



UNIVERSITY OF TWENTE.

Utilities – Operations and Maintenance conceptual schema

Overview of class models in UML

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4.1



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Foreword

This document provides the UML class models of the Operations and Maintenance conceptual schema. These class models include the concepts and relations relevant to the domain of operations and maintenance of utilities. To fully comprehend and understand the UML class models – and, thereby, the Operations and Maintenance conceptual schema – this document should be used alongside the following two documents:

- [1.] Operations and Maintenance – Data Specification version 4.1
 - OM_Data_Specification.pdf
- [2.] Operations and Maintenance – Feature Catalogue version 2.1
 - OM_Feature_Catalogue.pdf

Altogether the (1) data specification, (2) feature catalogue and (3) overview of UML class models form the complete documentation of the Operations and Maintenance conceptual schema. Of these three, the data specification is the main document, supported by the feature catalogue. If one only requires the sole class models, this document can be consulted. All documentation can be retrieved from the following online repository:

<https://github.com/RamonTerHuurne/UtilityNetwork-OperationsAndMaintenance>

The Operations and Maintenance conceptual schema is developed as part of the ReDUCE (Reduction of Damage to Utilities & Careful Excavation) programme, hosted by the University of Twente (Enschede, the Netherlands). In the context of the ReDUCE programme, the Operations and Maintenance conceptual schema not only covers reduction of damages to utilities and careful excavation, but also extends towards the domain of operations and maintenance. The Operations and Maintenance conceptual schema is developed with support of the developers of the internationally recognized CityGML UtilityNetwork ADE. As a result, the schema builds upon the CityGML UtilityNetwork ADE conceptual schema and adds those concepts and relations relevant for the domain of operations and maintenance.



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Ramon ter Huurne	(University of Twente)
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Tatjana Kutzner	(CityGML UtilityNetwork ADE, Technical University of Munich)

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Introduction

This documents presents the UML class models of the Operations and Maintenance conceptual schema. The description for each of the class models is included in the ‘Operations and Maintenance – Data specification’ (OM_Data_Specification.pdf). Clarification of the spatial object types, and accompanying codelist and enumerations is provided within the ‘Operations and Maintenance – Feature catalogue’ (OM_Feature_Catalogue.pdf).

This document does not contain any explanation on modelling with UML, nor does it include a list of definitions and abbreviations. One is referred to the main document of the Operations and Maintenance conceptual schema, the ‘Operations and Maintenance – Data Specification’ (OM_Data_Specification.pdf) for further explanation and information on the aforementioned.

