

# Installation

- Grab a USB Key
- Install Eclipse
- Save the Zip Files to Your Disk
  - `host_workspace.zip`
  - `runtime_workspace.zip`

# Xtext for Beginners

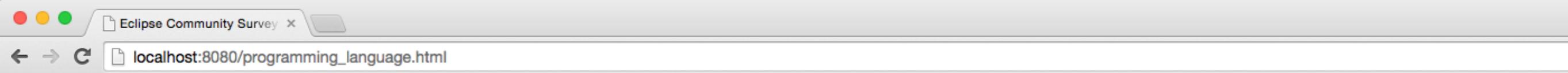
Jan Köhnlein, Holger Schill  
itemis

# Outline

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

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

C/C++  
 C  
 Lua  
 Groovy  
 Java  
 Java Script

# Demo

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

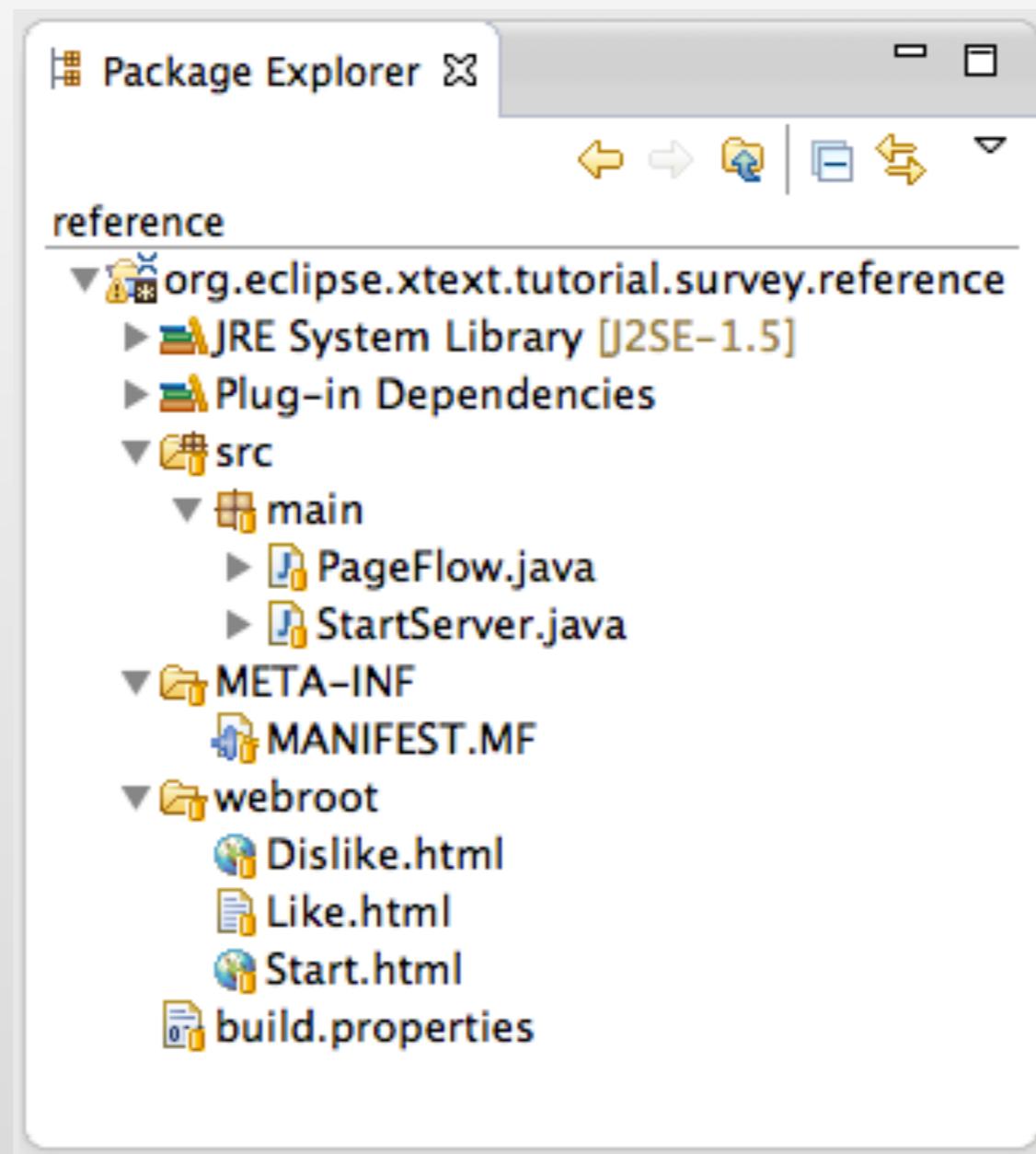
# Example: Surveys

- A Web-Based App for Surveys
- Multiple Pages
- Multiple Questions per Page
- Different Types of Questions

# Architecture

- HTML Forms
- Twitter Bootstrap CSS / JavaScript
- Jetty Server
- Simple Page-Flow Engine
- In-Memory Persistence

# Reference Project



# Challenges

- A Heterogeneous Platform
- Java, HTML, Database ...
- Difficult to Extend
- More Questions, Other Surveys
- Other Front-Ends (iOS, Android, PDF, ...)
- Hard to Maintain

