



COMPSCI 230

Software Design and Construction

GUI Frameworks

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- Originally from Berlin, Germany
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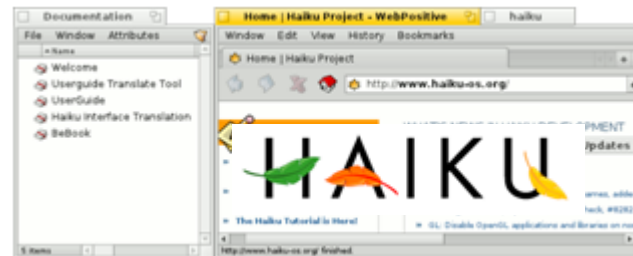
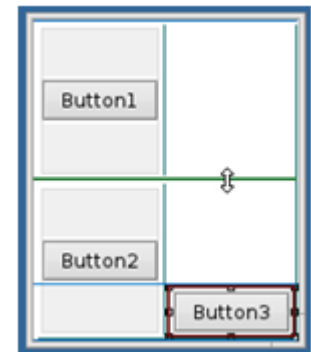
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- If you have questions, come to my office or email me :-)



Frameworks



Framework

Generic software platform for a certain type of applications

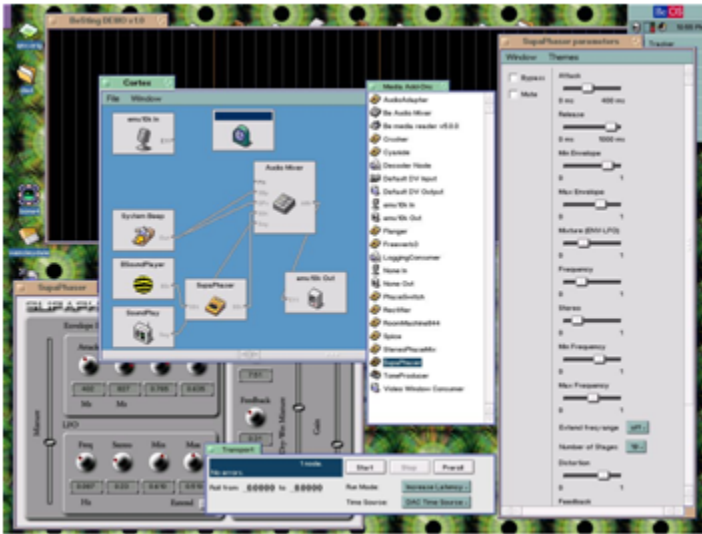
- Consists of **parts** that are found in many apps of that type
 - **Libraries** with APIs (classes with methods etc.)
 - Ready-made extensible programs ("**engines**")
 - Sometimes also **tools**
(e.g. for development, configuration, content)
- Often evolved by developing many apps of that type and **reusing code** more and more



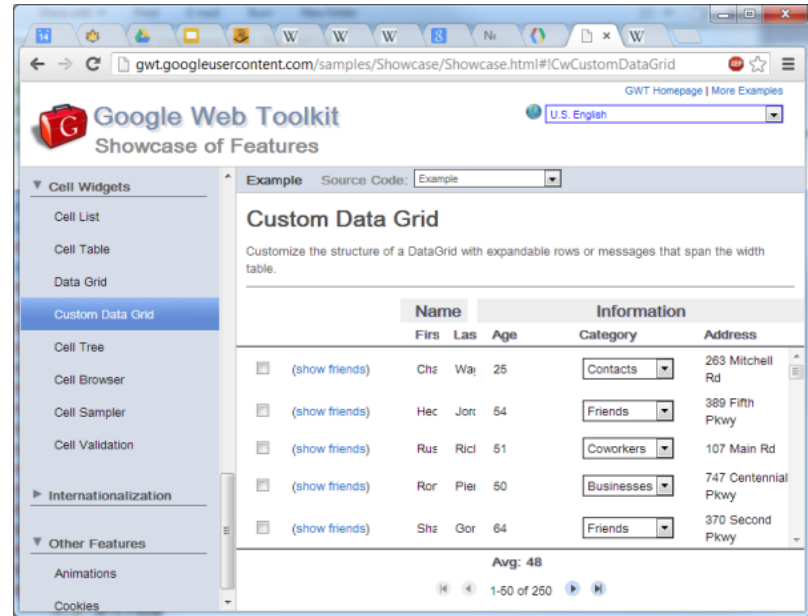
Characteristics:

