Politecnico di Milano

Facoltá di Ingegneria dell'Informazione

POLO REGIONALE DI COMO

Master of Science in Computer Engineering

ADVANCED SOFTWARE ENGINEERING COURSE PROJECT

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Contents

TICKET SYSTEM

Train ticket system has different types of ticketsa and actors . Depending on this system there are people who can use this ticket system and type of tickets. People who can buy tickets can be youth, child or adults. Depending on their age variance, seller decides what type of person they are. If the person is lower than seven years old that person is a child.If the person is between 7 and 25 that person is a youth. If the person is older than 25 that person is an adult. Person may have one subscription to system. They specific subscription numbers. They pay depending on their subscription days. These subscription tickets can ve used regionally in all transportation vehicles. For example, if a person lives in Milan in Lombardy and she wants to visit Como and wants to use telfer for seeing Brunate in Como she can use this subscription in all transportation vehicles. A person may have many city tickets. Depending on their voyage they buy diffferent types of city tickets. They can buy urban, cumulative or extra urban tickets. For urban tickets they can use it in tramways, buses and metro inside city. Urban ticket has two types one way and two way. For cumulative tickets ; person can use it for trams, museum,buses and metro inside the city as many times they want. Cumulative tickets may have different types; weekly, standard cumulative, cumulative one day. One day cumulative ticket can be used in large, medium and big area of the city. It is for one day. Weekly cumulative ticket can be used for 7 days. Standart cumulative tickets are useful for specific places during day . For city tickets there is a type which is called fair ticket. It can be used for fairs. These tickets can be single, return and daypass. Extra urban tickets for city and suburbs. For instance, if a person wants to come from airport she needs these type of city ticket.They pay depending on zone distance. Extra urban tickets can be standard one way, weekly and luggage. Person can buy also intercity tickets.

Depending on type of intercity ticket can be different types. For 5,10 and 15 journeys person can buy multijourney ticket type. For 3, 5 and 7 days person can buy multi day ticket. Or person can buy single ticket.

Depending on these scenario metamodel   is drawn. For metamodel , EMF modeling tool is used. Using ecore diagram property metamodel is drawn. Metamodel of scenarios is given in Figure 1.

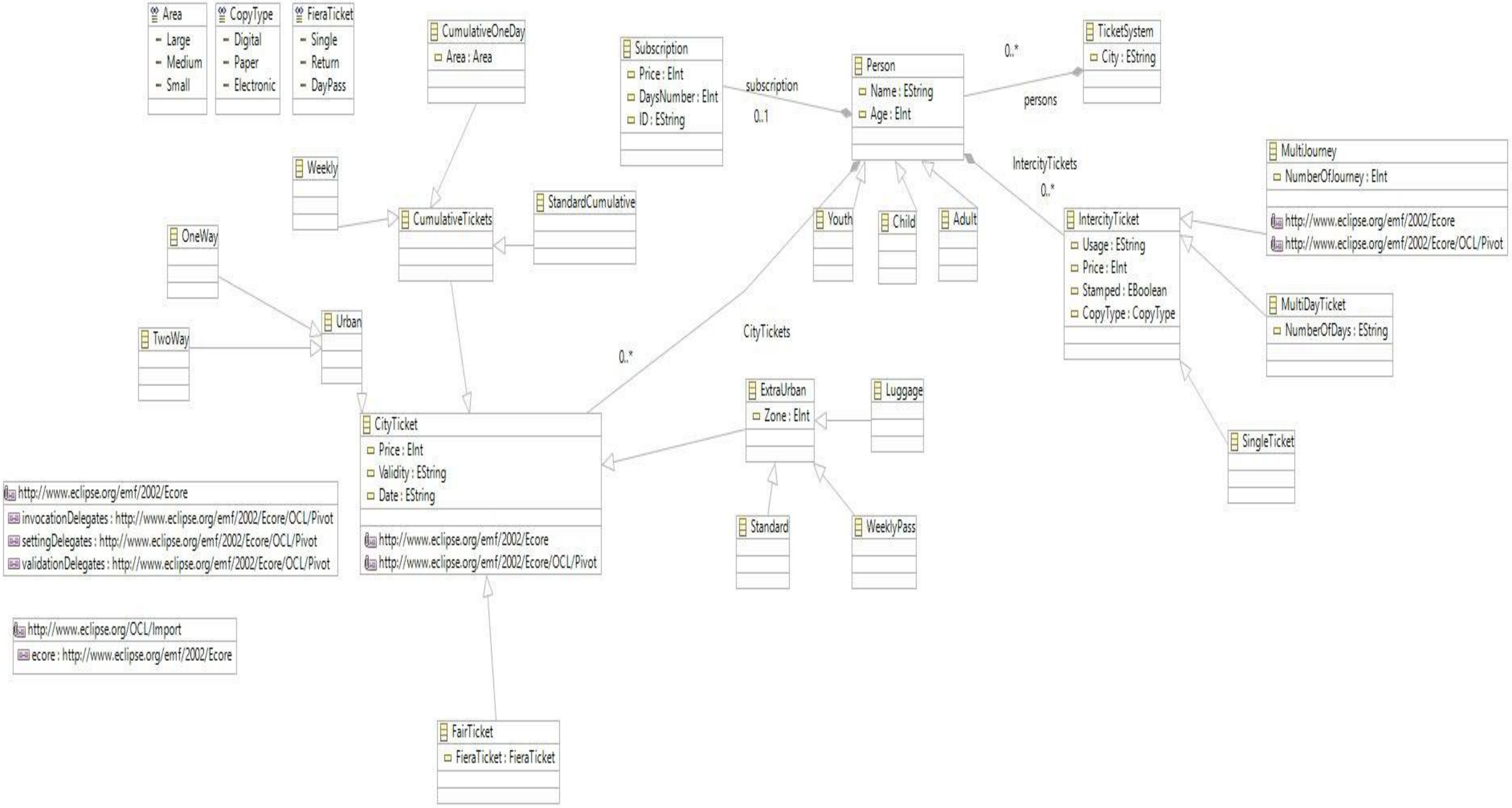
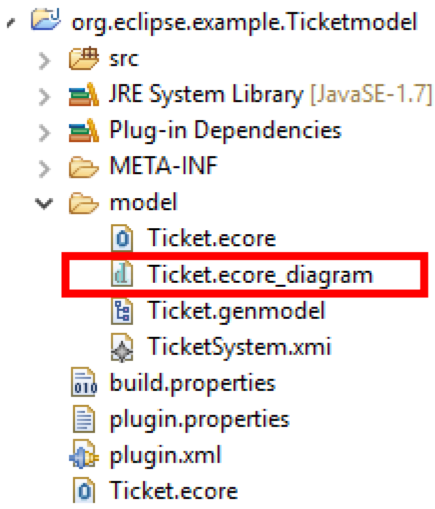


