

Digital Twins

Applied to network asset lifecycle management

21/10/2021 | Jan Van de Steen





Digital Twins

“Digital twins are the new hype in asset information management. We believe the concept of a digital twin is consistent, but unfortunately it is (mostly in a retroactive way) applied to physical equipment only”

From "What happens on the asset system stays on the asset system"

A digital twin starts with a clear identification



1976



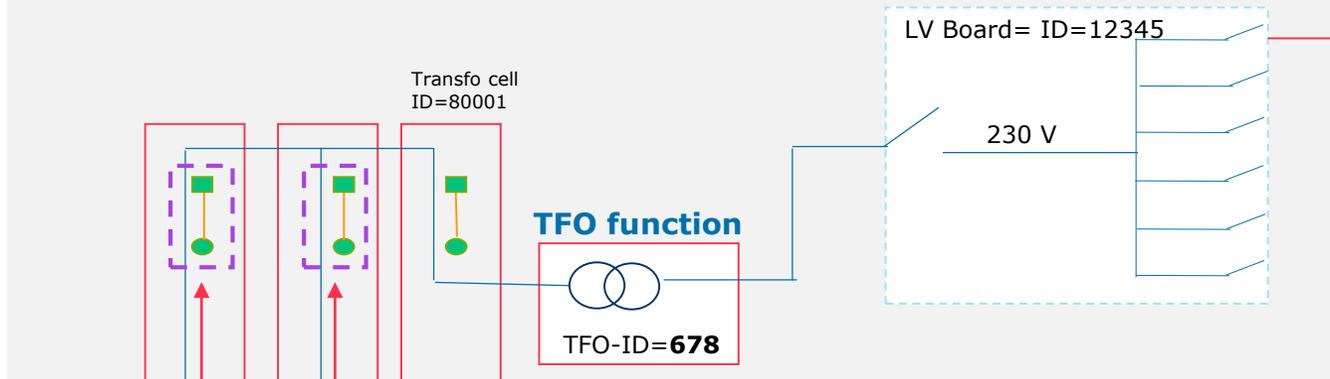
2020

Digital twin of physical equipment – the easy part

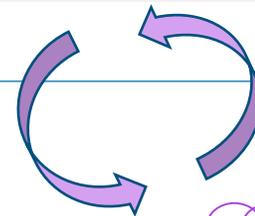
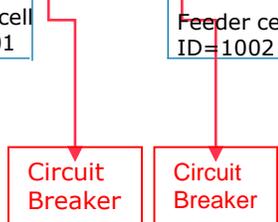


Example: electric distribution Substation

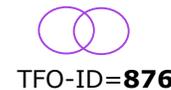
Substation ID = 110001



2 physical equipments for one functional LV switching unit!



