


eBOOK

SENSIBLE WATER SOLUTIONS FOR A DROUGHT STRICKEN SOUTH AFRICA

WWW.IMQS.CO.ZA

A large, stylized yellow graphic composed of several overlapping, irregular geometric shapes, including rectangles and triangles, positioned in the lower right quadrant of the page. The background of the entire page is a grayscale photograph of a dam and a reservoir, with mountains in the distance under a cloudy sky.

INFRASTRUCTURE MANAGEMENT SOLUTIONS.

IMQS is a specialised software solutions company. We have provided proven Infrastructure Asset Management (IAM) Solutions & Services to over 100 government and private organisations in South Africa and Internationally for more than a decade.



EXECUTIVE SUMMARY

This E-book outlines IMQS Software's envisioned contribution to the challenges drought-stricken South African municipalities currently face in terms of managing dwindling water resources.

IMQS showcases the ability to make use of the latest technologies in telemetry to enable municipalities to gain comprehensive control over their water distribution networks. Sensors are placed at various points along the network. They provide (near) real-time information to operate and optimise the network. The use of sensors can strongly increase the ability of utilities to proactively detect anomalies and risks. Moreover, intelligence emanating from captured data can help them make informed decisions regarding the management and maintenance of all assets within their water distribution network, especially the quality of water.

Smart water solutions contribute to cities becoming more resilient and thus smarter over time. With the help of smart information hardware and software, data can be captured from various sources and stored in a central database for analytics.

Integrated smart water management solutions enable municipalities to appreciate the value of their data. Valuable information increases the speed and scope of decision-making. Mapping information through GIS software adds extra value as information can be presented spatially and over time. Overlaying multiple data layers, and presenting it in an easy-to-interpret fashion, provide users with the appropriate level of context to make holistic decisions.

A reliable water quality information system enables utilities to develop a better understanding of water quality conditions in the distribution network. Valuable information can inform decision-making and facilitate preventative maintenance.

Smart water solutions, in effect, contribute to cities becoming more resilient and thus smarter over time.

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BEING SMART IN TIMES OF DROUGHT

South Africa is no stranger to water insecurity. Over the last decade, however, a convergence of factors has severely impacted the region's hydro-security. Climate variability, spurred on by El Nino, as well as global trends, has increased the frequency and severity of floods and droughts. Population growth, urbanisation, commercialisation and industrialisation place further pressures on authorities to meet growing demand.

Since 2015 a large portion of South Africa has experienced extended periods of drought, with five provinces being declared disaster zones. In 2017, the severity of Cape Town's water shortages, for example, caught international media attention, with extreme conditions being met with ever staggering water restrictions.

In reaction to the severity of the Western Cape's increasingly dire situation, Alan Winde, Minister of Economic Opportunities for the Western Cape Government, has called for innovative approaches to support local government in managing, and overcoming current and future challenges. Tackling the stronghold of increasing and longer periods of droughts requires significantly more than just managing the infrastructure and resources better.

Implementing smart solutions, built on the back of technological advance, does not only represent the future of city management. Smart technological solutions have, in effect, become a necessity!

Smarter, more effective management of water in relation to the urban water cycle can contribute to more effective Water Services Planning and Water Demand Management. The municipalities whose solutions are resilient and scalable have the most opportunities to become Smart Cities.

This document outlines IMQS Software's envisioned contribution to the challenges faced by South African municipalities. By making use of the latest technologies in sensing and remote monitoring, IMQS holds the ability to enable municipalities to gain comprehensive control over their water distribution network. Empowered by information aggregated from real-time and historical data analytics, and displayed, geographically, on an easy to use interface, IMQS users can make informed decisions about their current and future water management needs based on true business intelligence.

