SWAN Digital Twin H2O Workgroup Summary of the May 14th 2019 Workshop

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The first SWAN Digital Twin Workshop brought together key voices from around the world representing water utilities, academia, and technology vendors to help build consensus on the foundational definitions and guiding values needed to underpin digital twin concepts and architectural framework. There was a high level of enthusiasm and urgency on this important topic. Thank you to all of the participants for making this a successful launch to the workgroup! The links for the presentations and videos of the workshop can be found below.

Progressive Utilities Share

After hearing from several progressive utilities on their experiences utilizing or working towards digital twin technology, it is clear that digital twin technology is the future for all water utilities. Here are a few of the highlights from leading utility presenters at the workshop:

- *Town of Cary's* presentation, given by Sarah Braman, brought our attention to the business side and ROI of developing and calibrating a digital twin.
- Andy Smith of *Anglian Water Services* shared with us their vision and their digital twin roadmap, emphasizing the Gemini Principals.
- Torri Martin, of the *City of Atlanta*, discussed the critical role of useful-high-fidelity data to help drive utility decisions while creating a culture of change in order to become an innovative utility.
- *Clean Water Services* has been going through digital transformation for a while and continue to evolve their agile digital solutions co-created by collaborative teams as presented by Ting Lu.
- Director of *DC Water's* Elkin Hernandez shared lessons learned and what aspects of digital twin is hard, such as people and process, as compared some of the easier parts.
- Sri Kamojjala, from *Las Vegas Valley Water District, LVVWD* provided real outcomes and stats based on years of using digital twin technology in operations.
- Jera Layco, of *Maynilad Water* emphasized the critical role of cybersecurity and the importance IT and OT collaboration.

The Makeup of Digital Twin Technologies

A wide variety of digital technology vendors also participated, both as panelist and participants. There were companies representing sensors, data analytics, hydraulic modeling, data store, edge computing, and more with each technology having an important role in the development of a utility digital twin. First and foremost, was the role of near-real-time data from the sensors that produce the data (water quality, AMI meters, etc.) to robust data storage systems. Data infrastructure companies like *OSISoft*, and *IOSight* shared how they have helped utilities around the world breakdown the data silos and provide powerful insights.

Several presenters represented technology companies that provide hydraulic models and or AI analytics for their utility customers, including *Innovyze, DHI, GoAigua, EMAGIN, InCTRL Solutions, Xylem,* and *Veolia*. The important role of sensors and edge computing in digital twin was also presented by *KANDO*, and *Olea Edge*. Jacob's Consulting shared the important role they have with their clients on digital twin. Closing the loop on the water sector ecosystem, we heard from universities and national research organizations on the symbiotic role they play on the collaborative research side. *KWR Water* and *INRIA, French Research Institute for Digital*

Sciences and *NCSU* displayed research areas and results to further help utilities and vendors in the development of digital twin.

Debated Topics

Several discussions and debates took place over the course of the afternoon workshop. There was a debate on the periodicity of "near-real-time data," and what do we mean by that term. Towards the end of the workshop, we agreed that the frequency of data collection was very contextual and depended on what insights we were trying to collect, or what problem we were solving with the digital twin. Collectively, we will investigate this further through a **rich set of digital twin use cases**. Additionally, there were many discussions about the benefits and outcomes of the digital twin Towards the end of the workshop, we also agreed to collectively put together a **matrix of beneficial outcomes** of a digital twin. There was a healthy debate on whether the size of a utility may influence the business case, and if the ROI may not be there for smaller utilities. This idea was challenged, and we agreed as a community to dive deeper to get a better understanding of how to calculate the **ROI of digital twins**.

One heavily debated subject was on the role of a hydraulic model in developing a digital twin. Two schools of thoughts emerged on this topic. One school of thought had the hydraulic model as a core or backbone of the digital twin, while the other school felt that a utility could have a digital twin that does not necessarily involve a hydraulic model at its core, but rather creating a model from scratch based on the data being collected. Many panelists agreed that the digital twin may also include the biophysical and chemical models as well. This topic is an excellent area for the working group to develop a best practice around as we create a **high-level architecture** subgroup.

Digital Twin Definition

At the end of the workshop, we had a discussion on the **definition of "digital twin"** for water utilities that meets the majority of perspectives in the room. We decided to use portions of the definition given by *Anglian Water Services* and adding to it some phrasing regarding the data pairing. The temporary/working group definition is below:

"A Digital Twin can be defined as an integrated, accurate digital representation of our physical assets, systems, and treatments processes with near-real-time data pairing from the physical twin for continuous calibration. It will unlock value by enabling improved insights that support better decisions, leading to better outcomes in the physical world."

Next Steps

Moving forward, we agreed to establish three initial subgroups with clear objectives and goals. We welcome all of you to participate by volunteering to contribute to these subgroups. Colby, Michael, and I will help co-lead these subgroups, but are also looking for three volunteers to also help co-lead. Please write back to us (Colby, Michael, or I) if you are interested in contributing to any of these subgroups. Below are the initial subgroups:

1. **Holistic Digital Twin Technology Architecture** *(Led by Gigi Karmous-Edwards, Karmous-Edwards Consulting):*
    - What technology components and what approach is best practice for creating a useful, scalable, and high-performance digital twin? (includes hydraulic model debate.)

2. **Outcomes and Applications** *(Led by Colby Manwaring, CEO of Innovyze):*
    - What will you use it for? What are the highest priority and most common outcomes that guide digital twin adoption, creation, and usage?

3. **Case Studies & ROI Calculations** *(Led by Michael Kanellos, Head of Corp. Communications, OSIsoft):*
    - What has the experience been than can better inform #1 and #2; success stories and failure stories that demonstrate practical experiences with digital twins in the water industry business cases. How can the investment in people, technology and data be justified to support creation and usage of a digital twin?

We plan to hold around four conference calls a year for updates on the progress of each effort as well as two in person meetings a year in the form of a workshop. Again, on behalf of the co-chairs and SWAN organization, we want to thank all the participants for a successful start to this important work group.

- All presentations can be found on the SWAN website: https://www.swan-forum.com/digital-twin-h2o-workshop/
- Some of the videos of the presentations can be found here (Thank you to *Global Water Works*): http://bit.ly/SWANDT_Playlist