Digital Reference Framework

Water Sector

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1 BACKGROUND

1.1 Why a Digital Reference Framework for the water sector

Like other industry sectors, water utilities across Australia has embraced the internet of things, IoT, albeit cautiously, as an enabler to drive innovation. Some of the most talked about IoT innovation is about digital metering, leakage detection, asset conditioning monitoring, efficiency monitoring of asset such as water pumps, to name a few.

Despite seeing an increase in IoT application uptake rate in the water utility sector, it has been found that IoT is still interpreted differently by different organisations, and even within the same water utility organisation. It is quite clear that the term IoT conveys different things to different people. In addition, IoT is viewed as non-secure, with IoT devices being unreliable and not enterprise-grade, to be used for monitoring purposes only. The reasons such views exist are largely historical.

To date there has not been a common approach to IoT for the water utility, one that:

- Uses clear, simple, understandable words with no jargon or ambiguous terms
- Uses Water industry terms
- Provides a repeatable method for different enterprises and industries
- Helps in the selection of standardized solutions

The Water Workstream within the IoT Alliance Australia and the Water Services Association of Australia are jointly proposing a Digital Reference Framework for the Water Sector.

This document describes a Digital Reference Framework, which built from the IoTAA IoT Reference Framework for the Water Sector.

The IoTAA IoT Reference Framework is a simple, vendor-neutral and self-explanatory, and presents generic IoT building blocks that are found common for all IoT solutions. A key intent of the framework is to serve as reference building blocks for IoT architectures and solutions.

In addition, we believe that this Digital Reference Framework has broader applicability beyond IoT. Providing a simplified framework that can be applied across all aspects of IT and 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.

In this new iteration of the Digital Reference Framework we also add in an additional layer, suggesting the use of customer journey maps could be a key addition to facilitate and enable clearer understanding of the context and intended use of digital solutions (refer Section 3).

1.2 Purpose of a Digital Reference Framework

The purpose of the digital reference framework for the water sector is to

- facilitate a common narrative
- enable sharing/collaboration
- serve as a basis for more detailed design
- provide context for solution architecture
- provide a common language for describing the elements of an IoT solution in the water utility

- provide inputs to business case development
- generate options analysis
- serves as a collaboration framework between IT and OT
- facilitate like for like comparison of IoT solutions
- facilitate communications amongst the water utilities as well as between water utilities and vendors

1.3 Intended Audience

The following audiences can benefit from understanding this Digital Reference Framework.

- Business Leaders Digital, Executive Management
- Enterprise Architect
- Vendor
- OT Team
- IT Team
- IoT Team
- Industry Forums (WSAA, IWA, IoTAA)
- Other Industries

2 DIGITAL REFERENCE FRAMEWORK

2.1 Framework Description

Figure 1 (overleaf) illustrates the Digital Reference Framework, an adaptation of the IoT Reference Framework for the water sector. Note that this latest version includes a layer name change as well as adding a layer 0, which refers to the physical things that IoT endpoints are attached to.

10	Industry Solution	Digital Metering	Fire Detection	Asset Condition Monitoring	Incident Management		
9	Stakeholders	Water Utility	Service Providers	Regulator			
8	Users	Asset Maintenance Team	Field Crew	Customer			
7a	User Device	Corporate device	Rugged Device	Customer Device			
7b	User Channel	Asset Management Team Portal	Field Service App	Customer email	Customer Portal		
6a	Enterprise Application	Work Order Management	Field Service Edge	Asset Management	Geospatial	Other Enterprise Apps	
6b	Enablement/ Integration	Orchestration	Application Integration	Data Integration	API Management	Data Management	
5	Data Analytics	Data Ingestion	Data Lake	Predictive Analytics			
4	Connectivity Management	Device Management	Configuration Management	Business Rules (e.g. alarms/events)	SCADA	DCS (Distributed Control System)	
3	Connectivity	LPWAN NB-IoT	LPWAN LoRaWAN	LPWAN SigFox	WiFi		
2	Local Aggregation	Data/Signal Aggregator	EDGE ANALYTICS PLC	Data Logger	Modem		
1	Endpoint	SENSORS Flow	Pressure	Temperature	ACTUATORS Valve ON/OFF	Pressure ON/OFF	Chemical DOSING
0	Physical Asset	Pump	Pipe	Meter	Dam		

