- Gigi Karmous-Edwards
- Karmous-Edwards Consulting
- gigi@gigikarmous.com
- +1 919-274-0045

SWAN DIGITAL TWIN WORK GROUP

AGENDA

- Digital Twins defined
- SWAN Digital Twin Working Group Overview
- Sub working groups

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WHAT IS A SMART WATER NETWORK?

Digital Water

Digital Twin is a very specific sub area of Digital Water Involving behavioral models at the core of the system we are twinning

Digital Twin

Provides insights that results in actionable control (human/automation)

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ANALYTICS VS. DIGITAL TWIN(STATISTICAL ANALYSIS VS BEHAVIORAL MODEL)

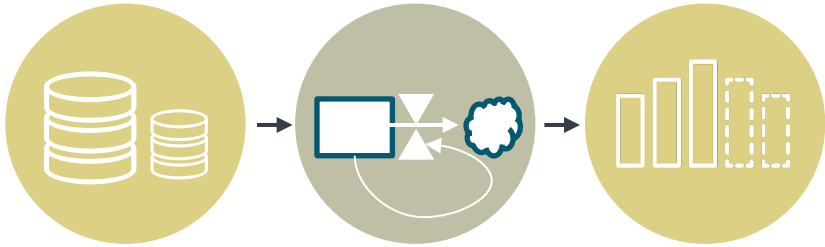
Pattern Recognition

Finding **patterns in data** to compute future outcomes

Big Data → Algorithms → Predictions

Digital Twin Simulation

Modelling **cause and effect** to compute future outcomes



Big *or Small* Data → Computer model or system → Predictions

- Deductive reasoning
- Scientific knowledge
- Expert experience

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Definition of Digital twin for Water Utilities

"A dynamic digital representation of real-world entity(s) and their behaviors using models with static and dynamic data that enable insights and interactions to drive actionable and improved outcomes."

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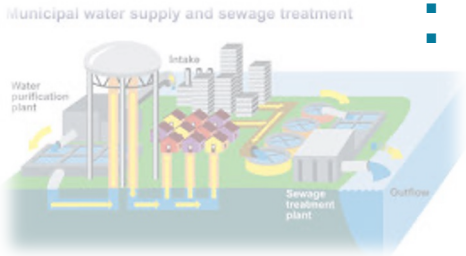
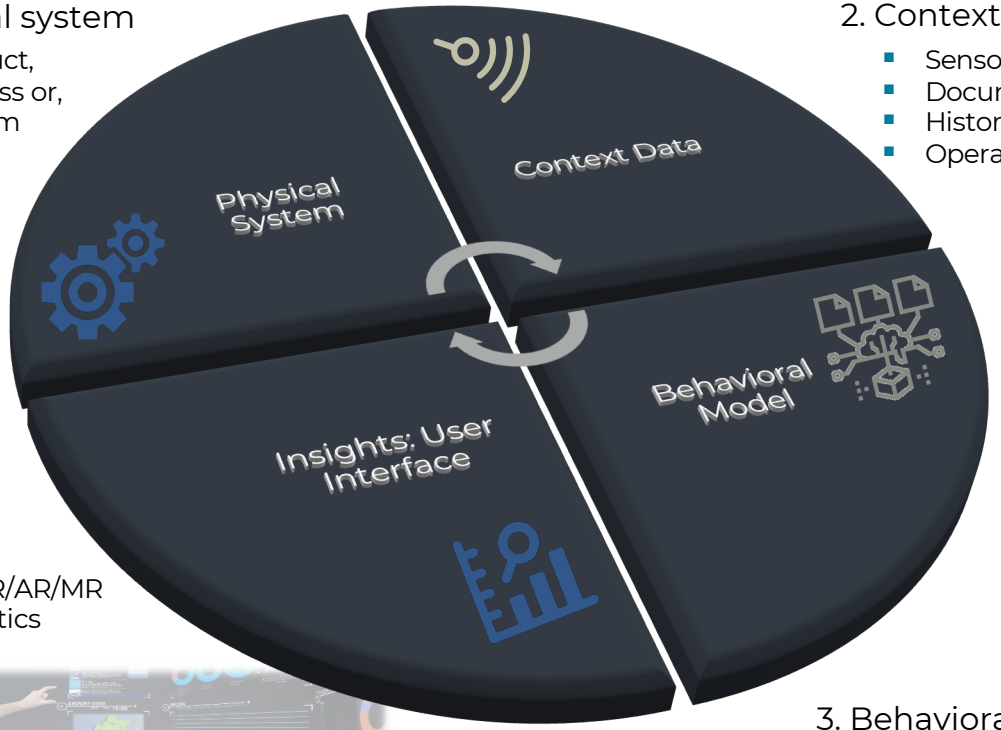
BREAKING DOWN A DIGITAL TWIN