Figure 1Metamodel of Ticket System

How Retrieve Metamodel

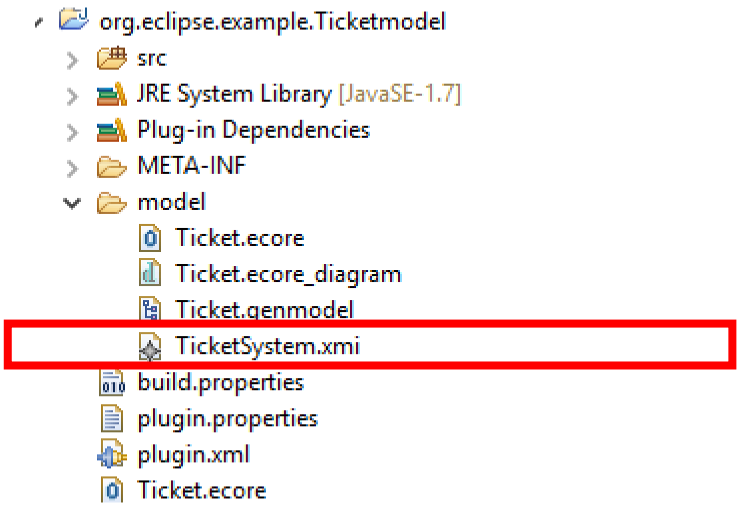
For retrtieving metamodel, after importing you can follow path which is given in figure 2.



```
org.eclipse.example.Ticketmodel
  src
  JRE System Library [JavaSE-1.7]
  Plug-in Dependencies
  META-INF
  model
    Ticket.ecore
    Ticket.ecore_diagram
    Ticket.genmodel
    TicketSystem.xmi
  build.properties
  plugin.properties
  plugin.xml
  Ticket.ecore
```

