

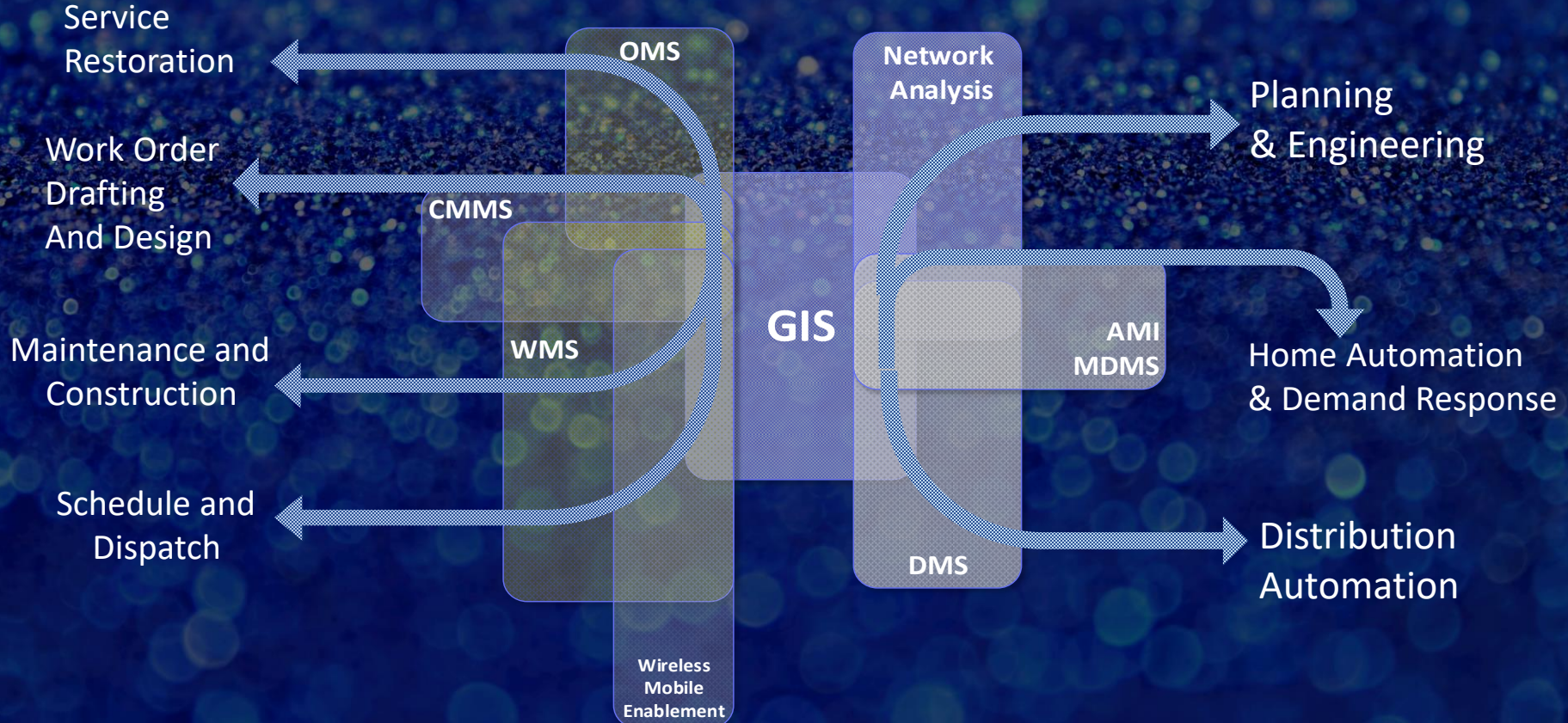


Using GIS in Smart Grid CIM Data Exchange

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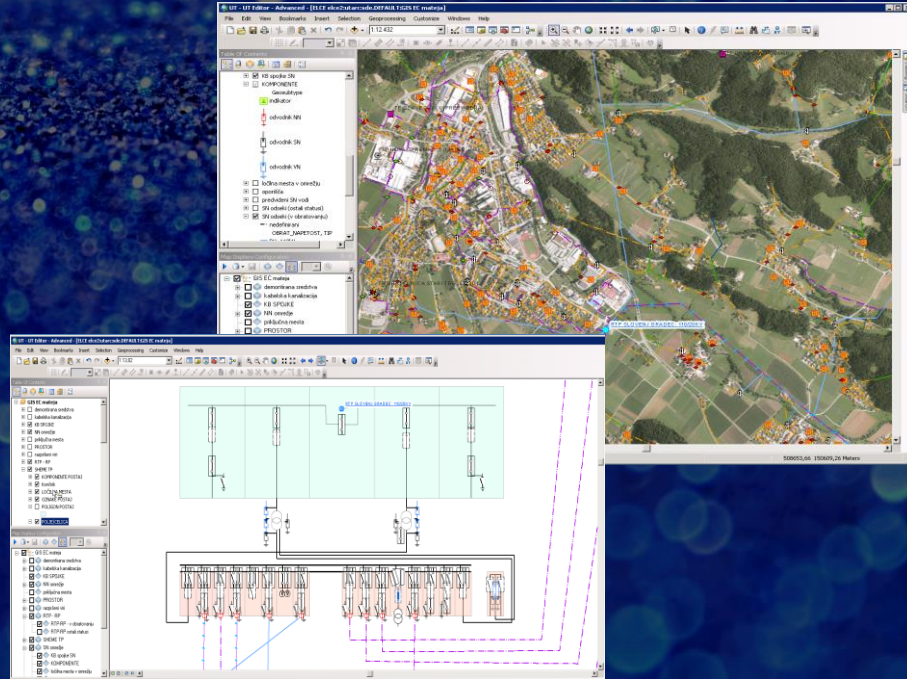
GIS