Components of a Digital Twin

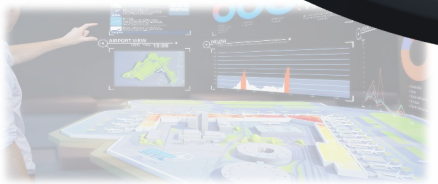


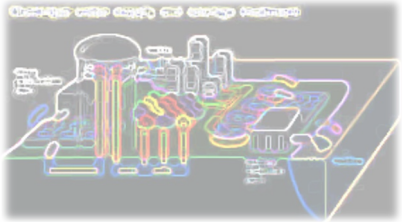
1. Physical system
   - Product,
   - Process or,
   - System



2. Context data
   - Sensor data
   - Documentation info
   - Historical data
   - Operational data

4. Insights : User interface
   - Insights via dashboards
   - Insights / collaboration via 3D VR/AR/MR
   - Predictive and prescriptive analytics
   - Holistic System Oversight





3. Behavioral Model
   - Model simulation
   - Model calibration based on physical context data

The actual system that the Digital Twin represents could be a product, process, or system.

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SWAN Digital Twin Workgroup Objectives

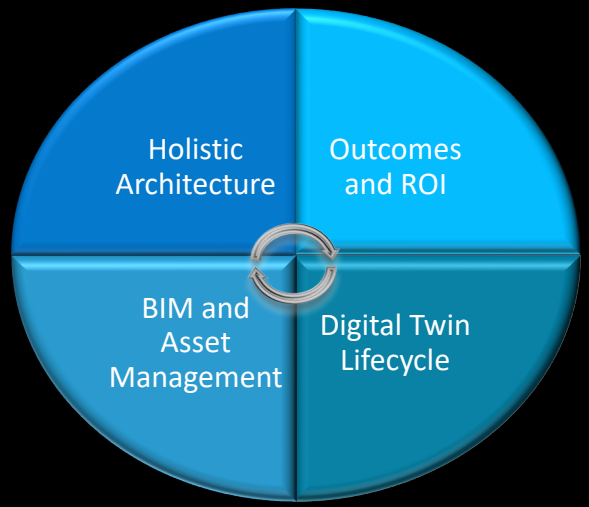
- Raise Awareness of Digital Twin Concepts
- Identify Key Challenges for Utilities
- Collectively Develop Best Practices
- Increase the Adoption Rate of Digital Twins

Architecture

- Building blocks and interfaces needed for a high-performance DT
- Must fulfill needs and outcomes
- What are the data flows across interfaces

BIM and Asset Management

- What is BIM and how can the water sector leverage it?
- What meta data should we collect for water assets?
- Develop Water sector BIM process blocks



Outcome & ROI

- Identify benefits of using DT in real applications
- Tabulate actual ROIs from case studies for reference
- Develop business case templates for DT development for Utilities

DT lifecycle

- Define DT components for the different phases, including Design, Construction, Operation, Customer
- How to support DT lifecycle
- Define best practices for asset lifecycle

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Workgroup Leadership Structure

Chairs:
Gigi Karmous-Edwards (Karmous-Edwards Consulting)
Andreu Fargas (Consorci Aigües de Tarragona)

Holistic Architecture: Michael Karl, National Smart Utility Technology Manager (Brown and Caldwell) & Chengzi Chew, Business Development Manager – Emerging Technology (DHI)

