Installation

- Grab a USB key
- Install Eclipse
- Save the zip files to your disk
  - host_workspace.zip
  - runtime_workspace.zip

Xtext for Beginners

Jan Köhnlein, Sebastian Zarnekow

Outline

- Example Application
- Build your DSL with Xtext
- Generate Code with Xtend
- Validate Models
- Introduce Cross-references
- Outlook

Outline

- **Example Application**
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Eclipse Community Survey 2013

Eclipse Community Survey 2013

Eclipse Community Survey 2013 Evaluate

What is the *primary* computer language you typically use to develop software?

- C/C++
- C
- Lua
- Groovy
- Java
- Java Script

Demo

- Ruby
- Scala
- Visual Basic/Visual Basic .Net
- None - I don't use a computer language for software development
- Don't know
- Other (please specify) Xtend

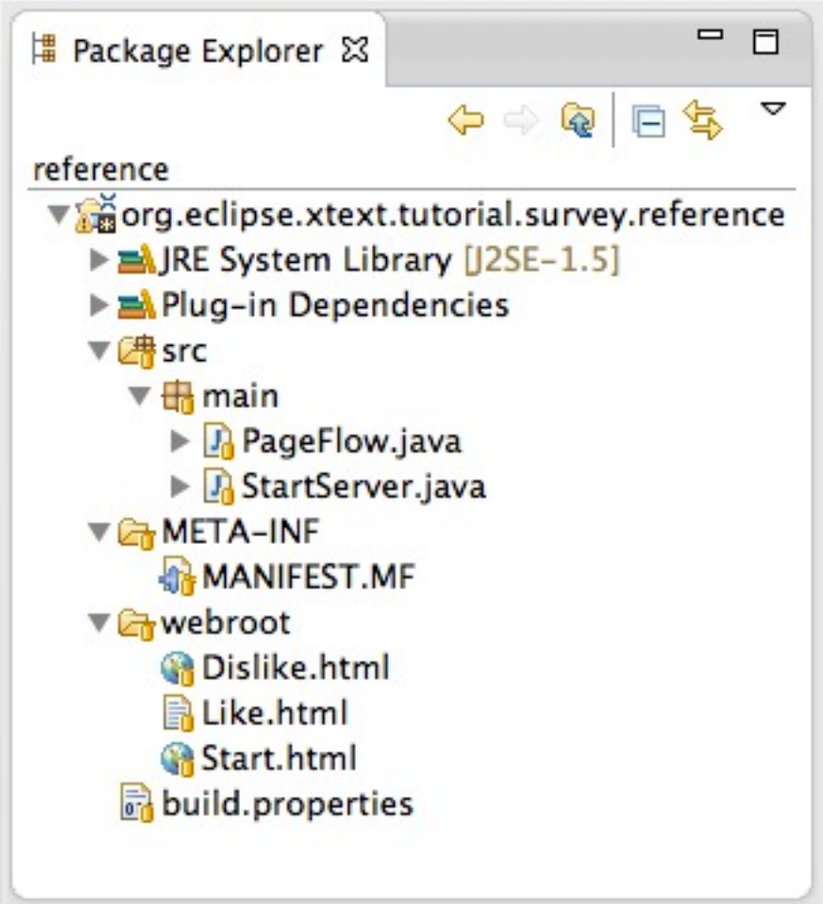
Example: Surveys

- A web-based app for surveys
  - online answering
  - multiple pages
  - different types of questions
  - online evaluation

Architecture

- HTML forms
- Twitter Bootstrap CSS / JavaScript
- Jetty server
- Simple pageflow engine
- In memory persistence

API View


Package Explorer
reference
org.eclipse.xtext.tutorial.survey.reference
JRE System Library [J2SE-1.5]
Plug-in Dependencies
src
main
PageFlow.java
StartServer.java
META-INF
MANIFEST.MF
webroot
Dislike.html
Like.html
Start.html
build.properties

Challenges

- A heterogeneous platform
  - Java, HTML, maybe a Database
- Difficult to extend
  - more questions, multiple surveys
  - other front ends
- Hard to maintain

The Domain

- The application is about **Surveys**.
- A **Survey** consists of **Pages**.
- A **Page** holds a couple of **Questions**.
- **Questions** can be answered with **FreeText** or predefined **Choices**.
  - Some **Choices** are **exclusive**.
- A page defines its **FollowUp** pages
  - **FollowUps** may depend on on given answers.

