SLEECVAL USER GUIDE

CD

MAINTENANCE

Prerequisites

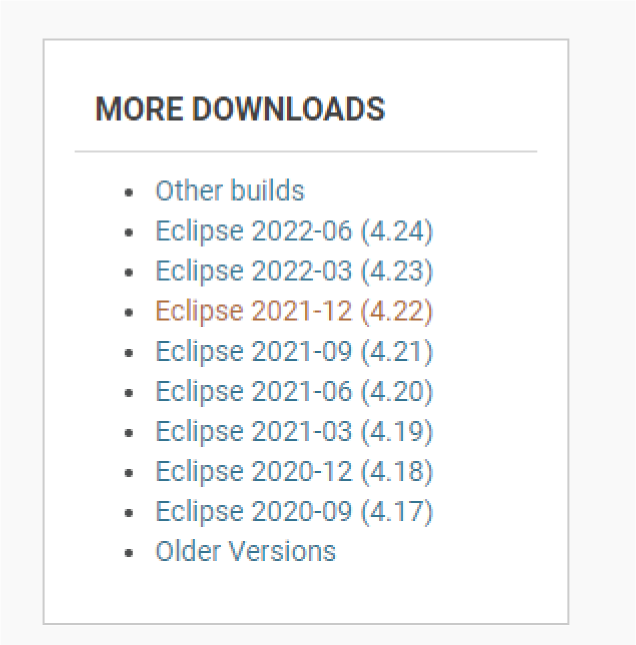
- Java 11 is required and can be downloaded using the following link:

  https://www.techspot.com/downloads/5553-java-jdk.html

- The 2021-12 version of Eclipse IDE is recommended. Below is a link to install the DSL package, which already has Xtext installed:

  https://www.eclipse.org/downloads/packages/release/2021-12/r/eclipse-ide-java-and-dsl-developers

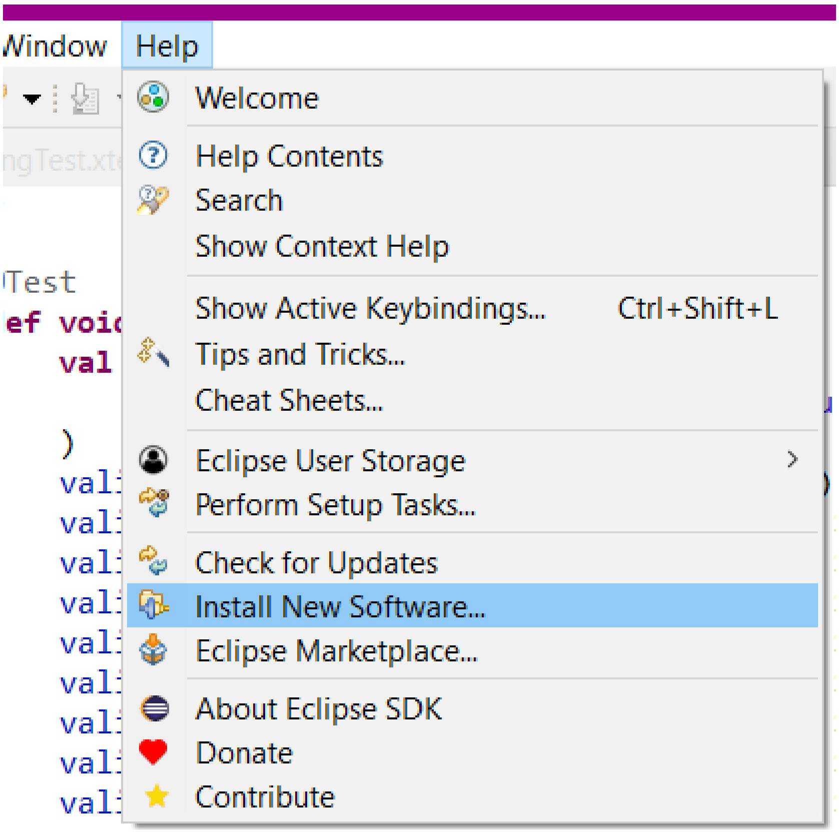
  Navigate to the “More Downloads” section and select the correct version:



MORE DOWNLOADS

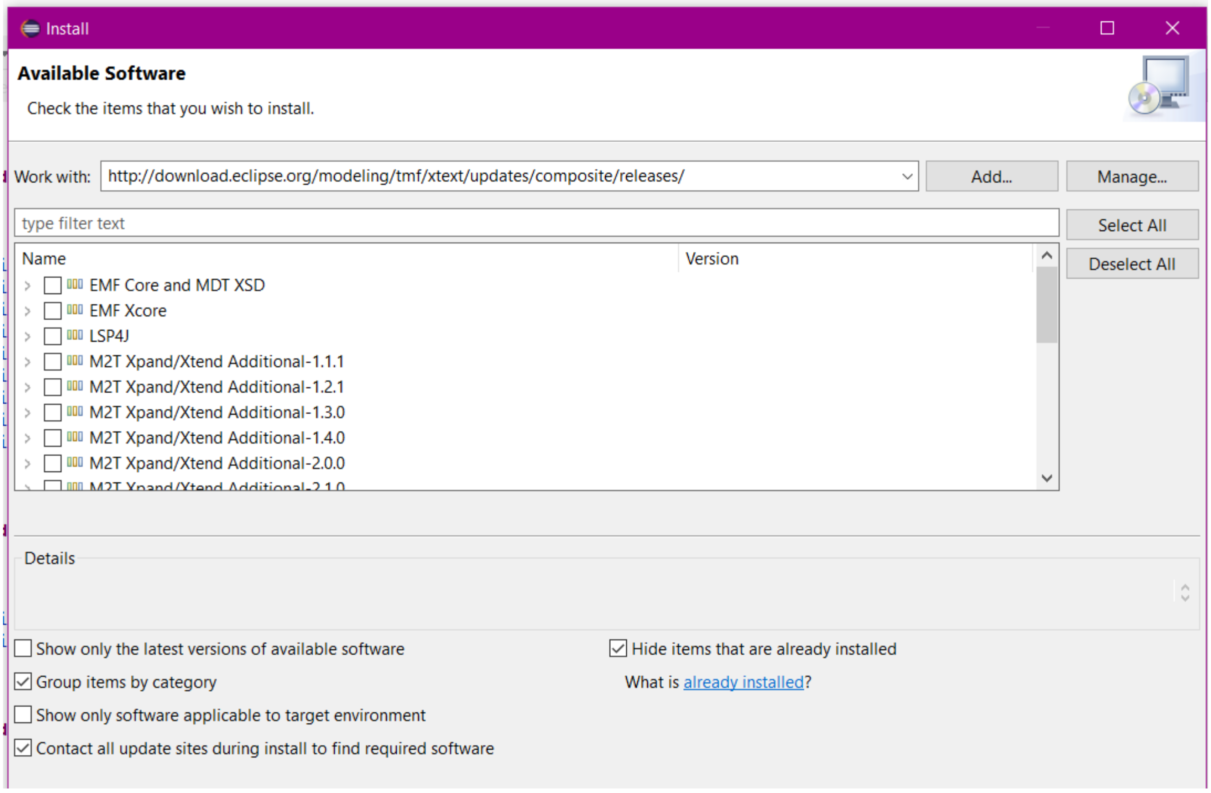
- Other builds
- Eclipse 2022-06 (4.24)
- Eclipse 2022-03 (4.23)
- Eclipse 2021-12 (4.22)
- Eclipse 2021-09 (4.21)
- Eclipse 2021-06 (4.20)
- Eclipse 2021-03 (4.19)
- Eclipse 2020-12 (4.18)
- Eclipse 2020-09 (4.17)
- Older Versions

- If installing Xtext separately, within Eclipse select “Help->Install New Software…”



Paste the following link in the “Work with” bar:

http://download.eclipse.org/modeling/tmf/xtext/updates/composite/releases/



Available Software

Check the items that you wish to install.

Work with: http://download.eclipse.org/modeling/tmf/xtext/updates/composite/releases/

type filter text

- □ EMF Core and MDT XSD
- □ EMF Xcore
- □ LSP4J
- □ M2T Xpand/Xtend Additional-1.1.1
- □ M2T Xpand/Xtend Additional-1.2.1
- □ M2T Xpand/Xtend Additional-1.3.0
- □ M2T Xpand/Xtend Additional-1.4.0
- □ M2T Xpand/Xtend Additional-2.0.0
- □ M2T Xpand/Xtend Additional-2.1.0

□ Show only the latest versions of available software

☑ Group items by category

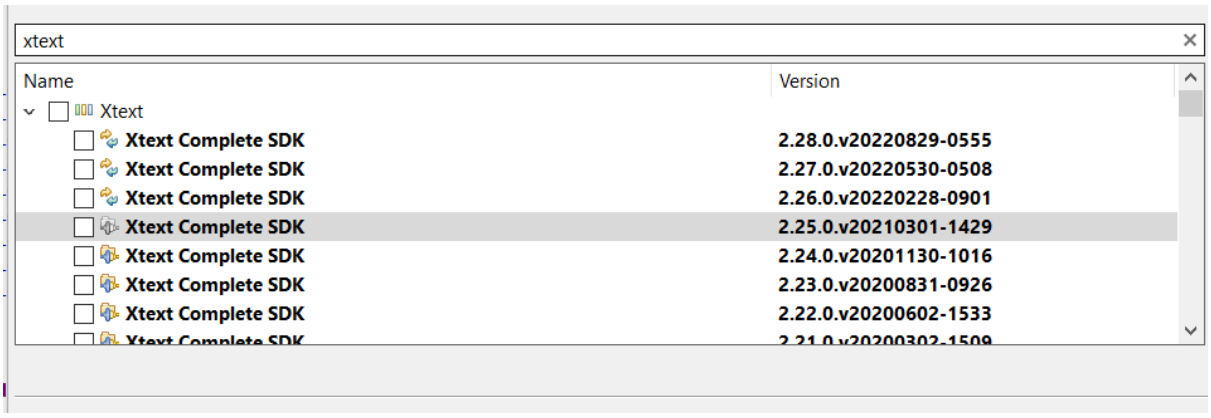
□ Show only software applicable to target environment

☑ Contact all update sites during install to find required software

☑ Hide items that are already installed

What is already installed?

Deselect the “Show only the latest versions” option and filter for Xtext. Version 2.25.0 is recommended (the version packaged with Eclipse 2021-12).



xtext

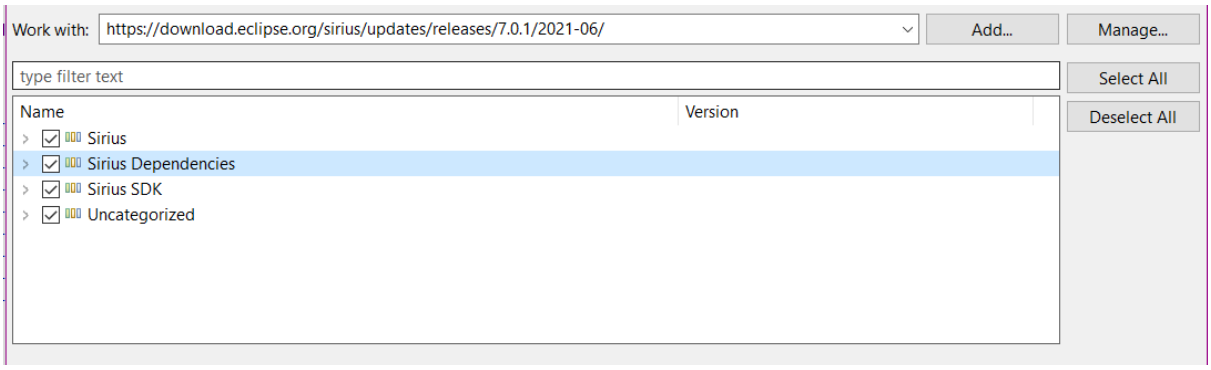
Name	Version
□ Xtext	
□ Xtext Complete SDK	2.28.0.v20220829-0555
□ Xtext Complete SDK	2.27.0.v20220530-0508
□ Xtext Complete SDK	2.26.0.v20220228-0901
□ Xtext Complete SDK	2.25.0.v20210301-1429
□ Xtext Complete SDK	2.24.0.v20201130-1016
□ Xtext Complete SDK	2.23.0.v20200831-0926
□ Xtext Complete SDK	2.22.0.v20200602-1533
□ Xtext Complete SDK	2.21.0.v20200302-1509

Once a version is selected, click Next and continue to do so until you can click Finish.

- To install Sirius in Eclipse for visualisation, got to “Help->Install New Software…” and paste the following link:

  https://download.eclipse.org/sirius/updates/releases/7.0.1/2021-06/

  Select all and click Next until you are able to click Finish:



Work with: https://download.eclipse.org/sirius/updates/releases/7.0.1/2021-06/

type filter text

Name	Version
☑ Sirius	
☑ Sirius Dependencies	
☑ Sirius SDK	
☑ Uncategorized	

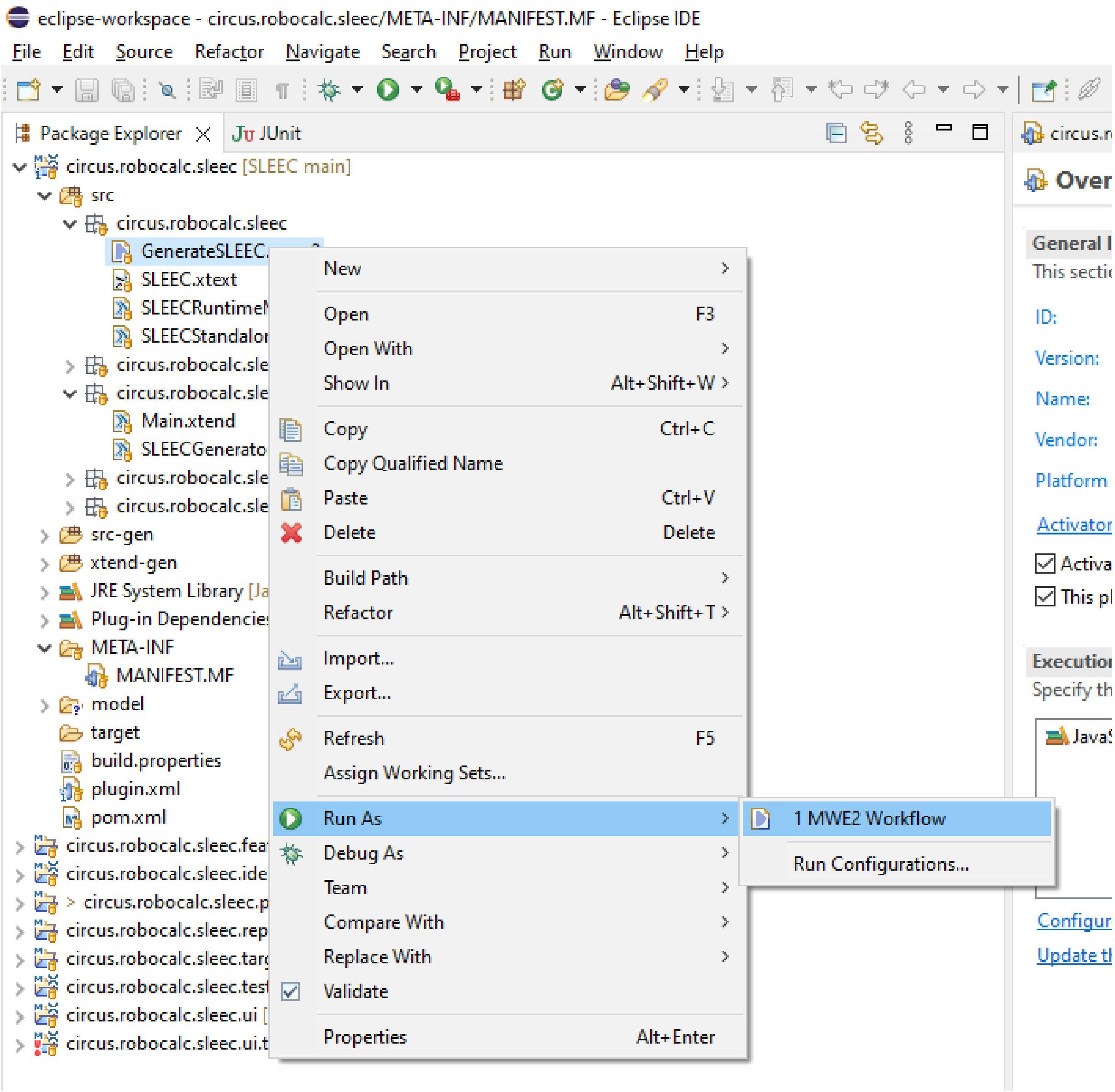
- To install Maven go to https://maven.apache.org/ and follow the download/installation instructions.
- To install FDR4 go to https://cocotec.io/fdr/ and run the installer.

Setup

In a command prompt type: git clone https://github.com/UoY-RoboStar/SLEEC.git.
In Eclipse: File > Open projects from file system
Enter the SLEEC folder as the input source

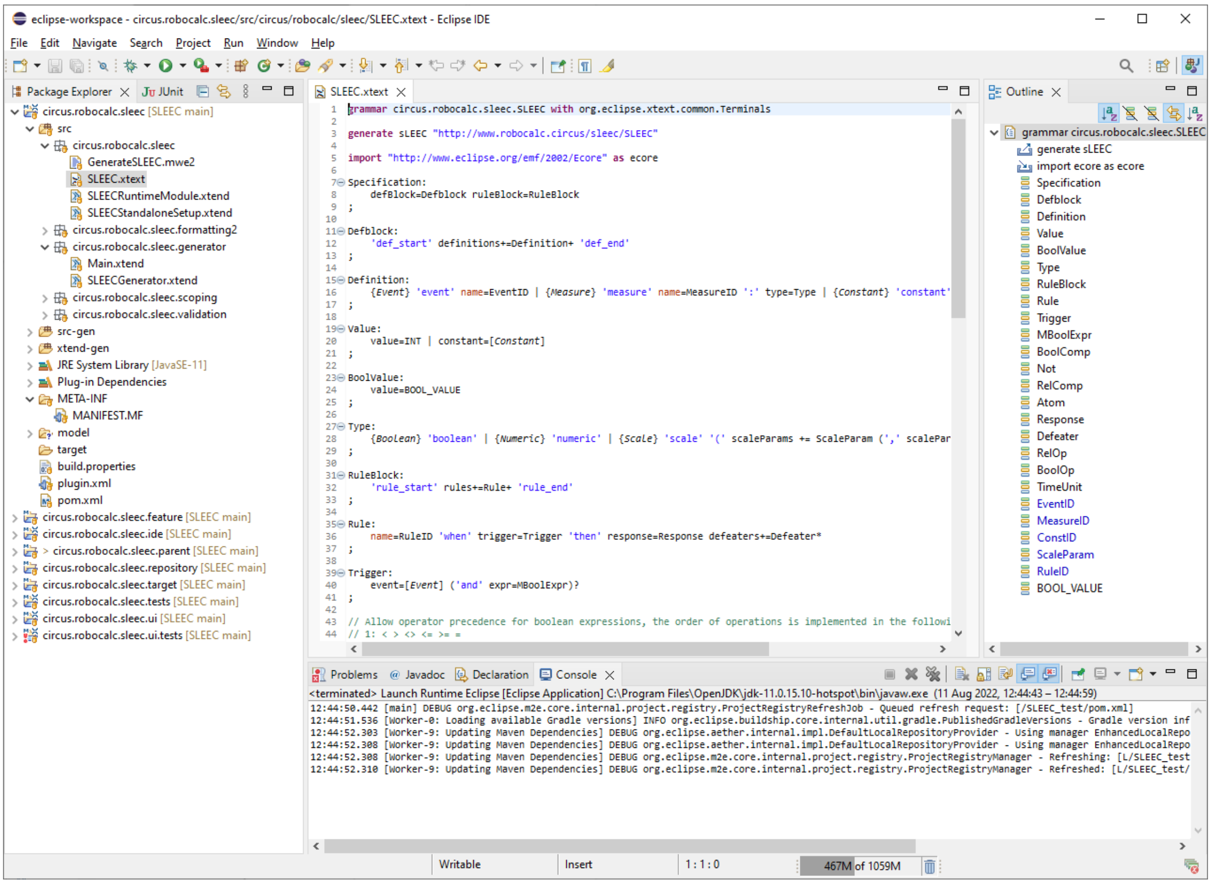
Removing Initial Errors

There should be some errors, the following command will get rid of them.



