The Smart Digital Twin: Finding a Real Time Solution

EnginSoft UK

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The Smart Digital Twin

BACKGROUND

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Background

10 Years experience helping the water industry work smarter…

ICMLive™ Innovyze®

Take the power of live simulation to another level

AECOM

Support industry innovation and data analytics

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Develop smart process and data analytic systems

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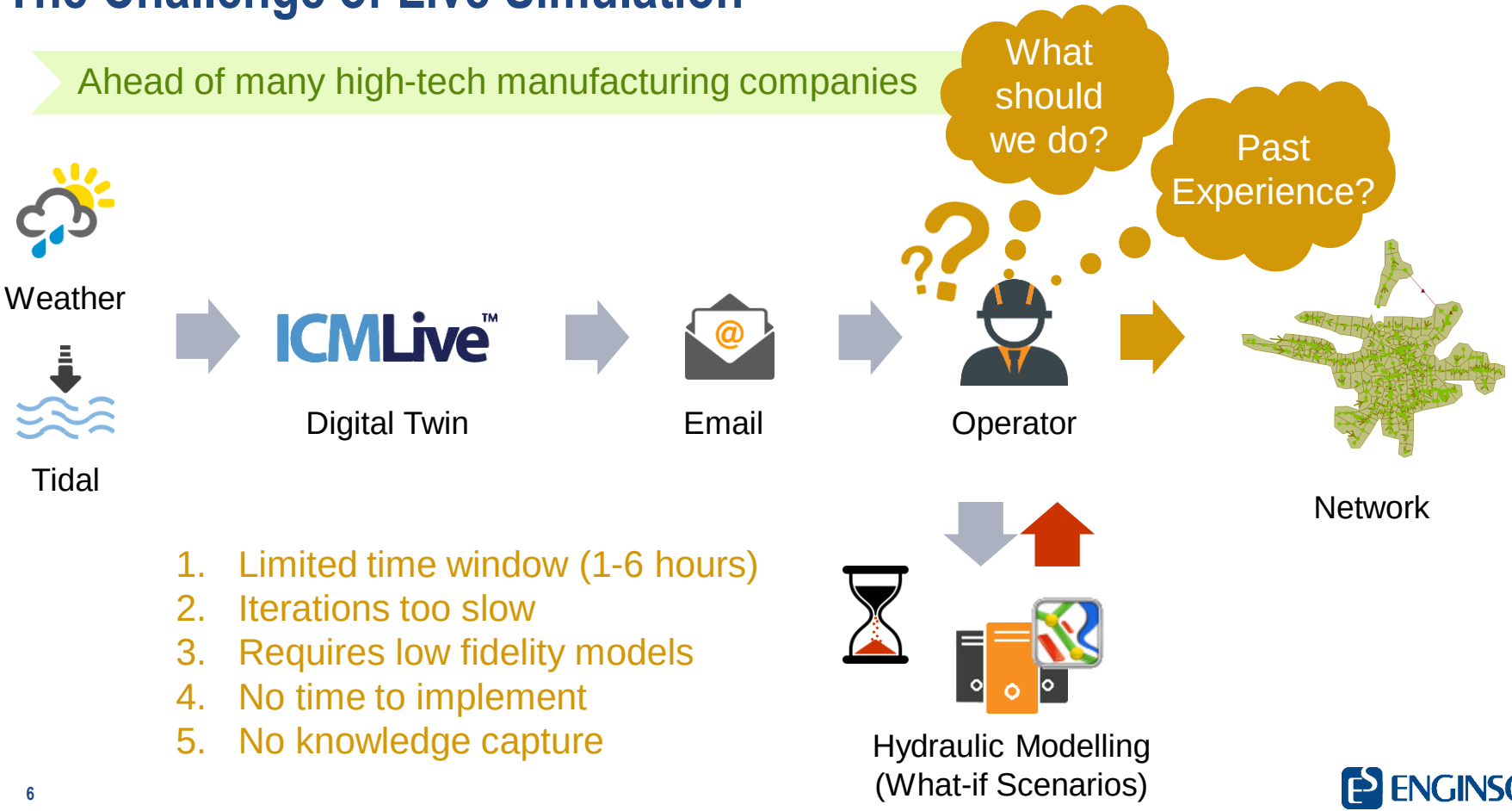
The Smart Digital Twin

CHALLENGE

The Challenge of Live Simulation

Ahead of many high-tech manufacturing companies



1. Limited time window (1-6 hours)
2. Iterations too slow
3. Requires low fidelity models
4. No time to implement
5. No knowledge capture

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Question

*Can we provide a **real-time solution** in the short-term and still **learn for future events**?*

