# Ontwerp van SoftwareSystemen

## 7 On Multi-user Development Tools,Versioning and Packaging of code, their Relations, the Universe and Everything.

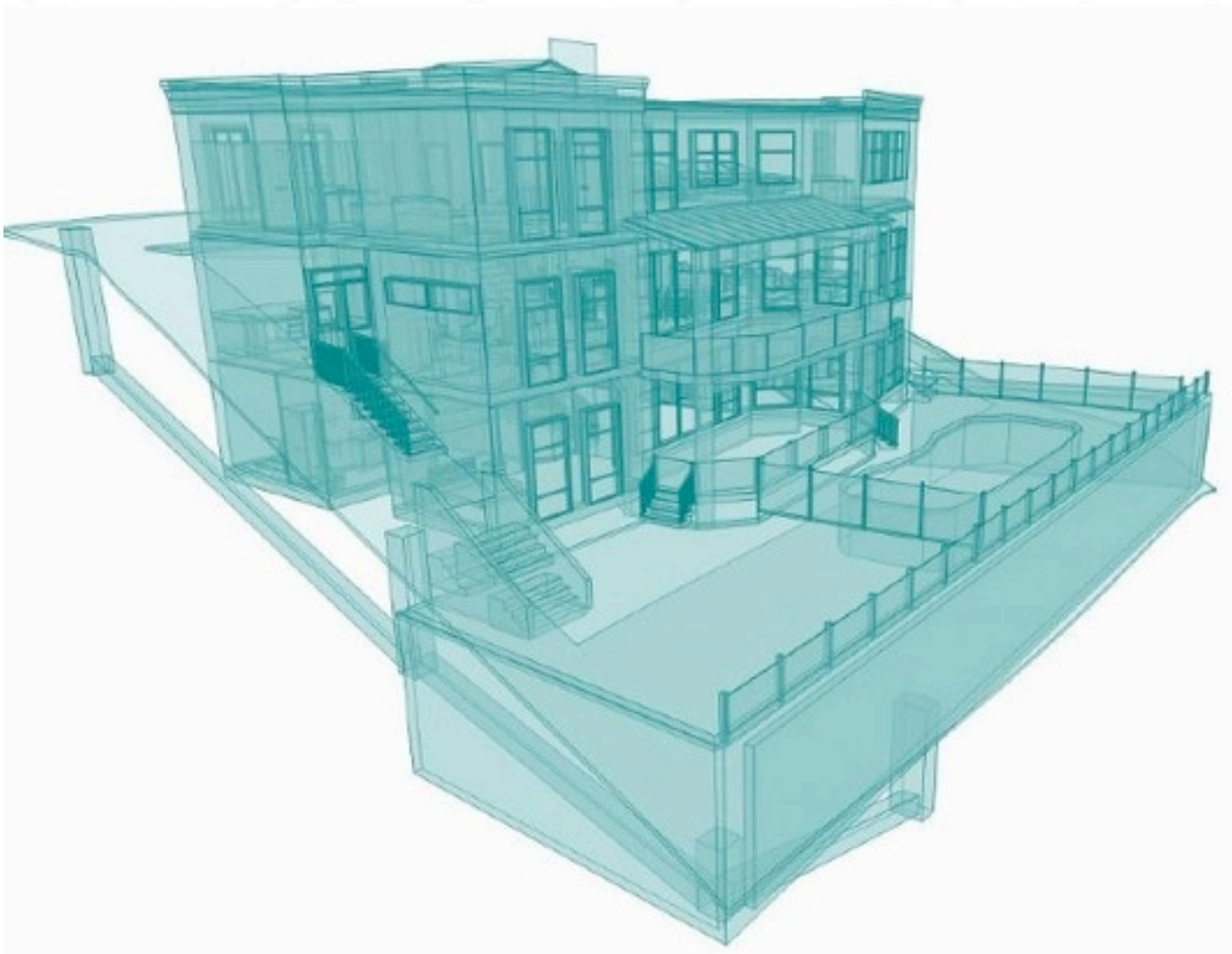
Roel Wuyts

OSS 2012-2013

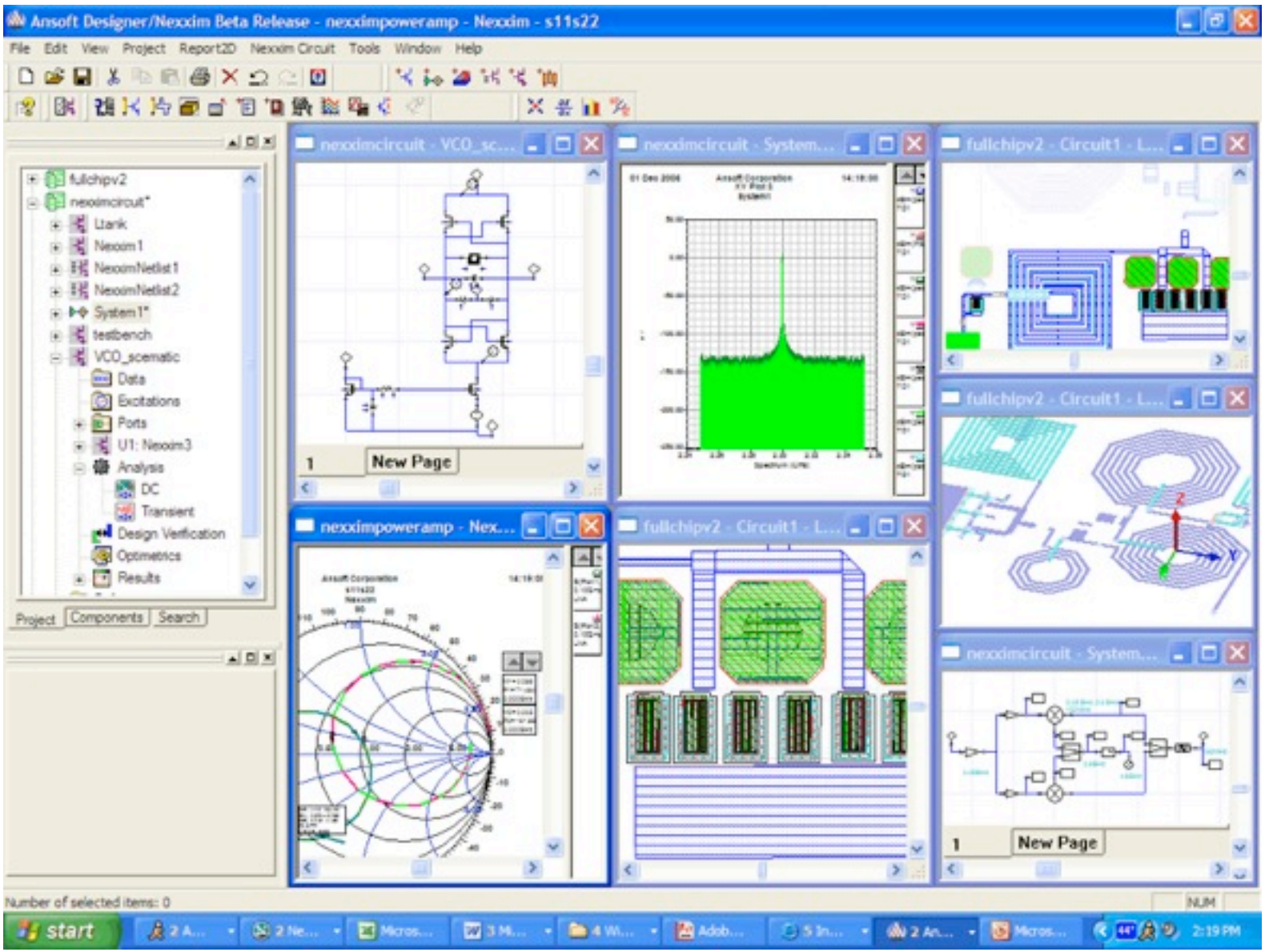
# Developing Complex Systems

- How do scientific disciplines construct complex systems ?