Grammar file

This creates the syntax tree from a .sleec input file. It’s located in circus.robocalc.sleec\src\circus\robocalc\sleec\SLEEC.xtext


eclipse-workspace - circus.robocalc.sleec/src/circus/robocalc/sleec/SLEEC.xtext - Eclipse IDE
File Edit Navigate Search Project Run Window Help
Package Explorer
JUnit
circus.robocalc.sleec [SLEEC main]
src
circus.robocalc.sleec
GenerateSLEEC.mwe2
SLEEC.xtext
SLEECRuntimeModule.xtend
SLEECStandaloneSetup.xtend
circus.robocalc.sleec.formatting2
circus.robocalc.sleec.generator
Main.xtend
SLEECGenerator.xtend
circus.robocalc.sleec.scoping
circus.robocalc.sleec.validation
src-gen
xtend-gen
JRE System Library [JavaSE-11]
Plug-in Dependencies
META-INF
MANIFEST.MF
model
target
build.properties
plugin.xml
pom.xml
circus.robocalc.sleec.feature [SLEEC main]
circus.robocalc.sleec.ide [SLEEC main]
> circus.robocalc.sleec.parent [SLEEC main]
circus.robocalc.sleec.repository [SLEEC main]
circus.robocalc.sleec.target [SLEEC main]
circus.robocalc.sleec.tests [SLEEC main]
circus.robocalc.sleec.ui [SLEEC main]
circus.robocalc.sleec.ui.tests [SLEEC main]
SLEEC.xtext
Outline
grammar circus.robocalc.sleec.SLEEC
generate sLEEC
import ecore as ecore
Specification
Defblock
Definition
Value
BoolValue
Type
RuleBlock
Rule
Trigger
MBoolExpr
BoolComp
Not
RelComp
Atom
Response
Defeater
RelOp
BoolOp
TimeUnit
EventID
MeasureID
ConstID
ScaleParam
RuleID
BOOL_VALUE
Problems
Javadoc
Declaration
Console
Writable
Insert
1 : 1 : 0
467M of 1059M

```
grammar circus.robocalc.sleec.SLEEC with org.eclipse.xtext.common.Terminals

generate sLEEC "http://www.robocalc.circus/sleec/SLEEC"

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

Specification:
    defBlock=Defblock ruleBlock=RuleBlock
;

Defblock:
    'def_start' definitions+=Definition+ 'def_end'
;

Definition:
    {Event} 'event' name=EventID | {Measure} 'measure' name=MeasureID ':' type=Type | {Constant} 'constant'
;

Value:
    value=INT | constant=[Constant]
;

BoolValue:
    value=BOOL_VALUE
;

Type:
    {Boolean} 'boolean' | {Numeric} 'numeric' | {Scale} 'scale' '(' scaleParams += ScaleParam (',' scalePar
;

RuleBlock:
    'rule_start' rules+=Rule+ 'rule_end'
;

Rule:
    name=RuleID 'when' trigger=Trigger 'then' response=Response defeaters+=Defeater*
;

Trigger:
    event=[Event] ('and' expr=MBoolExpr)?
;

// Allow operator precedence for boolean expressions, the order of operations is implemented in the followi
// 1: < > <> <= >= =
```

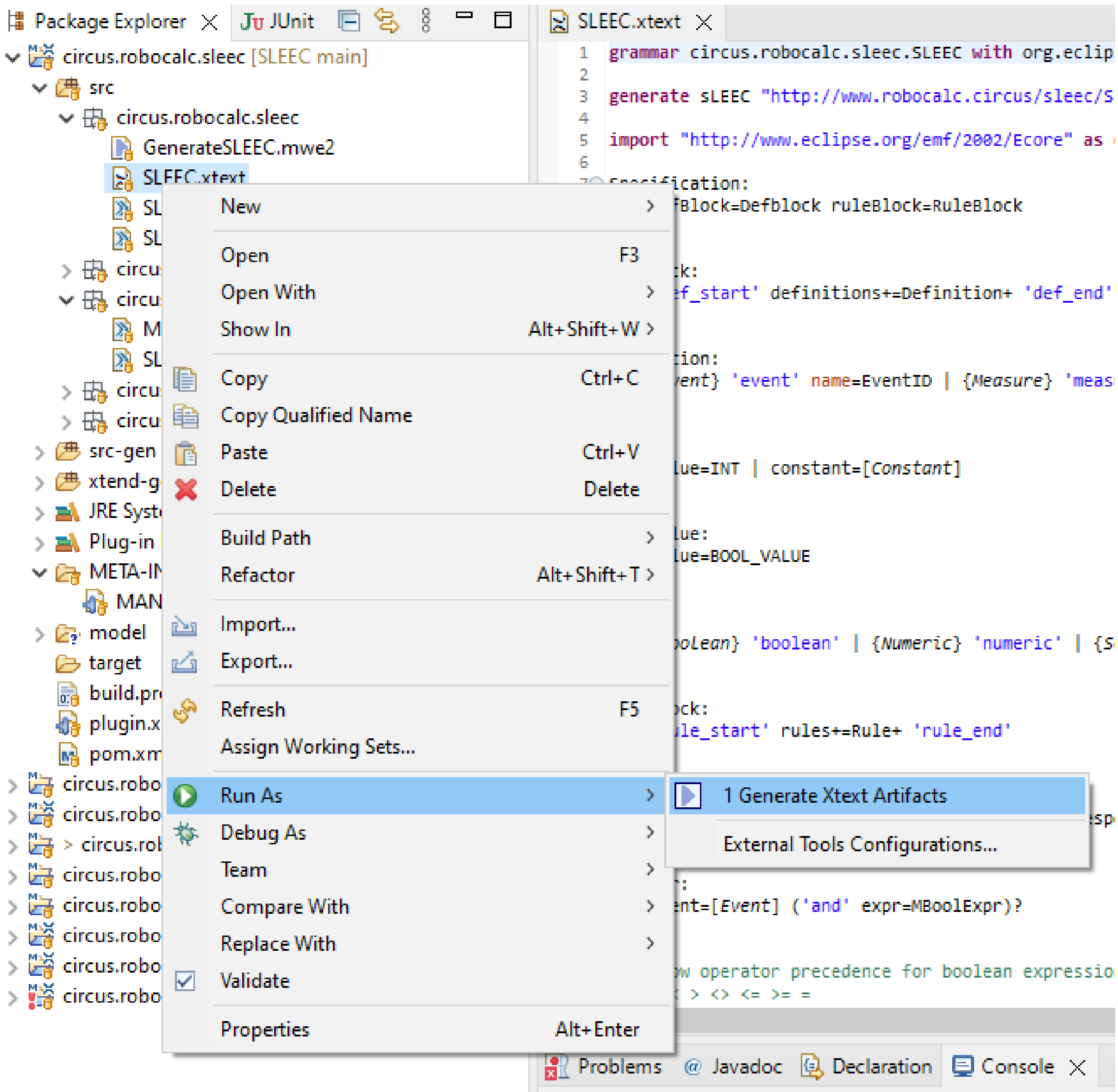
```
<terminated> Launch Runtime Eclipse [Eclipse Application] C:\Program Files\OpenJDK\jdk-11.0.15.10-hotspot\bin\javaw.exe  (11 Aug 2022, 12:44:43 – 12:44:59)
12:44:50.442 [main] DEBUG org.eclipse.m2e.core.internal.project.registry.ProjectRegistryRefreshJob - Queued refresh request: [/SLEEC_test/pom.xml]
12:44:51.536 [Worker-0: Loading available Gradle versions] INFO org.eclipse.buildship.core.internal.util.gradle.PublishedGradleVersions - Gradle version inf
12:44:52.303 [Worker-9: Updating Maven Dependencies] DEBUG org.eclipse.aether.internal.impl.DefaultLocalRepositoryProvider - Using manager EnhancedLocalRepo
12:44:52.308 [Worker-9: Updating Maven Dependencies] DEBUG org.eclipse.aether.internal.impl.DefaultLocalRepositoryProvider - Using manager EnhancedLocalRepo
12:44:52.308 [Worker-9: Updating Maven Dependencies] DEBUG org.eclipse.m2e.core.internal.project.registry.ProjectRegistryManager - Refreshing: [L/SLEEC_test
12:44:52.310 [Worker-9: Updating Maven Dependencies] DEBUG org.eclipse.m2e.core.internal.project.registry.ProjectRegistryManager - Refreshed: [L/SLEEC_test/
```

This is the implementation of the grammar rules.

```
specification ::= defBlock ruleBlock

defBlock      ::= def_start definitions def_end
definitions   ::= definition | definition definitions
definition    ::= event eventID | measure measureID : type | constant constID = value
type          ::= boolean | numeric | scale(scaleParams)
scaleParams   ::= literal | literal, scaleParams

ruleBlock     ::= rule_start rules rule_end
rules         ::= rule | rule rules
rule          ::= ruleID when trigger then response [defeaters]
trigger       ::= eventID | eventID and mBoolExpr
mBoolExpr     ::= measureID | not mBoolExpr | (mBoolExpr) | mBoolExpr relOp value |
                  mBoolExpr boolOp boolValue
response      ::= eventID [within value timeUnit [otherwise response]] | not event within value timeUnit
defeaters     ::= defeater | defeater defeaters
defeater      ::= unless mBoolExpr [then response]
relOp         ::= < | > | <> | <= | >= | =
boolOp        ::= and | or
```

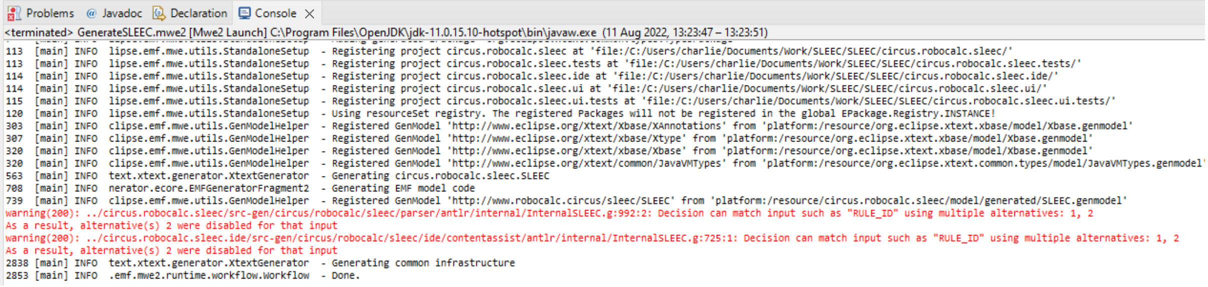
Changing the grammar.

After modifying the grammar file, save it and do:



```
grammar circus.robocalc.sleec.SLEEC with org.eclip

generate sLEEC "http://www.robocalc.circus/sleec/S

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

Specification:
fBlock=Defblock ruleBlock=RuleBlock
k:
ef_start' definitions+=Definition+ 'def_end'
ion:
ent} 'event' name=EventID | {Measure} 'meas
lue=INT | constant=[Constant]
lue:
lue=BOOL_VALUE
oolean} 'boolean' | {Numeric} 'numeric' | {S
ck:
ule_start' rules+=Rule+ 'rule_end'
:
ent=[Event] ('and' expr=MBoolExpr)?
w operator precedence for boolean expressio
< > <> <= >= =
```

These warnings in the output can be ignored.

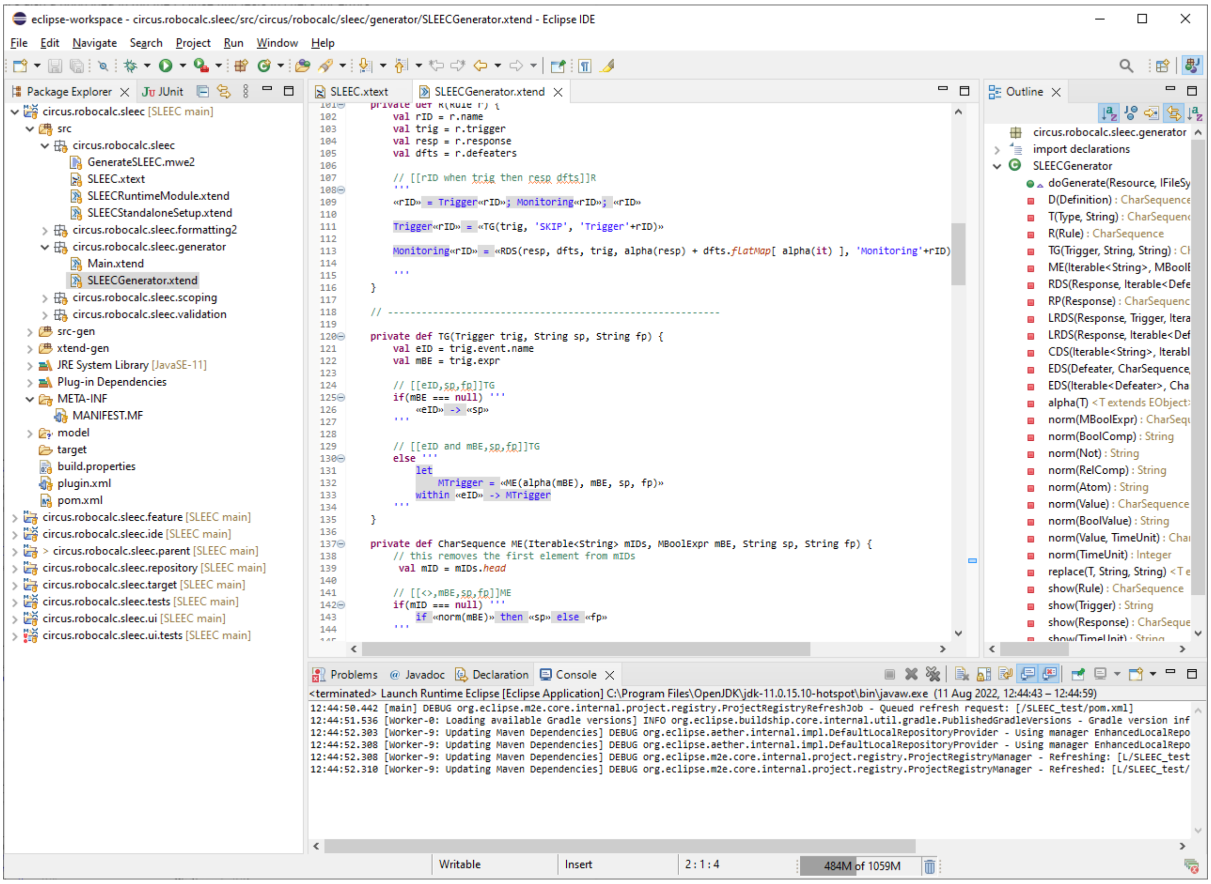


```
<terminated> GenerateSLEEC.mwe2 [Mwe2 Launch] C:\Program Files\OpenJDK\jdk-11.0.15.10-hotspot\bin\javaw.exe (11 Aug 2022, 13:23:47 – 13:23:51)
113  [main] INFO  lipse.emf.mwe.utils.StandaloneSetup  - Registering project circus.robocalc.sleec at 'file:/C:/Users/charlie/Documents/Work/SLEEC/SLEEC/circus.robocalc.sleec/'
113  [main] INFO  lipse.emf.mwe.utils.StandaloneSetup  - Registering project circus.robocalc.sleec.tests at 'file:/C:/Users/charlie/Documents/Work/SLEEC/SLEEC/circus.robocalc.sleec.tests/'
114  [main] INFO  lipse.emf.mwe.utils.StandaloneSetup  - Registering project circus.robocalc.sleec.ide at 'file:/C:/Users/charlie/Documents/Work/SLEEC/SLEEC/circus.robocalc.sleec.ide/'
114  [main] INFO  lipse.emf.mwe.utils.StandaloneSetup  - Registering project circus.robocalc.sleec.ui at 'file:/C:/Users/charlie/Documents/Work/SLEEC/SLEEC/circus.robocalc.sleec.ui/'
115  [main] INFO  lipse.emf.mwe.utils.StandaloneSetup  - Registering project circus.robocalc.sleec.ui.tests at 'file:/C:/Users/charlie/Documents/Work/SLEEC/SLEEC/circus.robocalc.sleec.ui.tests/'
120  [main] INFO  lipse.emf.mwe.utils.StandaloneSetup  - Using resourceSet registry. The registered Packages will not be registered in the global EPackage.Registry.INSTANCE!
303  [main] INFO  clipse.emf.mwe.utils.GenModelHelper  - Registered GenModel 'http://www.eclipse.org/Xtext/Xbase/XAnnotations' from 'platform:/resource/org.eclipse.xtext.xbase/model/Xbase.genmodel'
307  [main] INFO  clipse.emf.mwe.utils.GenModelHelper  - Registered GenModel 'http://www.eclipse.org/xtext/xbase/Xtype' from 'platform:/resource/org.eclipse.xtext.xbase/model/Xbase.genmodel'
320  [main] INFO  clipse.emf.mwe.utils.GenModelHelper  - Registered GenModel 'http://www.eclipse.org/xtext/xbase/Xbase' from 'platform:/resource/org.eclipse.xtext.xbase/model/Xbase.genmodel'
320  [main] INFO  clipse.emf.mwe.utils.GenModelHelper  - Registered GenModel 'http://www.eclipse.org/xtext/common/JavaVMTypes' from 'platform:/resource/org.eclipse.xtext.common.types/model/JavaVMTypes.genmodel'
563  [main] INFO  text.xtext.generator.XtextGenerator  - Generating circus.robocalc.sleec.SLEEC
708  [main] INFO  nerator.ecore.EMFGeneratorFragment2  - Generating EMF model code
739  [main] INFO  clipse.emf.mwe.utils.GenModelHelper  - Registered GenModel 'http://www.robocalc.circus/sleec/SLEEC' from 'platform:/resource/circus.robocalc.sleec/model/generated/SLEEC.genmodel'
warning(200): ../circus.robocalc.sleec/src-gen/circus/robocalc/sleec/parser/antlr/internal/InternalSLEEC.g:992:2: Decision can match input such as "RULE_ID" using multiple alternatives: 1, 2
As a result, alternative(s) 2 were disabled for that input
warning(200): ../circus.robocalc.sleec.ide/src-gen/circus/robocalc/sleec/ide/contentassist/antlr/internal/InternalSLEEC.g:725:1: Decision can match input such as "RULE_ID" using multiple alternatives: 1, 2
As a result, alternative(s) 2 were disabled for that input
2838 [main] INFO  text.xtext.generator.XtextGenerator  - Generating common infrastructure
2853 [main] INFO  .emf.mwe2.runtime.workflow.Workflow  - Done.
```

It’s also a good idea to run the Eclipse unit tests to check for errors.