DSL Approach

- Create a domain-specific language
  - Describes the data formally
- Generate code from its models

Survey

Page
- **TextQuestion**
- **ChoiceQuestion (single)**
  - **Choice**
  - **Choice**
- **FollowUp**
- **FollowUp**

Page
- **ChoiceQuestion**
  - **Choice**
  - **Choice**
  - **Choice**

Page
- **ChoiceQuestion**
  - **Choice**
  - **Choice**
  - **Choice**

```
survey tutorial "EclipseCon 2013 Tutorial Survey"

page Start (
    text name 'Your name'
    single choice like "Do you like the tutorial?" (
        yes "Yes"
        no "No"
    )
    if like=yes -> Like
    if like=no -> Dislike
)

page Like (
    choice particular "What do you like in particular?" (
        xtext 'Xtext is awesome'
        excercises 'The funny exercises'
        tutors 'The handsome tutors'
    )
)

page Dislike (
    choice particular "What do you hate in particular?" (
        xtext 'Xtext sucks'
        excercises 'The boring exercises'
        tutors 'The tutors stink'
    )
)
```

Advantages

- Addresses heterogeneity
- Easy design of surveys
- Easy to add new front ends
- Separation of roles during development
- Speedup for development
- Improved maintainability

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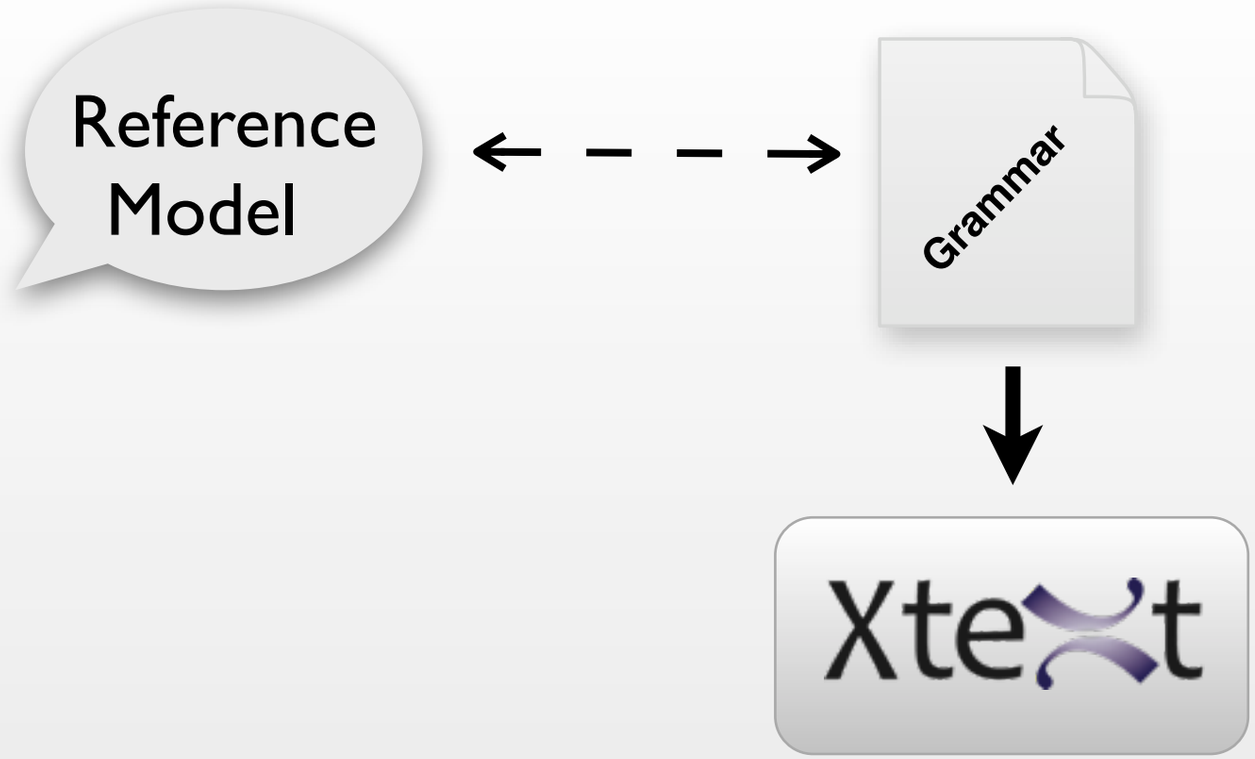
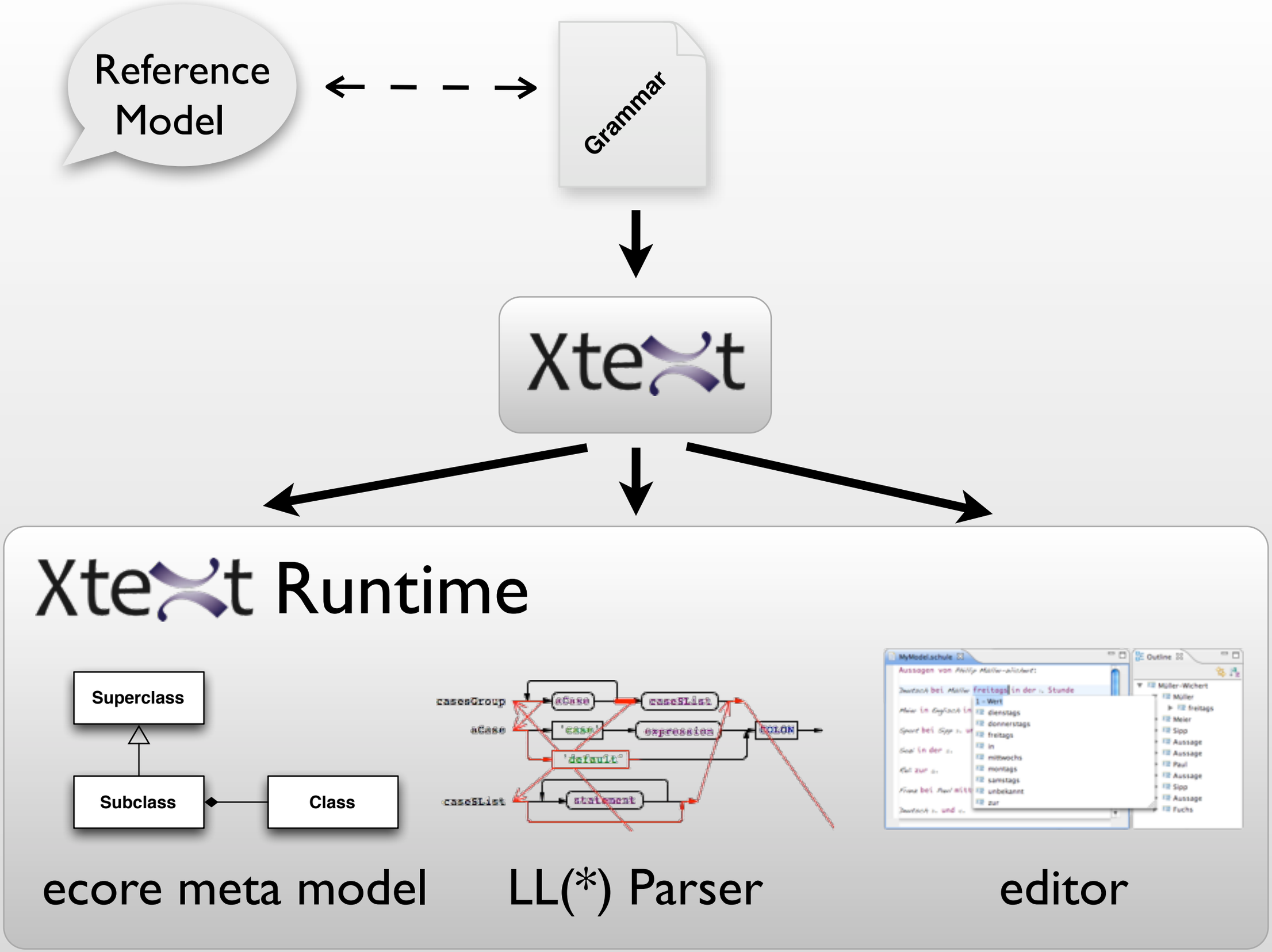
Grammar


