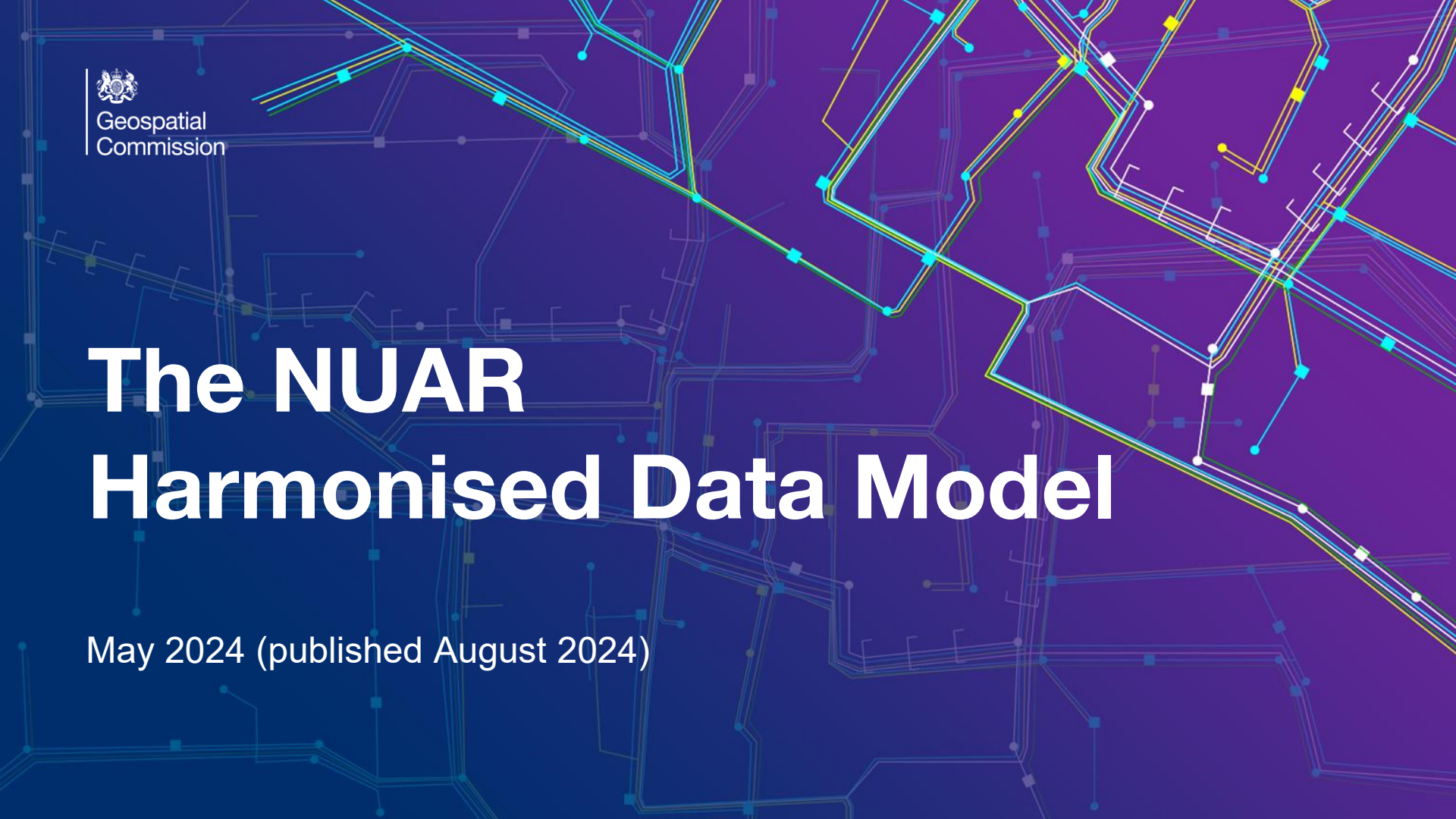


The NUAR Harmonised Data Model

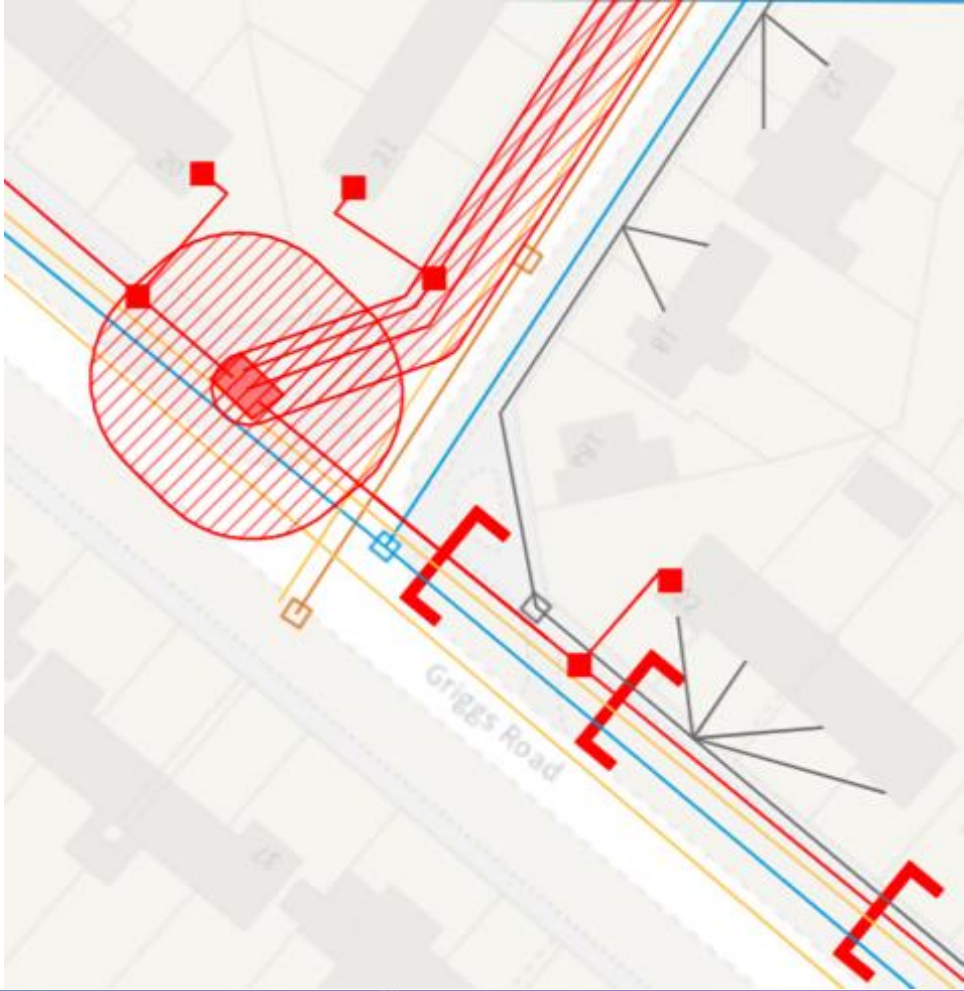
May 2024 (published August 2024)

What we will cover today

1. Introduction to NUAR
2. What is a Data Model and why bother with one?
3. The OGC MUDDI Model
4. The NUAR Data Model and how it relates to MUDDI
5. Key concepts and entities in the NUAR Data Model
6. What we've learned so far
7. Next steps on Data Model publication

