Data Models for Conceptual Structures

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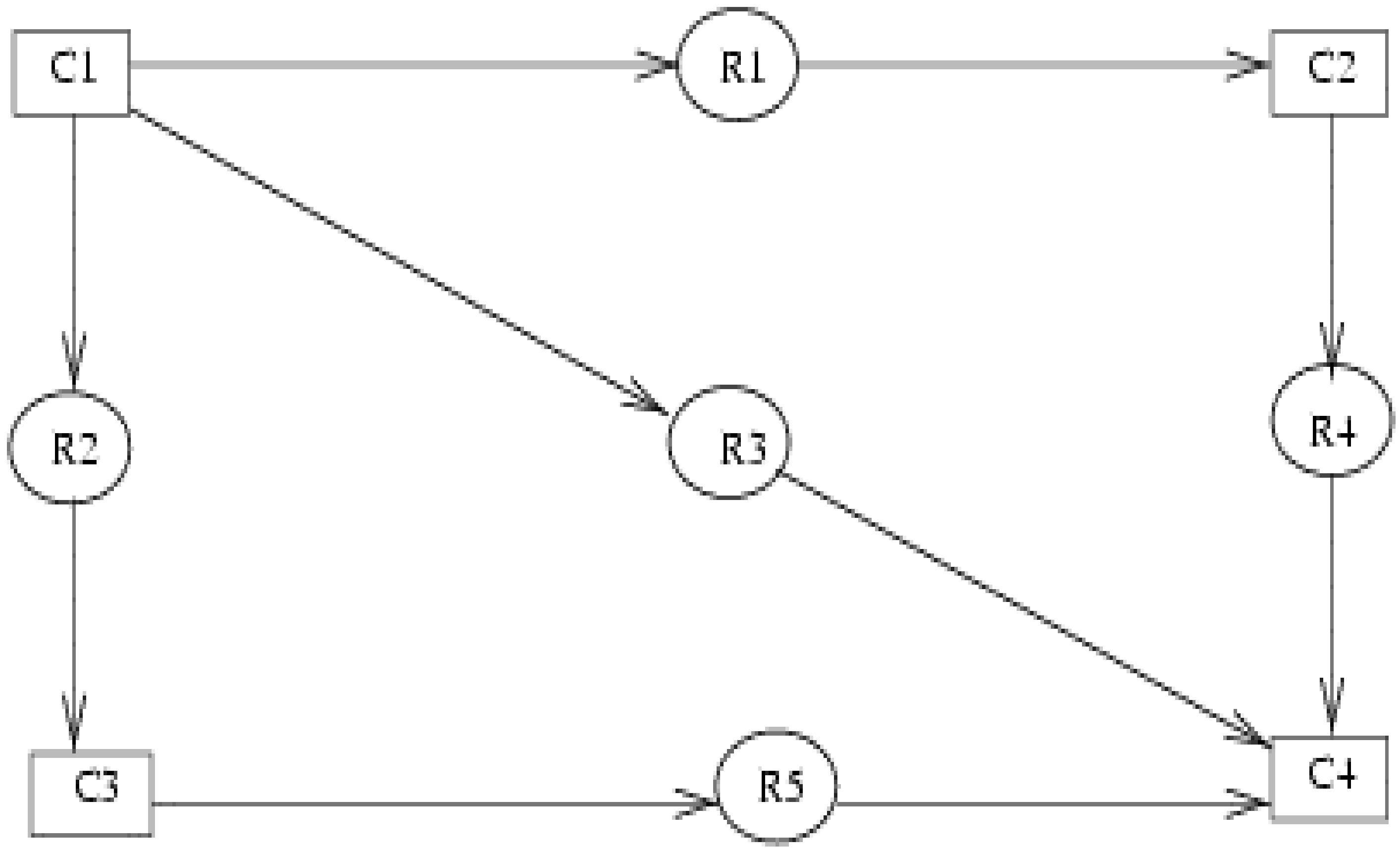
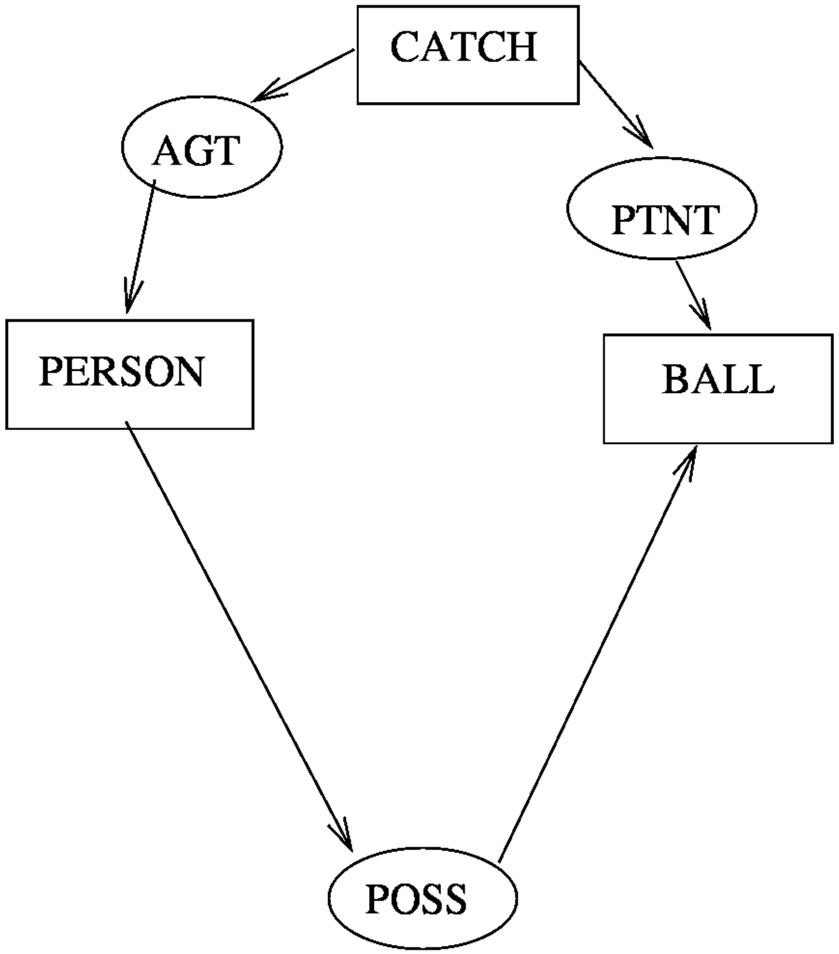
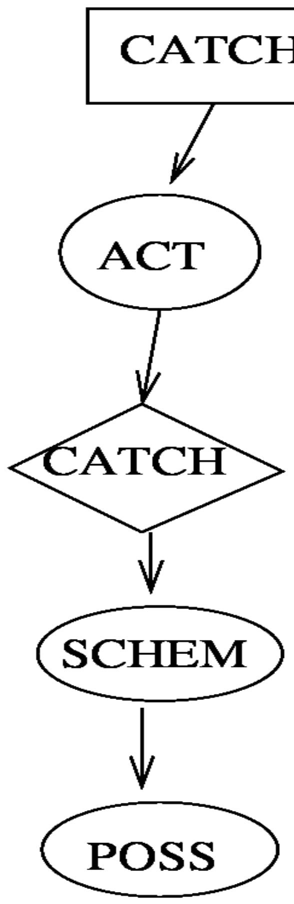
Basic CS Graph