Generator

Outputs a CSP file from the syntax tree.
Found in circus.robocalc.sleec\src\circus\robocalc\sleec\generator\SLEECGenerator.xtend


eclipse-workspace - circus.robocalc.sleec/src/circus/robocalc/sleec/generator/SLEECGenerator.xtend - Eclipse IDE
File Edit Navigate Search Project Run Window Help
Package Explorer
JUnit
circus.robocalc.sleec [SLEEC main]
src
circus.robocalc.sleec
GenerateSLEEC.mwe2
SLEEC.xtext
SLEECRuntimeModule.xtend
SLEECStandaloneSetup.xtend
circus.robocalc.sleec.formatting2
circus.robocalc.sleec.generator
Main.xtend
SLEECGenerator.xtend
circus.robocalc.sleec.scoping
circus.robocalc.sleec.validation
src-gen
xtend-gen
JRE System Library [JavaSE-11]
Plug-in Dependencies
META-INF
MANIFEST.MF
model
target
build.properties
plugin.xml
pom.xml
circus.robocalc.sleec.feature [SLEEC main]
circus.robocalc.sleec.ide [SLEEC main]
> circus.robocalc.sleec.parent [SLEEC main]
circus.robocalc.sleec.repository [SLEEC main]
circus.robocalc.sleec.target [SLEEC main]
circus.robocalc.sleec.tests [SLEEC main]
circus.robocalc.sleec.ui [SLEEC main]
circus.robocalc.sleec.ui.tests [SLEEC main]
SLEEC.xtext
SLEECGenerator.xtend
Outline
circus.robocalc.sleec.generator
import declarations
SLEECGenerator
doGenerate(Resource, IFileSy
D(Definition) : CharSequence
T(Type, String) : CharSequenc
R(Rule) : CharSequence
TG(Trigger, String, String) : Cl
ME(Iterable<String>, MBoolE
RDS(Response, Iterable<Defe
RP(Response) : CharSequenc
LRDS(Response, Trigger, Itera
LRDS(Response, Iterable<Def
CDS(Iterable<String>, Iterabl
EDS(Defeater, CharSequence,
EDS(Iterable<Defeater>, Cha
alpha(T) <T extends EObject>
norm(MBoolExpr) : CharSequ
norm(BoolComp) : String
norm(Not) : String
norm(RelComp) : String
norm(Atom) : String
norm(Value) : CharSequence
norm(BoolValue) : String
norm(Value, TimeUnit) : Char
norm(TimeUnit) : Integer
replace(T, String, String) <T e
show(Rule) : CharSequence
show(Trigger) : String
show(Response) : CharSeque
show(TimeUnit) : String
Problems
Javadoc
Declaration
Console
Writable
Insert
2 : 1 : 4
484M of 1059M

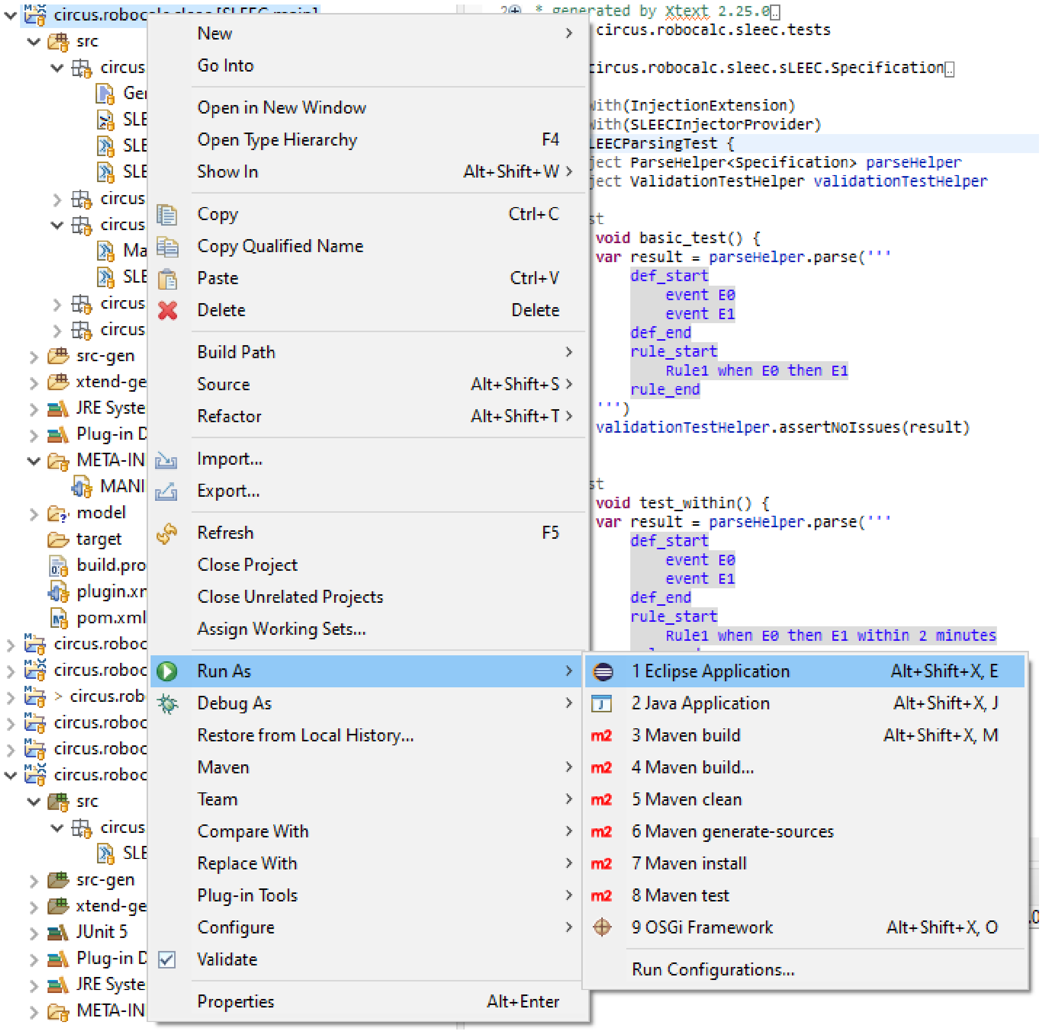
```
    private def R(Rule r) {
        val rID = r.name
        val trig = r.trigger
        val resp = r.response
        val dfts = r.defeaters

        // [[rID when trig then resp dfts]]R
        '''
        «rID» = Trigger«rID»; Monitoring«rID»; «rID»

        Trigger«rID» = «TG(trig, 'SKIP', 'Trigger'+rID)»

        Monitoring«rID» = «RDS(resp, dfts, trig, alpha(resp) + dfts.flatMap[ alpha(it) ], 'Monitoring'+rID)

        '''
    }

    // ------------------------------------------------------------

    private def TG(Trigger trig, String sp, String fp) {
        val eID = trig.event.name
        val mBE = trig.expr

        // [[eID,sp,fp]]TG
        if(mBE === null) '''
            «eID» -> «sp»
        '''

        // [[eID and mBE,sp,fp]]TG
        else '''
            let
                MTrigger = «ME(alpha(mBE), mBE, sp, fp)»
            within «eID» -> MTrigger
        '''
    }

    private def CharSequence ME(Iterable<String> mIDs, MBoolExpr mBE, String sp, String fp) {
        // this removes the first element from mIDs
         val mID = mIDs.head

        // [[<>,mBE,sp,fp]]ME
        if(mID === null) '''
            if «norm(mBE)» then «sp» else «fp»
        '''
```

```
<terminated> Launch Runtime Eclipse [Eclipse Application] C:\Program Files\OpenJDK\jdk-11.0.15.10-hotspot\bin\javaw.exe  (11 Aug 2022, 12:44:43 – 12:44:59)
12:44:50.442 [main] DEBUG org.eclipse.m2e.core.internal.project.registry.ProjectRegistryRefreshJob - Queued refresh request: [/SLEEC_test/pom.xml]
12:44:51.536 [Worker-0: Loading available Gradle versions] INFO org.eclipse.buildship.core.internal.util.gradle.PublishedGradleVersions - Gradle version inf
12:44:52.303 [Worker-9: Updating Maven Dependencies] DEBUG org.eclipse.aether.internal.impl.DefaultLocalRepositoryProvider - Using manager EnhancedLocalRepo
12:44:52.308 [Worker-9: Updating Maven Dependencies] DEBUG org.eclipse.aether.internal.impl.DefaultLocalRepositoryProvider - Using manager EnhancedLocalRepo
12:44:52.308 [Worker-9: Updating Maven Dependencies] DEBUG org.eclipse.m2e.core.internal.project.registry.ProjectRegistryManager - Refreshing: [L/SLEEC_test
12:44:52.310 [Worker-9: Updating Maven Dependencies] DEBUG org.eclipse.m2e.core.internal.project.registry.ProjectRegistryManager - Refreshed: [L/SLEEC_test/
```

This is the implementation of the translation rules.

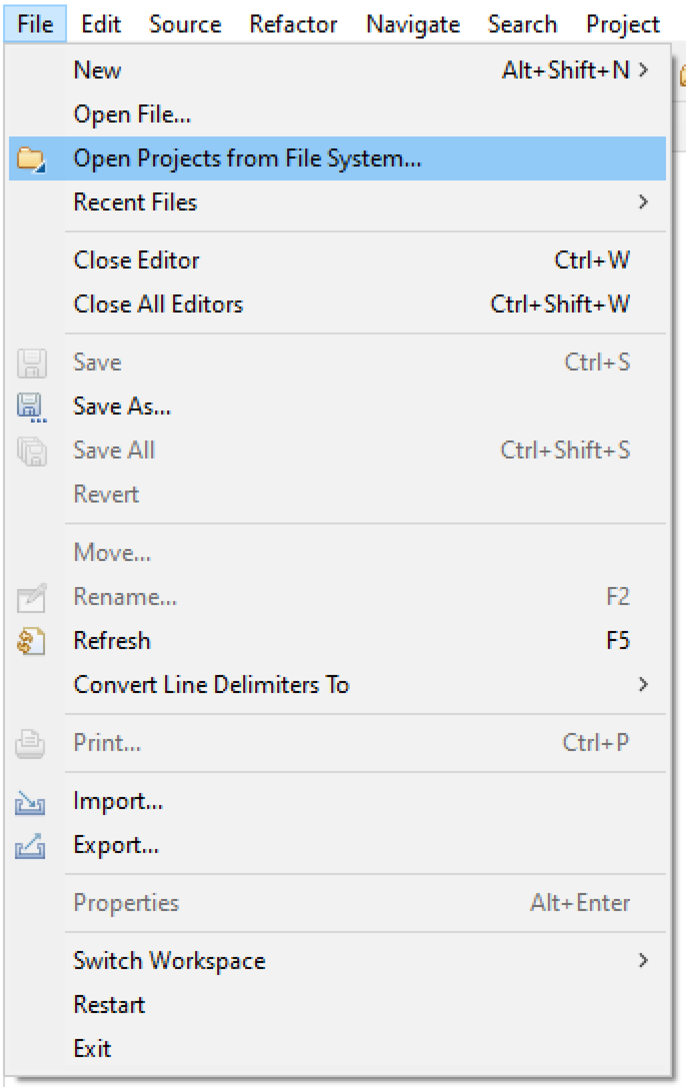
Accessing .sleec files

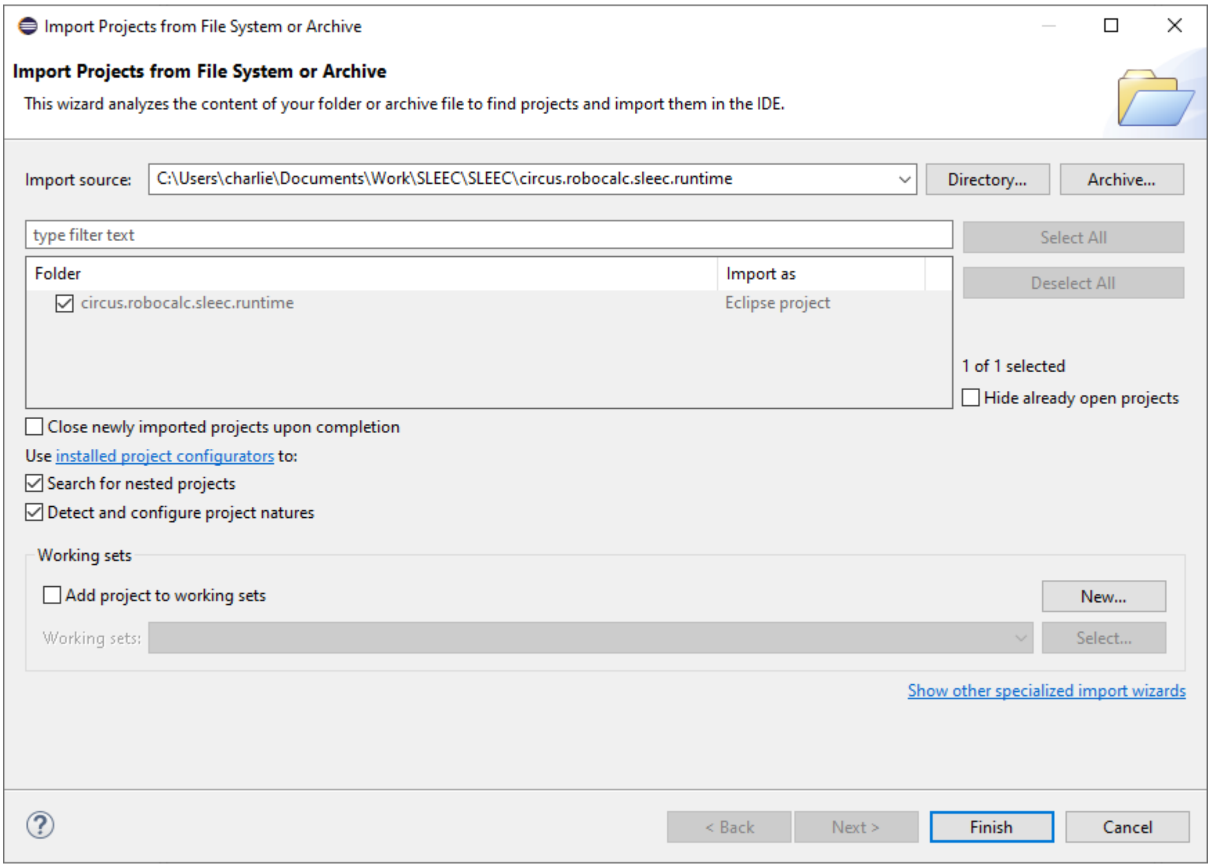
To access and edit .sleec files using Eclipse IDE, riight click circus.robocalc.sleec in the package explorer and run as Eclipse application. Make sure there are no errors.



```
2⊕ * generated by Xtext 2.25.0
circus.robocalc.sleec.tests

ircus.robocalc.sleec.sLEEC.Specification

ith(InjectionExtension)
ith(SLEECInjectorProvider)
LEECParsingTest {
ect ParseHelper<Specification> parseHelper
ect ValidationTestHelper validationTestHelper

t
void basic_test() {
var result = parseHelper.parse('''
    def_start
        event E0
        event E1
    def_end
    rule_start
        Rule1 when E0 then E1
    rule_end
''')
validationTestHelper.assertNoIssues(result)


t
void test_within() {
var result = parseHelper.parse('''
    def_start
        event E0
        event E1
    def_end
    rule_start
        Rule1 when E0 then E1 within 2 minutes
```

It should launch a new Eclipse application. Open the circus.robocalc.sleec.runtime project from this new workspace.


File
Edit
Source
Refactor
Navigate
Search
Project
New Alt+Shift+N >
Open File...
Open Projects from File System...
Recent Files >
Close Editor Ctrl+W
Close All Editors Ctrl+Shift+W
Save Ctrl+S
Save As...
Save All Ctrl+Shift+S
Revert
Move...
Rename... F2
Refresh F5
Convert Line Delimiters To >
Print... Ctrl+P
Import...
Export...
Properties Alt+Enter
Switch Workspace >
Restart
Exit



Import Projects from File System or Archive

Import Projects from File System or Archive

This wizard analyzes the content of your folder or archive file to find projects and import them in the IDE.

