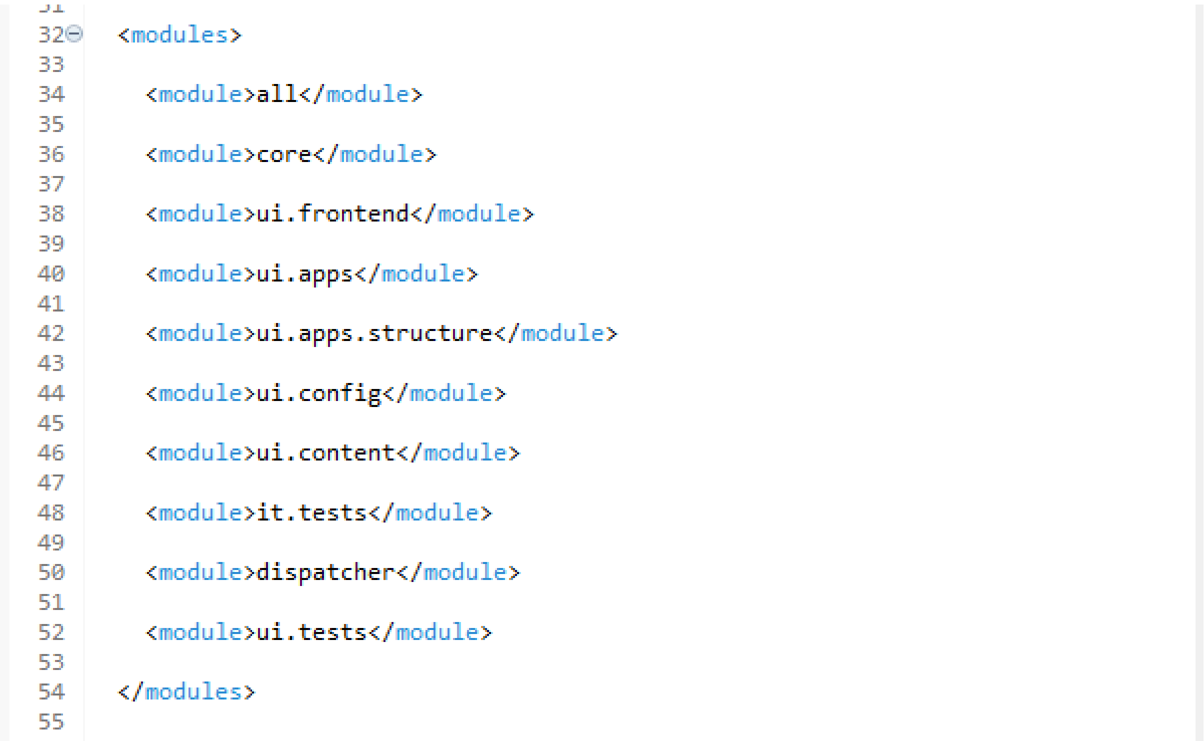
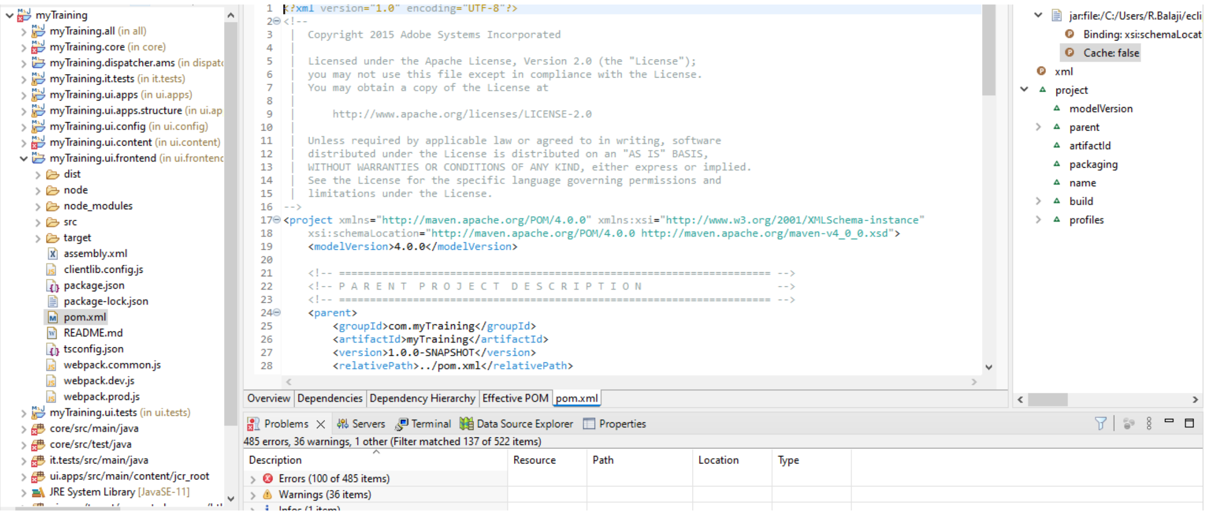
How aem modules are build

AEM modules follow a Maven-based multi-module structure



```
<modules>

  <module>all</module>

  <module>core</module>

  <module>ui.frontend</module>

  <module>ui.apps</module>

  <module>ui.apps.structure</module>

  <module>ui.config</module>

  <module>ui.content</module>

  <module>it.tests</module>

  <module>dispatcher</module>

  <module>ui.tests</module>

</modules>

```

These all modules are used to form a AEM project
we can see then at pom.xml in the root folder of the project each modules contains their own pom.xml and their implementation.



myTraining
myTraining.all (in all)
myTraining.core (in core)
myTraining.dispatcher.ams (in dispatc
myTraining.it.tests (in it.tests)
myTraining.ui.apps (in ui.apps)
myTraining.ui.apps.structure (in ui.ap
myTraining.ui.config (in ui.config)
myTraining.ui.content (in ui.content)
myTraining.ui.frontend (in ui.frontenc
dist
node
node_modules
src
target
assembly.xml
clientlib.config.js
package.json
package-lock.json
pom.xml
README.md
tsconfig.json
webpack.common.js
webpack.dev.js
webpack.prod.js
myTraining.ui.tests (in ui.tests)
core/src/main/java
core/src/test/java
it.tests/src/main/java
ui.apps/src/main/content/jcr_root
JRE System Library [JavaSE-11]

```
<?xml version="1.0" encoding="UTF-8"?>
<!--
 |  Copyright 2015 Adobe Systems Incorporated
 |
 |  Licensed under the Apache License, Version 2.0 (the "License");
 |  you may not use this file except in compliance with the License.
 |  You may obtain a copy of the License at
 |
 |      http://www.apache.org/licenses/LICENSE-2.0
 |
 |  Unless required by applicable law or agreed to in writing, software
 |  distributed under the License is distributed on an "AS IS" BASIS,
 |  WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 |  See the License for the specific language governing permissions and
 |  limitations under the License.
-->
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://maven.apache.org/POM/4.0.0 http://maven.apache.org/maven-v4_0_0.xsd">
    <modelVersion>4.0.0</modelVersion>

    <!-- ====================================================================== -->
    <!-- P A R E N T   P R O J E C T   D E S C R I P T I O N                    -->
    <!-- ====================================================================== -->
    <parent>
        <groupId>com.myTraining</groupId>
        <artifactId>myTraining</artifactId>
        <version>1.0.0-SNAPSHOT</version>
        <relativePath>../pom.xml</relativePath>
```

