UNLEASH THE POWER OF ECLIPSE TECHNOLOGIES

THE BENEFITS OF MODERNIZING YOUR PROJECT
Unleash the power of Eclipse technologies

Speakers

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Agenda

► Motivation

► General project improvements (Eclipse infrastructure)

► Issues and possible solutions (Eclipse technologies)

► Benefits – Eclipse APP4MC examples

► Conclusion
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Motivation

▶ Situation
- large codebase with contributions from many participants
- diversity is a barrier for new contributors
- monolithic build
- multiple dependencies between central model and tools

▶ Goals
- reduce the maintenance effort on builds
- increase maintainability of the code base
- simplify contributions to the project
- make it easier for adopters to seamlessly extend the project
General Project Improvements

*Eclipse Infrastructure*
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Modularization by splitting the code base

- **Origin**: big code base grown over time
- **Goal**: Modular repositories with history

Current repository

New repository

Contains only migration plugins (incl. history)
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Modularization by splitting the code base

1. Clone original repository
2. Untrack original remote branch
3. Delete unnecessary folders
4. Cleanup
5. Push to server

Eclipse Servers

Local
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Modularization by splitting the code base

1. Clone original repository
2. Untrack original remote branch
   ```
   git remote prune origin
   ```
3. Delete unnecessary folders
   ```
   git gc --aggressive --prune=now
   BYEBYE=$(paste -s -d ' ' /d/tmp/folderlist.txt); \
   git filter-branch -f --index-filter "git rm -q -r -f --cached --ignore-unmatch $BYEBYE" \ 
   --prune-empty --tag-name-filter cat -- --all
   ```
4. Cleanup
   ```
   git for-each-ref --format='delete %(refname)' refs/original | git update-ref -stdin
   git reflog expire --expire=now -all
   git gc --aggressive --prune=now
   git repack -ad
   ```
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Modularization – Builds and resulting artifacts

Feature based products and components
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Modularization – Results in Eclipse download area

download.eclipse.org/app4mc/components
|-- addon
   `-- migration
       |-- releases
           |-- 0.9.6
               |-- p2repo
               |   |-- org.eclipse.app4mc.converters.p2repo-0.9.6.zip
           |-- 0.9.7
               |-- p2repo
               |   |-- headless
               |       |-- org.eclipse.app4mc.converters.p2repo-0.9.7.zip
               `-- latest
                   |-- p2repo
                   |   |-- headless
                   |       |-- org.eclipse.app4mc.converters.p2repo-0.9.7.zip
                   `-- snapshot
                       |-- p2repo
                       |   |-- headless
                       |       |-- org.eclipse.app4mc.converters.p2repo-0.9.8-SNAPSHOT.zip

headless
- README.TXT
- amalthea_migration.jar
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Sonar scans as part of dedicated builds

- Code quality improvements with Sonar scans
  - [https://sonarcloud.io/organizations/eclipse/projects](https://sonarcloud.io/organizations/eclipse/projects)
- Coverage of PDE structured projects
- Examples

### APP4MC Tool Platform
- Bugs: 10 (C)
- Vulnerabilities: 1 (B)
- Code Smells: 1.5k (A)
- Coverage: 9.4%
- Duplications: 2.2%
- Lines of code: 60k (M)
- Languages: Java, XML

### APP4MC Migration Component
- Bugs: 0 (A)
- Vulnerabilities: 0 (A)
- Code Smells: 908 (A)
- Coverage: 60.1%
- Duplications: 8.7%
- Lines of code: 17k (M)
- Languages: Java, XML
Issues and possible solutions

Eclipse Technologies
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Eclipse Technologies

- Modular product updates
- Startup Performance – Plugin Activators
- Builds with pomless Tycho
- Extension Points → Declarative Services
- Eclipse 3 → Eclipse 4
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Modular product updates

- Feature based product
  - Easier product definition
  - Modular updates
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Modular product updates

- Configure product independent features as root features to enable modular product updates
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Modular product updates

- Feature based product
  - Easier product definition
  - Modular updates

Current platform
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Startup Performance – Remove Activator

- Created by Eclipse PDE tooling
- Executed in the UI thread when bundle is started by the framework
- Not used as intended but as single point of feature access