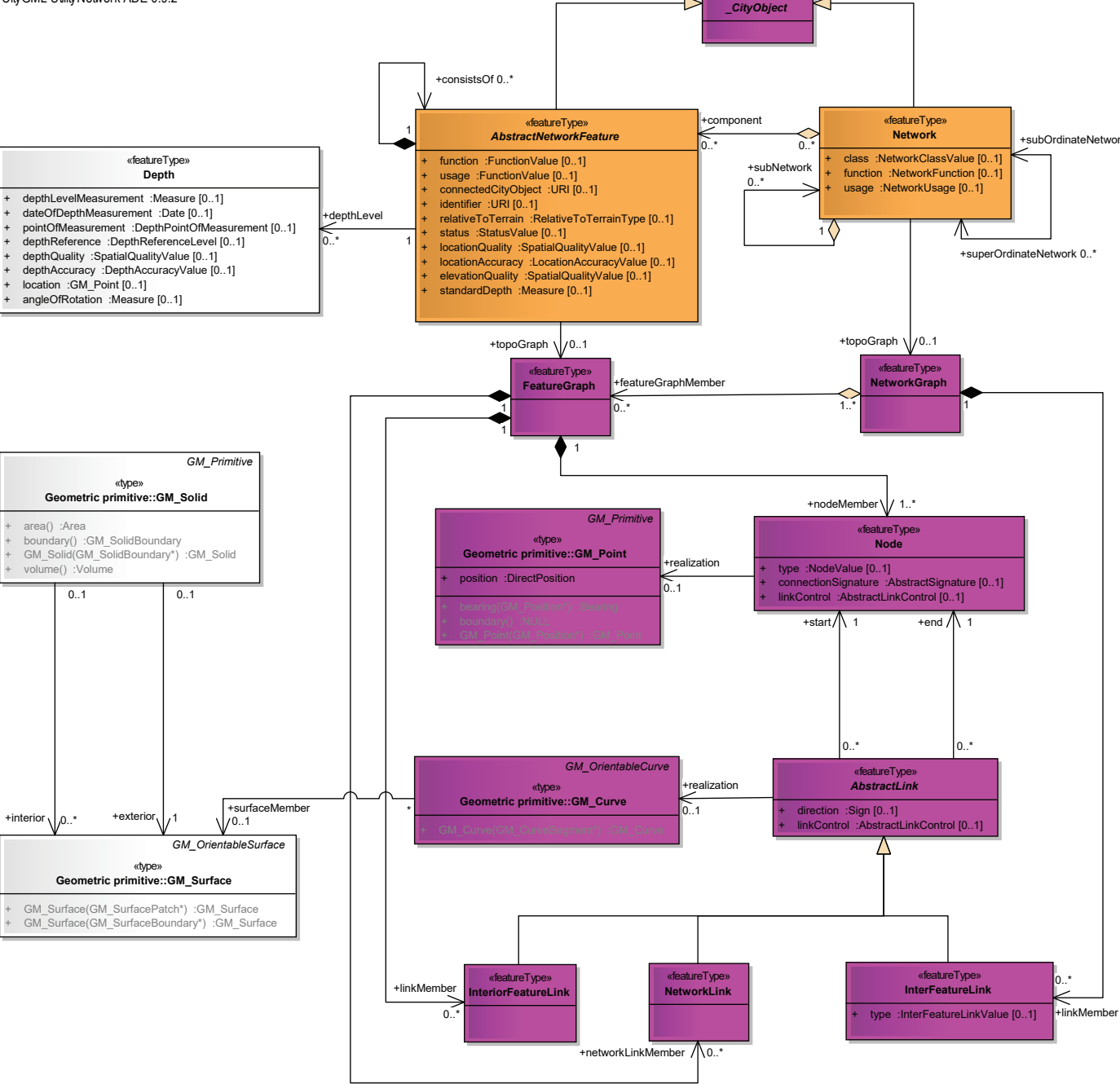
This document presents in total eight UML class models – starting at the next page – in the same order as they are explained within the data specification, being:

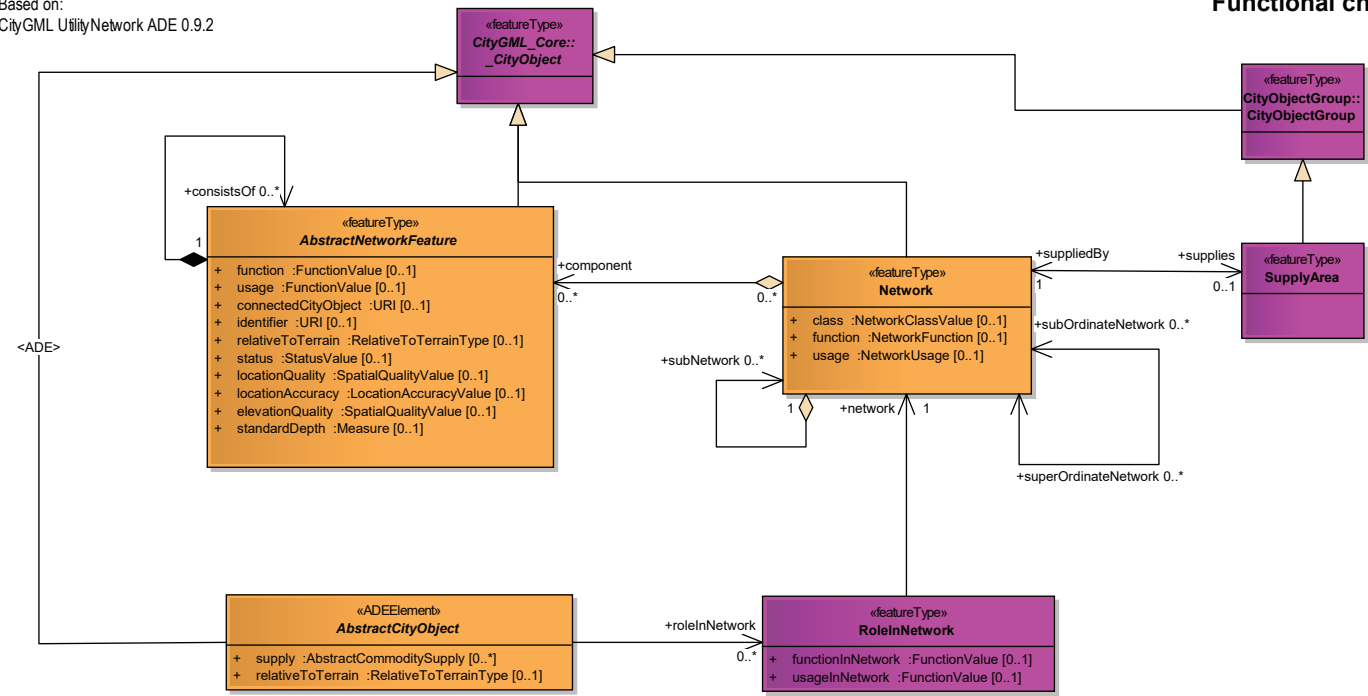
- [1.] Core and geometry
- [2.] Functional characteristics
- [3.] Network properties
- [4.] Network components
- [5.] Component properties
- [6.] Maintenance and operations properties
- [7.] Performance properties
- [8.] Hollow space

