

## DSL

### Workgroup 0102

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#### ***Selected DSL case:***

Query language to simplify the retrieval of patient data items.

#### ***Description of DSL:***

The DSL is called QueryDsl and serves to retrieve, add, and delete data related to Medical Records, Patient Monitoring items, and Prescriptions in the context of the developed project “telemed”.

In the grammar, a Model can consist of several QueryTypes. The QueryType itself can either be “Select”, “Insert”, “Drop”, or “Delete”. Within the “**Select**”, this QueryType can either refer to selecting a MedicalRecord, a PatientMonitoring item, or a Prescription.

The user can select one variable or more variables of the MedicalRecord/PatientMonitoring/Prescription, and optionally there is a “WHERE” statement that can be used to tailor the query. The “?” sign in the grammar means “optional”, therefore the user can decide if such an addition is desired or not.

With regard to the “**Insert**” statement, the user can again perform an insert operation for either MedicalRecord, PatientMonitoring or Prescription. For all of these sub-cases, there are tailored rules that need to be followed to add such a query. For example, to insert a MedicalRecord, the user needs to type (after the general “INSERT INTO”) “MedicalRecord Values (“ and then the appropriate information and data type for the corresponding instance variable of a MedicalRecord, and then “);”. The “;” sign marks the end of the query. The two other query options (i.e. for Prescription and PatientMonitoring) for the insert operation are specified in a similar way.

The “**Drop**” operation can be done for any kind of table, i.e. it looks alike for Prescription, MedicalRecord, and PatientMonitoring. The user has to write

“DROP TABLE”, then write the table name and then write “;” as the end sign of the rule to produce a valid query.

To perform a “*Delete*” query, there is a specific option for MedicalRecord, PatientMonitoring, and Prescription. For all delete queries, the user has to type “DELETE FROM”, and then write the specific table name (e.g. MedicalRecord, PatientMonitoring, or Prescription), and then “WHERE” to add a narrower description of the items the user would like to delete. As always in this DSL, the “;” sign marks the end of the query.

For the DSL to work as intended, several *enums* had to be defined:

- enum TableName
- enum VariableMedical Record
- enum VariablePatientMonitoring
- enumVariablePrescription
- enum MedicalCondition
- enum RiskPerception

In addition to this, several *terminals* were defined in the grammar:

- terminal DATE
- terminal DAY
- terminal MONTH
- terminal YEAR
- terminal DOUBLE
- terminal BOOLEAN

As follows, the *entire grammar for the QueryDsl* is specified (*using XText*):

```

grammar ase.QueryDsl with org.eclipse.xtext.common.Terminals

generate queryDsl "http://www.QueryDsl.ase"

Model:
    (queryType += QueryType)*
;

QueryType:
    Select | Insert | Drop | Delete
;

//-----Select-----
Select:
    'SELECT'
    (SelectMedicalRecord | SelectPatientMonitoring | SelectPrescription)

;

SelectMedicalRecord:
    variableMedicalRecord+=VariableMedicalRecord
    (',' variableMedicalRecordNext+=VariableMedicalRecord)*
    'From' 'MedicalRecord'
    ('WHERE' (where+=WhereMedicalRecord)+)?
    ';'
;

SelectPatientMonitoring:
    variablePatientMonitoring=VariablePatientMonitoring
    (',' variablePatientMonitoringNext+=VariablePatientMonitoring)*
    'From' 'PatientMonitoring'
    ('WHERE' (where+=WherePatientMonitoring)+)?
    ';'
;

SelectPrescription:
    variablePrescription=VariablePrescription
    (',' variablePrescriptionNext+=VariablePrescription)*
    'From' 'Prescription'
    ('WHERE' (where+=WherePrescription)+)?
    ';'
;

//-----Insert-----
Insert:
    'INSERT' 'INTO'
    (InsertMedicalRecord | InsertPatientMonitoring | InsertPrescription)

;

InsertMedicalRecord:
    'MedicalRecord'