# The Domain

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

# DSL Approach

- Create a Domain-Specific Language
- Describe the Data Formally
- Generate Code from DSL Files

# 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"
        wat "Which tutorial? I'm waiting for the bus!"
    )
    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'
    )
)
```

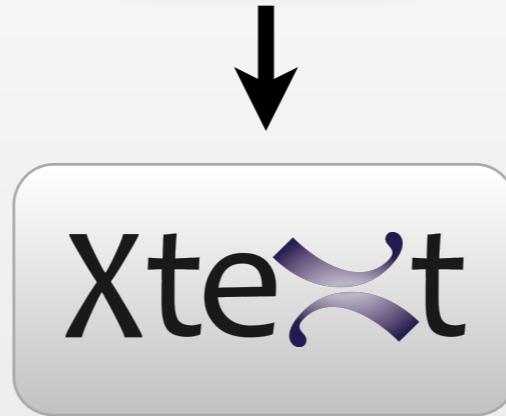
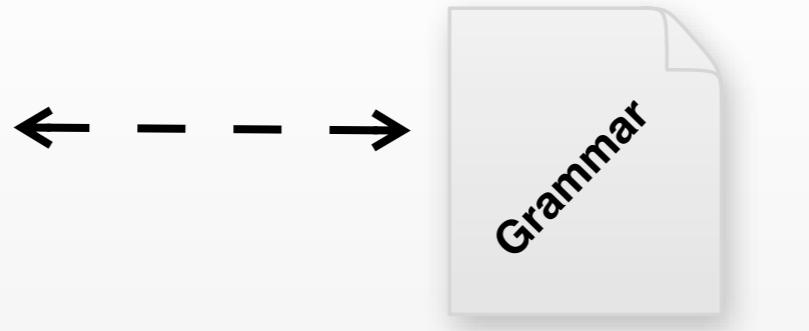
# Advantages

- Addresses Heterogeneity
- Easy Design of Surveys
- Easy to Add New Front-Ends