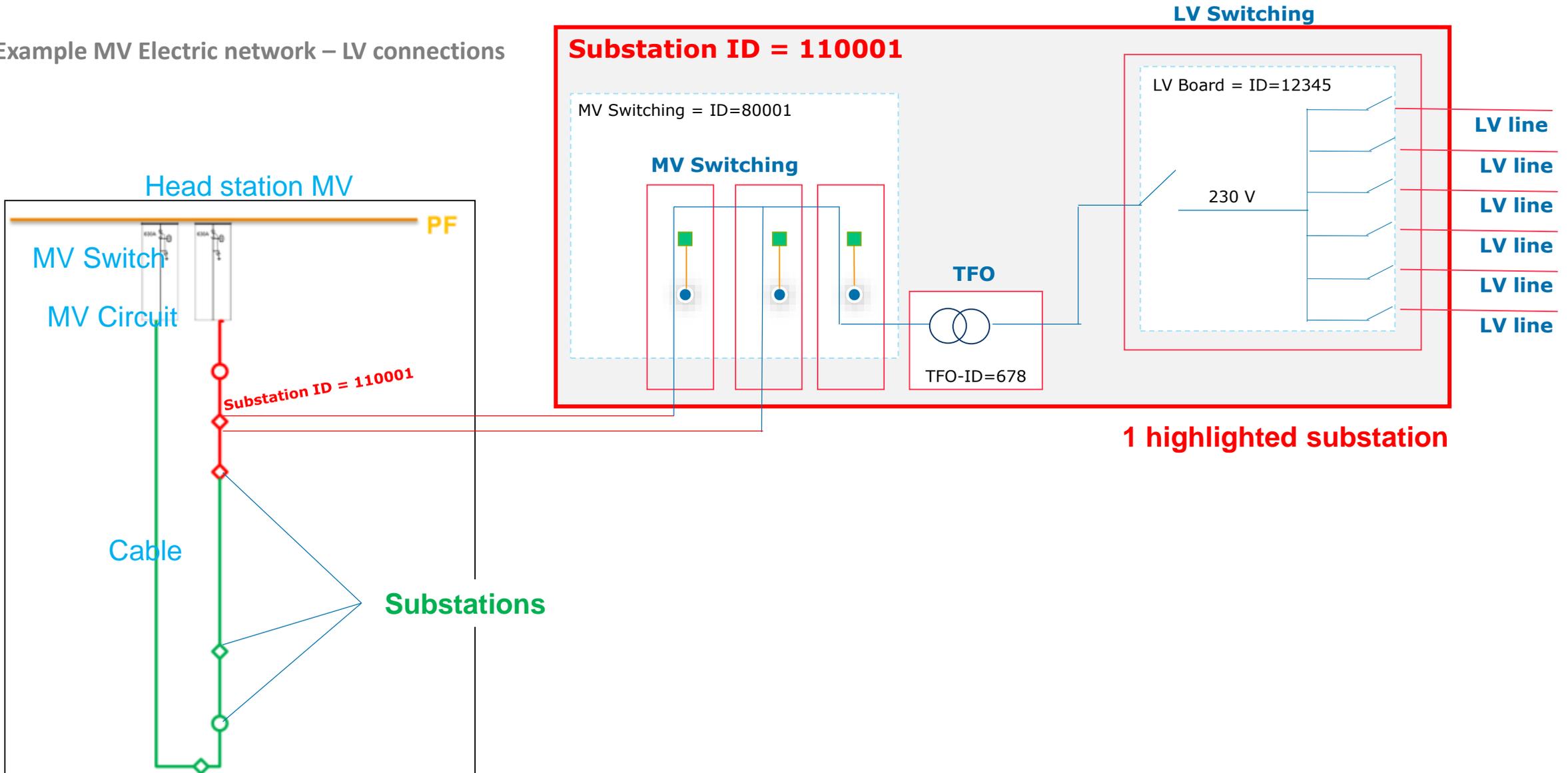
Replace equipment operation



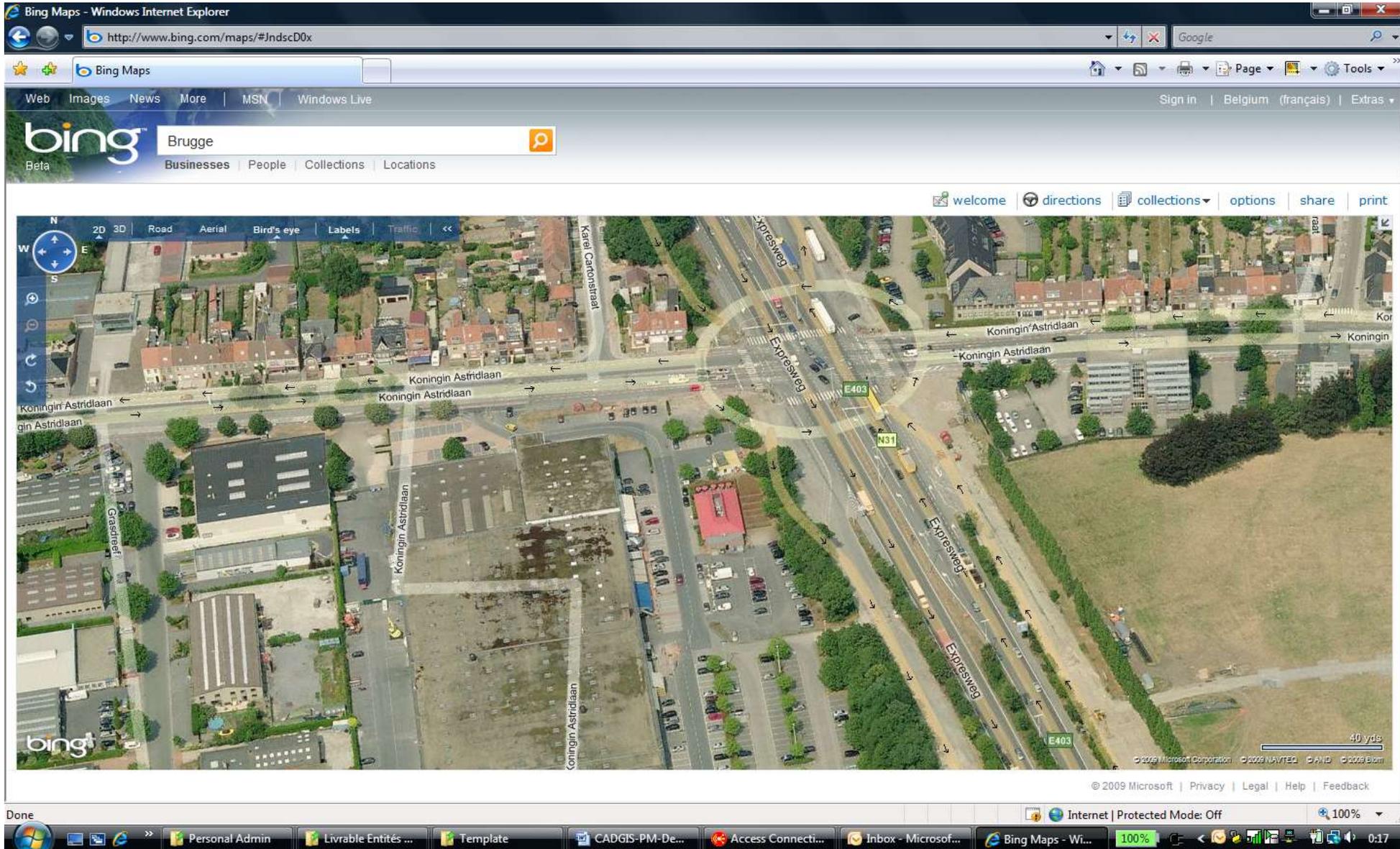
An electric distribution system - breakdown