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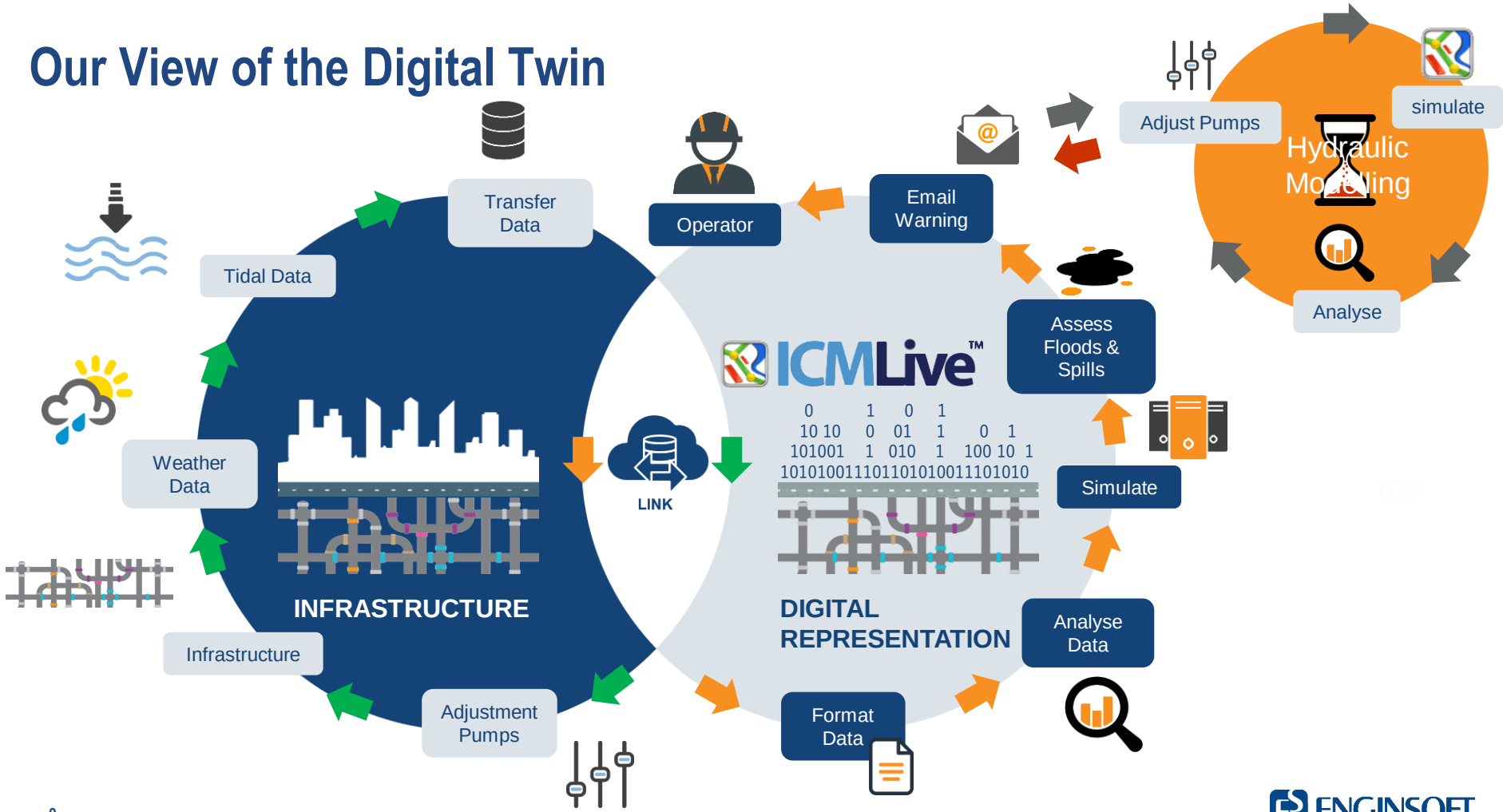
The Smart Digital Twin

SOLUTION

Our View of the Digital Twin



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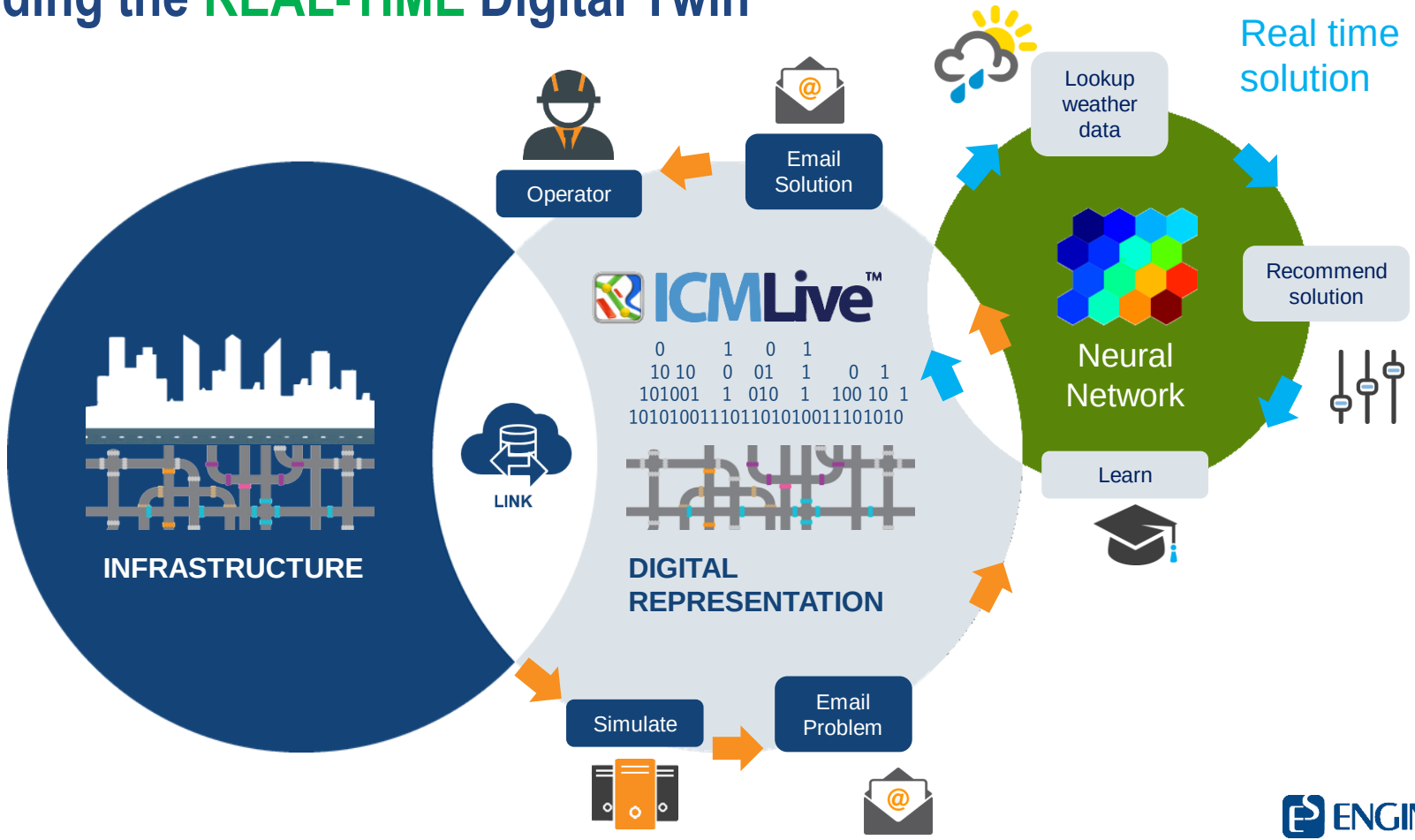
Building the REAL-TIME Digital Twin



