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Open Research Webinars



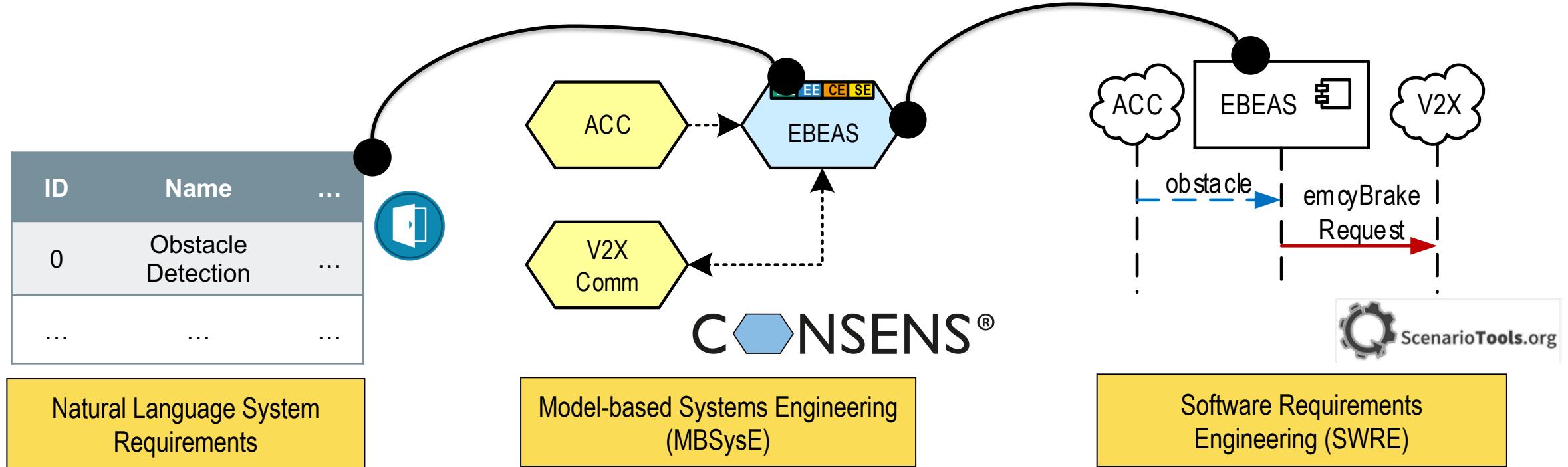
# Extensible Traceability Management with Eclipse Capra

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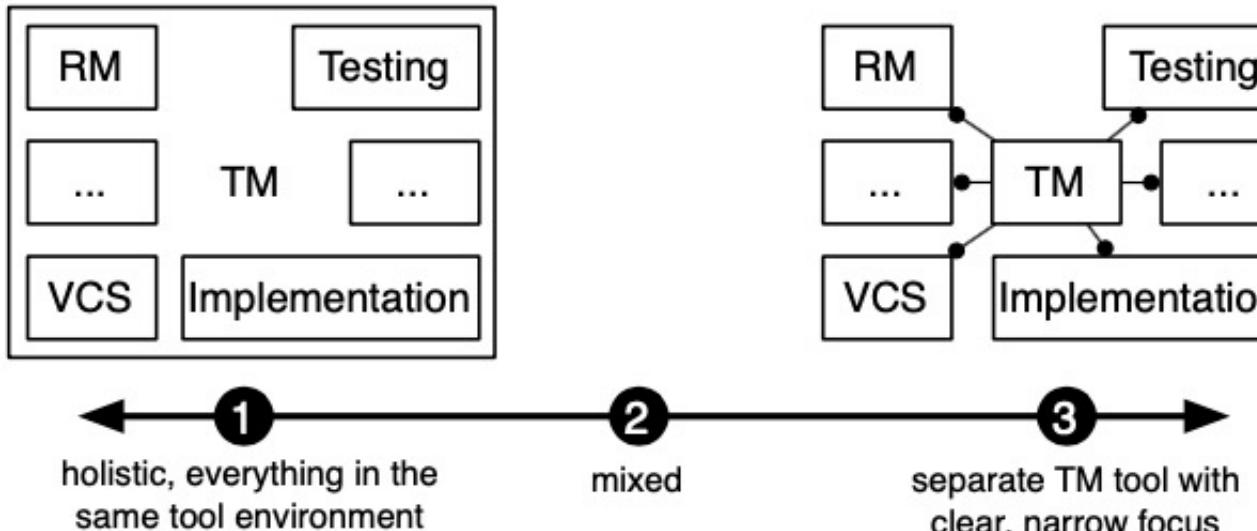