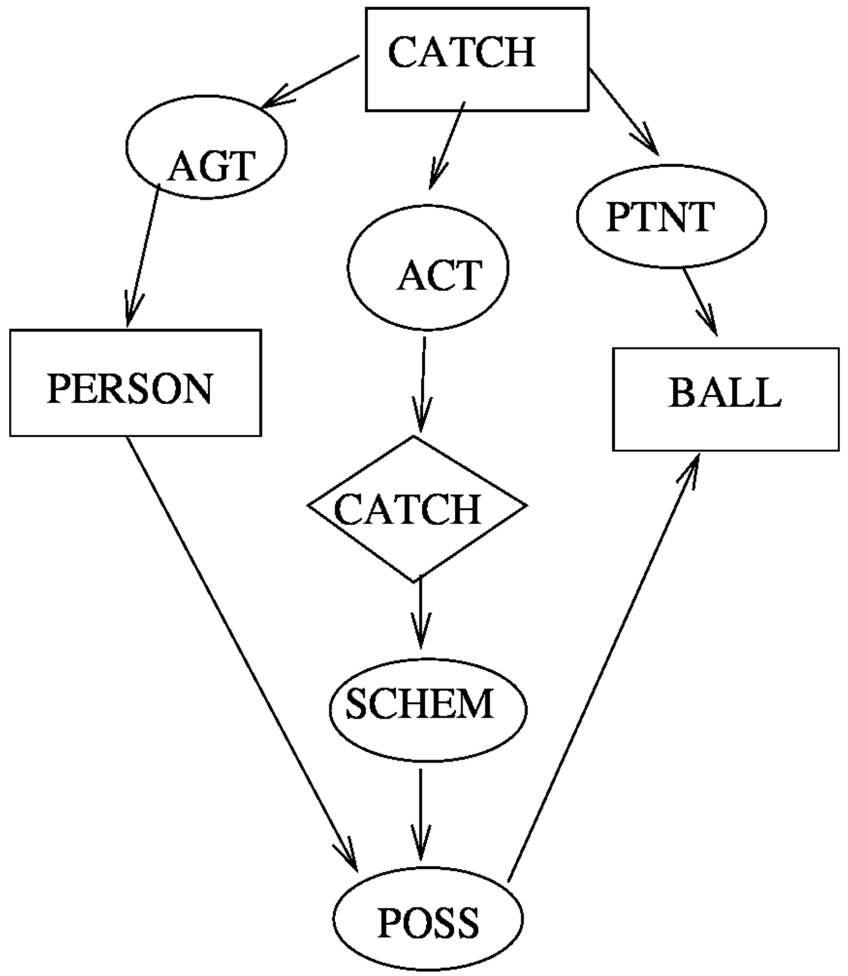
Definitional CP Graph



CP Overlay Graph



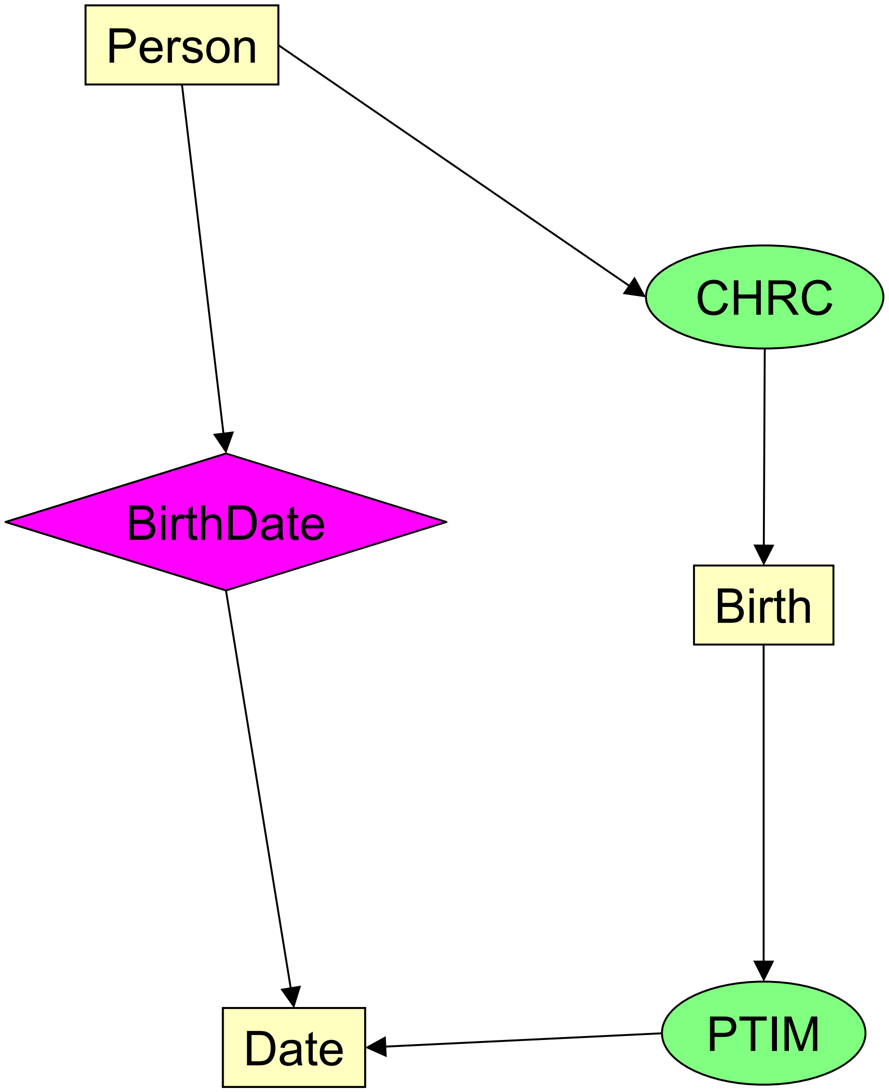
Complete CP Procedural Graph



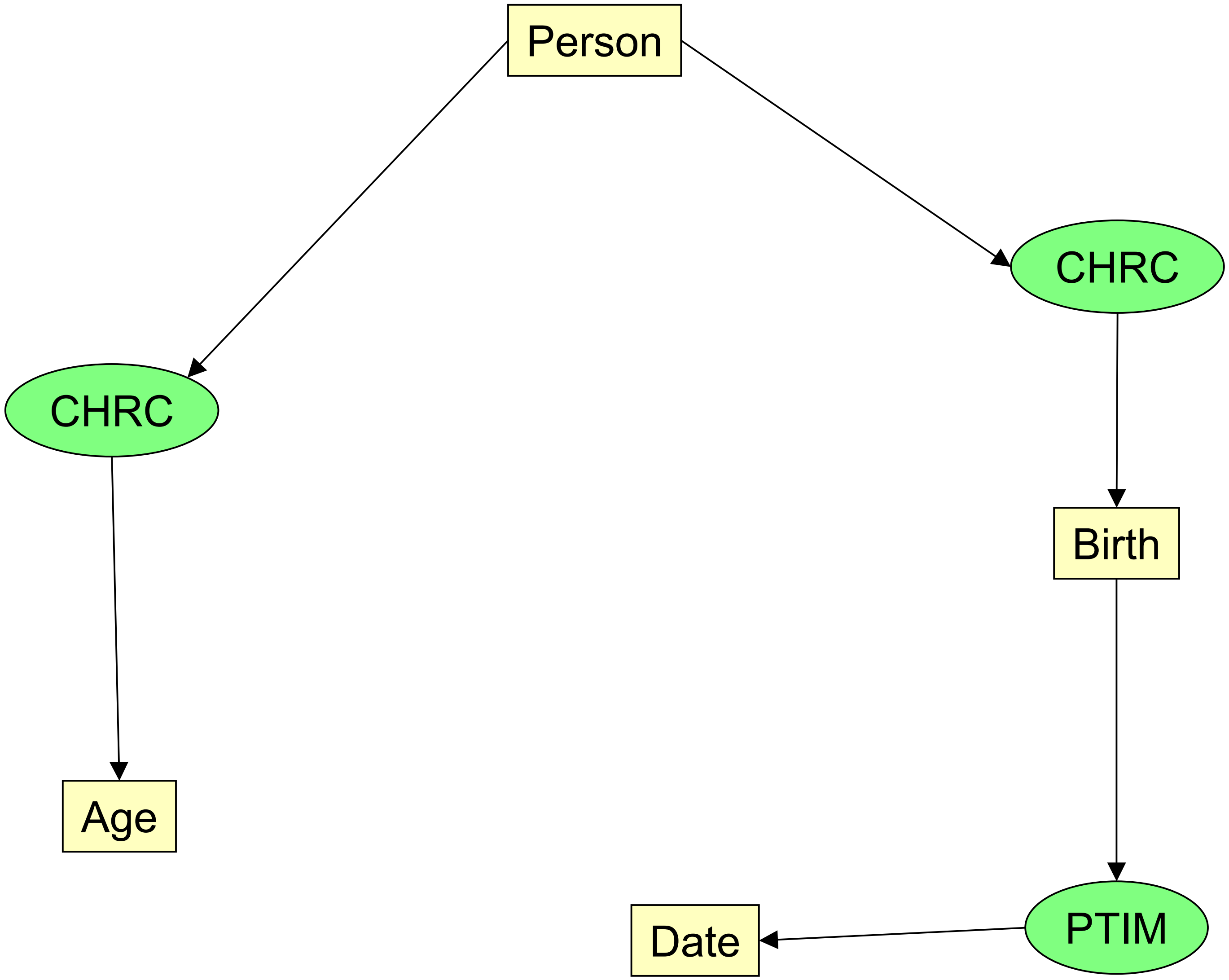
Small Example

- CS Graph example
- Simple CP overlay examples
- CP overlay across Definition Graphs
- CP Model