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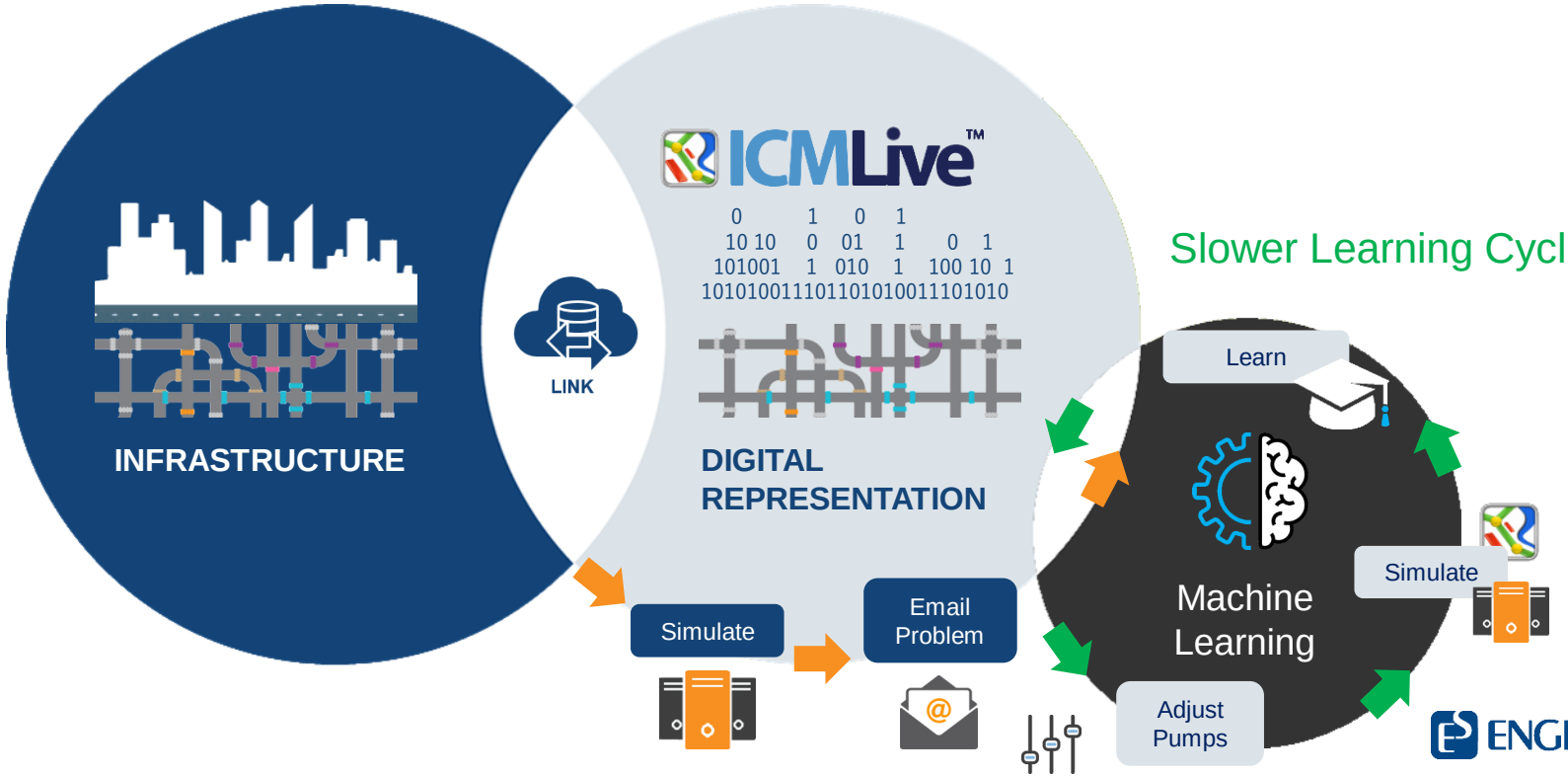
Building the SMART Digital Twin



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CASE STUDY

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Case study

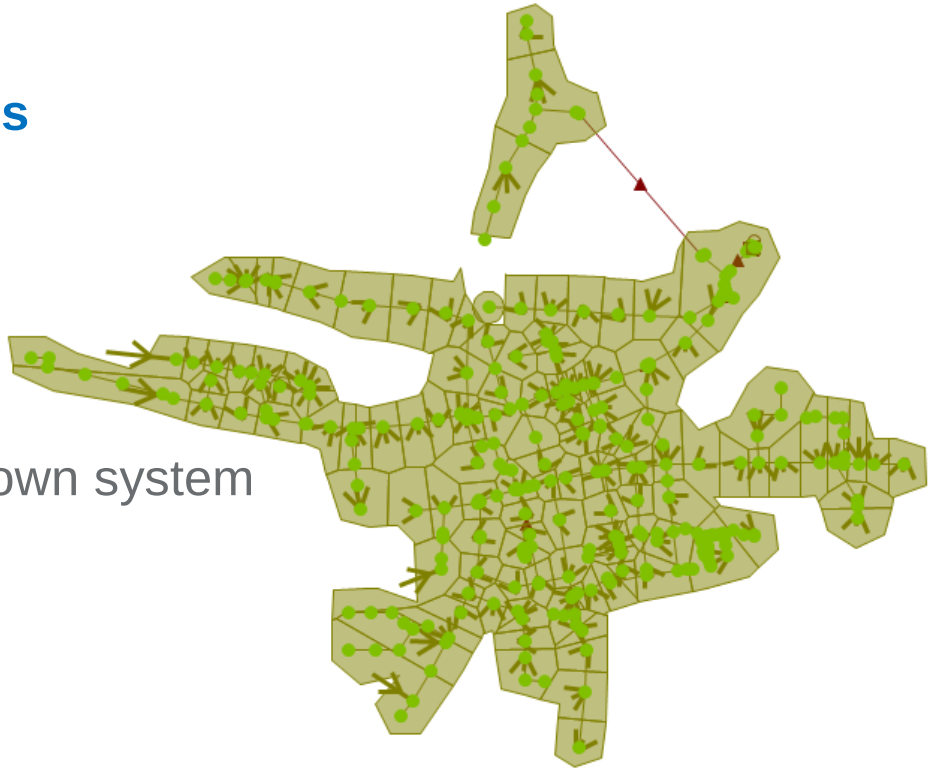
Set parameters for 5 pumps
To reduce impact of storm