- **Reusable**: the parts can be used for many apps of that type
- **Extensible**: developers can add their own app-specific code
- **Inversion of Control**: framework often calls your code

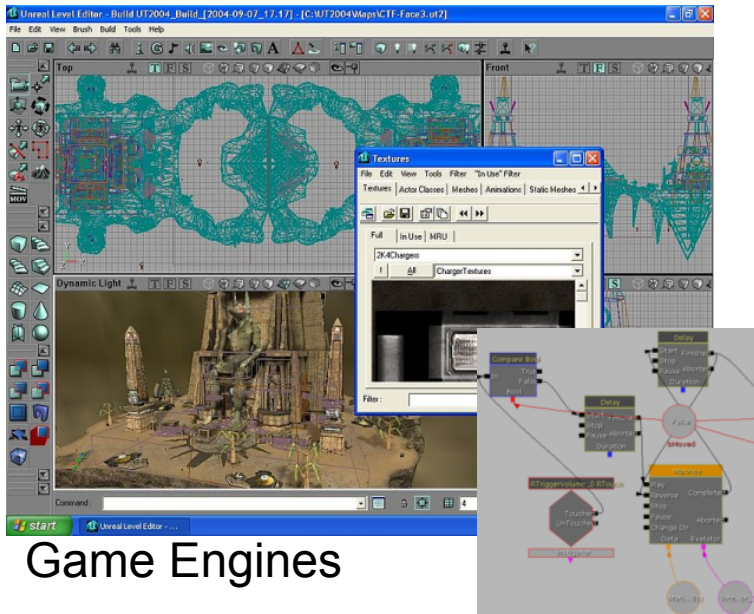
Framework Examples



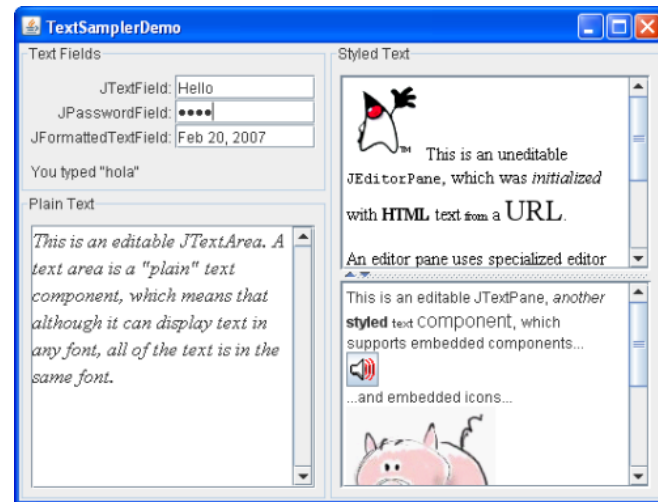
Multimedia Frameworks



Web Application Frameworks



Game Engines



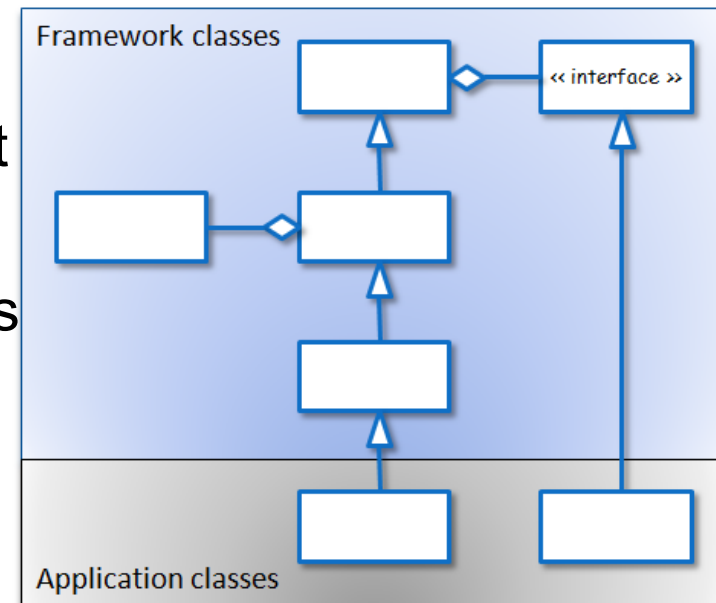
GUI Toolkits

Extensibility

