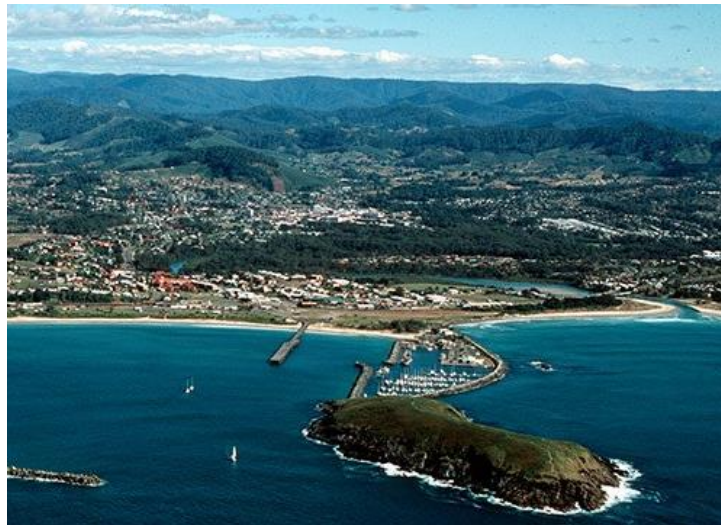


Cost Effectiveness and Scalability of an IoT based AMR System for Water Management Benefits

**(employing a unique approach made possible
by the advent of IoT)**



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1 EXECUTIVE SUMMARY

Traditional Automatic Water Meter Reading (AMR) and smart water metering technologies are capital and operating cost intensive. It makes it challenging for many water utilities to demonstrate a clear business case for it.

This paper outlines an innovative automatic meter reading and smart metering solution. It leverages new IoT communications infrastructure like Sigfox, LoRa WAN and NB-IoT to create system wide benefits within a water network and its management at a previously unattainable price point.

The key aspect that sets this approach apart is this: Instead of monitoring every single water meter, only a statistically significant number of meters within the water supply network are monitored. This reduces costs dramatically to 20% whilst still capturing over 80% of the benefits.

IoT allows to do this. It can cost effectively collect data from metering points thinly spread across the network. It no longer needs the economies of scale that all viable AMR systems to date have had to rely on: A large number of meters (AMR points) within a dedicated receiver station.

With this approach only 10-15% of carefully chosen representative sub-samples will be monitored, e.g. free standing houses with families, semis with retirees, apartments etc. This allows the network operator to obtain most of the benefits of traditional AMR/smart metering with significantly reduced capital and operational costs. Good old statistics can do the rest freeing up valuable cash flow and capital budgets, whilst still obtaining most AMR benefits.

The major benefits of rolling out such a low-power based wide area network (LP WAN) AMR system are to proof the use case and clearly quantify its costs and benefits such as:

- automatic meter reading instead of manual
- better, more efficient management of the water network
- decreased non-revenue water (including leakage and water theft)
- better asset management and utilisation
- improved demand forecasting
- increased meter reading efficiency
- better customer relations / less complaints

2 INTRODUCTION

Communities and utility service providers are attempting to move towards a smart city ideal. The proliferation of smart devices and utility automation efforts coupled with the expanded use of data analytics is transforming the development and delivery of key infrastructure services. These advances are reshaping the customer-utility relationship and making service providers more responsive, efficient, and resilient.

As utility operators seek to stretch limited capital budgets, maximise return on investment, and improve the customer experience, any discussion of how to achieve these goals and build smart utilities or smart cities will eventually focus on data. Specifically, the spotlight is on the use of data analytics to extract actionable system knowledge that will reduce costs and better position leadership to improve the organisation's performance.

3 THE PROBLEM

Traditionally, smart metering and automatic meter reading (AMR) devices have been cost prohibitive to implement utility-wide, as they involved high capital and ongoing data costs. Without access to accurate data on consumption profiles and network activities, it is difficult for utilities to effectively optimise their operational, maintenance, and capital activities.

3.1 Objective

The collection of smart water data aids water utilities in essential decision-making processes that make the system more effective and efficient. The collection of reliable and accurate data can be used for, and are not limited to, the following applications:

- Decreases in operational cost directly due to decreased man power required to perform meter readings and indirectly through better asset maintenance programs
- Undertake average demand forecasting, peak demand forecasting to inform capital expenditure decisions, and to optimise maintenance strategies
- Decrease non-revenue water (NRW) by implementing water loss management strategy
- Increase streamlined handling of customer complaints due to access to accurate, real-time data
- Increase meter reading accuracy and efficiency through the elimination of manual meter reads
- Streamline the operator's billing system through the provision of accurate, timely data

4 PROPOSED SOLUTION

With the development of emerging Internet of Things (IoT) technologies cost effective data collection is more accessible than ever.

In addition to the technological advances, WaterGroup propose an innovative deployment solution that will further decrease the capital and operational costs of implementing a network-wide smart metering solution.

The traditional methodology to implement a network-wide smart metering solution has revolved around the idea that all water billing meters within the system are required to be data logged. WaterGroup submits that only a statistically significant number of

meters needs to be logged to accurately model the consumption and behaviour of water flow within the network.