by…

Minimising flood volume
Increase pumping to draw down system

While…

Minimising energy usage
Reduce pumping rate



Network and Image provided courtesy of Innovyze Ltd

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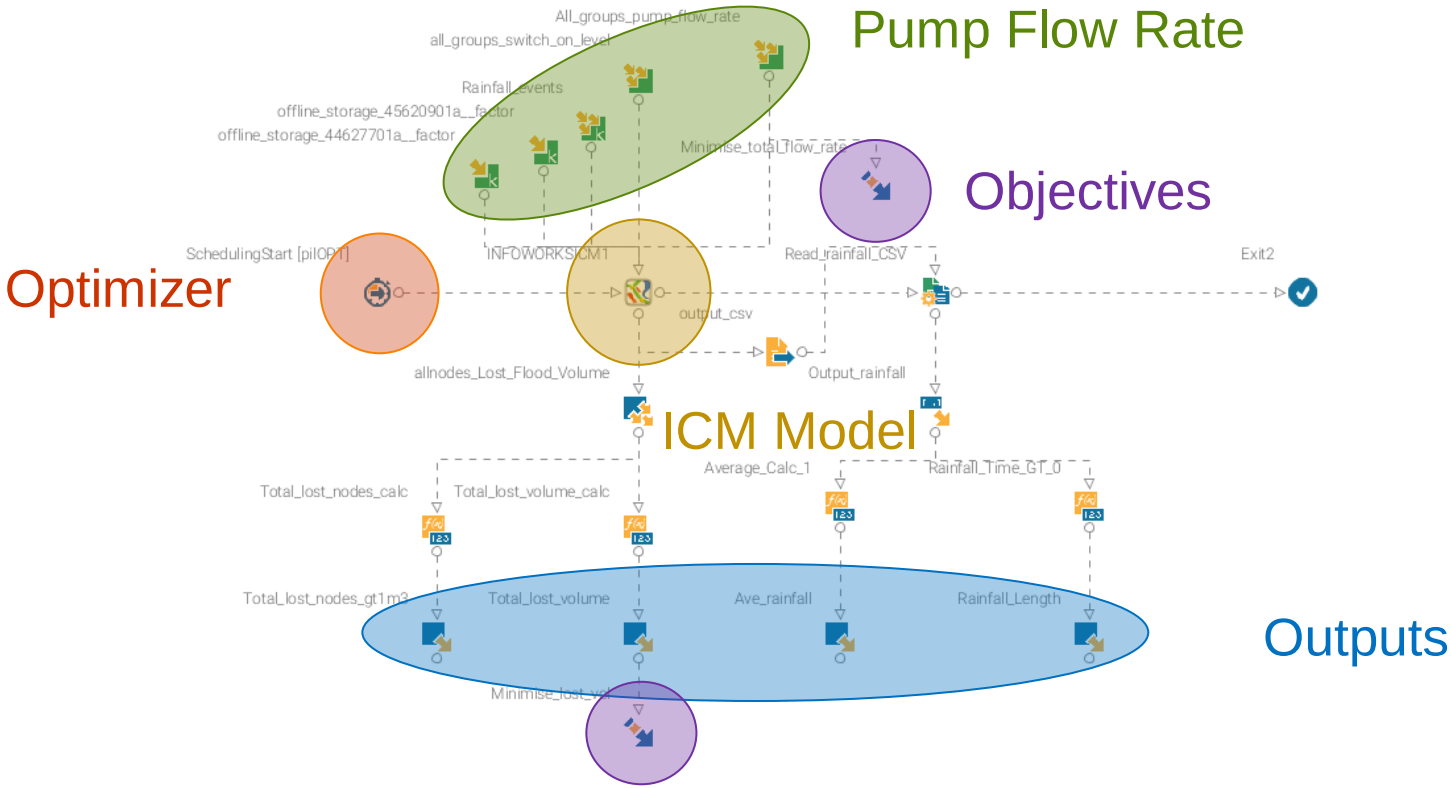
Workflow



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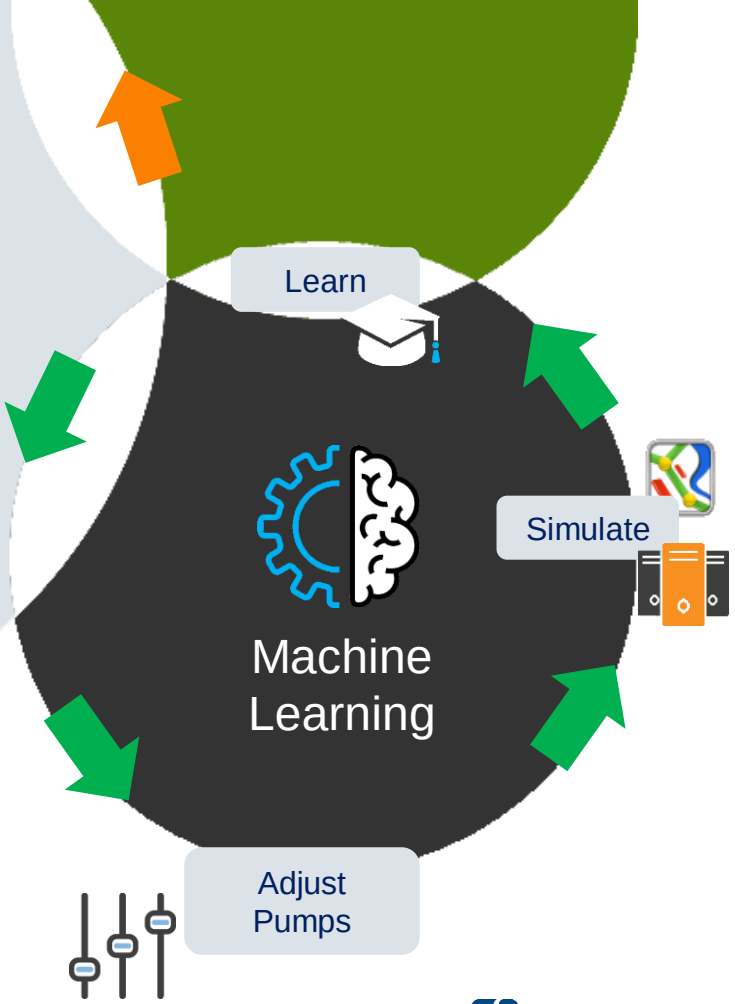

