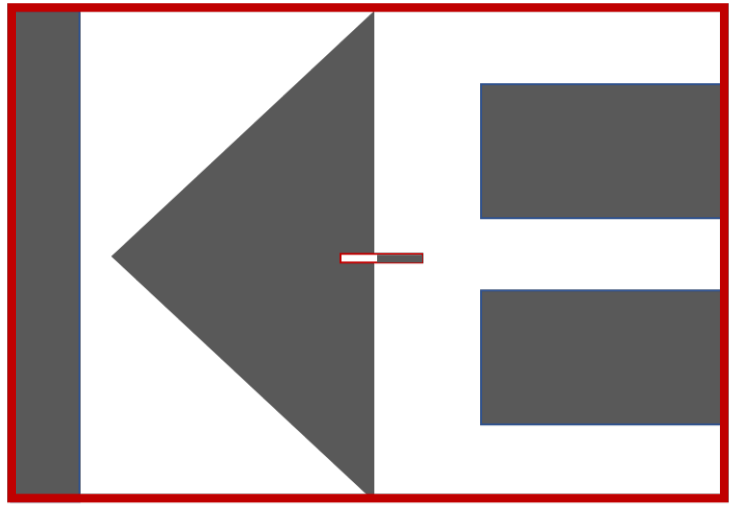


SWAN'S DIGITAL TWIN FOR H2O WORKSHOP

Gigi Karmous-Edwards

May 14th, 2019

WELCOME & INTRODUCTION

THANK YOU INNOVYZE FOR SPONSORING THIS WORKSHOP!

SWAN DIGITAL TWIN FOR H2O WORK GROUP

Gigi Karmous-Edwards

May 14th , 2019

AGENDA

- Introductions
- Digital Twin Definition
- Why is the time right for having this work group?
- SWAN Digital Twin for H2O Workgroup
- Today’s workshop

INTRODUCTIONS AND WELCOME

Thank you to Innovyze for sponsoring the workshop!

Colby Manwaring, Innovyze - Co-Chair

Michael Kanellos, OSIsoft - Co-Chair

Gigi Karmous-Edwards, Karmous-Edwards Consulting – Co-Chair

Digital Twin Definition

DEFINING DIGITAL TWIN

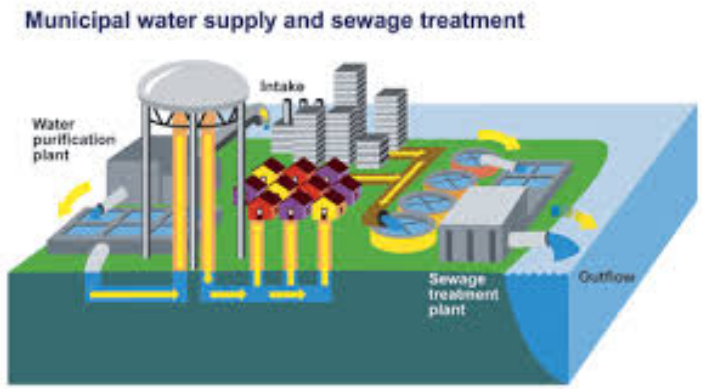
Digital Twin is a disruptive technology that provides a virtual/digital representation of both the elements and the dynamics of a plant or system.

A digital twin will influence the design, build and operation of the system throughout its life cycle (design-build-operate) and help optimize operation through informed insights.

In other words, it is a dynamic software model (hydraulic model + ML) of the physical plant/system.