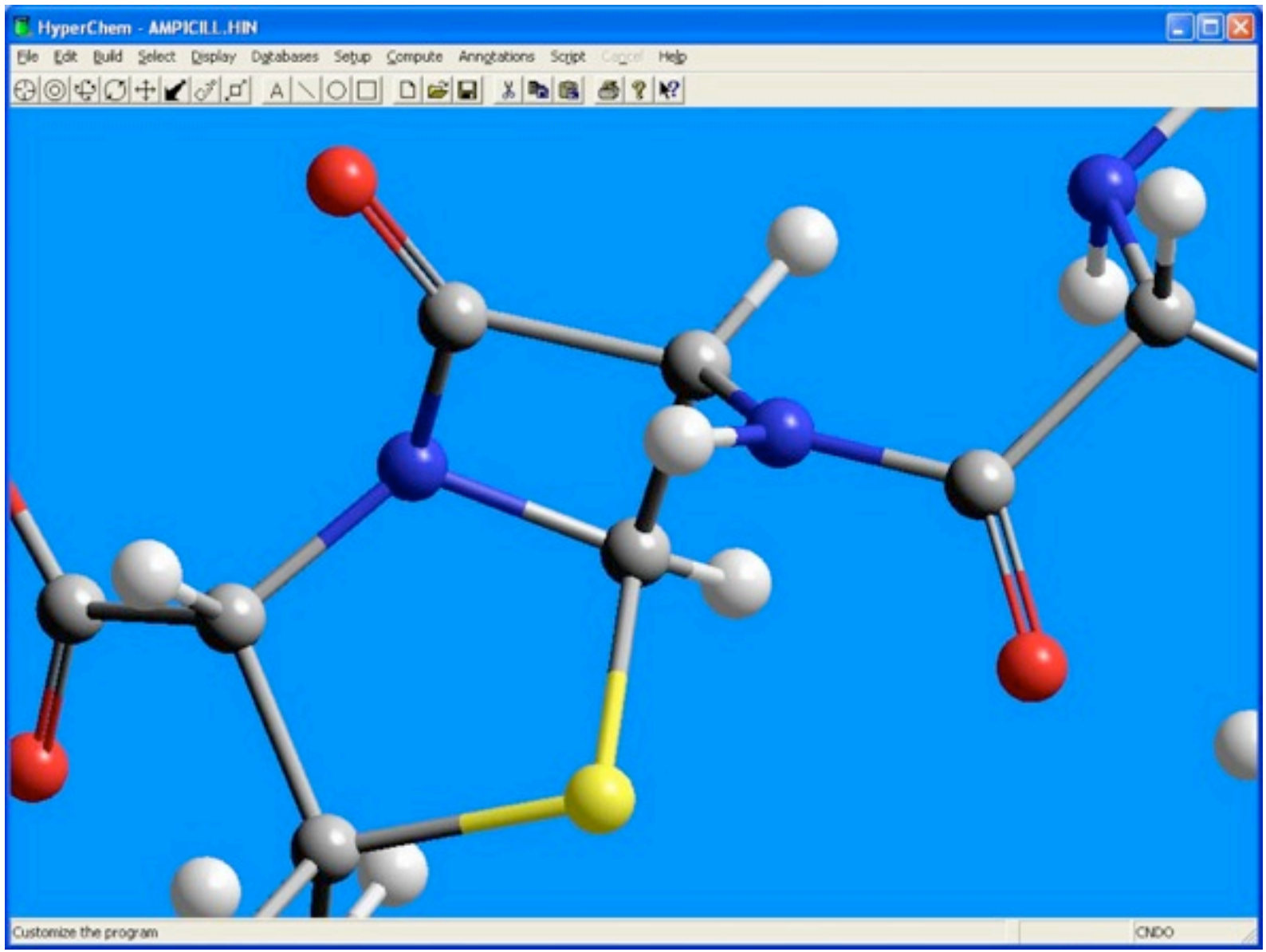
# Architectural Software



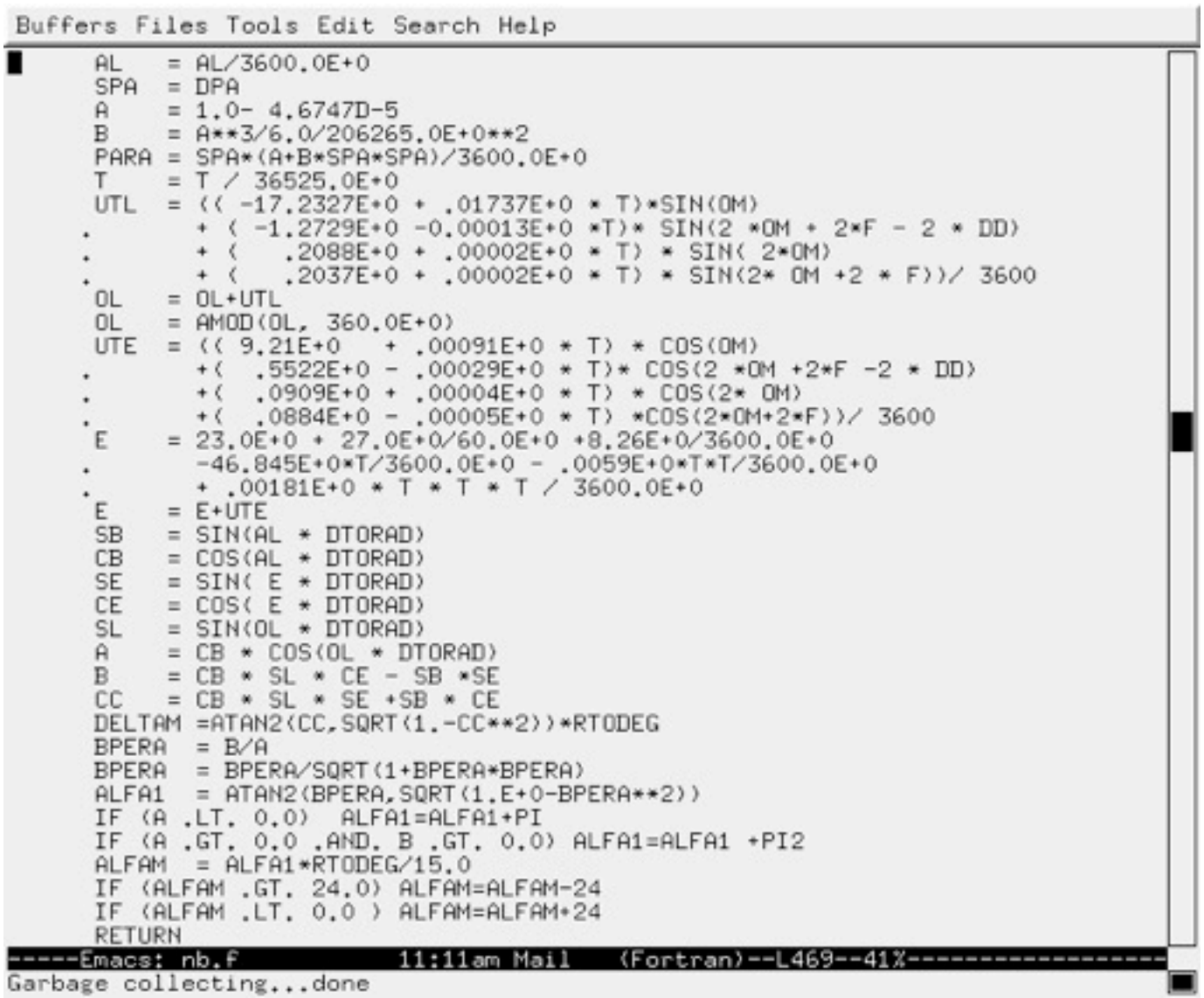
# RF/mW Design & Analog/RFIC Verification



# Visualization & Manipulation of molecules



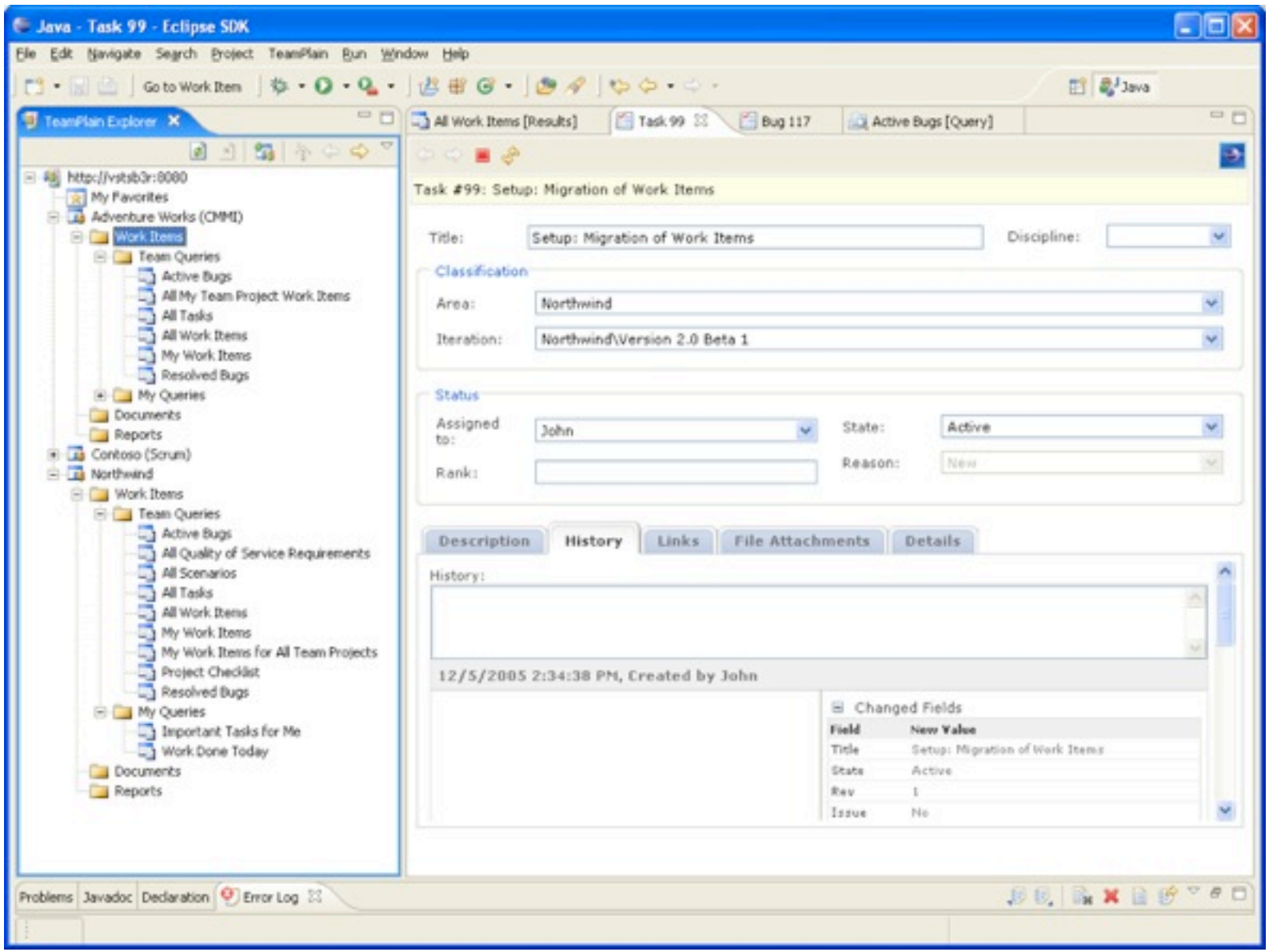
# Computer Science



# Corollary

- We need to construct systems that are typically more complex than in other disciplines
  - for several reasons
- We have tangible elements to manipulate
  - Buildings, circuits and molecules *need* a representation that is different than their physical one
- Yet lots of developers still seem to prefer basic tools
  - yes, emacs is a basic tool...