- Separation of Roles During Development
- Speed-up for Development
- Improved Maintainability

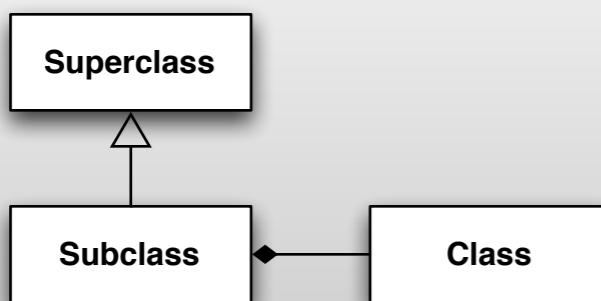
# Outline

- Example Application
- **Build your DSL with Xtext**
- Generate Code with Xtend
- Validate Models
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- Outlook

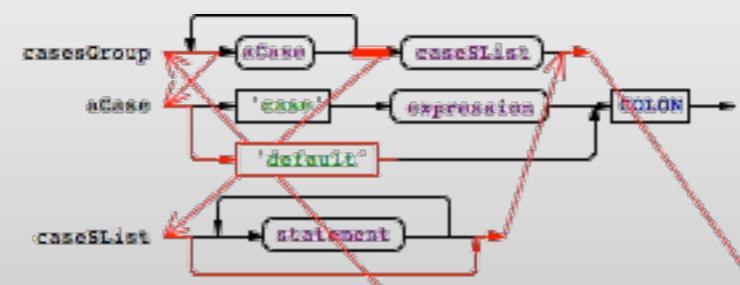
Reference Model



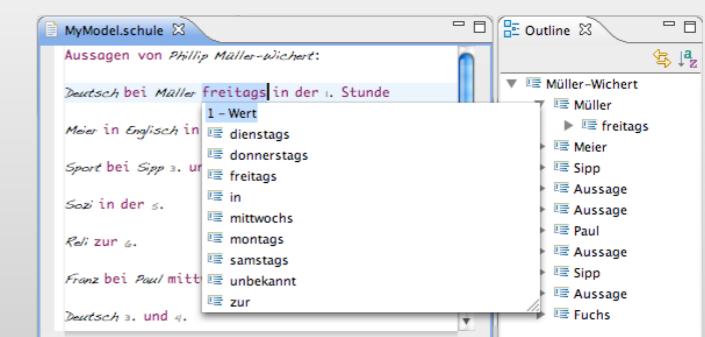
## Xtext Runtime



Ecore Package



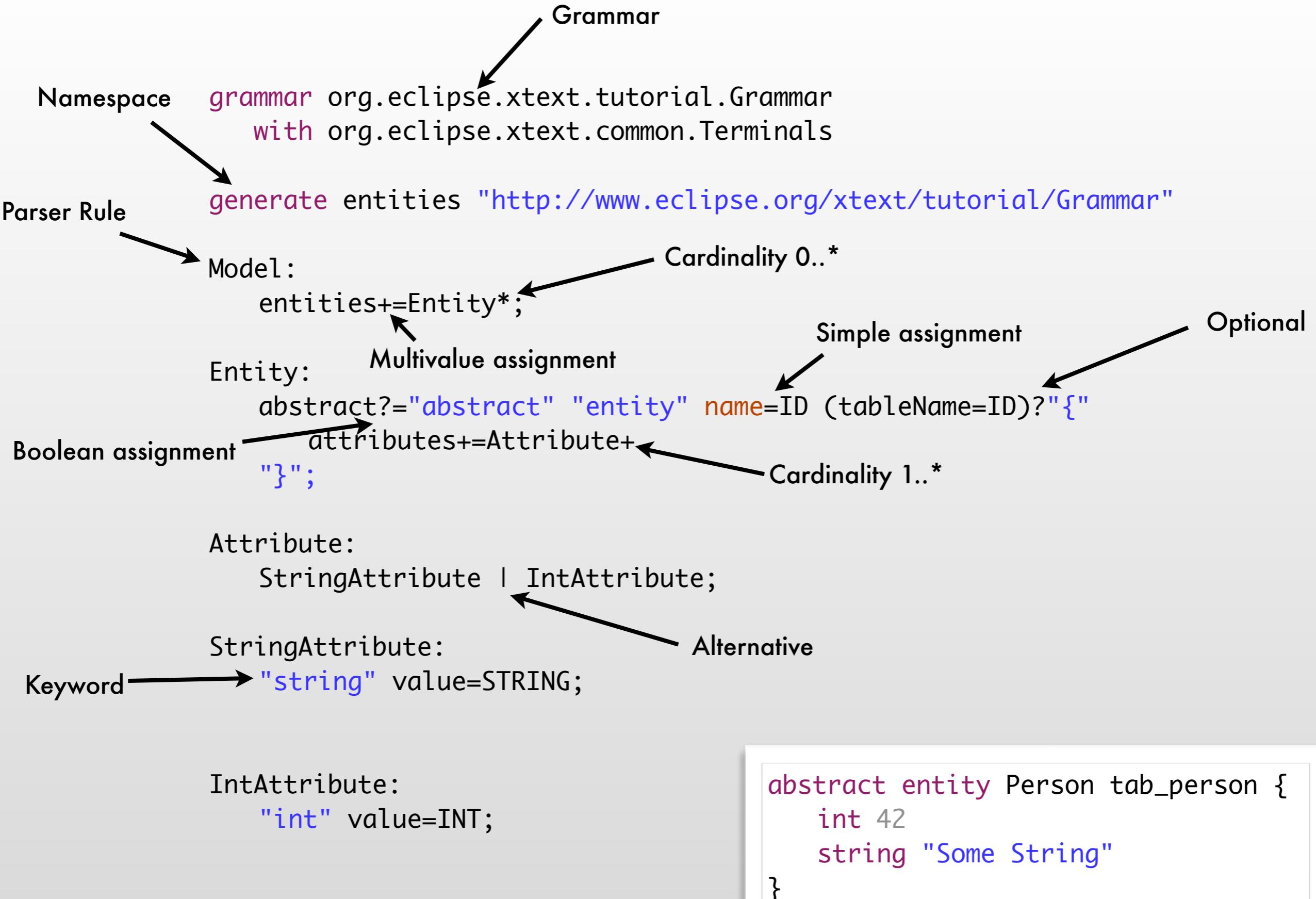
Parser



Editor

# Exercise 0

Create a New Xtext Project