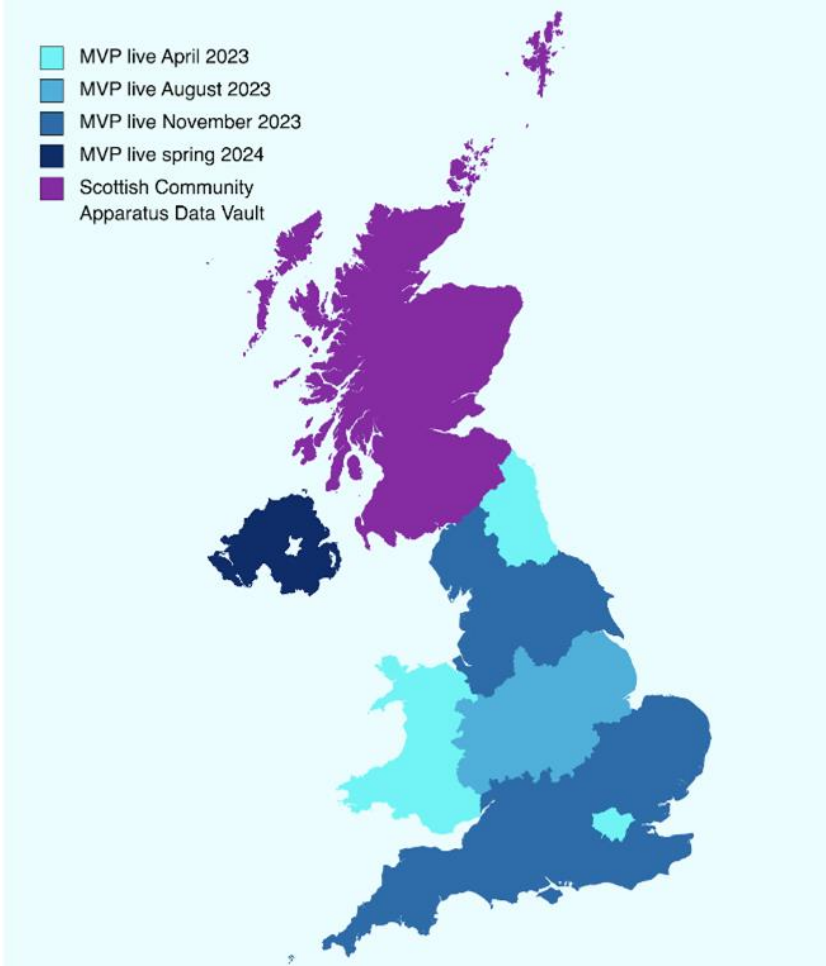
What is NUAR?

- NUAR is an interactive, digital map of underground pipes and cables
- Provides an interactive, secure and standardised view of buried asset data

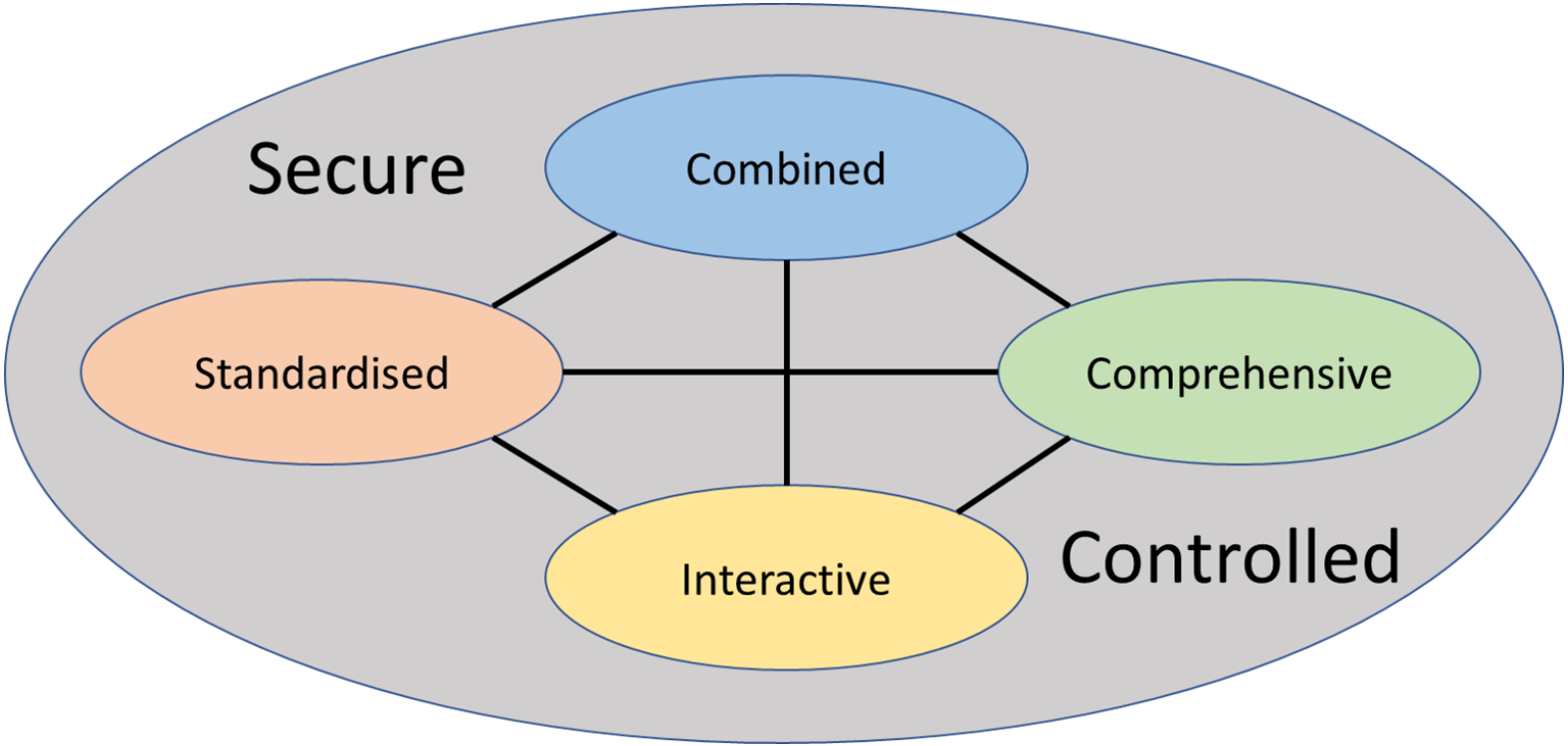


MVP available across England & Wales

- Core functionality for ‘safe dig’ use case
- Covers the whole of England and Wales
- Data from 257 organisations, with 215 others progressing through our on boarding process
- Available to fully onboarded asset owners and their suppliers
- Does not replace HSG47