<table>
<thead>
<tr>
<th>Activator Usage</th>
<th>Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plugin / Bundle ID</td>
<td><code>FrameworkUtil.getBundle(getClass()).getSymbolicName()</code></td>
</tr>
<tr>
<td>Logging functionality</td>
<td>Various approaches available, for simple 1-to-1 change use <code>Platform.getLog()</code></td>
</tr>
<tr>
<td>Access to preferences</td>
<td>use preference Singletons provided by the Eclipse runtime, e.g. <code>InstanceScope.INSTANCE.getNode(&quot;&quot;)</code></td>
</tr>
<tr>
<td></td>
<td><a href="https://www.vogella.com/tutorials/EclipsePreferences/article.html">https://www.vogella.com/tutorials/EclipsePreferences/article.html</a></td>
</tr>
<tr>
<td>Access to resources like images</td>
<td><code>ResourceLocator#imageDescriptorFromBundle(String, String)</code></td>
</tr>
<tr>
<td></td>
<td>JFace <code>ResourceManager</code></td>
</tr>
<tr>
<td></td>
<td><a href="https://www.vogella.com/tutorials/EclipseJFace/article.html#jface_localresoucemanager">https://www.vogella.com/tutorials/EclipseJFace/article.html#jface_localresoucemanager</a></td>
</tr>
<tr>
<td>Access to dialog settings</td>
<td><a href="http://eclips.se/549929">http://eclips.se/549929</a></td>
</tr>
</tbody>
</table>
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Startup Performance – Remove Activator

▶ Deal with required actions on startup
  ▶ Use OSGi Declarative Services *Immediate Components*
  ▶ Use an *EventHandler* for *APP_STARTUP_COMPLETE*

```java
@Component(property = {
    EventConstants.EVENT_TOPIC + "=" + UIEvents.UILifeCycle.APP_STARTUP_COMPLETE })
public class ViewpointRegistration implements EventHandler {

    @Override
    public void handleEvent(Event event) {
        Display.getDefault().asyncExec(() -> {
            // TODO Auto-generated method stub
        });
    }
}
```
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Startup Performance – Remove Activator

- Deal with required actions on startup
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```java
@Component(property = {
    EventConstants.EVENT_TOPIC + "=" + UIEvents.UILifeCycle.APP_STARTUP_COMPLETE })
public class ViewpointRegistration implements EventHandler {

- Use an *Activator* if ...
  - the action needs to be executed in the UI thread
  - the action needs to be executed once the bundle is started
  - example: Sirius viewpoint registration
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pomless Tycho

- no pom.xml for plugins, features and tests
- Since 1.5
  - no pom.xml for target definitions, products and update sites
  - no connector pom.xml files needed for “structured environments”

→ Number of pom.xml files reduced to a minimum
→ Maintenance effort for build topics (e.g. version update) reduced

http://blog.vogella.com/2015/12/15/pom-less-tycho-builds-for-structured-environments/
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Extension Points → Declarative Services

- Extension Points
  - Definition via XML & XML Schema
  - one-to-many relation design
  - Consumed programmatically using ExtensionRegistry via ID → No type safety!
  - No dynamics at runtime
  - Equinox only

- Declarative Services
  - Definition via XML → Generated by tooling (DS annotations)
  - many-to-many relation design
  - Consumed via injection → type safe!
  - Dynamics supported at runtime
  - OSGi standard
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Eclipse 3 → Eclipse 4

- Migrate UI contributions to Eclipse 4
  - Contribute via model fragments (fragment.e4xmi)
  - Commands, Handler, Menu Contributions
  - ViewPart → Part

- Migrate **Core Expressions** to **Imperative Expressions** (@Evaluate)

- Add context values via **Model Addons**

- Usage of the **Event Bus** in several places

→ Less code bloat
→ Participating in E4 programming model
→ Usage of injection even for OSGi services
→ Loose coupling between modules
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Examples: Extension Point vs. Declarative Service

- Service Provider: Extension Point → Declarative Service
  - Add @Component to implementation
  - Delete plugin.xml
  - Create component references via @Reference
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Examples: E3 vs. E4