# Eclipse ?


Java - Task 99 - Eclipse SDK
File Edit Navigate Search Project TeamPlain Run Window Help
Go to Work Item
Java
TeamPlain Explorer
http://vstsb3r:8080
My Favorites
Adventure Works (CMMI)
Work Items
Team Queries
Active Bugs
All My Team Project Work Items
All Tasks
All Work Items
My Work Items
Resolved Bugs
My Queries
Documents
Reports
Contoso (Scrum)
Northwind
Work Items
Team Queries
Active Bugs
All Quality of Service Requirements
All Scenarios
All Tasks
All Work Items
My Work Items
My Work Items for All Team Projects
Project Checklist
Resolved Bugs
My Queries
Important Tasks for Me
Work Done Today
Documents
Reports
All Work Items [Results]
Task 99
Bug 117
Active Bugs [Query]
Task #99: Setup: Migration of Work Items
Title:
Setup: Migration of Work Items
Discipline:
Classification
Area:
Northwind
Iteration:
Northwind\Version 2.0 Beta 1
Status
Assigned to:
John
State:
Active
Rank:
Reason:
New
Description
History
Links
File Attachments
Details
History:
12/5/2005 2:34:38 PM, Created by John
Changed Fields
Field
New Value
Title
Setup: Migration of Work Items
State
Active
Rev
1
Issue
No
Problems
Javadoc
Declaration
Error Log

# Eclipse...

- Eclipse is a decent integrated development environment
  - integrates navigation, editing, unit tests, refactoring, ...
  - was developed by a lot of former Smalltalk people :-)
- But at its core it is file-based
  - So ? Why don’t I like this ?

# Files versus Objects

- Non computer science disciplines:
  - Architects work with construction materials&buildings
    - So do their tools
  - Molecular biologists work with modules
    - Environment manipulates molecules
  - ...
- We work with objects
  - Most tools deal with files ?!

# Smalltalk image approach

- The Smalltalk image is a live environment
  - consists entirely of objects
  - objects are manipulated
- Files are one way of *storing* objects
  - code too, since code are objects
  - Databases are another mechanism, or network sockets or ...

# Sidenote on Environments

- Good developers tailor their environment
  - So they need to be easily extensible
    - emacs: easy
    - Smalltalk environments: easy
    - Eclipse: possible
    - Most environments: hard or not possible
- Always favor an extensible one
  - control your tools!

# Multi-user Development

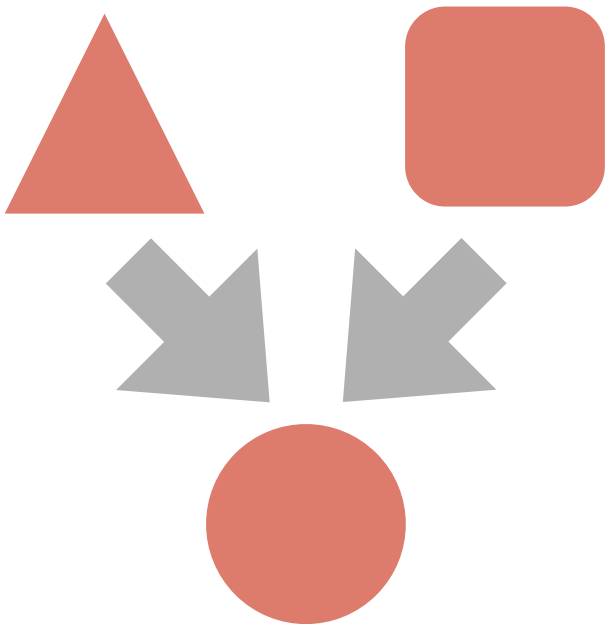
- Needed
  - a code repository that allows multiple users
  - integrated versioning
  - configuration management
- The language also has packaging mechanisms
  - with or without namespaces
- These concepts cross-cut

# Code repositories and multiple users

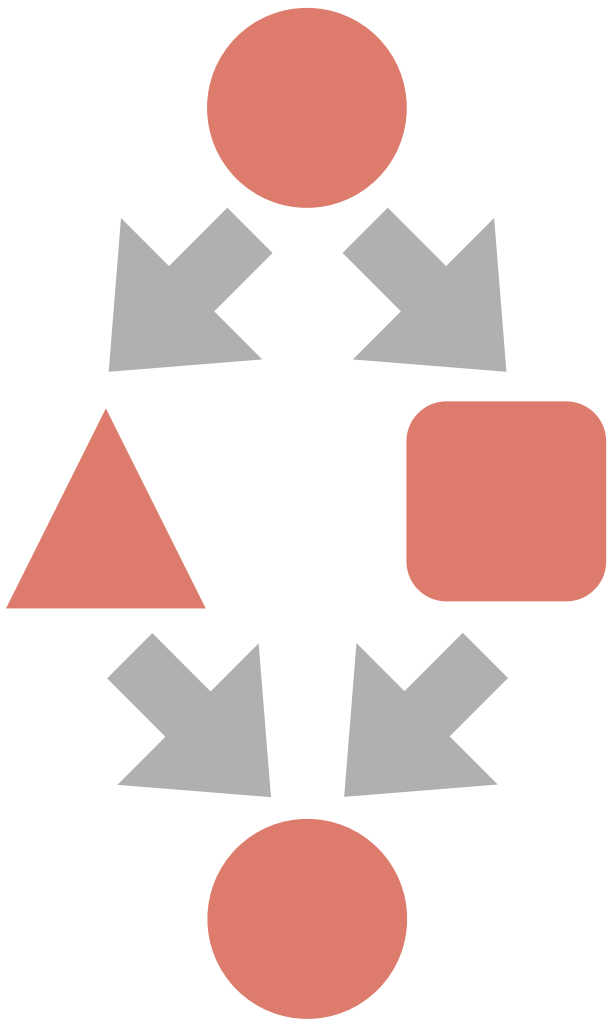
- Need to store code (obviously)
  - but preferable also binairies, documentation, tests, ...
- Locking vs. concurrent
  - Lock: one user has (part of) code, unlocks when done
  - Concurrent (lazy locking): several users can work simultaneously on the same system
- Support for merging