# Traceability



Example by David Schmelter, Fraunhofer IEM, Paderborn

# Tool Solutions



- Holistic solution: full control over all artifacts and trace models; simplifies maintenance; almost impossible to achieve in practice
- Separate TM tool: more effort in maintenance required, easier to extend, easier to use in existing heterogeneous environments



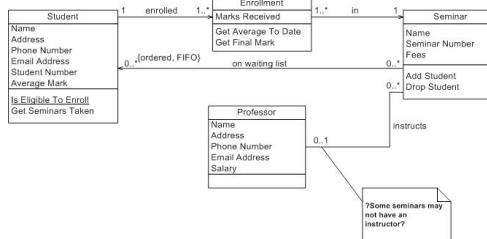
Salome Maro, Anthony Anjorin, Rebekka Wohlrab, Jan-Philipp Steghöfer:  
Traceability maintenance: factors and guidelines. ASE 2016: 414-425

# Eclipse Capra

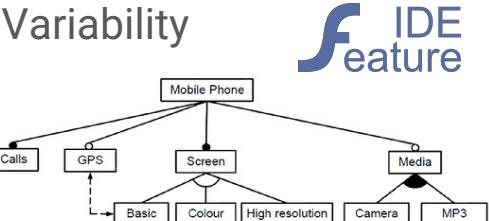
## Requirements



## Design



## Variability



## Source Code

```
public void setLocaleToCookie(HttpServletRequest request, String locale) {  
    cookieGenerator.addCookie(request, locale);  
}  
  
public String getLocaleFromCookie(HttpServletRequest request) {  
    Cookie cookie = WebUtils.getCookie(request, REQUEST_ATTRIBUTE_LANGUAGE);  
    return cookie != null ? cookie.getValue() : null;  
}  
  
@Override  
public void doInit() throws ServletException {  
    cookieGenerator.setCookieName(REQUEST_ATTRIBUTE_LANGUAGE);  
}
```



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## Tests

| All               | Grails Plugins            | S                 | W                | Job          | I | Last Success | Last Failure | Last Duration |  |
|-------------------|---------------------------|-------------------|------------------|--------------|---|--------------|--------------|---------------|--|
| 55 min (#10)      | grails-joda-time          | 55 min (#10)      | 7 hr 44 min (#8) | 36 sec       |   |              |              |               |  |
| 11 hr (#23)       | grails-selenium-rc        | 11 hr (#23)       | 23 hr (#18)      | 3 min 54 sec |   |              |              |               |  |
| 11 hr (#6)        | grails-session-temp-files | 11 hr (#6)        | 23 hr (#1)       | 23 sec       |   |              |              |               |  |
| 11 day 0 hr (#31) | grails-springcache        | 11 day 0 hr (#31) | 3 min 18 sec     |              |   |              |              |               |  |
| N/A               | grails-tellurium          | N/A               | 11 hr (#8)       | 2 min 16 sec |   |              |              |               |  |



Jenkins



Hudson



Heterogeneous systems

AMALTHEA Contents Tree

AMALTHEA\_Democar\_MappingExample\_with

This section enables the contents of this element

- ▶ Labels (71)
- ◀ Tasks (6)
  - ▶ Task\_PP3
  - ▶ Task\_PPO
  - ▶ Task\_PP2
  - ▶ Task\_PP4



# Eclipse Capra

- Driven by requirements from industrial partners in a number of research projects
- Only (known, active) universal open source traceability tool
- Goals:
  - Test-bed for new traceability approaches and ideas
  - Enable studies and research on traceability in practical settings
  - Industrial strength: should be usable in production