Figure 1 – Water Sector Digital Reference Framework

2.2 Digital Reference Framework Layer Description

Layer	Function	Intention
10	**Industry Solution**	Water utility specific industry solutions. Examples include • Digital Metering • Asset Conditioning Monitoring • Incident Management • Fire Detection • Irrigation
9	**Stakeholders**	Highlights the relationship and collaboration between digital solution owner/operator and the stakeholders that provide services, or products to the solution. Relevant stakeholders in the water utility include • Water utility • Service providers • Regulator
8	**User**	Who are the users of digital solutions within a water utility? or who are the main beneficiaries of an IoT solution? An solution (e.g., IoT/OT/IT) or application can have multiple types of users, and each type of user can have a different usage or consuming requirements. Example of user of include: • Customer • Engineer • Architect • Operator of IoT solution
7a	**User Device**	Refers to the type of devices and access that user can interact with the solution. Examples of user interface include • Corporate device • Rugged device • Customer device
7b	**User Channel**	Indicates how customer and staff interact, through a number of channels: • Asset maintenance team portal • Field service App • Customer eMail • Customer portal
6a	**Enterprise Application**	Enterprise applications such as • Work order management • Field service edge • Asset management • Geospatial • Etc.,
6b	**Enablement / Integration**	A set of functions that enables access and interaction between users and applications, and data, such as • Orchestration • Application integration • Data Integration • API management • Data Management
5	**Data Analytics**	Data analytics capability as key function in this digital reference framework include:

		• Data ingestion, cleansing and analytics • Predictive Analytics • Data lake
4	**Connection Management**	Connection Management refers to functions that manage connections of devices, including business rules engine to trigger actions based on the type of date received from the device, such as alarm, event types, etc. Existing SCADA system and Distributed Control Systems (DCS) functions would fall under this category. The key architectural functions identified for this layer are: • Device management • Device configuration • Business rules engine (alarms/events) • SCADA • DCS
3	**Connectivity**	Refers to different connectivity technologies used for communications between field sensors/devices and core functions described in layers 4, 5 and 6 above. The main connectivity technologies identified for this digital reference framework are: • LoRaWAN • SigFox • NB-IoT/Cat-M1 • WiFi
2	**Local Aggregation**	As the name suggests, this layer represents a local aggregation function, a local control function such as a programmable logic control (of a SCADA or DCS system), some sort of a data logger, or simply a modem as a gateway. The key reference digital architectural functions are: • Data/signal aggregator • Data Logger • PLC • Modem
1	**Endpoint**	This layer refers to the sensing and actuating functions that an solution/application (IoT/SCADA/PPLC) may be designed to do, be it monitoring or controlling. In the water utility sector, the sensors are of the following types: • Flow • Pressure • Temperature And the actuators are of type: • Valve • Pressure • Chemical
0	**Physical Asset**	Layer 0 refers to the type of physical assets that the sensors and actuators are 'attached' to. The types of assets in the water utility have been identified as: • Pump • Pipe • Meter • Dam

3 Applying the Digital Reference Framework

The Digital Reference Framework can be applied in many ways depending on the organisational need. The key is to use the framework as an initial construct to facilitate discussion and decision making. To assist users the IoTAA and WSAA are developing a library of Use Case Studies as a starting point to demonstrate some of the ways the reference framework has been used by water businesses and suppliers. The following are some key examples from the Use Case Studies. These include: the use of Customer Journey Maps to clarify the context of the Reference Framework; and use of the Reference Framework in demonstrating product value and key business touch points.

In addition, it is possible to view the Digital Reference Framework through different lenses or views to provide a decision tool about how the business could approach digital implementation. This has been used successfully in at least one water business, who has used to Reference Framework to look at the following aspects of a digital deployment:

- digital infrastructure and supporting systems
- governance arrangements and accountability
- cyber security
- procurement
- operations and maintenance deployment.

We would welcome additional case studies using the Digital Reference Framework. These can be provided directly to greg.ryan@wsaa.asn.au or paul.siemers@iot.org.au.

3.1 Customer journey maps – providing context to the reference framework

Customer 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 customer journey map. The building of a customer 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 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, how does that notification occur.

An example customer journey map is attached, see Figure 2, along with how that journey maps against the Digital Reference Framework (Example kindly provided by Urban Utilities in Queensland)

3.2 Waternamics Use Case

IoT and/or other digital solutions can be mapped using the DRF. An analytics solution by Veolia, Waternamics, has been mapped using the DRF showing clearly what the solution is and where it interfaces with other systems and enterprise applications. Refer to Figure 3.