# Merges

- Two-way merge



- Three-way merge



# Example

- One framework,
- instantiated for two different clients,
- each with their own customizations,
- Where there is a stable version,
- and two development branches
  - a new version and a brand new one
  - one dependent on the customization of the framework for one particular client

# Common Concepts

- Repository: holds data
- Local copy/working copy
- Change or Delta: a modification to the data

- Load or Check out: create local copy from repository
- Commit or Publish: copy changes to repository

# Version Control Concepts

- Edition: copy of data of the repository
- Version: frozen edition, identified by name/number

# Let’s view two systems

- cvs
- Envy

(Many more exist, but cvs is archetypical for most popular tools, and Envy is a nice contrast)

# cvs : Concurrent Versioning System

- Granularity: file
- Users work detached:
  - Load local copy of files from cvs server (*repository*)
  - Work on local copy (*working directory*)
  - Commit changed files back to server
- Loading local copy can be done from the network
  - using secure shell or not

# Conflicts

- Multiple users can work on same file
  - each in its own working directory
- When committing, versions in working directory are checked with versions in repository
  - triggers merge when there are differences

# Semantics

- cvs stores text
  - has no semantics about what it stores
  - works with latex files, C++ files, ...
- Therefore it cannot use semantics
  - e.g. renaming a method, changing a latex label, ...

# Envy

- Granularity: Method
- Users work connected to the repository
- Works with methods, classes, ...
  - e.g. have all versions for a particular method
- They load code in their environment, and version it when done
  - Everybody can see and use all versions

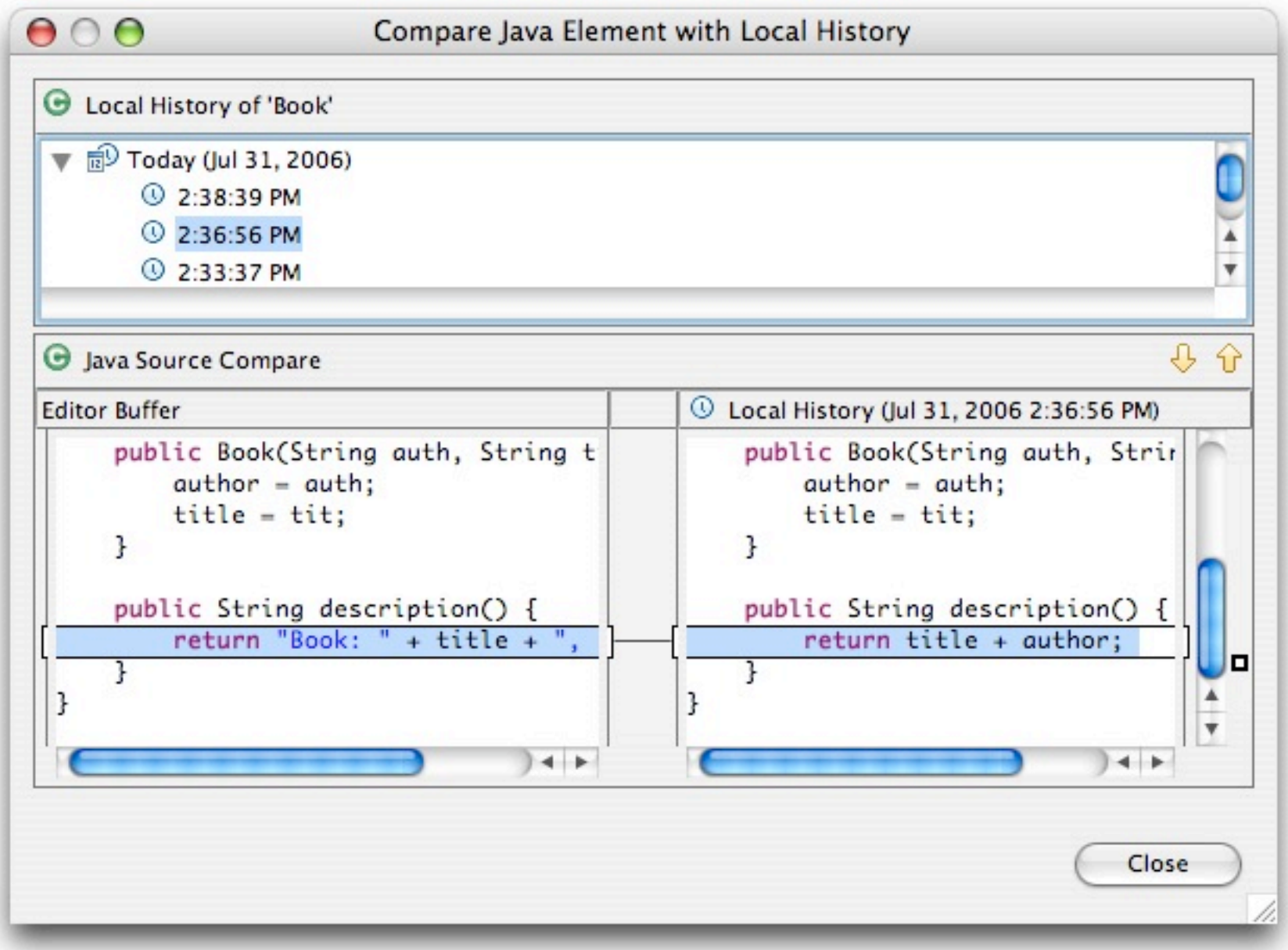
# Envy: Configuration Management features

- Editions are made into versions
- Applications group classes and methods
  - can have editions and versions themselves
  - have prerequisite versions (!)
- Configurations group applications
  - (e.g. Manifests)
- Support for conditional loading and prerequisites
  - Platform-specific code, for example

# On granularity...

- With cvs, you have a history of the *files* you've checked in
- With Envy, you have a history of the *development* you did
- This is fundamentally different

# What is Envy doing in Eclipse ?!



# More recent approaches

- svn
  - better cvs
- distributed version control systems
  - examples: git, mercurial
  - much better support for branching, versioning, integration