Digital Twin Lifecycle (Design – Construction – Operation – Customer Experience): Agnethe Pedersen, Industrial PhD Student (VandCenter Syd) & Youri Amerlinck, Researcher (Aquafin NV)

BIM and Asset Management: Chris Steele, Head of Digital Products and Services (Binnies) & Jamie Mills, Global BIM Manager (Xylem)

Outcomes and Applications: Andy Smith, Smart Water Strategy Manager (Anglian Water) & Pedro Vieira Moreira, IT & Innovation Director (Águas do Porto)

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SWAN DIGITAL TWIN WATER UTILITY OPERATIONAL ARCHITECTURE

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SMART WATER NETWORKS FORUM

PHYSICAL SYSTEM

Sensing/Control

SENSORS
Pressure, Temperature, Flow, etc.

ACTUATORS
Hydraulic, Electrical, Mechanical, etc.

ADVANCED MONITORING
IoT, AMI, Edge Devices etc.

Data Collection and Sources

BUSINESS & OPERATIONAL SYSTEMS
LIMS, CIS, GIS, CMMS, CAD/BIM etc.

AUTOMATION SYSTEMS
SCADA, Telemetry, etc.

ATTRIBUTES
Spatial
Transactional
Temporal

DIGITAL TWIN

Data Integration

DATA INGESTION AND INTEGRATION

DATA MANAGEMENT

Analytics

DATA DRIVEN MODELS
Machine Learning, AI, etc.

PHYSICS BASED MODELS
Hydraulic, Biological, etc.
(Static and Dynamic)

Visualization

SIMULATION AND DECISION SUPPORT TOOLS

User Experience

- WHAT/IF SCENARIOS
- REAL-TIME PERFORMANCE DASHBOARDS
- AUGMENTED/VIRTUAL REALITY
- MOBILE ALERTS
- ADVANCED AUTOMATION

Actionable Results < Optimized Performance < Informed Decisions

Secure and Connected Utility

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Thank you

Questions?

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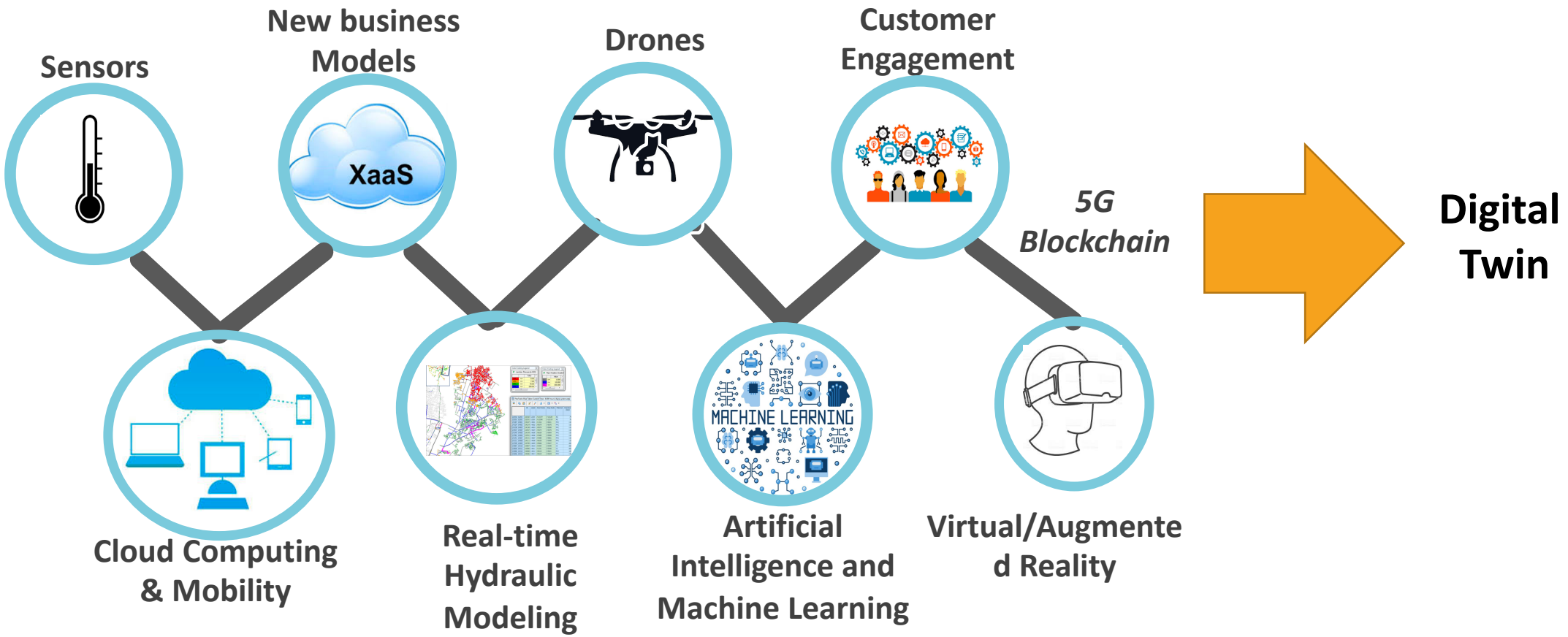
WHY DIGITAL TWINS NOW?
AN ARRAY OF DISRUPTIVE TECHNOLOGIES …CONNECTING T



