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GEOSPATIAL WORLD FORUM

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Flexible digital twins and their geospatial footprint

Utilities Summit 2024

JAN VAN DE STEEN, 15/05/2024





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

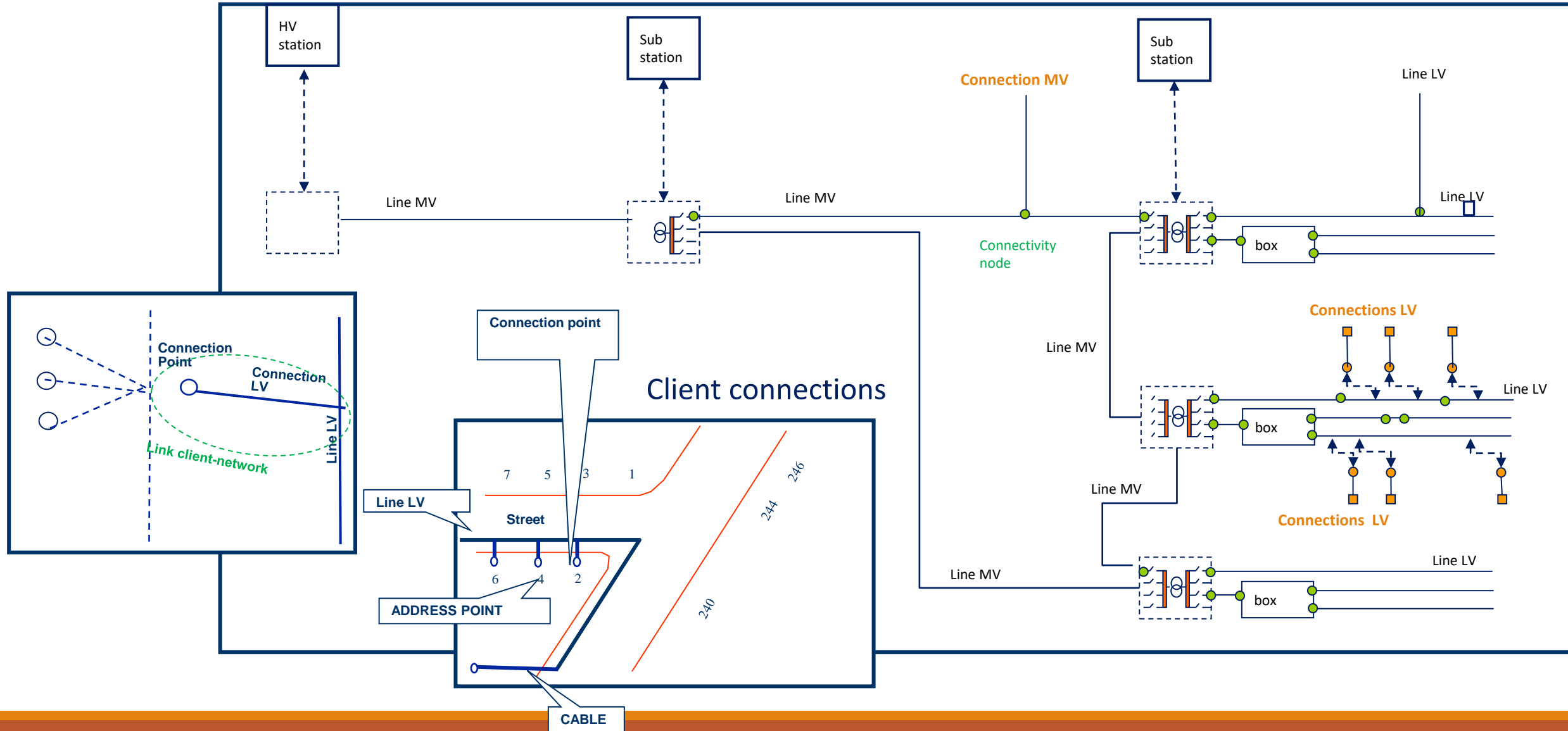


1976

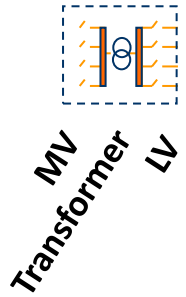


2020

An Electric Distribution System



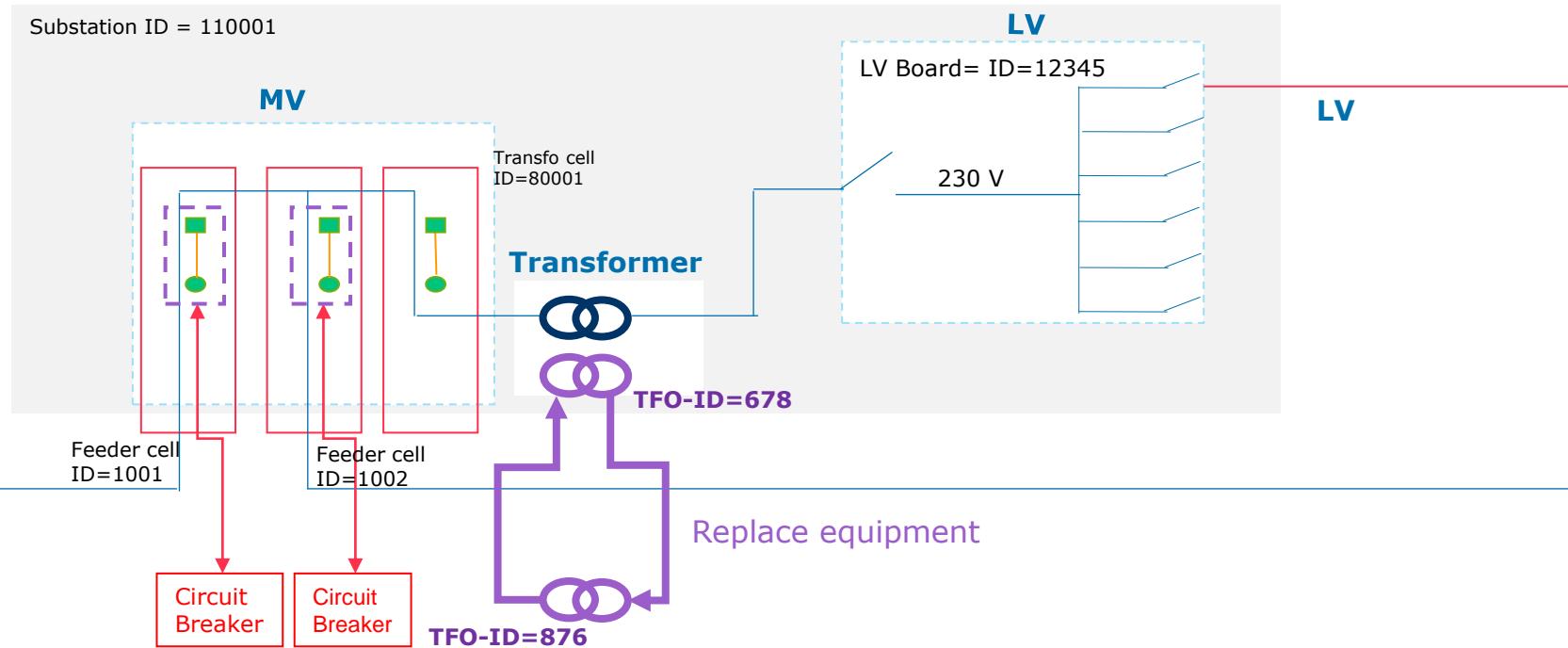
Replace transformer in a typical substation