Service Consumer: Extension Point / E3

```java
public class AmaltheaModelMigrationHandler extends AbstractModelConverterHandler {

    @Override
    public Object execute(final ExecutionEvent event) throws ExecutionException {
        // extract Shell and selection from event
        ...
    
    IExtensionRegistry registry = Platform.getExtensionRegistry();
    IExtensionPoint extensionPoint = registry.getExtensionPoint("org.eclipse.app4mc.amalthea.model.converters.cachebuilders");
    IConfigurationElement[] extensions = extensionPoint.getConfigurationElements();

    for (IConfigurationElement iConfigurationElement : extensions) {
        String definedInputModelVersion = iConfigurationElement.getAttribute("input-model-version");
        if (definedInputModelVersion.equals(inputModelVersion)) {
            Object cacheBuilder = iConfigurationElement.createExecutableExtension("class");
            caches.add((ICache) cacheBuilder);
        }
    }
}
```
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Examples: E3 vs. E4

▶ Service Consumer: **Declarative Service / E4**

```java
public class AmaltheaModelMigrationHandler {

    @Execute
    public void execute(
        Shell shell,
        @Service MigrationProcessor migrationProcessor,
        @Named(IServiceConstants.ACTIVE_SELECTION) ISelection selection,
        @Optional @Named("executioncontext") String executionContext,
        @Optional @Named("APP4MC_MODEL_VERSION") String modelEditorVersion) {

        // implement the desired functionality
        ...
    }
```

Examples: Events

Loose coupling: Trigger model migration from model editor

```java
@Inject
@Optional
private void handleConvertEvent(
    @UIEventTopic("org/eclipse/app4mc/amalthea/converter/CONVERT") Map<String, String> conversionArgs,
    @Service MigrationProcessor migrationProcessor,
    @Named(IServiceConstants.ACTIVE_SELECTION) ISelection selection) {

    String type = conversionArgs.get("type");
    String version = conversionArgs.get("version");

    AmaltheaModelMigrationHandler handler = new AmaltheaModelMigrationHandler();
    handler.execute(Display.getDefault().getActiveShell(), migrationProcessor, selection, type, version);
}
```

```java
IEventBroker broker = getSite().getService(IEventBroker.class);
if (broker != null) {
    String executionContext = (result == 0) ? "simplemigration" : "dialogmigration";
    HashMap<String, String> args = new HashMap<>();
    args.put("type", executionContext);
    args.put("version", versionFromMetaModel);
    broker.send("org/eclipse/app4mc/amalthea/converter/CONVERT", args);
}
```
Examples: Events

- Loose coupling: Trigger selection in model editor tree from anywhere
- Any contributor can trigger the selection in the tree viewer via event without any tight dependency on app4mc

```java
public void addSelectionSubscriber() {
    IEventBroker broker = getSite().getService(IEventBroker.class);
    if (broker != null) {
        broker.subscribe("org/eclipse/app4mc/amalthea/editor/SELECT", this.selectionListener);
    }
}

@Execute
public void execute(@Active MPart activePart, IEventBroker broker) {
    if (activePart.getObject() instanceof VisualizationPart) {
        VisualizationPart part = (VisualizationPart) activePart.getObject();
        if (part.hasActiveModelElement()) {
            HashMap<String, Object> data = new HashMap<>();
            data.put("modelElements", part.getActiveModelElements());
            broker.send("org/eclipse/app4mc/amalthea/editor/SELECT", data);
        }
    }
}
```
Benefits

Eclipse APP4MC Examples
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Eclipse APP4MC Examples

- Migration Framework
  - Small command line application
- Cloud Services
- Model Validation Framework
- Model Visualization Framework
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Command line application

- Create small Equinox “headless” application using Tycho
  - About 5MB
  - Folder structure
  - Native executable

- Create a small executable jar using bnd Maven plugins
  - About 4,5 MB
  - Single executable JAR

http://blog.vogella.com/2020/01/20/building-a-headless-rcp-application-with-tycho/
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APP4MC Cloud Services

- Create cloud services using OSGi specifications
  - HTTP Whiteboard
  - JAX-RS Whiteboard

- Extract APP4MC functions/services as services in a cloud infrastructure

- Chain APP4MC cloud services without an installed platform

Migration → Validation → Transformation → Simulation → Visualization

http://blog.vogella.com/2017/04/20/access osgi services via web interface/
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APP4MC - Validation Framework

► Flexible framework based on standard EMF validations

► Main concepts
  ► **Validation**
    implements validation(s) for a specific model class
  ► **Profile**
    allows grouping and (hierarchical) structuring of validations