```

```

        'Values('      recordId=INT ',',
                        patientId=INT ',',
                        doctorId=INT ',',
                        medicalCondition=MedicalCondition ',',
                        date=DATE ',',
                        price=DOUBLE ',',
                        description=STRING
        ')' ';'
;

InsertPatientMonitoring:
    'PatientMonitoring'
    'Values('      monitoringId=INT ',',
                    patientId=INT ',',
                    category=MedicalCondition ',',
                    date=DATE ',',
                    riskPerception=RiskPerception ',',
                    treadted=BOOLEAN ',',
                    deviceId=INT
    ')' ';'
;

InsertPrescription:
    'Prescription'
    'Values('      prescriptionId=INT ',',
                    recordId=INT ',',
                    medicationName=STRING ',',
                    start=DATE ',',
                    end=DATE ',',
                    ordered=BOOLEAN ',',
                    price=DOUBLE
    ')' ';'
;

//-----Drop-----
Drop:
    'DROP' 'TABLE'
    table_name+=TableName
    ';'
;

//-----Delete-----
Delete:
    'DELETE' 'FROM'
    (DeleteMedicalRecord | DeletePatientMonitoring | DeletePrescription)
;
DeleteMedicalRecord:
    'MedicalRecord' 'WHERE'
    whereMedicalRecord+=WhereMedicalRecord ('and'
whereMedicalRecord+=WhereMedicalRecord)*
    ';'
;

DeletePatientMonitoring:

```

```

        'PatientMonitoring' 'WHERE'
        wherepatientMonitoring+=WherePatientMonitoring ('and'
wherepatientMonitoring+=WherePatientMonitoring)*
        ';'
;

DeletePrescription:
    'Prescription' 'WHERE'
        whereprescription+=WherePrescription ('and'
whereprescription+=WherePrescription)*
        ';'
;

//-----Where-----
WhereMedicalRecord:
    (('recordId' '=' recordId+=INT) |
    ('patientId' '=' patientId+=INT) |
    ('doctorId' '=' doctorId+=INT) |
    ('medicalCondition' '=' medicalCondition+=MedicalCondition) |
    ('date' '=' date+=DATE) |
    ('price' '=' price+=DOUBLE) |
    ('description' '=' description+=STRING))
;

WherePatientMonitoring:
    (('monitoringId' '=' monitoringId+=INT) |
    ('patientId' '=' patientId+=INT) |
    ('category' '=' category+=MedicalCondition) |
    ('date' '=' date+=DATE) |
    ('riskPerception' '=' riskperception+=RiskPerception) |
    ('treated' '=' treated+=BOOLEAN) |
    ('deviceId' '=' deviceId+=INT))
;

WherePrescription:
    (('prescriptionId' '=' prescriptionId+=INT) |
    ('recordId' '=' recordId+=INT) |
    ('medicationName' '=' medicationName+=STRING) |
    ('start' '=' start+=DATE) |
    ('end' '=' end+=DATE) |
    ('ordered' '=' ordered+=BOOLEAN) |
    ('price' '=' price+=DOUBLE))
;

//-----Enums-----
enum TableName:
    MedicalRecord | PatientMonitoring | Prescription
;

enum VariableMedicalRecord:
    recordId | patientId | doctorId | medicalCondition | date | price |
description
;