```

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

```

# Exercise 1

Write a Grammar for an Example File

# Outline

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# Hello Xtend

```
class Greeter {  
    def static void main(String... args) {  
        println('Hello EclipseCon')  
    }  
}
```

# 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.

For decisions there is the IF statement

```
«IF elements.empty»  
    no elements.
```

```
«ELSE»
```

You can also iterate a collection with FOR:

```
«FOR element : elements.indexed»  
    Element «element.key + 1»: «element.value»  
«ENDFOR»  
«ENDIF»  
...  
»
```

# Dispatch Methods

```
// Xtend code
def dispatch area(Circle c) {
    c.radius * c.radius * Math.PI
}
def dispatch area(Rectangle r) {
    r.width * r.height
}

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();
    }
}
```

# Exercise 2

Implement a Code Generator

# Outline

- Example Application
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- **Validate Models**
- Introduce Cross-References
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# Validator

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

# Exercise 3

Implement a Custom Validation Rule

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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 '...'
    )
...
)
```

question=[ <b>Question</b>   <b>QualifiedName</b> ]		
"page Start"	File	Global
name	Start.name	Other.id
like	Start.like	
	Like.particular	

answer=[ <b>Choice</b>   <b>ID</b> ]
yes
no

default impl

custom impl

# Exercise 4

Customize Linking and Content Assist via Scoping

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Content  
Assist

Quick  
Fixes

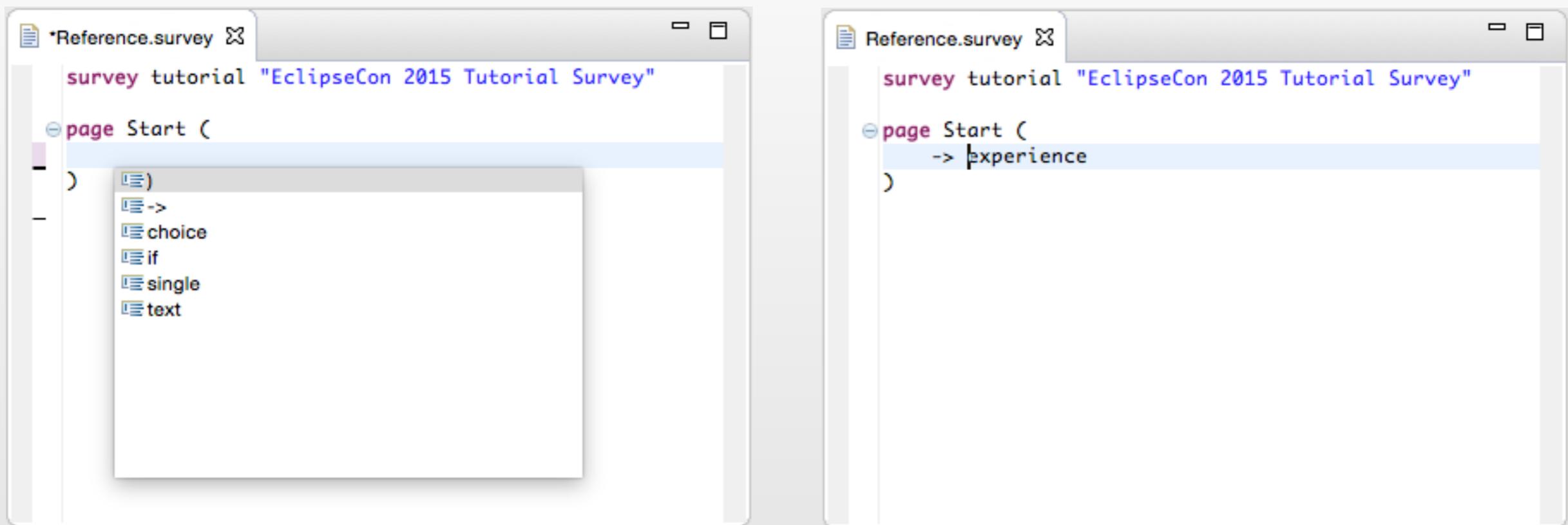
Syntax  
Highlighting

Outline

Template  
Proposals

Formatting

etc.



By default, it shows

- keyword (based on grammar)
- names of cross references (based on grammar and scoping)
- template proposals (based on context)

Code Pointer:

org.eclipse.xtext.tutorial.survey.ui.contentassist.SurveyProposalProvider

Content  
Assist

Quick  
Fixes

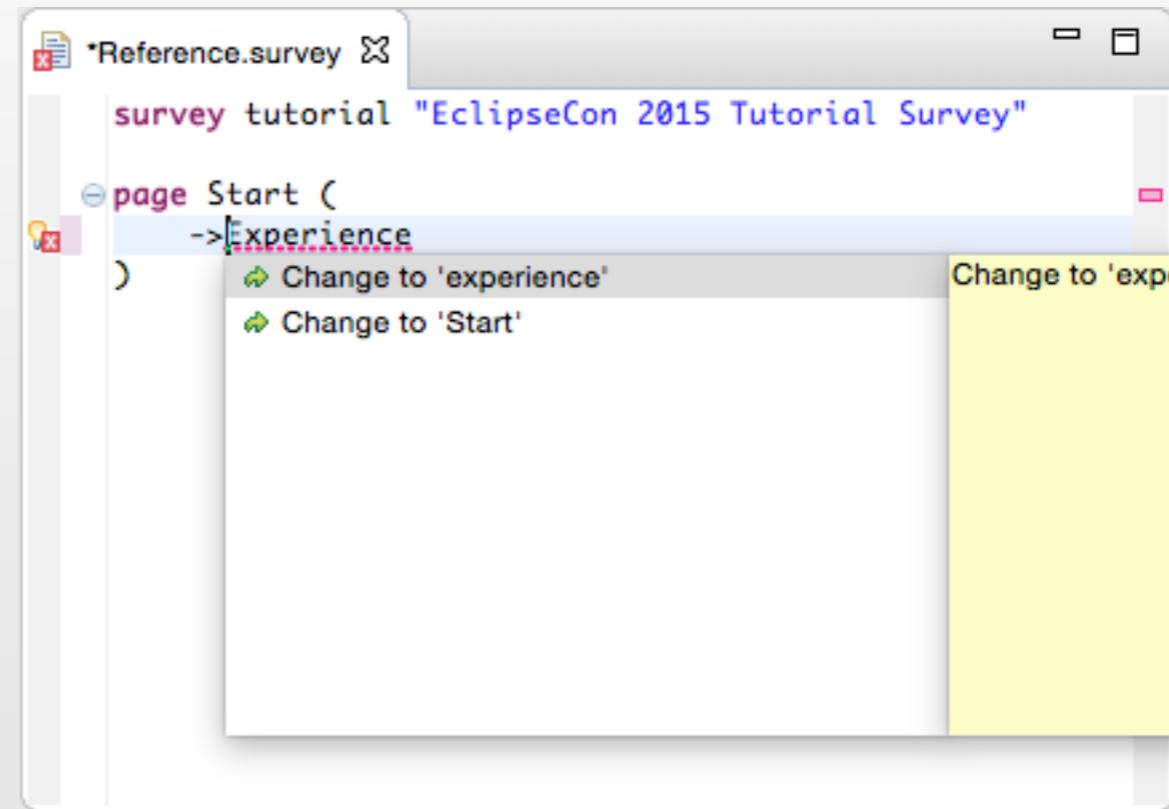
Syntax  
Highlighting

Outline

Template  
Proposals

Formatting

etc.