Being based upon the CityGML UtilityNetwork ADE, the class models of the Operations and Maintenance conceptual schema are colour coded, illustrating whether classes are:

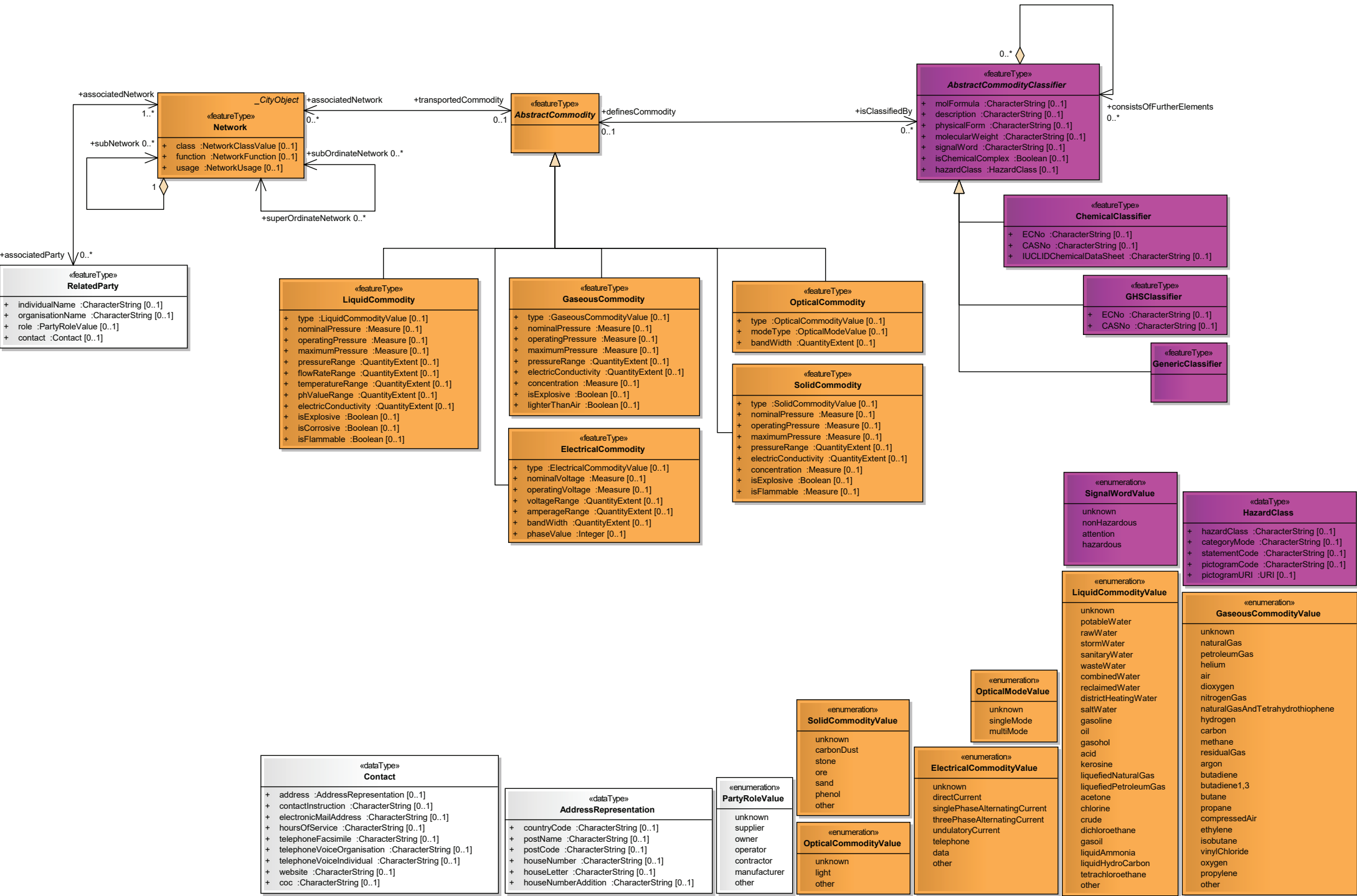
- Purple : copied from CityGML UtilityNetwork ADE version 0.9.2
- Orange : copied with alterations from CityGML UtilityNetwork ADE version 0.9.2
- White : newly added to CityGML UtilityNetwork ADE version 0.9.2