Installing and monitoring data loggers on a carefully selected but statistically significant proportion of meters (~10% of the whole) will reduce capital and operating costs significantly, whilst delivering almost the same amount of benefit to water utilities. Statistical significance is a mathematical concept where enough samples are taken of the whole ("population"), such that the results from the samples are representative for the behaviour of the overall population.

The statistically significant data collected from the water meters can be extrapolated to derive information for the whole of the network to create the benefits described above.

The implementation of the smart metering network is extremely flexible due to:

- Existing or utilising IoT communication infrastructure
- Economic data collection at a previously unseen price point
- No geographic limits – covers the whole network area
- Integrated into existing data infrastructure
- Data loggers can be rolled out in stages in accordance to any budget, whilst still delivering statistically relevant data

Table 1: Upload Frequency Required for Smart Metering Benefits

Benefits	Upload Frequency	
	15 min	24 hours
Decrease NRW		✓
Average Demand Forecasting		✓
Peak Demand Forecasting	✓	
Customer Complaint Handling		✓
Decrease Operating Costs		✓
Improve Billing System		✓
Leak Alarm		✓

An early rollout forms Stage 1 of an eventual whole of network coverage. This could be rolled out in several phase until it monitors all of the water network. This will enable increased data collection to further improve understanding of network behaviour. Eventually will also eliminate the need for manual meter readings.

A fictitious and illustrative example of a roll out strategy for the water supply network is shown below.

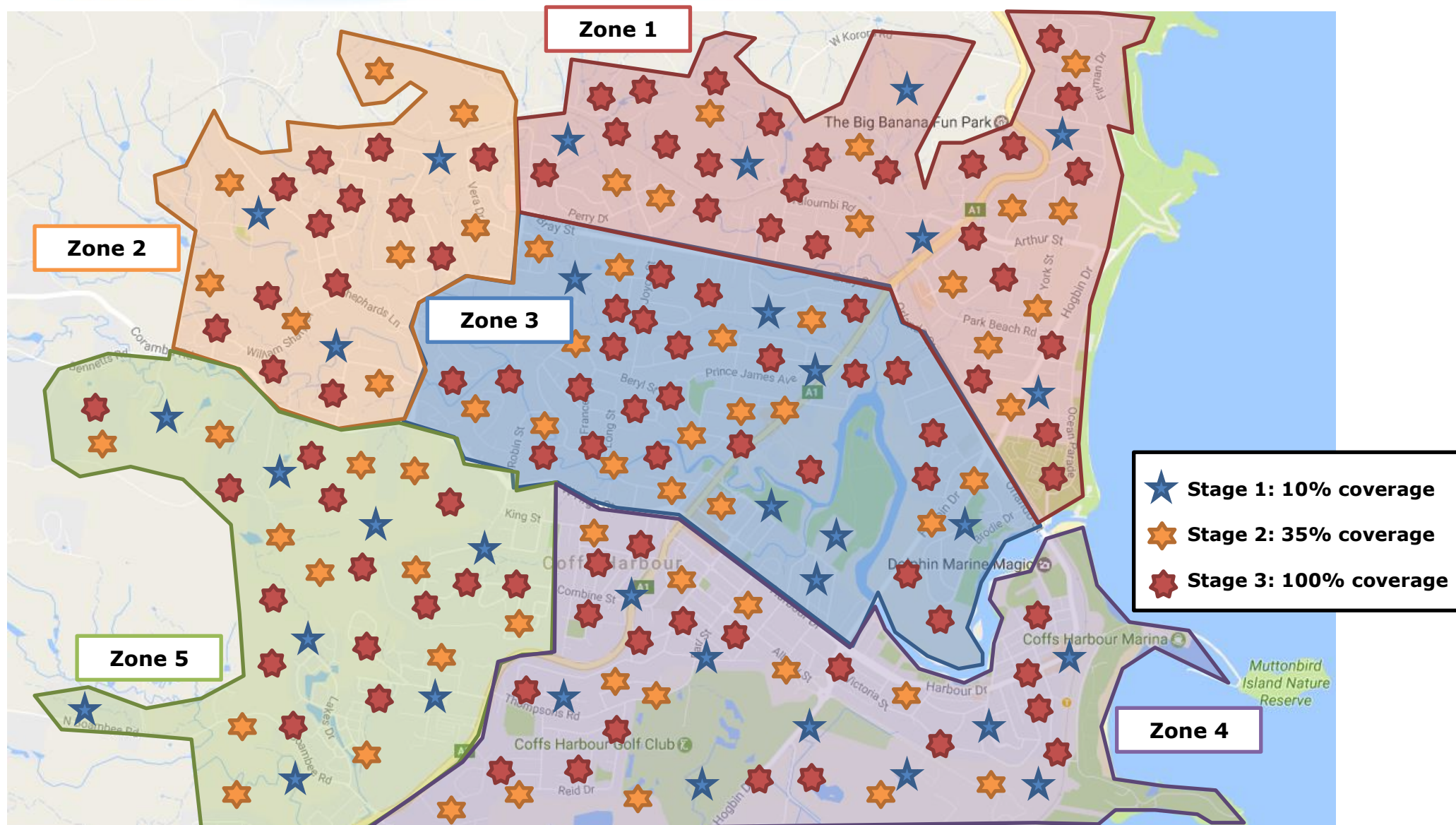


Figure 1: Example of a possible roll out of the proposed smart metering system (illustrative only)