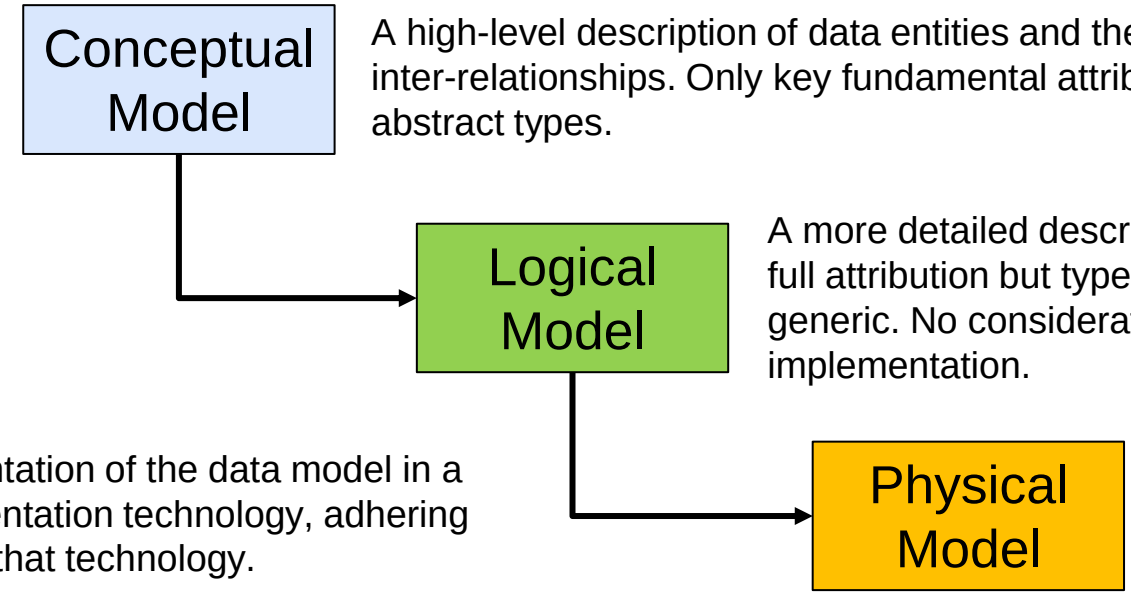


Key characteristics of NUAR



What is a Data Model?

An abstract **description** of data entities and the relationships between them. ***It does not include actual data***.



Why bother with a Data Model?

- **A Common Language:** standard, consistent representation of buried assets and their characteristics across geographies and sectors

- **Scalable:** standardised “joining instructions” for new organisations

- **Sustainable:** data load and transformation needs to be repeatable and frequent – data model provides an enduring, consistent target

Why bother with a Data Model?

- **Data Quality Improvement:** opportunity for data quality improvement – conformance to a standard is one way of communicating data quality

- **Roadmap:** Represent what's there now, but also headroom to grow as an industry – e.g. metadata about data quality