**11**  
Research  
Papers

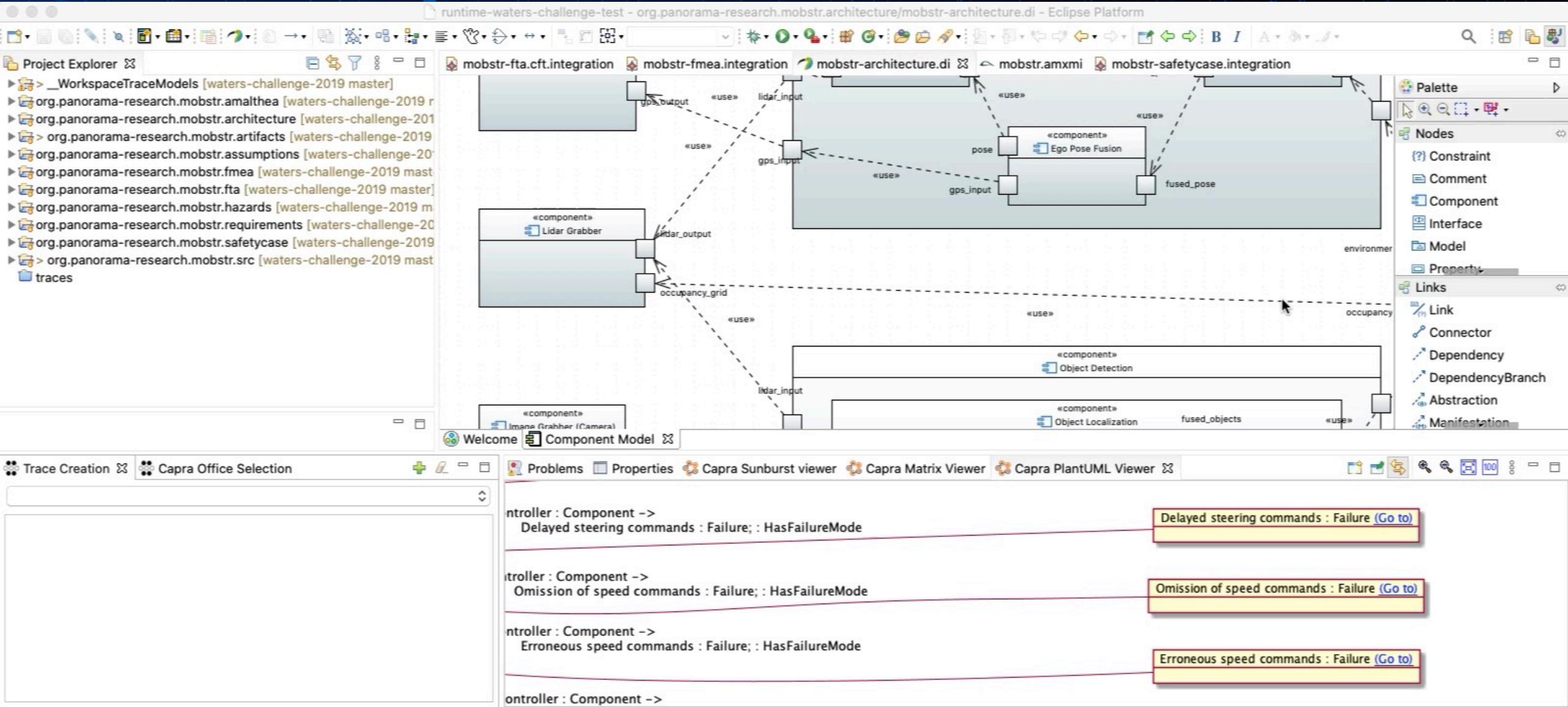
**15**  
Thesis  
Projects

**5**  
Research  
Projects

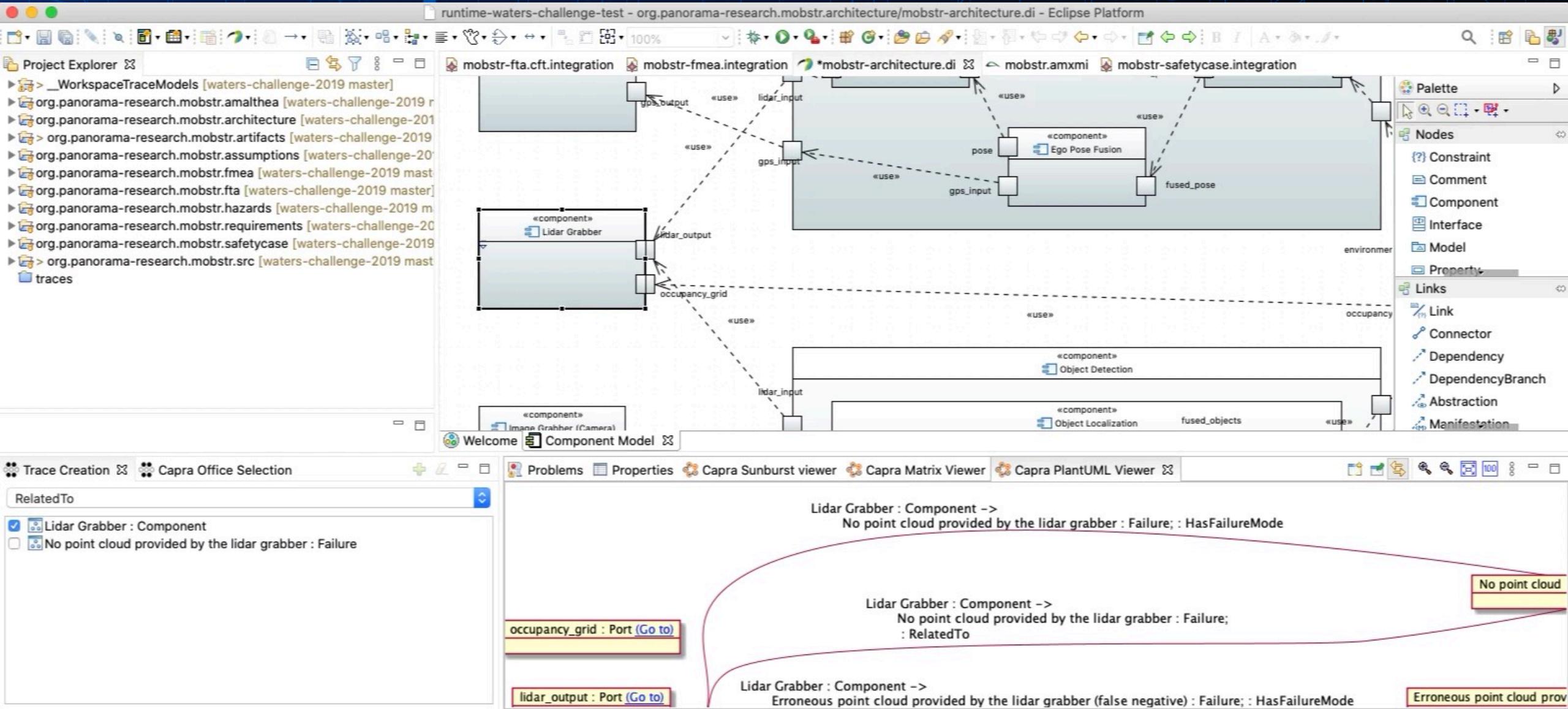


# Performing common traceability tasks with Eclipse Capra

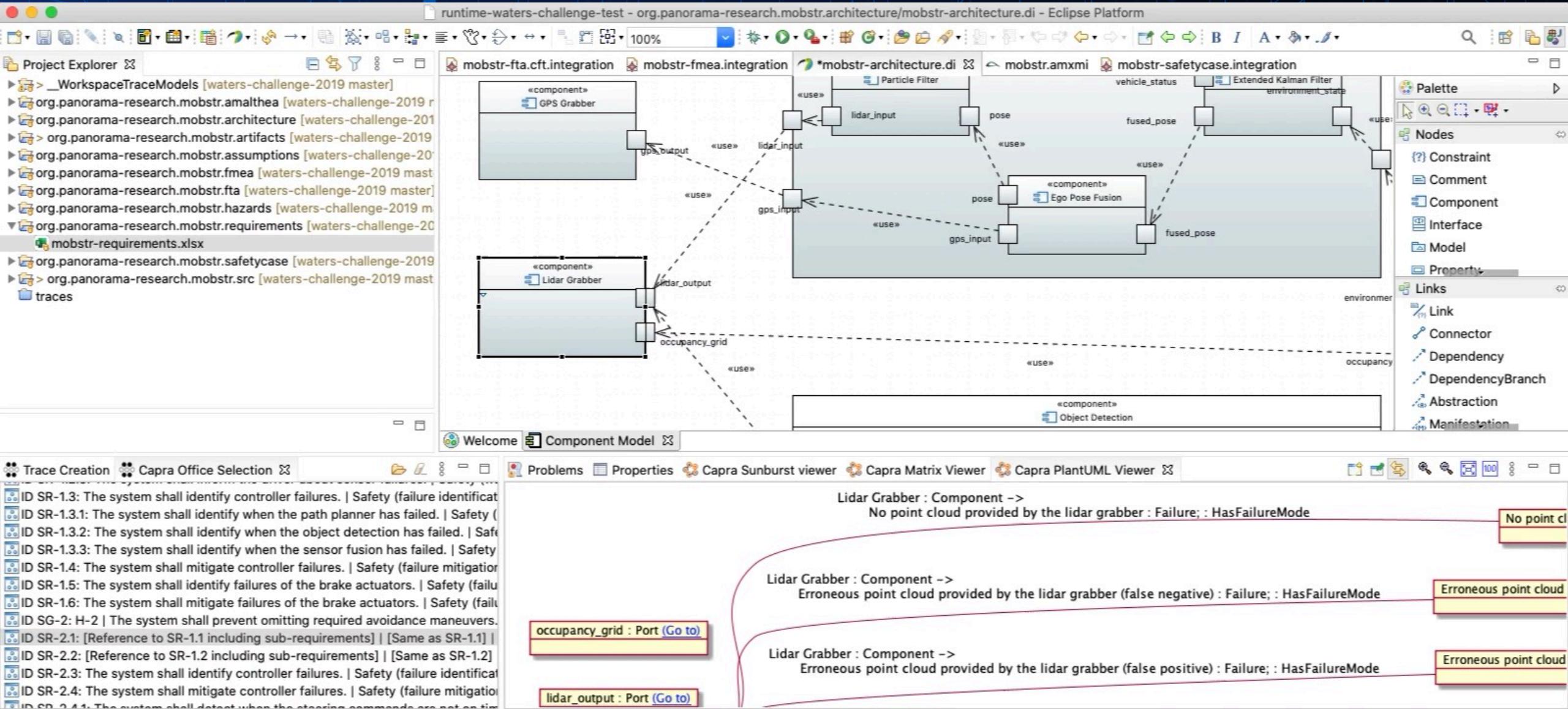
