THOUGHT PIECE

A Blueprint For a Smart Network

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This thoughtpiece offers guidance to directors and senior managers who want to achieve a step change in network performance - reduced leakage, improved customer satisfaction, and a more resilient network - without increasing costs and whilst maintaining or improving quality, pressure and environmental performance.

THE i2O LAYERS

The SWAN layers, as we have argued elsewhere[1], are out of date, and in some cases misleading people. We have previously proposed adding Business Objectives and People & Processes as new layers so that change is not assumed only to be the introduction of new technology, but is used by people in processes that are aimed at delivering a desired outcome.

We now additionally propose:

- Conflating the data layers, resisting the proposal to add yet another one for AI, and expanding them to include all software - because the real thrust is to apply software to problems that people cannot efficiently and effectively address on their own
- Subsuming the Collection and Communication layer into the Sensing and Control layer - given that all data from and to sensing and control devices requires communication

We offer you the i2O layers:

This gives us a much more balanced set of areas on which to concentrate when considering a blueprint for a smart network.

The core network-related business processes have operated historically in an analogue world - men in vans with simple tools for the most part. This involved primarily layers 1 and 4. This was necessary before the digital revolution but is very inefficient. It is labour-intensive, reactive and effort is poorly prioritised.

Making some broad generalisations, one can say this about each of the core network-related business processes in an analogue world:

Respond to events	Reactive: relies on customer calls to become aware
Find/fix leaks	Inefficient: prioritisation is difficult not least because leakage calculations are based on estimates, and leaks are difficult to find, so basis is rolling round by area
Rehabilitate/replace pipe	Inefficient: relies on imperfect intrusive condition assessment, so basis is age or on failure
Maintain assets	Inefficient: asset condition unknown so basis is time and/or risk or on failure
Optimise network performance	Inefficient: not easy to prioritise efforts, so basis is area by area, perceived area of need, or new schemes only

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A BLUEPRINT FOR A SMART NETWORK

In all cases, there are opportunities to improve performance. We therefore offer this blueprint for the smart network:

<table>
<tr><td>Business objectives</td><td colspan="6">Deliver water, equitably to customers, meeting targets for quality, pressure, outage, leakage cost, environmental impact, and price</td></tr>
<tr><td rowspan="2">People and process</td><td>Respond to events</td><td>Maintain assets</td><td>Find/fix leaks</td><td>Rehabilitate/ replace pipe</td><td>Extend network</td><td>Optimise network performance</td></tr>
<tr><td>Early detection team</td><td colspan="4">Maintenance/leakage/repair teams</td><td>Design and optimisation team</td></tr>
<tr><td rowspan="5">Software</td><td colspan="6">Project Evaluation</td></tr>
<tr><td colspan="2">Incident Management</td><td colspan="2">Valve Operations</td><td>Work and Asset Management</td><td>Network Modelling</td></tr>
<tr><td colspan="6">Network Performance Reporting
Quality, Pressure, Outages, Leakage, Cost, Environmental Compliance</td></tr>
<tr><td colspan="6">Network Monitoring and Analytics
Event detection; Asset condition assessment; Leakage detection and localisation; Pipe condition risk assessment; Network improvement opportunity identification including transient detection</td></tr>
<tr><td colspan="3">Asset geolocation (GIS)</td><td colspan="3">Data store</td></tr>
<tr><td rowspan="2">Sensing and control</td><td colspan="6">Flow meters, Pressure and flow loggers, Water quality sensors</td></tr>
<tr><td colspan="6">Actuators, Controllers</td></tr>
<tr><td>Physical layer</td><td colspan="6">Pipes, valves, pumps, PRVs</td></tr>
</table>

It illustrates the two key layers of technology which are required on top of the physical infrastructure: sensing and control, and software. It suggests a detailed shopping list for both of those. It offers a team structure, aligned with core business processes, which can use new and existing technology to deliver desired business outcomes.

The last decade has seen steps in this direction:

- Sensors are being more widely deployed; but not yet at the network-wide density (10 per DMA) that is required
- Networks have been sectorised; but not always across entire networks, they are permanently closed when they would benefit from being open at some times of the day, and pressure management is basic (PRV) rather than advanced (fully remotely controlled and automatically optimised)
- Point analytics solutions have emerged, but these need to be integrated to provide a layered network-wide perspective, and to deliver prioritised insights that are easy to action

The direction of change is correct, but this change now needs to accelerate significantly if business, regulatory, and political objectives are to be achieved in the face of enormous challenges created by population growth, more extreme weather, an ageing network, and more demanding customers.

To this end, i2O currently offers its clients:

- dNet for low cost pressure/flow instrumentation
- iNet for network monitoring and analytics of all network-relevant data creating actionable insight for all core network processes
- oNet for remote control and automatic optimisation of pressure across the entire network
- eNet for managing events swiftly and effectively to resolution, and learning lessons from them

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