

Tonto EBNF

In this section, we delineate the Extended Backus-Naur Form (EBNF) declaration pertinent to Tonto.

```
grammar Tonto

entry Model:
    imports+=Import*
    packageDeclaration=PackageDeclaration
;

/**
 * Package declaration
 */

PackageDeclaration:
    (isGlobal?='global')? 'package' (name=QualifiedName | name=!)
    declarations+=Declaration*
;

Import:
    'import' referencedModel=[PackageDeclaration:QualifiedName]
;

// <--- Declarations --->

Declaration:
    ClassDeclarationRule | AuxiliaryDeclaration
;

AuxiliaryDeclaration:
```

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    DataType | Enum | GeneralizationSetImpl | GeneralizationSet;
;

/**
 * Class Declaration
 */

ClassDeclarationRule returns ClassDeclaration:
    classElementType=OntologicalCategory
    name=QualifiedName
    ontologicalNatures=ElementOntologicalNature?
    ((' 'instanceOf' instanceOf=[ClassDeclaration:QualifiedName
    ('specializes' specializationEndurants+=[ClassDeclaration:Qualified
        (',' specializationEndurants+=[ClassDeclaration:Qualified
        )?
        ('{'
            (attributes+=Attribute | references+=InternalRelati
        '}')?
;

type DataTypeOrClass = DataType | ClassDeclaration;
type DataTypeOrClassOrRelation = DataType | ClassDeclaration | I

/**
 * Ontological Category
 */

OntologicalCategory:
    ontologicalCategory=(UnspecifiedType | NonEndurantType | End
;

UnspecifiedType returns string:
    'class'
;

NonEndurantType returns string:

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        'event' | 'situation' | 'process'
    ;

    EndurantType returns string:
        NonSortal | UltimateSortal | Sortal;

    NonSortal returns string:
        'category' | 'mixin' | 'phaseMixin' | 'roleMixin' | 'histori
    ;

    UltimateSortal returns string:
        'kind' | 'collective' | 'quantity' | 'quality' | 'mode' | '
    ;

    Sortal returns string:
        'subkind' | 'phase' | 'role' | 'historicalRole'

/**
 * Ontological Nature
 */

ElementOntologicalNature:
    'of' natures+=OntologicalNature (',' natures+=OntologicalNa
    ;

    OntologicalNature returns string:
        'objects' | 'functional-complexes' | 'collectives' | 'quan
        'relators' | 'intrinsic-modes' | 'extrinsic-modes' | 'quali
        'events' | 'situations' | 'types' | 'abstract-individuals'
    ;

/**
 * Attributes
 */

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Attribute:
    name=ID ':' attributeTypeRef=[DataType:QualifiedName]
    cardinality=Cardinality?
    ('{'((isOrdered?='ordered') & (isConst?='const') & (isDerive
;

Cardinality:
    '[' lowerBound=(INT | '*')
    ('..' upperBound=(INT | '*'))? ']'
;

/**
 * Relations
 */

ElementRelation:
    InternalRelation | ExternalRelation
;

InternalRelation infers ElementRelation:
    ('@'relationType=RelationStereotype)?
    RelationData
;

ExternalRelation infers ElementRelation:
    ('@'relationType=RelationStereotype)?
    'relation' firstEnd=[ClassDeclaration:QualifiedName]
    RelationData
;

fragment RelationData:
    firstEndMetaAttributes=RelationMetaAttributes?
    firstCardinality=Cardinality?
    RelationName
    secondCardinality=Cardinality?
    secondEnd=[DataTypeOrClassOrRelation:ID]

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        secondEndMetaAttributes=RelationMetaAttributes?
        ('specializes' specializeRelation=[ElementRelation:Qualified
        (hasInverse='inverseOf' inverseEnd=[ElementRelation:Qualified
;

fragment RelationName:
    (RelationType ((name=QualifiedName | name=STRING) '--'))? |
    (('--' name=QualifiedName | name=STRING)? RelationInvertedType
;

fragment RelationType:
    (isAssociation?='--' | isAggregation?='<>--' | isComposition?=
;

fragment RelationInvertedType:
    isAggregationInverted?='--<>' | isCompositionInverted?='--<
;

RelationMetaAttributes:
    '('
    ('{' endMetaAttributes+=RelationMetaAttribute
    (',' endMetaAttributes+=RelationMetaAttribute )* '}' )?
    (endName=ID)?
    ')'
;

RelationMetaAttribute:
    isOrdered?='ordered' | isConst?='const' | isDerived?='derived'
    ('subsets' subsetRelation=[ElementRelation:QualifiedName] )
    ('redefines' redefinesRelation=[ElementRelation:QualifiedName]
;

RelationStereotype returns string:
    'material' |
    'derivation' |

```

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    'comparative' |
    'mediation' |
    'characterization' |
    'externalDependence' |
    'componentOf' |
    'memberOf' |
    'subCollectionOf' |
    'subQuantityOf' |
    'instantiation' |
    'termination' |
    'participational' |
    'participation' |
    'historicalDependence' |
    'creation' |
    'manifestation' |
    'bringsAbout' |
    'triggers' |
    'composition' |
    'aggregation' |
    'inherence' |
    'value' |
    'formal' |
    'manifestation' |
    'constitution' |
    ID |
    STRING
;

/**
 * GenSets
 */

type ClassDeclarationOrRelation = ClassDeclaration | ElementRela

GeneralizationSet:
    (disjoint?='disjoint')? (complete?='complete')?

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'genset' name=ID '{'
    (
        'general' generalItem=[ClassDeclarationOrRelation]
        ('categorizer' categorizerItems+=[ClassDeclarationOrRelation])?
        'specifics' specificItems+=[ClassDeclarationOrRelation]
        (',' specificItems+=[ClassDeclarationOrRelation])?
    )
'}'
;

```

GeneralizationSetShort returns GeneralizationSet:

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(disjoint?='disjoint')? (complete?='complete')?
'genset' name=ID 'where'
specificItems+=[ClassDeclarationOrRelation:QualifiedNames]
'specializes' generalItem=[ClassDeclarationOrRelation:QualifiedNames]
;

```

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/**
 * DataTypes
 */

```

DataType:

```

'datatype' name=ID ontologicalNature=ElementOntologicalNature
('specializes' specializationEndurants+=[DataTypeOrClass:QualifiedNames])?
(',' specializationEndurants+=[DataTypeOrClass:QualifiedNames])?
('{ '
    (attributes+=Attribute)*
'}')?
;

```

Enum infers DataType:

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isEnum?='enum' name=ID
('specializes' specializationEndurants+=[DataTypeOrClass:QualifiedNames])?
(',' specializationEndurants+=[DataTypeOrClass:QualifiedNames])?
;

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    '{'
        (elements+=EnumElement
        ((',' ) elements+=EnumElement)*)?
    '}'
;

EnumElement:
    name=ID
;

/**
 * Terminals
 */

hidden terminal WS: /\s+;/
terminal ID: /[_a-zA-Z][_w_]*;/
terminal INT returns number: /[0-9]+;/
terminal STRING: /"[^"]*"|'['']*'/;

hidden terminal ML_COMMENT: /\/*[\s\S]*?\*\/;/
hidden terminal SL_COMMENT: /\/*[\s\S]*?\/;/

QualifiedName returns string:
    ID ('.' ID)*
;

```