# Create trace links



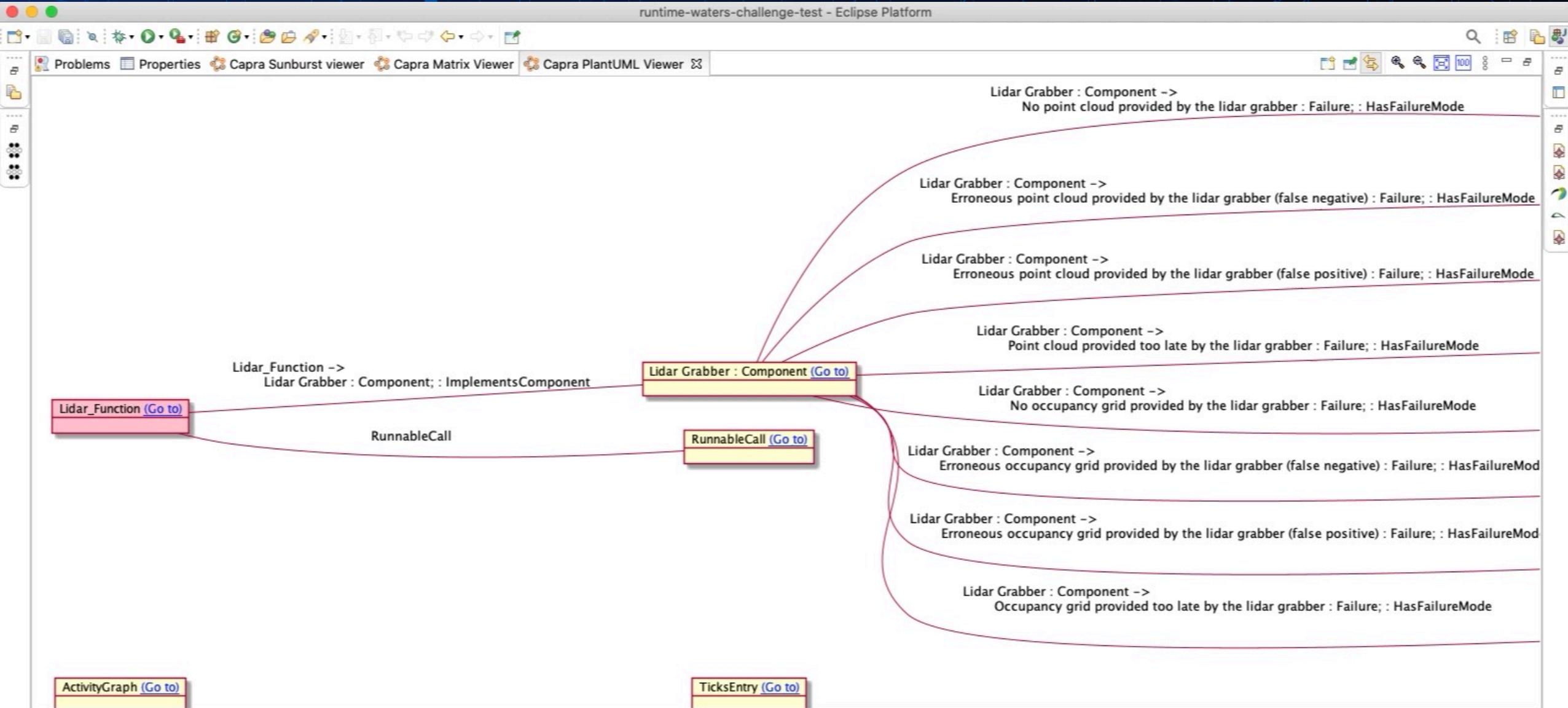
# Delete trace links



# Change Impact Analysis



# Coverage Analysis



# Extending Eclipse Capra

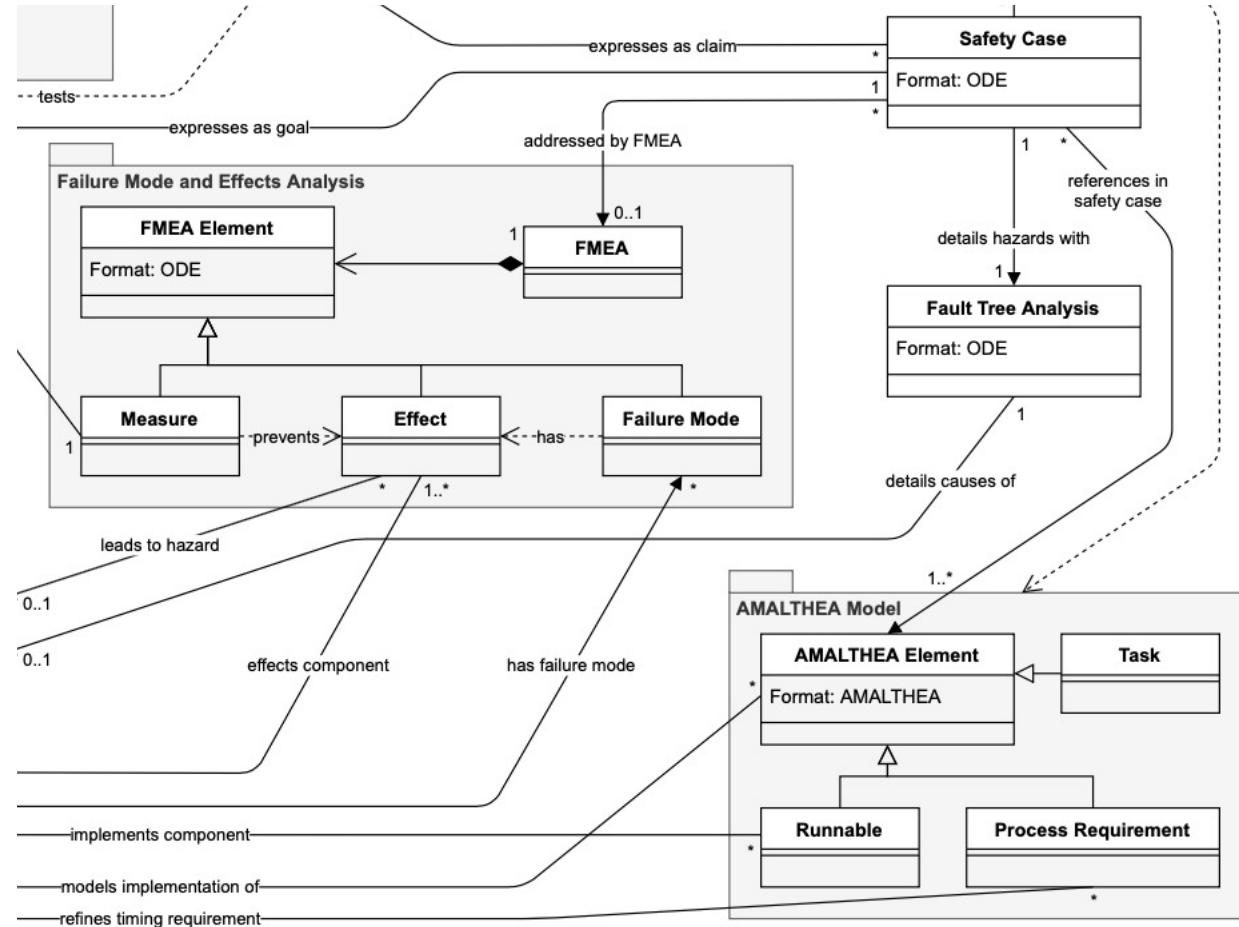
# Defining a custom TIM

```
/*
 * Links Safety Case to FMEA
 */
class AddressedByFMEA extends DirectedTraceLink {
    refers Element [1] source // Safety Case
    refers FMEA [1] target // FMEA
}

/*
 * Links Safety Case to Amalthea Element
 */
class ReferencesInEvidences extends DirectedTraceLink {
    refers Element [1] source // Element -- Safety Case
    refers INamed [1..*] target // Amalthea Element
}

/*
 * Links the Fault Tree Analysis to a Hazard
 */
class DetailsCausesOf extends DirectedTraceLink {
    refers Element [1] source // Element -- Fault Tree Analysis
    refers Element [1..*] target // Element -- Hazard
}

/*
 * Links the Safety Case to the Fault Tree Analysis
 */
class DetailsHazardWith extends DirectedTraceLink {
    refers Element [1] source // Element -- Safety Case
    refers Element [1] target // Element -- Fault Tree Analysis
}
```