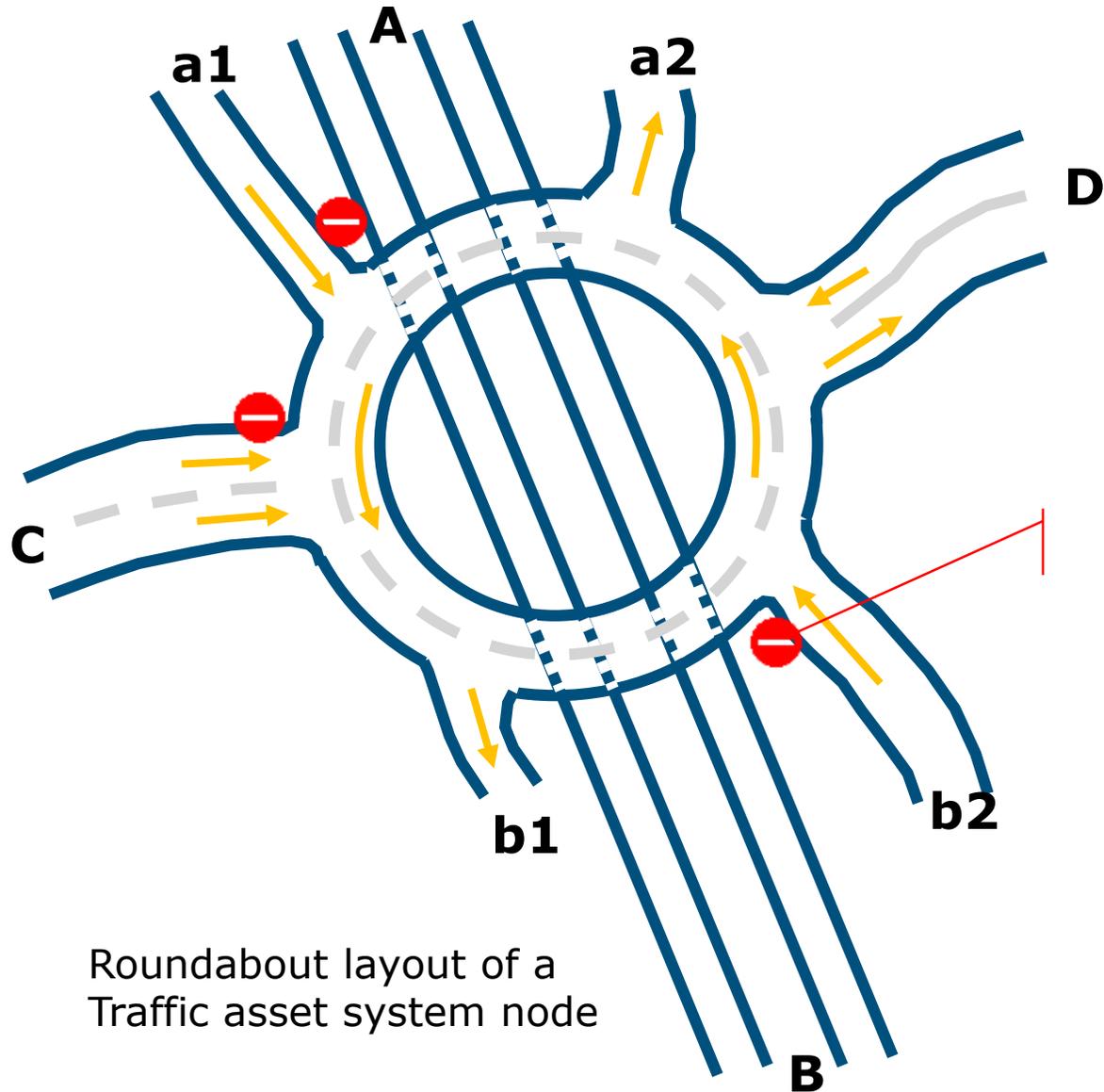
Example MV Electric network – LV connections



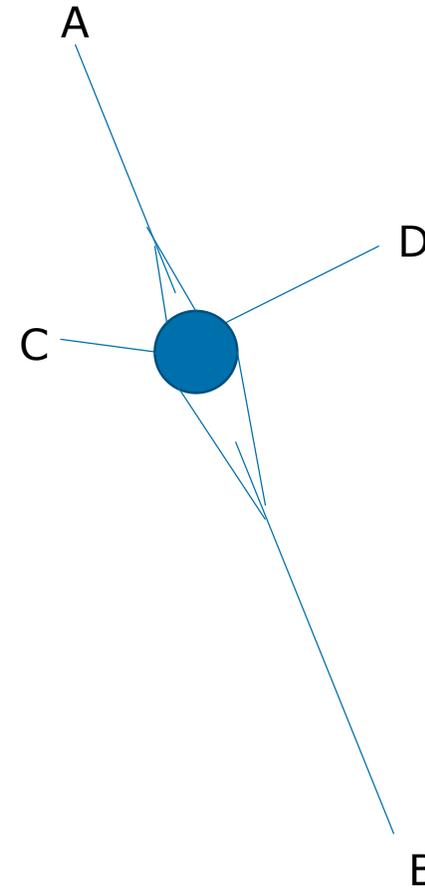
Adapting a traffic node in a roads network



