

EXTEND PIPE ASSET LIFE

MACHINE LEARNING UNCOVERS ROOT-CAUSE(S) OF PRESSURE TRANSIENTS FOR A CALM WATER NETWORK



CASE STUDY: Find. Identify. Mitigate.
Extending SA Water's pipe asset life through a calm water network.

Identifying the root cause of pressure transients can mitigate the effect on weakened sections of water mains. This is necessary for water utilities to reduce capex being brought forward, customer service interruptions, and unplanned opex.

THE CHALLENGE

Current pressure transient detection focuses on thresholds of large magnitude, slower events. In these systems, high speed short timescale pressure transients, which may reduce the lifespan of water mains through accumulated fatigue, currently do not trigger alerts or are hidden behind larger events. The scale of these datasets (~4 billion records per sensor / year) make it infeasible to be analysed manually.

In Stage 1 of their 2022 collaboration, TD-Cloud's capabilities in big data and machine learning (ML) were combined with SA Water's expertise in internal pressure management for rapid development of a solution that allowed detection and grouping of previously unknown fast events. **The analysis of the high-speed (128 Hz) data detected pressure transients to >97.5% accuracy** over 5 sensors from 2018 to 2022. However, the large number of transients detected (>22k for 5 sensors over 3 years) limited the ability to gain insights, prioritise and analyse trends.

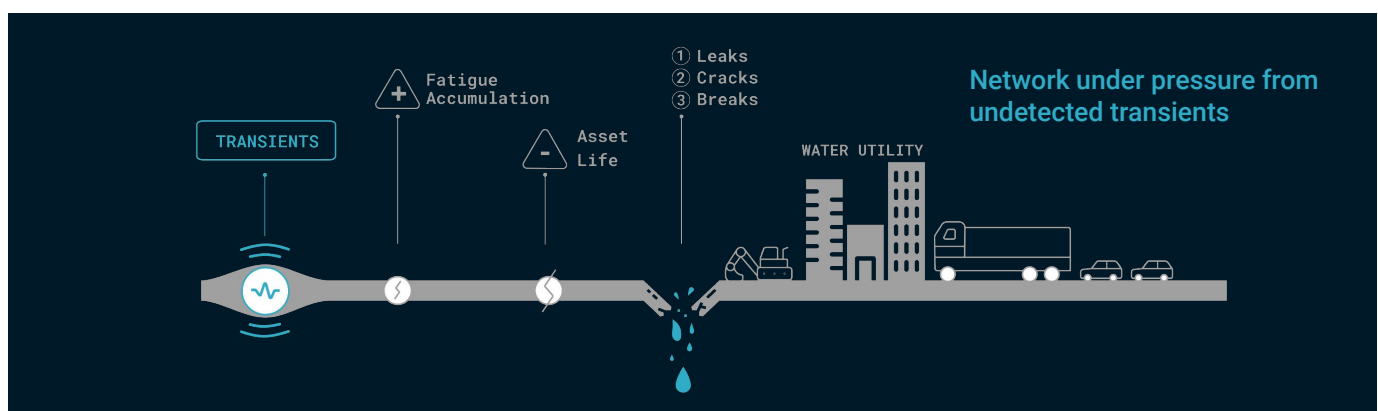
The latest project collaboration has continued to take the next step, extend the geographic area, and develop a new investigative tool to identify root-causes and move towards mitigation.

Our guiding question was, "How do we identify root-cause?"

CO-DESIGN FOR MLOPs

TD-Cloud provided the big data, data science expertise and AI platform, while SA Water led the insights into transient behaviour and desktop study which provided further feedback into the development. The guiding question was, "How do we find it? To identify and mitigate root-cause." A rapid co-design process led to design mockups that validated end-users' requirements and provided development blueprints. A series of sprints focussed on the user interface, improving the grouping algorithm and analytics to enable "finding it." Subject matter experts (SMEs) then used the tool to identify transient groups of concern for mitigation.