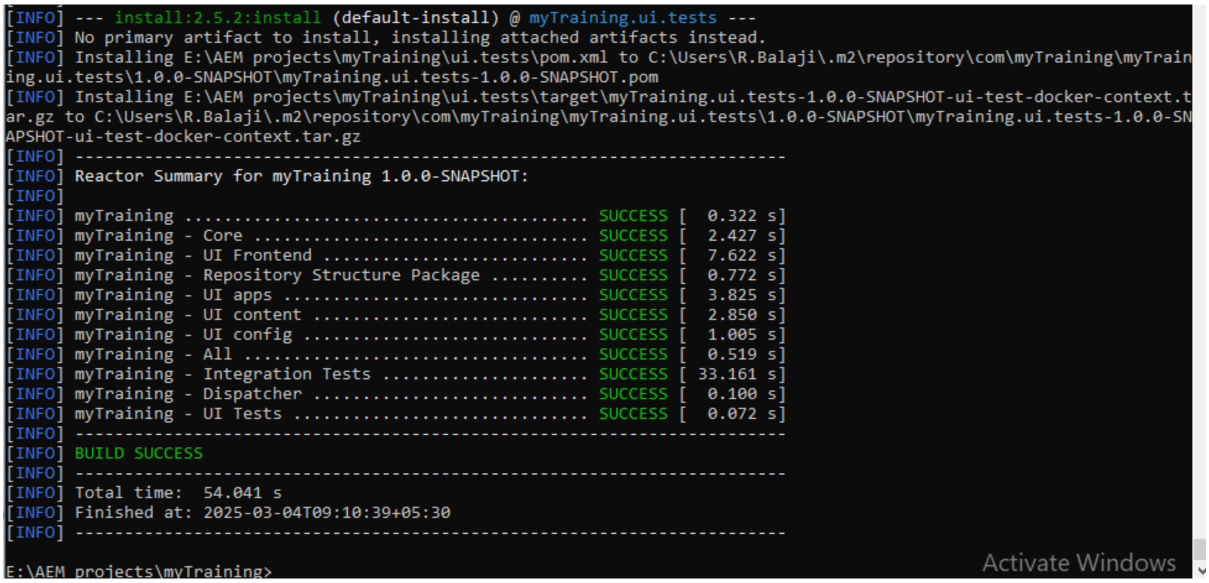
485 errors, 36 warnings, 1 other (Filter matched 137 of 522 items)

Description	Resource	Path	Location	Type
Errors (100 of 485 items)				
Warnings (36 items)				

Why Maven and its basic commands:

I have entered this command to clean install the dependencies for the AEM project
mvn clean install -PautoInstallPackage -Dmaven.test.skip=true

We can create packages for the AEM projects easily using Maven



```
[INFO] --- install:2.5.2:install (default-install) @ myTraining.ui.tests ---
[INFO] No primary artifact to install, installing attached artifacts instead.
[INFO] Installing E:\AEM projects\myTraining\ui.tests\pom.xml to C:\Users\R.Balaji\.m2\repository\com\myTraining\myTrain
ing.ui.tests\1.0.0-SNAPSHOT\myTraining.ui.tests-1.0.0-SNAPSHOT.pom
[INFO] Installing E:\AEM projects\myTraining\ui.tests\target\myTraining.ui.tests-1.0.0-SNAPSHOT-ui-test-docker-context.t
ar.gz to C:\Users\R.Balaji\.m2\repository\com\myTraining\myTraining.ui.tests\1.0.0-SNAPSHOT\myTraining.ui.tests-1.0.0-SN
APSHOT-ui-test-docker-context.tar.gz
[INFO] ------------------------------------------------------------------------
[INFO] Reactor Summary for myTraining 1.0.0-SNAPSHOT:
[INFO]
[INFO] myTraining ......................................... SUCCESS [  0.322 s]
[INFO] myTraining - Core .................................. SUCCESS [  2.427 s]
[INFO] myTraining - UI Frontend ........................... SUCCESS [  7.622 s]
[INFO] myTraining - Repository Structure Package .......... SUCCESS [  0.772 s]
[INFO] myTraining - UI apps ............................... SUCCESS [  3.825 s]
[INFO] myTraining - UI content ............................ SUCCESS [  2.850 s]
[INFO] myTraining - UI config ............................. SUCCESS [  1.005 s]
[INFO] myTraining - All ................................... SUCCESS [  0.519 s]
[INFO] myTraining - Integration Tests ..................... SUCCESS [ 33.161 s]
[INFO] myTraining - Dispatcher ............................ SUCCESS [  0.100 s]
[INFO] myTraining - UI Tests .............................. SUCCESS [  0.072 s]
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time:  54.041 s
[INFO] Finished at: 2025-03-04T09:10:39+05:30
[INFO] ------------------------------------------------------------------------

E:\AEM projects\myTraining>
```

it Activates the auto Install Package Maven profile, which typically deploys the generated AEM package directly to an AEM instance.

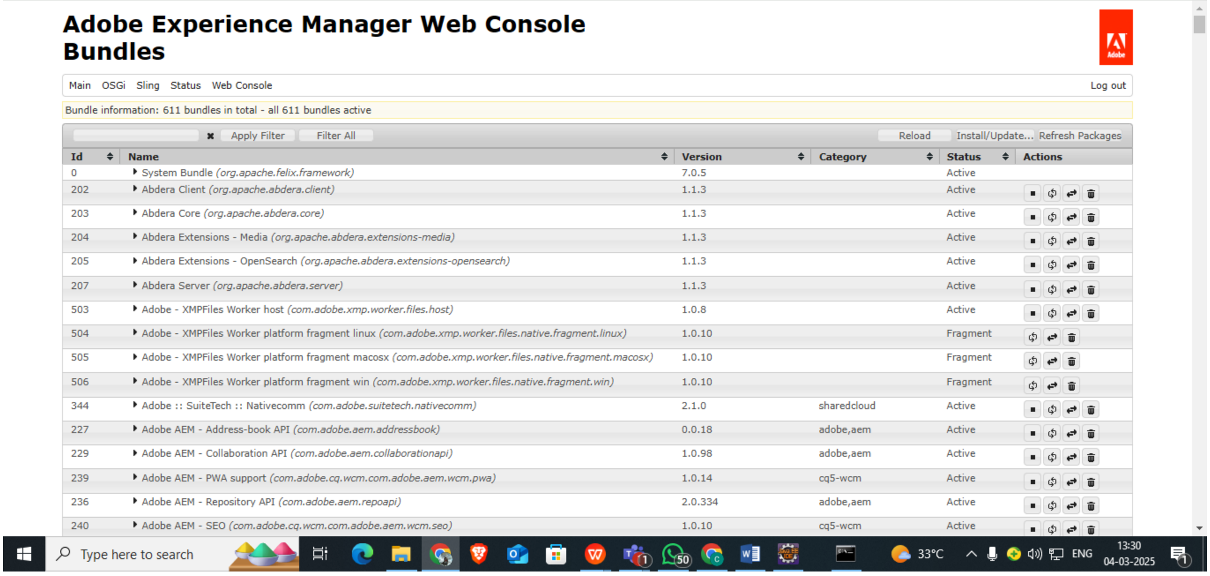
Core modules:

OSGi focus on backend code, services, and business logic.