- **Extensible:** Foundation for future use cases

- **Open:** helps to avoid lock-in and contributes to an open eco-system

Model for Underground Data Definition and Integration

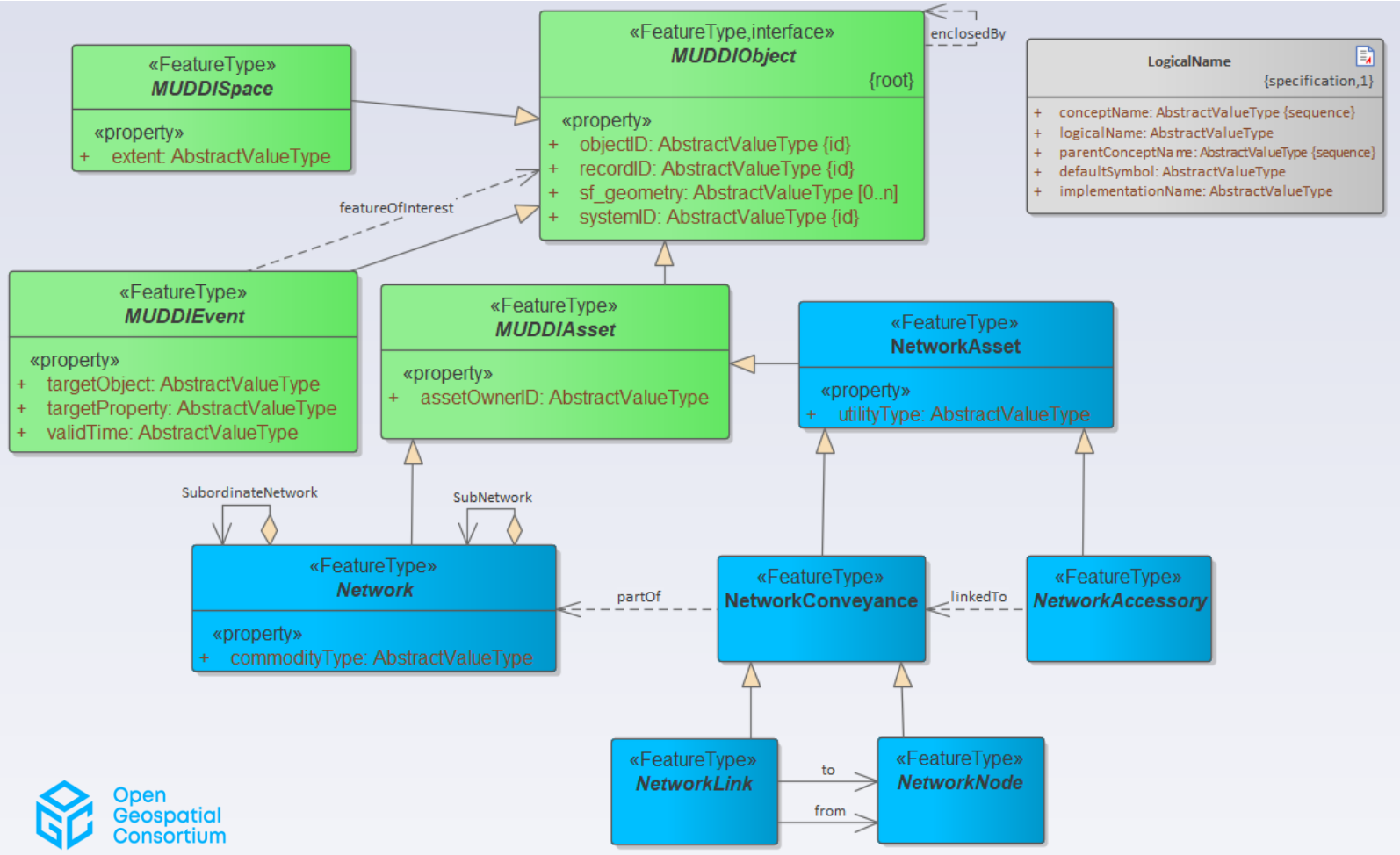
Open Geospatial Consortium

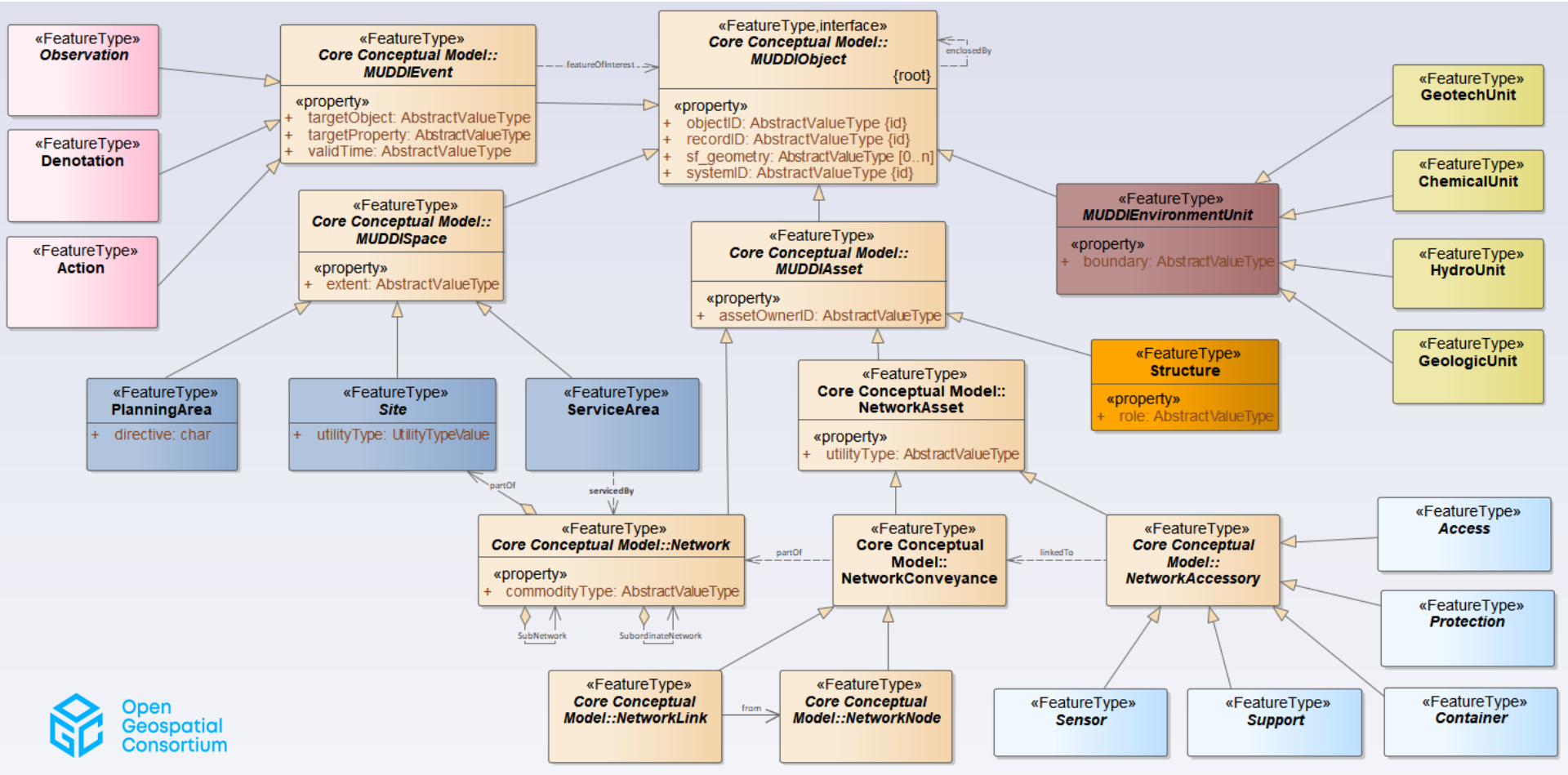
Geospatial Commission

"The **MUDDI Conceptual Model** is designed as a common basis to create **Logical Models** that make different types of sub-surface data interoperable in support of a variety of **use cases** and in different **jurisdictions and user communities**"

The MUDDI SWG: an international collaboration

Open Geospatial Consortium


«FeatureType,interface»
MUDDIObject
{root}
«property»
+ objectID: AbstractValueType {id}
+ recordID: AbstractValueType {id}
+ sf_geometry: AbstractValueType [0..n]
+ systemID: AbstractValueType {id}
enclosedBy
LogicalName
{specification,1}
+ conceptName: AbstractValueType {sequence}
+ logicalName: AbstractValueType
+ parentConceptName: AbstractValueType {sequence}
+ defaultSymbol: AbstractValueType
+ implementationName: AbstractValueType
«FeatureType»
MUDDISpace
«property»
+ extent: AbstractValueType
featureOfInterest
«FeatureType»
MUDDIEvent
«property»
+ targetObject: AbstractValueType
+ targetProperty: AbstractValueType
+ validTime: AbstractValueType
«FeatureType»
MUDDIAsset
«property»
+ assetOwnerID: AbstractValueType
«FeatureType»
NetworkAsset
«property»
+ utilityType: AbstractValueType
SubordinateNetwork
SubNetwork
«FeatureType»
Network
«property»
+ commodityType: AbstractValueType
partOf
«FeatureType»
NetworkConveyance
linkedTo
«FeatureType»
NetworkAccessory
«FeatureType»
NetworkLink
to
from
«FeatureType»
NetworkNode
Open
Geospatial
Consortium


«FeatureType» Observation
«FeatureType» Denotation
«FeatureType» Action
«FeatureType» Core Conceptual Model:: MUDDIEvent
«property»
+ targetObject: AbstractValueType
+ targetProperty: AbstractValueType
+ validTime: AbstractValueType
featureOfInterest
«FeatureType,interface» Core Conceptual Model:: MUDDIObject
{root}
«property»
+ objectID: AbstractValueType {id}
+ recordID: AbstractValueType {id}
+ sf_geometry: AbstractValueType [0..n]
+ systemID: AbstractValueType {id}
enclosedBy
«FeatureType» Core Conceptual Model:: MUDDISpace
«property»
+ extent: AbstractValueType
«FeatureType» Core Conceptual Model:: MUDDIAsset
«property»
+ assetOwnerID: AbstractValueType
«FeatureType» MUDDIEnvironmentUnit
«property»
+ boundary: AbstractValueType
«FeatureType» GeotechUnit
«FeatureType» ChemicalUnit
«FeatureType» HydroUnit
«FeatureType» GeologicUnit
«FeatureType» PlanningArea
+ directive: char
«FeatureType» Site
+ utilityType: UtilityTypeValue
«FeatureType» ServiceArea
«FeatureType» Core Conceptual Model:: NetworkAsset
«property»
+ utilityType: AbstractValueType
«FeatureType» Structure
«property»
+ role: AbstractValueType
partOf
servicedBy
«FeatureType» Core Conceptual Model::Network
«property»
+ commodityType: AbstractValueType
SubNetwork
SubordinateNetwork
partOf
«FeatureType» Core Conceptual Model:: NetworkConveyance
linkedTo
«FeatureType» Core Conceptual Model:: NetworkAccessory
«FeatureType» Access
«FeatureType» Protection
«FeatureType» Container
«FeatureType» Core Conceptual Model::NetworkLink
from
«FeatureType» Core Conceptual Model::NetworkNode
«FeatureType» Sensor
«FeatureType» Support
Open Geospatial Consortium

The Model Hierarchy

Reference Models (e.g. ISO19100)