## Default:

- mostly nothing ;)
- for unresolved cross references, guess reference name

## Code Pointer:

org.eclipse.xtext.tutorial.survey.ui.quickfix.SurveyQuickfixProvider  
org.eclipse.xtext.ui.editor.model.edit.IModification  
org.eclipse.xtext.ui.editor.model.edit.ISemanticModification

Content Assist

Quick Fixes

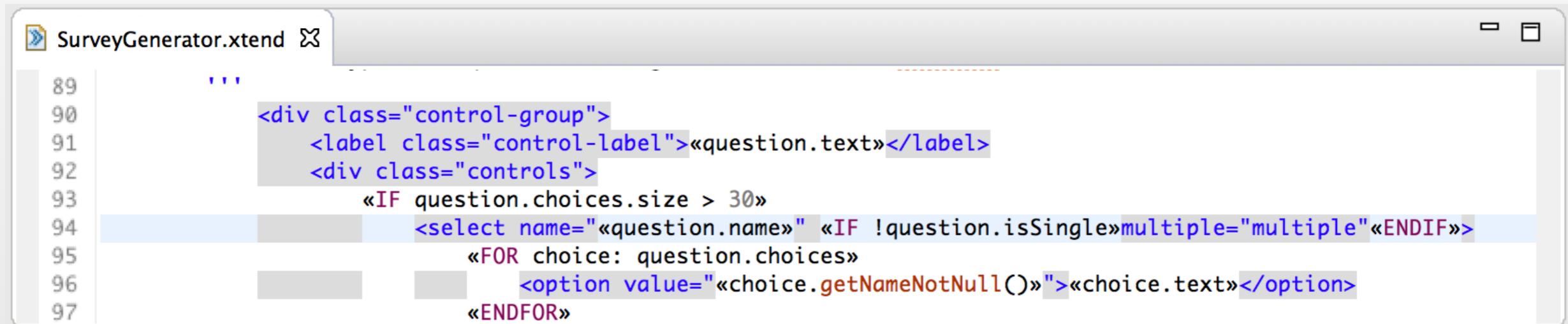
Syntax Highlighting

Outline

Template Proposals

Formatting

etc.



The screenshot shows an IDE editor window titled "SurveyGenerator.xtend". The code editor displays the following xtend code:

```
89 ...
90     <div class="control-group">
91         <label class="control-label">«question.text»</label>
92         <div class="controls">
93             «IF question.choices.size > 30»
94             <select name="«question.name»" «IF !question.isSingle»multiple="multiple"«ENDIF»>
95             «FOR choice: question.choices»
96                 <option value="«choice.getNameNotNull()»">«choice.text»</option>
97             «ENDFOR»
```

The code is color-coded: blue for XML tags like <div>, <label>, <select>, <option>, and <FOR>; purple for attributes like class and name; red for strings like "multiple"; and pink for control structures like IF and FOR. The background of the code editor has horizontal color bars corresponding to the code blocks.

Default: Lexer-based.

Code Pointers:

org.eclipse.xtext.ui.codetemplates.ui.highlighting.SemanticHighlighter  
org.eclipse.xtext.ui.editor.syntaxcoloring.DefaultHighlightingConfiguration