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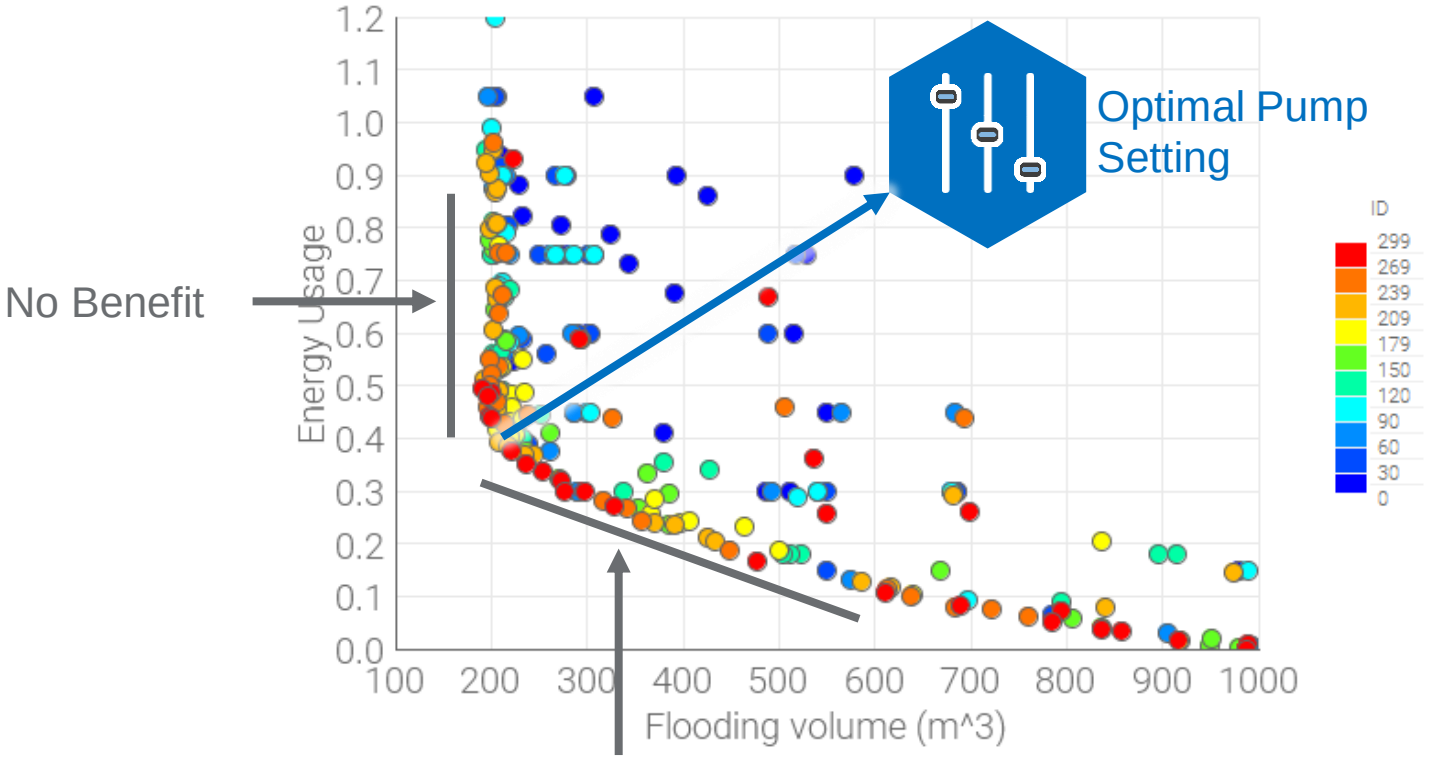
Find a Storms Optimal Pump Setting