Substation

Substation ID = 110001

Transformer



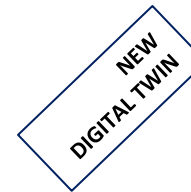
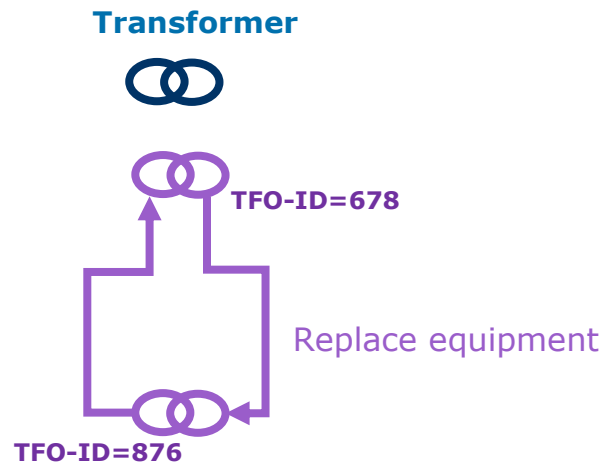
Digital twin geospatial footprint

Transformer Equipment digital twin

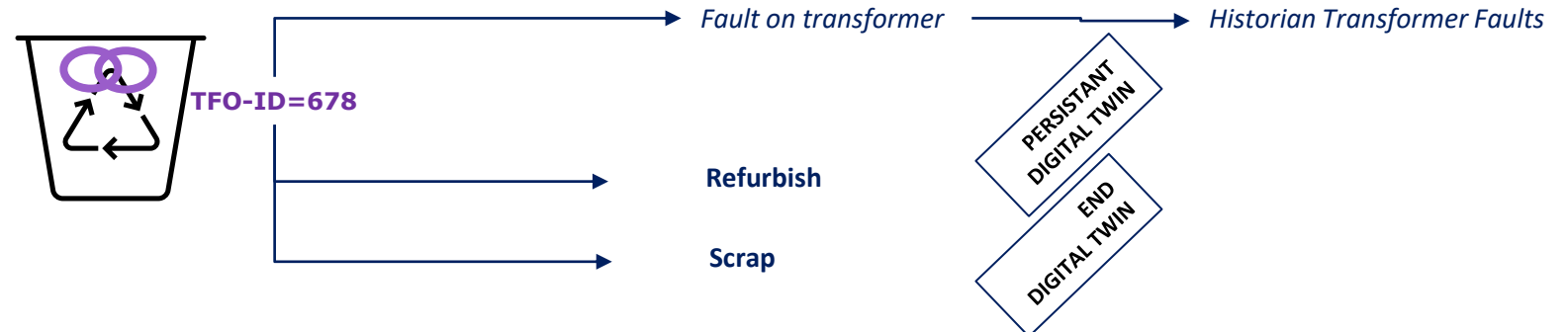
- is physical!
- inherits a spatial footprint
- is determined by logistics
- changes through maintenance even if electrical circuit does not change