The purple classes copied from CityGML UtilityNetwork ADE are direct copies. The orange classes are copied from CityGML UtilityNetwork ADE, but were altered to better fit to the domain of operations and maintenance of utilities. The white classes are newly added by the Operations and Maintenance conceptual schema in comparison with the CityGML UtilityNetwork ADE.

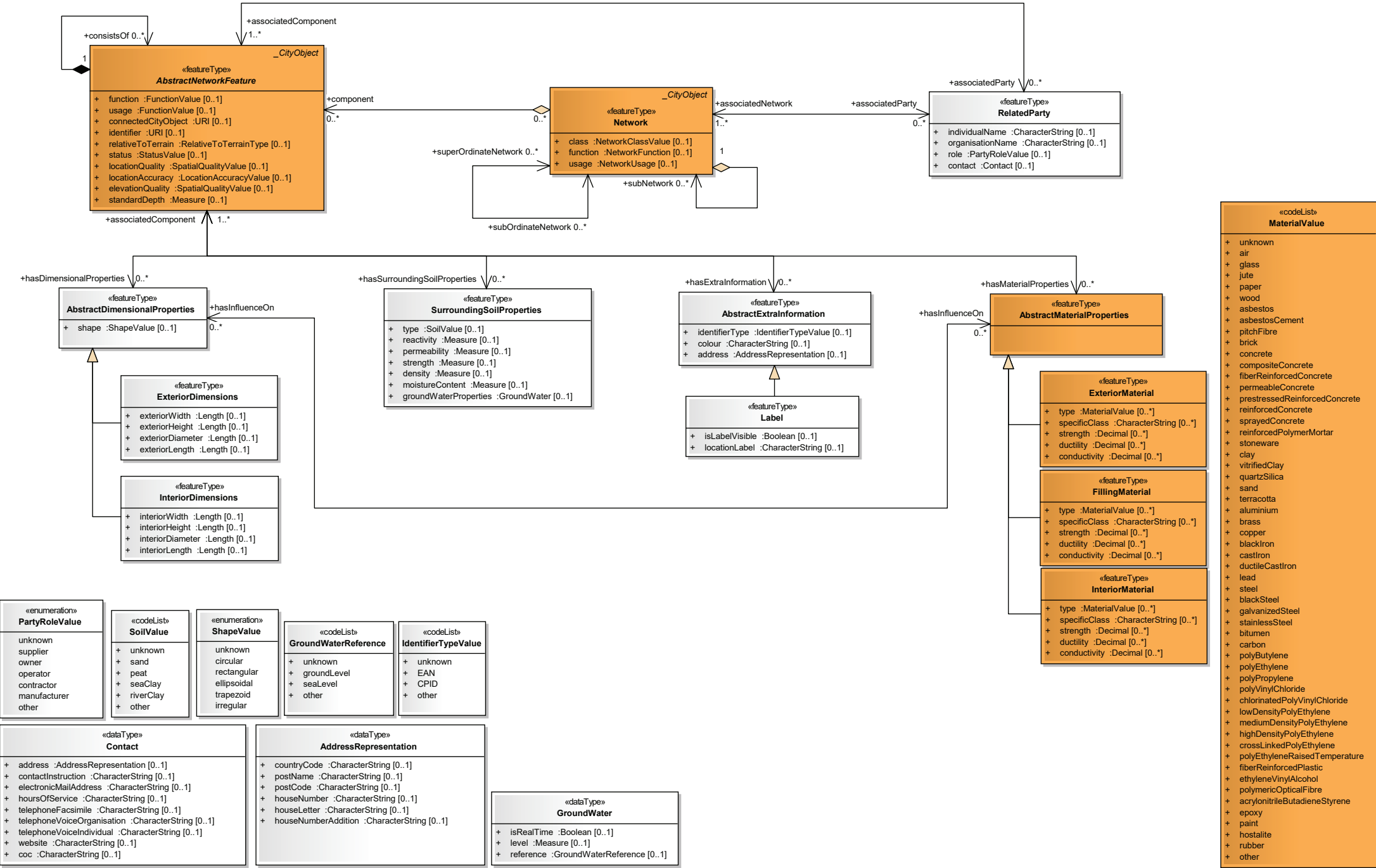


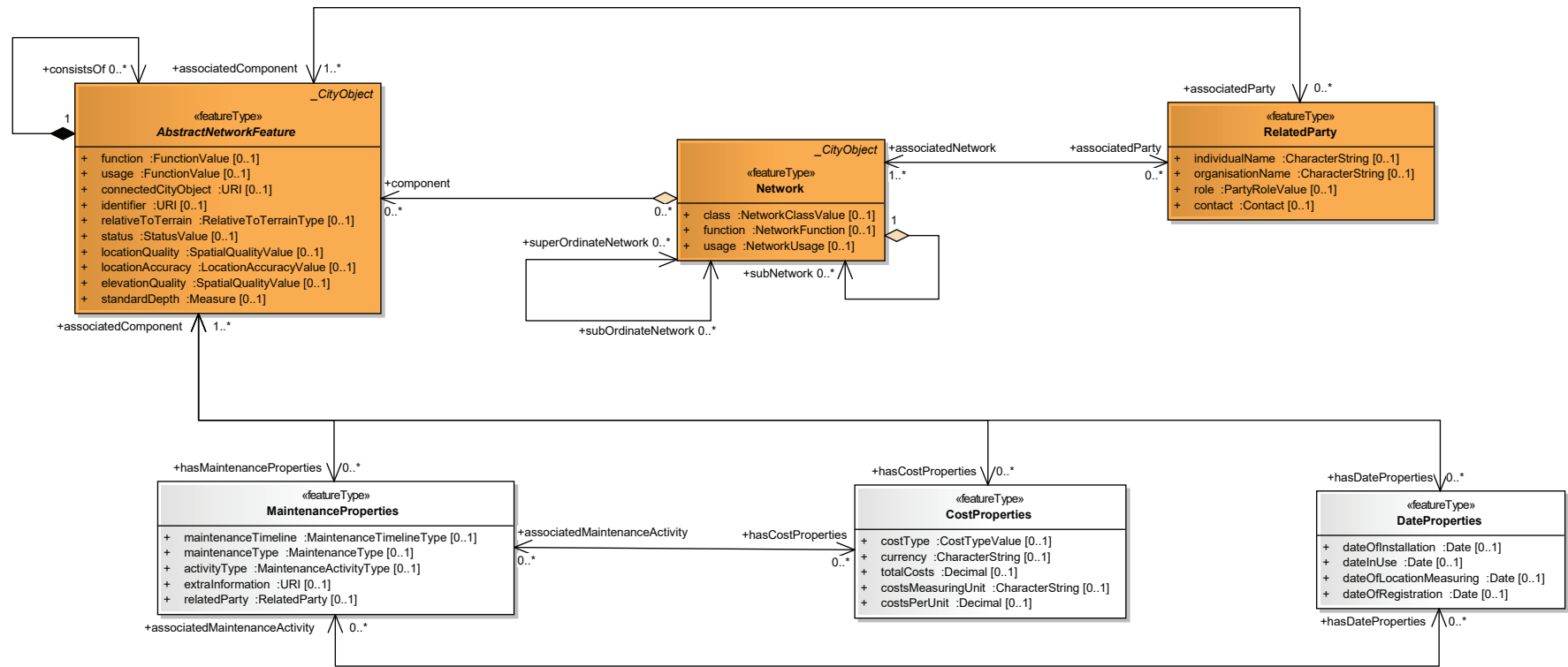


<div>«codeList» StorageComponentValue</div> <div>+ unknown + storageBassin + battery + tank + cistern + clearWell + inLineStoragePipe + other</div>	<div>«codeList» FunctionValue</div> <div>+ unknown + abstraction + branch + control + distribution + draining + feeding + measurement + observer + protection + shortCircuit + shutOff + storage + venting + other</div>	<div>«dataType» Supply</div> <div>+ flowRate :Measure [0..1] + status :StatusValue [0..1]</div>	<div>«dataType» Storage</div> <div>+ type :StorageComponentValue [0..1] + inFlowRate :Measure [0..1] + outFlowRate :Measure [0..1] + fillLevel :Measure [0..1] + maxCapacity :Measure [0..1]</div>	<div>«enumeration» ElectricalCommodityValue</div> <div>unknown directCurrent singlePhaseAlternatingCurrent