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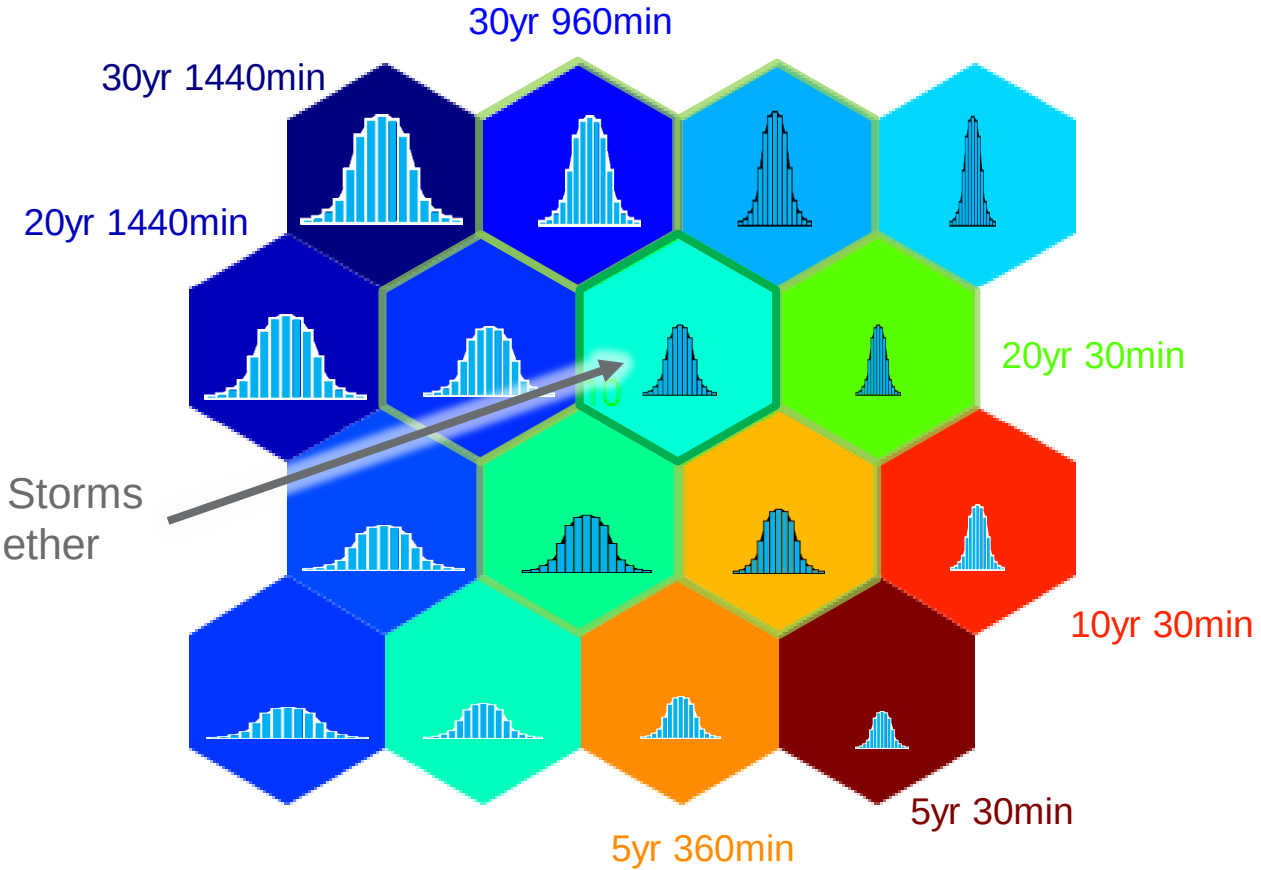
Neural Network of Storms



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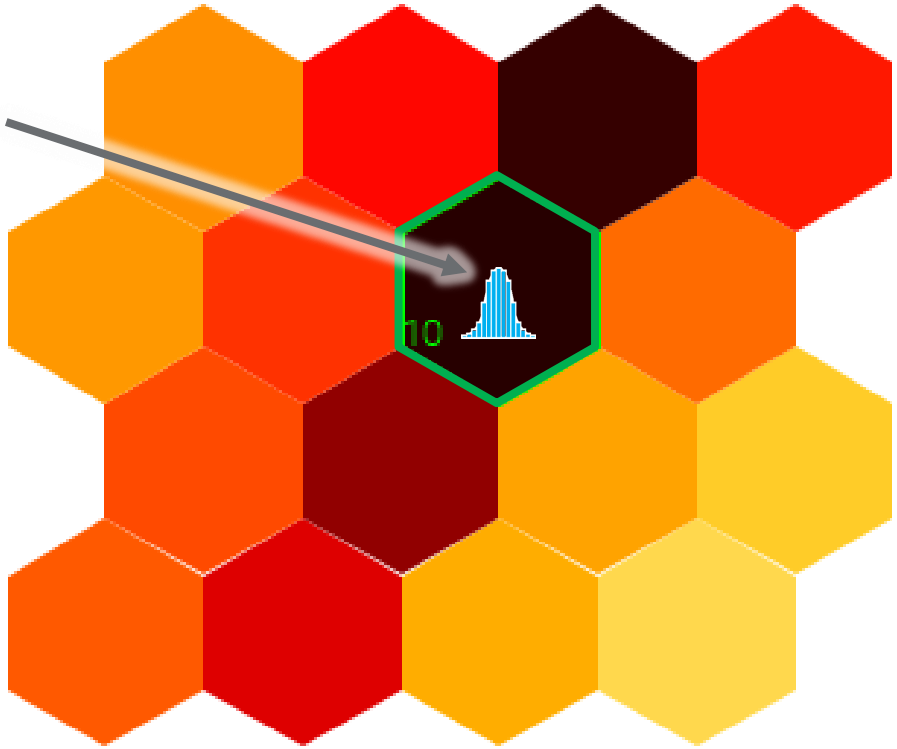
Weather Pattern Recognition

High confidence level

Best match to incoming weather



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Lookup weather data
Recommend solution
Neural Network
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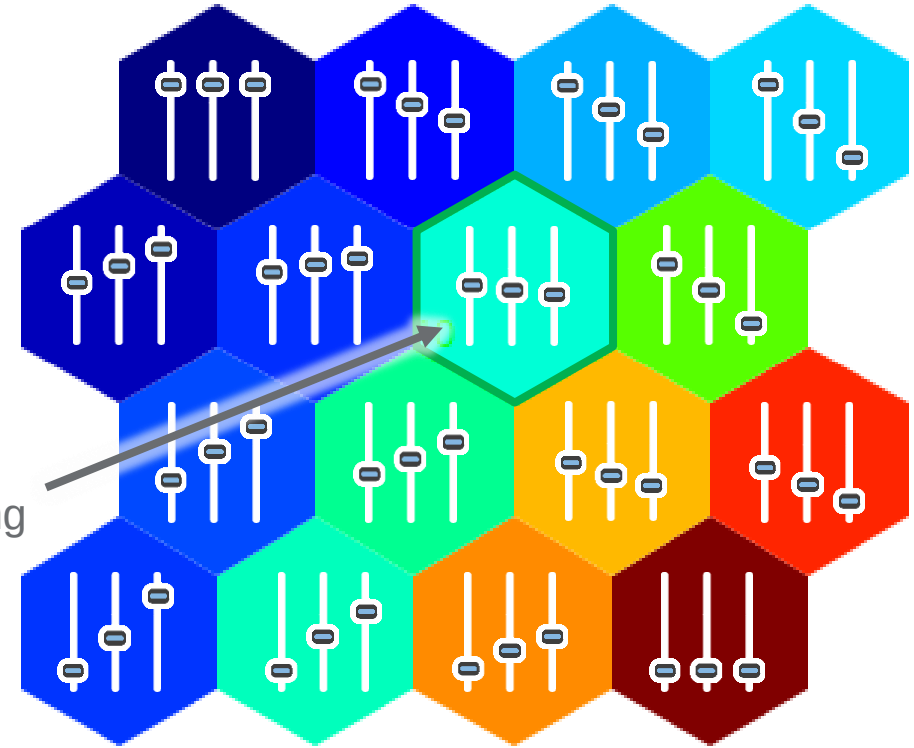
Determine the Optimal Setting