```

```
enum VariablePatientMonitoring:
    monitoringId | patientId | category | date | riskPerception | treated |
    deviceId
;

enum VariablePrescription:
    prescriptionId | recordId | medicationName | start | end | ordered |
    price
;

enum MedicalCondition:
    Bronchitis | Asthma | Diabetes | Flu | Hypertension
;

enum RiskPerception:
    High | Medium | Low
;

//-----Terminal-----
terminal DATE:
    DAY'.'MONTH'.'YEAR
;

terminal DAY:
    ('1'..'9') | (('1'..'3')('0'..'9'))
;

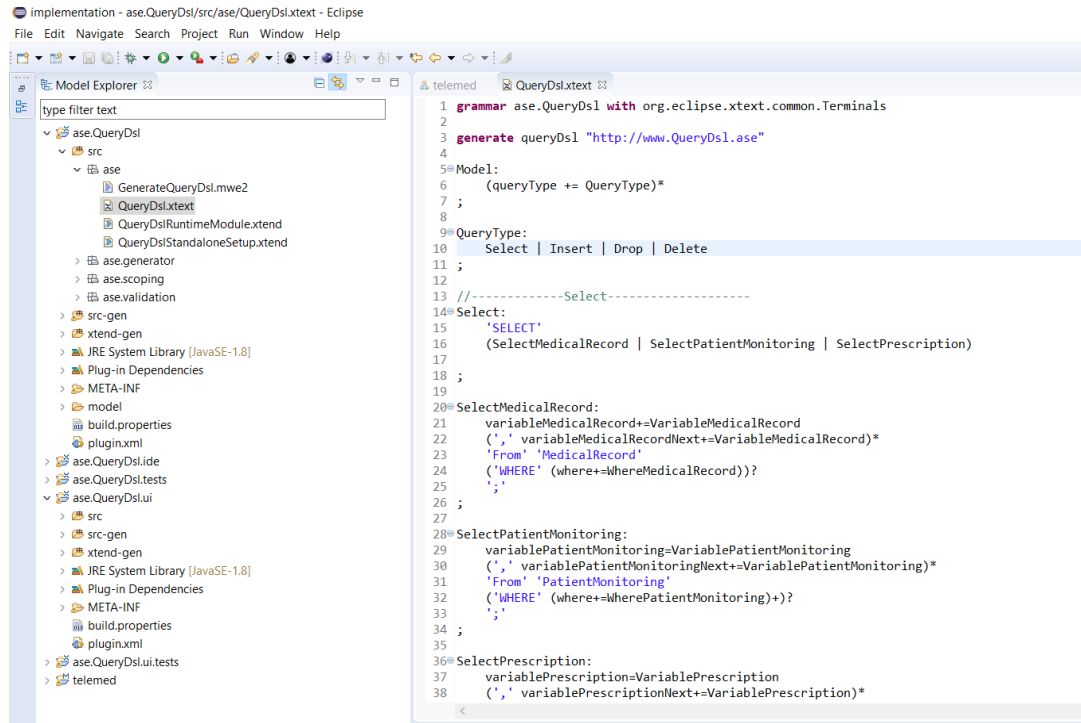
terminal MONTH:
    'Jan' | 'Feb' | 'Mar' | 'Apr' | 'May' | 'Jun' | 'Jul' | 'Aug' | 'Sep' | 'Oct' | 'Nov' | 'Dec'
;

terminal YEAR:
    ('0'..'2')('0'..'9')('0'..'9')('0'..'9')
;

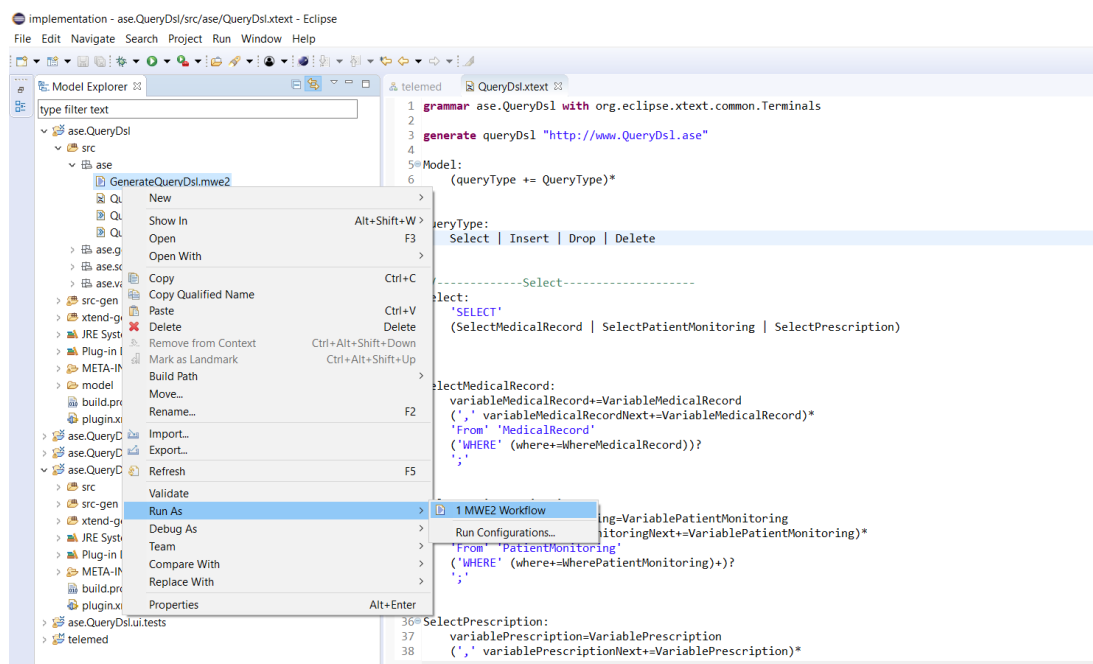
terminal DOUBLE:
    INT '.' INT
;

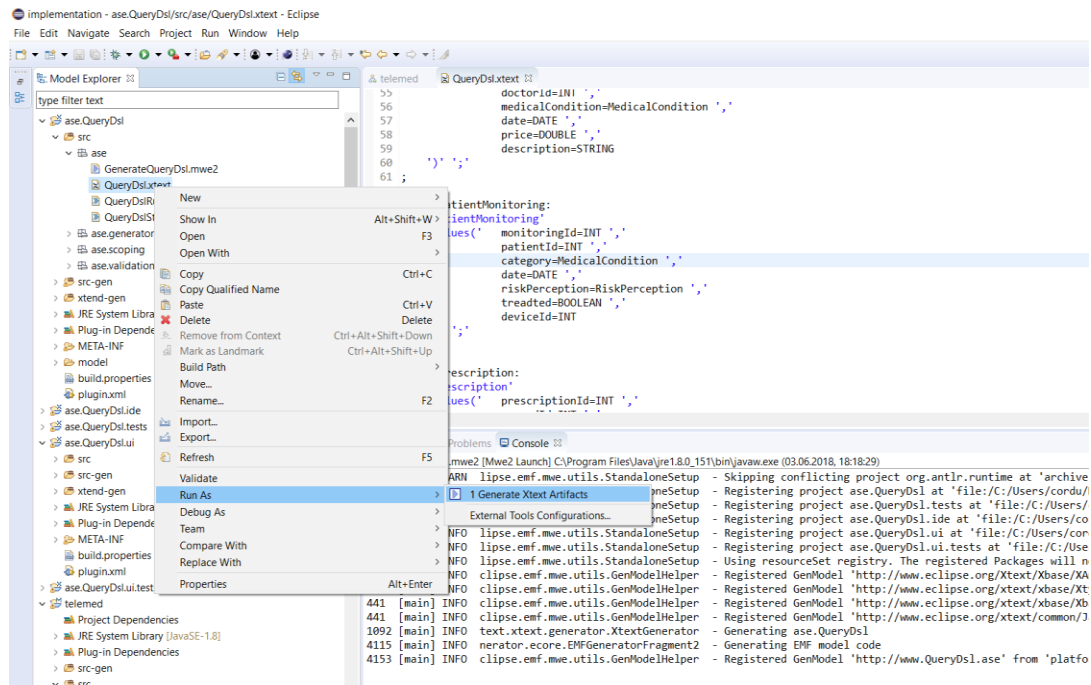
terminal BOOLEAN:
    'true' | 'false'
;
```

