water e-journal
Online Journal of the Australian Water Association
ISSN 2206-1991
Volume 6 No 2 2021
https://doi.org/10.21139/wej.2021.013

Digital Reference Framework Clarifies Communication in Water Sector

The Digital Reference Framework allows for a less jargonistic discussion about technology needs and how they can deliver against the organisational needs

N Nguyen, P Siemers, G Ryan, S Harrington

INTRODUCTION

This document describes a Digital Reference Framework (DRF) that has been jointly developed by the Water Services Association of Australia (WSAA) and the Internet of Things Alliance Australia (IoTAA) for the water sector in Australia.

The DRF is an extension of an existing framework developed by the IoTAA, the Internet of Things (IoT) Reference Framework, and is intended for broader applications across all digital solutions and architectures, beyond IoT applications

The DRF can be applied across all aspects of Information Technology (IT) and Operational Technology (OT), with the concept that these often divisive and sometimes confusing terms are avoided, focusing the conversation on the key aspects of the technology that need to be considered. Allowing for a clearer, less jargonistic discussion about technology needs and how they can deliver against the organisational needs, facilitating conversations within the organisation and with external vendors and customers.

WHY A DIGITAL REFERENCE FRAMEWORK FOR THE WATER SECTOR?

Water utilities across Australia are adopting digital technologies and innovative solutions to drive transformation across many areas of their operations. Examples include: digital metering; sensor networks for water leakage detection and asset condition monitoring; workforce automation; Virtual Reality (VR)/Augmented Reality (AR) for training and operation support; and drones and robots for asset inspection and maintenance.

Digital solutions such as those above are complex and often involve a diverse ecosystem of multiple stakeholders and enabling technologies such as Artificial Intelligence (AI), Machine Learning (ML), IoT platforms, analytics, digital connectivity, sensors and actuators, edge computing, and field devices such as IoT endpoints. A critical aspect of these solutions is the large volume of data that are collected, processed, stored, analysed and shared for business consumption.

Water utilities usually work with vendors and service providers to procure and/or develop solutions to solve specific problems, and often rely on technology vendors to learn about the latest technologies and solutions.

There are many challenges with adopting new technologies and solutions. One of the biggest challenges is the lack of a standardised, water industry-specific reference framework, which makes communications and understanding of different solutions confusing.

A Digital Reference Framework is a simplified representation of the key components of a digital system (Figure 1). It was developed to address the issue that to date there has not been a common approach to digital and IoT solutions in the water sector which:

- Uses clear, simple, understandable words with no jargon or ambiguous terms
- Uses water industry relevant terms
- Enables clear and unambiguous communication between vendors and utilities
- Provides a repeatable method for different utilities and business units
- Enables utilities to scale a solution quickly
- Helps in the selection of standardized solutions

The current DRF was built using the IoTAA Reference Framework using input from water utilities that comprise WSAA's Digital Strategy and Architecture Community of Practice, making the DRF directly relevant to the water industry (Figure 1). In this context the IoTAA Reference Framework and DRF are very similar documents. Essentially the term DRF is used to distinguish the document developed for the water sector that covers IT, OT and IoT. Whereas the original IoTAA Reference Framework only covered IoT and was generic for all industry sectors. Both WSAA and the IoTAA are seeking case studies and ongoing input to further improve the DRF.

BENEFITS OF A DIGITAL REFERENCE FRAMEWORK

The Digital Reference Framework can be applied in many situations depending on the organisational need. One of the key benefits is to use the framework as an initial construct to facilitate discussion and decision making.

It has also been used to assist with describing digital journey maps demonstrating product value and key business touch points. A digital journey map is a diagram or visualisation of the process that the data and information developed from a sensor or piece of equipment goes through to accomplish its end goal.

Stakeholders in the water sector, both from suppliers and water utilities can benefit from using the Digital Reference Framework, as it

- enables/facilitates a common narrative/language for describing digital solution components
- shows clear integration points and interfaces
- provides context for solution architecture (a diagram that helps visualise how the different aspects of business, information and technology come together in a particular solution).
- enables like for like comparison of similar solutions
- facilitates communications amongst the water utilities as well as between water utilities and vendors
- can be used for describing Operational Technology and Internet of Things (IoT) solutions which can come in many forms and include (Supervisory Control and Data Acquisition (SCADA), Programable Logic Controller (PLC), Industrial Control Systems (ICS))
- serves as a high-level solution map showing solution building blocks, and as a basis for more detailed design
- can be a tool for describing a digital journey map, showing data and business touch points
- can be an effective tool for collaboration between IT and OT

