

## Developer Guide BNF Tools

BNF Tools is a BNF-Editor based on xText DSLs, which gives away a lot of features.

### The used Features are:

- Grammardefinition
- Validation
- Quickfixing
- Generation of content from the BNF
- Formatting
- Outlining
- File import
- Deployment as Plugin
- Deployment as RCP (Rich Client Platform)

### Grammardefinition:

The corefeature of xText.

This is defined in `de.ugoe.cs.swe.bnftools.ebnf/de.ugoe.cs.swe.bnftools.ebnf/EBNF.xtext`

It contains the Entities after which the grammar must be defined, while the first rule is the Start e.g.:

EtsiBnf:

```
'grammar' name=ID
```

```
( type='bnf?';
```

```
(importSection=ImportSection)?
```

```
(bnfEntry+=BnfEntry)+
```

```
)
```

```
|
```

```
( type='/delta;'
```

```
(importSection=ImportSection)?
```

```

(deltaEntry+=DeltaEntry)*
)
|
( type='/merge;'
(importSection=ImportSection)?
(mergeEntry+=MergeEntry)*
)
;

```

To turn this into a runnable application the .mwe2 file in the same folder must be executed as MWE2 Workflow.

After this the whole project can be executed as an Eclipse Application for testing

#### **Validation allows to check for conditions in the BNF-Document:**

In the File de.ugoe.cs.swe.bnftools.ebnf/de.ugoe.cs.swe.ebnf.validation/EbnfValidator.xtend

validationrules can be defined e.g.:

```
@Check
```

```

defvoid checkUnusedRule(Rule rule) {
varList<RuleReference> references = EbnfAnalysisUtils.findReferences(rule);
varList<Rule> references1 = EbnfAnalysisUtils.findReferences(rule,resourceDescriptions);
if((references.size+references1.size ==0) && (rule.getRulenummer() !=1))
warning(unusedRuleDescription, EbnfPackage$Literals::RULE__NAME,unusedRuleDescription, rule.name);
}

```

For this the @Check annotation defines that the next function is a Validationcheck.

The parameter can be any Entity from the previously defined Grammar and every Entity of this Type will be checked this way.

And if the Check finds some inconsistency a warning will be displayed to this Entity Instance in the Editor.

The other files in the Package contain supporting Methodes for the validation

like

```
EbnfAnalysisUtils.findReferences(rule);
```

or

```
EbnfAnalysisUtils.findReferences(rule,resourceDescriptions);
```

Which find the Rule references inside a BNF-File or outside a BNF-File.

### **Quickfixing can be applied to warnings given by Validations:**

In the File `de.ugoe.cs.swe.bnftools.ebnf.ui/de.ugoe.cs.swe.bnftools.ui.quickfix/EbnfQuickfixProvider.xtend`

quickfixes for validation-warnings can be defined e.g.:

```
@Fix(EbnfValidator.unusedRuleDescription)
```

```
defvoid fixUnusedRule(Issue issue, IssueResolutionAcceptor acceptor) {
```

```
acceptor.accept(issue, "Remove unused rule", "Delete the unused rule", "upcase.png", [ element, context |
```

```
varRule rule = element as Rule;
```

```
varIXtextDocument xtextDocument = context.getXtextDocument();
```

```
varICompositeNode node = NodeModelUtils.findActualNodeFor(rule);
```

```
varint offset = node.textRegion.offset;
```

```
varString nodeText = node.text;
```

```
varint textLength = nodeText.length - 2;
```

```
xtextDocument.replace(offset, textLength, "");
```

```
]
```

```
}
```

The `@Fix(String token)` annotation defines that the following method is a quickfix for a validation warning, with that `token` as code parameter:

```
warning(unusedRuleDescription, EbnfPackage$Literals::RULE__NAME, unusedRuleDescription, rule.name);
```

```
@Fix(EbnfValidator.unusedRuleDescription)
```

The acceptor inside applies the changes, via two possible ways:

1. Change the Document itself (like the example shows).

1. Change the underlying ecoremodel.

### **Generation allows to generate other files from a BNF-Document:**

In our case we create a .fo document, that can be transformed into a PDF-Document using Apache FOP.

It can be customized in the File `de.ugoe.cs.swe.bnftools.ebnf/de.ugoe.cs.swe.ebnf.generator/EbnfGenerator.xtend`

Where the `doGenerate` methode defines how the files given by a Resource and a `IFileSystemAccess` should generate a new file. While for every relevant Entity from the

BNF a compile Methode handles the generation in the new file, while it calls the compile Methode for every related Entity e.g.:

```
override void doGenerate(Resource resource, IFileSystemAccess fsa) {  
  
for(e : resource.allContents.toIterable.filter(EtsiBnf)) {  
  
if(e.bnfEntry.size !=0) {  
  
fsa.generateFile(e.name + ".fo", e.compile)  
  
}  
  
}  
  
def compile(DefinitionList dList) «FORsDef : ist.singleDefinition» «sDef.compile»  
  
    «IF !sDef.equals(dList.singleDefinition.last)» | «ENDIF» «ENDFOR»"  
}
```

### **Generation of PDF using Apache FOP:**

Based on the generated .fo file a PDF-document can be generated for this the class `de.ugoe.cs.swe.bnftools.ebnf/de.ugoe.cs.swe.ebnf.generator/foToPDF` can be used, either by giving the .fo file and the output URI without Ending or simply the giving the classpath of the file.