REAL-TIME HYDRAULIC MODELING WITH REAL-TIME DATA FEEDS

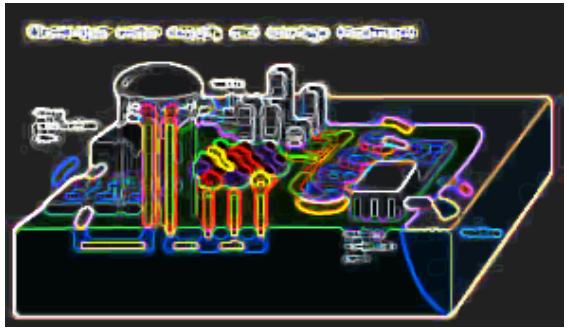
Physical Water Utility



- SCADA, CMMS, Lab, data
- GIS data
- Weather Data
- RT/batch sensor data
- Meter data – game changer
- Historical data
- Input parameter assumptions

Data pairing

Digital Double/Twin
-A software model of both the physical connected components and dynamicity of a system via data pairing



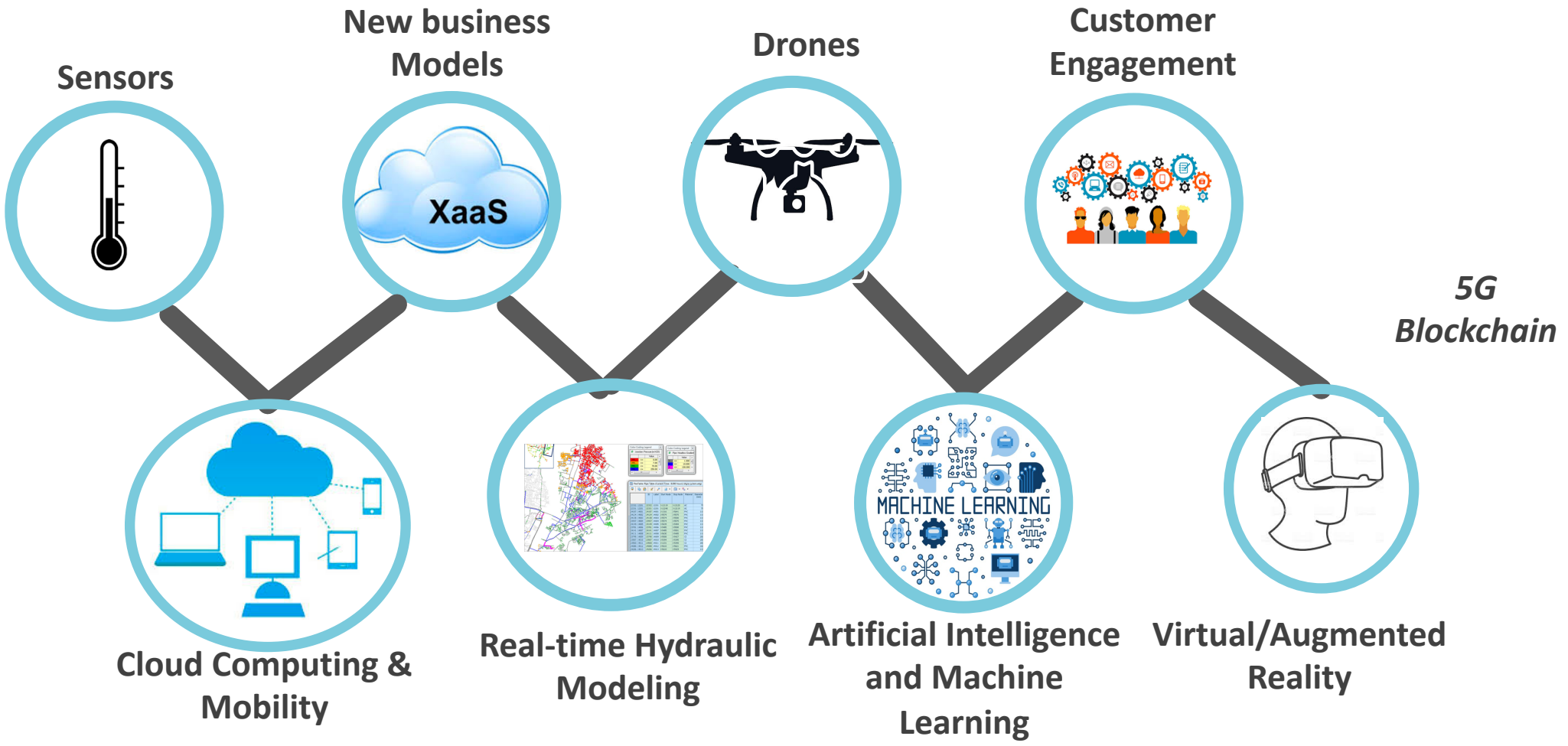
- Continuous Hydraulic Model Simulation augmented with machine learning for the gaps
- Replace mathematical assumptions with real-time data
- Run what-if scenarios, predictive analysis, and real-time alerts