# Concepts in Code Repositories

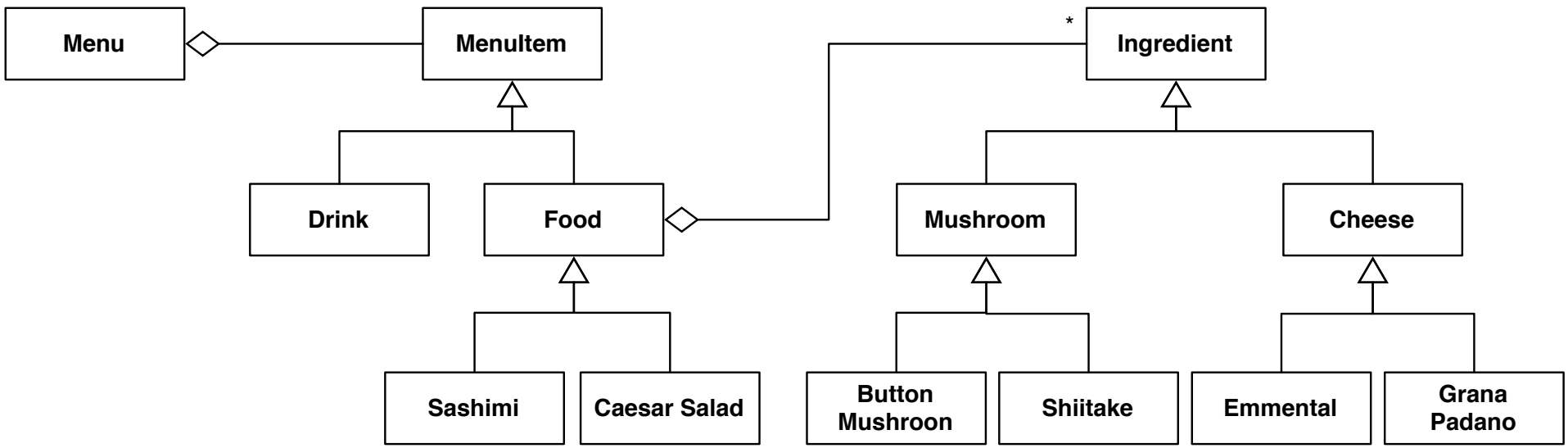
- Code
- Package
- Configuration

- Packages and Namespaces should be orthogonal
  - package contains definitions
  - namespaces is a visibility mechanism

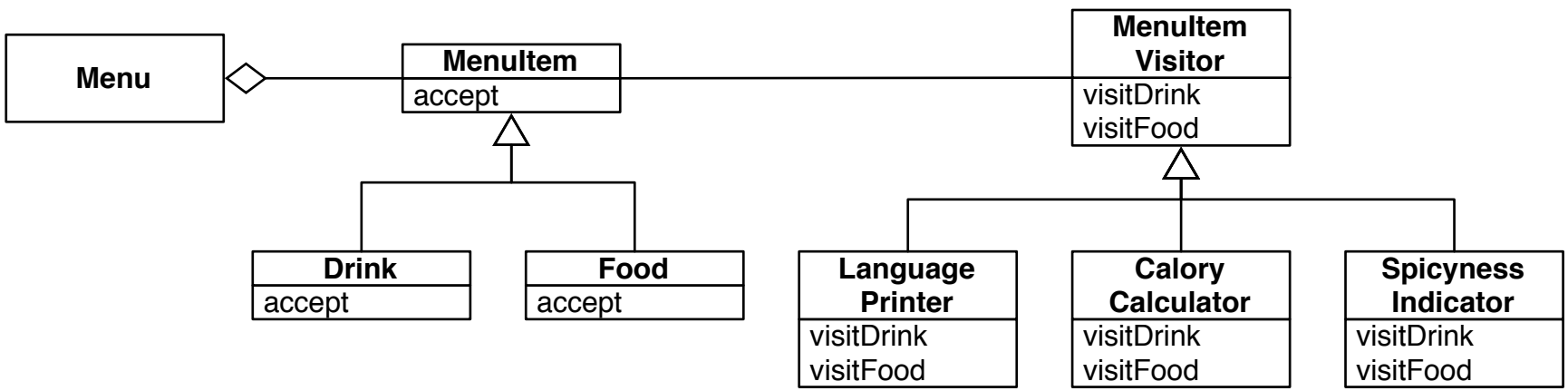
# Versioning

- All the elements need to be versionable
- Decisions, decisions:
  - granularity of version
    - line of code, method, class+methods, package, ...
  - forms of version numbers
    - single number, composed number, alphanumeric
  - version numbers versus release numbers
    - and their relationships