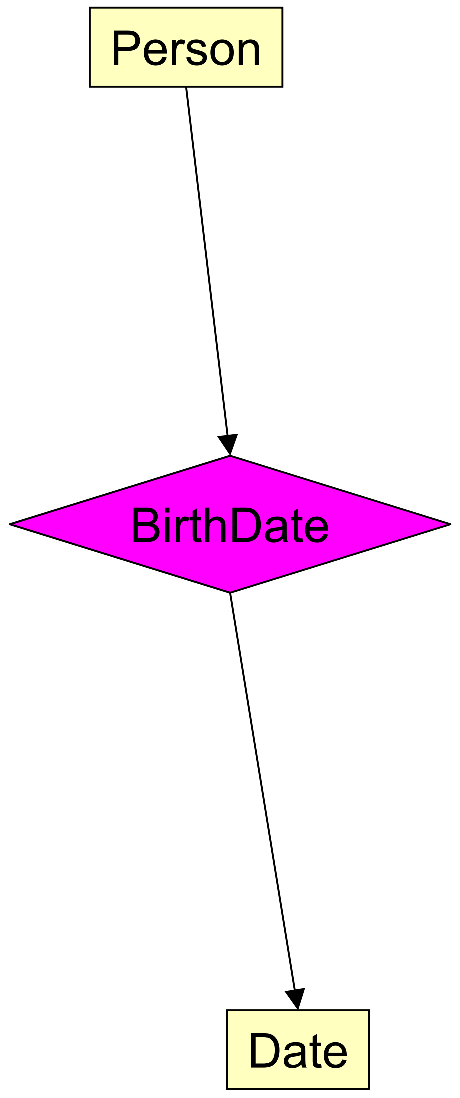
PersonBirth is Graph



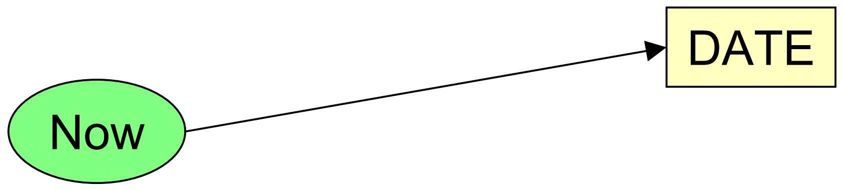
Person is DefGraph



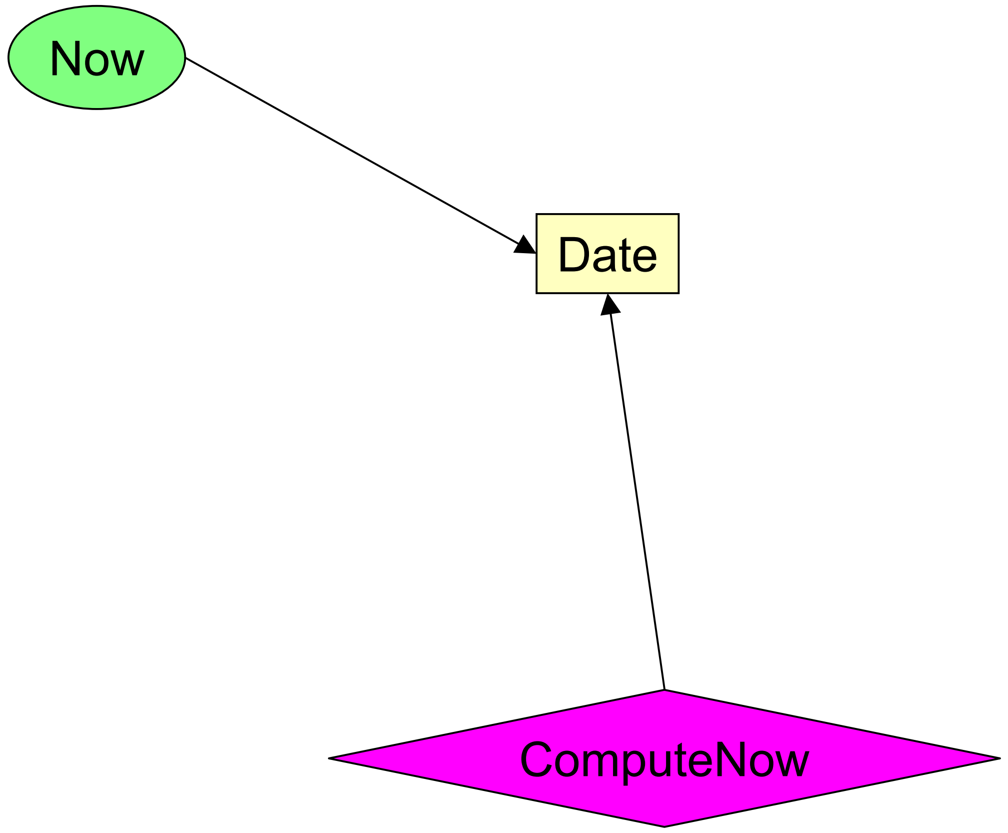
BirthDate is OvGraph



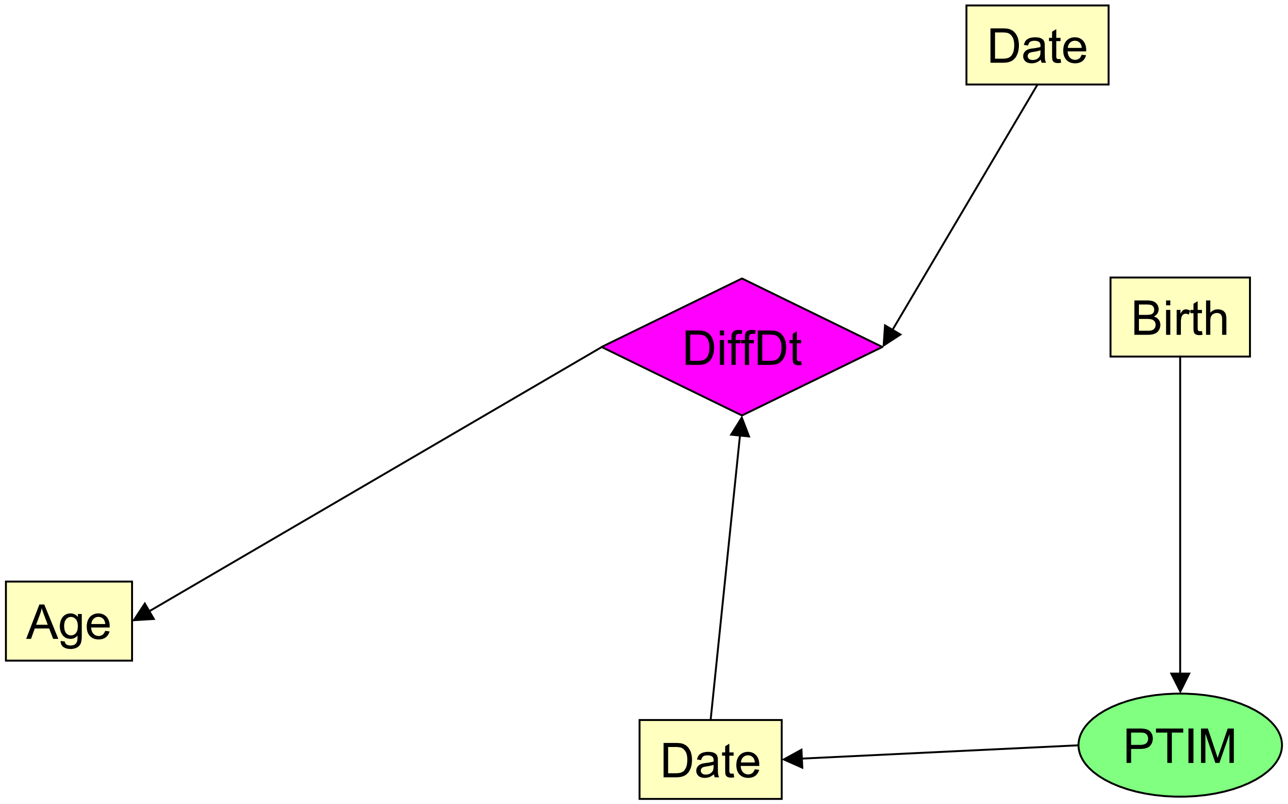
Now is DefGraph



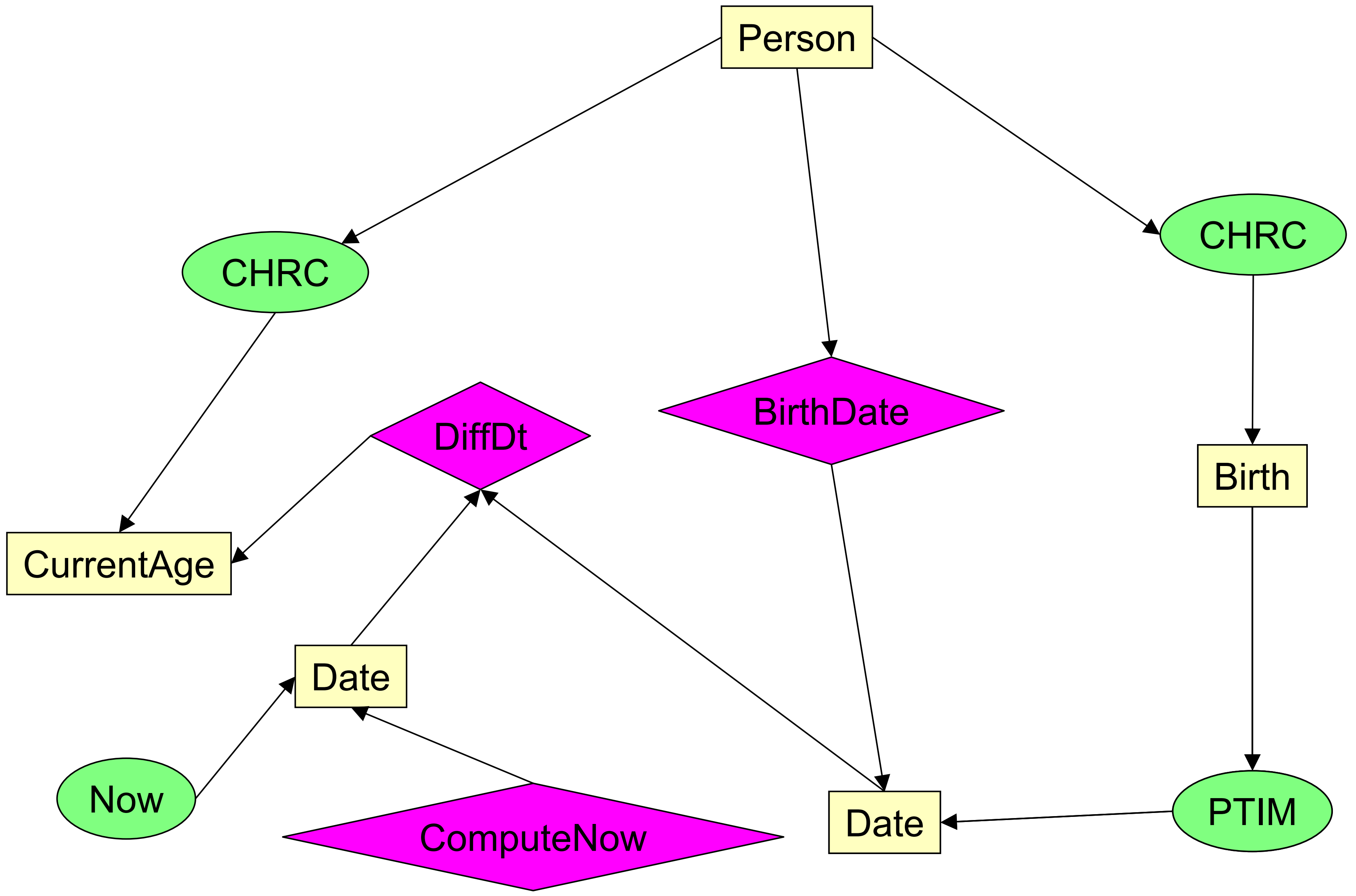
ComputeNow is OvGraph



Age is OvGraph



CurrentAge is PartModel



CGIF for Conceptual Structures

- CG
  CG ::= (Concept | Relation | Actor | SpecialContext | Comment)*
- Concept
  Concept ::= "[" Type(1)? {CorefLinks?, Referent?} Comment? "]“
- Relation
  Relation ::= "(" Type(N) Arc* Comment? ")"
- Actor
  Actor ::= "<" Type(N) Arc* "|" Arc* Comment? ">"
- SpecialContext
  SpecialContext ::= Negation | "[" SpecialConLabel ":"CG "]"
- Comment
  Comment ::= DelimitedStr(";")

Data Model

ADTs

- Definition of types and structures
- Operations on those types

DTD Structure

```
<!ELEMENT cg                (concept | relation | actor | specialcontext |
                              cgcomment)*>
<!ELEMENT concept           (contypelabel?, (coreflinks | referent |
                             ((coreflinks, referent) | (referent,
                                coreflinks)))?,concomment?)>
<!ELEMENT relation          (reltypelabel, arc*, relcomment?)>
<!ELEMENT actor             (reltypelabel, arc*,(actorcomment)?)>
<!ELEMENT specialcontext    (negation | (specialconlabel, cg))>
<!ELEMENT cgcomment         (#PCDATA)>
```

Creation of Data Models

- Haskell Language
- By Hand – using XmlSpy

Haskell Data Model (Basic CS Constructs)

```
type CG = ([CNode], [RNode])
type Label = String