So OSGi stands for Open Service Gateway Initiative

http://localhost:4502/system/console/bundles

this localhost link is used to navigate and see the OSGi bundles

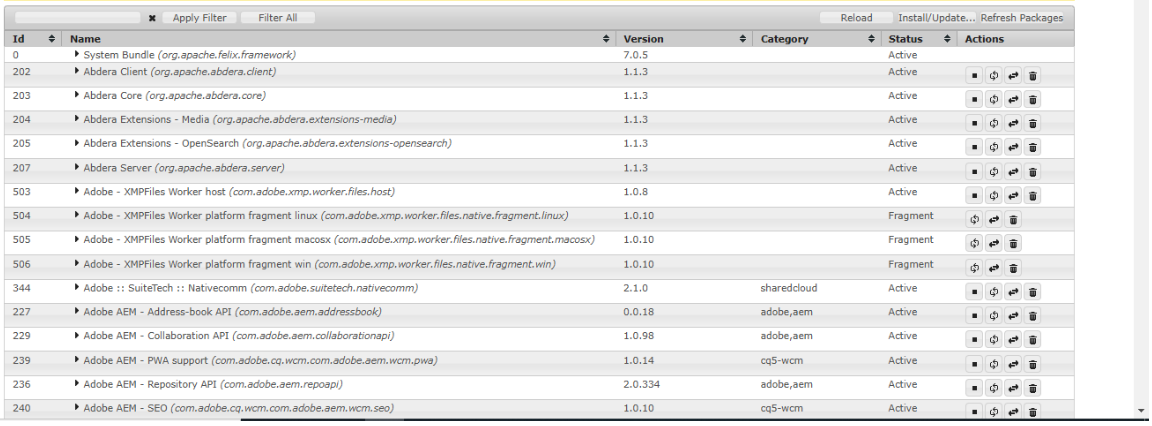


Adobe Experience Manager Web Console Bundles

Bundle information: 611 bundles in total - all 611 bundles active

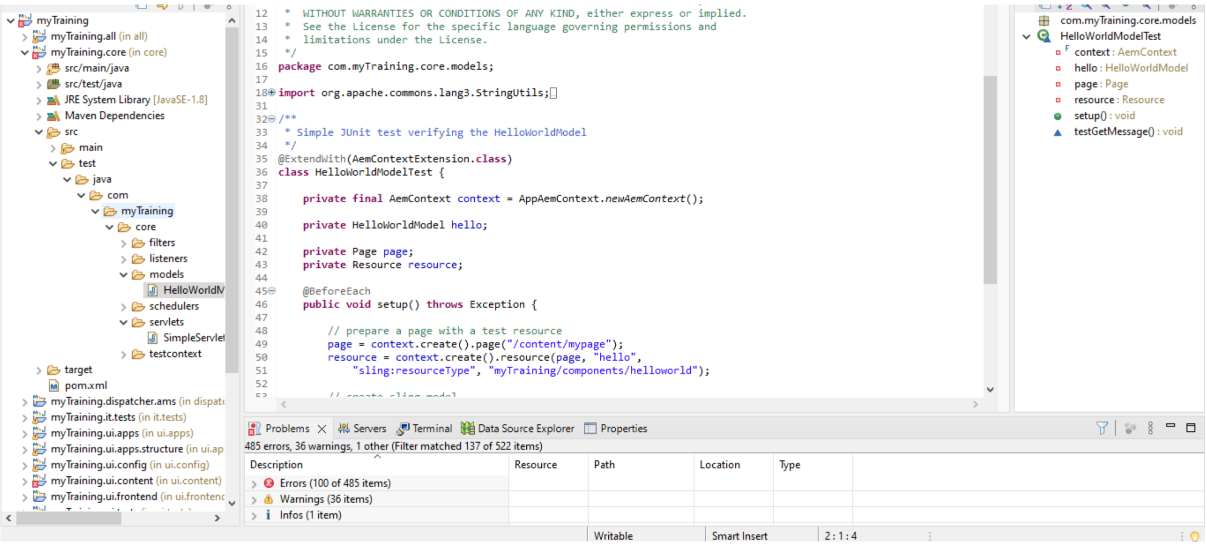
Id	Name	Version	Category	Status	Actions
0	System Bundle *(org.apache.felix.framework)*	7.0.5		Active	
202	Abdera Client *(org.apache.abdera.client)*	1.1.3		Active	■ ↻ ⇄ 🗑
203	Abdera Core *(org.apache.abdera.core)*	1.1.3		Active	■ ↻ ⇄ 🗑
204	Abdera Extensions - Media *(org.apache.abdera.extensions-media)*	1.1.3		Active	■ ↻ ⇄ 🗑
205	Abdera Extensions - OpenSearch *(org.apache.abdera.extensions-opensearch)*	1.1.3		Active	■ ↻ ⇄ 🗑
207	Abdera Server *(org.apache.abdera.server)*	1.1.3		Active	■ ↻ ⇄ 🗑
503	Adobe - XMPFiles Worker host *(com.adobe.xmp.worker.files.host)*	1.0.8		Active	■ ↻ ⇄ 🗑
504	Adobe - XMPFiles Worker platform fragment linux *(com.adobe.xmp.worker.files.native.fragment.linux)*	1.0.10		Fragment	↻ ⇄ 🗑
505	Adobe - XMPFiles Worker platform fragment macosx *(com.adobe.xmp.worker.files.native.fragment.macosx)*	1.0.10		Fragment	↻ ⇄ 🗑
506	Adobe - XMPFiles Worker platform fragment win *(com.adobe.xmp.worker.files.native.fragment.win)*	1.0.10		Fragment	↻ ⇄ 🗑
344	Adobe :: SuiteTech :: Nativecomm *(com.adobe.suitetech.nativecomm)*	2.1.0	sharedcloud	Active	■ ↻ ⇄ 🗑
227	Adobe AEM - Address-book API *(com.adobe.aem.addressbook)*	0.0.18	adobe,aem	Active	■ ↻ ⇄ 🗑
229	Adobe AEM - Collaboration API *(com.adobe.aem.collaborationapi)*	1.0.98	adobe,aem	Active	■ ↻ ⇄ 🗑
239	Adobe AEM - PWA support *(com.adobe.cq.wcm.com.adobe.aem.wcm.pwa)*	1.0.14	cq5-wcm	Active	■ ↻ ⇄ 🗑
236	Adobe AEM - Repository API *(com.adobe.aem.repoapi)*	2.0.334	adobe,aem	Active	■ ↻ ⇄ 🗑
240	Adobe AEM - SEO *(com.adobe.cq.wcm.com.adobe.aem.wcm.seo)*	1.0.10	cq5-wcm	Active	■ ↻ ⇄ 🗑

These are some of the OSGi bundles available in AEM



Id	Name	Version	Category	Status	Actions
0	System Bundle *(org.apache.felix.framework)*	7.0.5		Active	
202	Abdera Client *(org.apache.abdera.client)*	1.1.3		Active	
203	Abdera Core *(org.apache.abdera.core)*	1.1.3		Active	
204	Abdera Extensions - Media *(org.apache.abdera.extensions-media)*	1.1.3		Active	
205	Abdera Extensions - OpenSearch *(org.apache.abdera.extensions-opensearch)*	1.1.3		Active	
207	Abdera Server *(org.apache.abdera.server)*	1.1.3		Active	
503	Adobe - XMPFiles Worker host *(com.adobe.xmp.worker.files.host)*	1.0.8		Active	
504	Adobe - XMPFiles Worker platform fragment linux *(com.adobe.xmp.worker.files.native.fragment.linux)*	1.0.10		Fragment	
505	Adobe - XMPFiles Worker platform fragment macosx *(com.adobe.xmp.worker.files.native.fragment.macosx)*	1.0.10		Fragment	
506	Adobe - XMPFiles Worker platform fragment win *(com.adobe.xmp.worker.files.native.fragment.win)*	1.0.10		Fragment	
344	Adobe :: SuiteTech :: Nativecomm *(com.adobe.suitetech.nativecomm)*	2.1.0	sharedcloud	Active	
227	Adobe AEM - Address-book API *(com.adobe.aem.addressbook)*	0.0.18	adobe,aem	Active	
229	Adobe AEM - Collaboration API *(com.adobe.aem.collaborationapi)*	1.0.98	adobe,aem	Active	
239	Adobe AEM - PWA support *(com.adobe.cq.wcm.com.adobe.aem.wcm.pwa)*	1.0.14	cq5-wcm	Active	
236	Adobe AEM - Repository API *(com.adobe.aem.repoapi)*	2.0.334	adobe,aem	Active	
240	Adobe AEM - SEO *(com.adobe.cq.wcm.com.adobe.aem.wcm.seo)*	1.0.10	cq5-wcm	Active	