Transformer digital twin

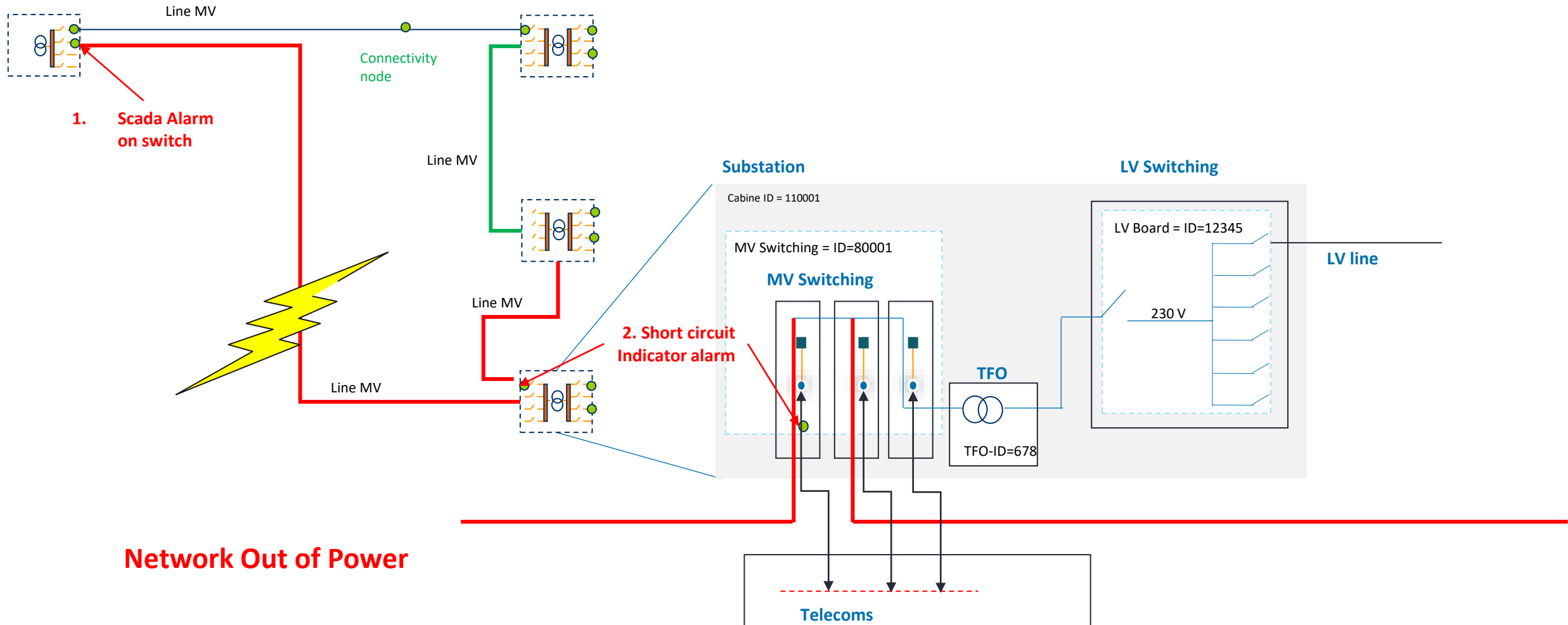
- is virtual!
- has a spatial footprint
- relies on physical equipment
- is defined by electrical design
- determines electrical characteristics capacity, in- and out-voltages, ...