All frameworks can be extended to cater for app-specific functionality.

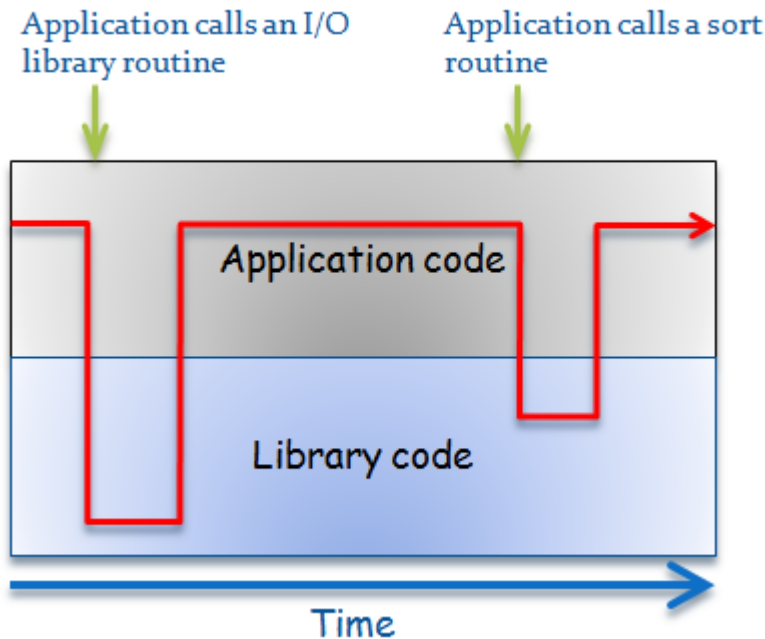
Common ways to extend a framework:

- **Scripting:** special programming language directly supported by the framework (e.g. JavaScript)
- **Plug-ins:** framework can load certain extra code in a specific format
- **Within the framework language:**
 - Subclassing & overriding methods
 - Implementing interfaces
 - Registering event handlers