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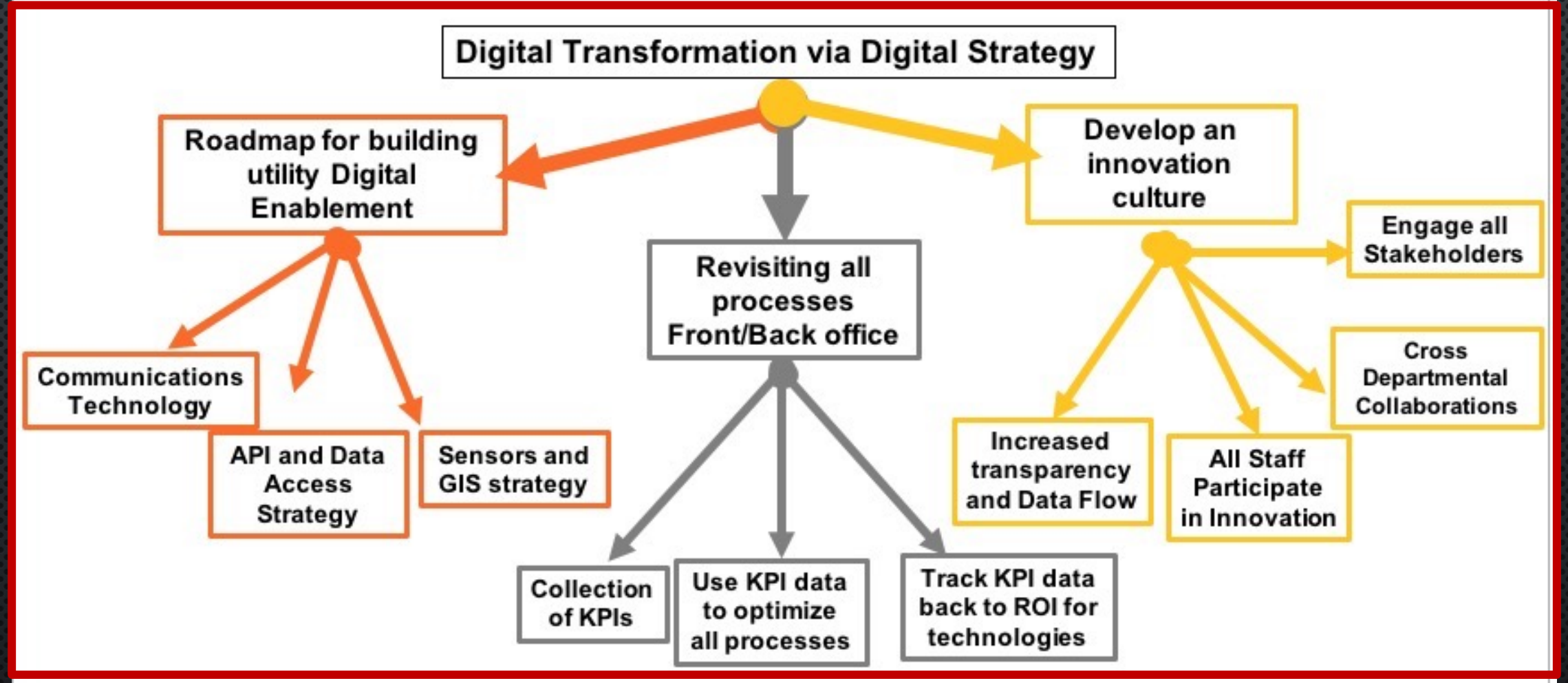
DIGITAL TRANSFORMATION