Content  
Assist

Quick  
Fixes

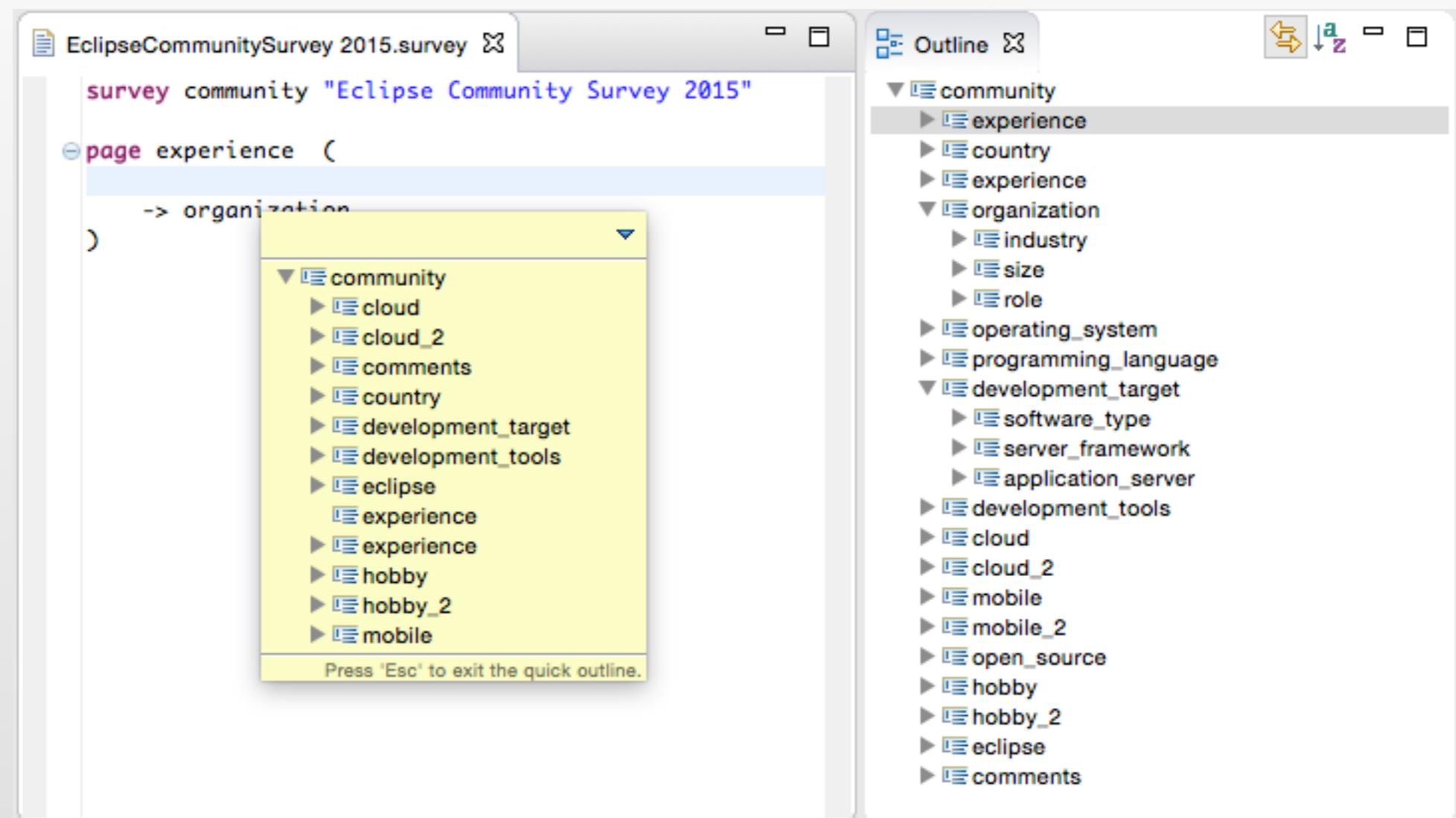
Syntax  
Highlighting

Outline

Template  
Proposals

Formatting

etc.



Default: Semantic Model

Code Pointer:

org.eclipse.xtext.tutorial.survey.ui.outline.SurveyOutlineTreeProvider  
org.eclipse.xtext.tutorial.survey.ui.labeling.SurveyLabelProvider