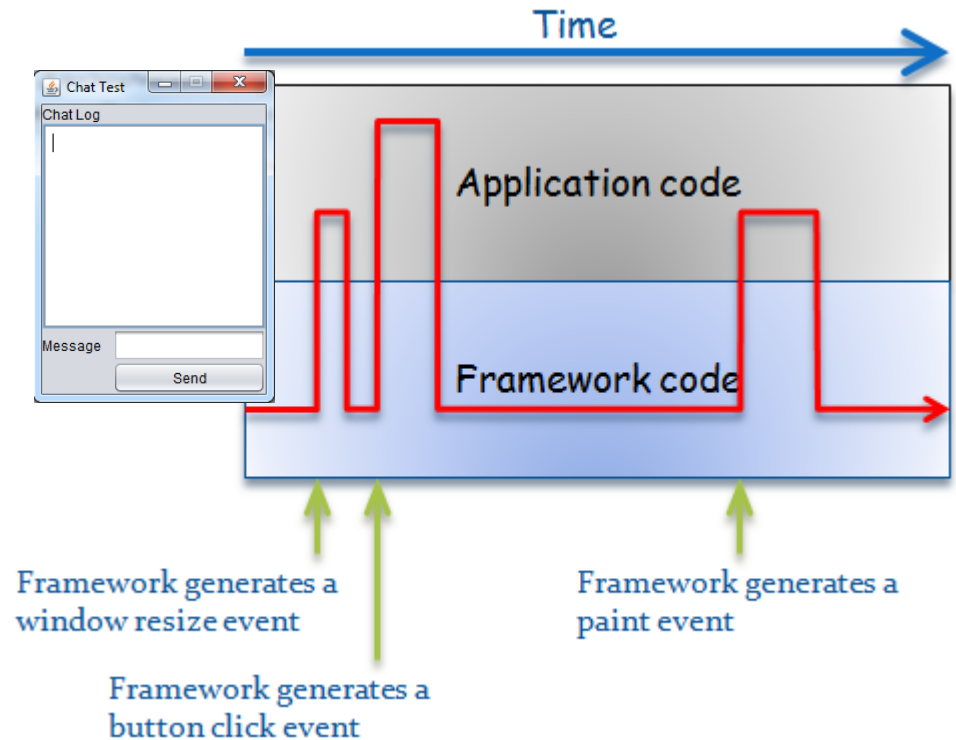
Inversion of Control

Traditional Program Execution



The app has control over the execution flow, calling library code when it needs to.