Reference Model
Grammar


Reference Model
Grammar
Xtext


Reference Model
Grammar
Xtext
Xtext Runtime
Superclass
Subclass
Class
ecore meta model
LL(*) Parser
editor

```
grammar org.eclipse.xtext.tutorial.Grammar
   with org.eclipse.xtext.common.Terminals

generate survey "http://www.eclipse.org/xtext/tutorial/Grammar"

Model:
    entities+=Entity*;

Entity:
    abstract?="abstract" "entity" name=ID (tableName=ID)?"{"
        attributes+=Attribute+
    "}";

Attribute:
    StringAttribute | IntAttribute;

StringAttribute:
    "string" value=STRING
;

IntAttribute:
    "int" value=INT
;
```

```
abstract entity Person tab_person {
    int 42
    string "Some String"
}
```

Grammar

Namespace

```
grammar org.eclipse.xtext.tutorial.Grammar
   with org.eclipse.xtext.common.Terminals

generate survey "http://www.eclipse.org/xtext/tutorial/Grammar"

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        attributes+=Attribute+
    "}";

Attribute:
    StringAttribute | IntAttribute;

StringAttribute:
    "string" value=STRING
;

IntAttribute:
    "int" value=INT
;
```

```
abstract entity Person tab_person {
    int 42
    string "Some String"
}
```

Parser Rule

```
grammar org.eclipse.xtext.tutorial.Grammar
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generate survey "http://www.eclipse.org/xtext/tutorial/Grammar"

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Attribute:
    StringAttribute | IntAttribute;

StringAttribute:
    "string" value=STRING
;

IntAttribute:
    "int" value=INT
;
```

```
abstract entity Person tab_person {
    int 42
    string "Some String"
}
```

```
grammar org.eclipse.xtext.tutorial.Grammar
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generate survey "http://www.eclipse.org/xtext/tutorial/Grammar"

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StringAttribute:
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;

IntAttribute:
    "int" value=INT
;
```

Keyword

```
abstract entity Person tab_person {
    int 42
    string "Some String"
}
```

```
grammar org.eclipse.xtext.tutorial.Grammar
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generate survey "http://www.eclipse.org/xtext/tutorial/Grammar"

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        attributes+=Attribute+
    "}";

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StringAttribute:
    "string" value=STRING
;

IntAttribute:
    "int" value=INT
;
```

Multivalue assignment

Simple assignment

Boolean assignment

```
abstract entity Person tab_person {
    int 42
    string "Some String"
}
```

```
grammar org.eclipse.xtext.tutorial.Grammar
   with org.eclipse.xtext.common.Terminals

generate survey "http://www.eclipse.org/xtext/tutorial/Grammar"

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    entities+=Entity*;

Entity:
    abstract?="abstract" "entity" name=ID (tableName=ID)?"{"
        attributes+=Attribute+
    "}";

Attribute:
    StringAttribute | IntAttribute;

StringAttribute:
    "string" value=STRING
;

IntAttribute:
    "int" value=INT
;
```

Cardinality 0..*

Cardinality 1..*

```
abstract entity Person tab_person {
    int 42
    string "Some String"
}
```

```
grammar org.eclipse.xtext.tutorial.Grammar
   with org.eclipse.xtext.common.Terminals

generate survey "http://www.eclipse.org/xtext/tutorial/Grammar"

Model:
    entities+=Entity*;

Entity:
    abstract?="abstract" "entity" name=ID (tableName=ID)?"{"
        attributes+=Attribute+
    "}";

Attribute:
    StringAttribute | IntAttribute;

StringAttribute:
    "string" value=STRING
;

IntAttribute:
    "int" value=INT
;
```

Optional

```
abstract entity Person tab_person {
    int 42
    string "Some String"
}
```

```
grammar org.eclipse.xtext.tutorial.Grammar
   with org.eclipse.xtext.common.Terminals

generate survey "http://www.eclipse.org/xtext/tutorial/Grammar"

Model:
    entities+=Entity*;

Entity:
    abstract?="abstract" "entity" name=ID (tableName=ID)?"{"
        attributes+=Attribute+
    "}";

Attribute:
    StringAttribute | IntAttribute;

StringAttribute:
    "string" value=STRING
;

IntAttribute:
    "int" value=INT
;
```