## Comments on the creation process of the QueryDsl:

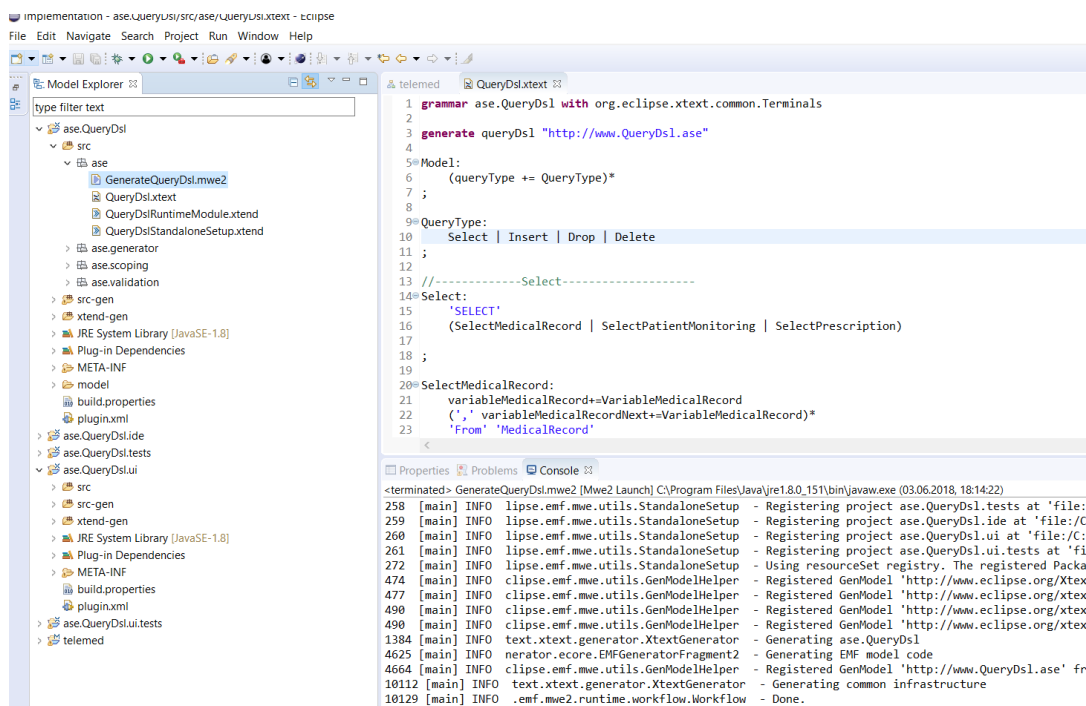


First, a new XText project is created and the grammar of the DSL (here: ase.QueryDsl) is created in the QueryDsl.xtext file. It contains all rules and terminal as well as enum definitions for the grammar.