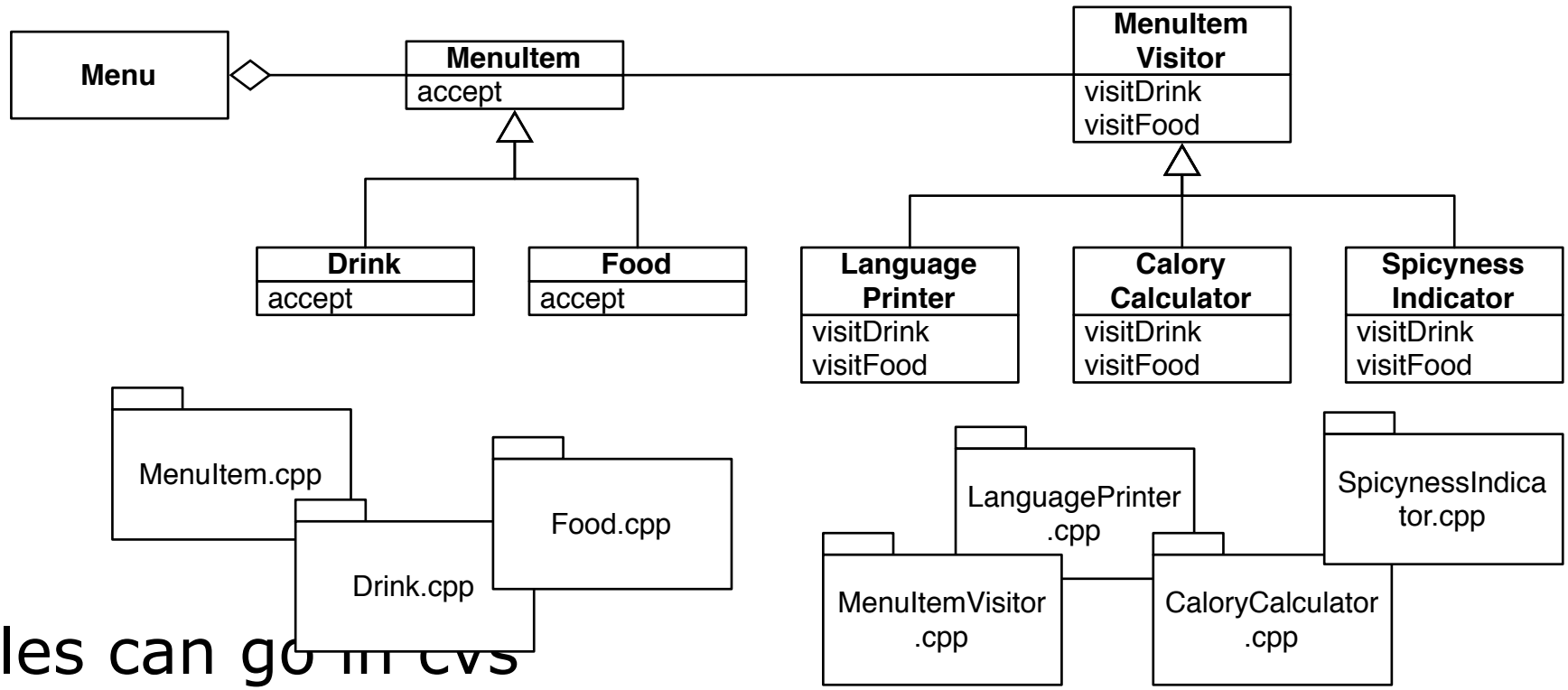
# Concrete example : Menu Framework



# Menu Framework with Visitor

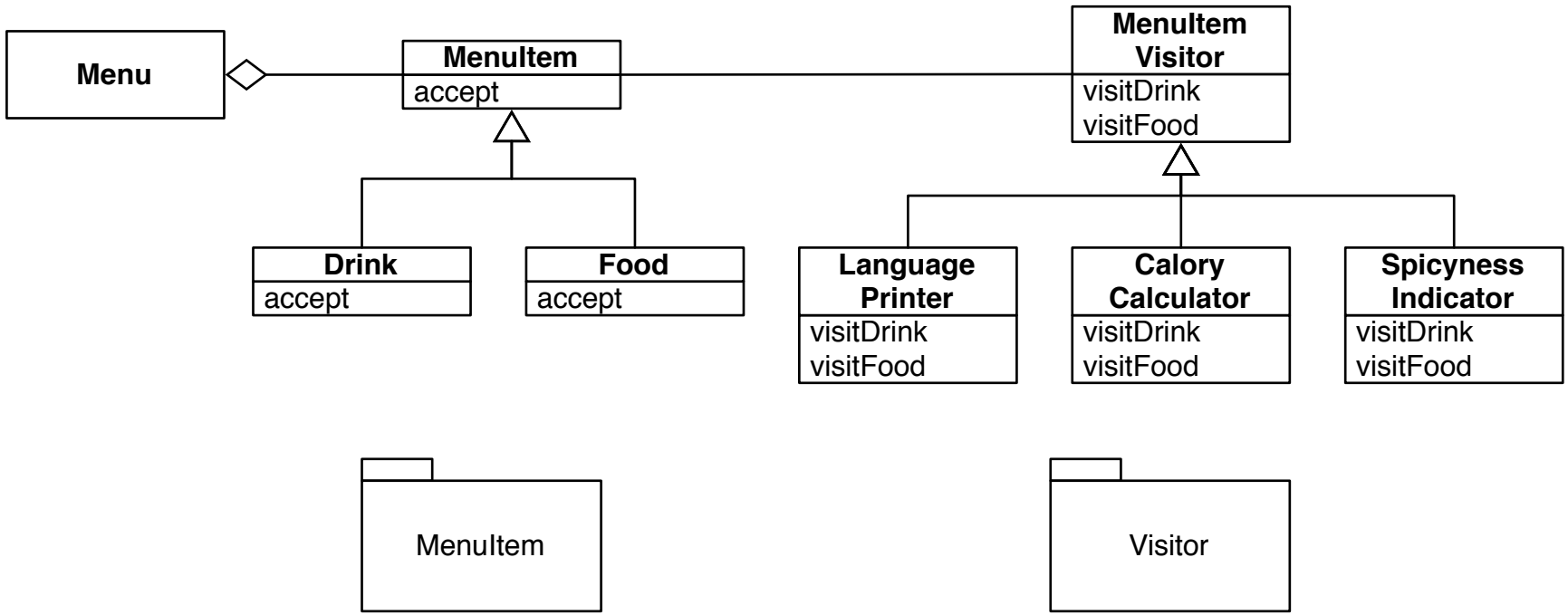


# C++ Files



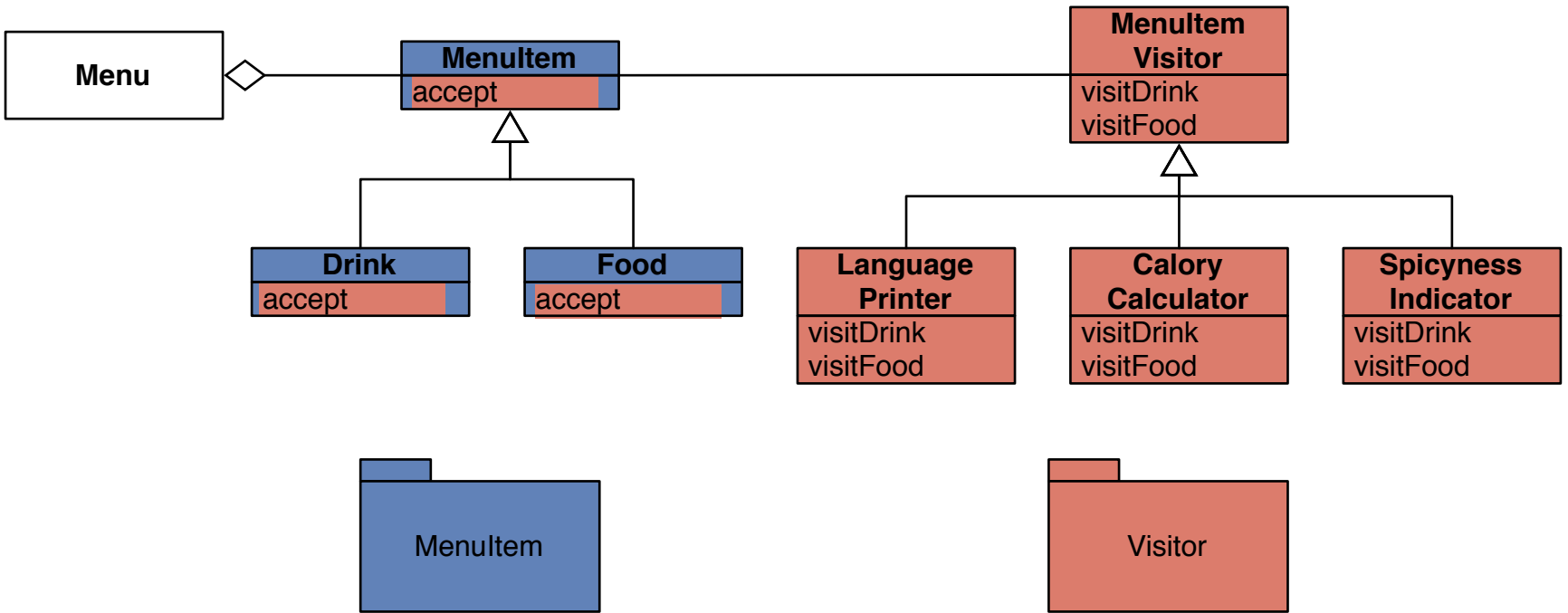

- Files can go in cvs
  - But decomposition is not the right one
  - What if the visitor traversal needs to be changed?

# Java Packages




- Packages to regroup classes, storage still in files
- Decomposition still not the right one
  - What would be the right decomposition?

# Smalltalk class extensions




- Packages defines classes and/or methods
  - Can be different versions, under control of different people/project/companies

# Note: declarative packages

- The Class Extensions scheme can be done with files
  - See Smalltalk file-outs
- Declarative system is needed
  - Class definition
  - Method definition, not nested within class
- Java Packages are different
  - Packages contain classes, classes contain methods
  - Watch out for a new Java package system :-)

# Software-engineering wise

- Important to be able to separate development into logical, manageable pieces