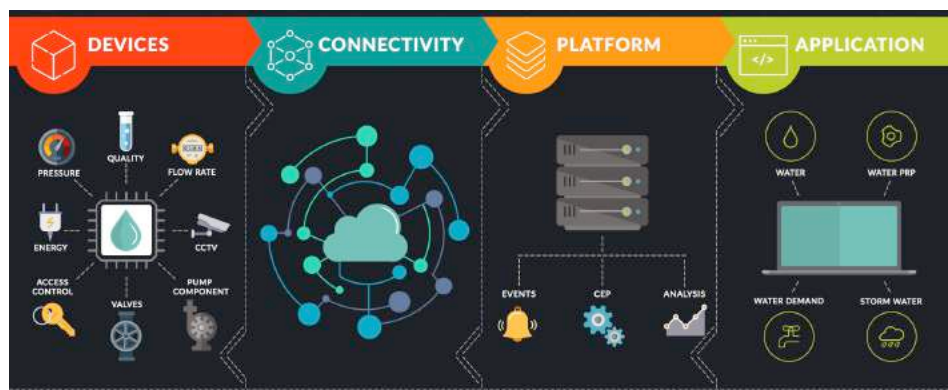


IMQS'S SMART WATER SOLUTION

A Smart City uses digital technologies to enhance performance and wellbeing, to reduce costs and resource consumption, and to engage more effectively and actively with its citizens. Smart Cities are those that have overcome the limited nature of their infrastructure.

Another key term is resilience. By harnessing smart technologies, Smart Cities can become resilient to population growth, climate change and man-made disasters, among other things. Moreover, in order to engineer social upliftment in complex development-centred contexts, systematic, holistic and integrated approaches to the maintenance and management of public assets are imperative.

A smart water network is an integrated set of products, solutions, and systems that enables municipalities and utilities to continuously and remotely monitor and diagnose problems in their water distribution network. Implementing a smart water network can increase visibility and flag risks early enough to take effective action.



Sensors are placed at various points along the network. They provide (near) real-time information to operate and optimise the network. The use of sensors can strongly increase the ability of utilities to proactively detect anomalies and risks. Moreover, intelligence emanating from captured data can help them make informed decisions regarding the management and maintenance of all assets within their water distribution network, especially the quality of water.



Sensors can measure physical properties like:

- Usage
- Flow
- Pressure
- Temperature
- Conductivity
- Water quality

Data can be streamed from the individual sensors through an industry standard protocol to a time series database where it is stored, extracted and analysed. Aggregated information can then be presented geospatially in order to derive value from it.

WATER NETWORK ANALYSIS AND REPORTING

Water Network Analysis involves enabling the reporting of hydraulic analysis results through the IMQS Web portal, which consists of:

- Spatial analysis tools
- Data query facility
- Standard reports
- Collaboration tools
- GIS layout view

The IMQS solution focuses on both real-time data monitoring and reporting services:

- **Real-time data monitoring:** involves enabling monitoring measurements from smart monitoring devices.
- **Reporting services:** encompass a centralised reporting service to create and publish relevant tabular and graphical reports, necessary to easily monitor KPI's.

Data streams in real time from sensors to a centralised data historian, which is backed by a time-series database. On top is a web-based, GIS oriented presentation layer, based on the IMQS platform. It integrates real-time, network and customer data, as well as data from other sources. The collected sensor and alarm data are shown by IMQS in real time. The time-series data is furthermore stored, aggregated and analysed by the data historian. Analytical data is then retrieved and presented by IMQS in a graphical format.

Stellenbosch Local Municipality is the latest client to implement a near-live view on their telemetry data in IMQS, as well as a view on other logger data, like MyCity and Zednet.