threePhaseAlternatingCurrent undulatoryCurrent telephone data other</div>	<div>«enumeration» OpticalCommodityValue</div> <div>unknown light other</div>	<div>«enumeration» SolidCommodityValue</div> <div>unknown carbonDust stone ore sand phenol other</div>	<div>«enumeration» LiquidCommodityValue</div> <div>unknown potableWater rawWater stormWater sanitaryWater wasteWater combinedWater reclaimedWater districtHeatingWater saltWater gasoline oil gasohol acid kerosine liquefiedNaturalGas liquefiedPetroleumGas acetone chlorine crude dichloroethane gasoil liquidAmmonia liquidHydroCarbon tetrachloroethane other</div>	<div>«enumeration» GaseousCommodityValue</div> <div>unknown naturalGas petroleumGas helium air dioxygen nitrogenGas naturalGasAndTetrahydrothiophene hydrogen carbon methane residualGas argon butadiene butadiene1,3 butane propane compressedAir ethylene isobutane vinylChloride oxygen propylene other</div>
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**«enumeration»
PartyRoleValue**
unknown
supplier
owner
operator
contractor
manufacturer
other

**«codeList»
CostTypeValue**
+ unknown
+ capitalCost
+ rehabilitationCost
+ replacementCost
+ maintenanceCost
+ operatingCost
+ other