## Content Assist

## Quick Fixes

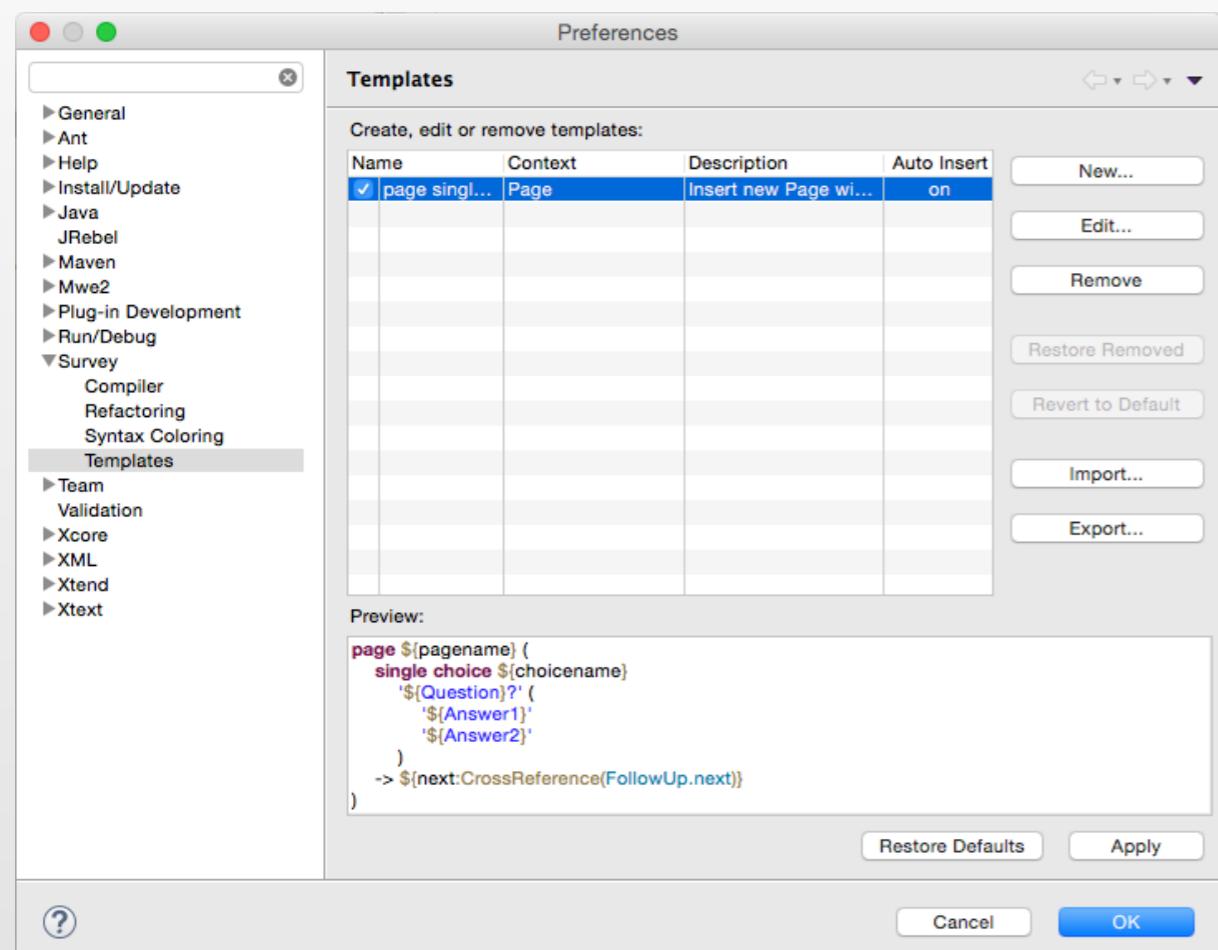
## Syntax Highlighting

## Outline

## Template Proposals

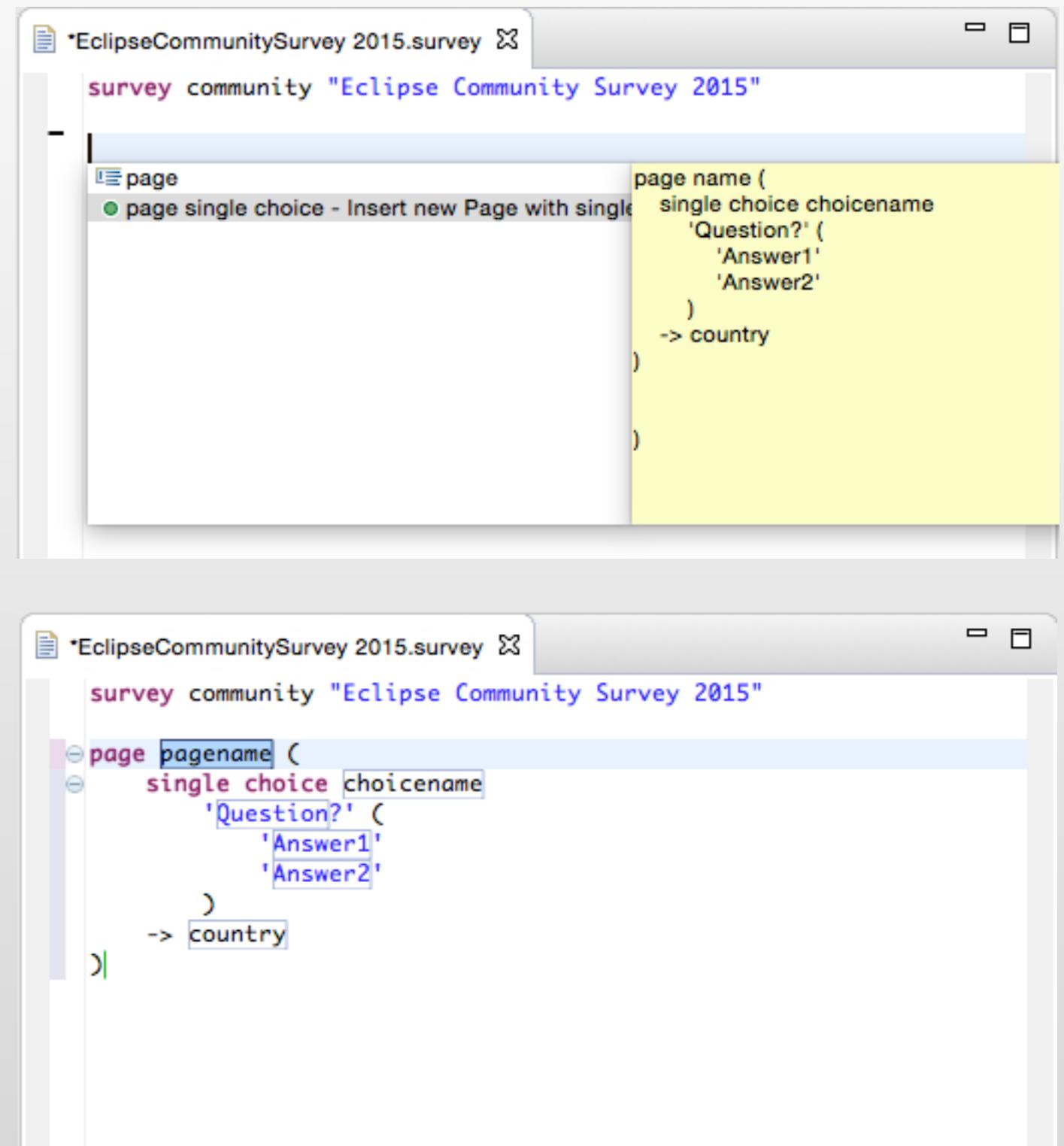
## Formatting

etc.