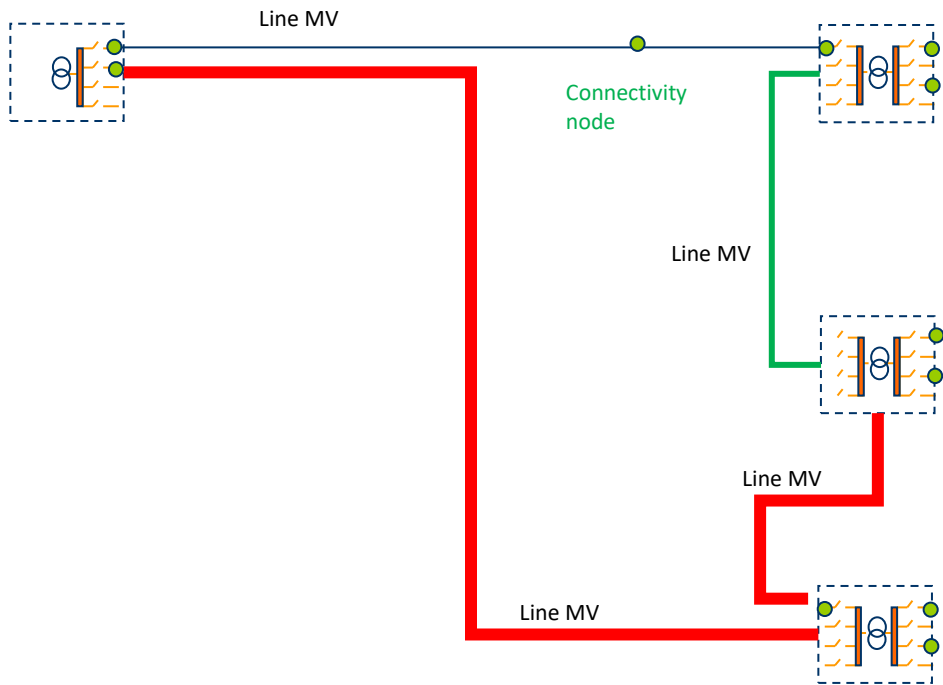
Transformer



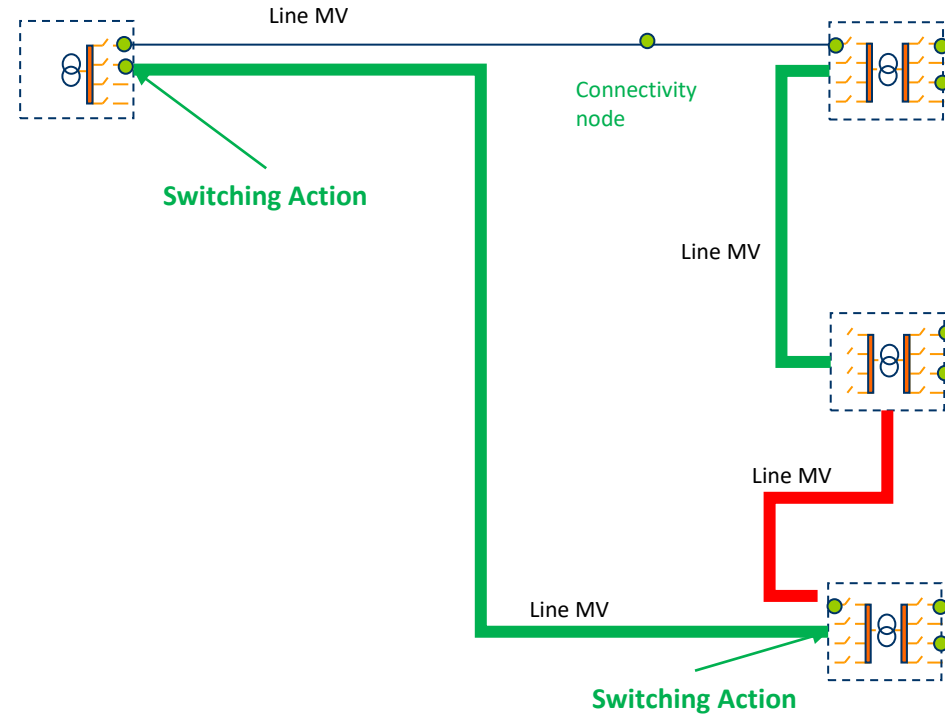
An Incident on the MV network



An Incident – partial restore service

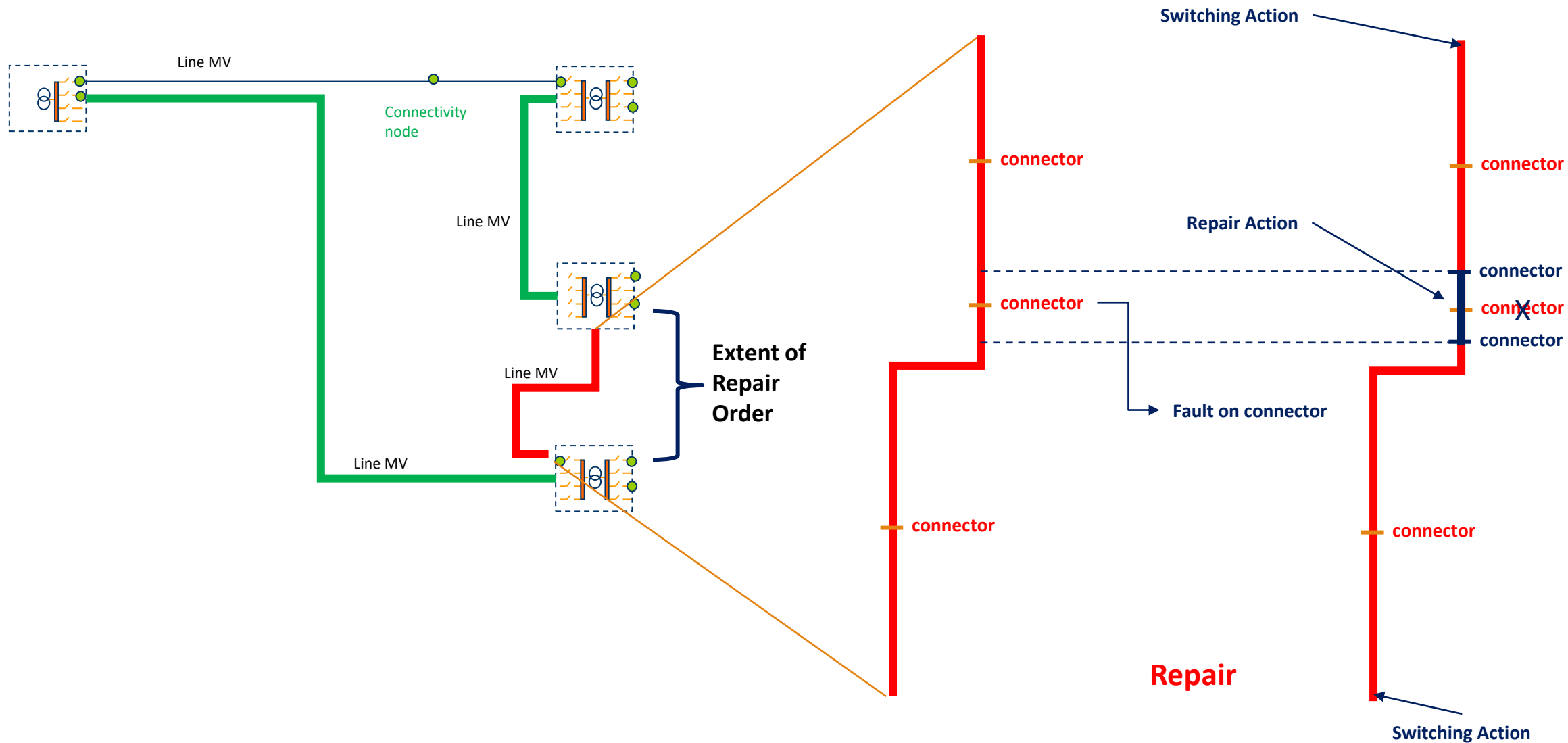


Network Out of Power

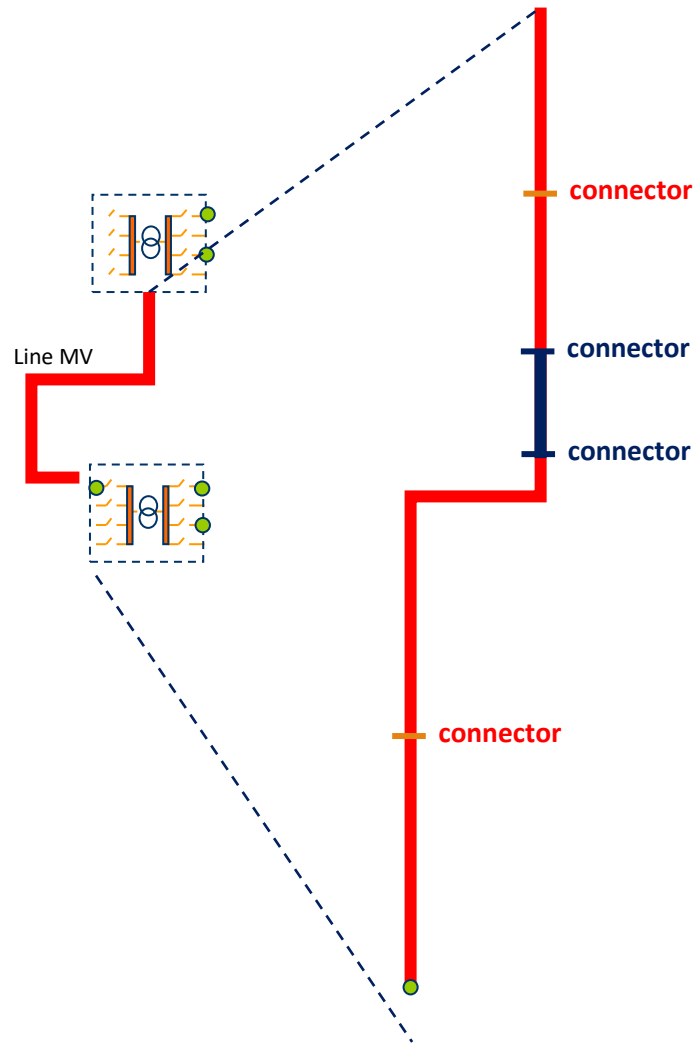


Partial Restore

An Incident – repair and restore service



Digital twin geospatial footprint



Equipment digital twin

- is physical!
- has or inherits a spatial footprint
- is determined by logistics
- changes through maintenance even if circuit does not change