This is a simple Helloworld model in core

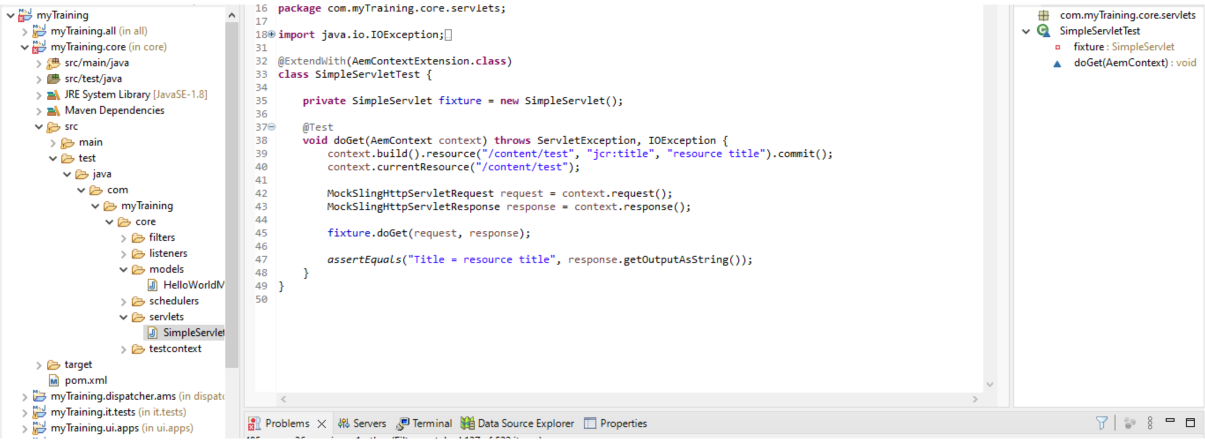


```java
 *  WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 *  See the License for the specific language governing permissions and
 *  limitations under the License.
 */
package com.myTraining.core.models;

import org.apache.commons.lang3.StringUtils;

/**
 * Simple JUnit test verifying the HelloWorldModel
 */
@ExtendWith(AemContextExtension.class)
class HelloWorldModelTest {

    private final AemContext context = AppAemContext.newAemContext();

    private HelloWorldModel hello;

    private Page page;
    private Resource resource;

    @BeforeEach
    public void setup() throws Exception {

        // prepare a page with a test resource
        page = context.create().page("/content/mypage");
        resource = context.create().resource(page, "hello",
            "sling:resourceType", "myTraining/components/helloworld");
```

485 errors, 36 warnings, 1 other (Filter matched 137 of 522 items)

Description	Resource	Path	Location	Type
Errors (100 of 485 items)				
Warnings (36 items)				
Infos (1 item)				

This is a simpleserverlet model in core

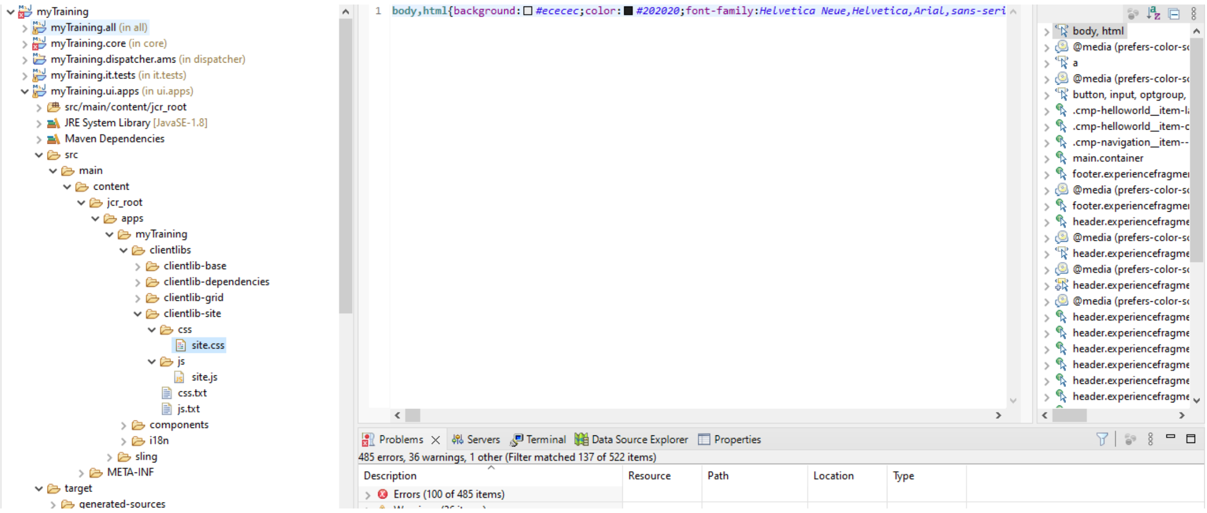


```java
package com.myTraining.core.servlets;

import java.io.IOException;

@ExtendWith(AemContextExtension.class)
class SimpleServletTest {

    private SimpleServlet fixture = new SimpleServlet();

    @Test
    void doGet(AemContext context) throws ServletException, IOException {
        context.build().resource("/content/test", "jcr:title", "resource title").commit();
        context.currentResource("/content/test");

        MockSlingHttpServletRequest request = context.request();
        MockSlingHttpServletResponse response = context.response();

        fixture.doGet(request, response);

        assertEquals("Title = resource title", response.getOutputAsString());
    }
}
```

UI.apps

it covers the front end part

Here’s a css and java script file present inside the Ui.apps



```
myTraining
  myTraining.all (in all)
  myTraining.core (in core)
  myTraining.dispatcher.ams (in dispatcher)
  myTraining.it.tests (in it.tests)
  myTraining.ui.apps (in ui.apps)
    src/main/content/jcr_root
    JRE System Library [JavaSE-1.8]
    Maven Dependencies
    src
      main
        content
          jcr_root
            apps
              myTraining
                clientlibs
                  clientlib-base
                  clientlib-dependencies
                  clientlib-grid
                  clientlib-site
                    css
                      site.css
                    js
                      site.js
                    css.txt
                    js.txt
                components
                i18n
              sling
            META-INF
    target
      generated-sources
```

```
body,html{background:□ #ececec;color:■ #202020;font-family:Helvetica Neue,Helvetica,Arial,sans-seri
```

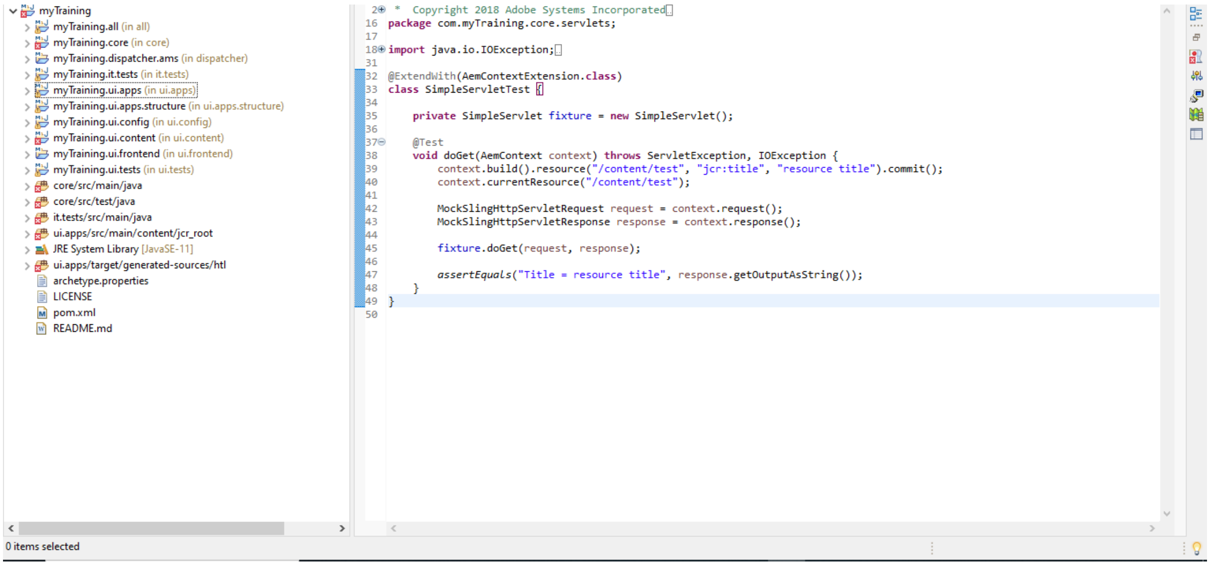
485 errors, 36 warnings, 1 other (Filter matched 137 of 522 items)