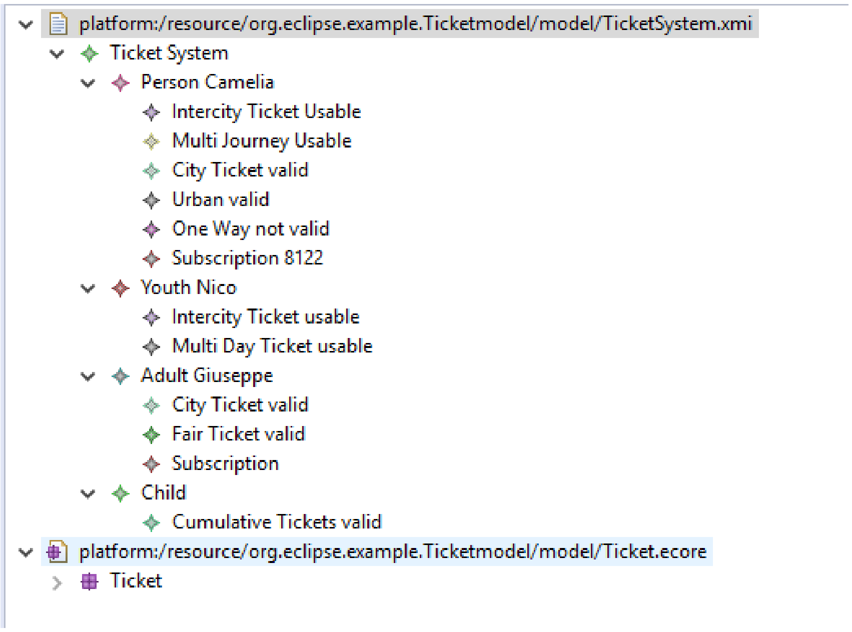
Figure 2Path of metamodel

How to Retrieve xmi sample model



```
org.eclipse.example.Ticketmodel
  src
  JRE System Library [JavaSE-1.7]
  Plug-in Dependencies
  META-INF
  model
    Ticket.ecore
    Ticket.ecore_diagram
    Ticket.genmodel
    TicketSystem.xmi
  build.properties
  plugin.properties
  plugin.xml
  Ticket.ecore
```

Figure 3 Path of xmi file



- platform:/resource/org.eclipse.example.Ticketmodel/model/TicketSystem.xmi
  - Ticket System
    - Person Camelia
      - Intercity Ticket Usable
      - Multi Journey Usable
      - City Ticket valid
      - Urban valid
      - One Way not valid
      - Subscription 8122
    - Youth Nico
      - Intercity Ticket usable
      - Multi Day Ticket usable
    - Adult Giuseppe
      - City Ticket valid
      - Fair Ticket valid
      - Subscription
    - Child
      - Cumulative Tickets valid
- platform:/resource/org.eclipse.example.Ticketmodel/model/Ticket.ecore
  - Ticket

Figure 4 Sample Model

OCL Constraints

```
package Ticket : _'org.eclipse.example.Ticket' = 'http://org/eclipse/example/ticketmodel'
{
 class Person
 {
  annotation;
  attribute Name : String[?];
  property IntercityTickets : IntercityTicket[*] { ordered composes };
  property CityTickets : CityTicket[*] { ordered composes };
  attribute Age : ecore::EInt[?];
  property subscription : Subscription[?] { composes };
  invariant mustHaveName: Name<>null;                                  1
  invariant AgeIsPositive: self.Age>0;                                  2
  invariant IDsAreUnique: self.subscription-> forAll(c1,c2| c1<>c2 implies c1.ID <> c2.ID);     3
  invariant
  AgeCategory:    if (Age>=7 and Age<25) then     'Youth'    else if (Age > 25) then     'Adult'    else
                                                                                                    4
   'Child'     endif endif;
 }
```

1-mustHaveName: For this constraint we can use it for not having null name of the person.

2-AgeIsPositive: Age of person must be positive.

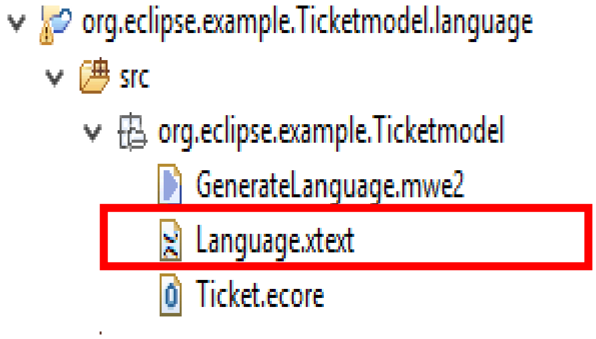
3-IDsAreUnique: All identification numbers of ticket owners should be unique.

4-AgeCategory: Age of person decides which type person she is. If the person’s age is greater than 6 and lower than 25 then person is a Youth, if person’s age is greater than 25 then person is adult. In other cases peson is a child.