* from Identification of GIS Data Dependencies, An Intelligrid Report 3002001042, EPRI

Modelling electric grid in GIS

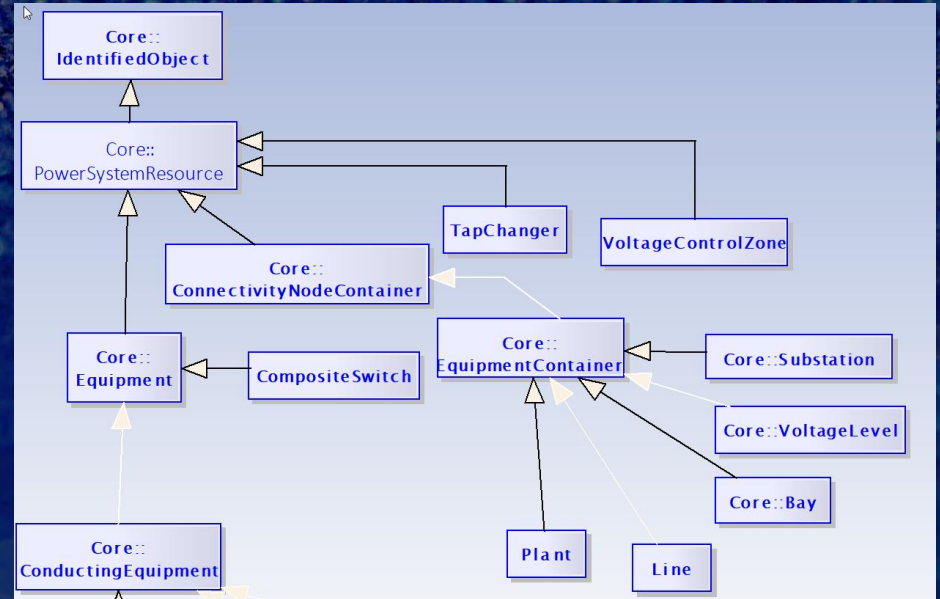
- Survey data (CAD)
- GIS System of Records
 - Asset Management
- Electrical topology