For this the `dodoGenerate` Methode needed an upgrade to access the filesystem via URIs:

```
override void doGenerate(Resource resource, IFileSystemAccess fsa) {  
  
var String workspacePath = WorkspaceResolver.getWorkspace();  
  
for(e : resource.allContents.toIterable.filter(EtsiBnf)) {  
  
if(e.bnfEntry.size !=0) {  
  
fsa.generateFile(e.name + ".fo", e.compile)  
  
}
```

*generatepdf*

```
var uri = (fsaasIFileSystemAccessExtension2).getURI(e.name + ".fo");  
varString fullUri = workspacePath + uri.path.substring(10, uri.path.length);  
varFile file = newFile(fullUri);  
if(file.exists) {  
foToPdf.createPdfFromFo(fullUri.substring(0, fullUri.length - 3));  
}  
}  
}  
}
```

To include apache fop you need to add all the jars in a folder e.g. Libs in your project, add this folder to your buildpath, configure buildpath and add the jars to it and add them in the plugin.xml on the page runtime at classpath.

### **Formatting or Prittey Printing is to format the BNF-Documnt:**

In the File de.ugoe.cs.swe.bnftools.ebnf/de.ugoe.cs.swe.ebnf.formatting/EbnfFormatter.xtend

the Method configureFormatting(FormattingConfig c) allows to define formatting rules

before, after or between Enteties or Keywords.

e.g.:

@Inject**extension**EbnfGrammarAccess

**overrideprotectedvoid**configureFormatting(FormattingConfig c) {

c.setLinewrap(0,1,2).before(SL\_COMMENTRule)

c.setLinewrap(0,1,2).before(ML\_COMMENTRule)

c.setLinewrap(0,1,1).after(ML\_COMMENTRule)

**var**EbnfGrammarAccess f = getGrammarAccess**as**EbnfGrammarAccess;

c.setLinewrap.before(f.ruleRule);

c.setLinewrap.before(f.importRule);

```
c.setNoSpace.after(f.ruleAccess.rulenummerINTTerminalRuleCall_0_0_0)
}
```

The Entities are received via an Injector that gives access to The Grammar.

### **Outlining and Labeling are Features, that show the document Structure of the BNF-Document:**

Outlining can be customized in the File

```
de.ugoe.cs.swe.bnftools.ebnf.ui/de.ugoe.cs.swe.bnftools.ui.outline/EbnfOutlineTreeProvider.xtend.
```

Here you can define a `_createChildren()` with the `rootNode` and the BNF-Entity of the Grammar to change the outline sequence:

```
defvoid _createChildren(DocumentRootNode parentNode, EtsiBnf bnf) {
createNode(parentNode,bnf);
}
```

Labeling is made to customize what the outline text for an Entity should look like.

It can be customized in the file

```
de.ugoe.cs.swe.bnftools.ebnf.ui/de.ugoe.cs.swe.bnftools.ui.labeling/EbnfLabelProvider.xtend
```

Where for every Entity a text can be defined:

```
deftext(ImportSection sec){
'Imports'
}
```

### **File import allows to reference Rules from one BNF-Document in another:**

There are 2 ways for imports, via URI and VIA Namespaces:

The BNF-Grammar uses the URI version. To Activate this the lines

```
fragment= scoping.ImportNamespacesScopingFragmentauto-inject{ }
```

```
fragment= exporting.QualifiedNamesFragmentauto-inject{ }
```

```
fragment= builder.BuilderIntegrationFragmentauto-inject{ }
```

```
fragment= types.TypesGeneratorFragmentauto-inject{ }
```

in the .mwe2 file have to be commented out and the lines:

```
fragment= scoping.ImportURIscopingFragmentauto-inject{ }
```

```
fragment= exporting.SimpleNamesFragmentauto-inject{ }
```

must be included.