OGC MUDDI Conceptual Model

Profile: UK Excavation

NUAR Platform Model

UK Excavation: room for specialisation

Electricity Network

Gas Network

Water Network

Sewer Network

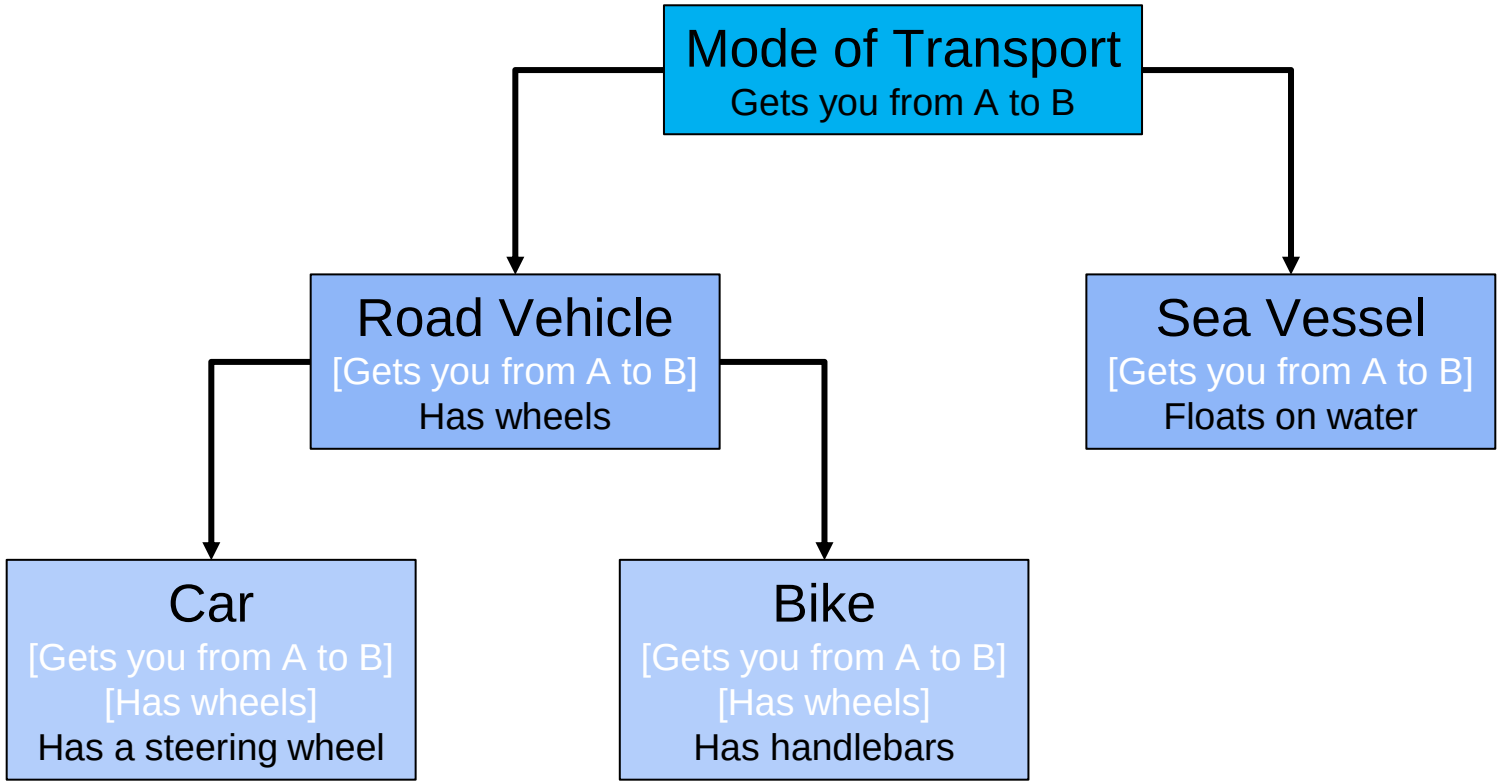
Telco Network

Thermal Network

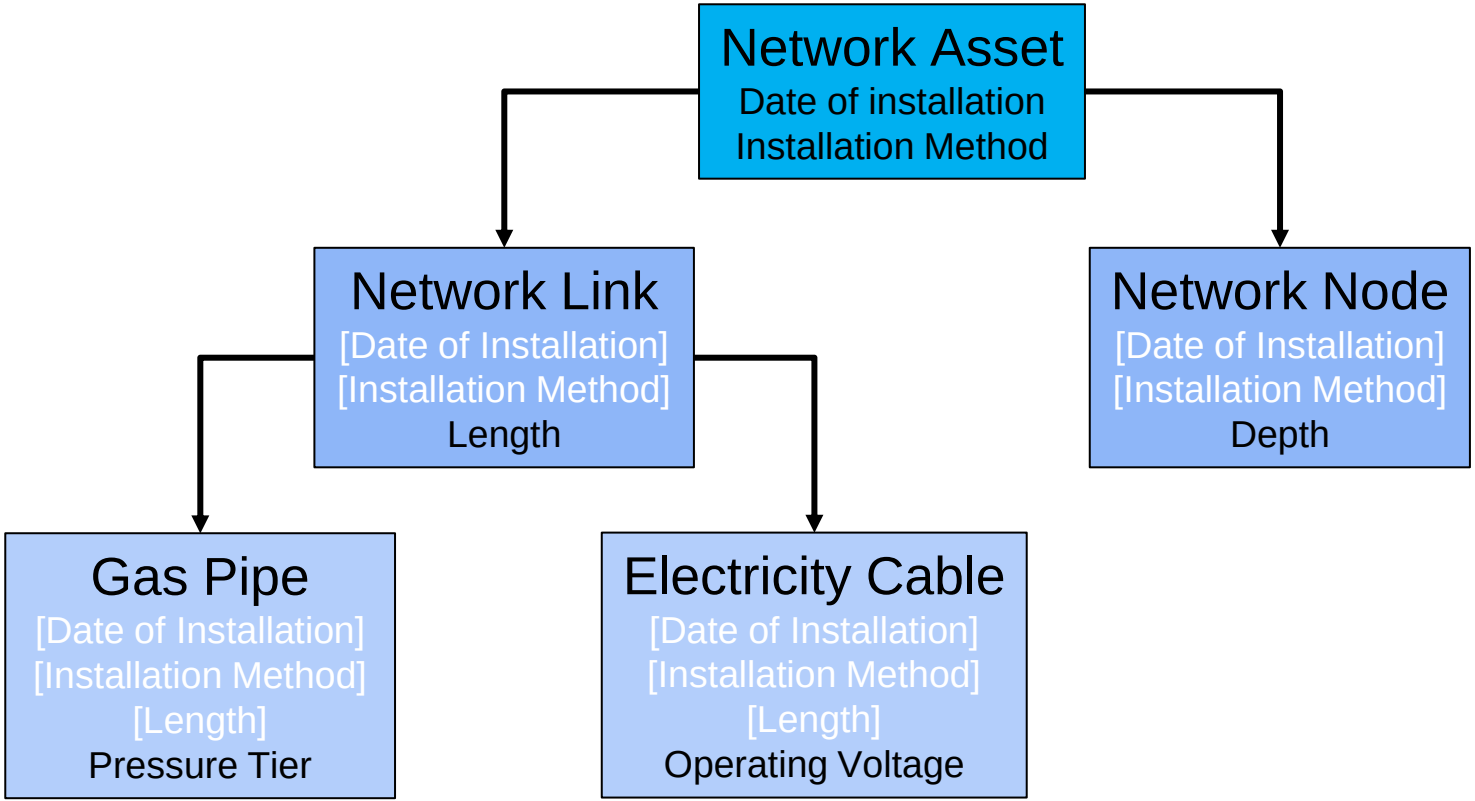
Fuel & Chemicals

Transport Network

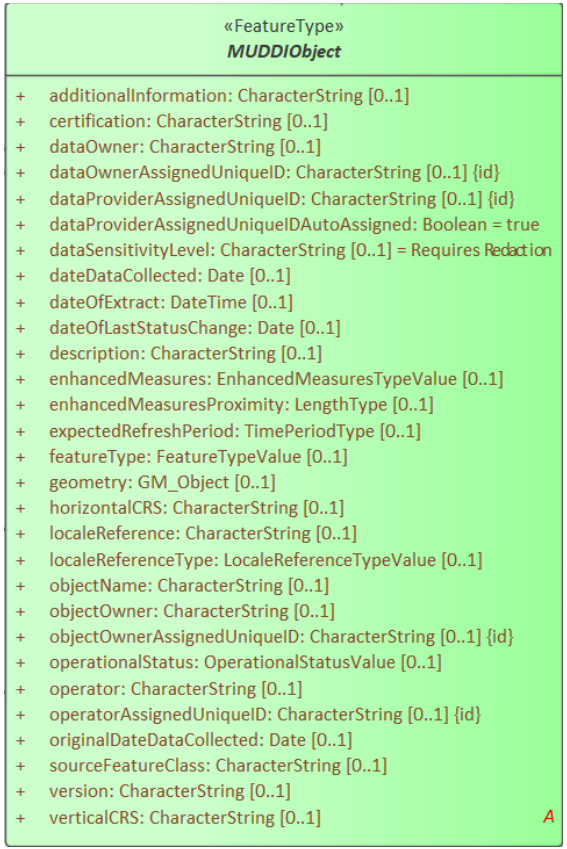
Inheritance: a primer

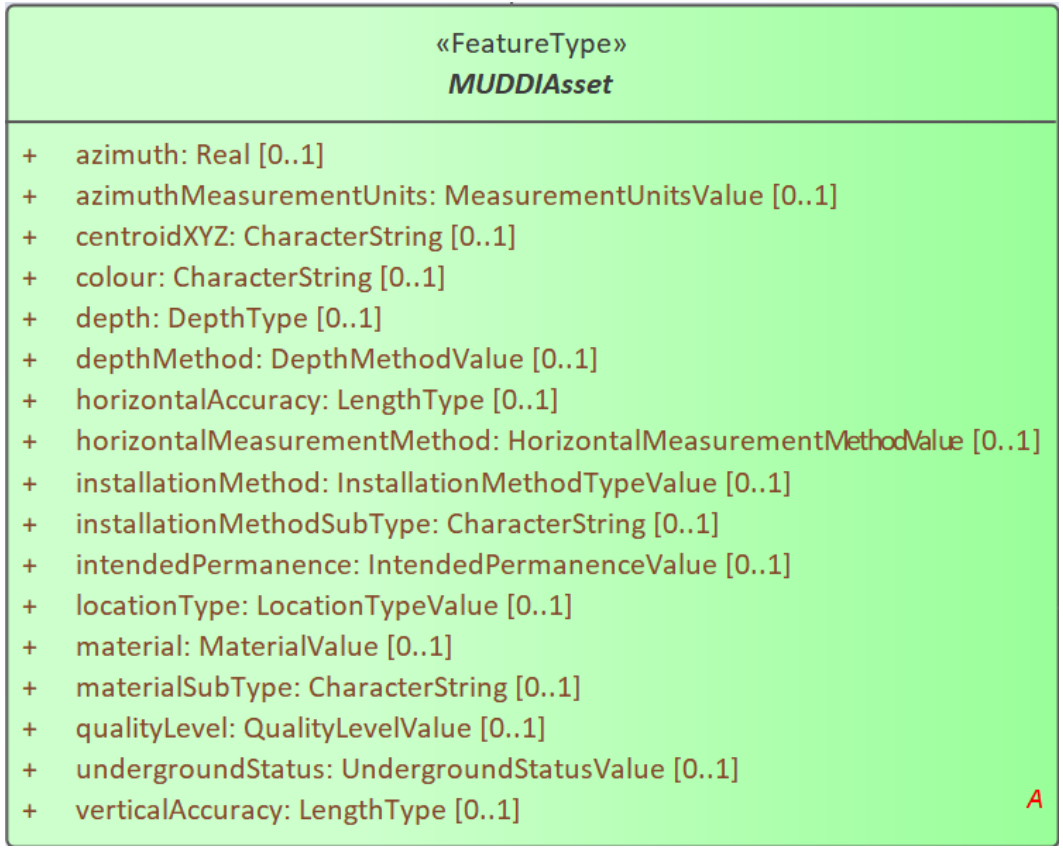


Inheritance: utility network example



NUAR Enrichment of the MUDDI Model

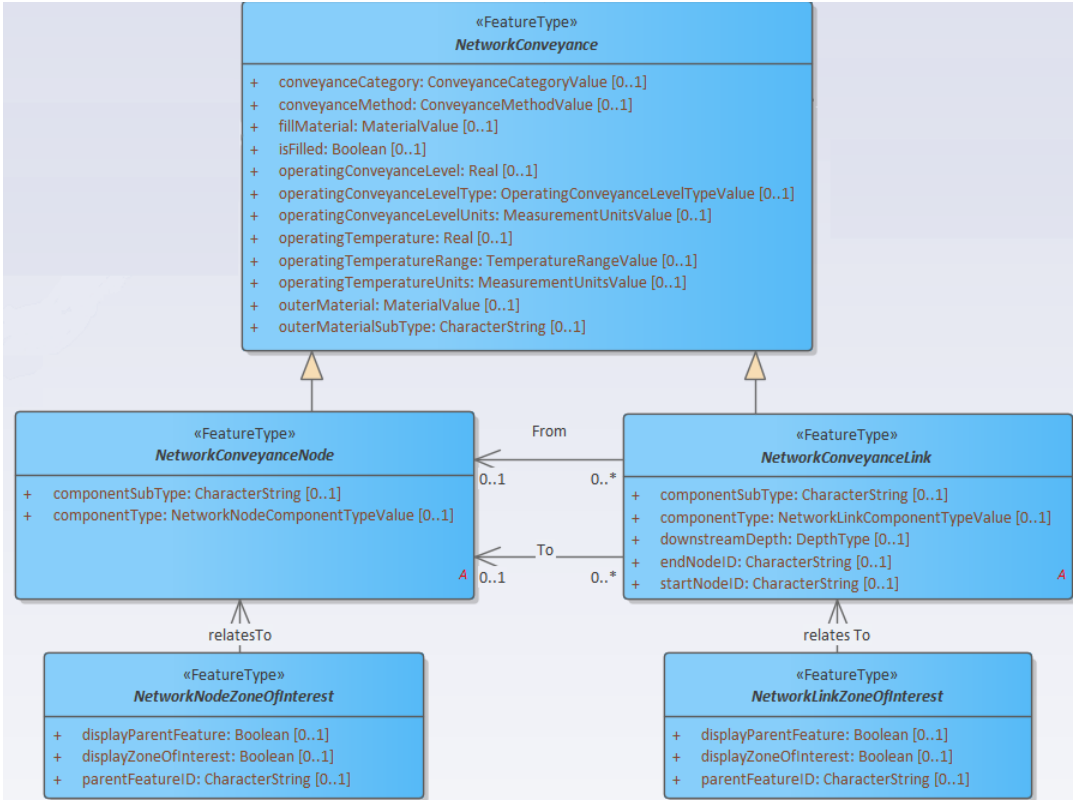




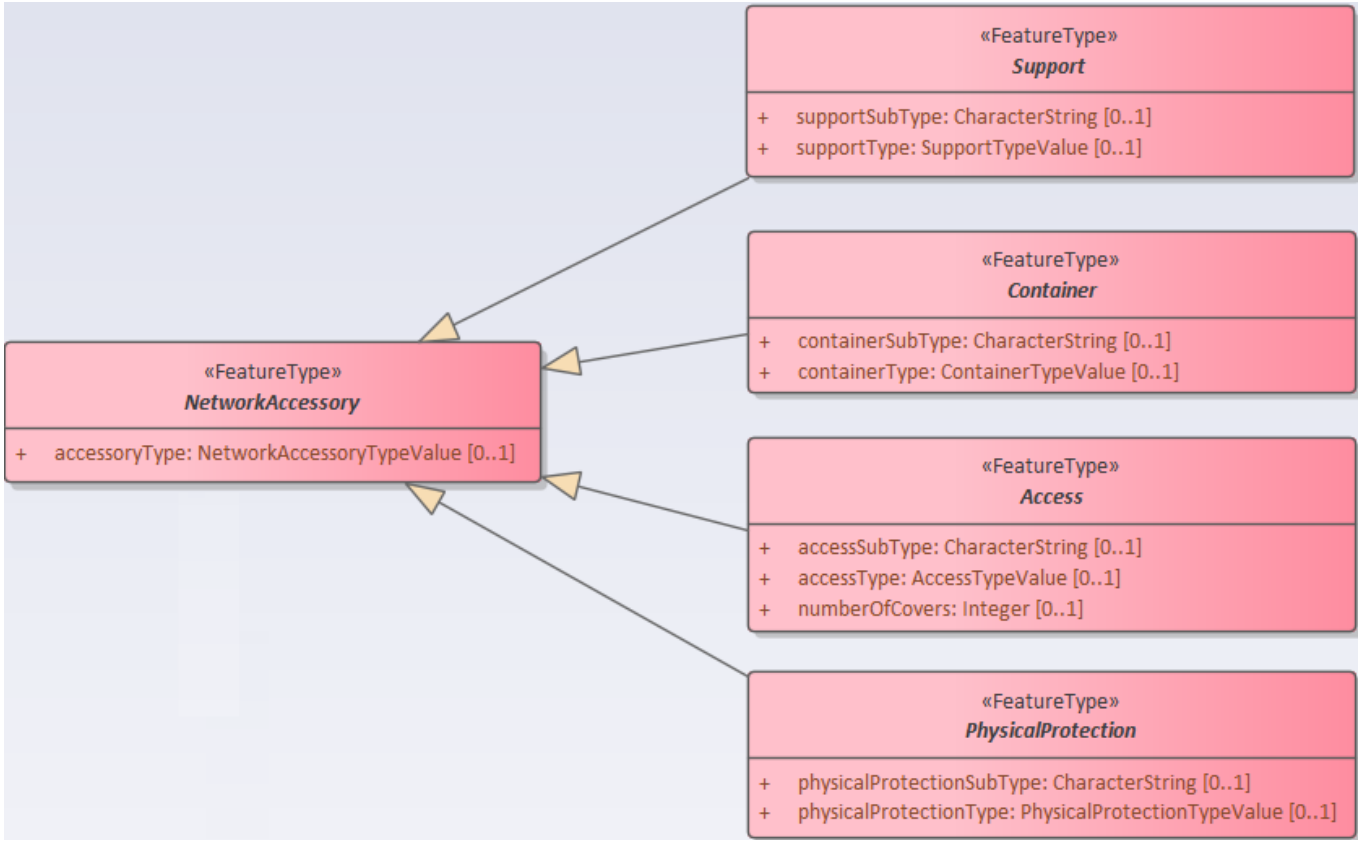
NUAR Enrichment of the MUDDI Model

«FeatureType»
NetworkAsset

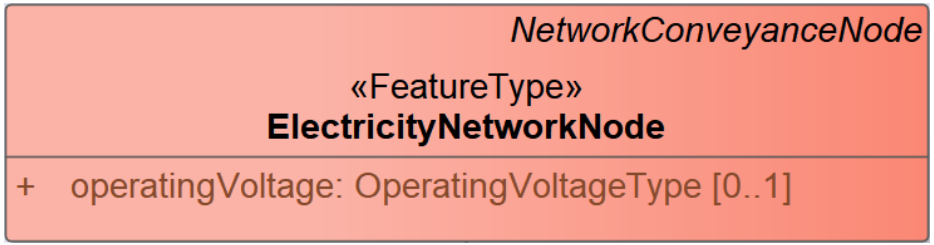