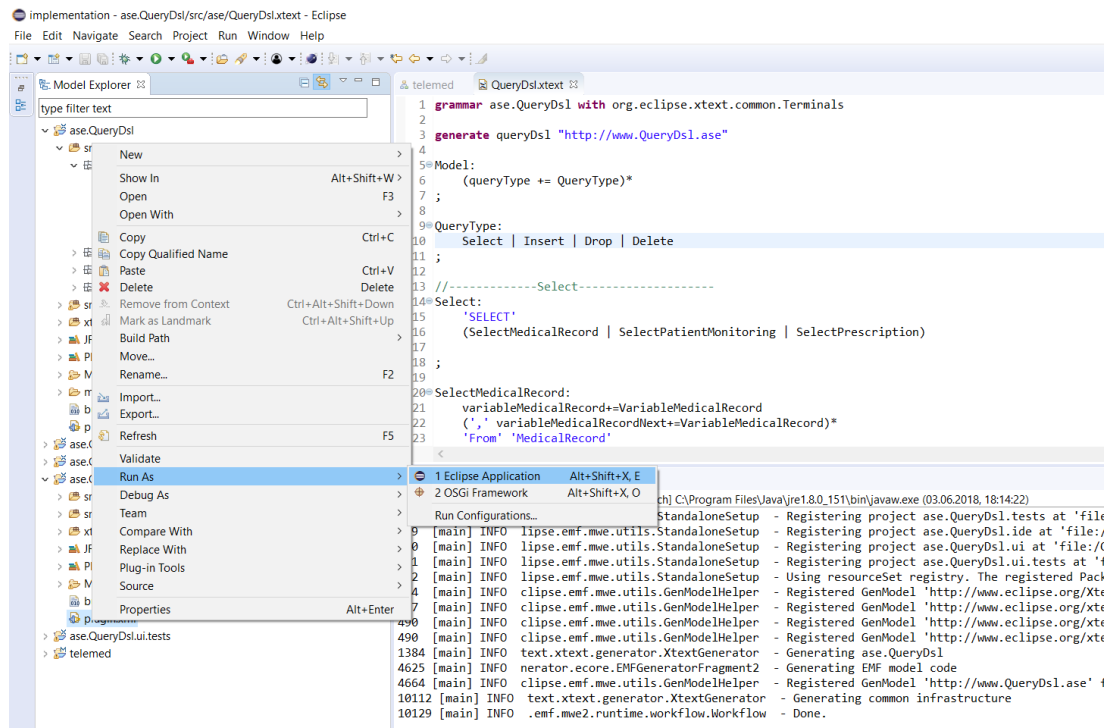


Then, right-click on the “GenerateQueryDsl.mwe2” and select “Run as MWE2 Workflow”, or “Run as – Generate XText Artifacts”.



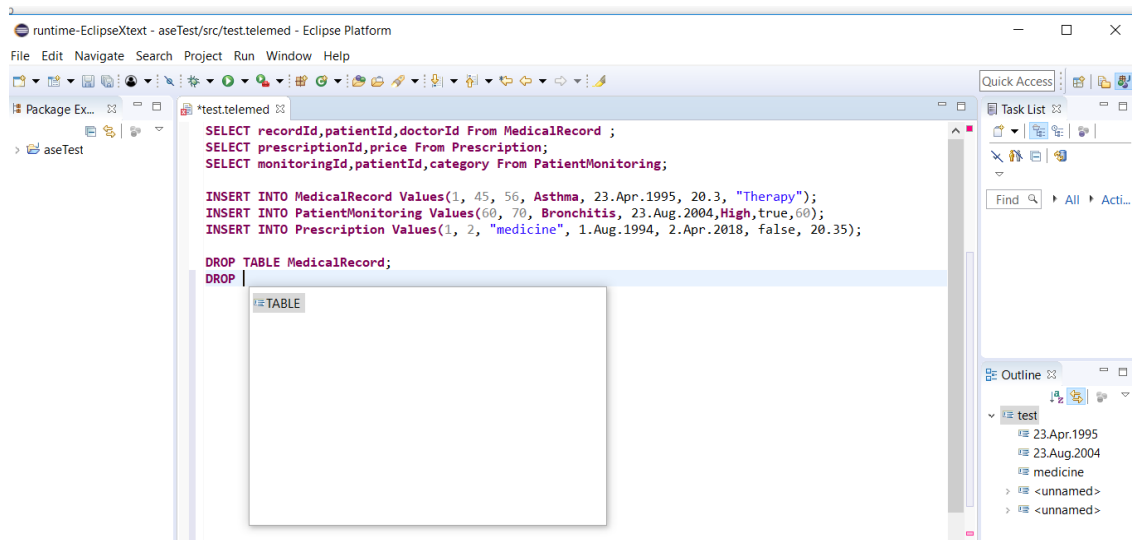
Once “Done.” Can be seen, the DSL has been configured successfully and can be tested in a separately running Java Application project.