5- NumberOfJourneys: Number of journeys can be 5, 10 or 15.

```
class MultiJourney extends IntercityTicket
 {
   attribute NumberOfJourney : ecore::EInt[?];
   invariant NumberOfJourneys: NumberOfJourney=10 or NumberOfJourney=5 or NumberOfJourney=15;      5
 }
```

How to Retrieve Xtext File



org.eclipse.example.Ticketmodel.language
src
org.eclipse.example.Ticketmodel
GenerateLanguage.mwe2
Language.xtext
Ticket.ecore

Figure 5 Path of Xtext File

```
// automatically generated by Xtext
grammar org.eclipse.example.ticketmodel.Language with org.eclipse.xtext.common.Terminals

import "http://org/eclipse/example/Ticketmodel"
import "http://www.eclipse.org/emf/2002/Ecore" as ecore

TicketSystem returns TicketSystem:
 {TicketSystem}
 'TicketSystem'
 '{'
  ('City' City=EString)?
  ('persons' '{' persons+=Person ( "," persons+=Person)* '}' )?
 '}';

Person returns Person:
 Person_Impl | Youth | Child | Adult;

IntercityTicket returns IntercityTicket:
 IntercityTicket_Impl | SingleTicket | MultiJourney | MultiDayTicket;

CityTicket returns CityTicket:
  CityTicket_Impl | Urban_Impl | Standard | ExtraUrban_Impl | TwoWay | OneWay | WeeklyPass | Luggage | CumulativeTickets_Impl | StandardCumulative | CumulativeOneDay | Weekly | FairTicket;


EString returns ecore::EString:
  STRING | ID;

Person_Impl returns Person:
  {Person}
  'Person'
  '{'
    ('Name' Name=EString)?
    ('Age' Age=EInt)?
    ('IntercityTickets' '{' IntercityTickets+=IntercityTicket ( "," IntercityTickets+=IntercityTicket)* '}' )?
    ('CityTickets' '{' CityTickets+=CityTicket ( "," CityTickets+=CityTicket)* '}' )?
    ('subscription' subscription=Subscription)?
  '}';

IntercityTicket_Impl returns IntercityTicket:
  {IntercityTicket}
  (Stamped?='Stamped')?
  'IntercityTicket'
  '{'
    ('Usage' Usage=EString)?
    ('Price' Price=EInt)?
    ('CopyType' CopyType=CopyType)?
  '}';

CityTicket_Impl returns CityTicket:
  {CityTicket}
  'CityTicket'
  '{'
  ('Price' Price=EInt)?
  ('Validity' Validity=EString)?
  ('Date' Date=EString)?
 '}';

EInt returns ecore::EInt:
 '-'? INT;

Subscription returns Subscription:
 {Subscription}
 'Subscription'
 '{'
  ('DaysNumber' DaysNumber=EInt)?
  ('Price' Price=EInt)?
  ('ID' ID=EString)?
 '}';

Youth returns Youth:
 {Youth}
 'Youth'
 '{'
  ('Name' Name=EString)?
  ('Age' Age=EInt)?
  ('IntercityTickets' '{' IntercityTickets+=IntercityTicket ( "," IntercityTickets+=IntercityTicket)* '}' )?
  ('CityTickets' '{' CityTickets+=CityTicket ( "," CityTickets+=CityTicket)* '}' )?
  ('subscription' subscription=Subscription)?
 '}';

Child returns Child:
 {Child}
 'Child'
 '{'
```

```
  ('Name' Name=EString)?
  ('Age' Age=EInt)?
  ('IntercityTickets' '{' IntercityTickets+=IntercityTicket ( "," IntercityTickets+=IntercityTicket)* '}' )?
  ('CityTickets' '{' CityTickets+=CityTicket ( "," CityTickets+=CityTicket)* '}' )?
  ('subscription' subscription=Subscription)?
 '}';

Adult returns Adult:
 {Adult}
 'Adult'
 '{'
  ('Name' Name=EString)?
  ('Age' Age=EInt)?
  ('IntercityTickets' '{' IntercityTickets+=IntercityTicket ( "," IntercityTickets+=IntercityTicket)* '}' )?
  ('CityTickets' '{' CityTickets+=CityTicket ( "," CityTickets+=CityTicket)* '}' )?
  ('subscription' subscription=Subscription)?
 '}';

EBoolean returns ecore::EBoolean:
 'true' | 'false';