+ container: CharacterString [0..1]
+ dateOfInstallation: Date [0..1]
+ insideHeight: HeightType [0..1]
+ insideLength: LengthType [0..1]
+ insideWidth: WidthType [0..1]
+ isAuxiliary: Boolean [0..1]
+ isCathodicProtected: Boolean [0..1]
+ isEncased: Boolean [0..1]
+ isNPS: Boolean [0..1]
+ outsideHeight: HeightType [0..1]
+ outsideLength: LengthType [0..1]
+ outsideWidth: WidthType [0..1]
+ protectiveMaterial: MaterialValue [0..1]
+ protectiveMaterialSubType: CharacterString [0..1]
+ utilitySubType: UtilitySubTypeValue [0..1]
+ utilityType: UtilityTypeValue [0..1]
+ wallThickness: WidthType [0..1]

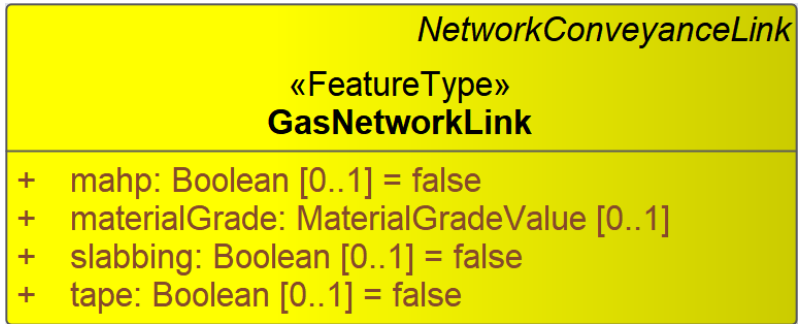


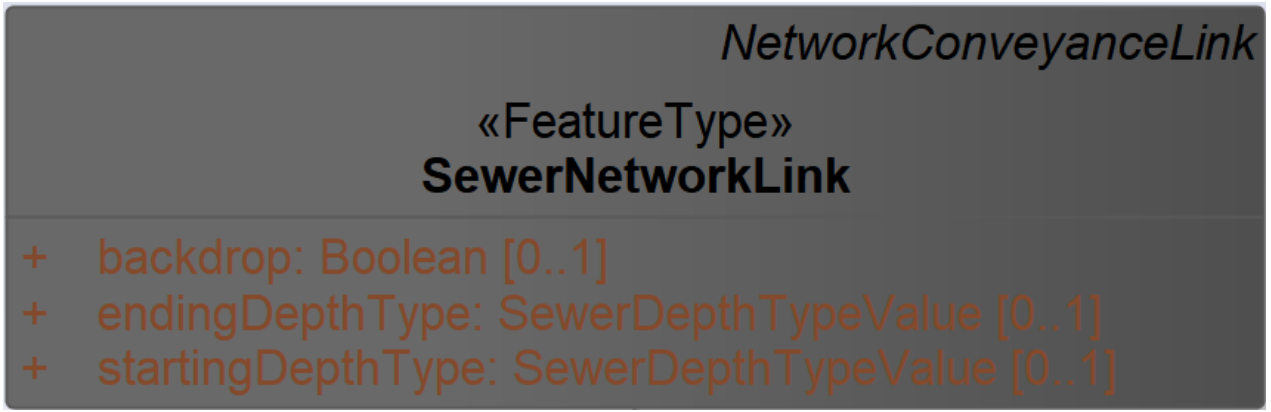
NUAR Enrichment of the MUDDI Model



NUAR Specialisation of the MUDDI Model







Some Key Concepts

- **Conveyance vs. “Accessories”**
  - Assets that directly convey the commodity vs
  - Assets that provide support, containment, access, protection…
- **Identifiers**
  - Globally unique NUAR identifier (assigned automatically)
  - Unique persistent identifiers within an organisation
    - Support incremental updates, asset-specific feedback/reporting etc
  - Local identifiers assigned by owner, operator, data custodian
- **Subordinate Networks**
  - Assets linked by shared characteristics rather than geographical location. E.g. high voltage element of electricity network, high pressure gas network, all assets of a particular material