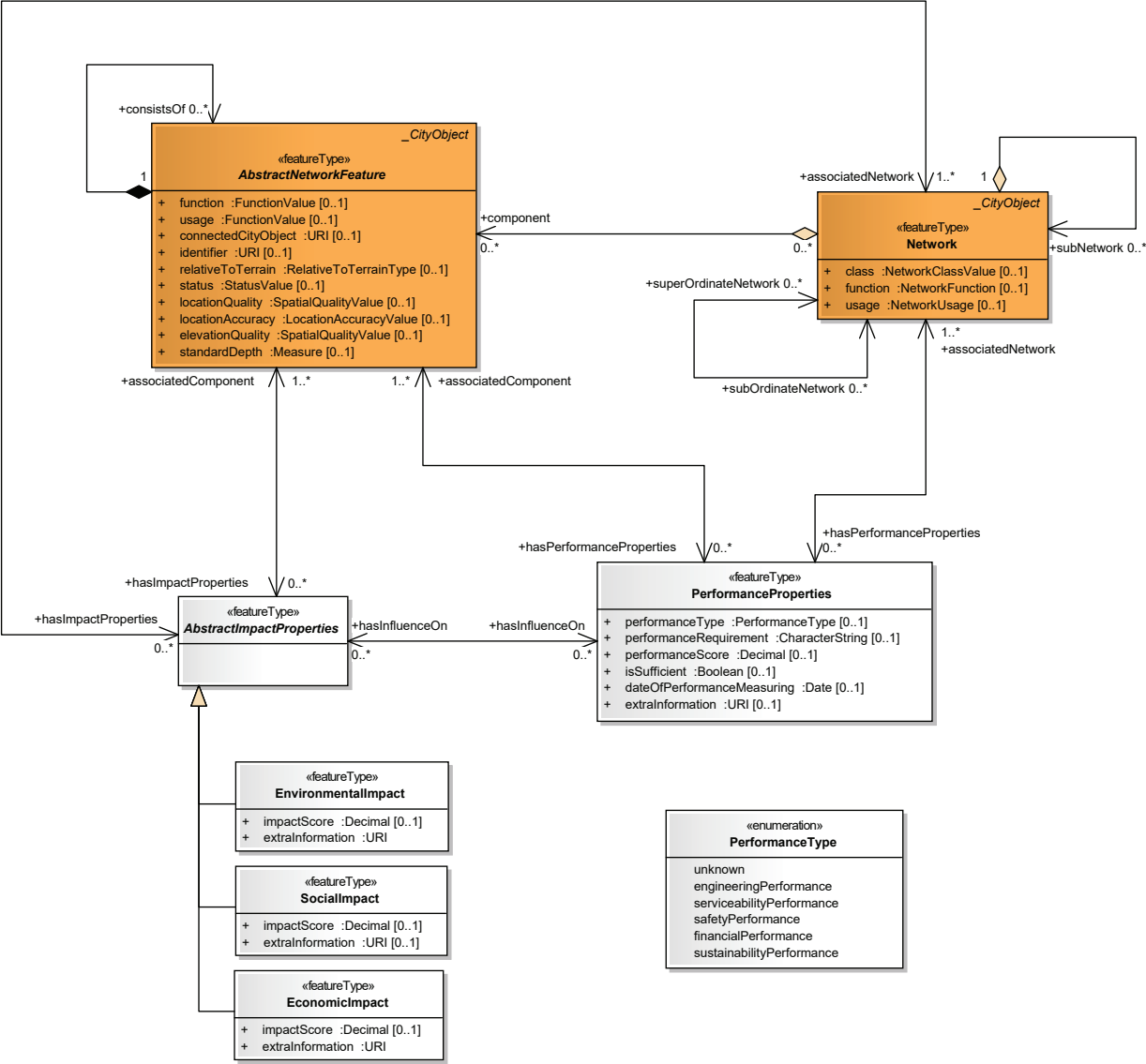
**«enumeration»
MaintenanceType**
unknown
correctiveMaintenance
preventiveMaintenance
predictiveMaintenance
prescriptiveMaintenance