Alternative

```
abstract entity Person tab_person {
    int 42
    string "Some String"
}
```

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Xtend

Xtend: Templates

```
def example(List<String> elements) '''
   Usually a template consists mainly of text spanning
    multiple lines.
   If you want to evaluate an expression you have to write it
   in french quotes «7*3*2». Code assist inserts a pair of
   these.
   You can also iterate a collection with FOR
   «FOR element: elements»
      Found another element: «element»
   «ENDFOR»
   For decisions there is the IF statement
   «IF elements.isEmpty()»
       no elements.
   «ENDIF»
'''
```

Xtend: Dispatch Methods

```
// Xtend code
def dispatch area(Rectangle r) {
   r.width * r.height
}

def dispatch area(Circle c) {
   c.radius * c.radius * Math.PI
}

def someCalculation(Object o) {
   area(o) // polymorphic call
}
```

Xtend: Dispatch Methods

```
// Xtend code
def dispatch area(Rectangle r) {
   r.width * r.height
}

def dispatch area(Circle c) {
   c.radius * c.radius * Math.PI
}

def someCalculation(Object o) {
   area(o) // polymorphic call
}
```

```
// generated Java code (dispatcher)
public double area(final Object c) {
  if (c instanceof Circle) {
    return _area((Circle)c);
  } else if (c instanceof Rectangle) {
    return _area((Rectangle)c);
  } else {
    throw new IllegalArgumentException();
  }
}
```

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Validator

```
class SurveyValidator extends AbstractSurveyValidator {
   @Check
   def textMustNotBeEmpty(Question question) {
      if(question.getText().isEmpty()) {
      error("Empty question is illegal",
         question,
         QUESTION__TEXT)
   }
}
```

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Cross References

```
page Start (
    single choice like "Do you like the tutorial?" (
        yes "Yes"
        no "No"
    )
    if like=yes -> Like
)

page Like (
    choice particular "What do you like in particular?" (
        xtext 'Xtext is awesome'
        excercises 'The funny exercises'
        tutors 'The handsome tutors'
    )
)
```

Grammar

```
Page:
   'page' name=ID '('
      // questions
      '->' next=[Page|ID]
   ')';
```

Scoping

```
page Start (
    text name 'Your name'
    single choice like "..." (
        yes "Yes"
        no "No"
    )
    if like=yes -> Like
)

page Like (
    choice particular "..." (
        xtext '...'
        excercises '...'
        tutors '...'
    )
...
```

referable **Questions** (default scoping)	
global scope	local scope
Start.name	name
Start.like	like
Like.particular	

Scoping

```
page Start (
    text name 'Your name'
    single choice like "..." (
        yes "Yes"
        no "No"
    )
    if like=yes -> Like
)

page Like (
    choice particular "..." (
        xtext '...'
        excercises '...'
        tutors '...'
    )
...
```

referable **Questions** (default scoping)	
global scope	local scope
Start.name	name
Start.like	like
Like.particular	

referable **Choices**
custom scope
yes
no

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Outlook

- Enhance generator
- Customize IDE
  - Outline, Formatter, Labels, ...
- Add more expressions

More on Xtext/Xtend at EclipseCon Europe 2013

- What You Get For Free with Xtext
- Rapid Android Development with Xtend
- Code Generation with Active Annotations
- Eclipse Diagram Editors: An Endangered Species
- Turn Ideas into Code Faster (Lightning talk)
- STEM 2.0: Helping save the world with EMF, GEF, and Xtext
- The prospering Eclipse Era in Automotive Industry
- Integrate your tools to help integrate your stakeholders
- Eclipse Smart Home
- Xcore meets IncQuery - How the New Generation of DSLs are Made
- Add some spice to your application! (using EMF Parsley in your UI)
- Beyond the box: How we built a JavaScript IDE with Xtext.
- Sirius: Changing the Game of Systems Architecture

Thank You

... and don’t forget the evaluation!