# Handlers for non-EMF artifacts

```
public class CDTHandler extends AbstractArtifactHandler<ICElement> implements IAnnotateArtifact {

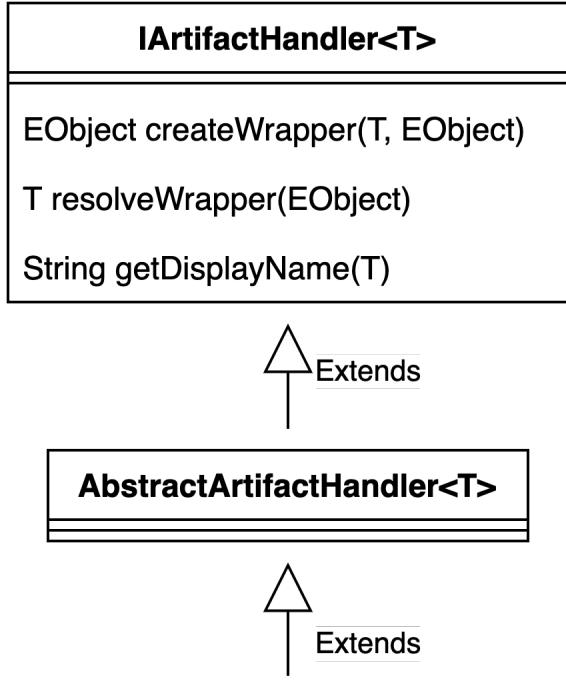
    @Override
    public EObject createWrapper(ICElement element, EObject artifactModel) {
        ICompositeType type = (ICompositeType) element.getParent().getAncestor(ICElement.C_CLASS);
        if (type == null)
            type = (ICompositeType) element.getParent().getAncestor(ICElement.C_STRUCT);
        if (type == null)
            type = (ICompositeType) element.getParent().getAncestor(ICElement.C_UNION);

        String typePrefix = type == null ? "" : type.getName() + "/";
        String uri = new UriBuilder().setScheme("platform").setPath("/resource" + element.getPath())
            .setFragment(typePrefix + element.getElementName()).toString();

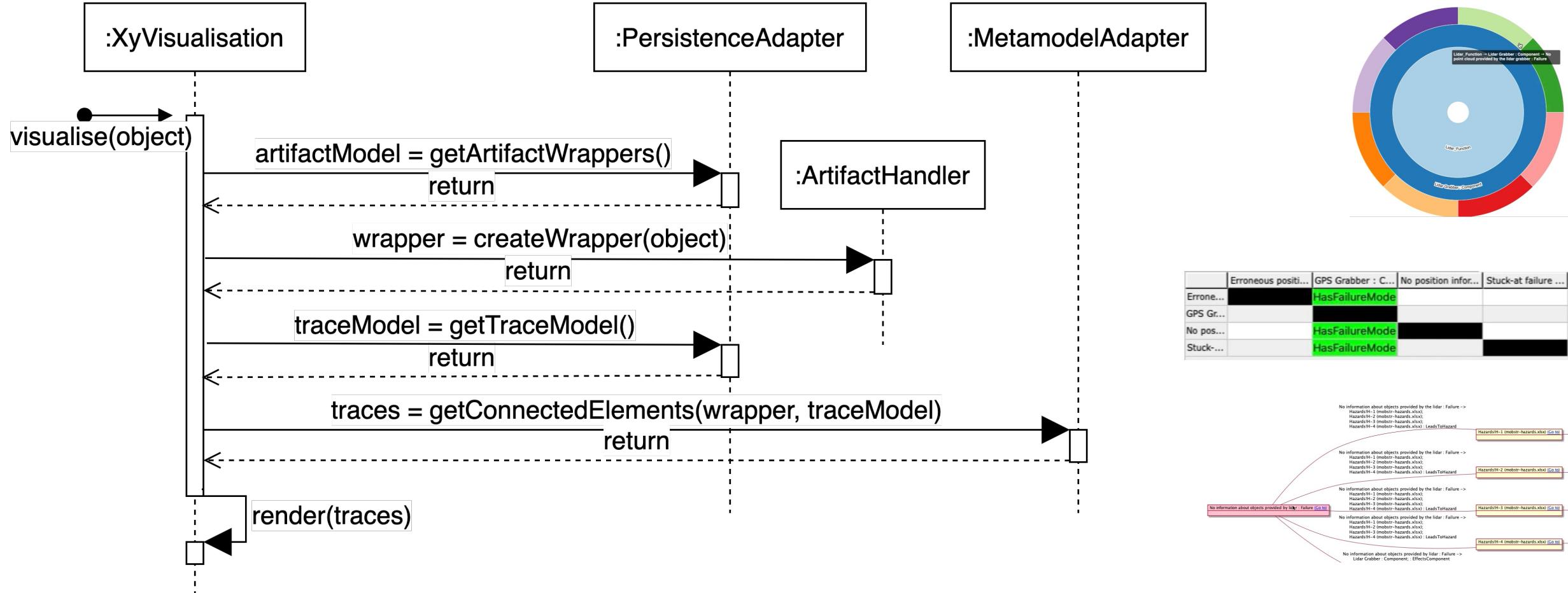
        ArtifactMetaModelAdapter adapter = ExtensionPointHelper.getArtifactWrapperMetaModelAdapter().orElseThrow();
        return adapter.createArtifact(artifactModel, this.getClass().getName(), uri, element.getHandleIdentifier(),
            element.getElementName(), element.getPath().toString());
    }

    @Override
    public ICElement resolveWrapper(EObject wrapper) {
        ArtifactMetaModelAdapter adapter = ExtensionPointHelper.getArtifactWrapperMetaModelAdapter().orElseThrow();
        return CoreModel.create(adapter.getArtifactIdentifier(wrapper));
    }

    @Override
    public String getDisplayName(ICElement element) {
        return element.getElementName();
    }
}
```



# Additional visualisations/analysis



# Eclipse Capra – Traceability management for the Eclipse platform

- Extensible and flexible – easy to adapt to your own needs
- Completely open source
- Compatible with many common artifacts out of the box
- Driven by research – driving research
- We are looking for additional committers!
- <https://eclipse.org/capra>