In addition, it is possible to use the Digital Reference Framework as a decision support tool to view a solution through different lenses or views on how the business could prepare for and approach digital implementation. The different business lenses can be:

- business investment lifecycle and procurement
- digital infrastructure and supporting systems
- governance arrangements and accountability
- cyber security
- operations and maintenance
- data collection, stewardship, privacy, governance and sharing

DIGITAL REFERENCE FRAMEWORK – DESCRIPTION

The DRF (Figure 1) comprises of some eleven layers. Testing of the DRF by water utilities and suppliers indicates these layers provide a consistent and robust approach to simplifying the digital relationships and requirements. If we build it from the bottom up (following Figure 1, noting that

the list of items to the right of the figure are examples only, they are not intended to be an exhaustive list):

- The base layer is the asset in its broadest sense – noting that this can include infrastructure, personnel or other types of assets which are typically non-digital in nature (Layer 0).
- This asset is then either monitored via sensors) or controlled via actuators in some manner (Layer 1).
- The information or data related to this monitoring or control then needs to be collected via local aggregation (Layer 2).
- Once the data is aggregated it then needs to be communicated to the organisation. The first stage of this communication is through broadcasting or connectivity (Layer 3)
- These broadcasts then need to be managed, to ensure quality of data, connectivity and engagement with the business rules engine to trigger actions based on the type of data received from the device e.g., alarms, event types (Layer 4).
- The data then needs to be verified, cleansed and analysed (Layer 5)
- Data can then be turned into useful information. It needs to be prepared for integration with enterprise systems (Layer 6b), and then processed through these enterprise-wide systems (Layer 6a).
- Once in the enterprise systems, data needs to be funnelled to users. Initially through channels, portals, and other notification systems to flag that data is ready (Layer 7b). then to move the data to the user device in an easy to view format (Layer 7a).
- Now the users become directly involved in viewing and using the presented information (Layer 8).
- There is then the option to share outcomes and information with key stakeholders outside the organisation (Layer 9).
- At the highest level there is commonality in approach such that each solution is applicable/ usable at the industry or sector level (Layer 10).

This simplification is generic enough to be applicable to all digital systems, whilst also providing a clear plan on a page that outlines each component of the system that is touched by a monitoring or control system. It is of particular benefit in understanding the key engagement and integration points within an organisation that need to be involved in decision making.