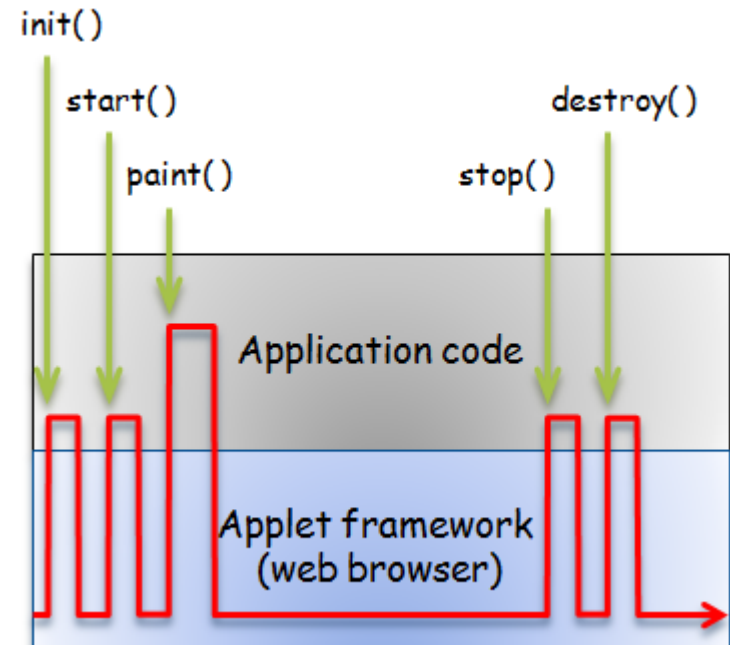
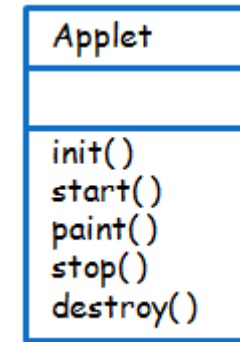
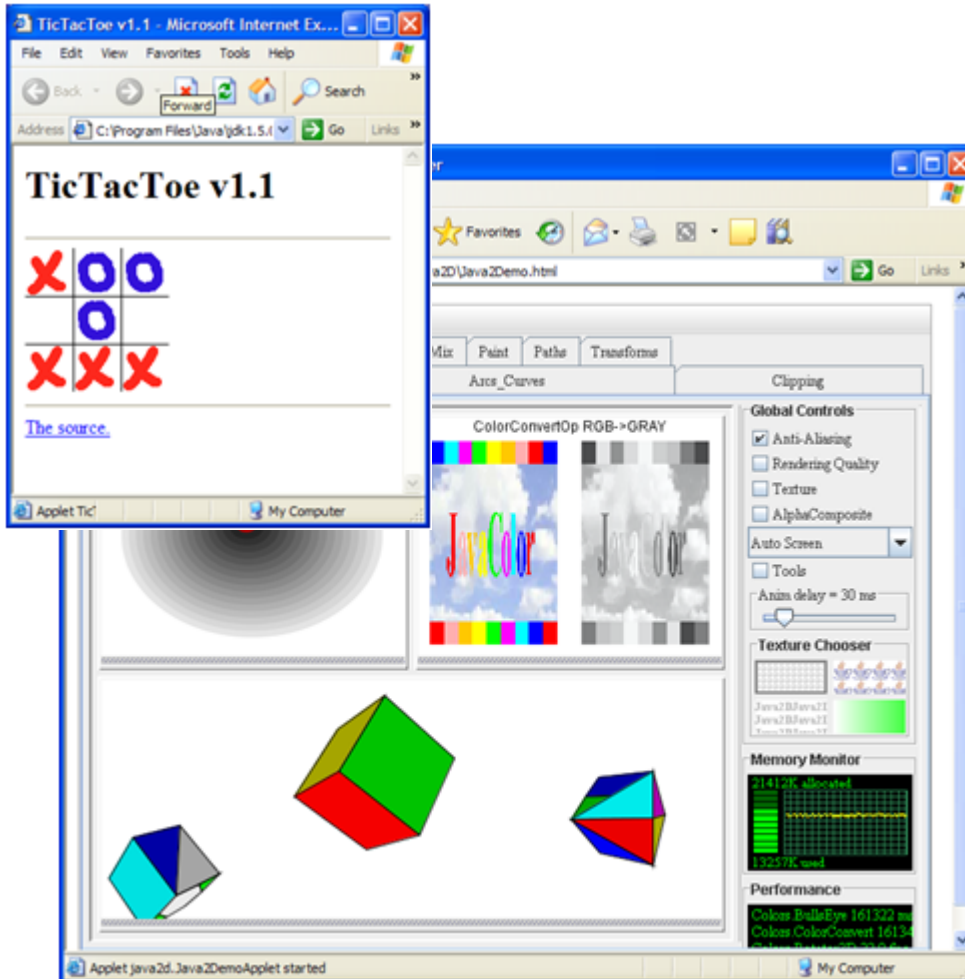
Inversion of Control



The framework has control over the execution flow, calling app code for app-specific behavior.

Inversion of Control

Example: Java Applets



Should I Use A Framework?

Advantages

- **Reuse** can save cost and time
- Higher level of **abstraction**
 - Less low-level work
 - Easier to understand
(if the framework has a good API)
- Reduced **maintenance** cost
(if the framework is maintained by someone else)



Disadvantages

- Can lead to code **bloat**
 - Framework may contain lots of unused code
 - May need to use several frameworks
- Cost of **learning** a framework (needs to be amortised by reuse)
- **Licensing** cost (for commercial frameworks)
- Risk of **vendor lock-in**



Summary



Frameworks are platforms for certain apps

- Contain common, **reusable parts**
- **Extensible** with scripting, plug-ins, inheritance etc.
- Use **Inversion of Control**
- Using a framework typically saves a lot of work in the long run
- But you should select the frameworks you use carefully (initial investment of learning, licensing costs, risks)

Quizz



1. Describe three common characteristics of a framework.
2. Give an example of inversion of control.
3. Describe an advantage and a possible disadvantage of using a framework, using a game engine as an example.