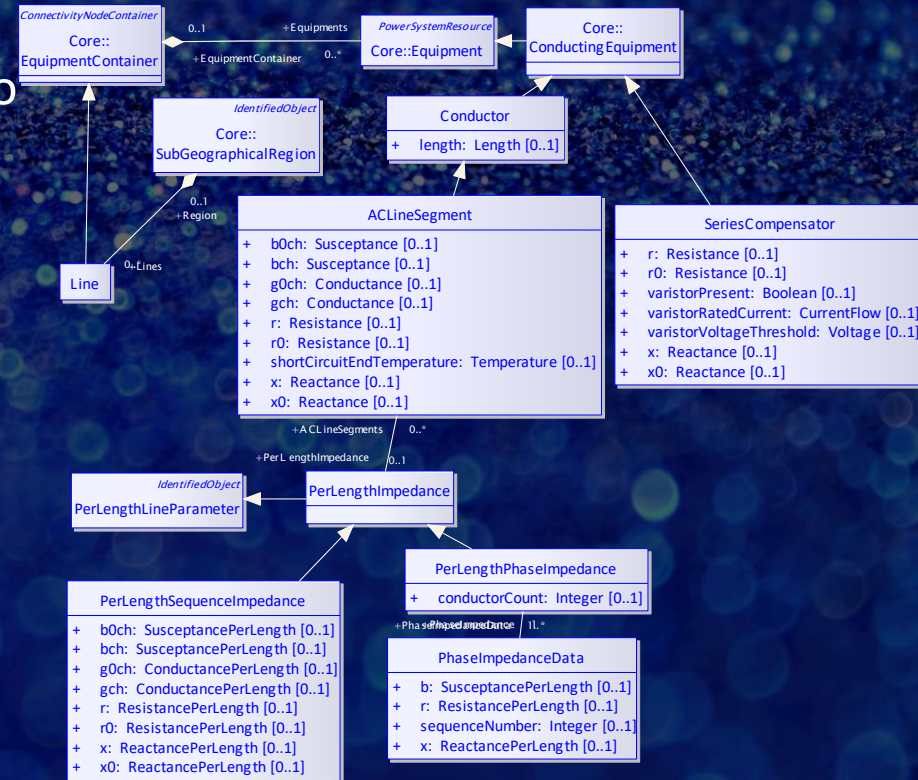
CIM Standard

- Allow SW to exchange information about an electrical power system model
- Developed by the electrical power industry, adopted by IEC
- UML Model is used to describe the standard