Switchable circuit digital twin

- is virtual!
- has a spatial footprint
- relies on physical equipment
- is defined by electrical design
- determines service KPIs like Power Quality, Customer Minutes Lost, ...

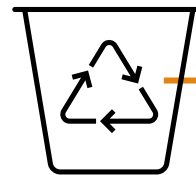
● Short circuit indicator: unchanged

— Connector : 2 unchanged

— Cable: 2 changed

— Repair Cable: 1 new

— Connector: 2 new

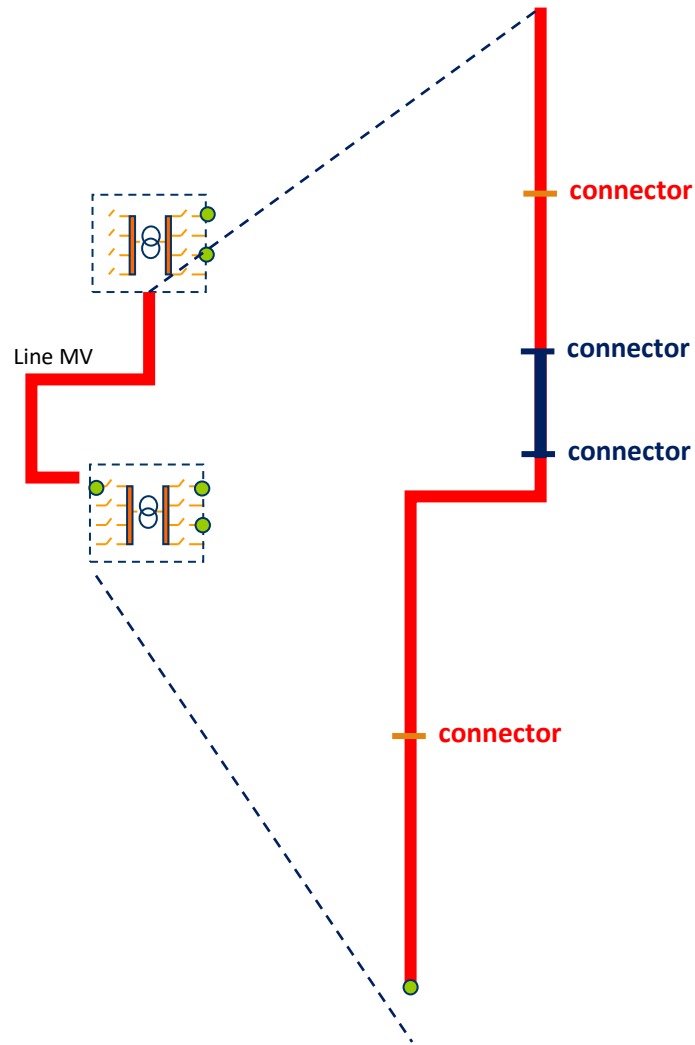


— connector

Fault on connector

Historian Connector Faults

Digital twin geospatial footprint



Equipment digital twin

- is physical!
- has or inherits a spatial footprint
- is determined by logistics
- changes through maintenance even if circuit does not change

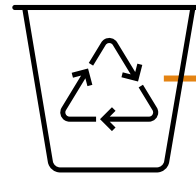
● Short circuit indicator: unchanged

— Connector : 2 unchanged

— Cable: 2 changed

— Repair Cable: 1 new

— Connector: 2 new



— connector

PERSISTANT DIGITAL TWIN

NEW DIGITAL TWIN

END OF DIGITAL TWIN

Switchearable circuit digital twin

- is virtual!
- has a spatial footprint
- relies on physical equipment
- is defined by electrical design
- determines service KPIs like Power Quality, Customer Minutes Lost, ...