data CNode = Concept Label Referent
data RNode = Relation Label InArcs OutArc
type InArcs = [CNode]
type OutArc = CNode
data Referent = Nil | Literal Literal | Graph CG
data Literal = LitString String | Name String | Marker String
```

Haskell Simple Example

```
let sit = Concept “Sit” Nil in
  ([],[Relation “AGT” [sit] Concept “Cat” Literal Name “Fred”,
        Relation “LOC” [sit] Concept “Mat” Nil])
```

Haskell Data Model (Add Co-references)

```
type CG = ([CNode], [RNode])
type Label = String
type CoRef = String
data CNode = Concept Label Referent |
             DefConcept Label CoRef Referent |
             BoundConcept CoRef
data RNode = Relation Label InArcs OutArc
type InArcs = [CNode]
type OutArc = CNode
data Referent = Nil | Literal Literal | Graph CG
data Literal = LitString String | Name String | Marker String
```

Haskell Example (With Co-references)

```
([],[Relation “AGT”
                [DefConcept “Sit” “x” Nil]
                Concept “Cat”  Literal Name “Fred”,
    Relation “LOC”
                [BoundConcept “x”]
                Concept “Mat” Nil])
```

Haskell Grammar (Part 1)

```
CG      : Node
        | Node CG

Node    : Relation
        | Concept
        | Actor
        | Negation
```

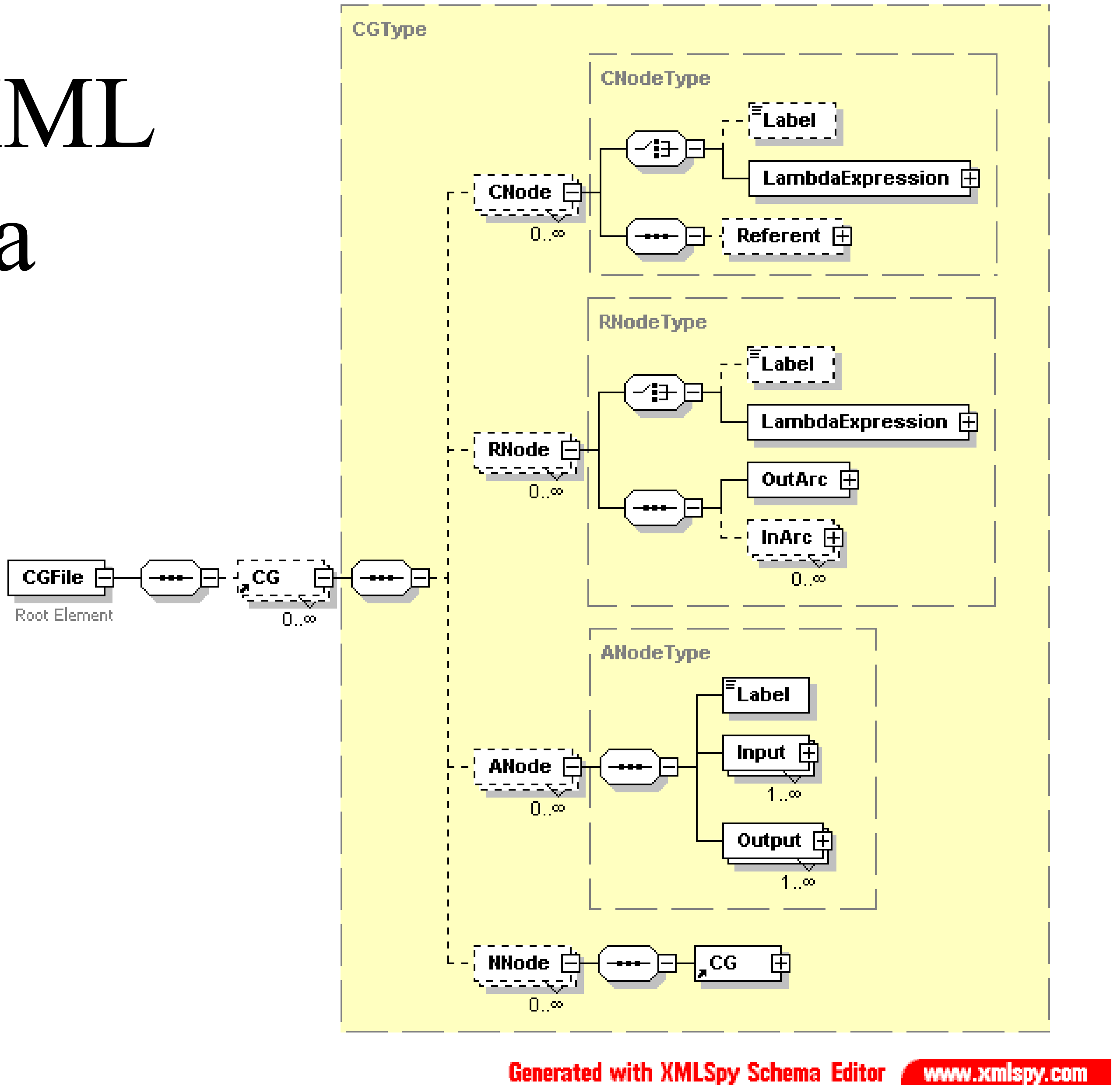
Haskell Grammar (Part 2)

```
Relation: '(' TypeExp Arcs ')'
Actor   : '<' id Arcs '|' Arcs '>'
Negation: '~' '[' CG ']'
Concept : '[' TypeExp ':' Referent ']'
        | '[' TypeExp '*' id ':' Referent ']'
        | '[' TypeExp ']'
        | '[' TypeExp '*' id ']'
        | '[' ']'
        | '[' ':' Referent ']'
```