Import source: C:\Users\charlie\Documents\Work\SLEEC\SLEEC\circus.robocalc.sleec.runtime

type filter text

Folder	Import as
☑ circus.robocalc.sleec.runtime	Eclipse project

1 of 1 selected

☐ Hide already open projects

☐ Close newly imported projects upon completion

Use installed project configurators to:

☑ Search for nested projects

☑ Detect and configure project natures

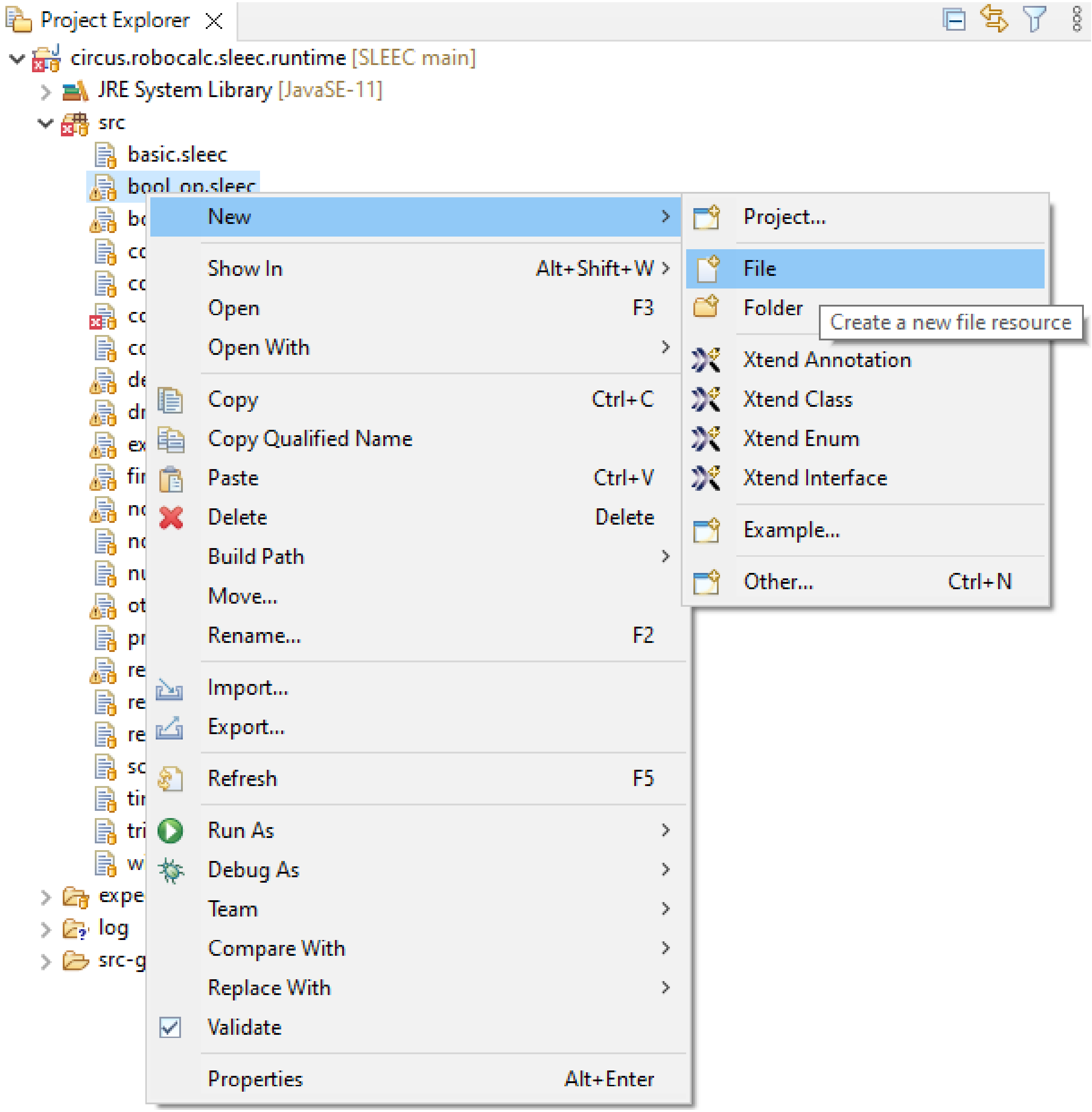
Working sets

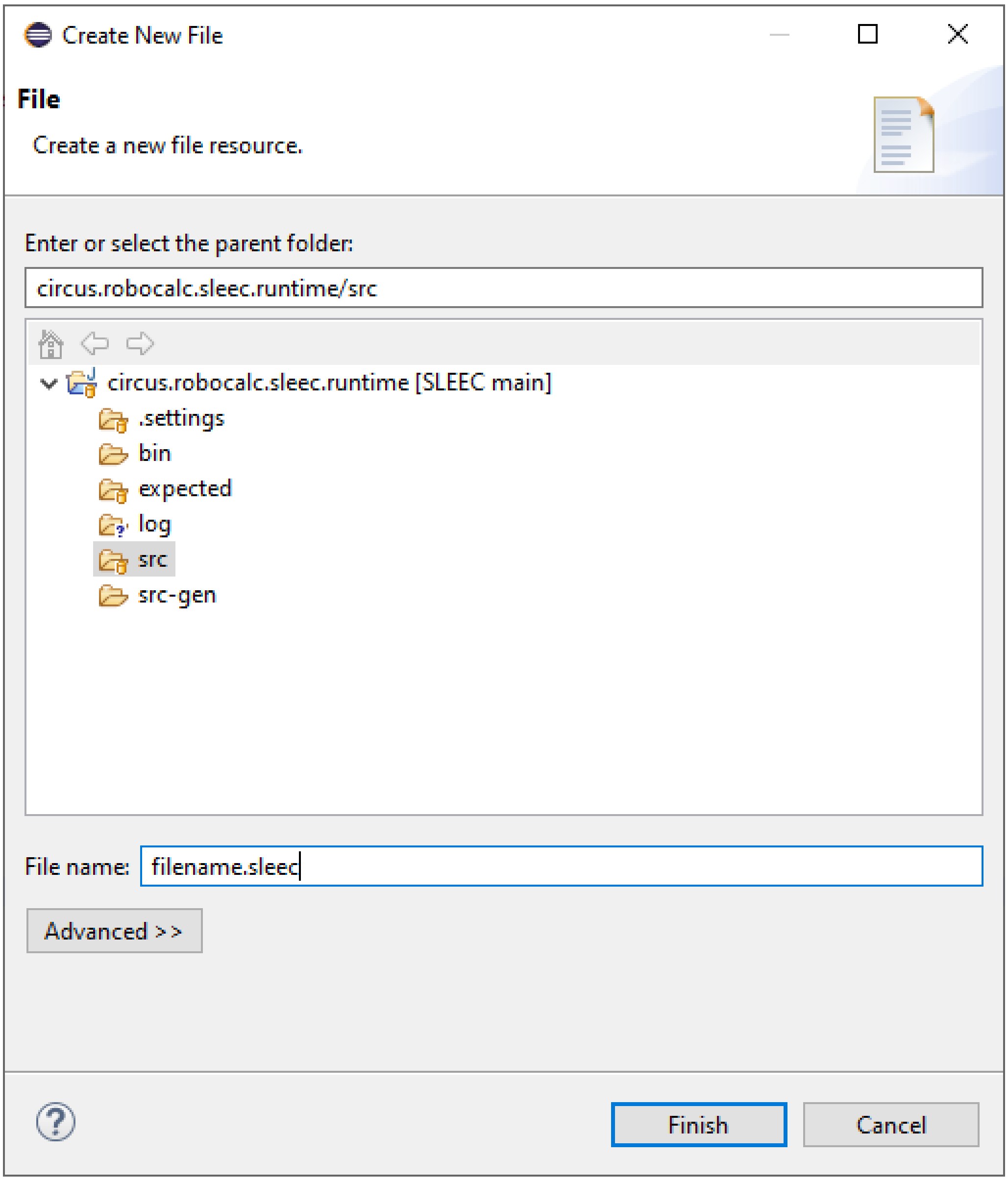
☐ Add project to working sets

Working sets:

Show other specialized import wizards

Create new .sleec file





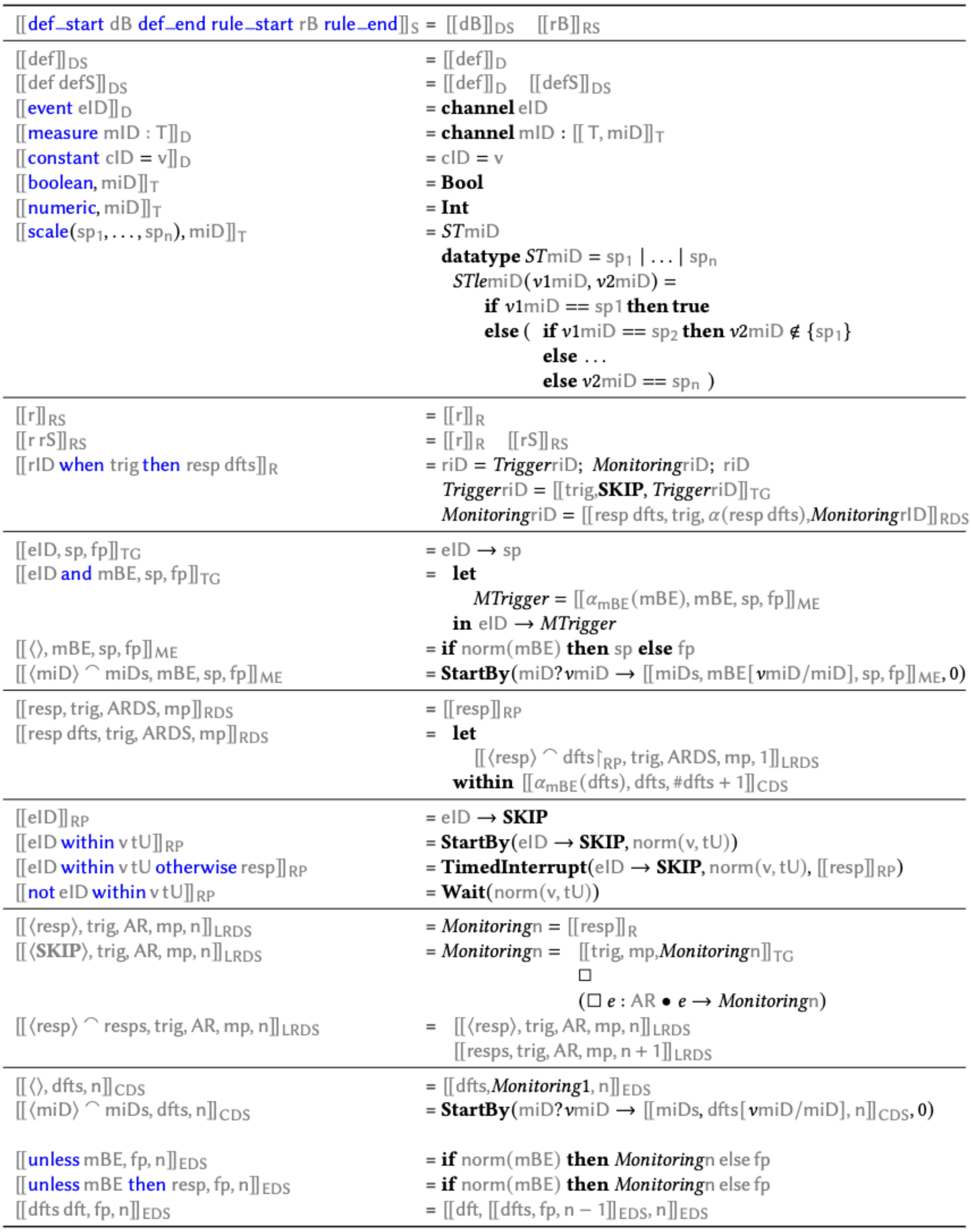
File

Create a new file resource.

Enter or select the parent folder:

circus.robocalc.sleec.runtime/src

File name: filename.sleec



$[\![\text{def\_start dB def\_end rule\_start rB rule\_end}]\!]_{S}$	$= [\![\text{dB}]\!]_{DS} \quad [\![\text{rB}]\!]_{RS}$
$[\![\text{def}]\!]_{DS}$	$= [\![\text{def}]\!]_{D}$
$[\![\text{def defS}]\!]_{DS}$	$= [\![\text{def}]\!]_{D} \quad [\![\text{defS}]\!]_{DS}$
$[\![\text{event eID}]\!]_{D}$	$= \textbf{channel}\ \text{eID}$
$[\![\text{measure mID} : \text{T}]\!]_{D}$	$= \textbf{channel}\ \text{mID} : [\![\text{T}, \text{miD}]\!]_{T}$
$[\![\text{constant cID} = \text{v}]\!]_{D}$	$= \text{cID} = \text{v}$
$[\![\text{boolean}, \text{miD}]\!]_{T}$	$= \textbf{Bool}$
$[\![\text{numeric}, \text{miD}]\!]_{T}$	$= \textbf{Int}$
$[\![\text{scale}(\text{sp}_1, \ldots, \text{sp}_n), \text{miD}]\!]_{T}$	$= \mathit{ST}\text{miD}$ $\quad \textbf{datatype}\ \mathit{ST}\text{miD} = \text{sp}_1 \mid \ldots \mid \text{sp}_n$ $\quad\ \mathit{STle}\text{miD}(v1\text{miD}, v2\text{miD}) =$ $\qquad \textbf{if}\ v1\text{miD} == \text{sp}1\ \textbf{then true}$ $\qquad \textbf{else}\ (\ \ \textbf{if}\ v1\text{miD} == \text{sp}_2\ \textbf{then}\ v2\text{miD} \notin \{\text{sp}_1\}$ $\qquad\qquad \textbf{else}\ \ldots$ $\qquad\qquad \textbf{else}\ v2\text{miD} == \text{sp}_n\ )$
$[\![\text{r}]\!]_{RS}$	$= [\![\text{r}]\!]_{R}$
$[\![\text{r rS}]\!]_{RS}$	$= [\![\text{r}]\!]_{R} \quad [\![\text{rS}]\!]_{RS}$
$[\![\text{rID when trig then resp dfts}]\!]_{R}$	$= \text{riD} = \mathit{Trigger}\text{riD};\ \mathit{Monitoring}\text{riD};\ \text{riD}$ $\quad \mathit{Trigger}\text{riD} = [\![\text{trig}, \textbf{SKIP}, \mathit{Trigger}\text{riD}]\!]_{TG}$ $\quad \mathit{Monitoring}\text{riD} = [\![\text{resp dfts}, \text{trig}, \alpha(\text{resp dfts}), \mathit{Monitoring}\text{rID}]\!]_{RDS}$
$[\![\text{eID}, \text{sp}, \text{fp}]\!]_{TG}$	$= \text{eID} \longrightarrow \text{sp}$
$[\![\text{eID and mBE}, \text{sp}, \text{fp}]\!]_{TG}$	$= \ \ \textbf{let}$ $\qquad \mathit{MTrigger} = [\![\alpha_{\text{mBE}}(\text{mBE}), \text{mBE}, \text{sp}, \text{fp}]\!]_{ME}$ $\quad\ \textbf{in}\ \text{eID} \longrightarrow \mathit{MTrigger}$
$[\![\langle\rangle, \text{mBE}, \text{sp}, \text{fp}]\!]_{ME}$	$= \textbf{if}\ \text{norm}(\text{mBE})\ \textbf{then}\ \text{sp}\ \textbf{else}\ \text{fp}$
$[\![\langle\text{miD}\rangle \frown \text{miDs}, \text{mBE}, \text{sp}, \text{fp}]\!]_{ME}$	$= \textbf{StartBy}(\text{miD}?v\text{miD} \longrightarrow [\![\text{miDs}, \text{mBE}[v\text{miD}/\text{miD}], \text{sp}, \text{fp}]\!]_{ME}, 0)$
$[\![\text{resp}, \text{trig}, \text{ARDS}, \text{mp}]\!]_{RDS}$	$= [\![\text{resp}]\!]_{RP}$
$[\![\text{resp dfts}, \text{trig}, \text{ARDS}, \text{mp}]\!]_{RDS}$	$= \ \ \textbf{let}$ $\qquad [\![\langle\text{resp}\rangle \frown \text{dfts}\restriction_{RP}, \text{trig}, \text{ARDS}, \text{mp}, 1]\!]_{LRDS}$ $\quad\ \textbf{within}\ \ [\![\alpha_{\text{mBE}}(\text{dfts}), \text{dfts}, \#\text{dfts} + 1]\!]_{CDS}$
$[\![\text{eID}]\!]_{RP}$	$= \text{eID} \longrightarrow \textbf{SKIP}$
$[\![\text{eID within v tU}]\!]_{RP}$	$= \textbf{StartBy}(\text{eID} \longrightarrow \textbf{SKIP}, \text{norm}(\text{v}, \text{tU}))$
$[\![\text{eID within v tU otherwise resp}]\!]_{RP}$	$= \textbf{TimedInterrupt}(\text{eID} \longrightarrow \textbf{SKIP}, \text{norm}(\text{v}, \text{tU}), [\![\text{resp}]\!]_{RP})$
$[\![\text{not eID within v tU}]\!]_{RP}$	$= \textbf{Wait}(\text{norm}(\text{v}, \text{tU}))$
$[\![\langle\text{resp}\rangle, \text{trig}, \text{AR}, \text{mp}, \text{n}]\!]_{LRDS}$	$= \mathit{Monitoring}\text{n} = [\![\text{resp}]\!]_{R}$
$[\![\langle\textbf{SKIP}\rangle, \text{trig}, \text{AR}, \text{mp}, \text{n}]\!]_{LRDS}$	$= \mathit{Monitoring}\text{n} = \quad [\![\text{trig}, \text{mp}, \mathit{Monitoring}\text{n}]\!]_{TG}$ $\qquad\qquad\qquad\quad \Box$ $\qquad\qquad\qquad\quad (\Box\, e : \text{AR} \bullet e \longrightarrow \mathit{Monitoring}\text{n})$
$[\![\langle\text{resp}\rangle \frown \text{resps}, \text{trig}, \text{AR}, \text{mp}, \text{n}]\!]_{LRDS}$	$= \quad [\![\langle\text{resp}\rangle, \text{trig}, \text{AR}, \text{mp}, \text{n}]\!]_{LRDS}$ $\qquad [\![\text{resps}, \text{trig}, \text{AR}, \text{mp}, \text{n} + 1]\!]_{LRDS}$
$[\![\langle\rangle, \text{dfts}, \text{n}]\!]_{CDS}$	$= [\![\text{dfts}, \mathit{Monitoring}1, \text{n}]\!]_{EDS}$
$[\![\langle\text{miD}\rangle \frown \text{miDs}, \text{dfts}, \text{n}]\!]_{CDS}$	$= \textbf{StartBy}(\text{miD}?v\text{miD} \longrightarrow [\![\text{miDs}, \text{dfts}[v\text{miD}/\text{miD}], \text{n}]\!]_{CDS}, 0)$
$[\![\text{unless mBE}, \text{fp}, \text{n}]\!]_{EDS}$	$= \textbf{if}\ \text{norm}(\text{mBE})\ \textbf{then}\ \mathit{Monitoring}\text{n else fp}$
$[\![\text{unless mBE then resp}, \text{fp}, \text{n}]\!]_{EDS}$	$= \textbf{if}\ \text{norm}(\text{mBE})\ \textbf{then}\ \mathit{Monitoring}\text{n else fp}$
$[\![\text{dfts dft}, \text{fp}, \text{n}]\!]_{EDS}$	$= [\![\text{dft}, [\![\text{dfts}, \text{fp}, \text{n} - 1]\!]_{EDS}, \text{n}]\!]_{EDS}$

SLEEC file validation

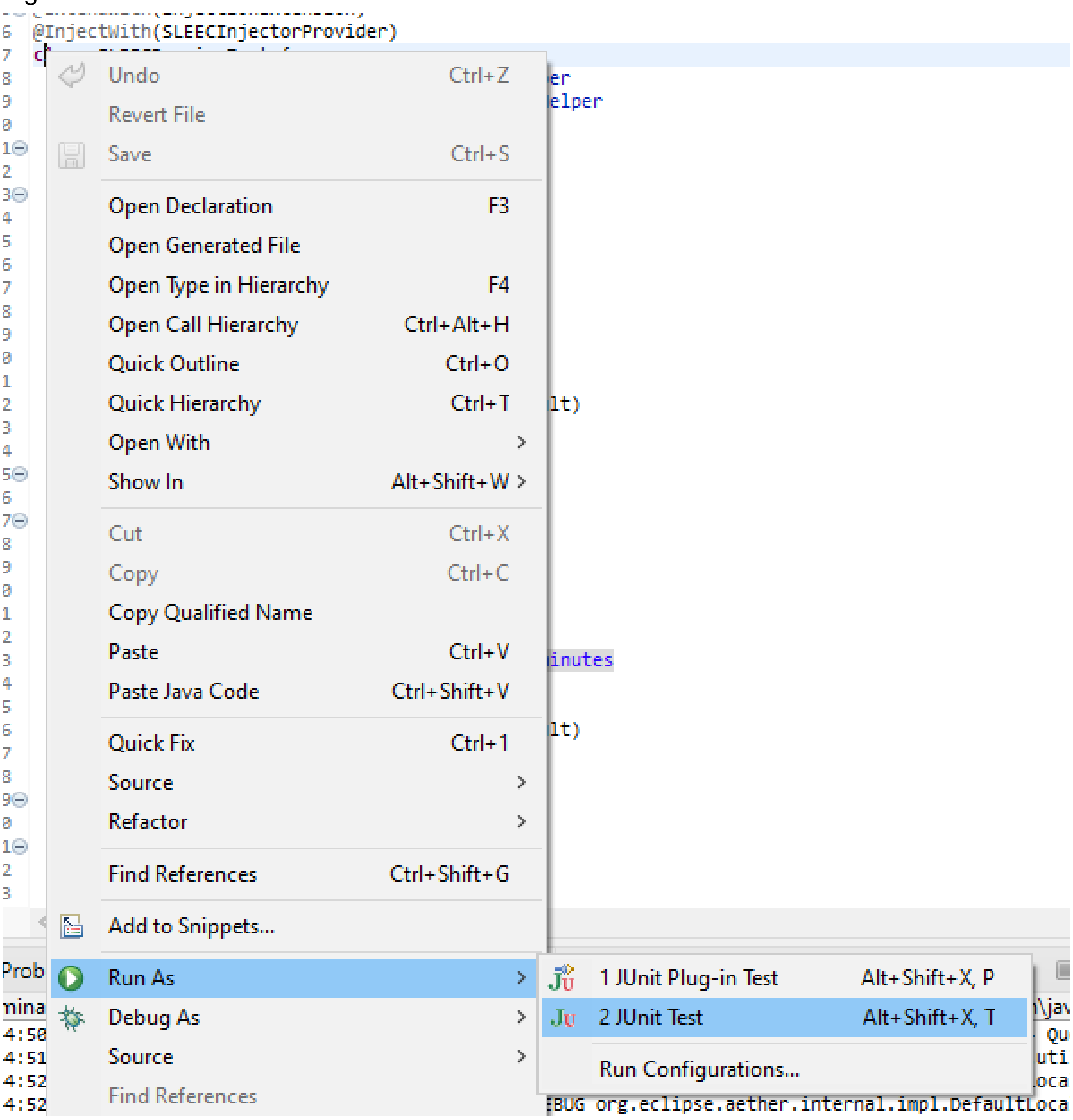
Found in circus.robocalc.sleec\src\circus\robocalc\sleec\validation\SLEECValidator.xtend
This is how custom warnings and errors can be raised when using the Eclipse IDE. SLEEC files won't also be translated to CSP if there are any errors.