Storms correspond to
an optimal pump setting



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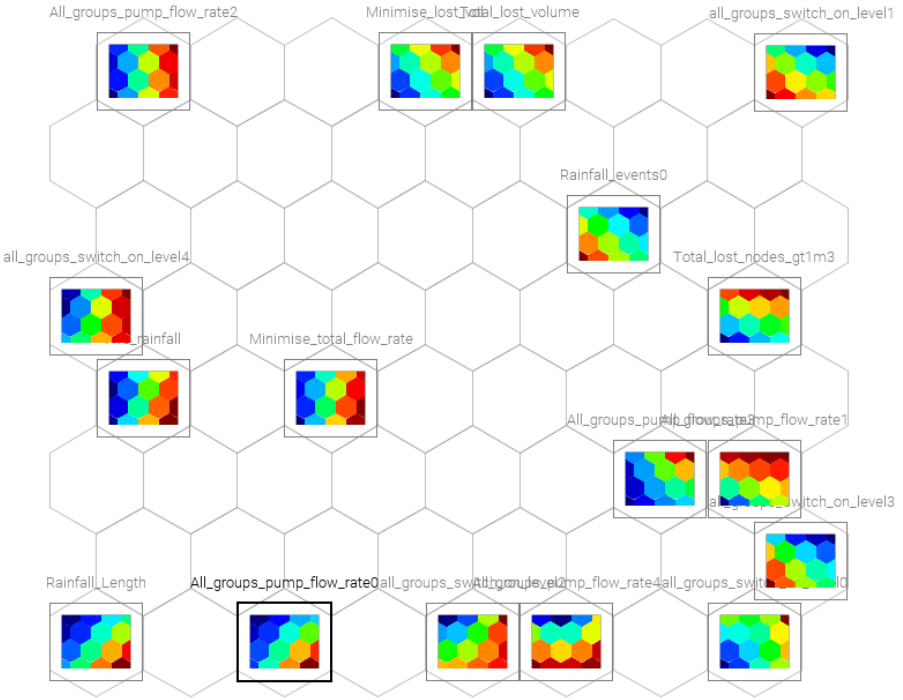
Comprehensive Parameter Map

- Maps can be created for any modelling parameter
- It will then recommend the optimal pump settings to respond to the incoming storm



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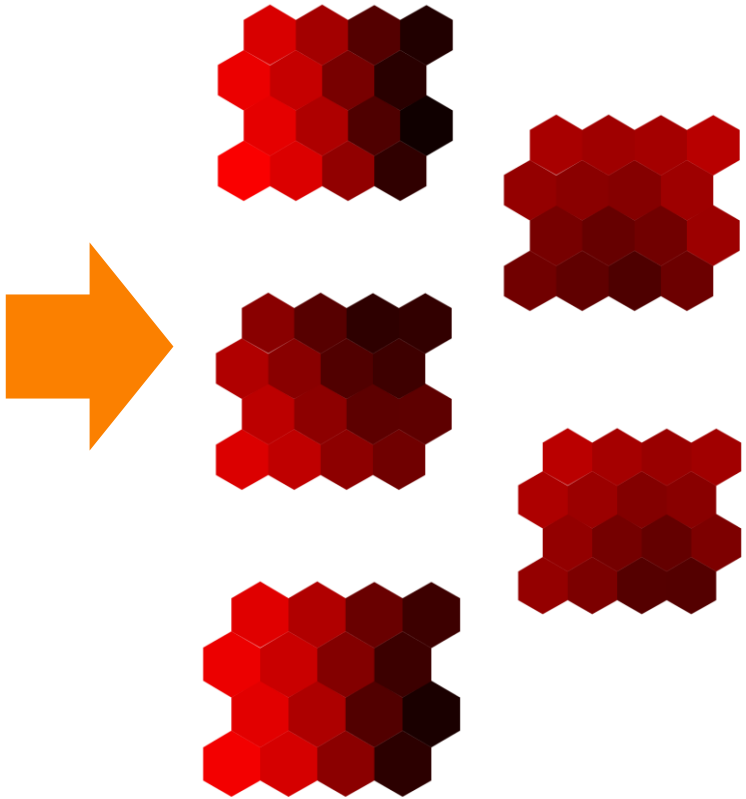
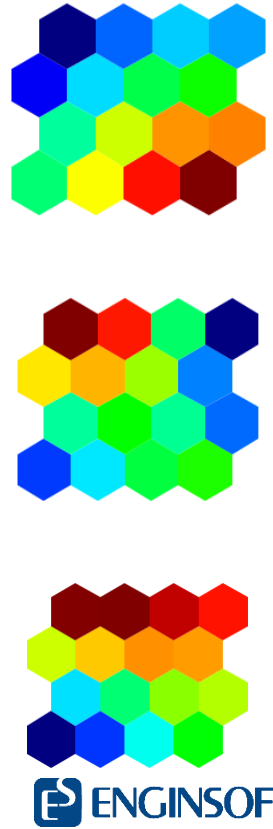
Testing