Infographic I: Typical impact of pressure transients on the asset life of a pipe network



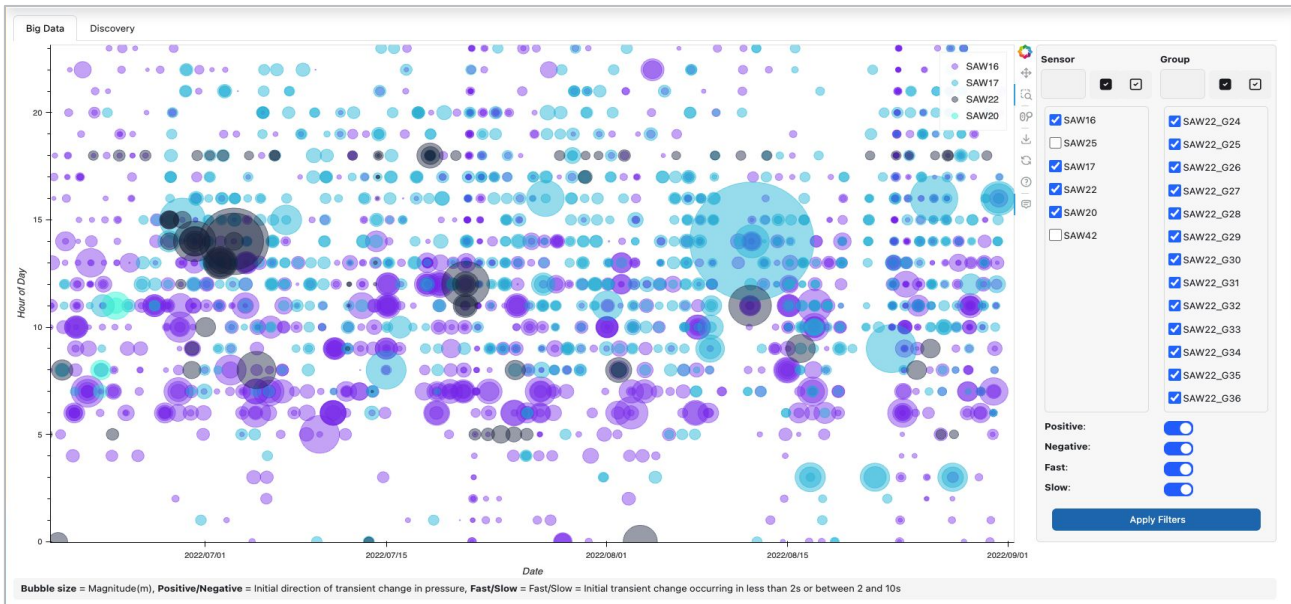


Figure 1: TD-Cloud user interface dashboard showing pressure transients across 3 months by time of day for a few select locations

THE PLATFORM

The **TD-Cloud** software delivers organisational value through reducing the cost, effort and time to data decisioning. Our unified platform is powered by Amazon Web Services (AWS) and enables:

- ✓ Directly ingest, store and analyse pressure transient data at scale and speed
- ✓ Algorithms co-designed with SA Water
- ✓ Reliable, user-friendly, secure software platform
- ✓ AI that converts Big Data into transient detection
- ✓ Visualise billions of data points through a user-friendly UI

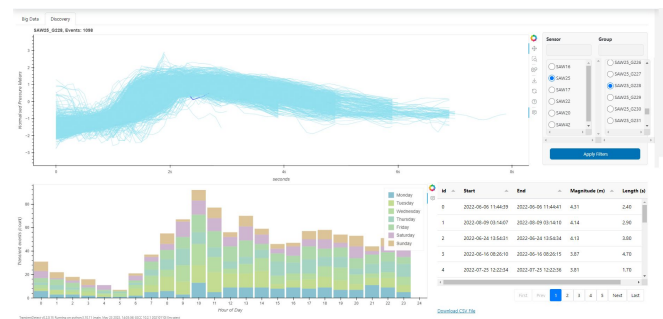


Figure 2: a clustered group of small frequent events that may be leading to fatigue accumulation in the pipe network shown in the Discovery dashboards

THE RESULTS

Detection of patterns in high-speed transients is possible due to new capabilities within the tool. As a result, findings include:

- ✓ Significantly differing levels of activity at different geographic locations
- ✓ Different diurnal patterns in CBD vs suburban and across seasons (summer vs winter)
- ✓ Large infrequent yet repeated events (may lead to breaks in weakened sections)
- ✓ Small frequent events that may lead to accumulate pipe fatigue (refer to Figure 2)
- ✓ Repeated automated events at specific times of the day (refer to Figure 3)

The ability to drill quickly and easily into more detail via desk-based investigations within the tool uncovered probable **root-causes**, including but not limited to:

1. Customer irrigation systems
2. Pump operations
3. Fire testing

“Measurable impacts include extension of pipe life, reduced opex/capex and reduced service interruptions”

THE IMPACT

The accumulation of measurable impacts from implementing TD-Cloud are leading to a calmer water network for SA Water.

An additional benefit is ongoing delivery of actionable insights without the need for field investigations.

This project moves a major utility in the water industry from being data rich but insights scarce to having new insights that drive mitigation – a key step towards realising a calm network.

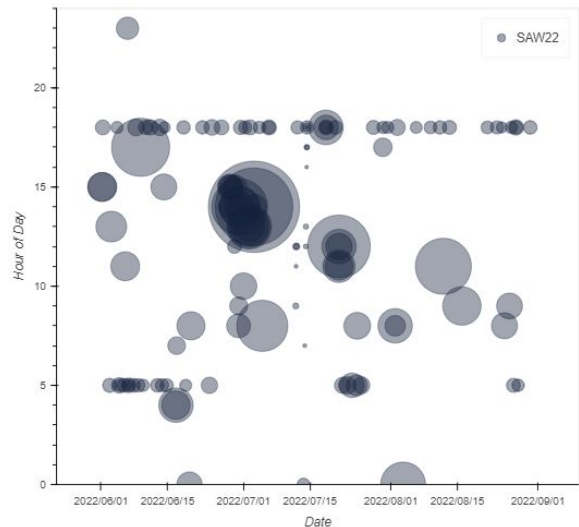
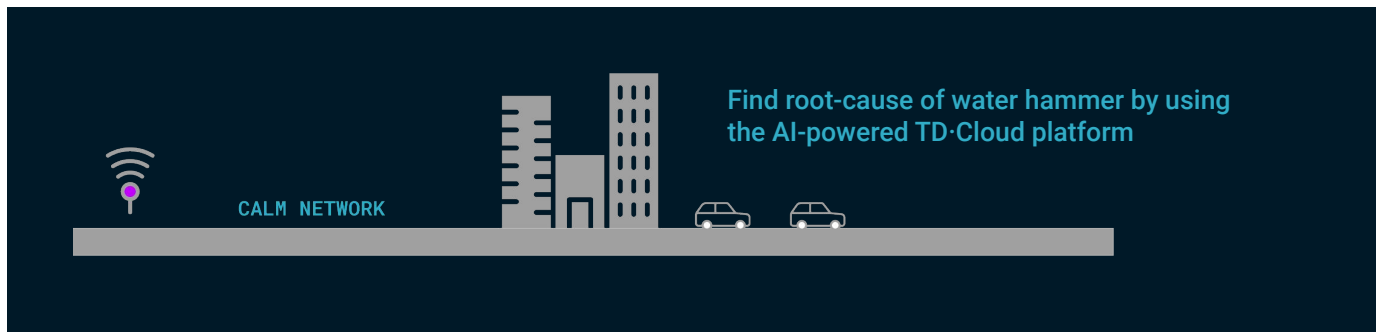


Figure 3: automated events likely the cause of repeat pressure transients at specific times of day (5 am)



THE FUTURE

Development of an investigative tool, with ML algorithms in the back-end, gives Planning, Engineering, Operations and Maintenance teams autonomy in analysing pressure transients in their water network. Further de-risking investment in expansion of pressure monitoring programs for water utilities like SA Water.

“The next step is to use the TD-Cloud platform to monitor, alert and quantify accumulated fatigue.

Resulting in a calmer network, improving asset life and potentially reshaping the design process for asset planning.”

Infographic II: the ideal state of a calm network achieved through monitoring and mitigating pressure transients.

FIND. IDENTIFY. MITIGATE.

Talk with us about how to calm your water network.

email sales@transientdetect.io

Scan QR code to book a call with our technical experts.