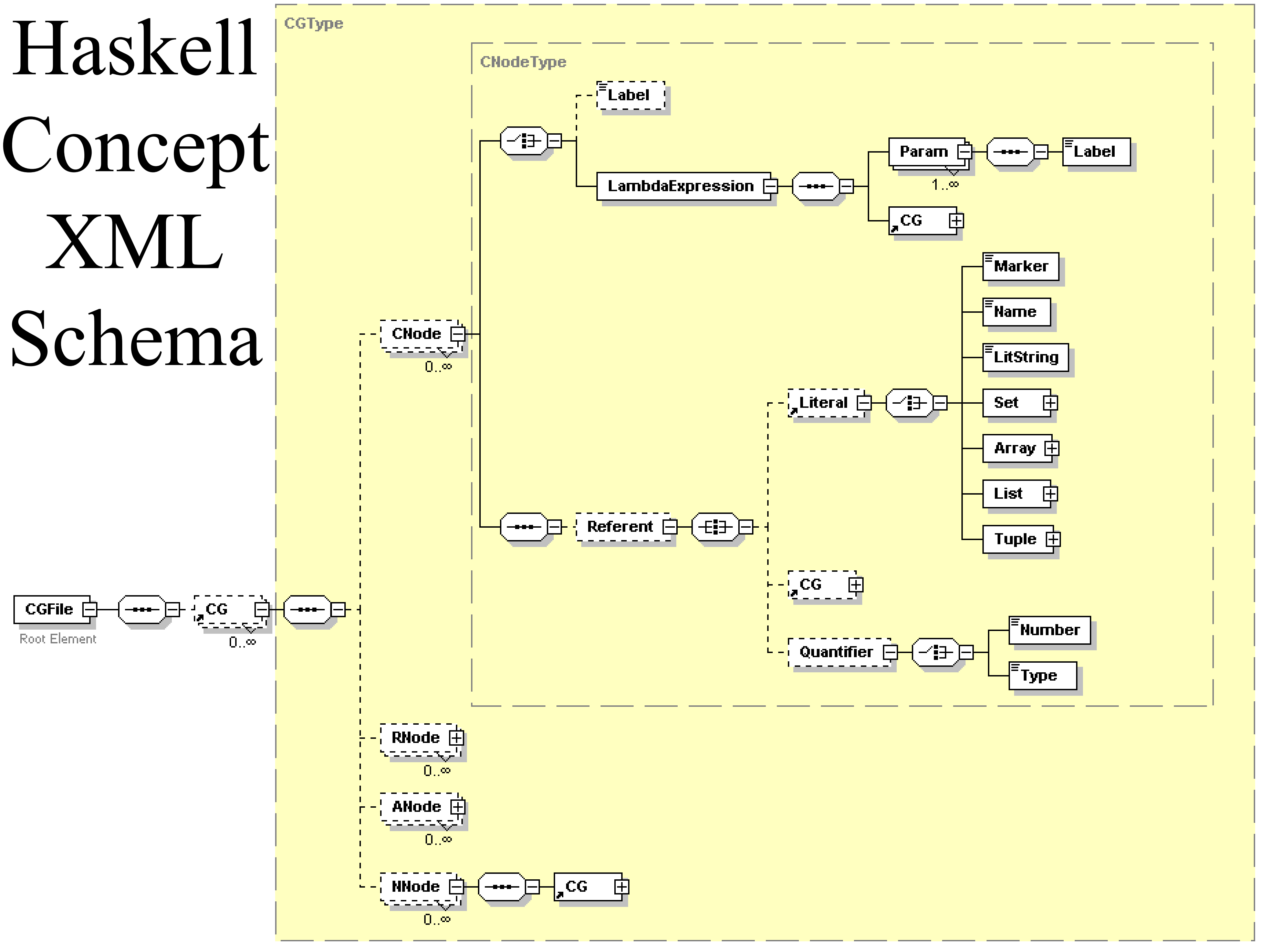
Graph Data Model Types

- Pointer Type
- Adjacency List Type
- Adjacency Matrix Type

Haskell XML Schema



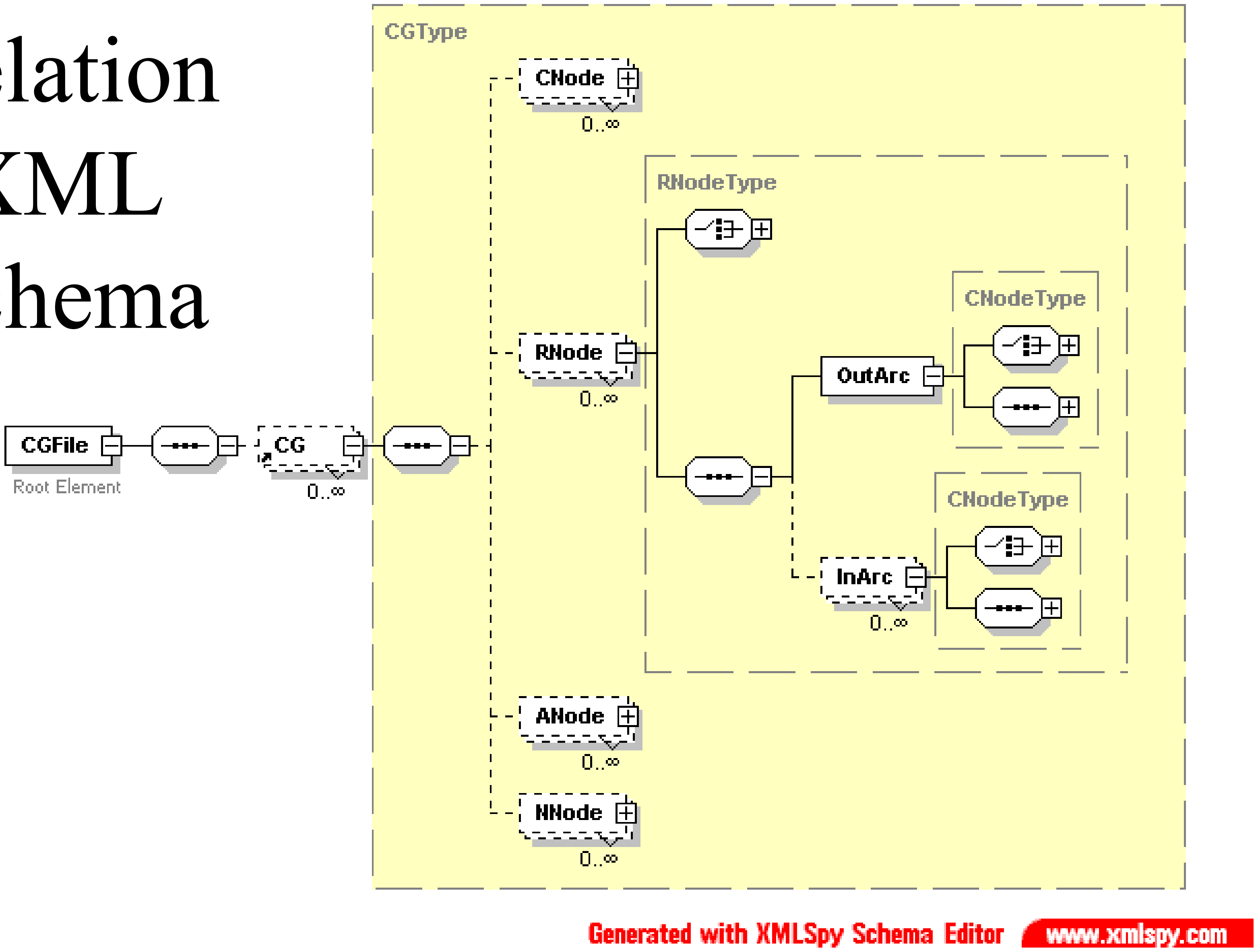
Haskell Concept XML Schema



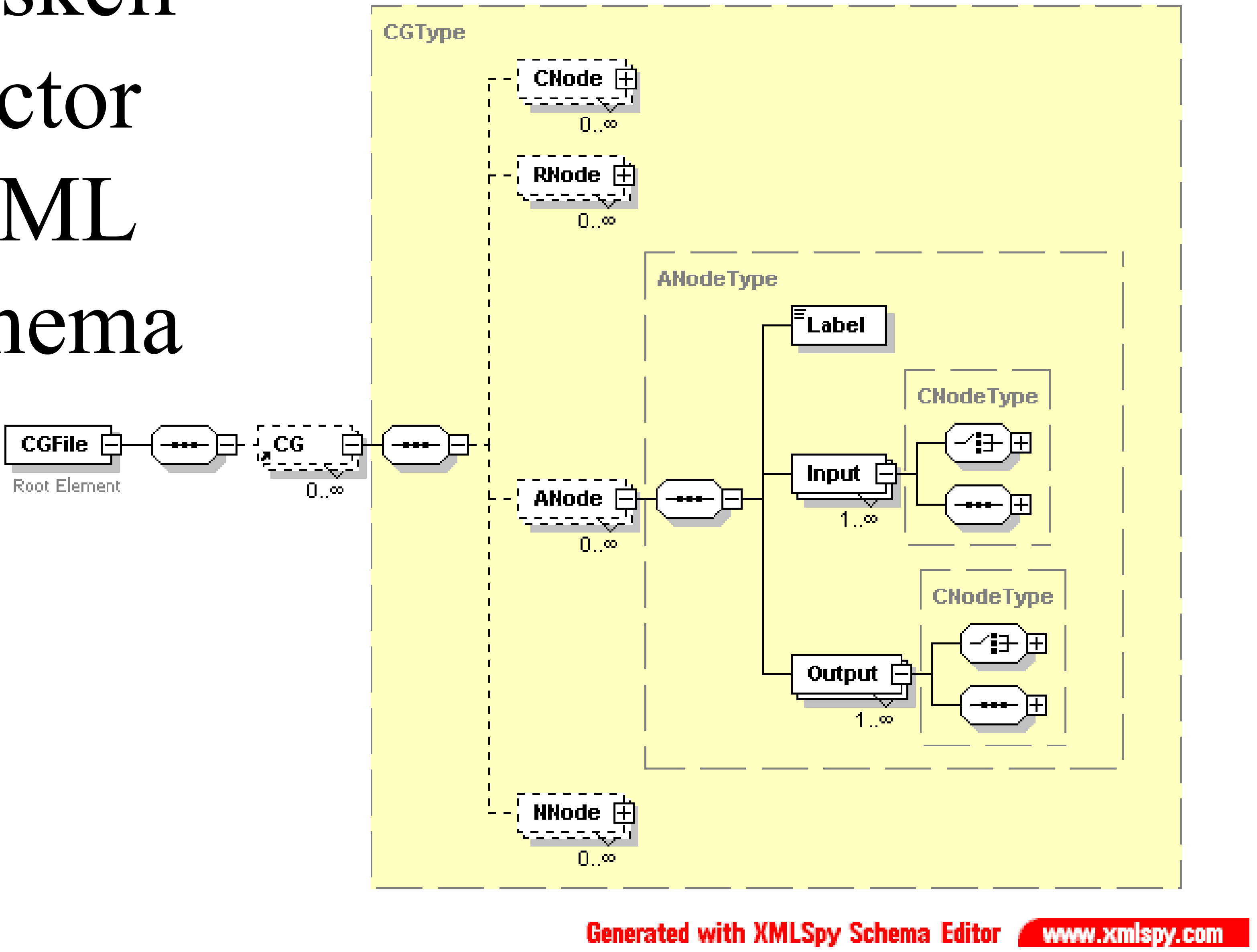
Haskell Concept Attribute

Name	- CoRef
Type	- xs:string
Use	- optional

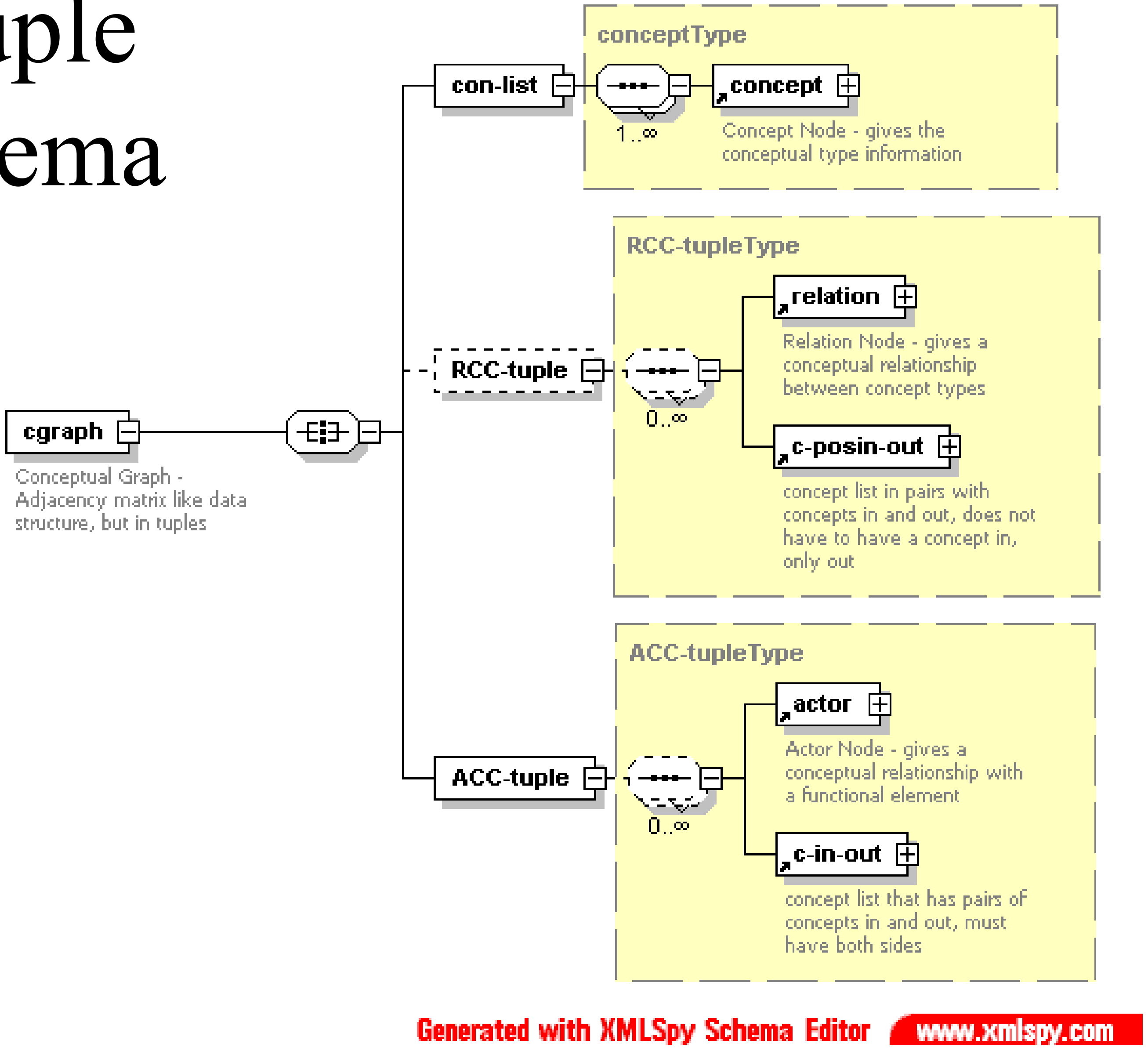
Haskell Relation XML Schema



Haskell Actor XML Schema

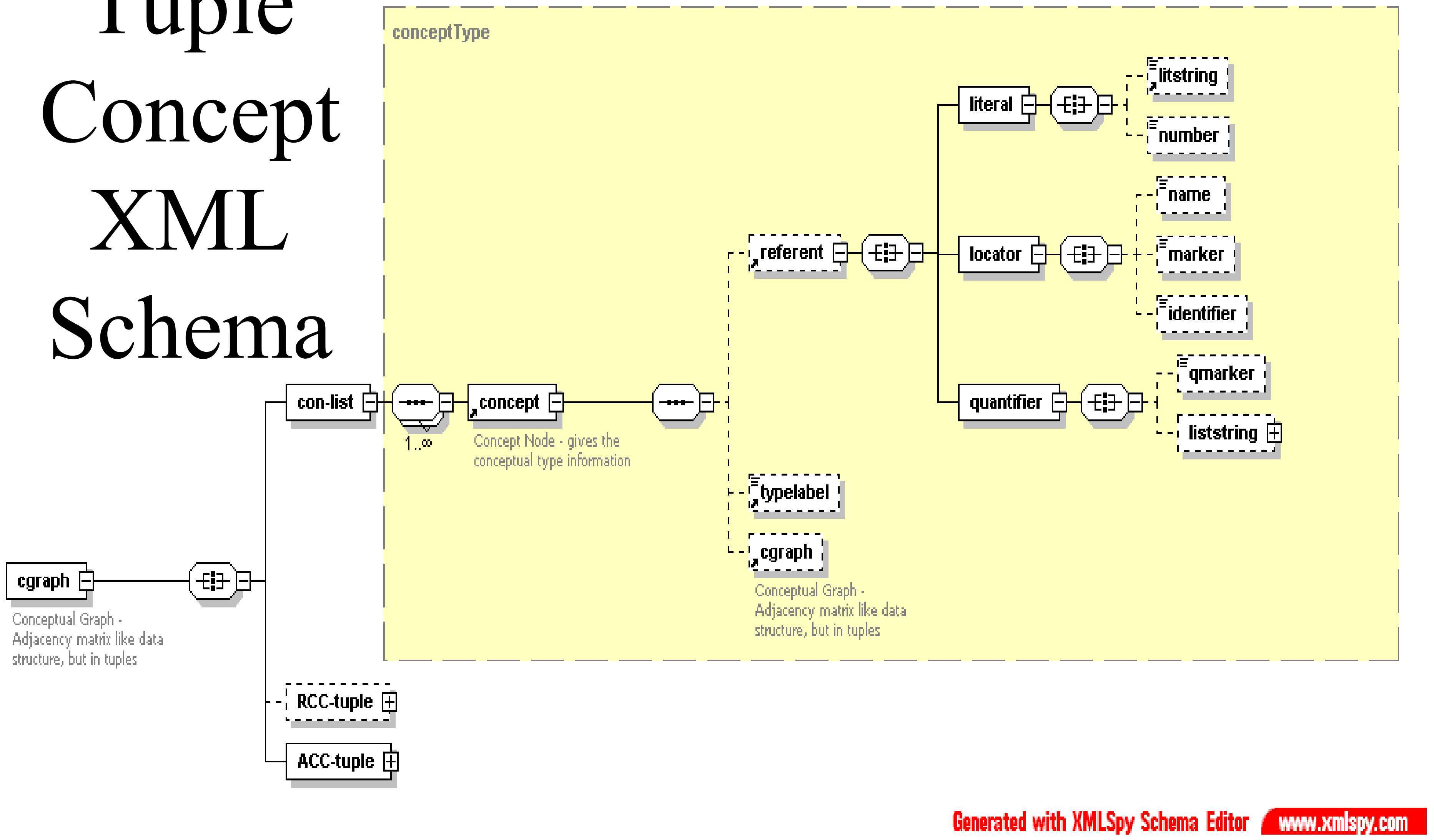


Graph Tuple XML Schema



conceptType
con-list
1..∞
concept