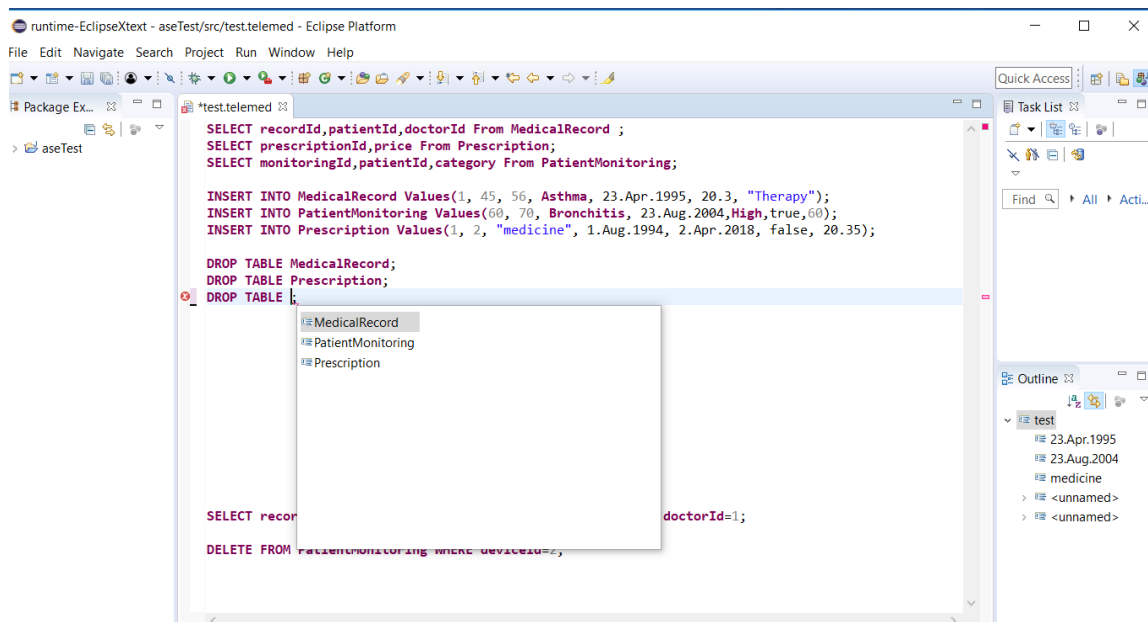


To test the DSL, right-click on “plugin.xml”, the select “Run as Eclipse Application”, which opens a separate Eclipse instances. Create a new normal “Java Application project”, and then add a new file in this project and start creating DSL instances. In Eclipse, it is showed whether the intended instances can be produced or if there are syntax rule errors.