Some Key Concepts

- **Temporal and currency data**
  - Date of load/last update in NUAR
  - Date of extract from source system
  - Expected refresh period
  - Date that asset data was originally collected/digitised
  - Date of last survey
  - Date of installation
- **Data Quality Metadata**
  - PAS128 Quality Level
  - Method of data capture
  - Accuracy metrics (horizontal and vertical)
  - Point descriptions/measures
  - Annotations and Dimensions

Standardised Terminology

- **Codelist Register** for the UK Excavation profile
- Jurisdiction and use case drive the terminology and the **level of detail**
- Standard terms for various elements of the data model
- Three different packages for different domains:
  - Data Management
  - Platform
  - Transformation
- Room is always left for the original value from source data
- Use of “Other” will be a useful way to measure domain consistency and test the data model
- Maintained as a set of database tables

Feature Types (layers/tables) for each domain

- **NetworkConveyance**
  - NetworkLink
  - NetworkLinkZoneOfInterest
  - NetworkNode
  - NetworkNodeZoneOfInterest
- **NetworkAccessory**
  - AccessObject
  - Containerobject
  - PhysicalProtectionObject
  - SupportObject
- **NetworkDescription**
  - NetworkDescriptionObject
  - NetworkAnnotation
  - NetworkDimension
- **Networks and Areas**
  - Network
  - ServiceArea
  - Site

Reference Data; Planning Areas

- ArchaeologicalSite
- AreasOfSpecialScientificInterestNorthernIreland
- ConservationArea
- GeneralPlanningArea
- PlanningAreaNetwork
- RestrictedPlanningArea
- SiteOfPreviousIndustrialUse
- SiteOfSpecialScientificInterestEngland
- SiteOfSpecialScientificInterestScotland
- SiteOfSpecialScientificInterestWales
- TreeLocation

Relationships

- (ObjectTo)Guidance
- (ObjectTo)LinkedFile
- ObjectToContactDetails
- ObjectToRule
- LinkToLinkZoneOfInterest
- NodeToNodeZoneOfInterest
- SiteToSiteZoneOfInterest
- SubordinateNetworkToRule
- CoverageToBackdropObject
- SupplementalDataCoverageToObject
- NetworkConveyanceToNetworkAccessory
- NetworkToNetworkConveyance
- NetworkToServiceArea
- NetworkToSite
- NetworkToSubNetwork
- NetworkToSubordinateNetwork
- SiteToAsset
- VariableObjectValueToAsset

NUAR meets the real world

“Everyone has a plan
until they get
punched in the mouth”

NUAR meets the real world

"Everyone has a Data Model until they get Real Data"

What have we learned?

Based on data published from 146 organisations

Focus on linear assets in electricity, gas, sewer and water networks

Total Features	53,421,228
Component Type “Other”	17% (Electricity & Sewer: 30%+)
Material “Other”	25% (Sewer 46%; Water 28%)
“Unknown” Depth	86% (variation in how recorded)
Data Quality Metadata provision	24% (Electricity: 12%)
Invalid Geometries	~0.1%

So why bother with a Data Model?

- **Data Quality Improvement:** opportunity for data quality improvement – conformance to a standard is one way of communicating data quality

- **Roadmap:** Represent what's there now, but also headroom to grow as an industry – e.g. metadata about data quality

- **Extensible:** Foundation for future use cases

- **Open:** helps to avoid lock-in and contributes to an open eco-system

Next Steps

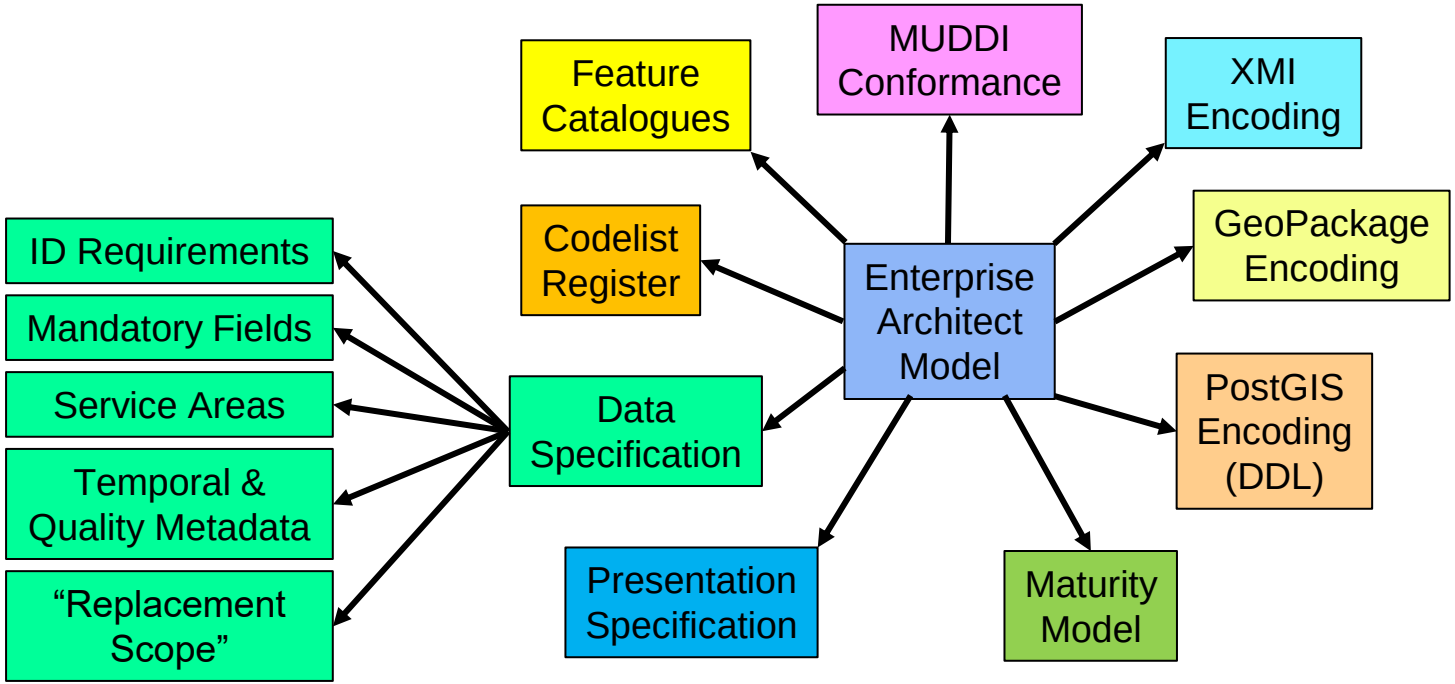
MUDDI

- Conceptual Model published as an OGC standard later in the year
- Continued work on reference Logical Models, e.g. simplified model for illustration, models aligned with existing standards etc
- Different encodings and sample implementations
- Work on Environmental and Disaster Recovery use cases

NUAR Data Model

- Continuous improvement of model. Utility survey/PAS128 extensions
- First publication in a few weeks – to introduce the NUAR Data Model, build familiarity and gain feedback
- Further iterations to enrich and extend the supporting content
- GeoPackage encoding – submission template

What will we publish?



Thank you

Geospatial Commission

Email us at geospatialcommission@dsit.gov.uk with any questions

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Contact our onboarding team:

Asset owner onboarding form