A customer journey can be mapped using the DRF

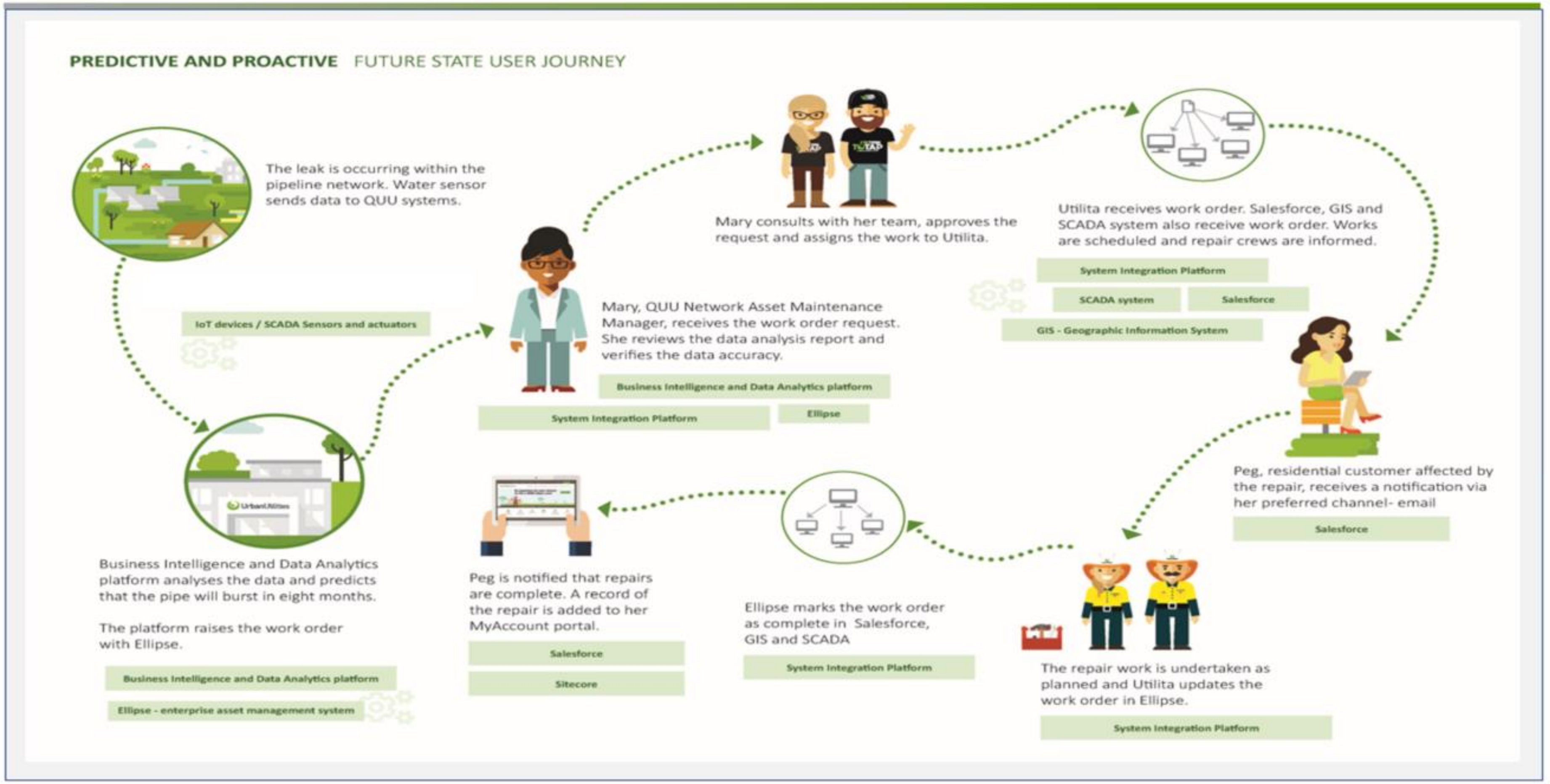

Figure 2 - Customer journey mapping by Urban Utilities

The DRF can be a good tool to map a solution, in this case a water analytics solution from Veolia, Waternamics.

10	Industry Solution	Work Order Dispatch (WOD)	Water Quality Analysis (WQA)	Customer Fault Diagnosis (CFD)		
9	Stakeholders	Veolia	Western Water			
8	Users	Operation Centre members	Work Order Dispatcher	Water Quality Advisor		
7	User Interface	Web Browser (computer)				
6	Application Enablement	Web-based I/F (Waternamics)	Google Maps API	Water Quality Dashboard		
5	Data Analytics	Data Analytics				
4	Connection Management	Data Integration Layer (E.T.L)	SFTP Server LANDING ZONE	Data Warehouse	CROSSCOM	KAPTA
3	Connectivity	Wired (SCADA)	3G/4G (KAPTA & TurboTrack)	Orion Network (TRBOnet)		
2	Local Aggregation	KAPTA Data Logger				
1	EndPoint	SCADA sensors	KAPTA probes	TRBOnet (Crew & Vehicle)	TurboTrack (mobile equipment)	
0	Physical Asset	Water Network	Sewer Network	Recycled Water Network		

Figure 3 - Waternamics Use Case