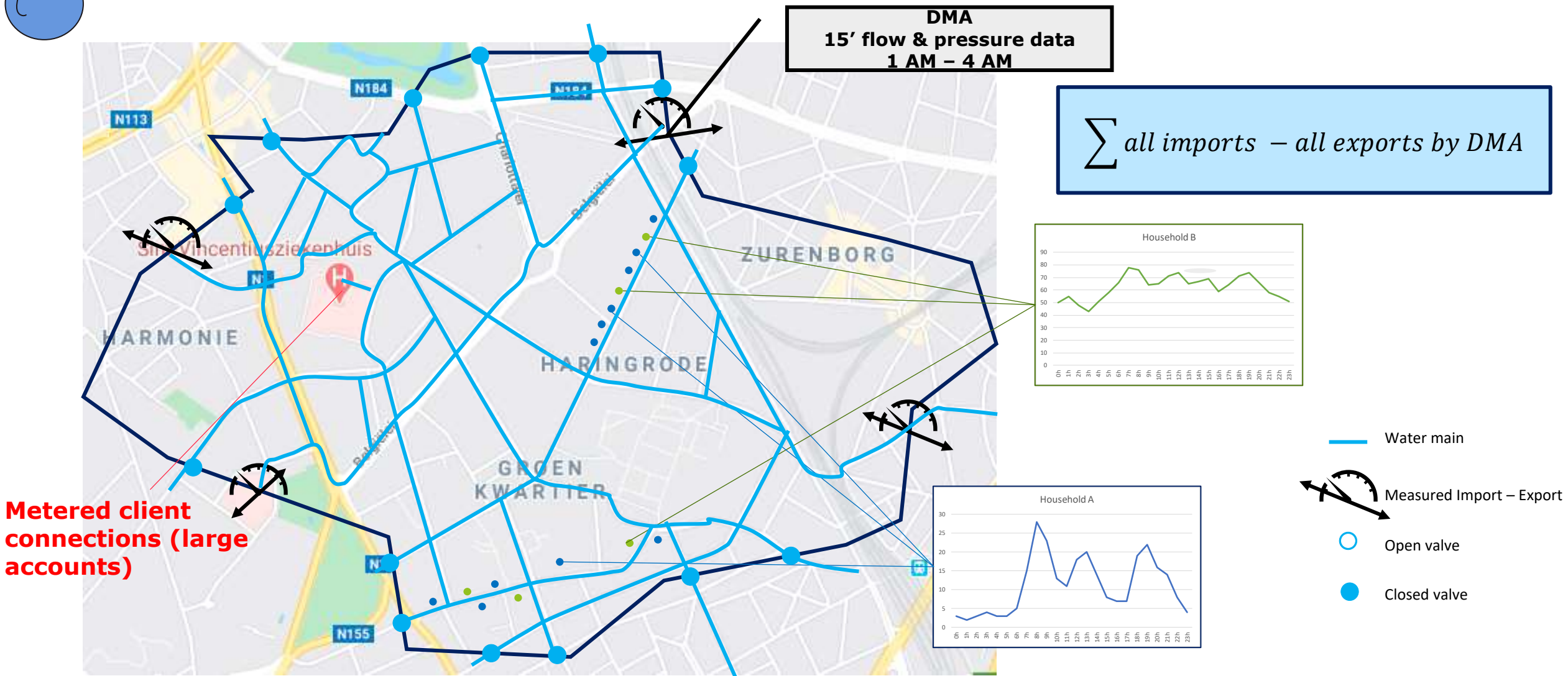
PERSISTANT DIGITAL TWIN

Fault on connector

Historian Connector Faults

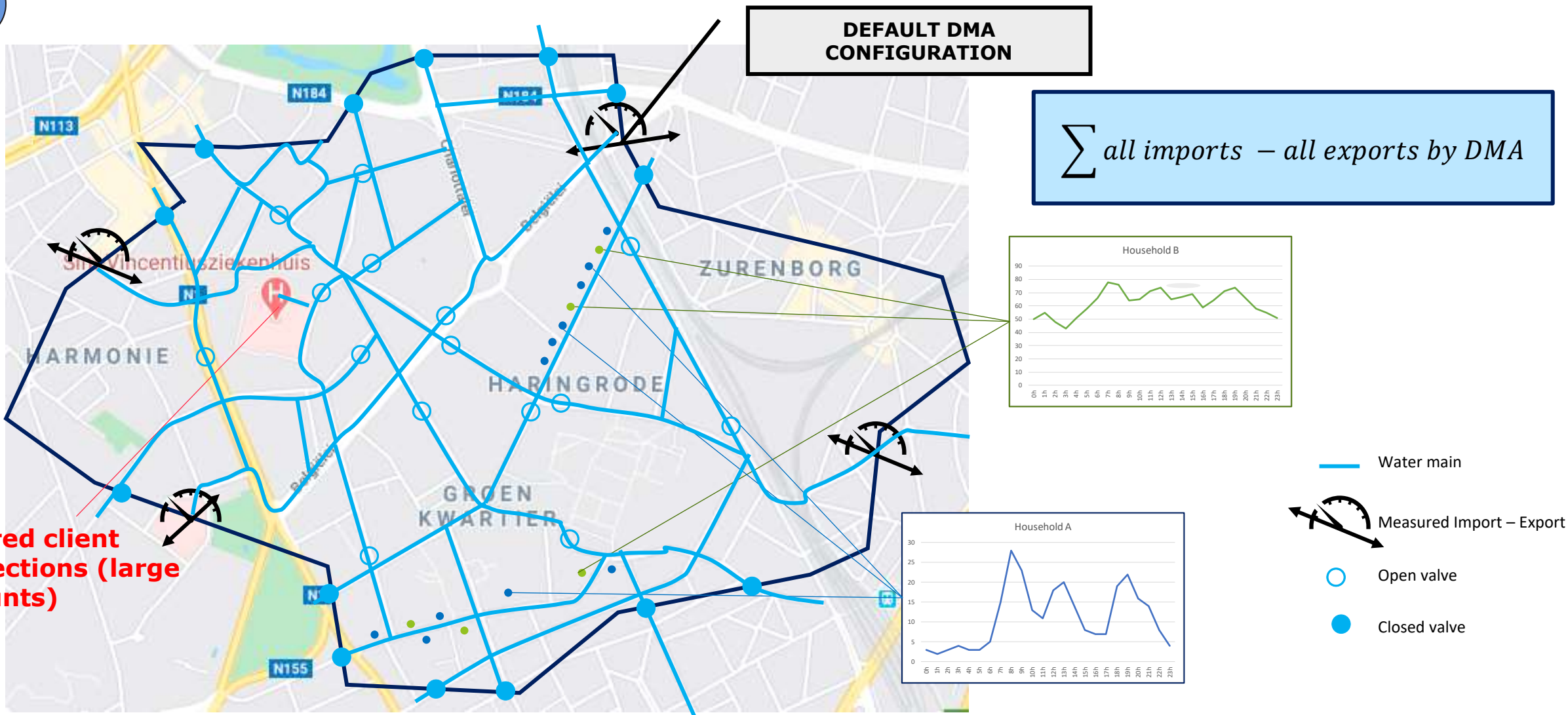


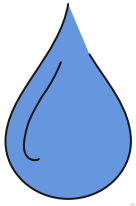
Water losses in a water distribution network