enum CopyType returns CopyType:
    Digital = 'Digital' | Paper = 'Paper' | Electronic = 'Electronic';

SingleTicket returns SingleTicket:
 {SingleTicket}
 (Stamped?='Stamped')?
 'SingleTicket'
 '{'
  ('Usage' Usage=EString)?
  ('Price' Price=EInt)?
  ('CopyType' CopyType=CopyType)?
 '}';

MultiJourney returns MultiJourney:
 {MultiJourney}
 (Stamped?='Stamped')?
 'MultiJourney'
 '{'
  ('Usage' Usage=EString)?
  ('Price' Price=EInt)?
  ('CopyType' CopyType=CopyType)?
  ('NumberOfJourney' NumberOfJourney=EInt)?
 '}';

MultiDayTicket returns MultiDayTicket:
 {MultiDayTicket}
 (Stamped?='Stamped')?
 'MultiDayTicket'
 '{'
  ('Usage' Usage=EString)?
  ('Price' Price=EInt)?
  ('CopyType' CopyType=CopyType)?
  ('NumberOfDays' NumberOfDays=EString)?
 '}';

Urban_Impl returns Urban:
 {Urban}
 'Urban'
 '{'
  ('Price' Price=EInt)?
  ('Validity' Validity=EString)?
  ('Date' Date=EString)?
 '}';
```

```
Standard returns Standard:
 {Standard}
 'Standard'
 '{'
  ('Price' Price=EInt)?
  ('Validity' Validity=EString)?
  ('Date' Date=EString)?
  ('Zone' Zone=EInt)?
 '}';

ExtraUrban_Impl returns ExtraUrban:
 {ExtraUrban}
 'ExtraUrban'
 '{'
  ('Price' Price=EInt)?
  ('Validity' Validity=EString)?
  ('Date' Date=EString)?
  ('Zone' Zone=EInt)?
 '}';

TwoWay returns TwoWay:
 {TwoWay}
 'TwoWay'
 '{'
  ('Price' Price=EInt)?
  ('Validity' Validity=EString)?
  ('Date' Date=EString)?
 '}';

OneWay returns OneWay:
 {OneWay}
 'OneWay'
 '{'
  ('Price' Price=EInt)?
  ('Validity' Validity=EString)?
  ('Date' Date=EString)?
 '}';

WeeklyPass returns WeeklyPass:
 {WeeklyPass}
 'WeeklyPass'
 '{'
  ('Price' Price=EInt)?
  ('Validity' Validity=EString)?
  ('Date' Date=EString)?
  ('Zone' Zone=EInt)?
 '}';

Luggage returns Luggage:
 {Luggage}
 'Luggage'
 '{'
  ('Price' Price=EInt)?
  ('Validity' Validity=EString)?
  ('Date' Date=EString)?
  ('Zone' Zone=EInt)?
 '}';

CumulativeTickets_Impl returns CumulativeTickets:
 {CumulativeTickets}
 'CumulativeTickets'
 '{'
  ('Price' Price=EInt)?
```

```
   ('Validity' Validity=EString)?
   ('Date' Date=EString)?
 '}';

StandardCumulative returns StandardCumulative:
 {StandardCumulative}
 'StandardCumulative'
 '{'
   ('Price' Price=EInt)?
   ('Validity' Validity=EString)?
   ('Date' Date=EString)?
 '}';

CumulativeOneDay returns CumulativeOneDay:
 {CumulativeOneDay}
 'CumulativeOneDay'
 '{'
   ('Price' Price=EInt)?
   ('Validity' Validity=EString)?
   ('Date' Date=EString)?
   ('Area' Area=Area)?
 '}';

Weekly returns Weekly:
 {Weekly}
 'Weekly'
 '{'
   ('Price' Price=EInt)?
   ('Validity' Validity=EString)?
   ('Date' Date=EString)?
 '}';
```

```
FairTicket returns FairTicket:
 {FairTicket}
 'FairTicket'
 '{'
  ('Price' Price=EInt)?
  ('Validity' Validity=EString)?
  ('Date' Date=EString)?
  ('FieraTicket' FieraTicket=FieraTicket)?
 '}';

enum Area returns Area:
    Large = 'Large' | Medium = 'Medium' | Small = 'Small';

enum FieraTicket returns FieraTicket:
    Single = 'Single' | Return = 'Return' | DayPass = 'DayPass';
```

REFERENCES

1. https://eclipse.org/Xtext/documentation/308_emf_integration.html
2. http://archive.eclipse.org/modeling/mdt/ocl/javadoc/1.3.0/org/eclipse/ocl/uml/package-summary.html
3. http://www.slideshare.net/EdWillink/eclipse-ocl-summary
4. https://eclipse.org/modeling/emf/
5. http://publik.tuwien.ac.at/files/PubDat_166165.pdf