Decomposition of a node in a traffic system

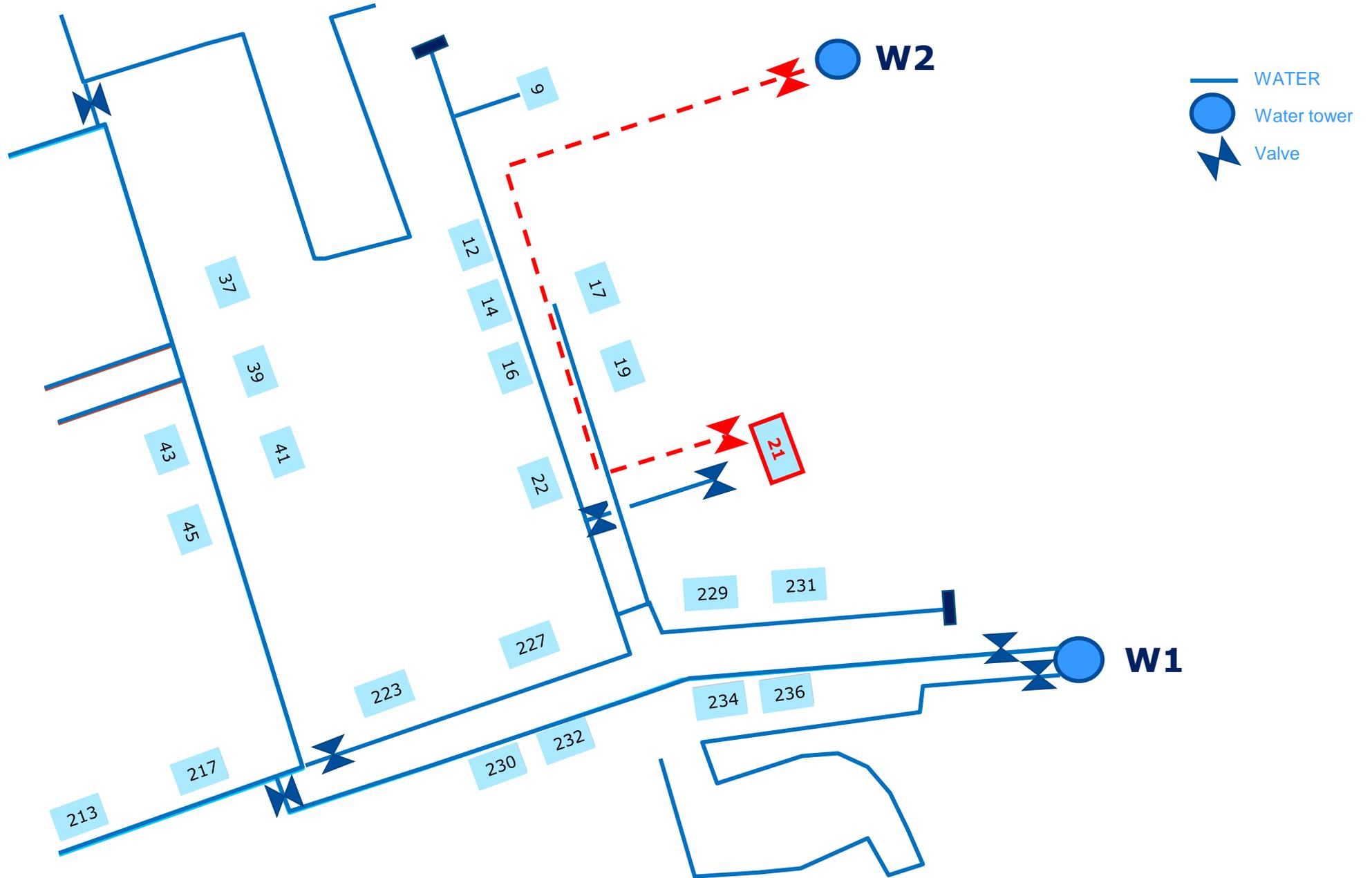


Roundabout layout of a Traffic asset system node



Network model of the Traffic asset system

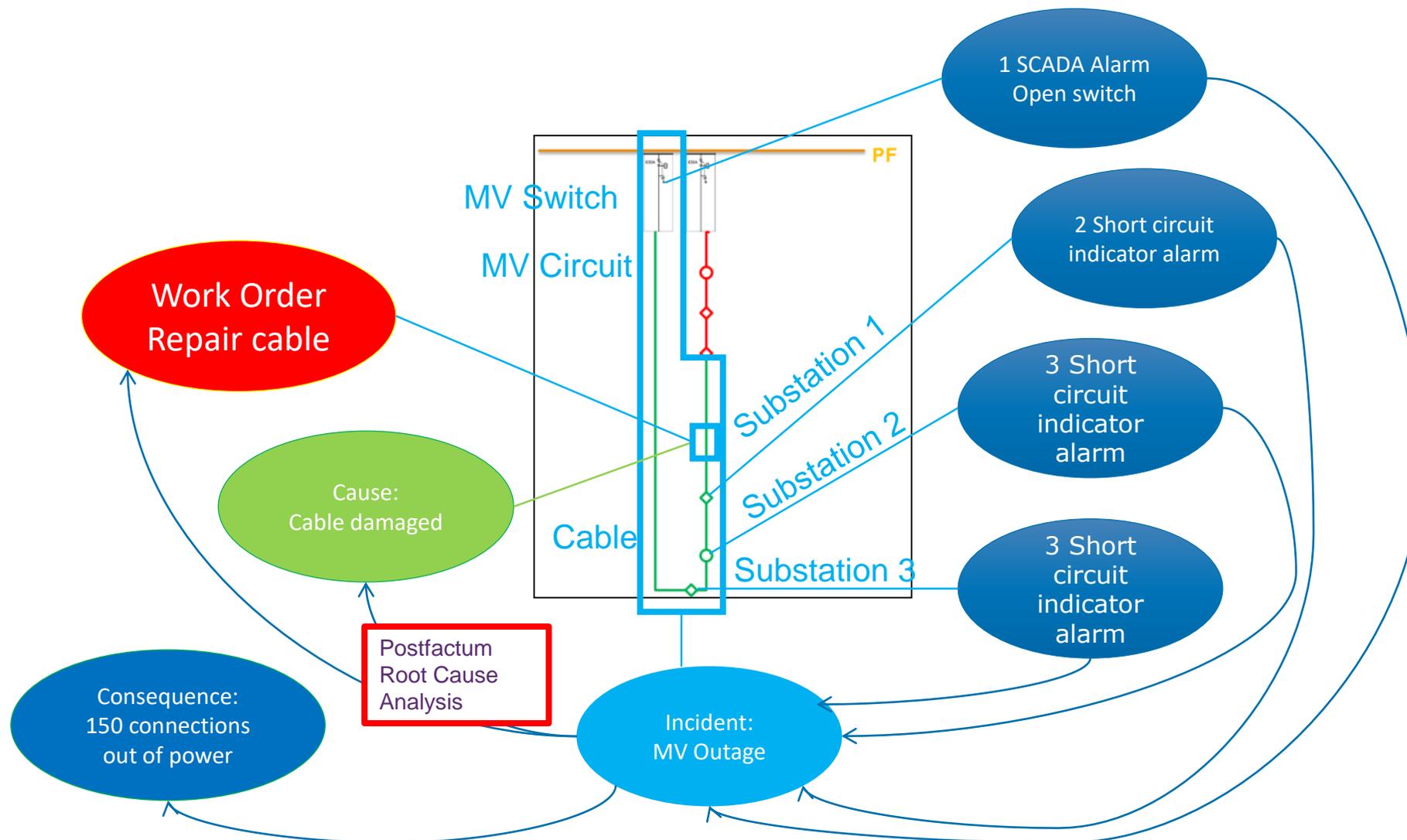
Asset Investment in a water distribution system