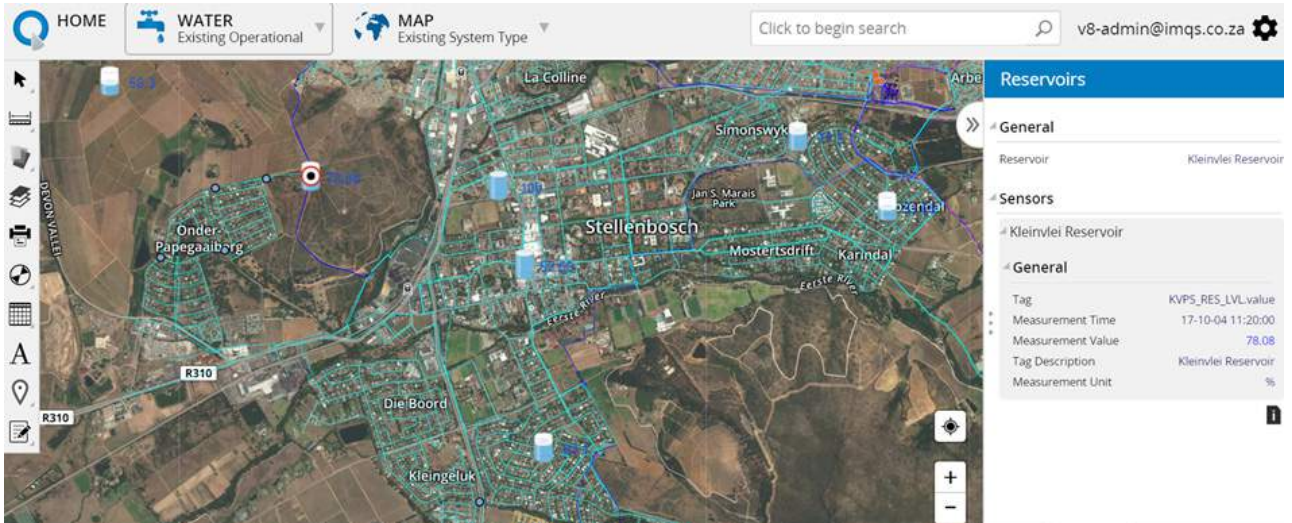


Figure 1: Reservoir telemetry data

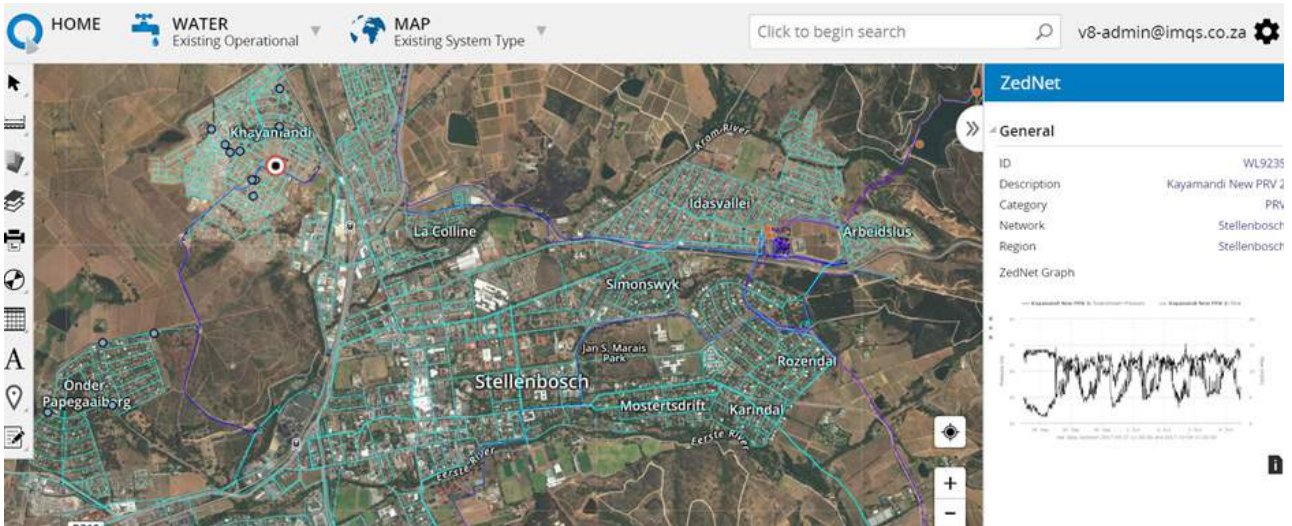


Figure 2: Integration with Zednet or other data logger systems

IMQS presentation layer presents network and sensor information in a geospatial context, for example the location of sensors in DMA zones:

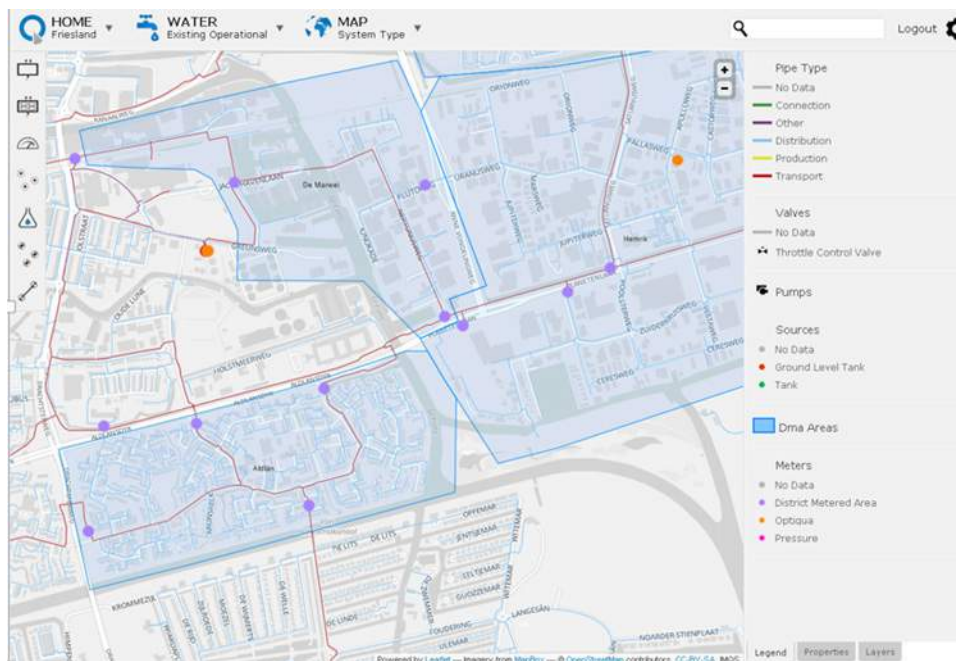


Figure 3: DMAs in selected zones (blue areas) and sensor locations (purple dots)

Users have immediate access to current values and historic trends of the sensor data as exemplified in Figure 4 below:

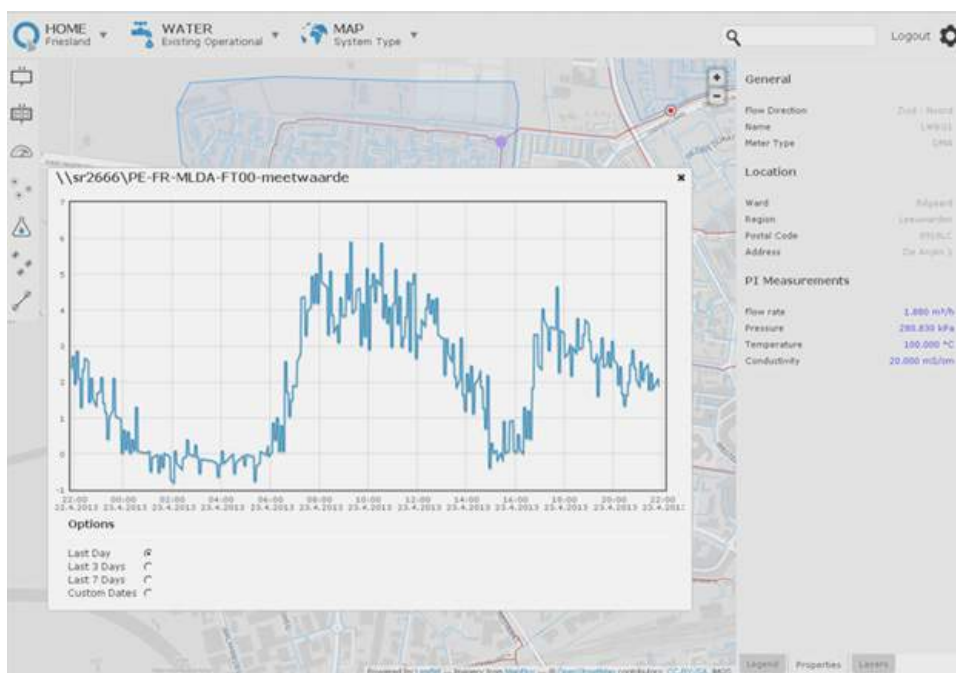


Figure 4: Historic trends of a selected sensor measurement

According to feedback, the user interface is both responsive (quick to navigate and display data) and easy to use (avoiding deeply nested menu structures). This is especially important for users such as operators.

Not only does the geospatial presentation provide an intuitive way to access the information at various aggregation levels (e.g. zooming in from region, via city all the way to street level), it also offers the opportunity for novel information tools.

A good example is the Flow Map depicted in Figure 5 below. The Flow Map displays flow arrows proportionate to the actual flow measured at sensor locations. The flow map can be used as a tool to quickly identify the possible location area of large breaks ('follow the flow').