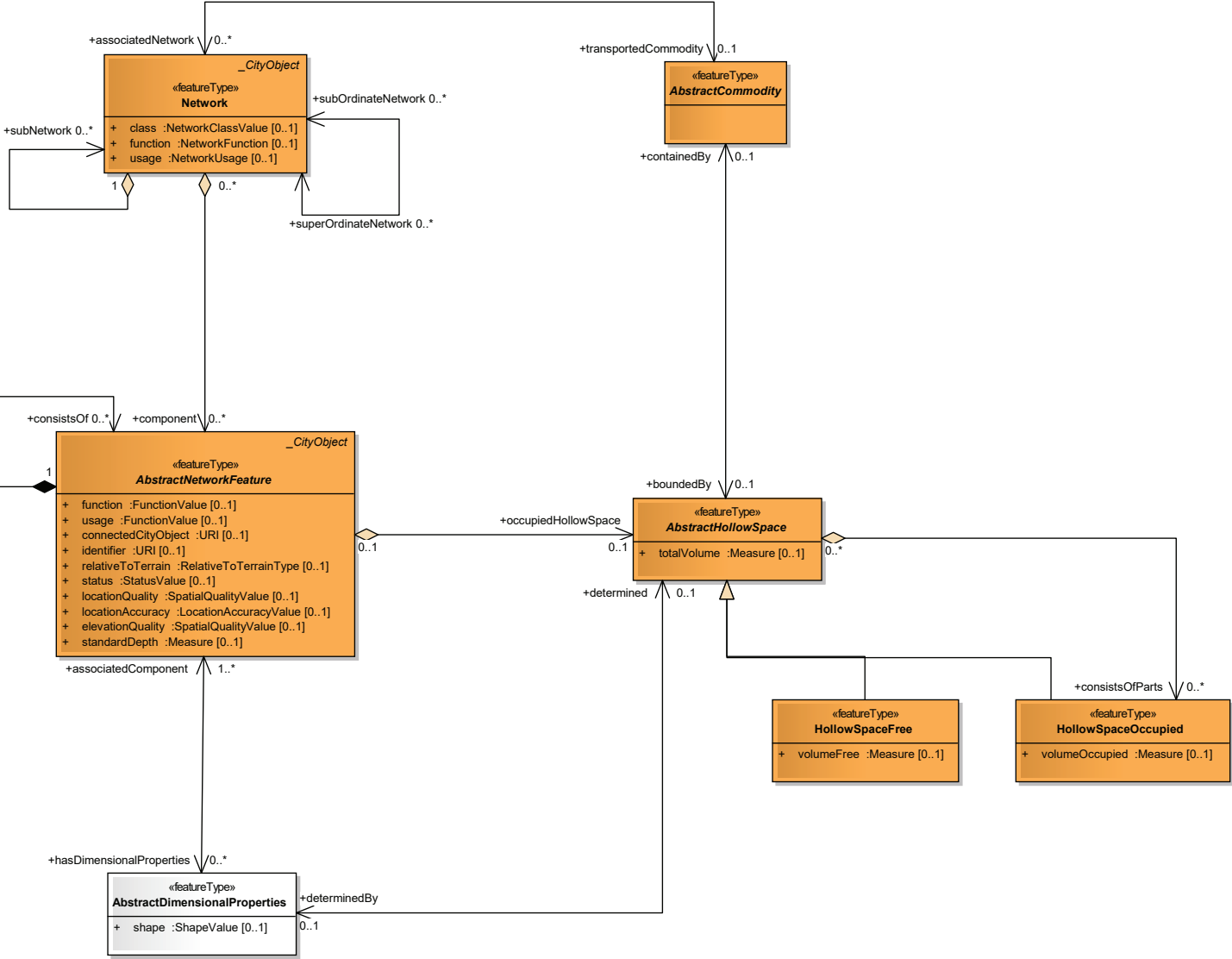
**«enumeration»
MaintenanceTimelineType**
unknown
lastMaintenance
currentMaintenance
plannedMaintenance

**«codeList»
MaintenanceActivityType**
+ unknown
+ inspection
+ surveillance
+ rehabilitation
+ replacement
+ other

**«dataTypes»
Contact**
+ address :AddressRepresentation [0..1]
+ contactInstruction :CharacterString [0..1]
+ electronicMailAddress :CharacterString [0..1]
+ hoursOfService :CharacterString [0..1]
+ telephoneFacsimile :CharacterString [0..1]
+ telephoneVoiceOrganisation :CharacterString [0..1]
+ telephoneVoiceIndividual :CharacterString [0..1]
+ website :CharacterString [0..1]
+ coc :CharacterString [0..1]

**«dataTypes»
AddressRepresentation**
+ countryCode :CharacterString [0..1]
+ postName :CharacterString [0..1]
+ postCode :CharacterString [0..1]
+ houseNumber :CharacterString [0..1]
+ houseLetter :CharacterString [0..1]
+ houseNumberAddition :CharacterString [0..1]







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