Eclipse unit tests

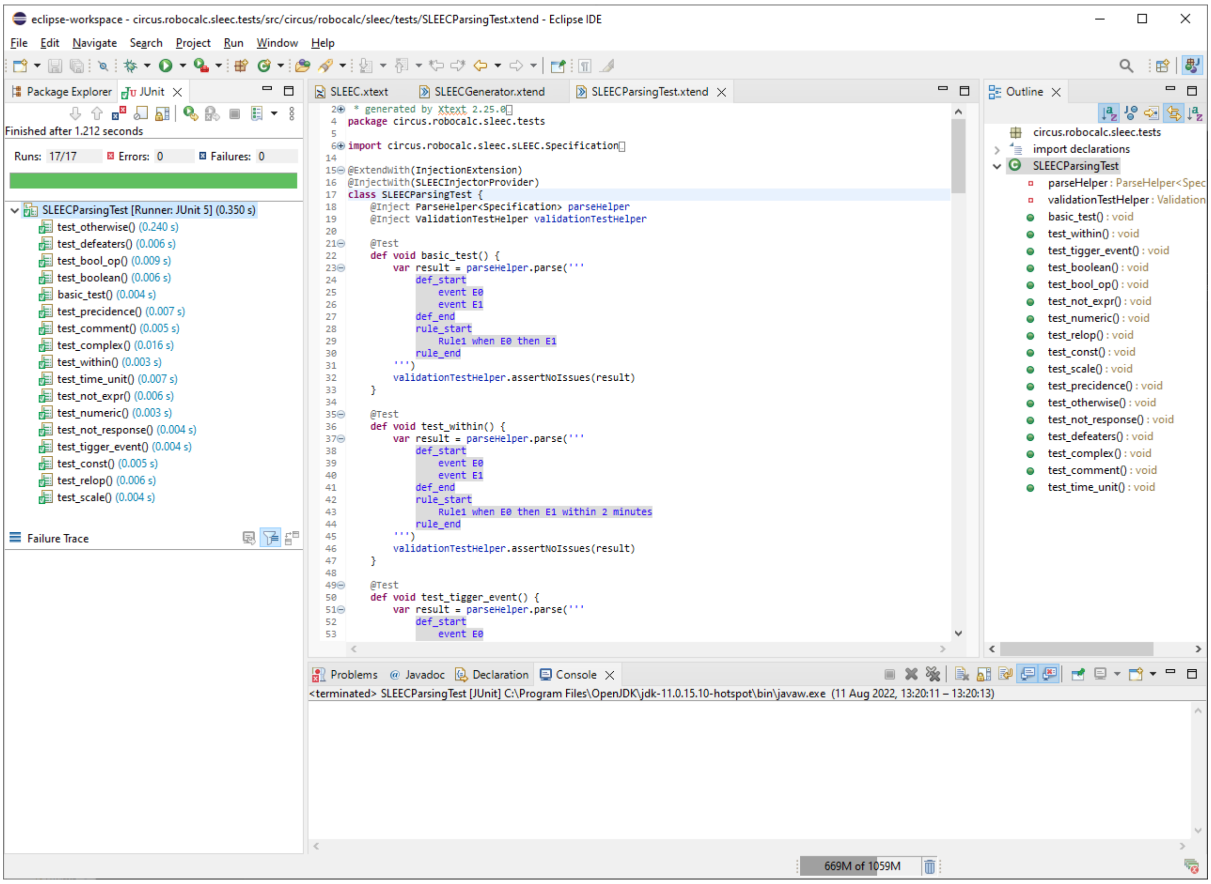
Found in circus.robocalc.sleec.tests\src\circus\robocalc\sleec\tests\SLEECParsingTest.xtend
Source files are found in circus.robocalc.sleec.runtime\src\

Run unit tests

Right click the class and run as JUnit test



```
@InjectWith(SLEECInjectorProvider)
```



eclipse-workspace - circus.robocalc.sleec.tests/src/circus/robocalc/sleec/tests/SLEECParsingTest.xtend - Eclipse IDE
File Edit Navigate Search Project Run Window Help
Package Explorer
JUnit
SLEEC.xtext
SLEECGenerator.xtend
SLEECParsingTest.xtend
Outline
Failure Trace
Problems
Javadoc
Declaration
Console
669M of 1059M

Finished after 1.212 seconds

Runs: 17/17 Errors: 0 Failures: 0

```
SLEECParsingTest [Runner: JUnit 5] (0.350 s)
    test_otherwise() (0.240 s)
    test_defeaters() (0.006 s)
    test_bool_op() (0.009 s)
    test_boolean() (0.006 s)
    basic_test() (0.004 s)
    test_precidence() (0.007 s)
    test_comment() (0.005 s)
    test_complex() (0.016 s)
    test_within() (0.003 s)
    test_time_unit() (0.007 s)
    test_not_expr() (0.006 s)
    test_numeric() (0.003 s)
    test_not_response() (0.004 s)
    test_tigger_event() (0.004 s)
    test_const() (0.005 s)
    test_relop() (0.006 s)
    test_scale() (0.004 s)
```

```
 * generated by Xtext 2.25.0
package circus.robocalc.sleec.tests

import circus.robocalc.sleec.sLEEC.Specification

@ExtendWith(InjectionExtension)
@InjectWith(SLEECInjectorProvider)
class SLEECParsingTest {
    @Inject ParseHelper<Specification> parseHelper
    @Inject ValidationTestHelper validationTestHelper

    @Test
    def void basic_test() {
        var result = parseHelper.parse('''
            def_start
                event E0
                event E1
            def_end
            rule_start
                Rule1 when E0 then E1
            rule_end
        ''')
        validationTestHelper.assertNoIssues(result)
    }

    @Test
    def void test_within() {
        var result = parseHelper.parse('''
            def_start
                event E0
                event E1
            def_end
            rule_start
                Rule1 when E0 then E1 within 2 minutes
            rule_end
        ''')
        validationTestHelper.assertNoIssues(result)
    }

    @Test
    def void test_tigger_event() {
        var result = parseHelper.parse('''
            def_start
                event E0
```

```
circus.robocalc.sleec.tests
import declarations
SLEECParsingTest
    parseHelper : ParseHelper<Spec
    validationTestHelper : Validation
    basic_test() : void
    test_within() : void
    test_tigger_event() : void
    test_boolean() : void
    test_bool_op() : void
    test_not_expr() : void
    test_numeric() : void
    test_relop() : void
    test_const() : void
    test_scale() : void
    test_precidence() : void
    test_otherwise() : void
    test_not_response() : void
    test_defeaters() : void
    test_complex() : void
    test_comment() : void
    test_time_unit() : void
```

```
<terminated> SLEECParsingTest [JUnit] C:\Program Files\OpenJDK\jdk-11.0.15.10-hotspot\bin\javaw.exe (11 Aug 2022, 13:20:11 – 13:20:13)
```

Add unit tests

In the runtime eclipse application, create a new sleec file to test.
In SLEECParsingTest, create new function with the name 'test_<filename.sleec>'
Make sure that the filename in the string is the same as the one that is being tested.

```
@Test
def void test_not_response() {
    val result = parseHelper.parse(
        Files.readString(Paths.get(path + 'not_response.sleec'))
    )
    validationTestHelper.assertNoErrors(result)
}
```

If you want to check that an error is generated in an invalid input file do the following.

```
@Test
def void test_conflict_error() {
    val result = parseHelper.parse(
        Files.readString(Paths.get(path + 'conflict_error.sleec'))
    )
    validationTestHelper.assertError(result, SLEECPackage.Literals.RULE, null, 'R12 conflicts with R13.')
    validationTestHelper.assertError(result, SLEECPackage.Literals.RULE, null, 'R13 conflicts with R12.')
    validationTestHelper.assertError(result, SLEECPackage.Literals.RULE, null, 'R8 conflicts with R9.')
    validationTestHelper.assertError(result, SLEECPackage.Literals.RULE, null, 'R9 conflicts with R8.')
    validationTestHelper.assertError(result, SLEECPackage.Literals.RULE, null, 'R0 conflicts with R1.')
    validationTestHelper.assertError(result, SLEECPackage.Literals.RULE, null, 'R1 conflicts with R0.')
}
```

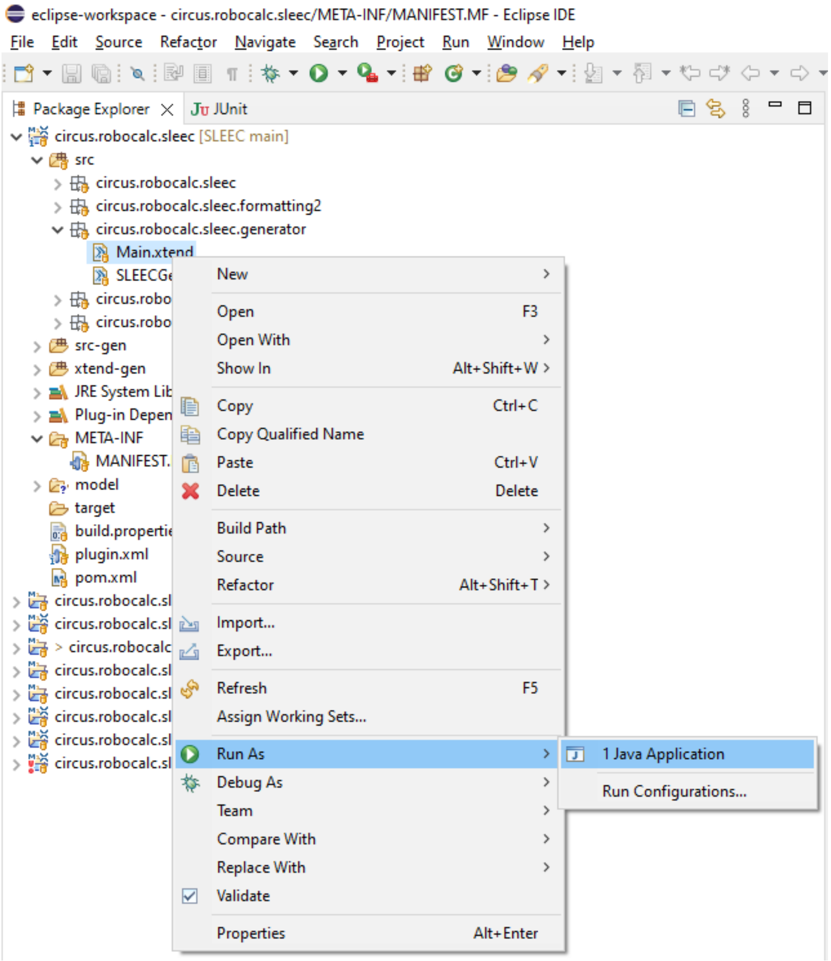
"SLEECPackage.Literals.RULE" is the grammar rule where the error came from.
"R12 conflicts with R13" is the name of the error.

To test for a warning instead, change the method name to “assertWarning”.

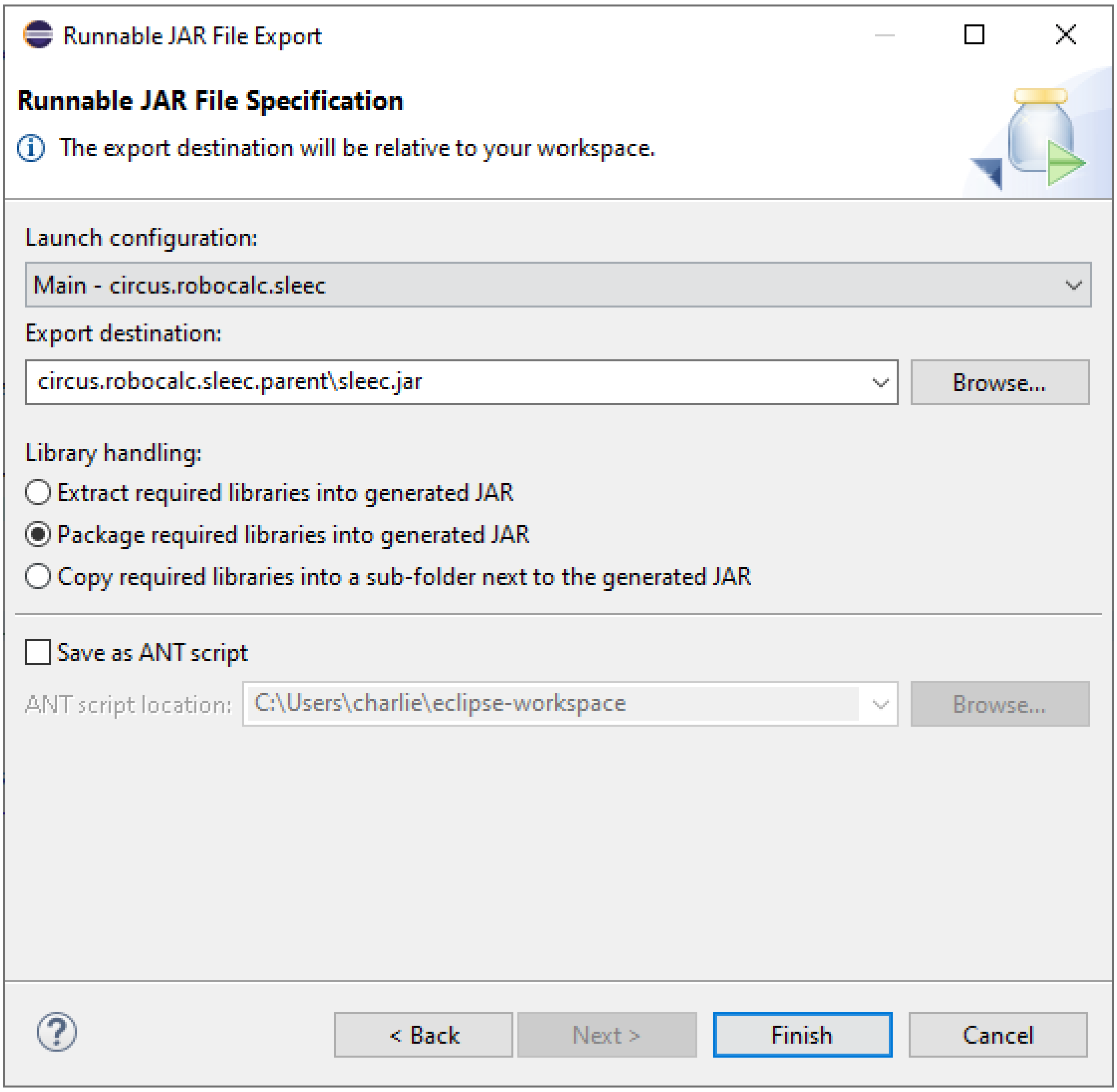
Create runnable .jar file

Export .jar file

Run main.xtend as a java application. This should only need to be done when exporting for the first time.



File > Export… > Java > Runnable Jar file



Runnable JAR File Export

Runnable JAR File Specification

ⓘ The export destination will be relative to your workspace.

Launch configuration: Main - circus.robocalc.sleec

Export destination: circus.robocalc.sleec.parent\sleec.jar

Library handling:

○ Extract required libraries into generated JAR

● Package required libraries into generated JAR

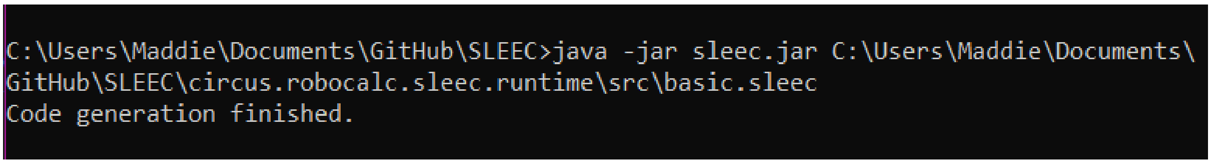
○ Copy required libraries into a sub-folder next to the generated JAR

□ Save as ANT script

ANT script location: C:\Users\charlie\eclipse-workspace

Run .jar file

In the command line type: “java -jar sleec.jar <filename.sleec>” where <filename.sleec> is the name of the sleec file to be compiled. It should output a file called <filename.csp> if there were no errors.

