

# Tonto EBNF

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

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grammar Tonto

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

/***
 * Package declaration
 */

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

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

// <--- Declarations --->

Declaration:
    ClassDeclarationRule | AuxiliaryDeclaration
;

AuxiliaryDeclaration:
```

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    DataType | Enum | GeneralizationSetImpl | GeneralizationSets;
;

/***
* Class Declaration
*/
ClassDeclarationRule returns ClassDeclaration:
    classElementType=OntologicalCategory
    name=QualifiedName
    ontologicalNatures=ElementOntologicalNature?
    ('(' 'instanceOf' instanceOf=[ClassDeclaration:QualifiedName]
    ('specializes' specializationEndurants+=[ClassDeclaration:QualifiedName]
        (',' specializationEndurants+=[ClassDeclaration:QualifiedName]
        )?
        ('{''
            (attributes+=Attribute | references+=InternalRelation
        '}')?
    ;
;

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

/***
* Ontological Category
*/
OntologicalCategory:
    ontologicalCategory=(UnspecifiedType | NonEndurantType | EndurantType);
;

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' | 'historicalRole'
;

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

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

/**
 * Ontological Nature
 */
ElementOntologicalNature:
    'of' natures+=OntologicalNature (',' natures+=OntologicalNature)*
;

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

/**
 * Attributes
 */

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

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:QualifiedName] )
(hasInverse='inverseOf' inverseEnd=[ElementRelation:QualifiedName])
;

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

GeneralizationSetShort returns GeneralizationSet:
(disjoint?='disjoint')? (complete?='complete')?
'gensem' name=ID 'where'
specificItems+=[ClassDeclarationOrRelation:QualifiedName]
'specializes' generalItem=[ClassDeclarationOrRelation:QualifiedName]
;
/***
* DataTypes
*/
;

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

Enum infers DataType:
isEnum?='enum' name=ID
('specializes' specializationEndurants+=[DataTypeOrClass:QualifiedName])
( ',' specializationEndurants+=[DataTypeOrClass:QualifiedName])
)?
;
```

```

'{'  

    (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: /\/*[^\\n\\r]*/;  
  

QualifiedName returns string:  

    ID ('.' ID)*  

;

```