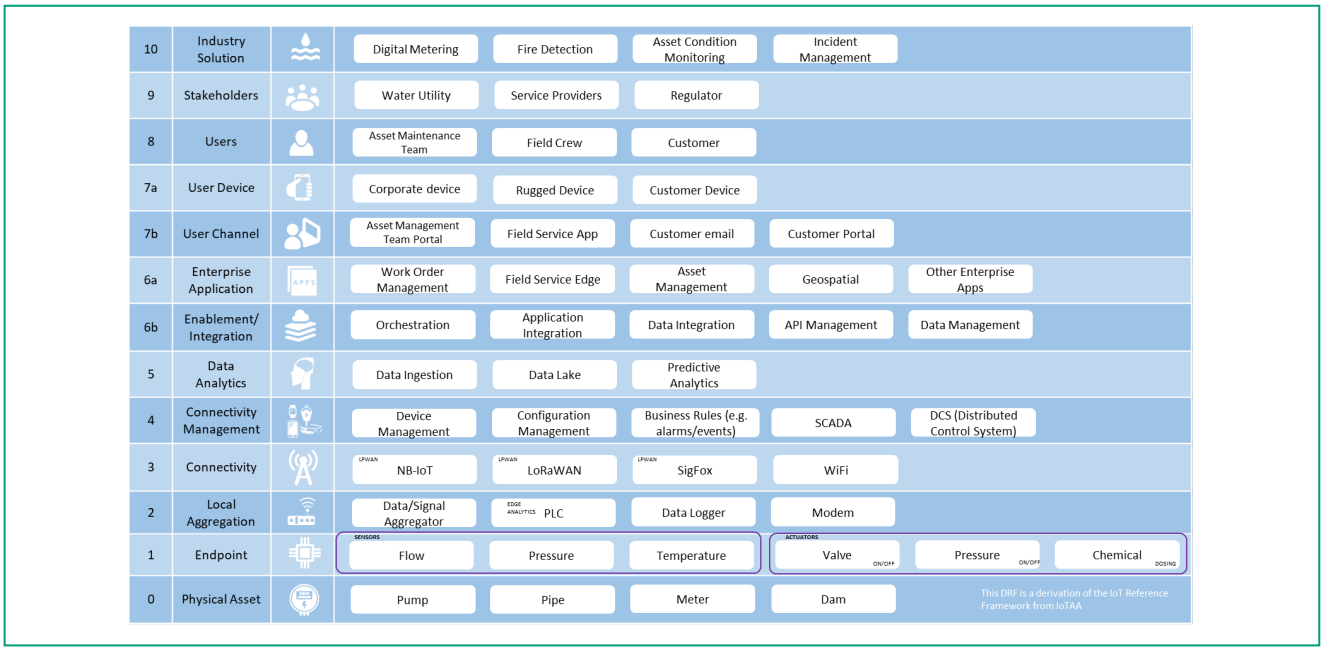


Figure 1: Water Sector Digital Reference Framework

Key to abbreviations: NB-IoT - Narrow Band IoT, LoRaWAN - a global standard for Low Power Wide Area IoT networks, WiFi - a wireless networking technology that allows computers and other devices to communicate over a wireless signal, API – Application Programming Interface, a set of rules that explain how computers or applications communicate with one another.

DIGITAL JOURNEY MAPS

These are maps that highlight the key touchpoints (internal and external) for a water business in implementing any digital solution.

Digital journey maps are a diagrammatic 'plan on a page' representation of how the product and the data associated with its use appear to different parts of the business that are associated with it. Almost any item or process can be represented as a digital journey map.

The building of a digital journey map is done as follows:

1. Start with the sensor or device being installed. Describe what is intended to be monitored and the outcome of that monitoring.
2. Then move up through the layers of the Digital Reference Framework to describe the analysis performed and outcome.
3. Then look to the users and what do they do with that information – are there any communications external to the digital ecosystem that occur, describe them.
4. How is the information processed into work orders, schedules etc.
5. What is the interaction with customers and other stakeholders?
6. What is the link to any field or business responses, follow up actions etc.
7. How is the response to the initial data tracked and closed out, who is notified, and how does that notification occur?

An example digital journey map is attached (provided curtesy of Urban Utilities - Figure 2). Figure 3 indicates shows how this journey maps against the DRF.

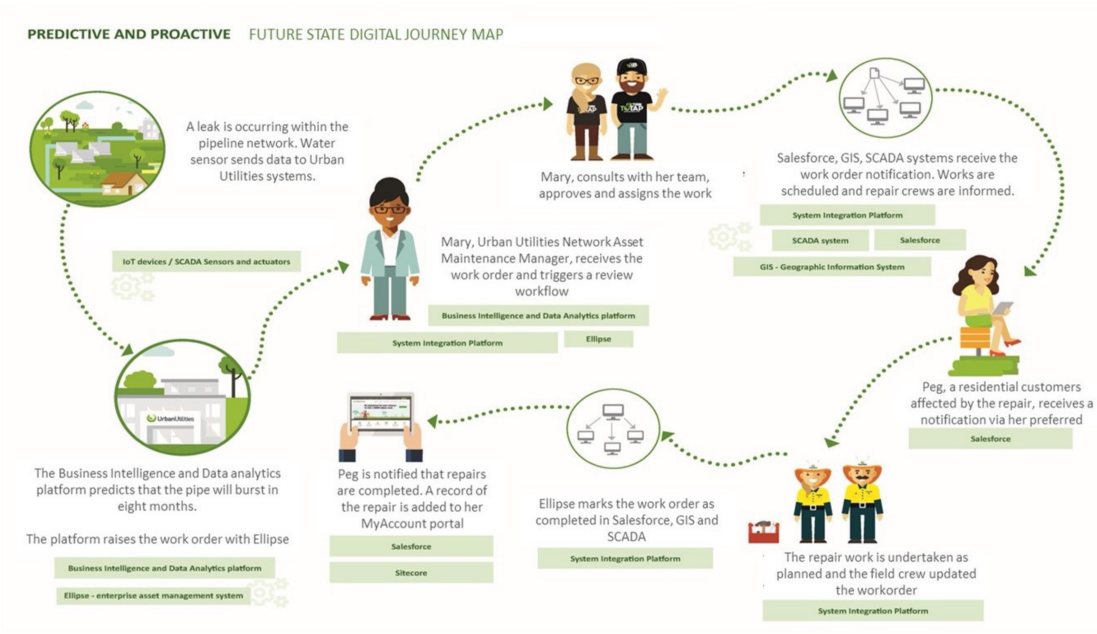
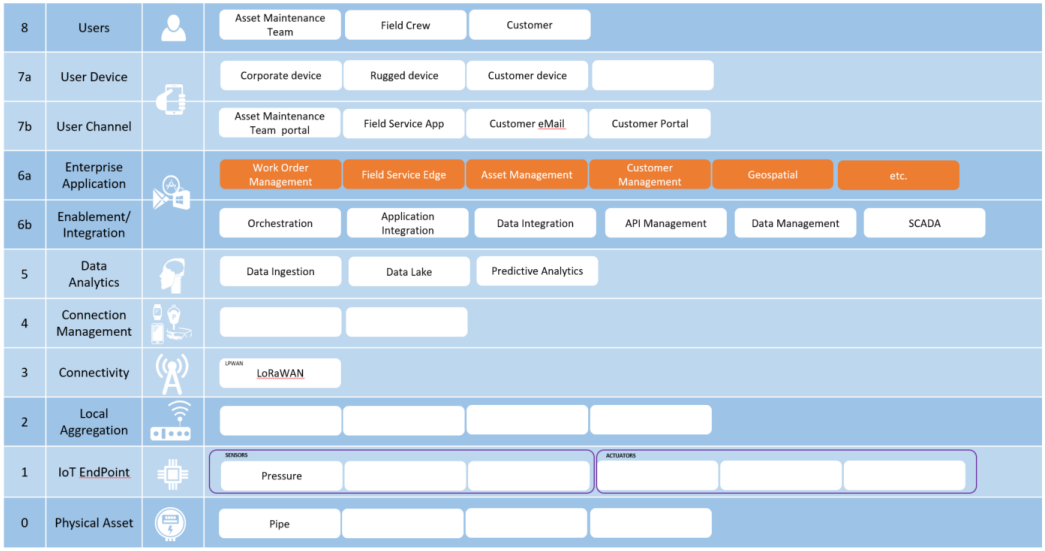