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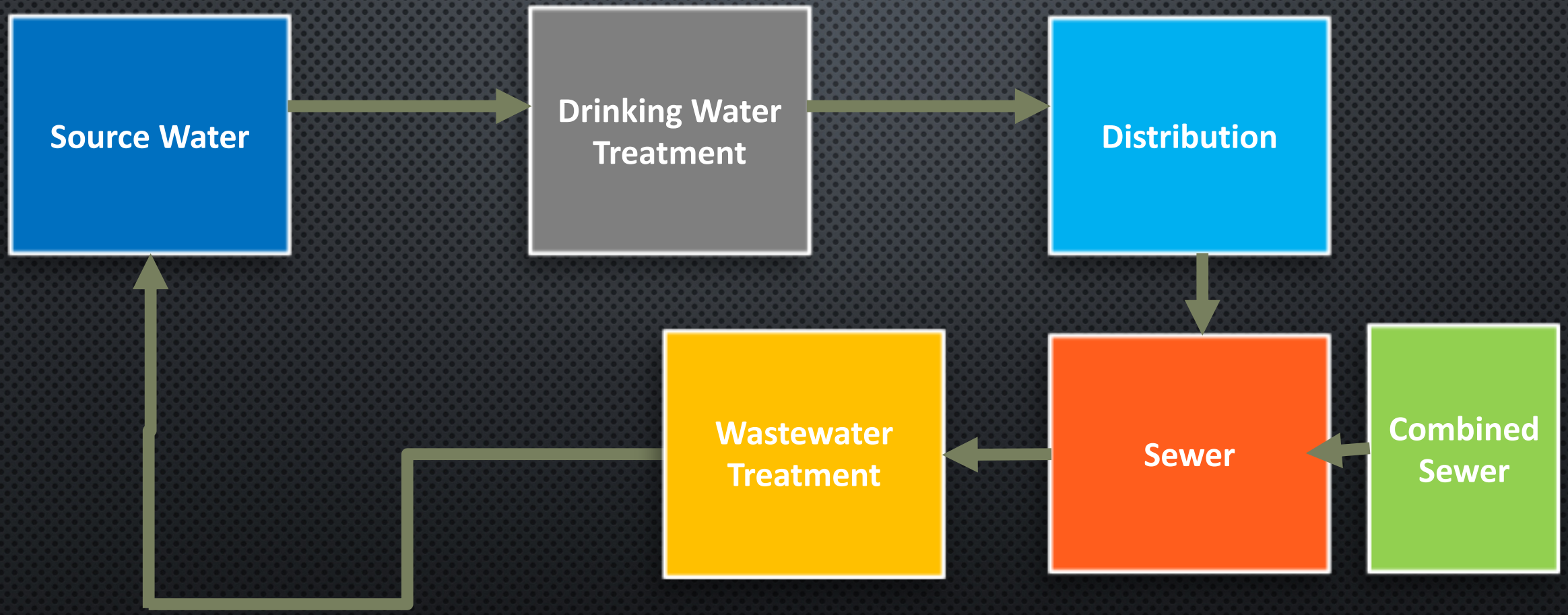
FUTURE DIGITAL TWIN WATER CYCLE

DRINKING WATER + SEWER + STORM + SOURCE WATER



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