BENEFITS OF THE DIGITAL TWIN

- Drive outcomes from critical business insights
- Provide one comprehensive view
- Reduce maintenance costs and unplanned outages by early alerts
- Give ability to optimize or provide mitigation events
- Forecast opportunities
- Warns if anomalies occur early to avoid failure
- View the dynamic status of the physical system via an integrated and holistic view
- Reducing the data silos and departmental silos
- Provide predictive analysis to avoid future failures
- Proactive operation instead of reactive
- A near-real-time holistic connection between the physical world and the digital world
- Improve efficiency and increase optimization of operations
- Ability to run what-if analysis at any time
- Leveraging IoT, hydraulic modeling, and machine learning
- Maximizes ROI of investments of assets and tools and extending lifecycle of systems
- Bringing cross-discipline teams together across the utility
- Leads to better participation from water utilities into smart cities

Digital Twin, Why the Time is Right

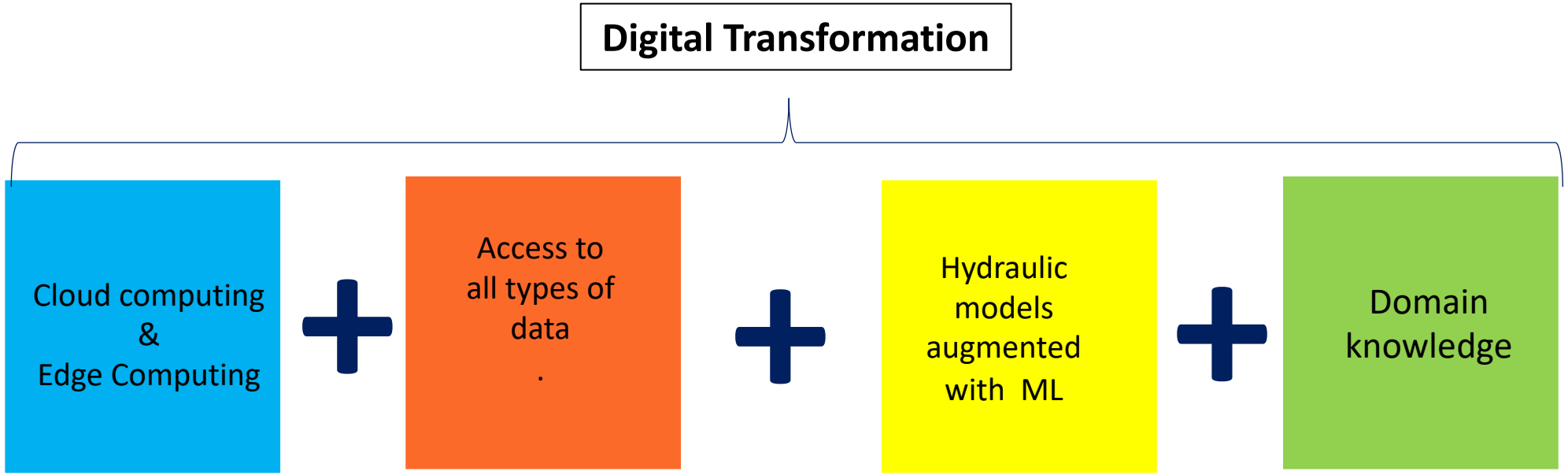
AN ARRAY OF DISRUPTIVE TECHNOLOGIES …CONNECTING THE DOTS



WHY THE TIME IS RIGHT

Digital Twin is all about building blocks

- Cloud computing and Edge Computing – access to elastic compute resources
- IoT, AMI meters, legacy data access, IoT , SCADA, CMMS, GIS, weather, etc.
- Hydraulic models and ML
- Domain knowledge