Concept Node - gives the conceptual type information
RCC-tupleType
relation
Relation Node - gives a conceptual relationship between concept types
RCC-tuple
0..∞
c-posin-out
concept list in pairs with concepts in and out, does not have to have a concept in, only out
cgraph
Conceptual Graph - Adjacency matrix like data structure, but in tuples
ACC-tupleType
actor
Actor Node - gives a conceptual relationship with a functional element
ACC-tuple
0..∞
c-in-out
concept list that has pairs of concepts in and out, must have both sides
Generated with XMLSpy Schema Editor
www.xmlspy.com

Graph Tuple Concept XML Schema



conceptType
con-list
1..∞
concept
Concept Node - gives the conceptual type information
referent
literal
litstring
number
locator
name
marker
identifier
quantifier
qmarker
liststring
typelabel
cgraph
Conceptual Graph - Adjacency matrix like data structure, but in tuples
cgraph
Conceptual Graph - Adjacency matrix like data structure, but in tuples
RCC-tuple
ACC-tuple
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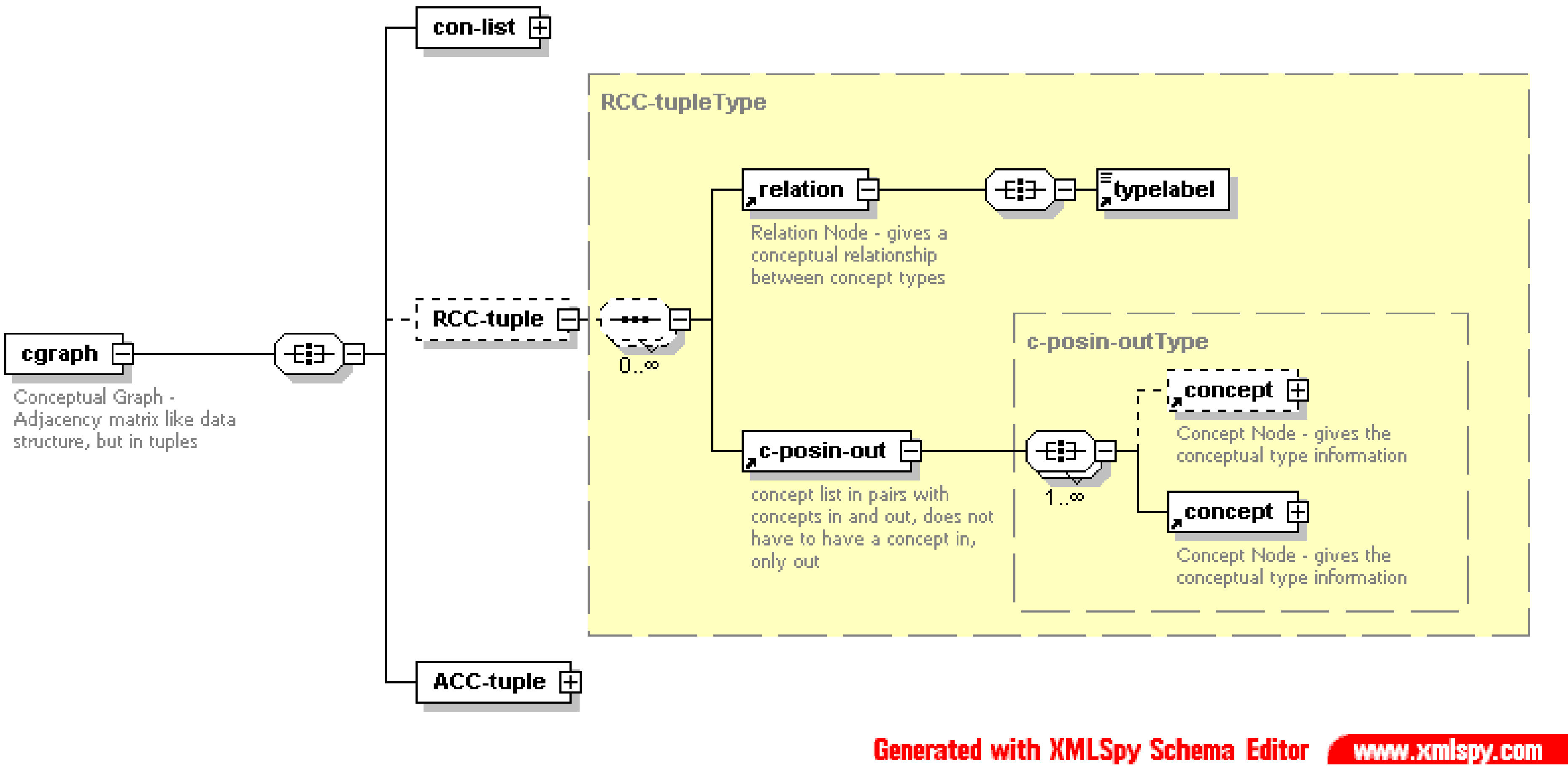
Graph Tuple Concept Attribute