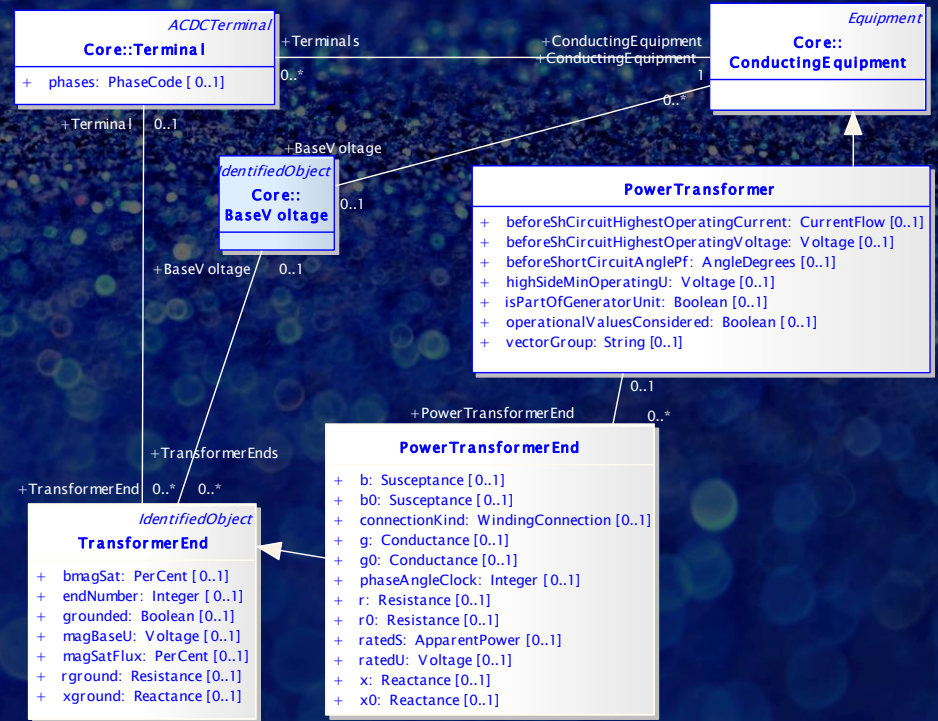
Modeling electrical grid in CIM

- Provides flexibility
- Main CIM standards in focus for GIS to CIM adapter, From IEC61970 and IEC 61968 families:
 - IEC61970-301 - Common information model (CIM) base
 - IEC 61970-552 - CIM XML Model Exchange Format
 - IEC 61970-501 - CIM Resource Description Framework (CIM RDF) Schema
 - IEC 61968-100 - System interfaces for distribution management - implementation profiles, interfaces



Modeling electrical grid in CIM

- Flexibility is constrained by profiles defining detailed data exchange between particular systems in accordance to an use case specification.
- Schemes can be derived from profiles (e.g. XSD for XML).



„GIS CIM adapter“

- Why GIS as a master system for so many of major CIM Network Model object?
 - Workflow / business process → data are entered first (planning)
 - Data visualization → readable more easily by different users
 - Data shared easily → attributes management shared/secured among groups = quality improved
 - Most systems require/utilize geography more or less at some point
- Vision and challenge
 - Test ArcGIS model through customer projects
 - Configurable and flexible GIS CIM adapter

GIS CIM adapter

Project case:

Distribution company 131.000 pts.

Operating variety: Urban Coastal & Alpine regions

Full export of network data into CIM –
file based / per feeder provisioned early
and taken into account at database
model design

Target: Configurable CIM profiles

Features:

- Topology Recalculation
 - UT for ArcGIS → CIM XML file
- Configurable Mapping of GIS Objects into CIM Objects



GIS CIM adapter

Project case (on going)

Distribution Comp. appx. 89.000 pts.

Quality Awarded Company with long term IT strategy:

GIS to provide high quality data for DMS.

Existing status

- CIM and ESB implementation.

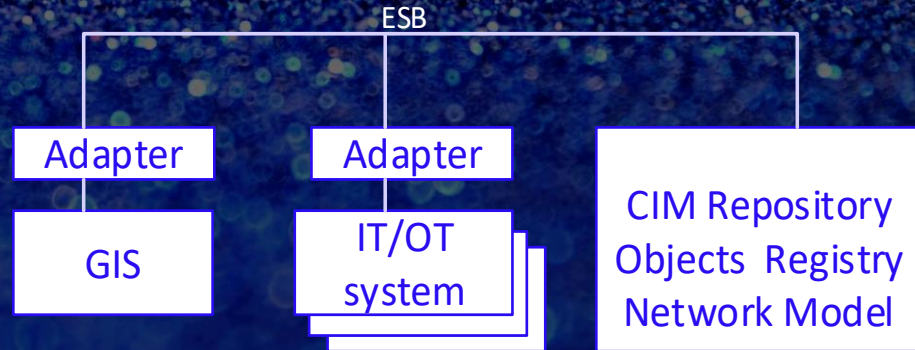
GIS CIM Adapter Implementation

Full export into CIM (file, ESB)