► Details are specified with Java annotations
► Top level profiles are OSGi components
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APP4MC - Validation Framework

Validations

```java
@Validation(id = "AM-Basic-Quantity")
public class AMBasicQuantity implements IValidation {
    @Override
    public EPackage getEPackage() {
        return AnaltheaPackage.eINSTANCE;
    }
    @Override
    public EClassifier getEClassifier() {
        return AnaltheaPackage.eINSTANCE.getQuantity();
    }
    @Override
    public void validate(
        final EObject object,
        final List<ValidationDiagnostic> results)
    {
        if (object instanceof Quantity) {
            Quantity quantity = (Quantity) object;
            // <Add validation code here>
        }
    }
}
```

Profiles

```java
@ValidationGroup(
    severity = Severity.ERROR,
    validations = {
        AMBasicQuantity.class,
        AMBasicTimeRange.class
    }
)

@ValidationGroup(
    severity = Severity.WARNING,
    validations = {
        AMBasicCustomPropertyKey.class
    }
)

public class BasicProfile implements IProfile {
    // Do nothing
}

@Profile(
    name = "Analthea Standard Validations",
    description = "Standard validations for ANALTHEA models ..."
)

@ProfileGroup(
    profiles = {
        BasicProfile.class,
        HardwareProfile.class,
        SoftwareProfile.class,
        ...
    }
)

@Component
public class AnaltheaProfile implements IProfileConfiguration {
    // Do nothing
}
```
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APP4MC - Validation Framework Example

```java
@Component
public class AmaltheaProfile implements IProfileConfiguration {

@Profile(name = "Hardware Validations")
@ValidationGroup(
    severity = Severity.ERROR,
    validations = {
        AmaltheaStructure.class,
        AmaltheaPort.class,
        AmaltheaConnection.class,
        AmaltheaAccessPath.class,
        AmaltheaDefinition.class
    }
)

@Validation(id = "AM-HW-Connection",
    checks = {
        "HWConnections must refer to two HwPorts",
        "HWConnections must be linked to HwPorts of the same Interface"
    }
)
public class AmaltheaConnection extends AmaltheaValidation {
    @Override
    public [[Classifier getClassifier() {
        return @package.getHWConnection();
    }
]

    @Override
    public void validate(final Object object, final List<ValidationDiagnostic> results) {
        ...
    }

    @ValidationGroup
    @Profile(name = "Hardware Validations")
    public class AmaltheaPort implements IProfileConfiguration {
```

Hardware Validations

AM-HW-AccessPath
- HwAccessPath ranges and memory size must be consistent
- HwAccessPath elements must be consistent

AM-HW-Port-Definition
- PortType must be set
- PortInterface must be set

AM-HW-Connection
- HwConnections must refer to two HwPorts
- HwConnections must be linked to HwPorts of the same Interface

AM-HW-Port
- A HwPort can only have one (non internal) HwConnection

AM-HW-Structure
- Connections must only refer to contained HwPorts
- Inner connections always need one Initiator and one Responder HwPort
- Delegated connections always connect HwPorts of the same type

AM-HW-Definition
- Only one feature of a category can be referred

AM-HW-Module-Definition
- Memory definition must be set
- ProcessingUnit definition must be set
- ConnectionHandler definition must be set
- Cache definition must be set

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APP4MC - Visualization Framework Example

- Generic view part integrated in APP4MC
  - Consumes OSGi services of type `Visualization`
    \(\rightarrow\) Make it easy to contribute
  - Executes methods annotated with `@PostConstruct` via Eclipse 4 injection
    \(\rightarrow\) Make it easy to implement

```java
@Component(property= {
   "name=Runnable Visualization Demo",
   "description=Shows the runnable name (demo)"
})
public class RunnableDemo implements Visualization {

   @PostConstruct
   public void createVisualization(Runnable runnable, Composite parent) {
       Label label = new Label(parent, SWT.NONE);
       label.setText(runnable.getQualifiedName());
   }
}
```
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APP4MC - Visualization Framework Example

Complete code of a demo visualization component
Conclusion
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Conclusion

► Main achievements
  ▶ smaller code base
  ▶ reduced maintenance effort
  ▶ simplified contribution and adoption

► Advantages (of the proposed actions)
  ▶ independent steps
  ▶ can be applied gradually
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