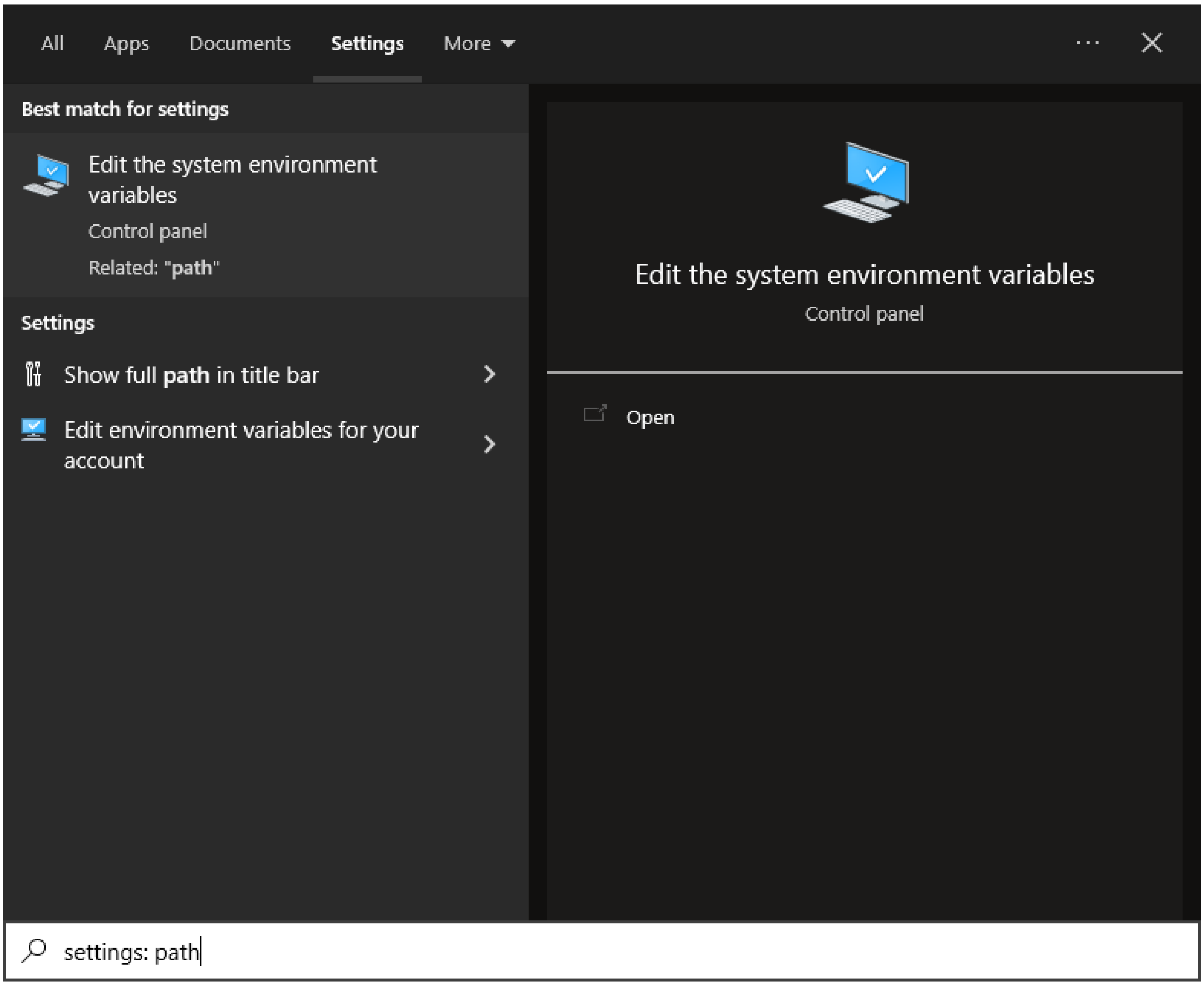


```
C:\Users\Maddie\Documents\GitHub\SLEEC>java -jar sleec.jar C:\Users\Maddie\Documents\
GitHub\SLEEC\circus.robocalc.sleec.runtime\src\basic.sleec
Code generation finished.
```

Using FDR4

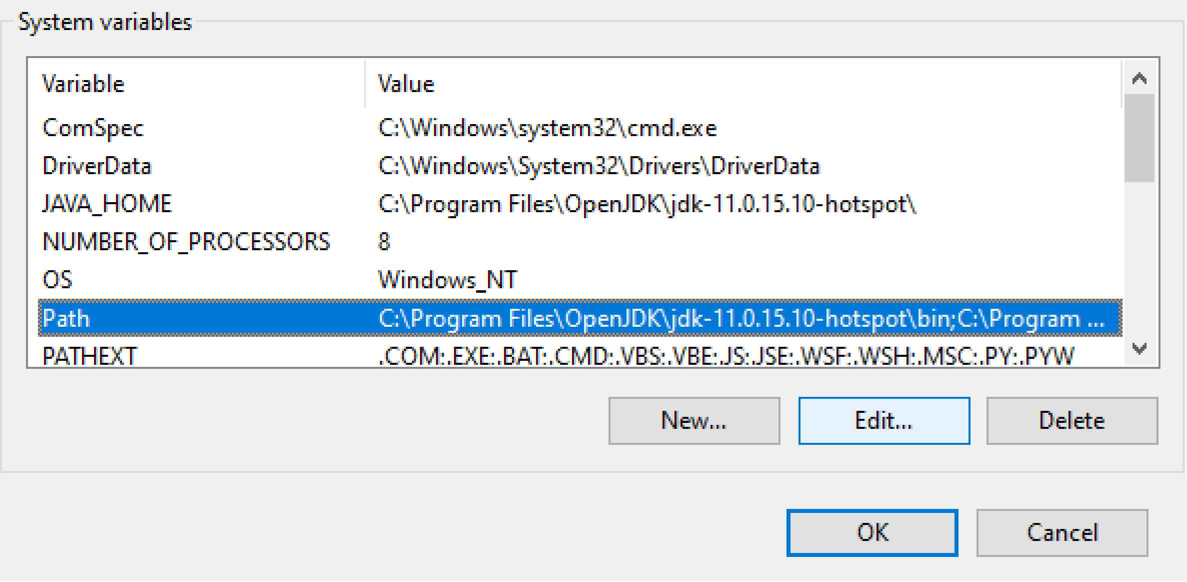
Add FDR4 to the %PATH% environment variable (on Windows).

Type path in Windows search


All
Apps
Documents
Settings
More
Best match for settings
Edit the system environment variables
Control panel
Related: "path"
Settings
Show full path in title bar
Edit environment variables for your account
Edit the system environment variables
Control panel
Open

settings: path

Click the environment variables box
Find the path variable under system variables, select it and then click Edit…

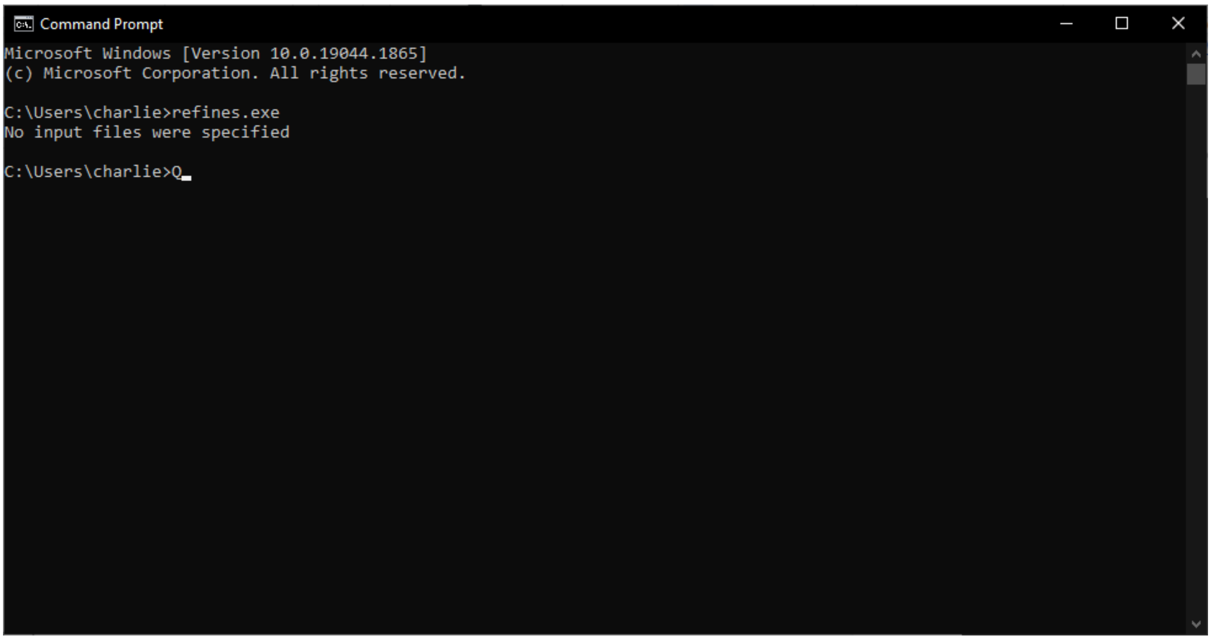


Variable	Value
ComSpec	C:\Windows\system32\cmd.exe
DriverData	C:\Windows\System32\Drivers\DriverData
JAVA_HOME	C:\Program Files\OpenJDK\jdk-11.0.15.10-hotspot\
NUMBER_OF_PROCESSORS	8
OS	Windows_NT
Path	C:\Program Files\OpenJDK\jdk-11.0.15.10-hotspot\bin;C:\Program ...
PATHEXT	.COM;.EXE;.BAT;.CMD;.VBS;.VBE;.JS;.JSE;.WSF;.WSH;.MSC;.PY;.PYW

Click new then click browse.
Select the folder C:\Program Files\FDR\bin and press add.
Ok / Apply the changes.

Use from the command line

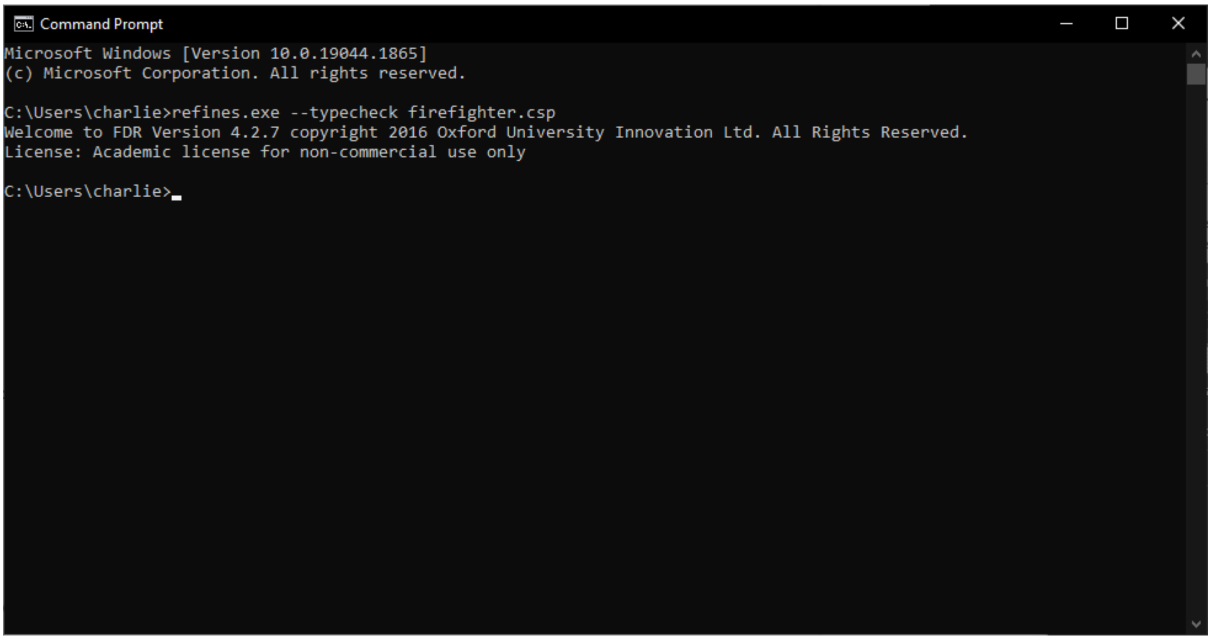
The commandline program is called refines.exe and the GUI one is called fdr4.exe



```
Microsoft Windows [Version 10.0.19044.1865]
(c) Microsoft Corporation. All rights reserved.

C:\Users\charlie>refines.exe
No input files were specified

C:\Users\charlie>Q
```

Run a CSP file

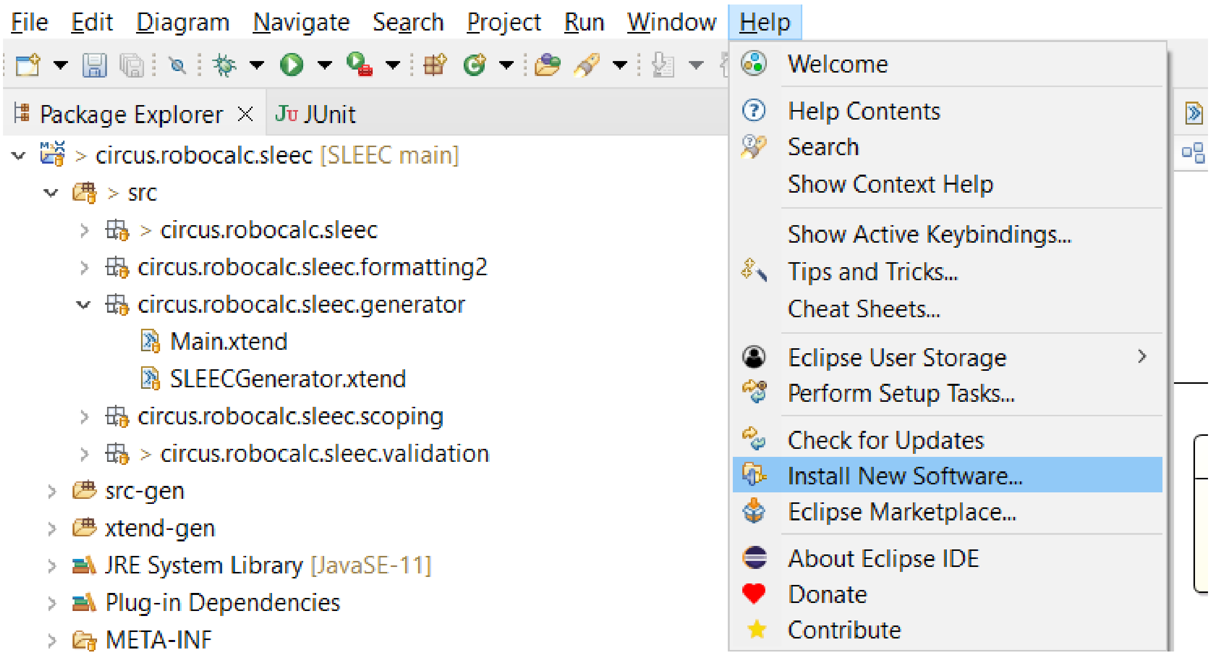
refines –typecheck <filename.csp>



```
Microsoft Windows [Version 10.0.19044.1865]
(c) Microsoft Corporation. All rights reserved.

C:\Users\charlie>refines.exe --typecheck firefighter.csp
Welcome to FDR Version 4.2.7 copyright 2016 Oxford University Innovation Ltd. All Rights Reserved.
License: Academic license for non-commercial use only

C:\Users\charlie>
```

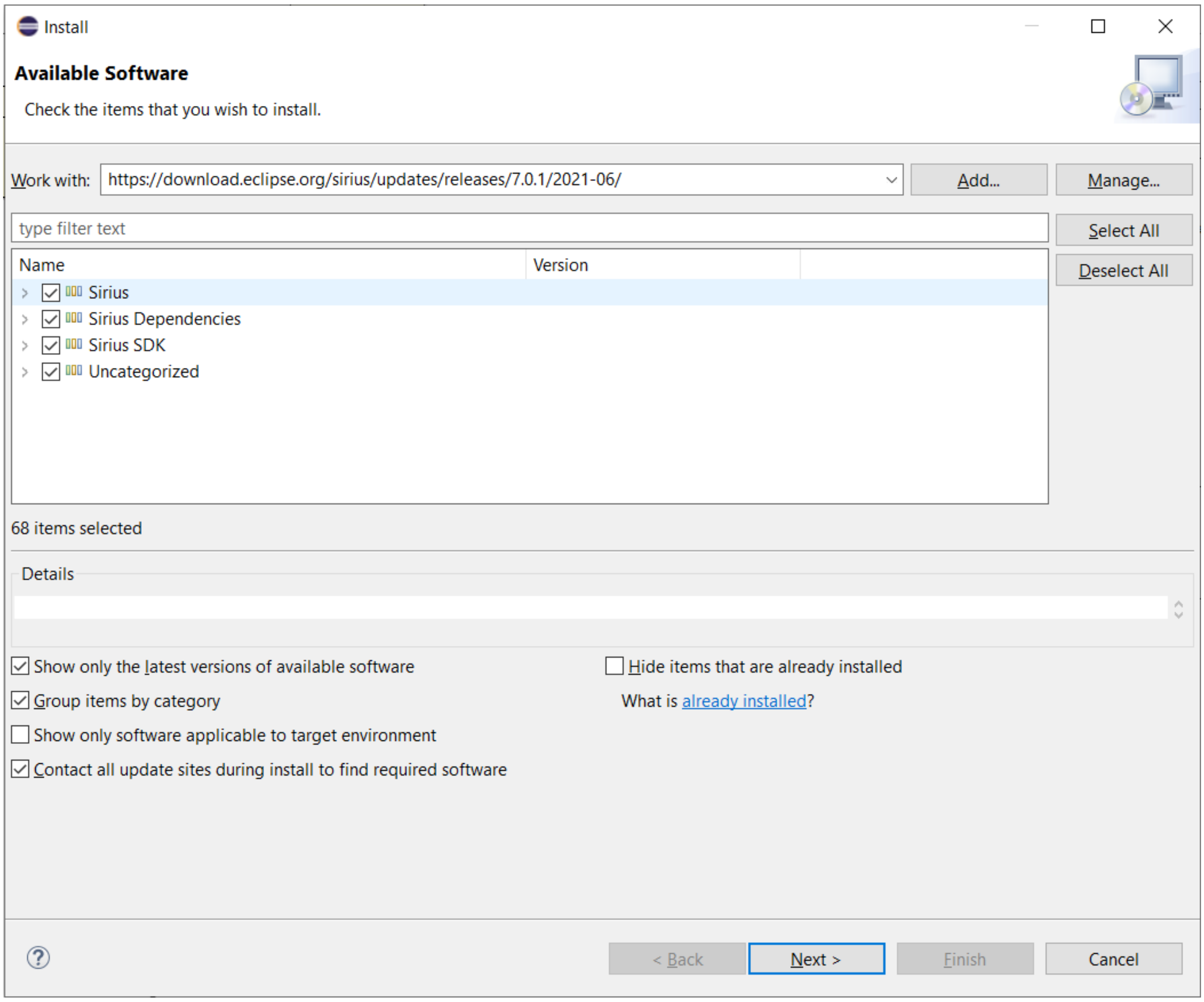
There should be no output when there are no problems.