Description	Resource	Path	Location	Type
Errors (100 of 485 items)				

These files are present inside the clientlibs

Reviewing POM Files:

There are different pom files present in different hierarchy



```
myTraining
  myTraining.all (in all)
  myTraining.core (in core)
  myTraining.dispatcher.ams (in dispatcher)
  myTraining.it.tests (in it.tests)
  myTraining.ui.apps (in ui.apps)
  myTraining.ui.apps.structure (in ui.apps.structure)
  myTraining.ui.config (in ui.config)
  myTraining.ui.content (in ui.content)
  myTraining.ui.frontend (in ui.frontend)
  myTraining.ui.tests (in ui.tests)
  core/src/main/java
  core/src/test/java
  it.tests/src/main/java
  ui.apps/src/main/content/jcr_root
  JRE System Library [JavaSE-11]
  ui.apps/target/generated-sources/htl
  archetype.properties
  LICENSE
  pom.xml
  README.md
```

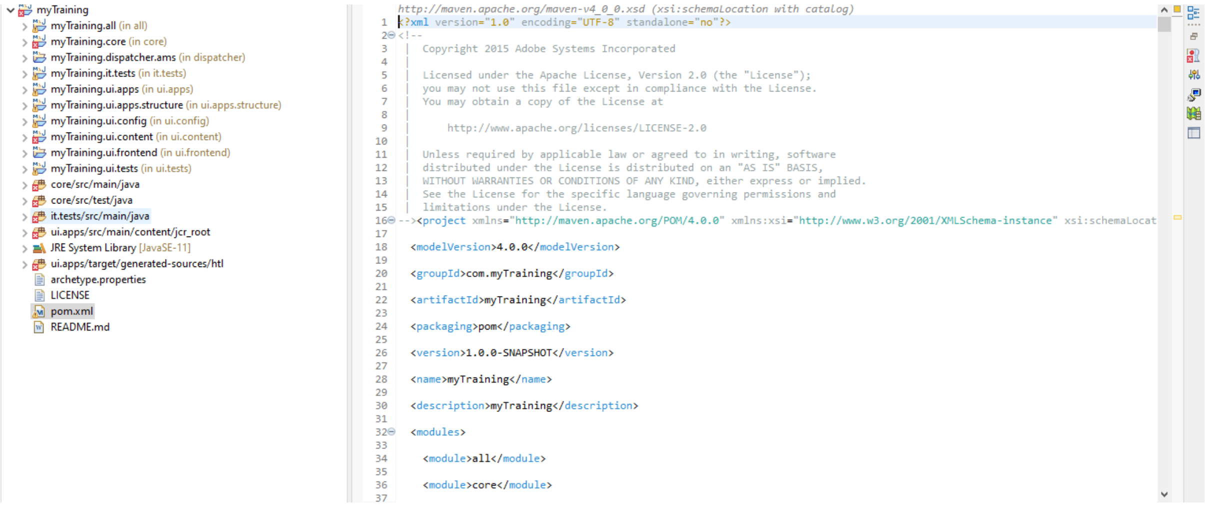
```java
 *  Copyright 2018 Adobe Systems Incorporated
package com.myTraining.core.servlets;

import java.io.IOException;

@ExtendWith(AemContextExtension.class)
class SimpleServletTest {

    private SimpleServlet fixture = new SimpleServlet();

    @Test
    void doGet(AemContext context) throws ServletException, IOException {
        context.build().resource("/content/test", "jcr:title", "resource title").commit();
        context.currentResource("/content/test");

        MockSlingHttpServletRequest request = context.request();
        MockSlingHttpServletResponse response = context.response();

        fixture.doGet(request, response);

        assertEquals("Title = resource title", response.getOutputAsString());
    }
}
```

0 items selected

This is the main POM file which is present in the project directory itself it manages all other POM files present in the sub modules

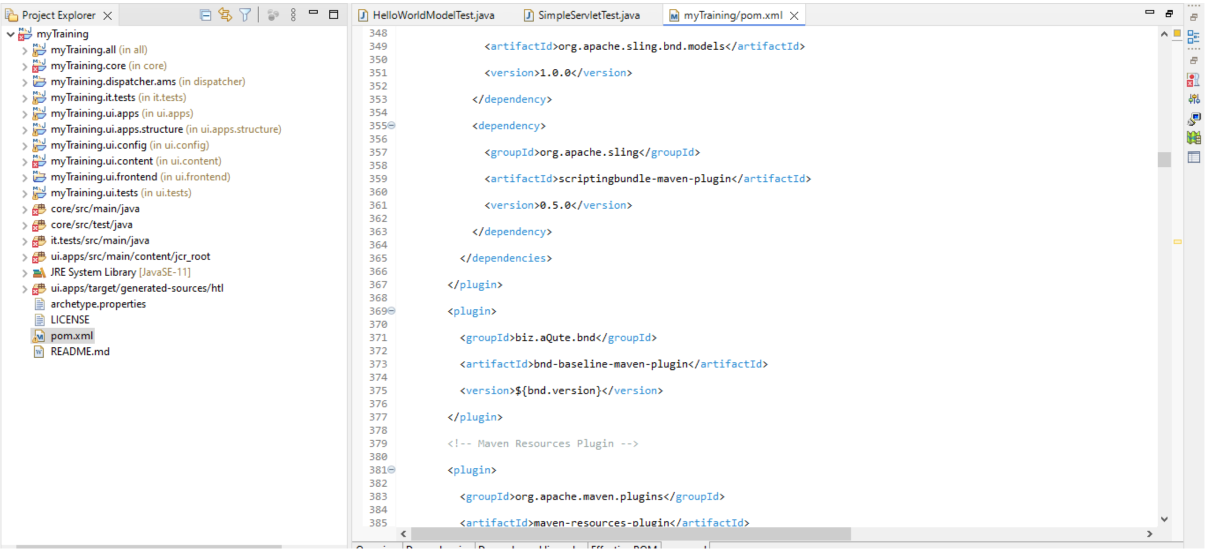
in there we can see several tags like username,password,model version, group ID ,name,description each has their own values.