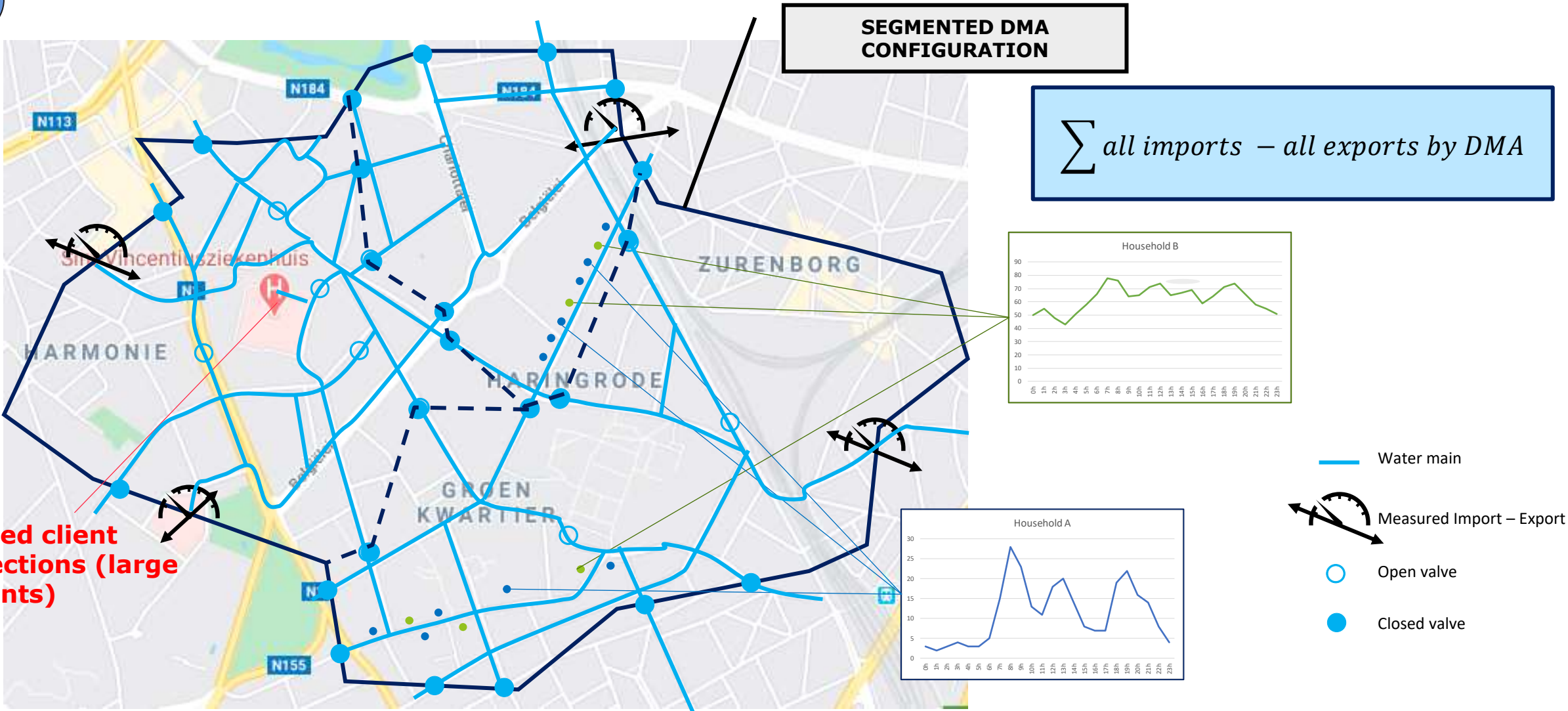


Water losses in a water distribution network

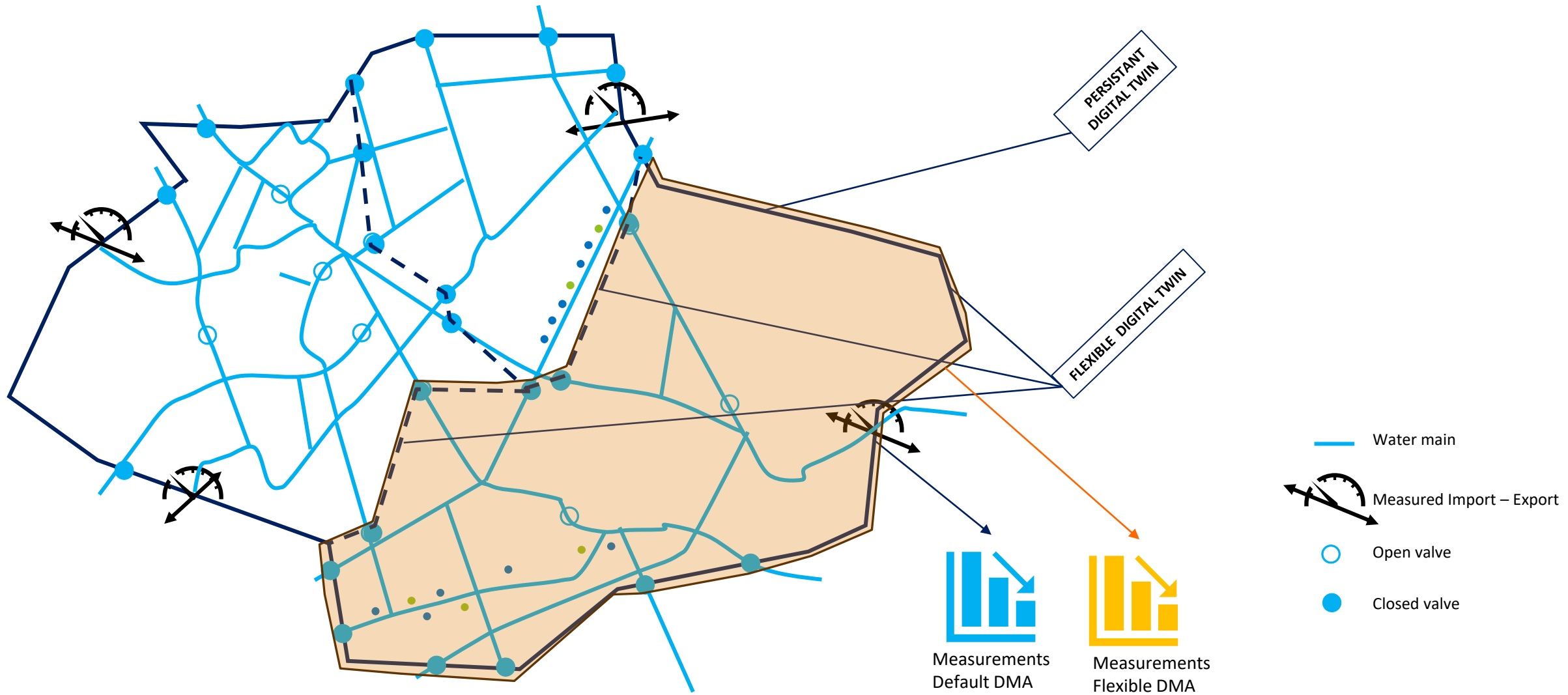




Leak detection from flow data



Digital Twin geospatial footprint



Conclusion

System Thinking

- Electrical or Hydraulical 'features' are part of an ASSET SYSTEM
- The features are spatially defined by LOCATION and by CONNECTIVITY

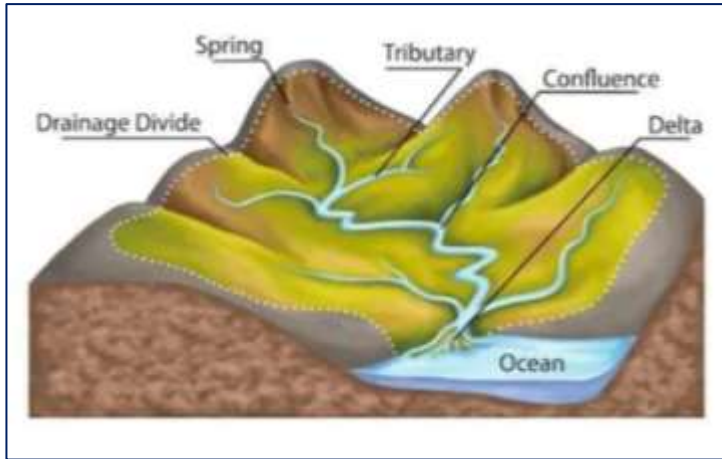
Digital Twin

- There are 2 levels of digital twin to be considered
- The electrical / hydraulical features with their role in the asset system – determined by design
- The equipment fulfilling a role in the asset system – determined by construction

Flexible System Twin

- 'Event data' (SCADA / IoT) is collected in the network
- It is important to understand what subnetwork the recorded events relate to
- Since the network changes through switching and other operations, the recorded event data should be linked to the right network status and context (that change over time)

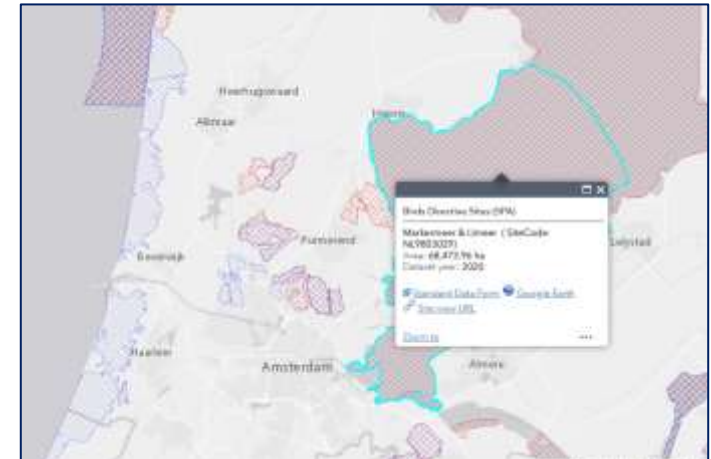
Geospatialists are used to 'think system'



Hydrographic system



Transportation system



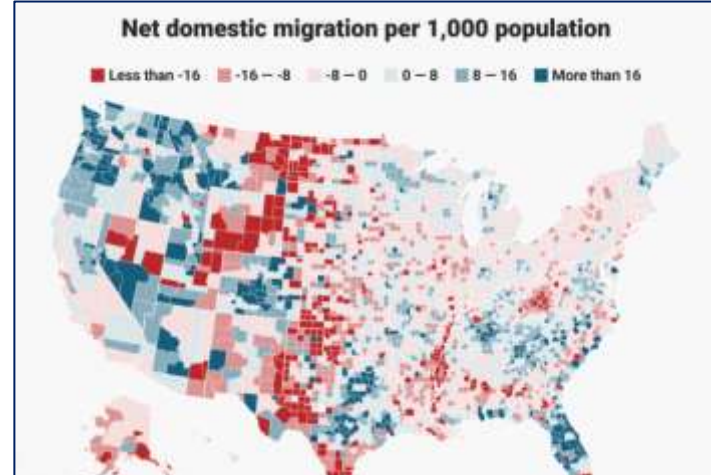
Eco system



Pipeline system



Cadastral system



Demographic system



Contact



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Further reading

Capgemini

What is an **asset system** for a **network company**?



Jan Van de Steen
Senior Manager GIS & Asset Management
Capgemini Belgium

Capgemini

What's so **spatial** about **asset systems**?



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Senior Manager GIS & Asset Management
Capgemini Belgium

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Smart grid or **silly tube** maps?



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Senior Manager GIS & Asset Management
Capgemini Belgium

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Wearables, whereabouts and **roundabouts**



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Senior Manager GIS & Asset Management
Capgemini Belgium

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What's so special about **asset systems**?



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Senior Manager GIS & Asset Management
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What happens on the **asset system**, stays on the **asset system**



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