Visualise with Sirius



- > circus.robocalc.sleec [SLEEC main]
  - > src
    - > circus.robocalc.sleec
    - circus.robocalc.sleec.formatting2
    - circus.robocalc.sleec.generator
      - Main.xtend
      - SLEECGenerator.xtend
    - circus.robocalc.sleec.scoping
    - > circus.robocalc.sleec.validation
  - src-gen
  - xtend-gen
  - JRE System Library [JavaSE-11]
  - Plug-in Dependencies
  - META-INF

Copy this link: https://download.eclipse.org/sirius/updates/releases/7.0.1/2021-06/



Available Software

Check the items that you wish to install.

Work with: https://download.eclipse.org/sirius/updates/releases/7.0.1/2021-06/

type filter text

Name	Version
☑ Sirius	
☑ Sirius Dependencies	
☑ Sirius SDK	
☑ Uncategorized	

68 items selected

Details

☑ Show only the latest versions of available software

☐ Hide items that are already installed

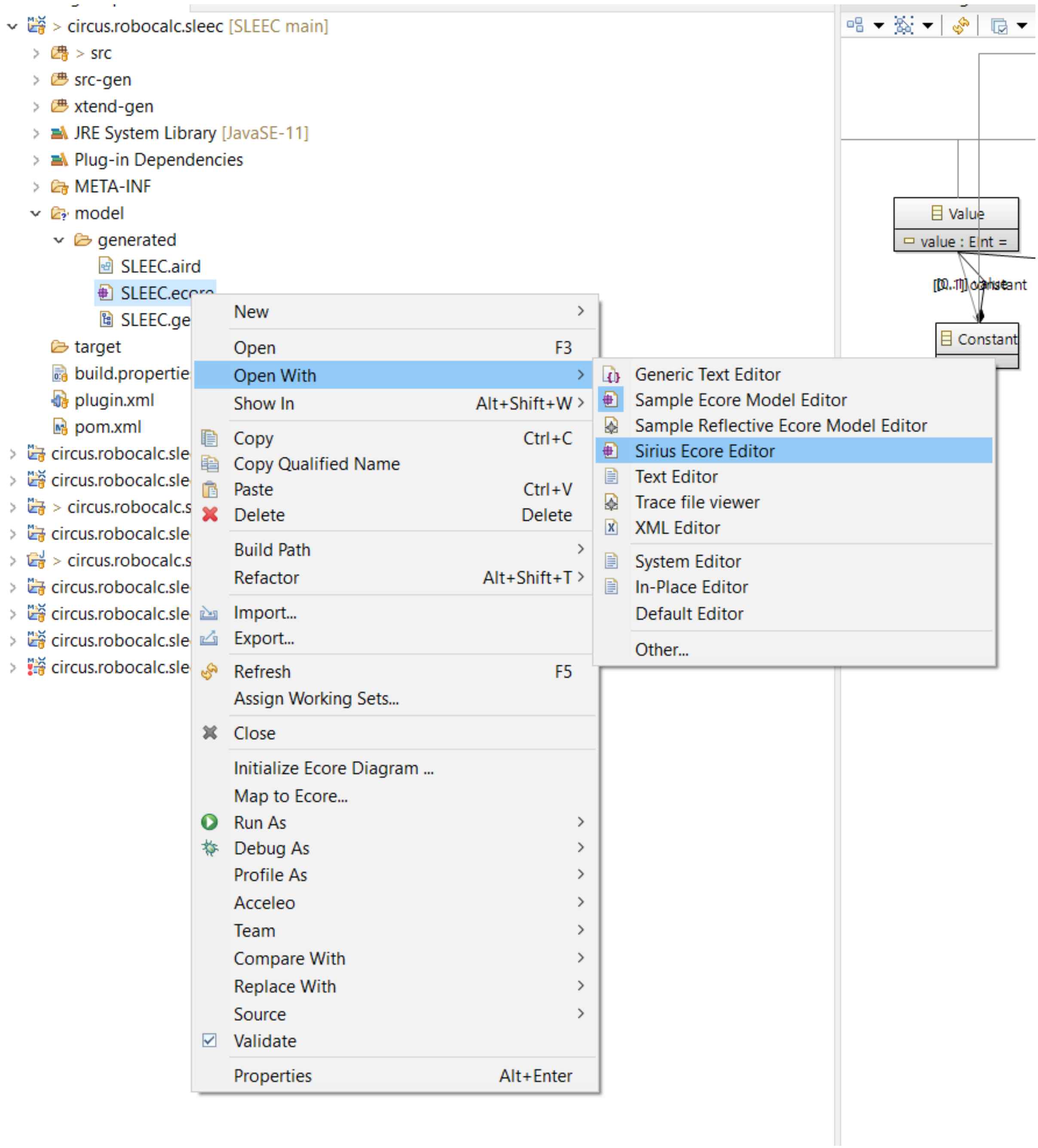
☑ Group items by category

What is already installed?

☐ Show only software applicable to target environment

☑ Contact all update sites during install to find required software

Restart Eclipse.



Testing

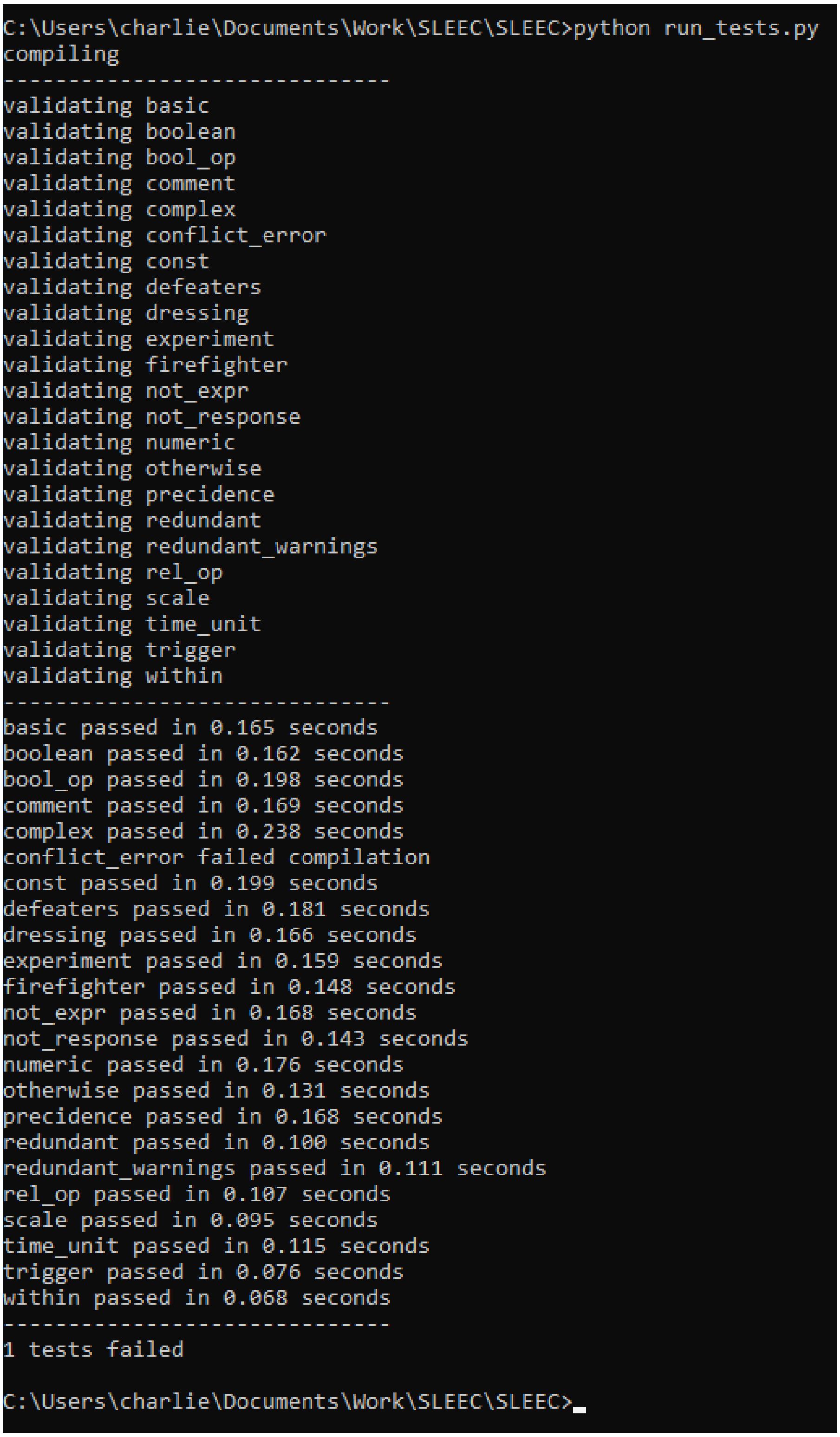
Install Python3: https://www.python.org/downloads/
Make sure that the sleec.jar file is in the same folder as run-tests.py.
Tests can be run either from the command line with the command ‘python run-tests.py’ or from an IDE, however this does not work in VSCode, use the command line or IDLE instead.

Testing process

SLEEC input files are translated to CSP using the Eclipse application. Then the CSP files are validated using FDR4.
A test passes if it was translated to CSP without errors, validated without errors and matches the expected CSP file (found in expected/<filename.csp>).

Testing from the command line

After changes are made to the project Create runnable .jar file.



```
C:\Users\charlie\Documents\Work\SLEEC\SLEEC>python run_tests.py
compiling
------------------------------
validating basic
validating boolean
validating bool_op
validating comment
validating complex
validating conflict_error
validating const
validating defeaters
validating dressing
validating experiment
validating firefighter
validating not_expr
validating not_response
validating numeric
validating otherwise
validating precidence
validating redundant
validating redundant_warnings
validating rel_op
validating scale
validating time_unit
validating trigger
validating within
------------------------------
basic passed in 0.165 seconds
boolean passed in 0.162 seconds
bool_op passed in 0.198 seconds
comment passed in 0.169 seconds
complex passed in 0.238 seconds
conflict_error failed compilation
const passed in 0.199 seconds
defeaters passed in 0.181 seconds
dressing passed in 0.166 seconds
experiment passed in 0.159 seconds
firefighter passed in 0.148 seconds
not_expr passed in 0.168 seconds
not_response passed in 0.143 seconds
numeric passed in 0.176 seconds
otherwise passed in 0.131 seconds
precidence passed in 0.168 seconds
redundant passed in 0.100 seconds
redundant_warnings passed in 0.111 seconds
rel_op passed in 0.107 seconds
scale passed in 0.095 seconds
time_unit passed in 0.115 seconds
trigger passed in 0.076 seconds
within passed in 0.068 seconds
------------------------------
1 tests failed

C:\Users\charlie\Documents\Work\SLEEC\SLEEC>
```

Log files are found in circus.robocalc.sleec.runtime\log\
SLEEC to CSP translation output is stored in compilation.log
CSP validation log files are called <filename>.validation.log.

END USERS

Prerequisites

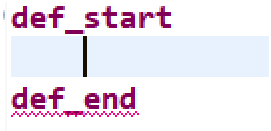
Java 11 is needed so that sleec.jar may be executed. Install Java 11 using the link below:

https://www.techspot.com/downloads/5553-java-jdk.html

Writing in SLEEC

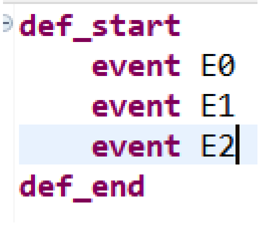
Definitions

To write a program in SLEEC, you must first define any events, measures, and constants that you will be using. These are declared inside a def block, which begins with “def_start” and ends with “def_end”:



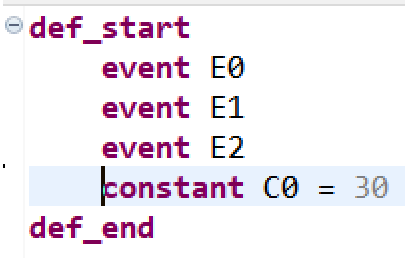
```
def_start

def_end
```

An event is an activity that can be carried out by the automaton.



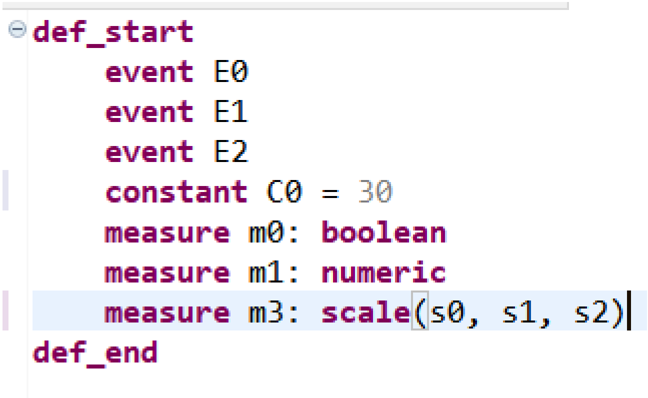
```
def_start
    event E0
    event E1
    event E2
def_end
```

A constant is an unchanging value.



```
def_start
    event E0
    event E1
    event E2
    constant C0 = 30
def_end
```

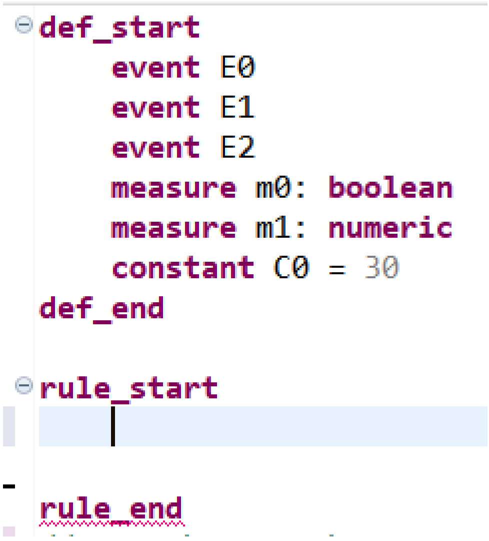
A measure is a variable, which can be a Boolean (true or false), a numeric (numerical value), or a scale (list of values in ascending order).



```
def_start
    event E0
    event E1
    event E2
    constant C0 = 30
    measure m0: boolean
    measure m1: numeric
    measure m3: scale(s0, s1, s2)
def_end
```

Rules

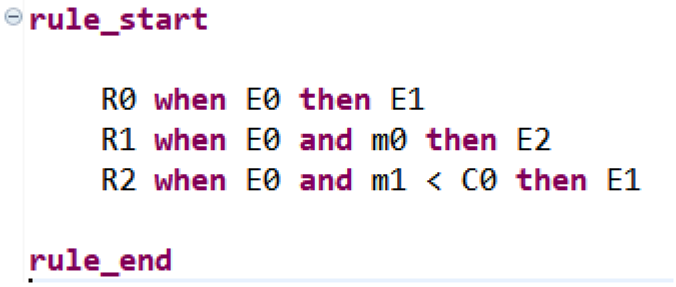
Once these are all defined, the rules for the automaton are written in a rule block, which begins with “rule_start” and ends with “rule_end”:



```
def_start
    event E0
    event E1
    event E2
    measure m0: boolean
    measure m1: numeric
    constant C0 = 30
def_end

rule_start


rule_end
```

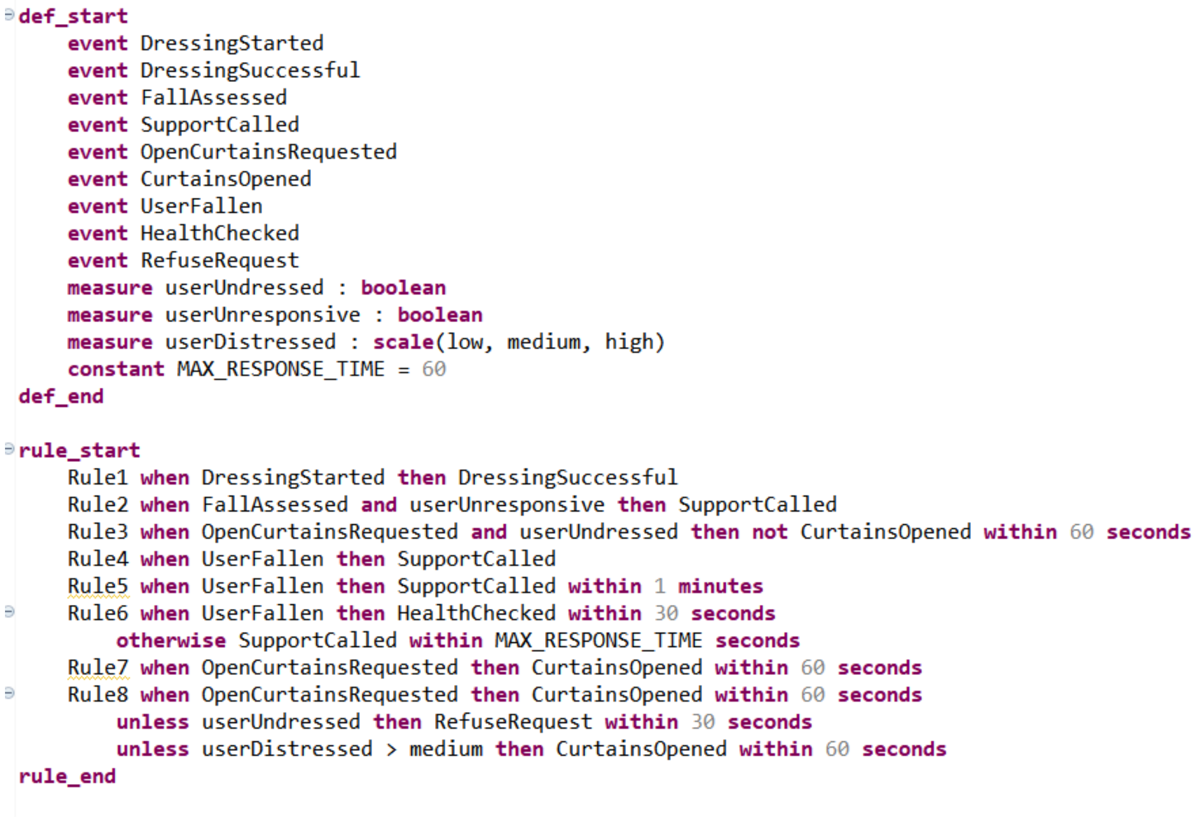
A simple rule (R0) could be that when one event is occurring (E0) then a different event is triggered (E1) in response.