Usage of existing CIM Repository

Incremental export into CIM (file, ESB)

Integration of CIM data into GIS



GIS CIM adapter

Project case

NEDO Project :

Japanese / Slovenian government joint investment in advanced network functionalities

- demand side management
- advanced voltage regulation
- faults localization/isolation

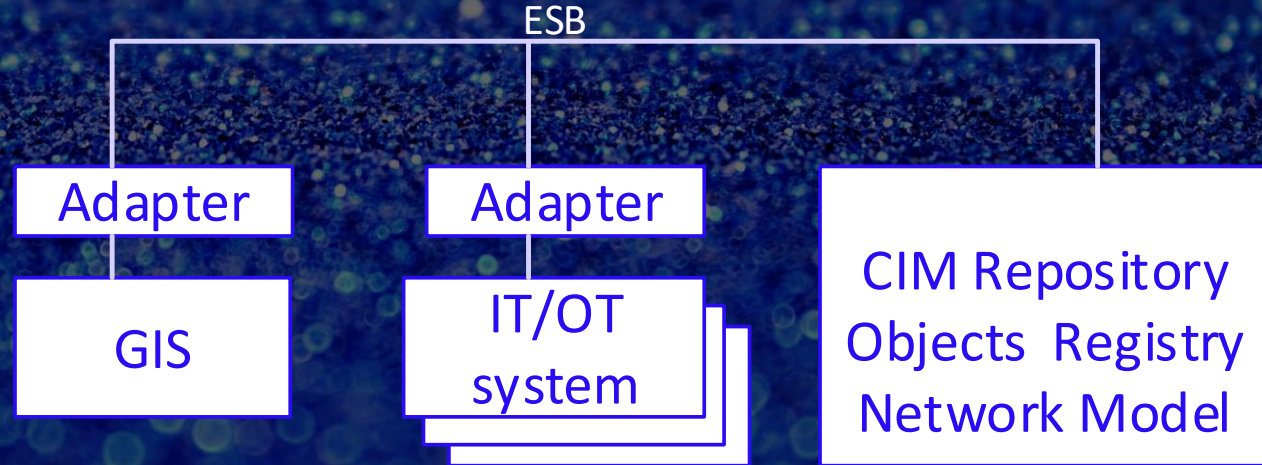
Unique in Europe in terms of stakeholders:

- transmission, distribution, R&D institution, consumers (dynamic tariff.), solution providers (smart devices, IT etc.)

GIS CIM adapter

NEDO Implementation site:

Distribution company appx. 180.000 pts.



Full export of network data into CIM.

Usage of CIM repository (vendor Iskratel)