SWAN Digital Twin for H2O workgroup

GOAL OF THE DIGITAL TWIN FOR H2O WORKGROUP

To develop a common strategy for developing Digital Twin technology for global water utilities. To have a common understanding of the role of: the physics-based hydraulic model, diverse data sets (GIS, IoT, SCADA, etc.) in both real-time and historical data, machine learning algorithms, and application integration for the calibration and use of the digital twin.

OBJECTIVES OF THE DIGITAL TWIN FOR H2O WORKGROUP

- Leverage and learn from other industries on the usefulness of digital twin via case studies (formula one, Smart cities, etc.
- Build best practices for accessing diverse data sets from existing data silos
- Agree on high-level API strategies for data set access including CMMS, GIS, SCADA, etc. regardless of the make
- Best practices on data sets normalizations – bring in real use cases
- Best practices on developing key analytics (useful algorithms) for actionable insights
- Best practices for utilizing the digital twin for optimized asset management
- Best practices for the use of real-time data to calibrate the Hydraulic model
- Utilization of the hydraulic model in real-time operations
- Adding new sensors (sharing what and where) for model calibration
- Utilizing ML for improving model accuracy
- Take the tiered approach to developing a digital twin for the utility: Getting started, 2) first use case (simple), 3) more advanced what-if scenarios, 4) Optimization