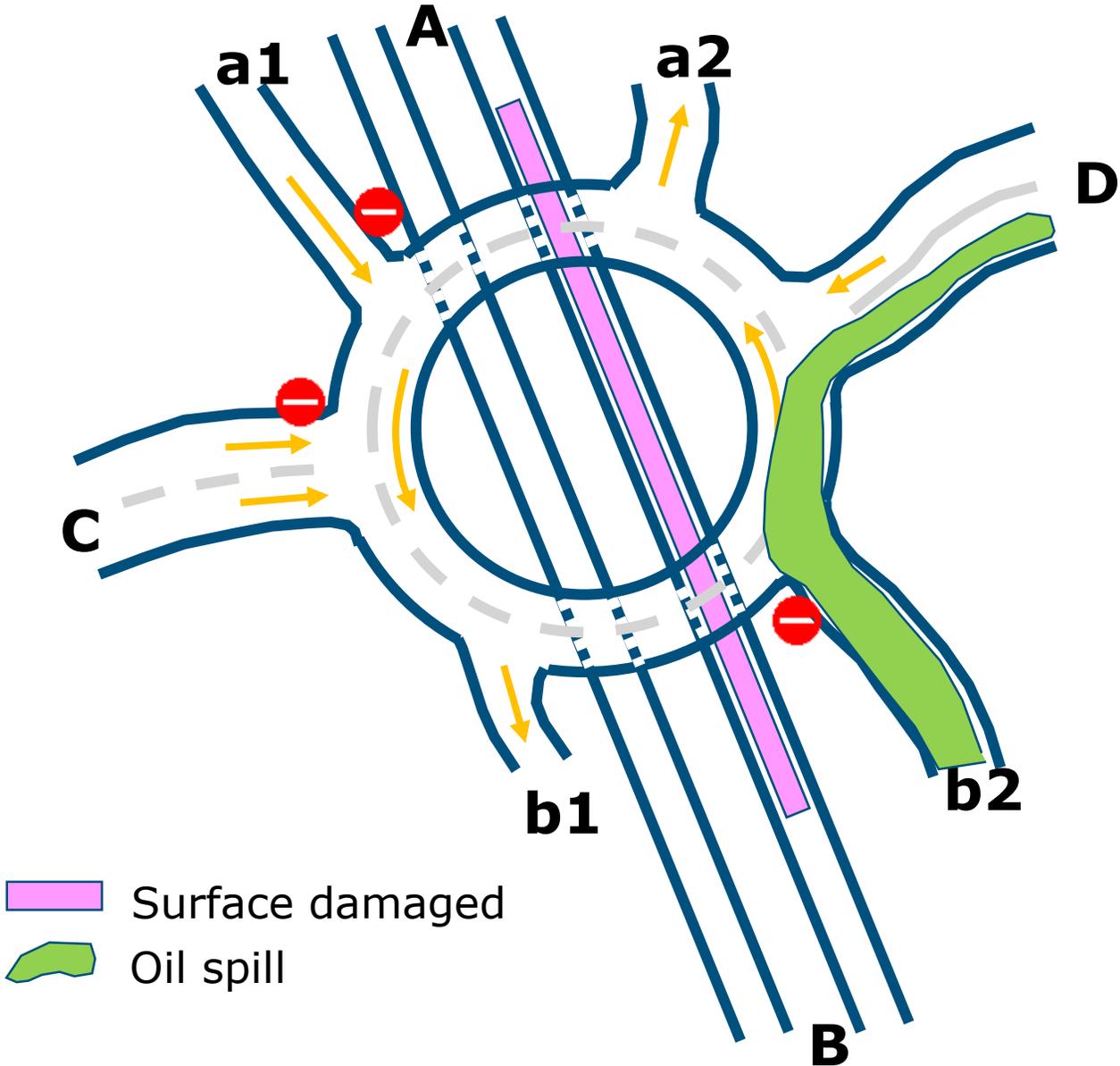


Operation events against network assets on a MV grid

Example ADMS, MV Incident workflow



