Digital Twin

Powering smart water networks

Colby Manwaring & David Fortune

Innovyze®

Empowering water experts

Innovyze Digital Twin Statement

- A Water Digital Twin is an integrated multiphysics, multiscale, probabilistic simulation of the assets of a water, wastewater, stormwater, or river system that uses the best available physical models, real-time sensor updates, historical performance data, machine learning/AI, etc., to replicate the life of its corresponding real world twin.

Digital Twin:

Why now?

Innovyze®

Empowering water experts

It's all coming together ....

- Digital models can be truly representative
  - larger & run faster on parallel processing, high-performance computers, cloud
  - Coupled/embedded models allow variable scale
- Models can be updated and maintained continuously
  - always ready for use
  - data stream connections to asset and performance data are common
- More monitored network data for calibration and validation:
  - but still not dense enough in time or space for pure data-driven modelling
- Better information on drivers: customer demands, weather forecasts
  - But don't rely on universal smart metering just yet

It is all about trust

- The water utility (not only modelers) needs to trust the digital twin
- To rely on the digital twin giving the best picture of the network performance:
  - What has happened
  - What is happening now
  - What will happen in the future
- The model, data streams, simulations, analytic processes must be maintained, calibrated and validated so it is always realistic
- Model results must be presented appropriately: tailored to the audience (engineering, operations, management, IT, etc.)

Digital Twin:

Virtual Water Networks

Innovyze®

Empowering water experts

Digital Twin:
Virtual Model of the Real World

The real world: water, wastewater, stormwater networks

Hierarchy of models:

- Static infrastructure model
- Dynamic network model
- Real-time performance model

Static infrastructure model

Mainly for asset management:

- What you have (pipes, sewers, drains, pumps, valves, etc)
- Where it is
- How it is connected
- How it was built
- Inspection and survey history
- What condition it is in

Innovyze®

Dynamic network model

For design, analysis of events, and planning

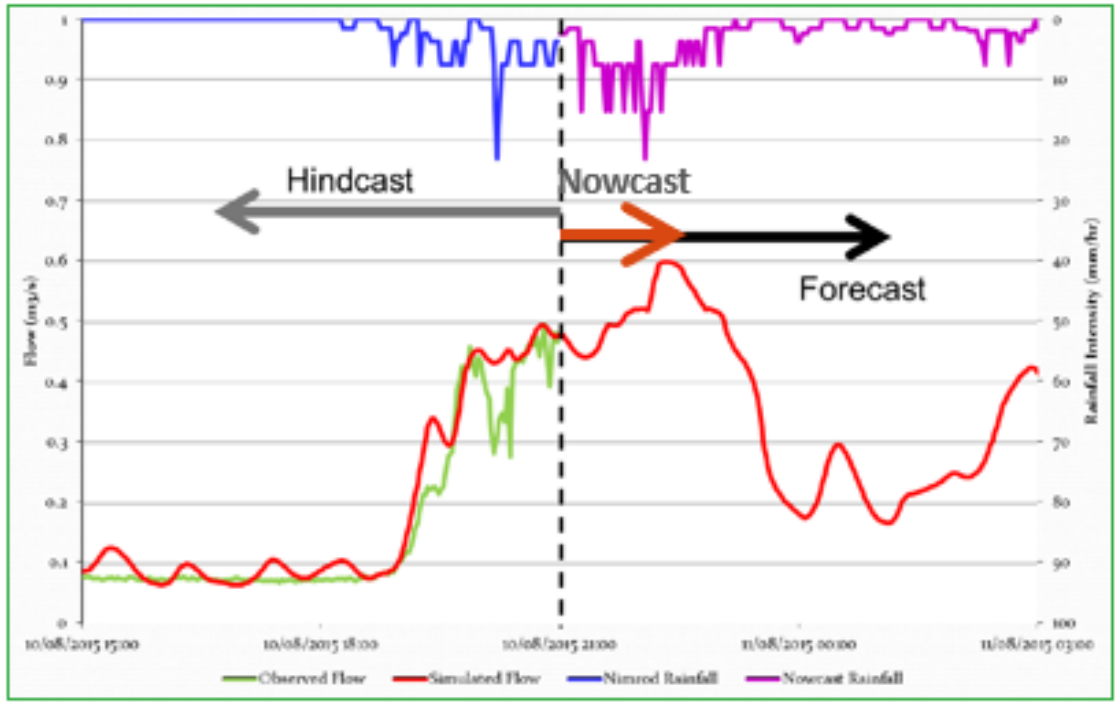
- Hydraulic model of the flows, pressures and levels in the network
- Driven by demands on the network
- Includes the response of control structures (pumps & valves)
- Calibrated and validated using monitored data (if possible)

Innovyze®

Real-time performance model

For everyday operational management

- Dynamic model representing the performance of the network as it is now
- Validated against real-time monitoring
- Used to predict network performance in the hours and days to come
- Gives warnings of potential service-level failures
- Used to optimize control actions



Innovyze®

Digital Twin model technology?

- Tried-and-tested physics-based hydraulic models win:
  - Robustness
  - Accuracy
  - Results throughout the network
  - Stable and predictive
- Pure data driven models (neural networks for example) can be faster, but lose out in every other way
- Artificial Intelligence (AI) shows huge potential as part of the modelling process:
  - Calibrating and validating models
  - Interpreting data and model results
  - Creating and interpreting warnings
  - Optimizing control actions

Innovyze®

Empowering water experts