It also contains what are the dependencies needed for the main project to run
The dependencies are enclose with the dependency tags.



```
myTraining
  myTraining.all (in all)
  myTraining.core (in core)
  myTraining.dispatcher.ams (in dispatcher)
  myTraining.it.tests (in it.tests)
  myTraining.ui.apps (in ui.apps)
  myTraining.ui.apps.structure (in ui.apps.structure)
  myTraining.ui.config (in ui.config)
  myTraining.ui.content (in ui.content)
  myTraining.ui.frontend (in ui.frontend)
  myTraining.ui.tests (in ui.tests)
  core/src/main/java
  core/src/test/java
  it.tests/src/main/java
  ui.apps/src/main/content/jcr_root
  JRE System Library [JavaSE-11]
  ui.apps/target/generated-sources/htl
  archetype.properties
  LICENSE
  pom.xml
  README.md
```

```
http://maven.apache.org/maven-v4_0_0.xsd (xsi:schemaLocation with catalog)
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!--
 |  Copyright 2015 Adobe Systems Incorporated
 |
 |  Licensed under the Apache License, Version 2.0 (the "License");
 |  you may not use this file except in compliance with the License.
 |  You may obtain a copy of the License at
 |
 |      http://www.apache.org/licenses/LICENSE-2.0
 |
 |  Unless required by applicable law or agreed to in writing, software
 |  distributed under the License is distributed on an "AS IS" BASIS,
 |  WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
 |  See the License for the specific language governing permissions and
 |  limitations under the License.
--><project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocat

  <modelVersion>4.0.0</modelVersion>

  <groupId>com.myTraining</groupId>

  <artifactId>myTraining</artifactId>

  <packaging>pom</packaging>

  <version>1.0.0-SNAPSHOT</version>

  <name>myTraining</name>

  <description>myTraining</description>

  <modules>

    <module>all</module>

    <module>core</module>

```

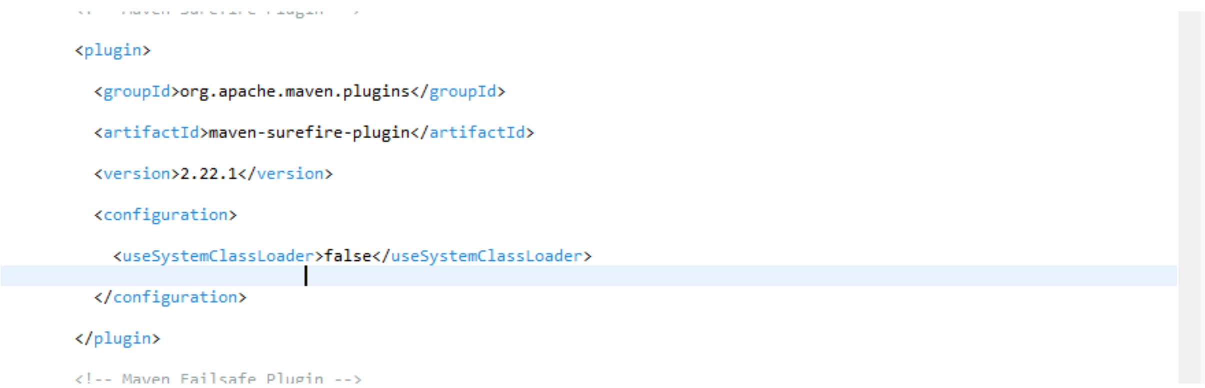


Project Explorer | HelloWorldModelTest.java | SimpleServletTest.java | myTraining/pom.xml

```
myTraining
  myTraining.all (in all)
  myTraining.core (in core)
  myTraining.dispatcher.ams (in dispatcher)
  myTraining.it.tests (in it.tests)
  myTraining.ui.apps (in ui.apps)
  myTraining.ui.apps.structure (in ui.apps.structure)
  myTraining.ui.config (in ui.config)
  myTraining.ui.content (in ui.content)
  myTraining.ui.frontend (in ui.frontend)
  myTraining.ui.tests (in ui.tests)
  core/src/main/java
  core/src/test/java
  it.tests/src/main/java
  ui.apps/src/main/content/jcr_root
  JRE System Library [JavaSE-11]
  ui.apps/target/generated-sources/htl
  archetype.properties
  LICENSE
  pom.xml
  README.md
```

```

              <artifactId>org.apache.sling.bnd.models</artifactId>

              <version>1.0.0</version>

            </dependency>

            <dependency>

              <groupId>org.apache.sling</groupId>

              <artifactId>scriptingbundle-maven-plugin</artifactId>

              <version>0.5.0</version>

            </dependency>

          </dependencies>

        </plugin>

        <plugin>

          <groupId>biz.aQute.bnd</groupId>

          <artifactId>bnd-baseline-maven-plugin</artifactId>

          <version>${bnd.version}</version>

        </plugin>

        <!-- Maven Resources Plugin -->

        <plugin>

          <groupId>org.apache.maven.plugins</groupId>

          <artifactId>maven-resources-plugin</artifactId>
```

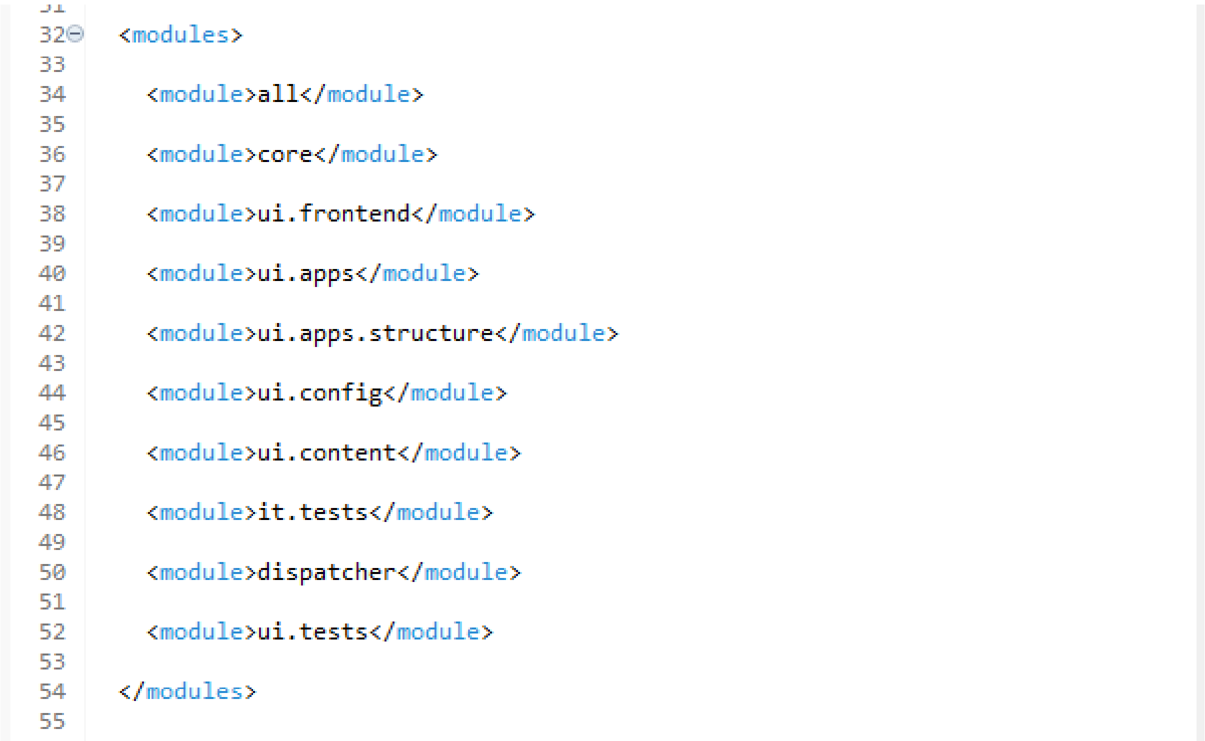
Build configuration is used to set the properties to the project wheather to run a process or not



```
<!-- Maven Surefire Plugin -->

<plugin>

  <groupId>org.apache.maven.plugins</groupId>

  <artifactId>maven-surefire-plugin</artifactId>

  <version>2.22.1</version>

  <configuration>

    <useSystemClassLoader>false</useSystemClassLoader>

  </configuration>

</plugin>

<!-- Maven Failsafe Plugin -->
```

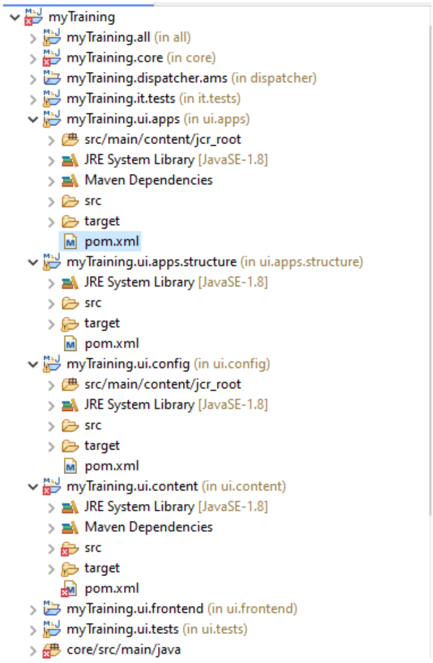
Exploring Multi-Module Projects:

There several modules in a AEM projects we will be managing them in main POM file like this



```
<modules>

  <module>all</module>

  <module>core</module>

  <module>ui.frontend</module>

  <module>ui.apps</module>

  <module>ui.apps.structure</module>

  <module>ui.config</module>

  <module>ui.content</module>

  <module>it.tests</module>

  <module>dispatcher</module>

  <module>ui.tests</module>

</modules>
```

Each modules contains their own POM file



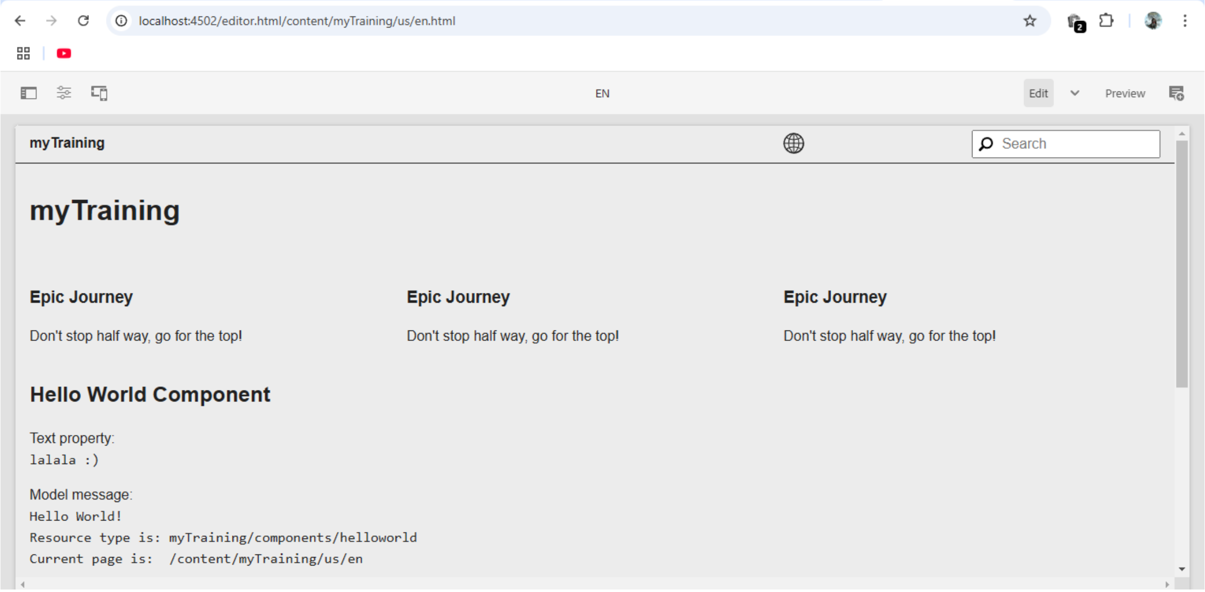
```
myTraining
  myTraining.all (in all)
  myTraining.core (in core)
  myTraining.dispatcher.ams (in dispatcher)
  myTraining.it.tests (in it.tests)
  myTraining.ui.apps (in ui.apps)
    src/main/content/jcr_root
    JRE System Library [JavaSE-1.8]
    Maven Dependencies
    src
    target
    pom.xml
  myTraining.ui.apps.structure (in ui.apps.structure)
    JRE System Library [JavaSE-1.8]
    src
    target
    pom.xml
  myTraining.ui.config (in ui.config)
    src/main/content/jcr_root
    JRE System Library [JavaSE-1.8]
    src
    target
    pom.xml
  myTraining.ui.content (in ui.content)
    JRE System Library [JavaSE-1.8]
    Maven Dependencies
    src
    target
    pom.xml
  myTraining.ui.frontend (in ui.frontend)
  myTraining.ui.tests (in ui.tests)
  core/src/main/java
```

we can also add or remove some of these modules as per our need
each of them contain the Model version,groupID,artifactID,versio,relativepath which are inherited from the parent POM file

```
<modelVersion>4.0.0</modelVersion>

    <!-- ====================================================================== --
>
```

```
    <!-- P A R E N T   P R O J E C T   D E S C R I P T I O N                      --
>
    <!-- ======================================================================= --
>
    <parent>
        <groupId>com.myTraining</groupId>
        <artifactId>myTraining</artifactId>
        <version>1.0.0-SNAPSHOT</version>
        <relativePath>../pom.xml</relativePath>
    </parent>
```

This is the output of helloworld module in the project



myTraining

Epic Journey

Don't stop half way, go for the top!

Epic Journey

Don't stop half way, go for the top!

Epic Journey

Don't stop half way, go for the top!