Default: no templates available

User-Customizable!



Content Assist

Quick Fixes

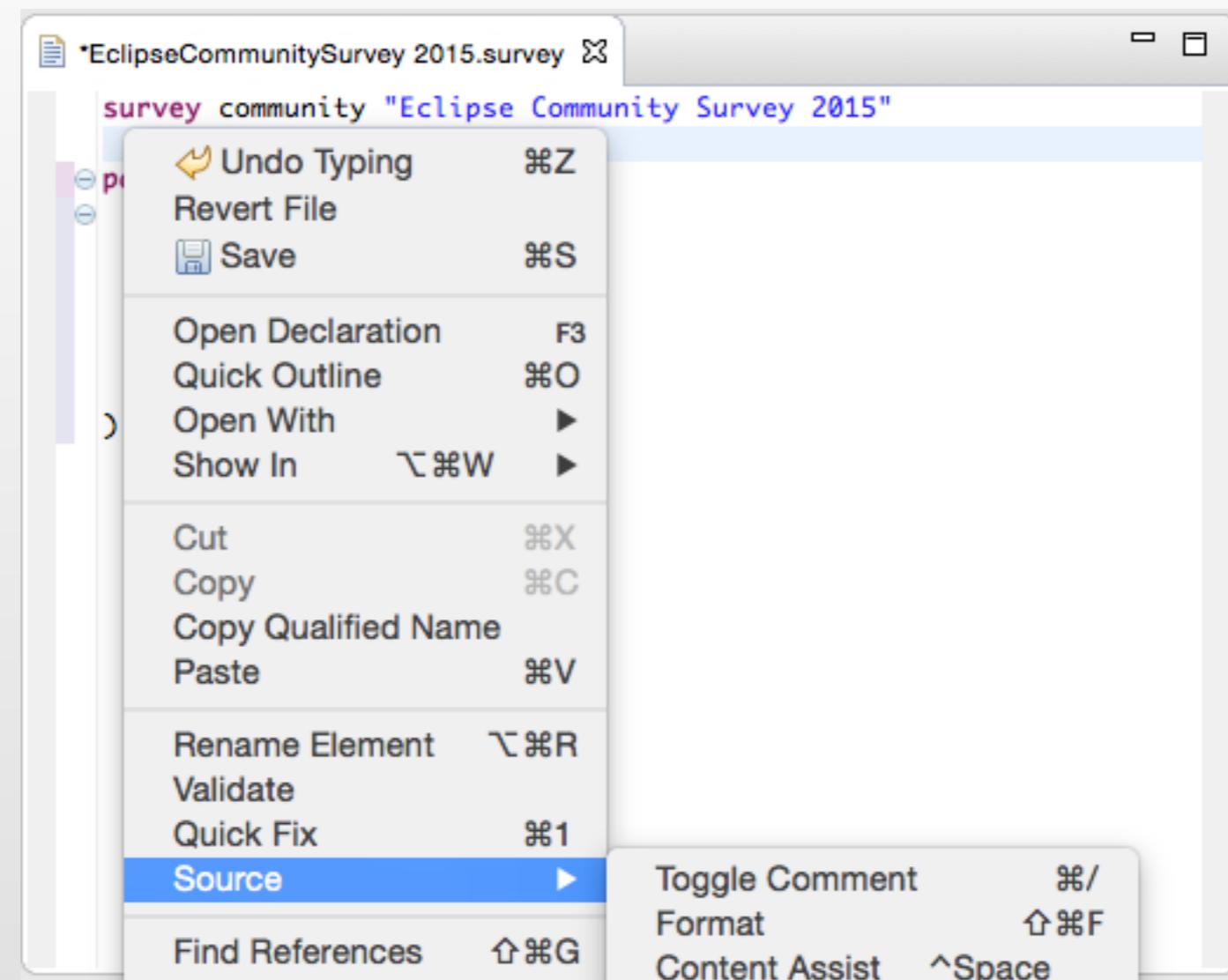
Syntax Highlighting

Outline

Template Proposals

Formatting

etc.



Default: insert single whitespace between tokens

Code Pointer:

org.eclipse.xtext.tutorial.survey.formatting.SurveyFormatter

Content  
Assist

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Fixes

Syntax  
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Formatting

etc.

Rename Refactoring

Match Braces

Mark Occurrences

Find References

Indexing

Error Markers

Toggle Comment

Open Model Element Dialog

Open Declaration

Code Folding

Autobuild

Open Source/Generated File

Hovers

Autoedit

# Further Steps

Install via Update Site or Download Eclipse DSL Distribution

What others have built with Xtext:

<http://www.eclipse.org/Xtext/community.html>

Web Forum:

<https://www.eclipse.org/forums/index.php/f/27/>

Professional Support:

**itemis**

Book: Implementing Domain-Specific Languages with Xtext and Xtend by Lorenzo Bettini





2015

Mark the Date!

May 18 - 20

[www.xtextcon.org](http://www.xtextcon.org)



# XRobots

Program your robot in a web browser. Teach it sumo wrestling.  
Challenge others and watch the show at the itemis booth.

join the game at  
[xrobots.itemis.de](http://xrobots.itemis.de)