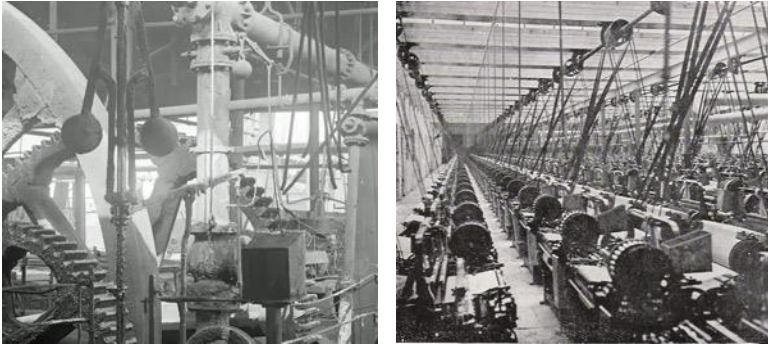
Before any change deploys, it runs against a virtual model of the equipment. The fix that fails in simulation never reaches the plant; the one that passes deploys with evidence, not hope. This is the trust layer that lets us cross from "recommend" to "act."



# Technology alone won't move the needle – value is in redesign people, process and operating model

## STEAM AGE

1881 1<sup>st</sup> electricity generating station



## REDESIGN MANUFACTURING PROCESS

~40 years of process redesign



## ELECTRIC AGE

~1920 Productive Soared



Electric motors were available from the 1880s, yet factory output stayed flat for ~40 years – owners first just bolted a motor onto the old steam-engine driveshaft, and only later redesigned the plant around a motor on every machine.

**Robert Solow:** *"You can see the computer age everywhere but in the productivity statistics."*



# What does the future of an autonomous self-healing system look like?



## Operational Awareness

Contextualised data on current & historical operating conditions



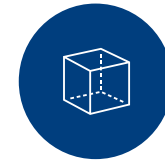
## Deep Intelligence

Domain expertise for rapid issue identification & automated resolution



## Agile Infrastructure

Software-defined automation for rapid system adjustment



## Virtual Environment

Simulates the real world to test changes before production

### PEOPLE, PROCESS & OPERATING MODEL



## Subject Matter Experts with Digital Skills



## Fully Codified Business Process



## Flatter Operating Model & Structure



Start the autonomy journey now – three moves to make while technology and people mature

## Start Now data & process

- Extend your data foundation with semantic context
- Document how core business processes run today

## Near Term agentic framework

- Start with proven use cases like root-cause analysis
- Establish a governance model for adopting GenAI

## Longer Term simulation & SDA

- Explore software-defined automation in your OT environment
- Simulate critical assets to validate change safely

Build AI and data literacy across the frontline, and encourage teams to adopt technology and develop GenAI “muscle”



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PRESENTATION



# Q & A