Figure 2: Example digital journey map for a leak detection sensor (Figure curtesy of Urban Utilities)



Example 3: Mapping the digital journey back to the DRF (Figure curtesy of Urban Utilities)

NEXT STEPS

Version 1.0 of the DRF has been formally launched by WSAA and IoTAA, and water utility members have been encouraged to adopt it in their work in the manner that best suits their business. For example, to document their digital solution use cases, or to assist in the creation of future digital journey maps.

Vendors in the water sector are also encouraged to use it to facilitate solution discussions with water utilities.

It is expected that the DRF will be formally revised by members of WSAA's Digital Strategy and Architecture Community of Practice in mid-2021.

As the DRF continues to evolve, feedback for improvements can be forwarded to WSAA (greg.ryan@wsaa.asn.au) and/or IoTAA.

REFERENCES

Ref no.	Reference	Description
1	IoTAA IoT Reference Framework	The IoTAA IoT Reference Framework is simple, vendor-neutral and self-explanatory. It presents generic IoT building blocks that are common to all IoT solutions. A key intent of the framework is to serve as reference building blocks for IoT architectures and solutions. IoT Reference Framework – Overview IoT Reference Framework – Application Guide
2	Urban Utilities Water Digital Journey map	The Urban Utilities Future Digital Journey Map is an internally developed schematic that clearly shows the key user touch points that would form part of their DRF document.

THE AUTHORS

Nam Nguyen
Managing Principal, Infrya

Nam has over 28 years of global and local experience in the ICT industry, and currently working in IoT, Emerging Tech Strategy, Architecture and Solutions Development. Nam has worked across multiple sectors including Telecoms, Water and Energy Utilities, IoT technology and integration sectors.

Email: nam@infyra.net

Dr Paul Siemers
Manager Digital Strategy, Architecture & Innovation, Information Technology, Melbourne Water

Dr Paul Siemers is a strategic technology leader with over 25 years international experience in technology-driven business change. Paul leads digital strategy at Melbourne Water, and chairs the IoTAA Water Workstream and the WSAA Digital Strategy & Architecture Community of Practice. His PhD focused on the broader implications of IoT.

Email: paul.siemers@melbournewater.com.au

Simon Harrington
Enterprise Architect, Urban Utilities

Simon Harrington is an outcome-focused Digital leader. From the UK but now an Aussie, Simon has held various technical and senior leadership roles leading global teams to drive business growth and transformation, leveraging technology. Simon is now enabling Urban Utilities digital journey to transform its services, operations, and customer experience.

Email: Simon.harrington@urbanutilities.com.au

Dr Greg Ryan
Director Business Excellence, Water Services Association of Australia

Dr Greg Ryan is a senior leader and advisor who has deep expertise in the water industry. Passionate about driving industry-wide change through global collaboration and leading teams to achieve outcomes. A key focus is on driving digital innovation in the Australian and New Zealand water industry through effective partnerships.

Email: greg.ryan@wsaa.asn.au