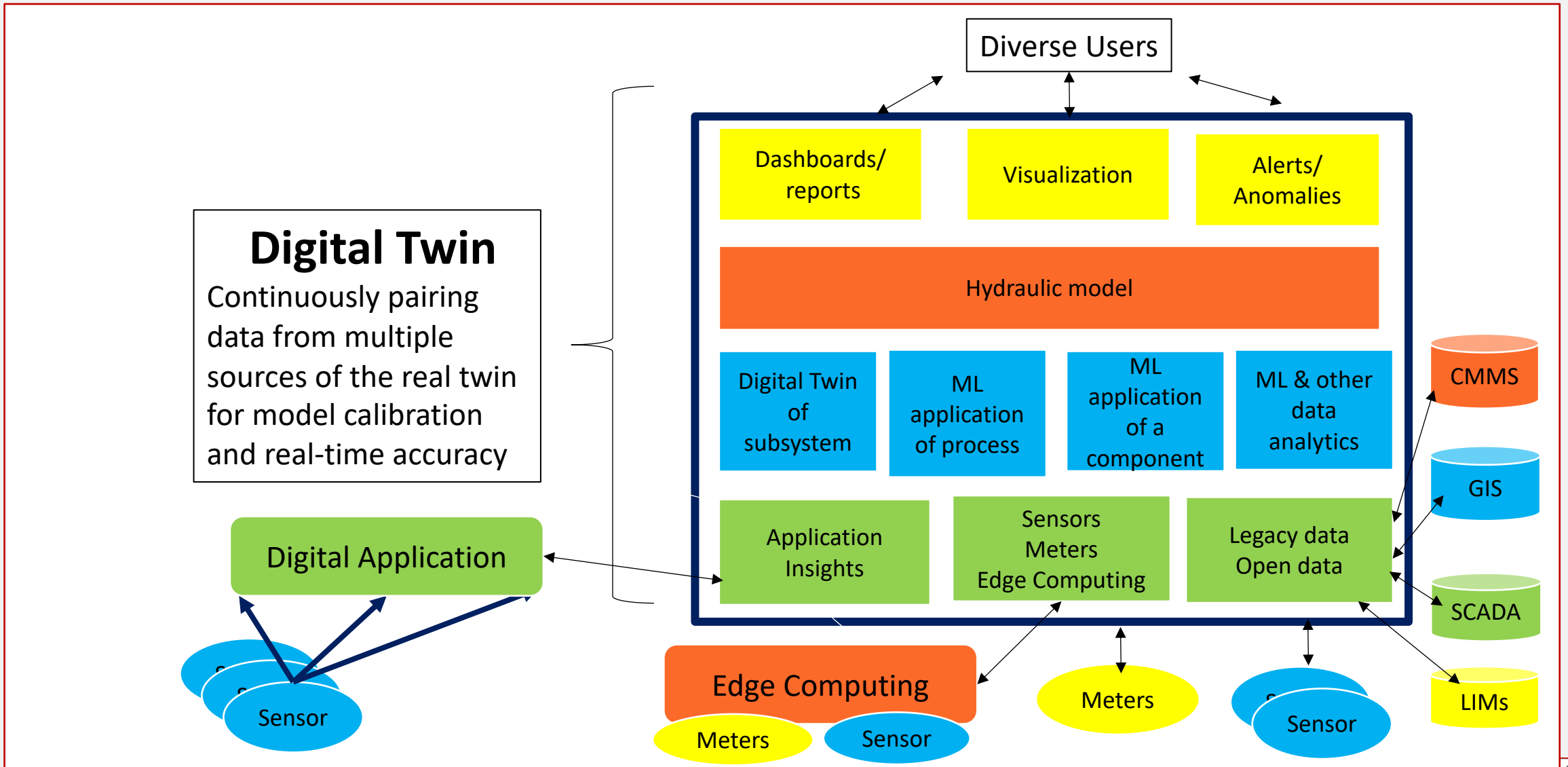
Digital Twin for H2O Workshop

FOUR PANELS FOR TODAY'S WORKSHOP

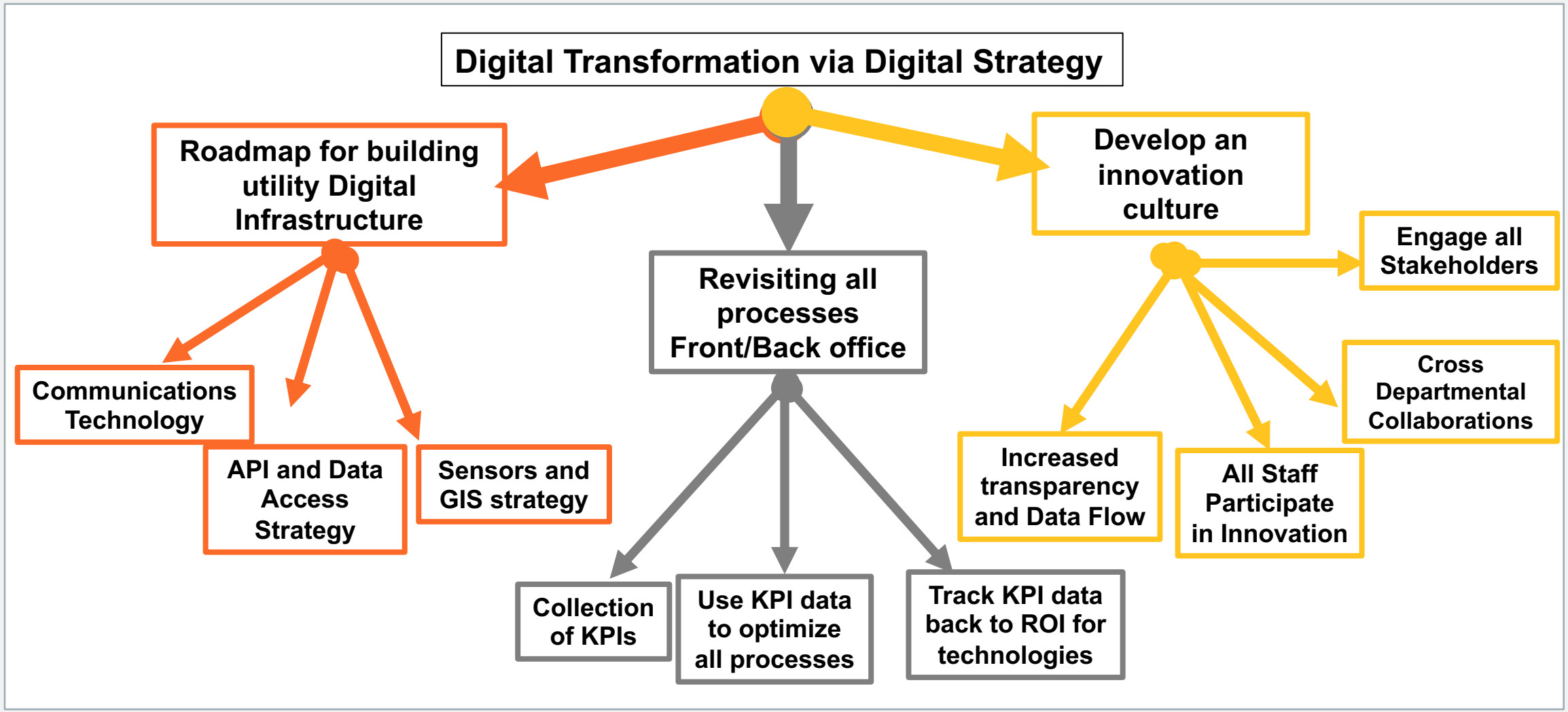
1. Digital Twin Core Components
2. Digital Twin Data Challenges
3. Digital Twin Analytics Challenges
4. Digital Twin for Drinking water, WW, Storm water, and Source Water