The time slider at the bottom can be used to go back in time, which is useful in a post-event analysis or comparing night/day patterns.

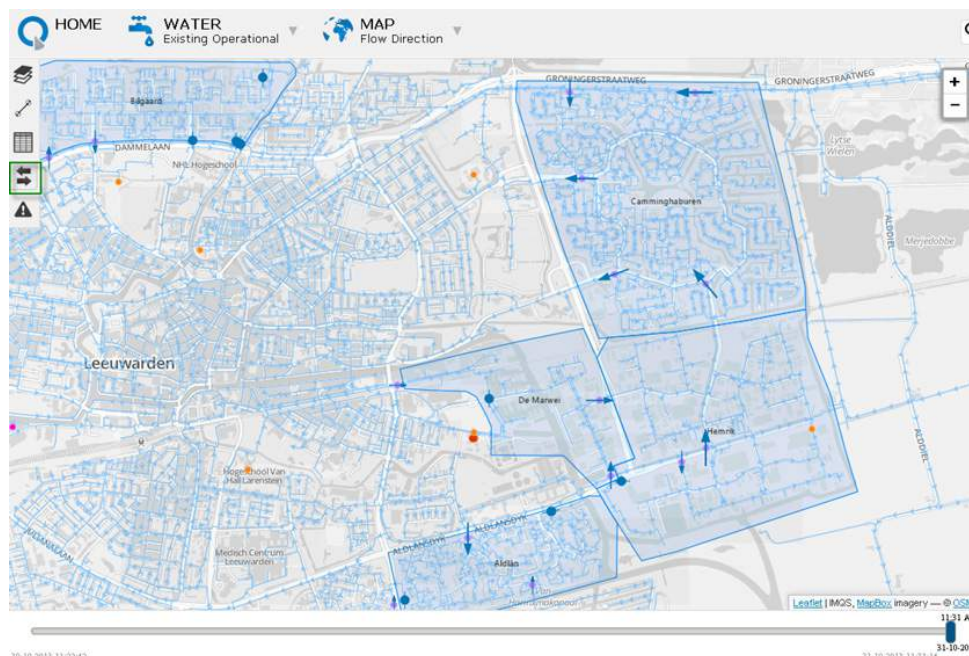


Figure 5: Flow map with time slider

Apart from showing raw measurement values (e.g. temperature value in degree Celsius), the presentation also includes categorization (e.g. too low, low, normal, high, too high) and warning levels (normal, warning, alarm).

Warning and alarm events are pushed immediately from IMQS to the user's browser, as depicted in Figure 6 below, where a map of events is provided:

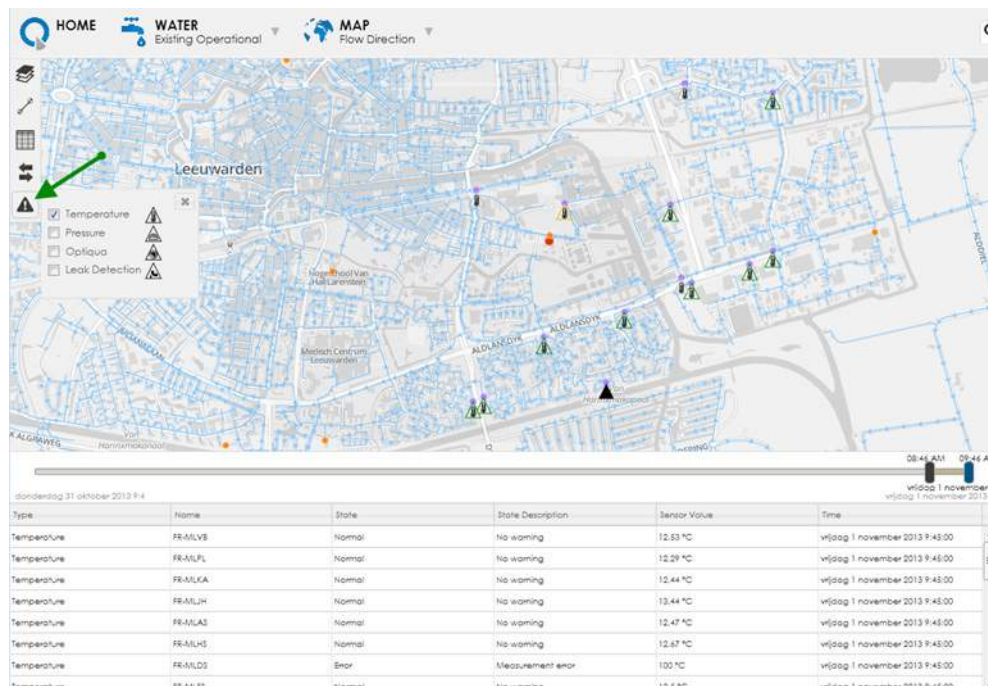


Figure 6: Notification for Water Quality, Pressure, Leak detection and Temperature events

When read together, Figure 7 and 8 below offer a more concrete example of how real-time data presentation facilitates rapid maintenance activities.

In the case of a pipe burst in Figure 7, IMQS was made aware of a problem by observing a drop in pressure along with a spike in flow. The resulting speed in reaction time minimized downtime and thus achieved better customer service for the utilities company.

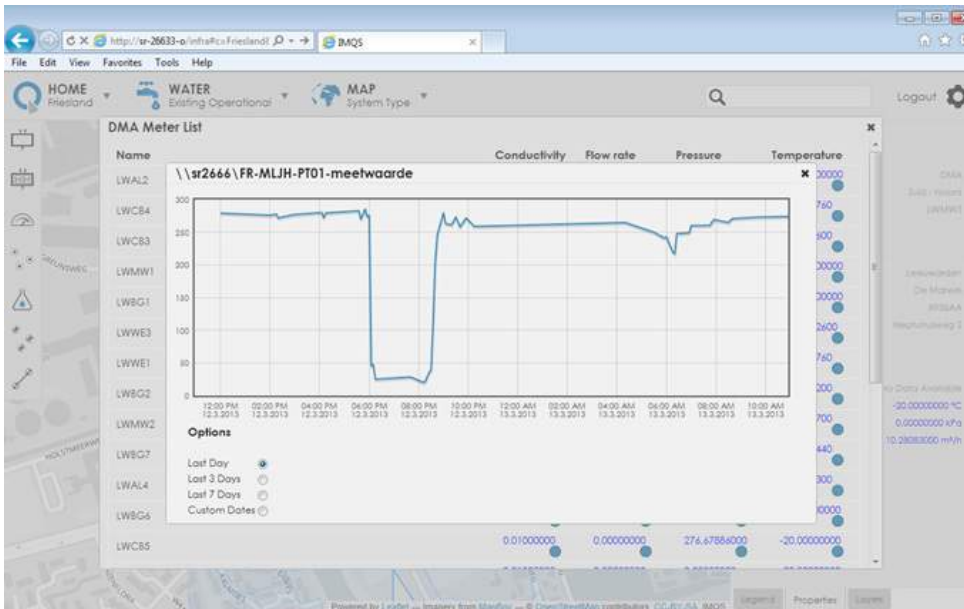


Figure 7: IMQS picks up a drop in water pressure



Figure 8: IMQS picks up a spike in flow

RESULTS ACHIEVED

- A wide variety of sensors were integrated with IMQS.
- Sensor data is centrally collected and stored through IMQS.
- A web-based, GIS oriented presentation layer provides a single, integrated and user-friendly interface dealing with multiple data sources.
- The geospatial presentation and access to information offers new means to interpret and act on real-time data, e.g. the localisation of pipe breaks.
- Presenting the outcomes of various activities and themes to the senior management and other stakeholders has been made easier.

BENEFITS OF SMART DATA MANAGEMENT

- With the help of smart information hardware and software, data can be captured from various sources and stored in a central database for analytics.
- Integrated smart water management solutions enable municipalities to appreciate the value of their data.
- Valuable information increases the speed and scope of decision-making.
- Mapping information through GIS software adds extra value as information can be presented spatially and over time.
- Overlaying multiple data layers, and presenting it in an easy-to-interpret fashion, provide users with the appropriate level of context to make holistic decisions.
- A reliable water quality information system enables utilities to develop a better understanding of water quality conditions in the distribution network.
- Valuable information can inform decision-making and facilitate preventative maintenance.
Smart water Solutions contribute to cities becoming more resilient and thus smarter over time.



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