..so strange to call this planet Earth, when it is so clearly Ocean.

Arthur C. Clarke

Marine Simulations on Eclipse RCP

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Presentation outline

• Introduction and background
• Demonstration
• Technical aspects and experiences
• Q&A

Development of software tools at MARINTEK

MARINTEK

SINTEF
What is SIMA?

A powerful tool for modelling and analysing scenarios within the field of marine technology.

Purpose of SIMA

Beginners:
A tool to shorten the time to become proficient in modelling and analysis

Experts:
A tool to shorten the time from project initiation to conclusion
SIMA Philosophy

- 3D graphical representation of objects as they are being modelled
- Instant validations of all changes done to a model
- Feed input files to physics engines (numerical modules)
- Run analysis
- Post process analysis results
- Generate reports

SIMA - Simulation Workbench for Marine Applications

**Simulation of marine operations**
**Simulation of offshore wind turbines**
...  
SIMA workbench (Java, Eclipse, Hoops3D, ...)

**SIMO**  **RIFLEX**  **...**

Numerical software
SIMA – an important tool for the industry

Active use of simulation technology in development projects has proven to be a great success

- Communication
  - Partners
  - Media
- Familiarization
  - Project team
  - Contractors
- Design and construction
  - Verification and validation (specialist analysis)
  - Interface meetings with contractors
  - Company representative on board construction vessels

Gangway between Floatel and Platform
Connecting the gangway - The offshore operation

SIMA – From the user’s perspective
The old user interface
Formula Editor

The formula editor offers users to enter formulas as a full-featured representation. It supports syntax coloring and context assist.

A new formula to try out

Open up a formula editor and paste the following expression to see how the editor interacts:

\[ R(t) = \left( \frac{A \cdot e^t}{2} \right) \left( \frac{B}{2} \right) \]
The SIMA RCP application

- SIMA is for the most part based on Eclipse technologies.
  - HOOPS 3D is used for visualization.
  - UI-Bindings is used to generate a user interface from the data model.

SIMA

- Mylyn Docs
- HOOPS 3D
- Graphiti
- MathJax
- Apache
- UI-Bindings
- GMF
- Rich Client Platform
- Eclipse Modeling Framework
- Draw2D
- Eclipse Platform
## Report generator

- Based on Mylyn Docs.
- Text is written in wiki markup.
- LaTeX formula editor with syntax colouring and content assist.
- Generates Word files with the help of Docx4j.
- Proper support for formulas, tables and charts.
- Planned extensions for handling cross references, scripting etc.

![Formula editor and resulting equation as show in Microsoft Word Document.](image)

## Diagram editor

- Based on Graphiti.
- “Everything” is EMF in SIMA, including diagram and its graphical representation.

![Diagram editor](image)
Plotting

• We use a modified version of SWT XYGraph (now part of Eclipse Nebula).
• Works just fine but we had to do a few adjustments.
  – Scientific number formatting.
  – Able to handle several hundred thousand samples.
  – A little bit of API tweaking.
• We would like to contribute our changes!

The SIMA plot view using SWT XYGraph

Installation as MSI: WiX

• Customer with enterprise IT department requires
  • MSI
  • Installation of required and optional modules (Visual C++ runtime & DirectX)
• We have good experience with the (non-Eclipse) open source “WiX”
• RCP-app: Working- and configuration-directory NOT in the install-path!
We persist the CommandStack

- As you know: CommandStack executes "Command"s (on an EditingDomain) to manipulate data in the EMF model, allowing the users to undo and redo.
- It would be a Good Thing™ for our users to be able to undo actions taken earlier, in another session, even if SIMA have been restarted and/or another workspace has been worked on in the mean time.

Persist the CommandStack: Help from the newsgroup

- The people are very friendly and helpful!
- Of course it helps, when asking a question on the list:
  - to have a concrete and informative subject
  - To state what you have tried yourself
  - to prove that you have read all relevant documentation
  - to prove that you have done all searching for answers in old conversations
How we persist the CommandStack

- Many Command-classes have been subclassed to enable conversion from EObjects to commands, as if they had been executed.
- Very smart that ‘private’ is sparsely used, ‘protected’ has simplified our work MUCH

```java
// Read private field
field = removeCommandField;
try {
    removeCommandField = SetCommand.class.getDeclaredField("removeCommand");
    removeCommandField.setAccessible(true);
    removeCommand = (Command) removeCommandField.get(setCommand);
} catch (SecurityException | NoSuchFieldException | IllegalArgumentException | IllegalAccessException e) {
    throw new RuntimeException("Could not convert SetCommand (read its private field removeCommand)", e);
}
```

3D Graphics

- Many EMF-objects have a 3D visualisation
- Each time e.g. the position changes, the 3D image is updated

Examples:
- Listen to a BodyPoints x,y,z values:
  ```java
  create(bodyPoint, 
  \[
  \text{[x,y,z]}
  \]
  ```
- Listen to all values in bodypoint
  ```java
  create(bodyPoint, 
  \[
  *\]
  ```
- Listen to the winch feature in bodypoint
  ```java
  create(bodypoint, "winch")
  ```
- Append several notifiers with "|
  ```java
  create(coupling, "endPoint1.[x,y,z]|endPoint2.[x,y,z]")
  ```
Using “HOOPS Visualize” for 3D graphics

- The good:
  - Multi-platform
  - Java API
  - Fast rendering
  - Support
- The bad:
  - Closed source (hard to get new features, and to fix bugs)
  - Buggy (used to be)
  - ‘Java API’ is a C++ API wrapped
- The alternatives?
  - Arbor3D
  - jMonkeyEngine
  - Aviatrix3D
  - (Do not use a thin layer on top of e.g. OpenGL, such as LWJGL)

Experimenting with Oculus Rift

- What would it look like, seen from the oil rig, or from the gangway bridge?
- SWIG is very convenient technology for wrapping a C++ API to Java. [http://swig.org](http://swig.org)
- We need a change in HOOPS to make this work nicely. With Eclipse we are used to making the changes ourselves if we need a new feature. With proprietary code HOOPS, this is a showstopper.
- Open source ☺
- Closed source ☹
Oculus Rift integration

- Head-tracking: OK
- Split-screen: OK
- Low-latency: Well...
- Barrel distortion: Uh...

Thank you for your attention!

Questions?