  - e.g. Visitor design pattern
- Each piece should have:
  - owners & responsibles
  - versions
  - dependencies
  - post-load and pre-unload statements

# Corollary

- Good packages support evolution
  - Company can sell parsetree
  - Other company can sell visitor for parsetree
- Code repositories and packages should support flexible forms of packaging code
- Code repositories, packaging & storage are linked

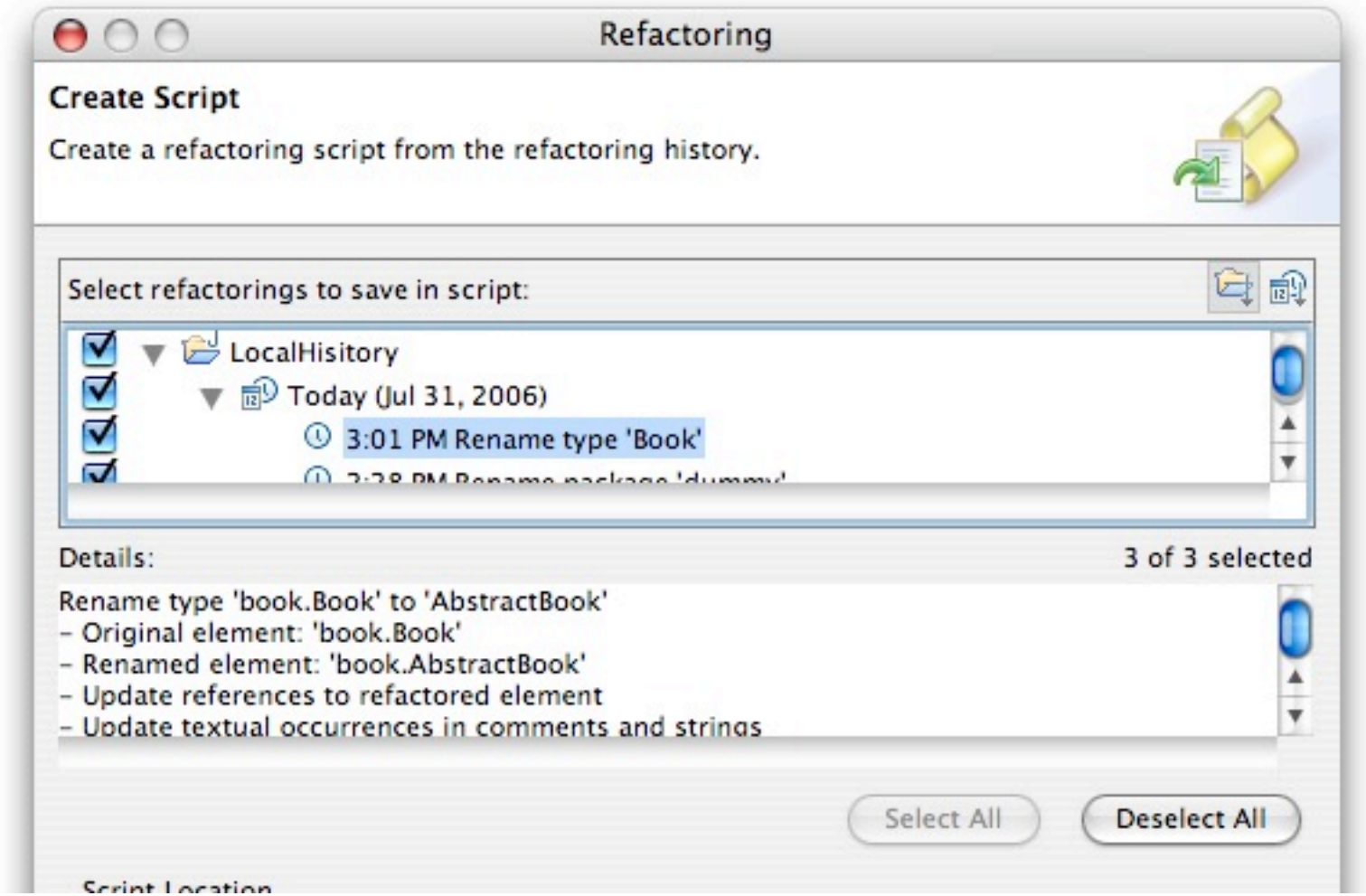
# Sidenote

- Design question:
  - why is the plug-in mechanism in Eclipse so difficult?

# Last but not least

- We discussed granularity
  - want to see the development you really did, not the changes you made
- Nice example: Refactoring Scripts in Eclipse
  - Record and replay the refactorings you did
- Why is this practical ?

# Saving & Replaying Refactoring Scripts



# Conclusion

- Multi-user development needs to be supported
  - code repositories with concurrent access
  - version support
  - (automatic) merge support
  - configuration management
- Current systems are quite weak
  - cvs & files
  - watch out for newer offerings