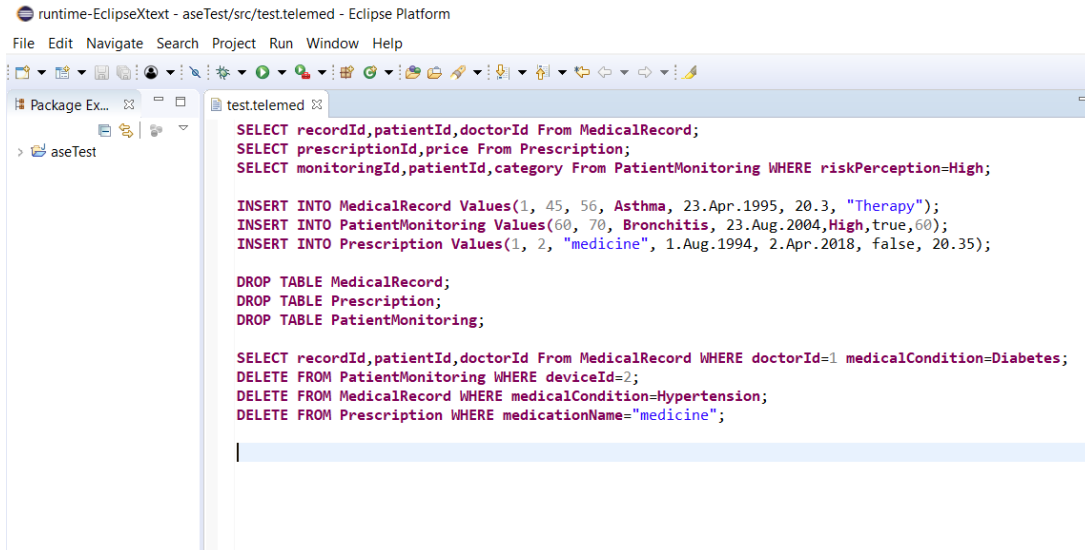
## Exemplary DSL instances:



In this case, several Query DSL instances have been entered. For the last “DROP” statement, it shows the auto-complete functionality, which is available for all DSL instances entered on the screen. For example in this case, it says that after “DROP” has been entered, the user needs to type “TABLE”, for the query statement to conform with the ase.QueryDsl grammar.



After “DROP TABLE”, the options “MedicalRecord”, “PatientMonitoring”, or “Prescription” are available to form a valid instance of the DSL.



```
runtime-EclipseXtext - aseTest/src/test.telemed - Eclipse Platform
File Edit Navigate Search Project Run Window Help

Package Ex... test.telemed
> aseTest

SELECT recordId,patientId,doctorId From MedicalRecord;
SELECT prescriptionId,price From Prescription;
SELECT monitoringId,patientId,category From PatientMonitoring WHERE riskPerception=High;

INSERT INTO MedicalRecord Values(1, 45, 56, Asthma, 23.Apr.1995, 20.3, "Therapy");
INSERT INTO PatientMonitoring Values(60, 70, Bronchitis, 23.Aug.2004,High,true,60);
INSERT INTO Prescription Values(1, 2, "medicine", 1.Aug.1994, 2.Apr.2018, false, 20.35);

DROP TABLE MedicalRecord;
DROP TABLE Prescription;
DROP TABLE PatientMonitoring;

SELECT recordId,patientId,doctorId From MedicalRecord WHERE doctorId=1 medicalCondition=Diabetes;
DELETE FROM PatientMonitoring WHERE deviceId=2;
DELETE FROM MedicalRecord WHERE medicalCondition=Hypertension;
DELETE FROM Prescription WHERE medicationName="medicine";
```

Above, a series of valid DSL instances are presented.

### *Selected valid DSL instances using the ase.QueryDsl:*

```
SELECT recordId,patientId,doctorId From MedicalRecord;
SELECT prescriptionId,price From Prescription;
SELECT monitoringId,patientId,category From PatientMonitoring WHERE
riskPerception=High;

INSERT INTO MedicalRecord Values(1, 45, 56, Asthma, 23.Apr.1995, 20.3,
"Therapy");
INSERT INTO PatientMonitoring Values(60, 70, Bronchitis,
23.Aug.2004,High,true,60);
INSERT INTO Prescription Values(1, 2, "medicine", 1.Aug.1994, 2.Apr.2018,
false, 20.35);

DROP TABLE MedicalRecord;
DROP TABLE Prescription;
DROP TABLE PatientMonitoring;

SELECT recordId,patientId,doctorId From MedicalRecord WHERE doctorId=1
medicalCondition=Diabetes;
DELETE FROM PatientMonitoring WHERE deviceId=2;
DELETE FROM MedicalRecord WHERE medicalCondition=Hypertension;
DELETE FROM Prescription WHERE medicationName="medicine";
```