After That imports can be defined like this and will automatically be used:

```
'import'importURI=STRING
```

### **Also it is possible to add features to the UI via Xtext:**

In the File de.ugoe.cs.swe.bnftools.ebnf.ui/plugin.xml new extensions to the UI can be created in the plugin.xml tab. e.g.:

```
<extension
```

```
point="org.eclipse.ui.handlers">
```

```
<handler
```

```
class="de.ugoe.cs.swe.bnftools.ui.EbnfExecutableExtensionFactory:de.ugoe.cs.swe.bnftools.ui.handler.GenerationHandler"
```

```
commandId="de.ugoe.cs.swe.bnftools.ui.handler.GenerationCommand">
```

```
</handler>
```

```
</extension>
```

```
<extension
```

```
point="org.eclipse.ui.commands">
```

```
<commandname="Generate Code"
```

```
id="de.ugoe.cs.swe.bnftools.ui.handler.GenerationCommand">
```

```
</command>
```

```
</extension>
```

```
<extensionpoint="org.eclipse.ui.menus">
```

```
<menuContributionlocationURI="popup:org.eclipse.jdt.ui.PackageExplorer">
```

```
<command
```

```
commandId="de.ugoe.cs.swe.bnftools.ui.handler.GenerationCommand"
```

```

style="push">
<visibleWhen
checkEnabled="false">
<iterate>
<adapttype="org.eclipse.core.resources.IResource">
<testproperty="org.eclipse.core.resources.name"
value="*.bnf"/>
</adapt>
</iterate>
</visibleWhen>
</command>
</menuContribution>
</extension>

```

This extension creates a new button in the popupmenu that opens when rightclicking a .bnf file which triggers a handler `de.ugoe.cs.swe.bnftools.ui.handler.GenerationHandler` for this File that should call the Generator of the Grammar for this File.

@Override

```

public Object execute(ExecutionEvent event) throws ExecutionException {
    ISelection selection = HandlerUtil.getCurrentSelection(event);
    if(selection instanceof IStructuredSelection) {
        IStructuredSelection structuredSelection = (IStructuredSelection) selection;
        Object firstElement = structuredSelection.getFirstElement();
        if(firstElement instanceof IFile) {
            IFile file = (IFile) firstElement;
            IProject project = file.getProject();

```

```

IFolder srcGenFolder = project.getFolder("src-gen");

if(!srcGenFolder.exists()) {

try{

srcGenFolder.create(true,true,newNullProgressMonitor());

}catch(CoreException e) {

returnnull;

}

}

final!EclipseResourceFileSystemAccess2 fsa =fileAccessProvider.get();

fsa.setOutputPath(srcGenFolder.getFullPath().toString());

URI uri = URI.createPlatformResourceURI(file.getFullPath().toString(),true);

ResourceSet rs =resourceSetProvider.get(project);

Resource r = rs.getResource(uri,true);

generator.doGenerate(r, fsa);

}

}

returnnull;

}

```

Here is a Problem since the!EclipseResourceFileSystemAccess2does not contain all the needed inforamtion. Maybe it can be looked up in the normal call of the generator.

### Deployment as Plugin:

If you want to deploy your the BNF Tools you can use the deployment as plugin:

Rightclick your xTextProject, chooseexport, choosePlug-in development --> Deployable plug-ins and fragments, choose all parts of the project, \*.ebnf \*.ebnf.tests \*.ebnf.ui and a directory. After you finish this will generate a jar for every one of the choosen projects. Add these to the plugin-folder of a eclipse and it should be installed

### Deployment as RCP:

If you want to create a Rich client platform for a standalone minimal workbench setup with only your plugin and required plugins in it RCP is a good choice (This is for an Eclipse 3.x RCP).

First create your `Text Project`, then create a new `Plug-in Project`. Give it a name,

e.g. `de.ugoe.cs.swe.bnftools.ebnf.product`. Click next, and unchoose `Generate an Activator`, a Java Class that controls the plug-in's life cycle and this plug-in will make contributions to the UI. Also choose `no Rich client Platform`. Press finish.

Now open the `Manifest.MF`, go to the `Overview` page and choose this plug-in in a singleton. Then go to the `Dependencies` page and add `org.eclipse.core.runtime`.

Now create a product configuration in your product project, on its `Overview` Page click `new`, choose a fitting name and ID, your product project as defining `Plugin` and `org.eclipse.ui.ide.workbench` as application. Now go back to the `Manifest.MF` and open the `Extensions` Page. There you should now see 1 Extension `org.eclipse.core.runtime.products` with a product inside. This should have `org.eclipse.ui.ide.workbench` as application and the given name of the product configuration as name. Rightclick the product and create a new property and if you want you can give it a customized name and value.

Now back to the product configuration and its dependencies page. There you add all your `Text` projects and your product, then click `add Required Plug-ins`. After this you still need to add the `Plugins` `org.eclipse.ui.ide.application` and `org.eclipse.core.net`

. Now you can test your product by running it as a `Runtime Eclipse`, if there is a missing plugin you can find it using the `validate plugins` option in the run configurations `plug-ins` page. Deploy it using `Export` as an `Eclipse Product` in the product configuration.

@ To make the generator run properly you need to add `org.eclipse.xtext.xbase` to your product configuration dependencies