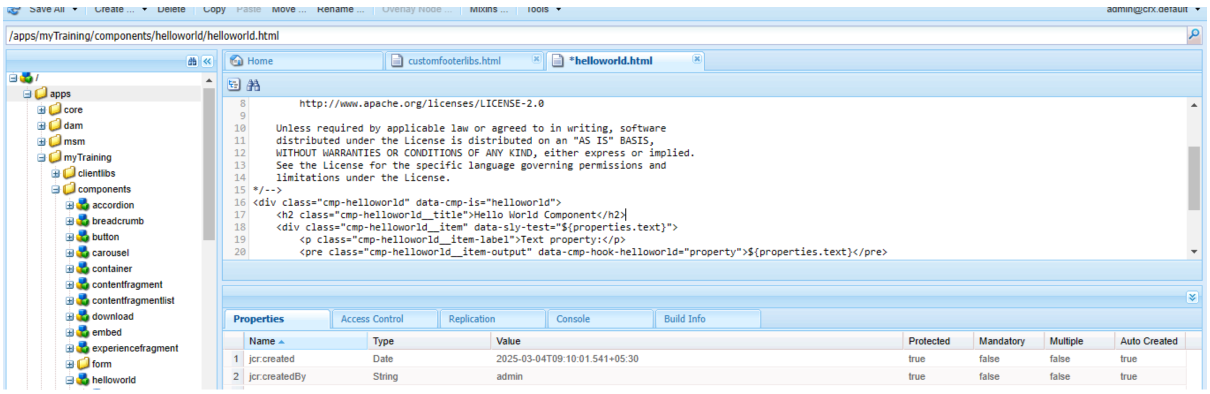
Hello World Component

Text property:

```
lalala :)
```

Model message:

```
Hello World!
Resource type is: myTraining/components/helloworld
Current page is:  /content/myTraining/us/en
```



```
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    distributed under the License is distributed on an "AS IS" BASIS,
    WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
    See the License for the specific language governing permissions and
    limitations under the License.
*/-->
<div class="cmp-helloworld" data-cmp-is="helloworld">
    <h2 class="cmp-helloworld__title">Hello World Component</h2>
    <div class="cmp-helloworld__item" data-sly-test="${properties.text}">
        <p class="cmp-helloworld__item-label">Text property:</p>
        <pre class="cmp-helloworld__item-output" data-cmp-hook-helloworld="property">${properties.text}</pre>
```
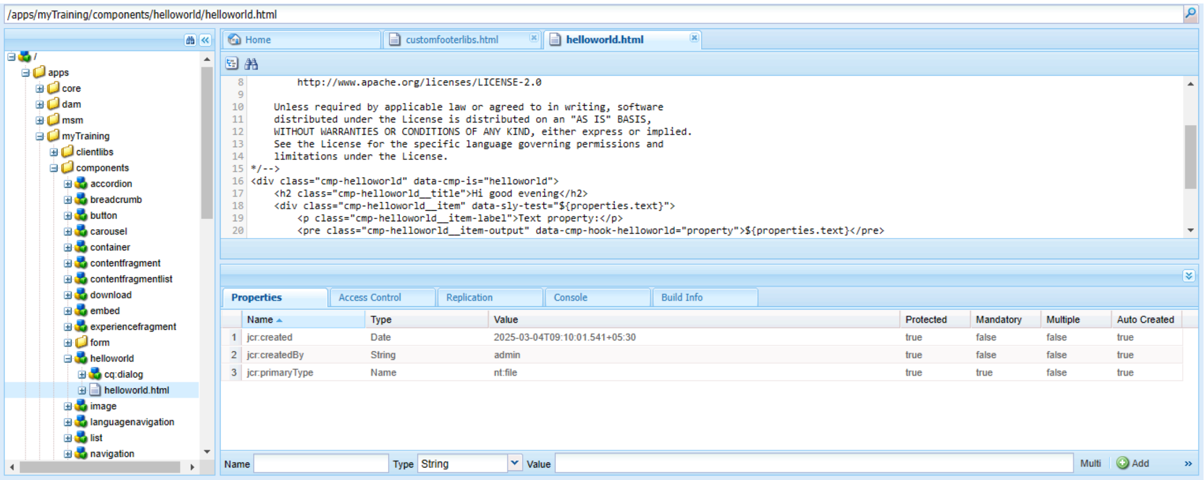

	Name	Type	Value	Protected	Mandatory	Multiple	Auto Created
1	jcr:created	Date	2025-03-04T09:10:01.541+05:30	true	false	false	true
2	jcr:createdBy	String	admin	true	false	false	true

We can also modify this helloworld component


/apps/myTraining/components/helloworld/helloworld.html

```
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    distributed under the License is distributed on an "AS IS" BASIS,
    WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
    See the License for the specific language governing permissions and
    limitations under the License.
*/-->
<div class="cmp-helloworld" data-cmp-is="helloworld">
    <h2 class="cmp-helloworld__title">Hi good evening</h2>
    <div class="cmp-helloworld__item" data-sly-test="${properties.text}">
        <p class="cmp-helloworld__item-label">Text property:</p>
        <pre class="cmp-helloworld__item-output" data-cmp-hook-helloworld="property">${properties.text}</pre>
```
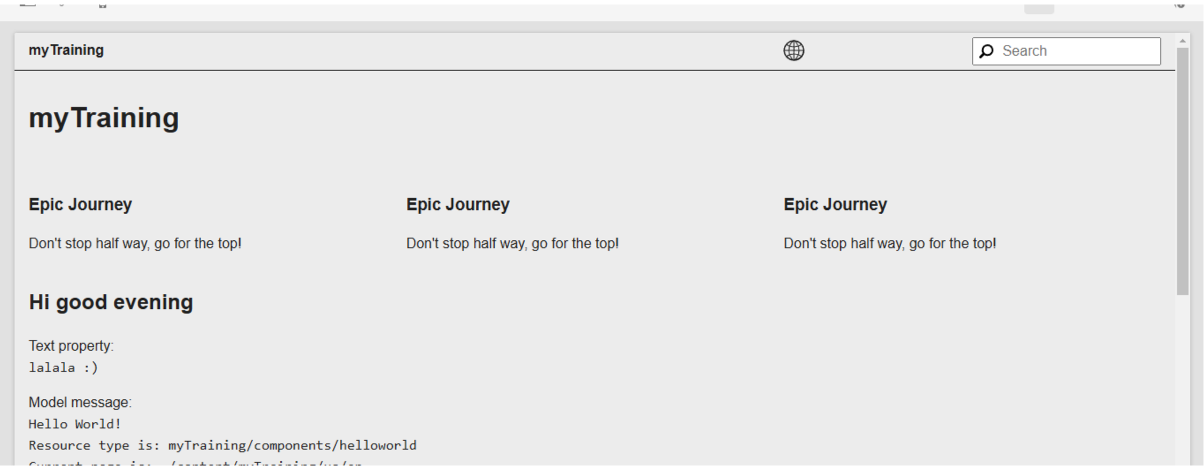

	Name	Type	Value	Protected	Mandatory	Multiple	Auto Created
1	jcr:created	Date	2025-03-04T09:10:01.541+05:30	true	false	false	true
2	jcr:createdBy	String	admin	true	false	false	true
3	jcr:primaryType	Name	nt:file	true	true	false	true

Name ____ Type String Value ____ Multi Add

Now instead of “Helloworld” “Hi good evening is printed”



myTraining

Epic Journey

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Hi good evening

Text property:

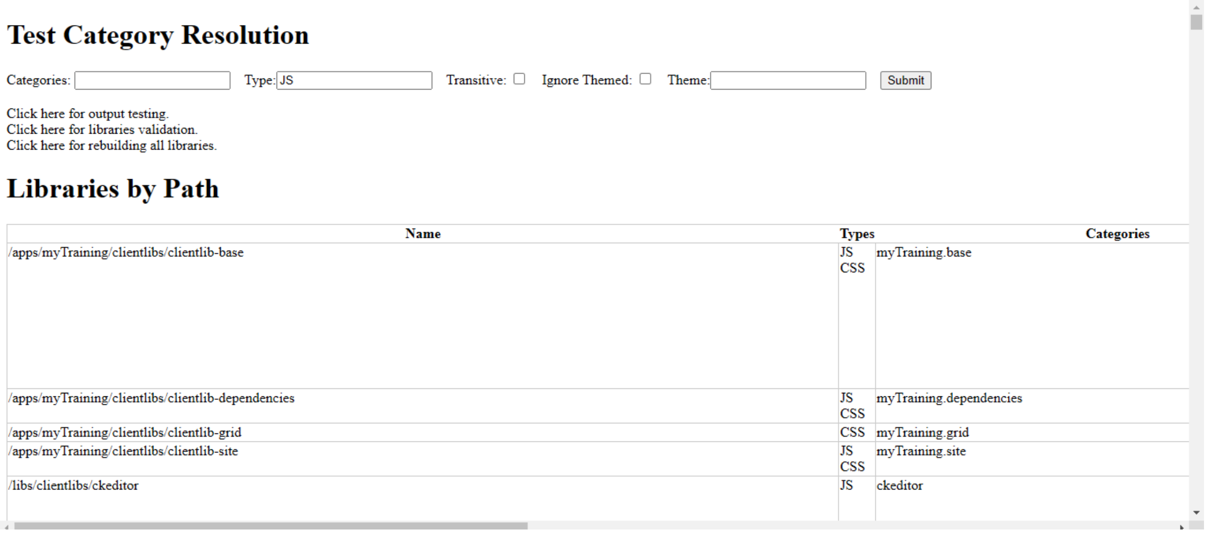
```
lalala :)
```

Model message:

```
Hello World!
Resource type is: myTraining/components/helloworld
```

Dumplibs:

Dumplibs are used to debug the Clientlibs simply we can say it can solve front end (CSS and JS) issues by going to this url we can see its libraries http://localhost:4502/libs/granite/ui/content/dumplibs.html



Test Category Resolution

Categories: ____ Type: JS Transitive: □ Ignore Themed: □ Theme: ____ Submit

Click here for output testing.
Click here for libraries validation.
Click here for rebuilding all libraries.

Libraries by Path

Name	Types	Categories
/apps/myTraining/clientlibs/clientlib-base	JS CSS	myTraining.base
/apps/myTraining/clientlibs/clientlib-dependencies	JS CSS	myTraining.dependencies
/apps/myTraining/clientlibs/clientlib-grid	CSS	myTraining.grid
/apps/myTraining/clientlibs/clientlib-site	JS CSS	myTraining.site
/libs/clientlibs/ckeditor	JS	ckeditor

it is used to resolve client-side resource loading issues.