Digital Twins
Applied to network asset lifecycle management
21/10/2021 | Jan Van de Steen
“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

Transfo cell ID=80001

LV Board= ID=12345

LV

2 physical equipments for one functional LV switching unit!

Replace equipment operation

230 V
An electric distribution system - breakdown

Example MV Electric network – LV connections

Substation ID = 110001

MV Switching = ID=80001

LV Board = ID=12345

1 highlighted substation
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

Sign 1234
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

Surface damaged
Oil spill
Field workers need good maps or diagrams ....

... to pinpoint exactly where to register any event
Asset managers then get a view on asset condition – regardless of underlying ‘digital twin’
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.

Linked documents:
- Inspection report
- Site photograph
- Maintenance report
- Technical instruction

Linked events:
- Measurements
- Leakage
- Alarms
- Incidents
- Outages
- Repairs
- Field observations
- Maintenance actions

Lifecycle status information:
- Projected
- Designed
- Under construction
- As built
- Out of service
- Retired

Events not always linked to assets or asset system elements but geographically located.

Network Investment Cycle:
- Equipment replacement
- Equipment
- Line/Cable
- Station
- Equipment
- Station
- Equipment
- Station
- Equipment
You design and operate asset systems

Asset System
- Study
- Asset System Design
- Network model (asset system digital twin) established

You build and maintain assets

Assets
- Engineering
- Build
- asset digital twin established

As designed (asset system)
As built (assets/equipments)

(De)commissioned

Operate
Operations
Maintain
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, ...)

![Diagram](image-url)
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
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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