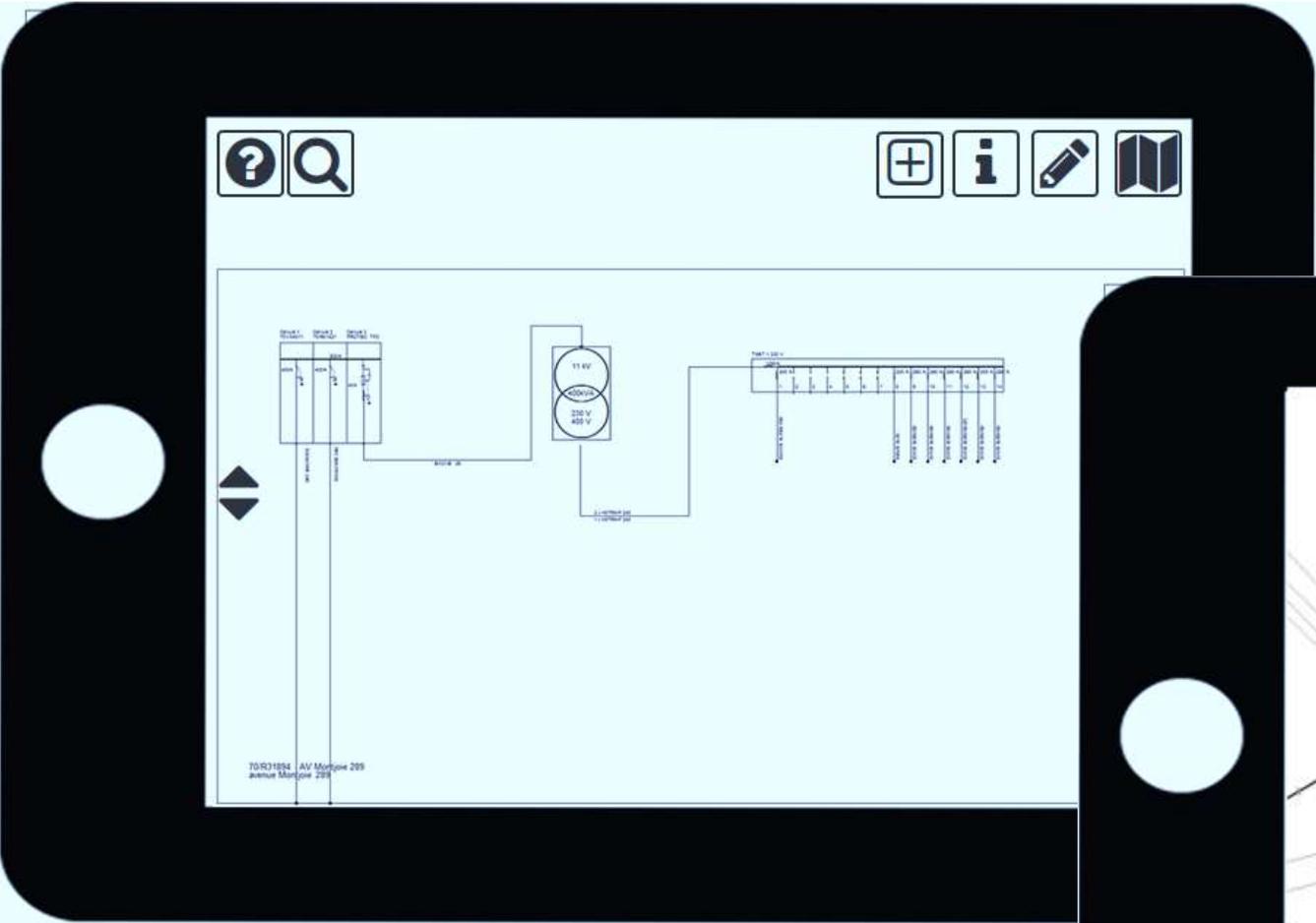
Mapping events on a traffic system



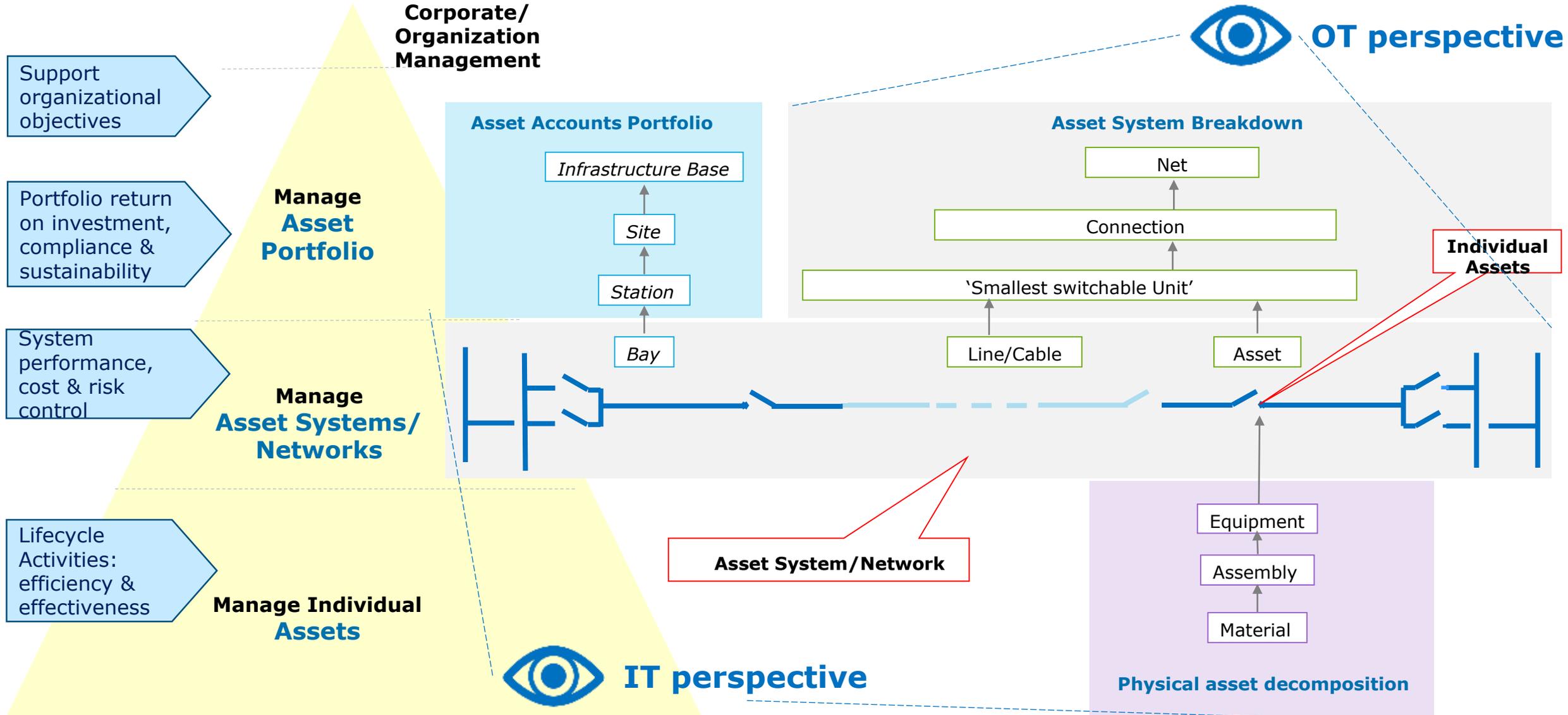
Field workers need good maps or diagrams



