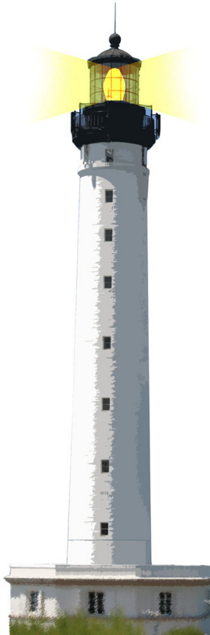
Learning Object-Oriented
Programming and Design with TDD



Runtime Architecture

Stéphane Ducasse
http://stephane.ducasse.free.fr

http://www.pharo.org

W2S12

Pharo's Execution Model

Pharo virtual machine (VM) executes compiled code (similar to Java, C#)

- The virtual machine and its plugins are platform specific (different versions for different OSes)
- VMs exist for MacOS, Windows, Linux (different versions), iOS, ARM, Android

Multiple Stage Compilation

1. Pharo code is compiled to bytecodes (platform neutral instructions)
2. The virtual machine transforms dynamically bytecodes to assembly

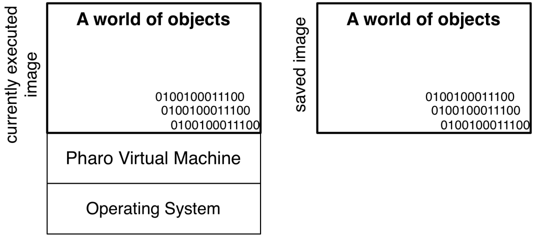
Virtual Machine

- Pharo.exe, Pharo.app... are the virtual machines
- There are two modes:
  - from command-line or in interactive (UI) mode
- It executes compiled code / generates on the fly assembly
- Compiled code is packaged / stored in an *image* (memory snapshot)
- The virtual machine only needs the *image* to execute programs

Image Files: Memory Snapshots

.image files is a cache of objects:

- Simple objects (points, strings ...)
- But also **compiled** classes and **compiled** methods
- Each time we save the image, all objects are saved to disc
- At startup we get back all the objects we saved
- PC (program counter) is also saved and restored
  - frozen execution is restarted at launch time



Change Files: a Change Tape

.changes file is a tape of all the changes performed to the system

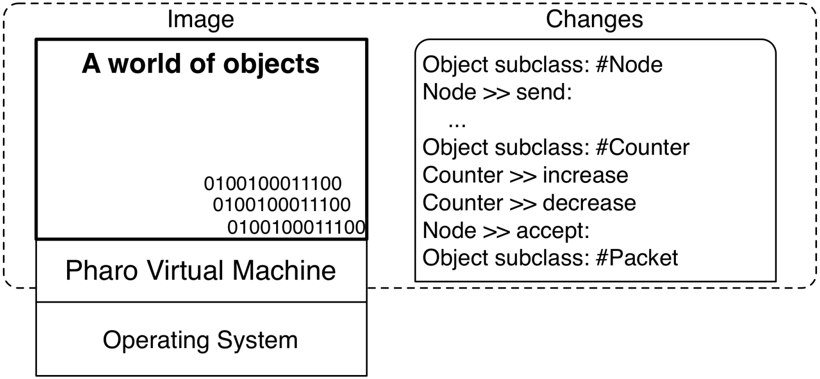
- Logs class creation/deletion, method addition/removal, actions...
- Used to browse versions
- Can replay/undo actions

A change is associated to an image

- To display class/method definition, tools look in the changes file associated to the current image

Image/Change Files

- A change is associated to an image
- Image contains all the objects in binary form. Can be executed without the changes file
- Changes file simply contains the textual representation of the changes made to the image



```
Object subclass: #Node
Node >> send:
    ...
Object subclass: #Counter
Counter >> increase
Counter >> decrease
Node >> accept:
Object subclass: #Packet
```

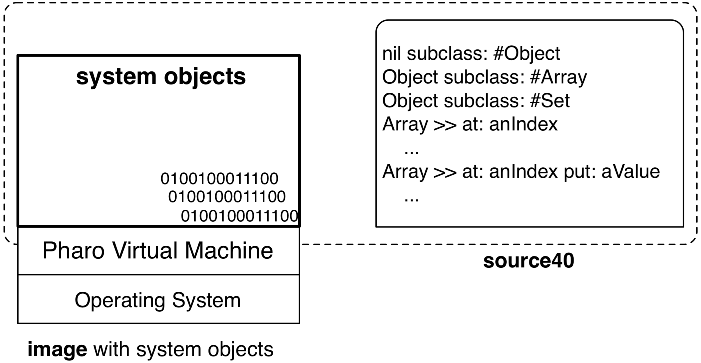
Save your code using a package and version control system

- Change and image are handy to develop
- But **they are not a software engineering artefact**
- Always have a loading script that takes an image, load your code, run the tests, build your application
- Usually
  - save code using a Version Control System (monticello, git)
  - use an integration server to build automatically applications

About the Source/Changes Files

PharoXX.sources

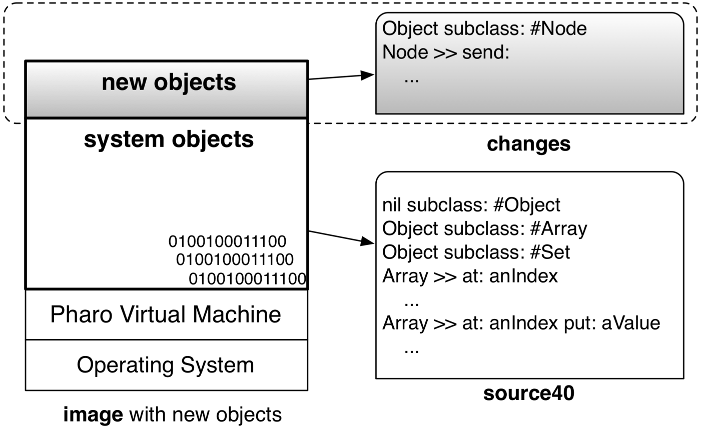
- Contains the *textual* definition of **system** classes and predefined objects
- Is read-only
- Created during release of new Pharo versions
- Shared to all the users (images)



When you Define New Classes

During development or code loading

- New objects are compiled in the image
- New definitions are added to the changes file
- Still you can browse the definition of the system class (stored in the *PharoXX.sources*)



New Change Management is in Pharo 60

Pharo change logging system

- Getting improved
    - new recording mechanism (Epicea)
    - better replay
    - new tooling (Epicea)
- Integrate better with Git and other modern distributed version control systems
- Offering new ways to produce images

Conclusion

- Powerful deployment
- Fast boot-time
- Support micro commits
- Will use modern version control

Resources

- Pharo Mooc - W6S06 Videos `http://mooc.pharo.org`
- Pharo by Example `http://books.pharo.org`

A course by Stéphane Ducasse
`http://stephane.ducasse.free.fr`

Reusing some parts of the Pharo Mooc by

Damien Cassou, Stéphane Ducasse, Luc Fabresse
`http://mooc.pharo.org`