Another rule (R1) could be that the event, together with the conditions of a certain measure being true (E0 and m0) are both triggers for a different response event (E2).



```
rule_start

    R0 when E0 then E1
    R1 when E0 and m0 then E2
    R2 when E0 and m1 < C0 then E1

rule_end
```

Case Study Example: Dressing Robot

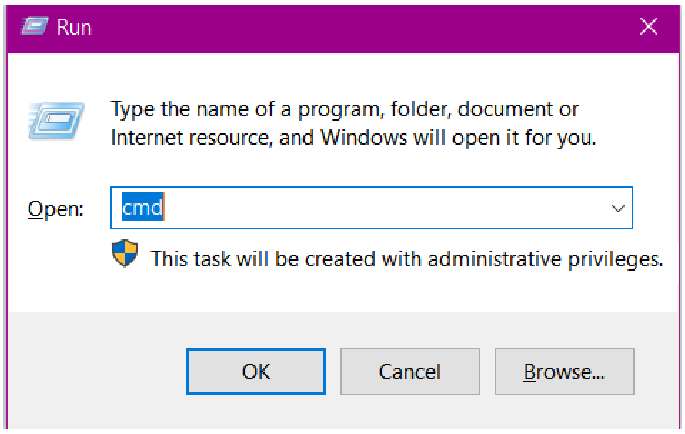


```
def_start
    event DressingStarted
    event DressingSuccessful
    event FallAssessed
    event SupportCalled
    event OpenCurtainsRequested
    event CurtainsOpened
    event UserFallen
    event HealthChecked
    event RefuseRequest
    measure userUndressed : boolean
    measure userUnresponsive : boolean
    measure userDistressed : scale(low, medium, high)
    constant MAX_RESPONSE_TIME = 60
def_end

rule_start
    Rule1 when DressingStarted then DressingSuccessful
    Rule2 when FallAssessed and userUnresponsive then SupportCalled
    Rule3 when OpenCurtainsRequested and userUndressed then not CurtainsOpened within 60 seconds
    Rule4 when UserFallen then SupportCalled
    Rule5 when UserFallen then SupportCalled within 1 minutes
    Rule6 when UserFallen then HealthChecked within 30 seconds
        otherwise SupportCalled within MAX_RESPONSE_TIME seconds
    Rule7 when OpenCurtainsRequested then CurtainsOpened within 60 seconds
    Rule8 when OpenCurtainsRequested then CurtainsOpened within 60 seconds
        unless userUndressed then RefuseRequest within 30 seconds
        unless userDistressed > medium then CurtainsOpened within 60 seconds
rule_end
```

How to convert to CSP

1. Open the command line

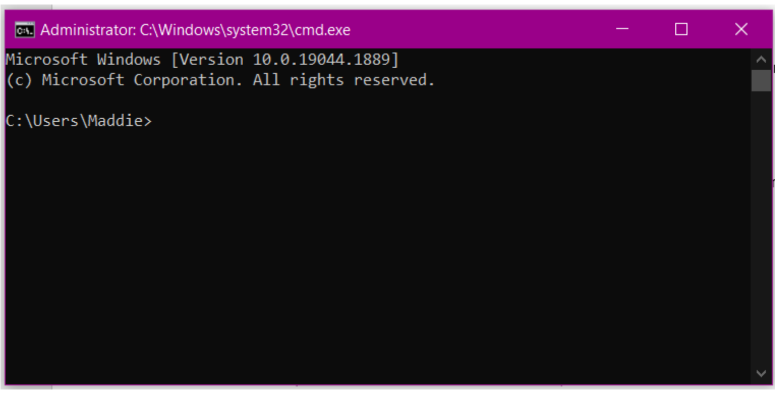
- **Windows**: Press Windows+R to open “Run” box. Type “cmd” and then click “OK” to open a regular Command Prompt.



Type the name of a program, folder, document or Internet resource, and Windows will open it for you.

Open: cmd

This task will be created with administrative privileges.



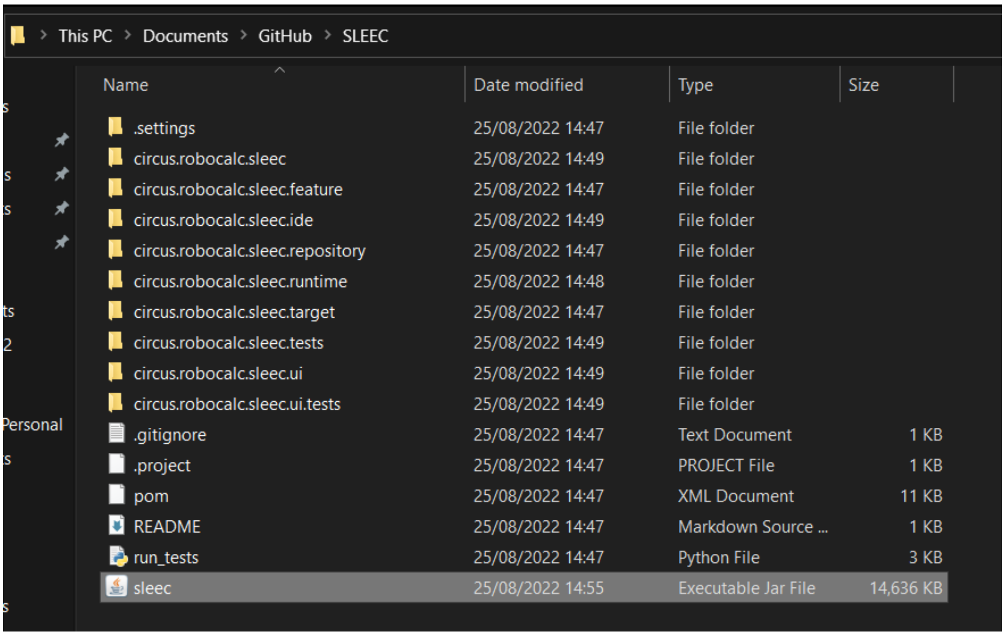
```
Microsoft Windows [Version 10.0.19044.1889]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Maddie>
```

- **Mac**: Click the Launchpad icon in the Dock, type Terminal in the search field, then click Terminal.
- **Linux**: Click on the Activities item at the top left of the screen, then type the first few letters of “terminal”, “command”, “prompt” or “shell”.

2. Change directory

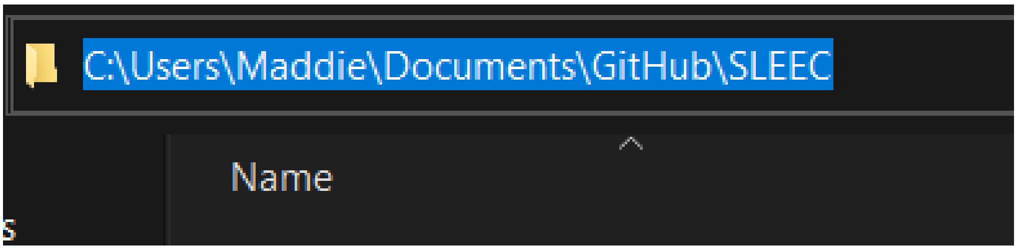
To ensure you are writing the command in the correct place, change the directory to the place where you saved the sleec.jar file.

Type “cd” followed by the file’s location, which you can find in File Explorer:

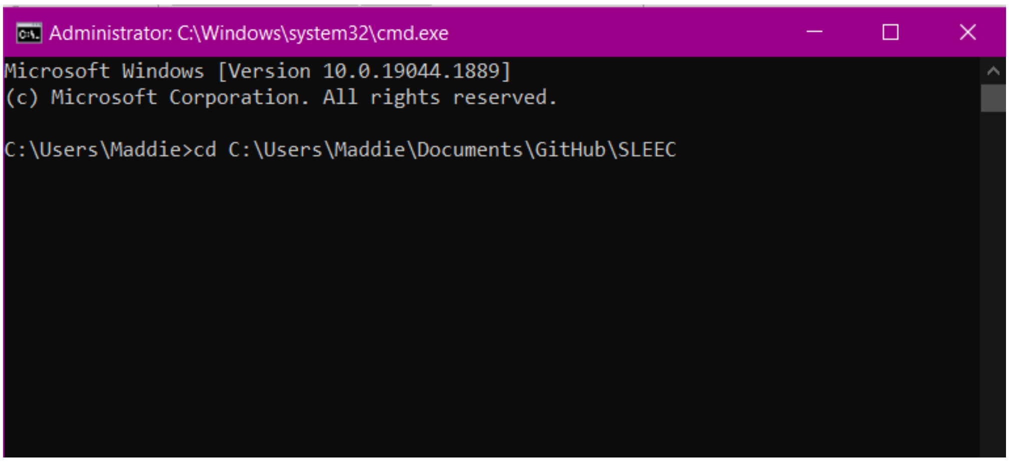


This PC > Documents > GitHub > SLEEC

Name	Date modified	Type	Size
.settings	25/08/2022 14:47	File folder	
circus.robocalc.sleec	25/08/2022 14:49	File folder	
circus.robocalc.sleec.feature	25/08/2022 14:47	File folder	
circus.robocalc.sleec.ide	25/08/2022 14:49	File folder	
circus.robocalc.sleec.repository	25/08/2022 14:47	File folder	
circus.robocalc.sleec.runtime	25/08/2022 14:48	File folder	
circus.robocalc.sleec.target	25/08/2022 14:47	File folder	
circus.robocalc.sleec.tests	25/08/2022 14:49	File folder	
circus.robocalc.sleec.ui	25/08/2022 14:49	File folder	
circus.robocalc.sleec.ui.tests	25/08/2022 14:49	File folder	
.gitignore	25/08/2022 14:47	Text Document	1 KB
.project	25/08/2022 14:47	PROJECT File	1 KB
pom	25/08/2022 14:47	XML Document	11 KB
README	25/08/2022 14:47	Markdown Source ...	1 KB
run_tests	25/08/2022 14:47	Python File	3 KB
sleec	25/08/2022 14:55	Executable Jar File	14,636 KB



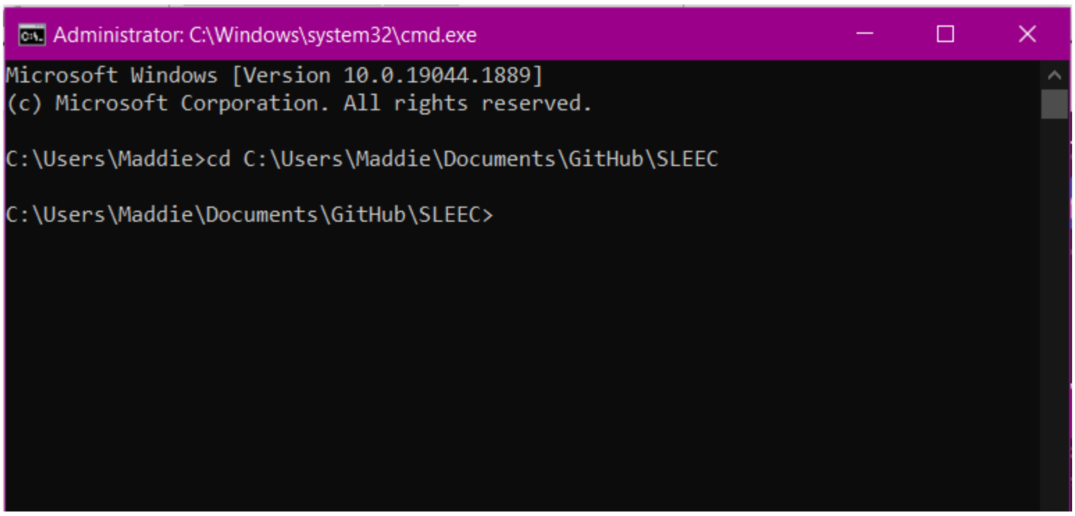
C:\Users\Maddie\Documents\GitHub\SLEEC



Administrator: C:\Windows\system32\cmd.exe

```
Microsoft Windows [Version 10.0.19044.1889]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Maddie>cd C:\Users\Maddie\Documents\GitHub\SLEEC
```

Hit Enter:



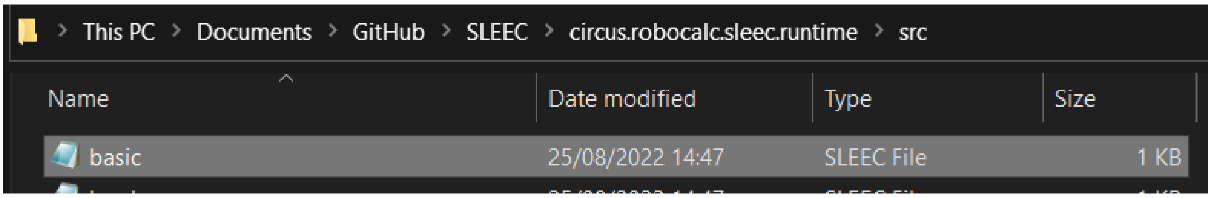
```
Microsoft Windows [Version 10.0.19044.1889]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Maddie>cd C:\Users\Maddie\Documents\GitHub\SLEEC

C:\Users\Maddie\Documents\GitHub\SLEEC>
```

3. Execute .jar file

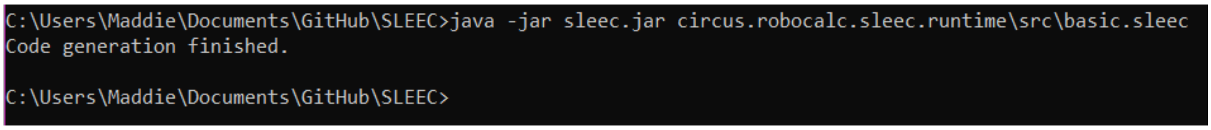
Type the following command:

“java -jar sleec.jar” followed by the name of the SLEEC file you wish to convert.

If this is inside more folders, include the path leading to it. For example, basic.sleec was written and saved inside circus.robocalc.sleec.runtime/src and is converted using the command as shown below:


This PC > Documents > GitHub > SLEEC > circus.robocalc.sleec.runtime > src

Name	Date modified	Type	Size
basic	25/08/2022 14:47	SLEEC File	1 KB

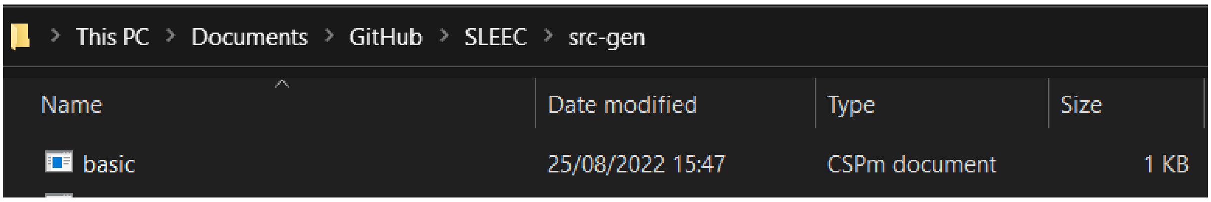


```
C:\Users\Maddie\Documents\GitHub\SLEEC>java -jar sleec.jar circus.robocalc.sleec.runtime\src\basic.sleec
Code generation finished.

C:\Users\Maddie\Documents\GitHub\SLEEC>
```

If all has gone well, you should see this output: “Code generation finished.” This means that a CSP file has been successfully created from your SLEEC file.

4. Locating the CSP file

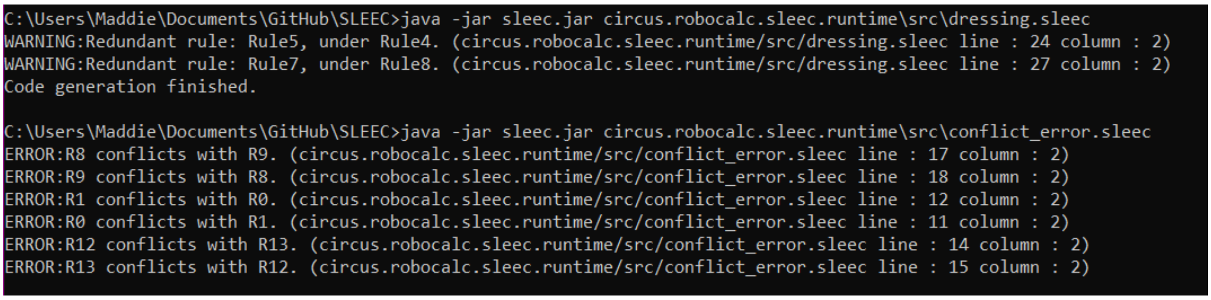
Where your sleec.jar file was saved, a new folder named “src-gen” should have been created. Inside is the resulting CSP file, which can be understood by the autonomous system.



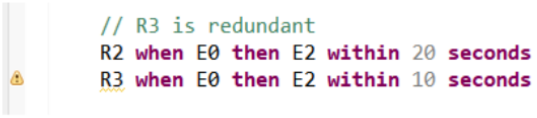
Name	Date modified	Type	Size
basic	25/08/2022 15:47	CSPm document	1 KB

Conflicts and Redundancies in SLEEC Rules

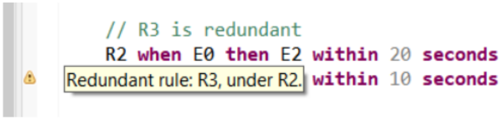
If the rules written in a SLEEC file contain conflicts, the CSP file will not be generated, and you will receive an error. If the rules contain redundancies, the CSP file is generated with warnings.



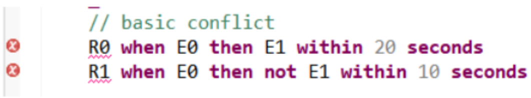
```
C:\Users\Maddie\Documents\GitHub\SLEEC>java -jar sleec.jar circus.robocalc.sleec.runtime\src\dressing.sleec
WARNING:Redundant rule: Rule5, under Rule4. (circus.robocalc.sleec.runtime/src/dressing.sleec line : 24 column : 2)
WARNING:Redundant rule: Rule7, under Rule8. (circus.robocalc.sleec.runtime/src/dressing.sleec line : 27 column : 2)
Code generation finished.

C:\Users\Maddie\Documents\GitHub\SLEEC>java -jar sleec.jar circus.robocalc.sleec.runtime\src\conflict_error.sleec
ERROR:R8 conflicts with R9. (circus.robocalc.sleec.runtime/src/conflict_error.sleec line : 17 column : 2)
ERROR:R9 conflicts with R8. (circus.robocalc.sleec.runtime/src/conflict_error.sleec line : 18 column : 2)
ERROR:R1 conflicts with R0. (circus.robocalc.sleec.runtime/src/conflict_error.sleec line : 12 column : 2)
ERROR:R0 conflicts with R1. (circus.robocalc.sleec.runtime/src/conflict_error.sleec line : 11 column : 2)
ERROR:R12 conflicts with R13. (circus.robocalc.sleec.runtime/src/conflict_error.sleec line : 14 column : 2)
ERROR:R13 conflicts with R12. (circus.robocalc.sleec.runtime/src/conflict_error.sleec line : 15 column : 2)
```



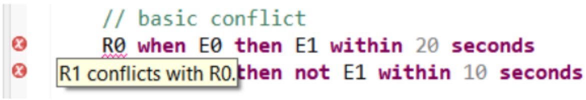
```
// R3 is redundant
R2 when E0 then E2 within 20 seconds
R3 when E0 then E2 within 10 seconds
```



```
// R3 is redundant
R2 when E0 then E2 within 20 seconds
Redundant rule: R3, under R2. within 10 seconds
```



```
// basic conflict
R0 when E0 then E1 within 20 seconds
R1 when E0 then not E1 within 10 seconds
```



```
// basic conflict
R0 when E0 then E1 within 20 seconds
R1 conflicts with R0.then not E1 within 10 seconds
```