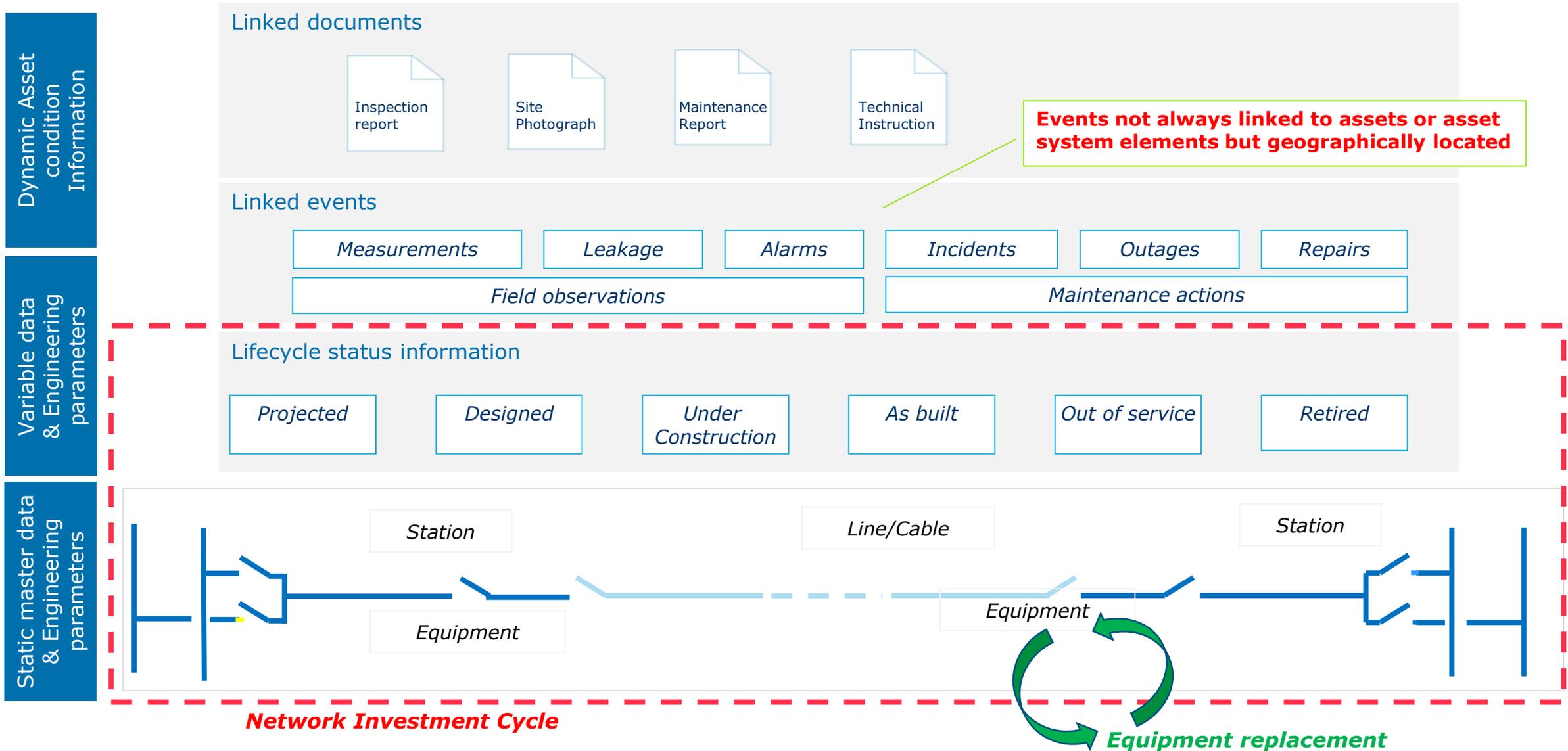
... to pinpoint exactly where to register any event



The "asset system" level that delivers the value from assets, consists of virtual objects



Asset condition is documented as a combination of intrinsic asset information with 'event' data, linked to the right digital twin



Asset and asset system lifecycle perspective



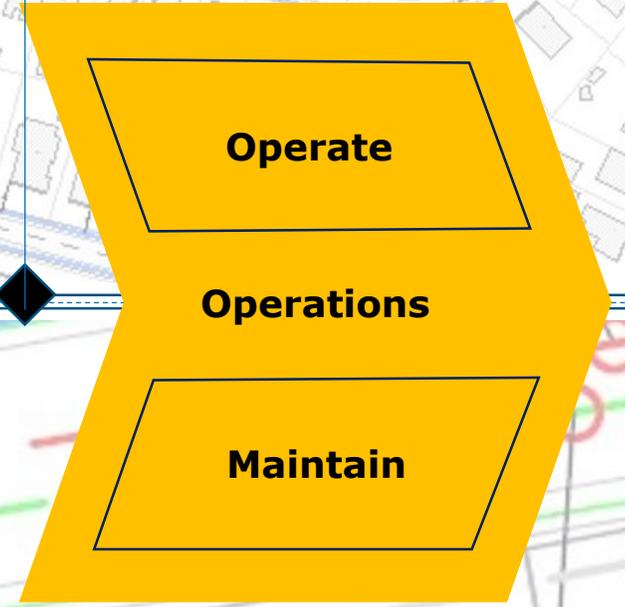
You design and operate asset systems

Asset System



Network model
(asset system digital twin)
established

(De)commissioned



You build and maintain assets

Assets



asset digital twin
established

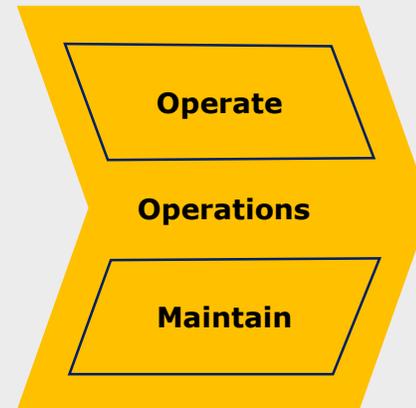
As designed
(asset system)

As built
(assets/equipments)