Incremental network data export into CIM

Interaction of switches status from iDMS / SCADA

Other system: Advanced DMS, MDMS

GIS CIM adapter

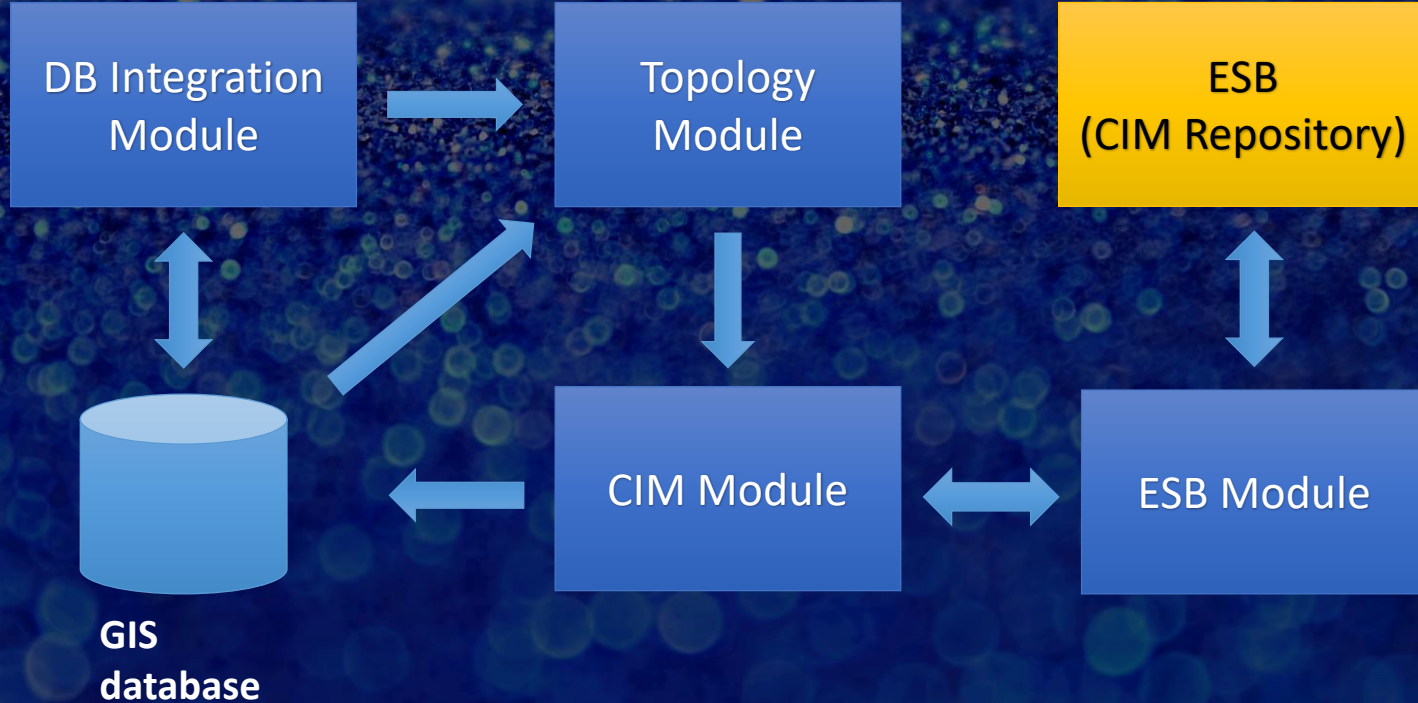
- Spatial assets
- Attribute data
- Connectivity information



CIM Network Model

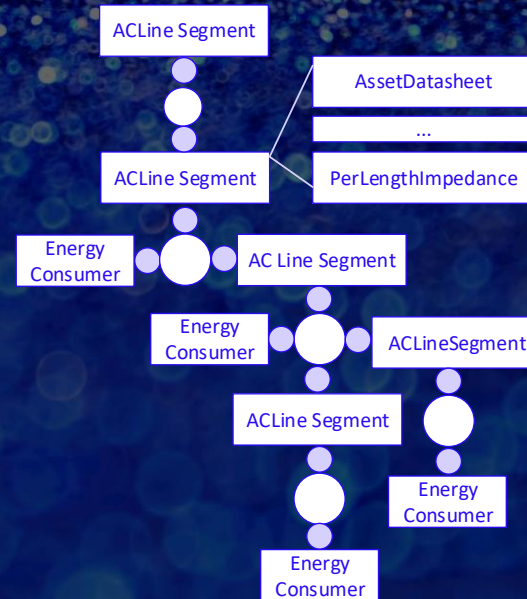
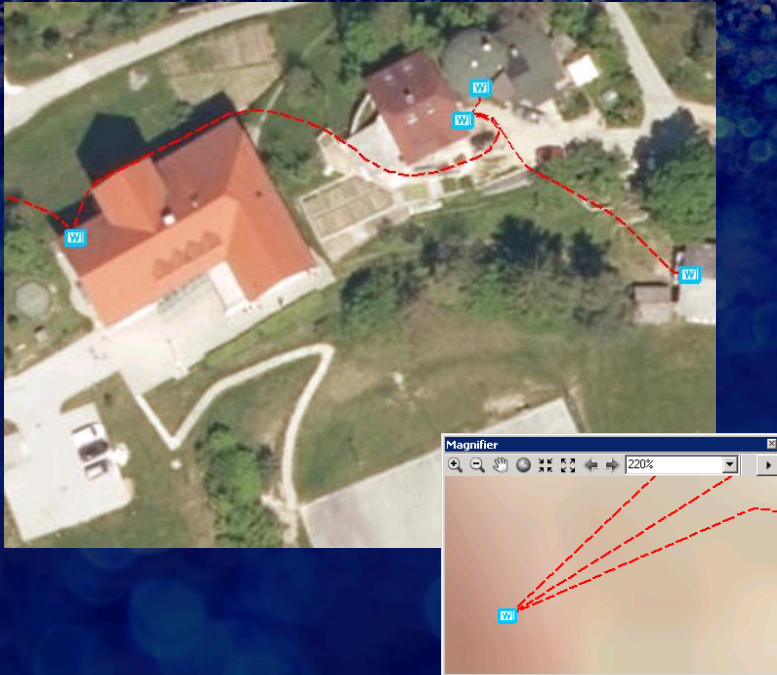
GIS topology to CIM topology
GIS features to CIM classes
Management of the exported CIM objects
Management of CIM Repository IDs