Weather pattern recognition

Optimal setting

Input data	
Ave rainfall (m^3s^{-1})	Rainfall length (min)
285.3	109.7
151.7	97.7
253.9	115.1
135.4	87.8
231.6	46.2
332.4	69.4
193.8	64.3
280.0	38.9
313.6	82.6
172.5	55.4





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Testing

Optimal setting

Input data		Pump flow rates (m^3s^{-1})					Flooding
Ave rainfall (m^3s^{-1})	Rainfall length (min)	Pump1	Pump2	Pump3	Pump4	Pump5	Lost volume (m^3)
285.3	109.7	0.1621	0.2760	0.0823	0.1439	0.0852	154.9
151.7	97.7	0.1476	0.2726	0.0929	0.1199	0.0971	117.8
253.9	115.1	0.1621	0.2760	0.0823	0.1439	0.0852	154.9
135.4	87.8	0.1089	0.2675	0.0662	0.1139	0.0953	104.4
231.6	46.2	0.0378	0.2895	0.0255	0.1590	0.0499	222.3
332.4	69.4	0.1068	0.2876	0.0568	0.1864	0.0557	223.3
193.8	64.3	0.0870	0.2710	0.0476	0.1288	0.0842	134.1
280.0	38.9	0.0378	0.2895	0.0255	0.1590	0.0499	222.3
313.6	82.6	0.1460	0.2852	0.0670	0.2035	0.0487	214.8
172.5	55.4	0.0830	0.2611	0.0398	0.1218	0.0903	90.2


Email Solution
Lookup weather data
Recommend solution
Neural Network
Learn
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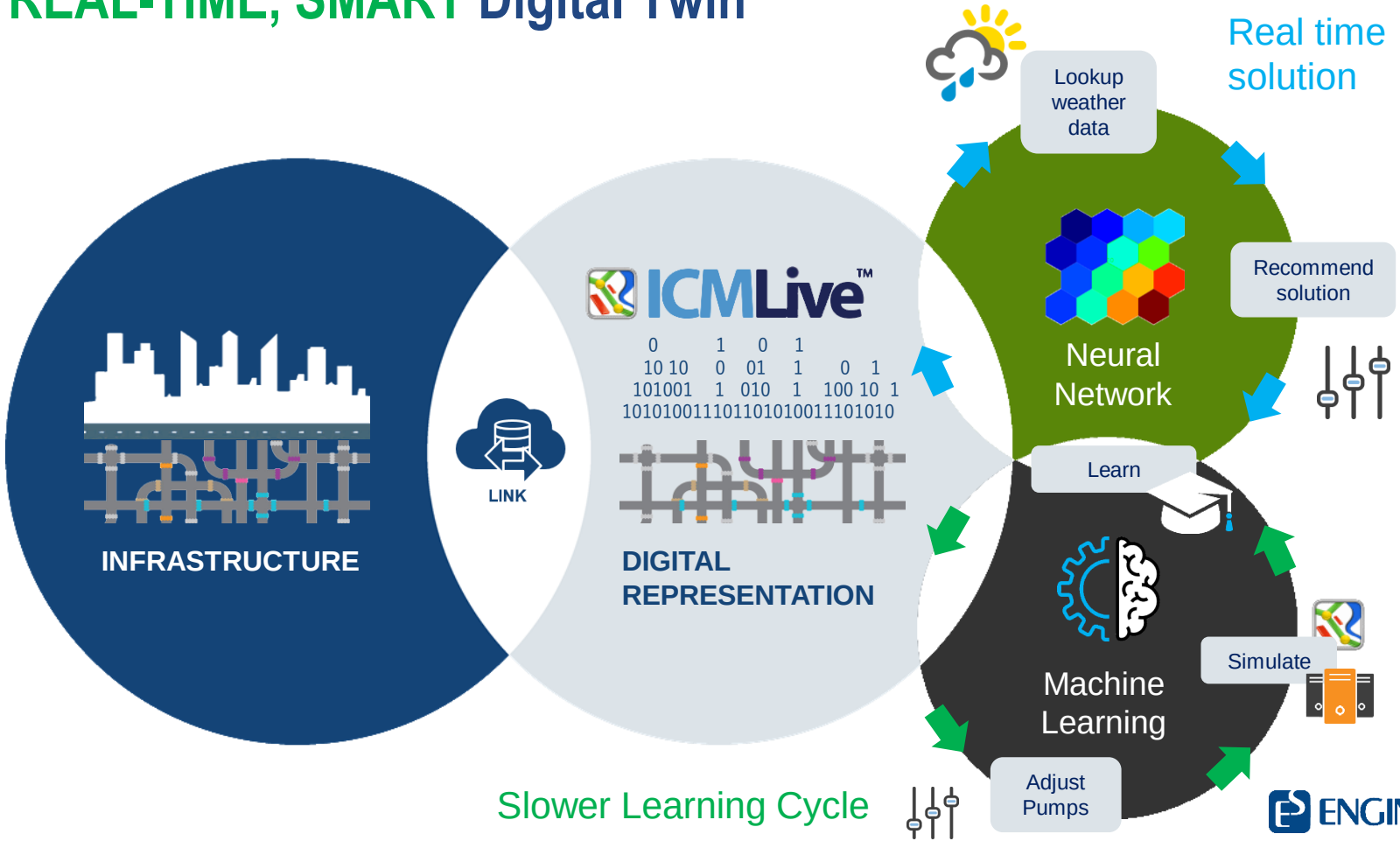
The REAL-TIME, SMART Digital Twin



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Improving the Neural Network

What if the weather is **not well represented** in the Neural Network?

- Provide a prediction
- Run ICM once to **confirm prediction**
- Run pump optimisation for storm and **retrain Neural Network**

Neural network becomes **better prepared** for new weather as it is trained by more **weather data**

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HIGHLIGHTS

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Technology Highlights

- ICM Live can **auto start AI system**
- **Recognise Storms** within its database
- Balance pump energy and flood **optimisation**
- Provide optimal pump settings in **Real-Time**
- **Self-learning** System
- Based on **high fidelity** hydraulic models
- **Validate Solution** with one ICM run

Business Highlights

- Minimise flood risk

While…

- Minimise energy cost

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Thank you!
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