Core Components

BUILDING BLOCKS



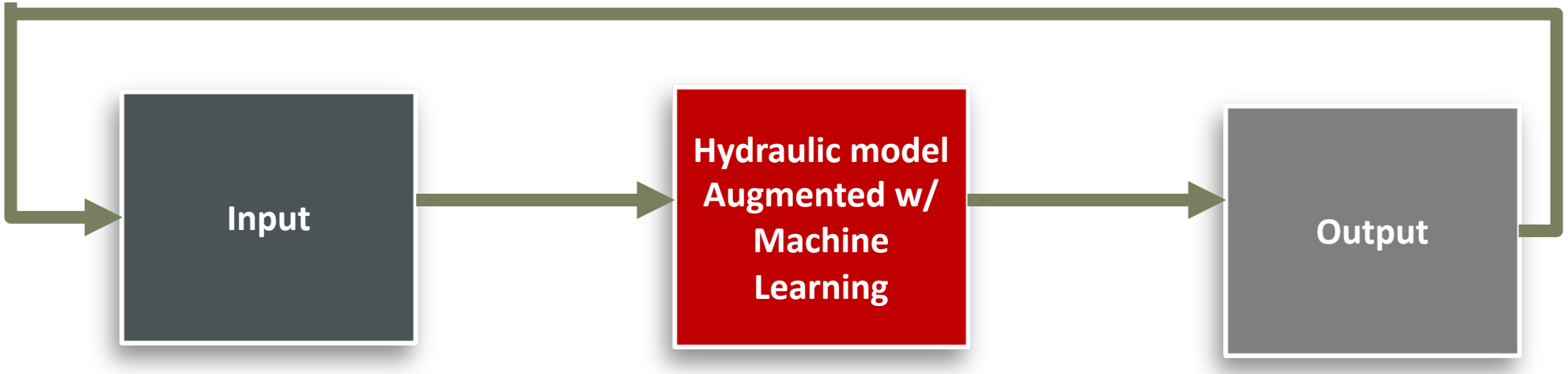
DIGITAL TRANSFORMATION



Digital Twin for DW, WW, Storm water, Source water

DESCRIPTION OF OPERATIONAL HYDRAULIC MODEL

Continuous calibration based on real-time sensor data

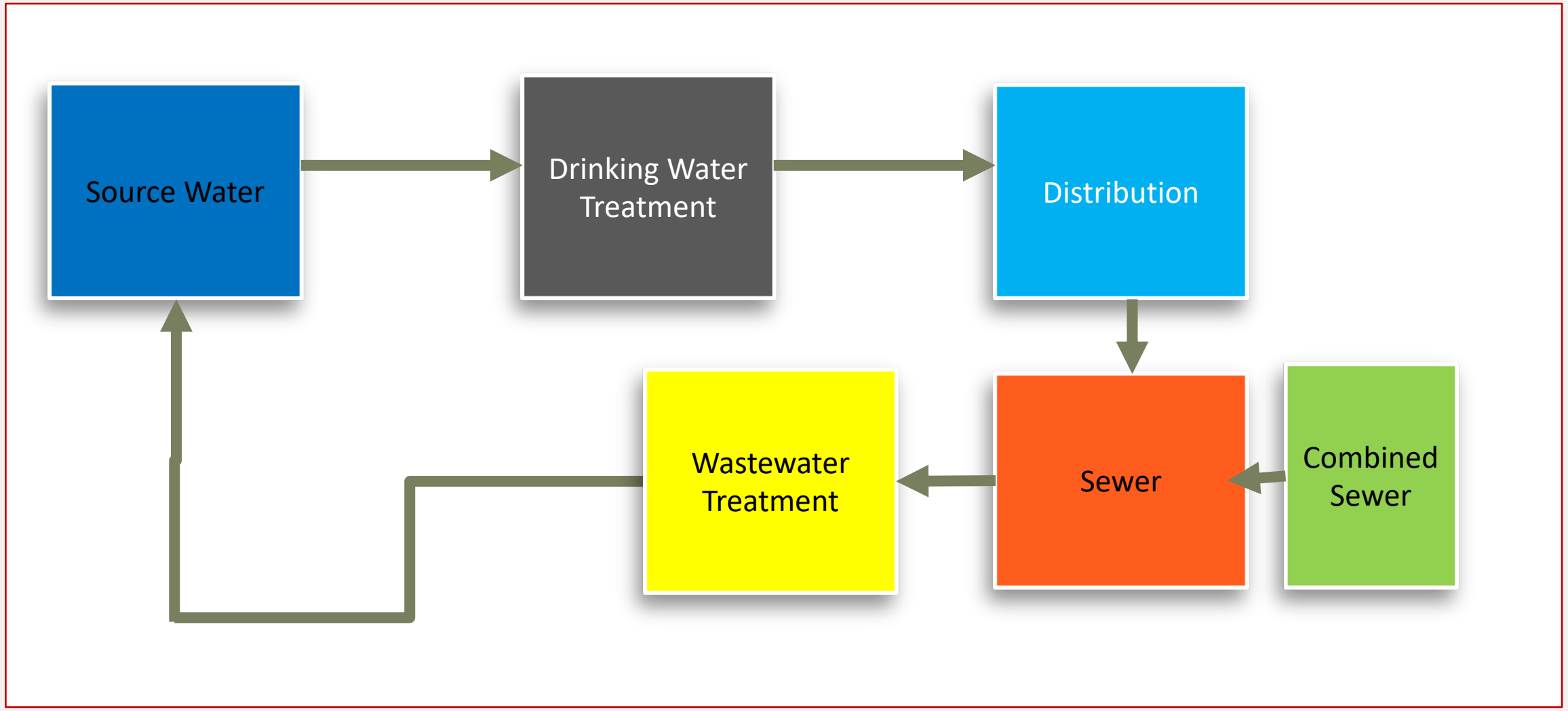


- RT/batch sensor data
- Meter data – game changer
- Historical data
- GIS
- CAD
- SCADA operational data
- Input parameter assumptions

Model calculated results
Virtual sensors
+
RT sensor data
->Discrepancies are refed into the input for calibration

FUTURE DIGITAL TWIN WATER CYCLE

DRINKING WATER + SEWER + STORM + SOURCE WATER



THANK YOU!

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May, 14th, 2019