GIS CIM adapter



Mapping of GIS topology to CIM topology

- How elements are connected in GIS?
- Elements in CIM have terminals which are connected to CN Connectivity Nodes

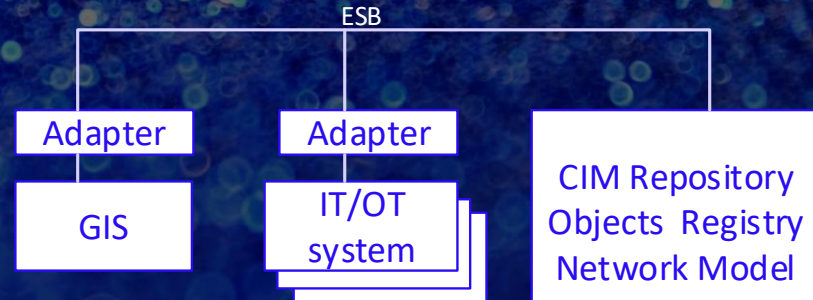


Mapping of GIS topology to CIM topology

- Using classification of „topological types“ on GIS objects
- Calculation of CIM topology based on topological types of neighboring GIS features
- Calculating forward and backward differences
- Supporting full and incremental export
- **GIS-CIM Adapter maintains current state of CIM topology**

Management of the exported CIM objects and CIM repository ID's

- GIS objects are extended by MrID is CIM unique ID:
 - Primary and Secondary Registration
- GIS Objects are extended by new objects:
 - originate from attribute data in GIS
 - generated on-the-fly
- GIS - CIM adapter stores all extensions of GIS objects:
 - Maintaining of local, GIS IDs
 - Maintaining of CIM repository IDs



Summary CIM Projects experience

- CIM Profile definition is crucial
 - participants knowledge presents projects risks so reasonably long testing shall be provisioned
- Performance:
 - Optimization in terms of database design and data access must be taken into account and incremental export planned
- Positive side effect:
 - quality and completeness of data are improved: when providing data to advanced DMS and other operational systems, a small error in data may have huge impact

Summary CIM Projects experience

- GIS CIM Adapter
 - UT for ArcGIS GIS Model is well suited as a basis to map to CIM while retaining GIS modelling suitable for other GIS processing
 - Extensions were developed via configurable „GIS CIM adapter“ to manage numerous additional CIM objects required
- CIM
 - Data exchange between systems is a must and by using „CIM“ we avoid to „reinvent the wheel“ when defining data exchange format between systems. CIM is extensible so it does not set limitations of when we can use it.

Thank you for your attention

- **Contacts**

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