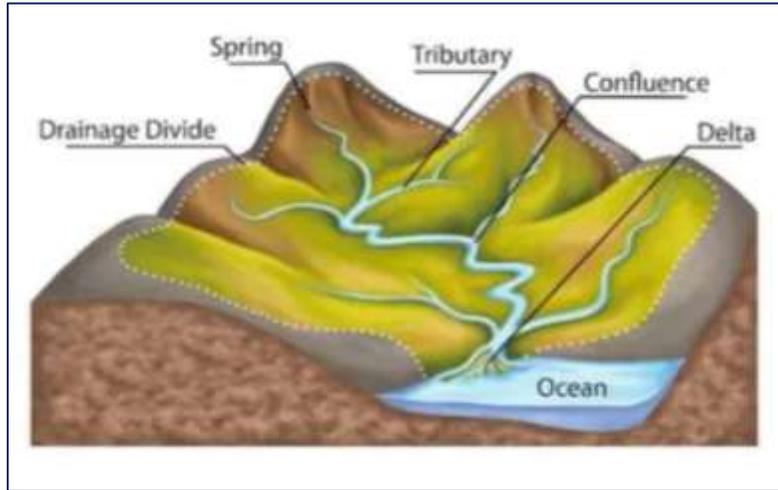
The Digital Twin should

- Represent functional entities of asset systems as engineered systems that together deliver service and value, with their associated system lifecycles (construction, commissioning and decommissioning)
- Track operational statuses and condition of functional entities of asset systems in (near-) real time and preserve historical behaviour of these entities
- Allow for simulations against system components both in the operational state and in the engineering/design state of asset systems



- Represent the digital equivalent of physical equipment with technical characteristics, financial and logistic lifecycles
- Enable containment of physical assets in other physical assets, and lifecycles of the containers as a whole in a physical, financial and logistic sense
- Allow for simulations against physical equipment (reliability, fault tolerance testing, predictive maintenance, ...)

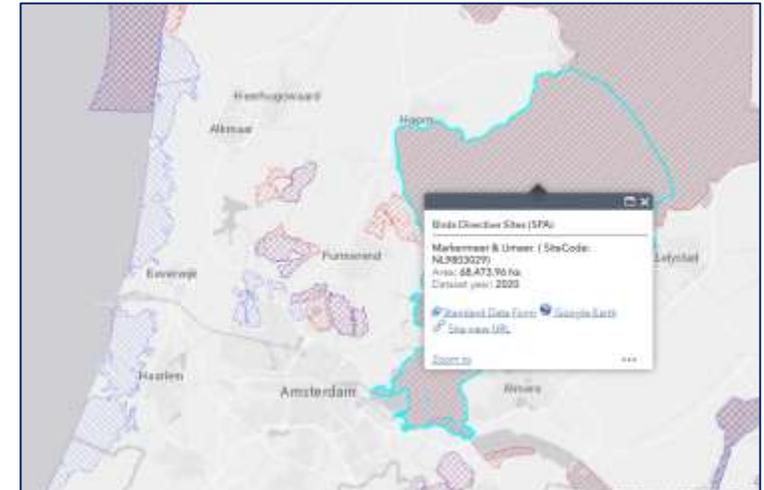
Geospatialists are used to 'think system'



Hydrographic system



Transportation system



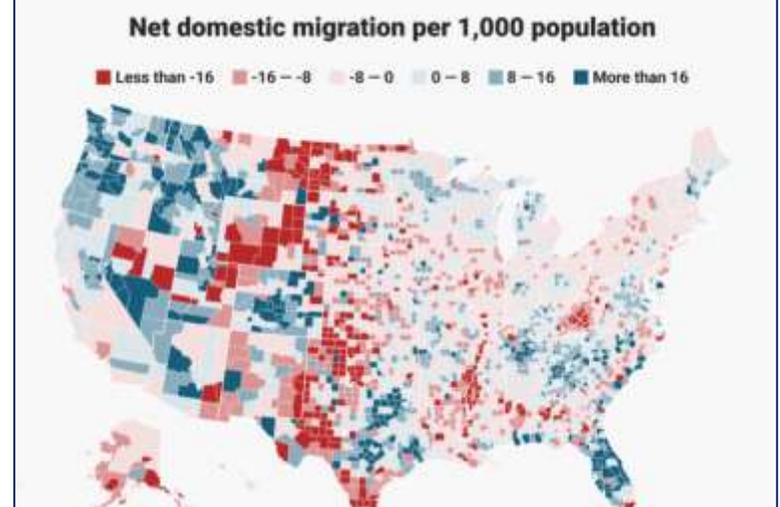
Eco system



Pipeline system



Cadastral system



Demographic system

We geospatialists should help AEC communities set up digital twins for complex realities

Further reading



Capgemini Technovision

2018 'Twin worlds'



“The key is to constantly take a **virtual world perspective**: how do consumers, corporations, and products behave digitally, and how is this translated into the next-generation digital IT landscape?”

2021 'Simply the Edge'



“ ‘Digital twins’ pop up in all major industries, but more notably in manufacturing and utilities, where **operational technology (OT) and information technology (IT) merge.**”

Further reading

on this specific subject

Capgemini

What is an asset system for a network company?



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What's so spatial about asset systems?



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Smart grid or silly tube maps?



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Wearables, whereabouts and roundabouts



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What's so special about asset systems?



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What happens on the asset system, stays on the asset system



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ENERGY, UTILITIES & CHEMICALS

Jan Van de Steen

Expert in Energy, Utilities & Chemicals

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Expert in GIS and linear asset management I advise network operators and other large infrastructure companies in setting up intelligent asset information management structures aligned with network lifecycle and asset lifecycle. On their journey from document-centric to data-centric digital asset management, I help clients articulate their integrated enterprise GIS (Geographic Information System) strategy. My GIS-centric view on Enterprise Asset Management (EAM) enables clients to increase asset lifetime while remaining compliant with regulations and managing risks. Apart from transformational advice, I also play a key role in successful GIS and asset management implementation programmes for large utilities and public infrastructure operators.





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