• Name	- uniquecon
• Type	- xs:ID
• Use	- required

Graph RCC Tuple XML Schema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Relation Node - gives a conceptual relationship between concept types
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1..∞
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ACC-tuple
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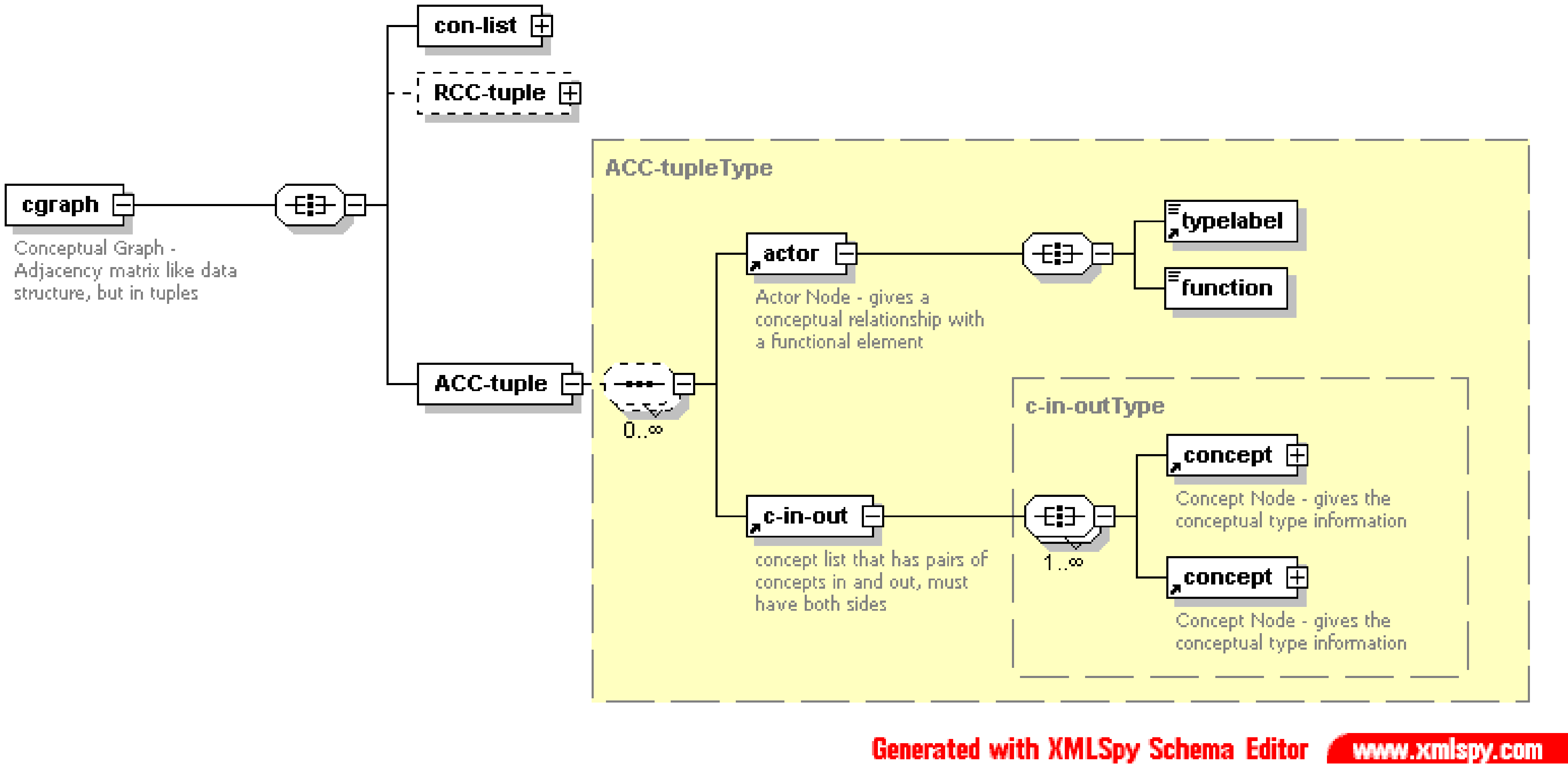
Graph ACC Tuple XML Schema



cgraph
Conceptual Graph - Adjacency matrix like data structure, but in tuples
con-list
RCC-tuple
ACC-tuple
0..∞
ACC-tupleType
actor
Actor Node - gives a conceptual relationship with a functional element
typelabel
function
c-in-out
concept list that has pairs of concepts in and out, must have both sides
c-in-outType
1..∞
concept
Concept Node - gives the conceptual type information
concept
Concept Node - gives the conceptual type information
Generated with XMLSpy Schema Editor
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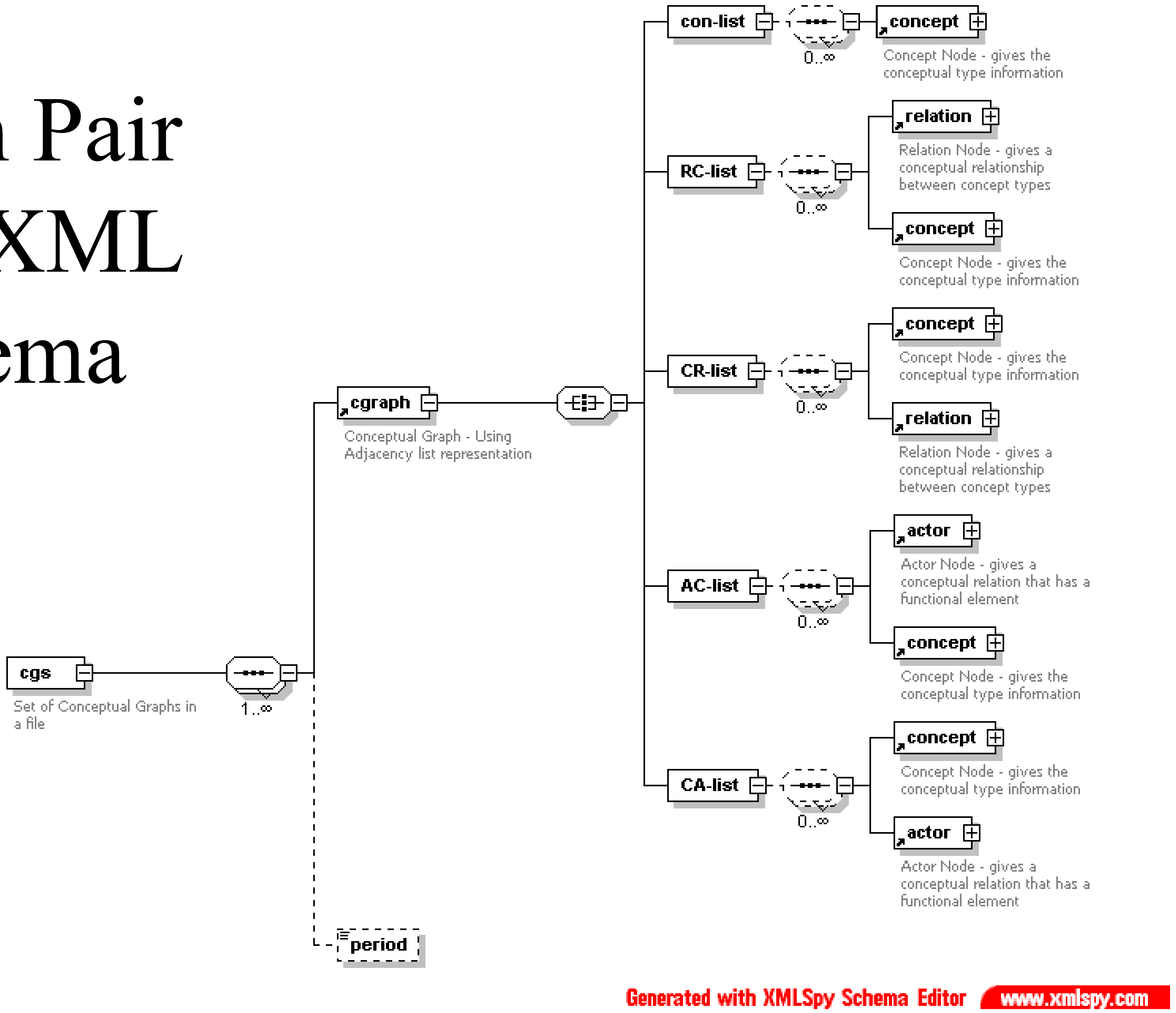
Graph Pair Lists XML Schema


cgs
Set of Conceptual Graphs in a file
1..∞
cgraph
Conceptual Graph - Using Adjacency list representation
period
con-list
0..∞
concept
Concept Node - gives the conceptual type information
RC-list
0..∞
relation
Relation Node - gives a conceptual relationship between concept types
concept
Concept Node - gives the conceptual type information
CR-list
0..∞
concept
Concept Node - gives the conceptual type information
relation
Relation Node - gives a conceptual relationship between concept types
AC-list
0..∞
actor
Actor Node - gives a conceptual relation that has a functional element
concept
Concept Node - gives the conceptual type information
CA-list
0..∞
concept
Concept Node - gives the conceptual type information
actor
Actor Node - gives a conceptual relation that has a functional element
Generated with XMLSpy Schema Editor
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