

The Galaxy Tool Shed: A Framework for Building Galaxy Tools

<http://usegalaxy.org/toolshed>

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The Tool Shed enables sharing Galaxy tools and utilities...

- Galaxy utilities are:
 - Galaxy tools
 - Galaxy Data Managers
 - Custom datatype definitions and classes
 - Tool dependency definitions
 - Repository dependency definitions
 - Exported Galaxy workflows
- The Tool Shed framework supports versioning of Galaxy utilities, enabling discovery and installation of specific versions to ensure reproducibility when installed into Galaxy.

...but it also provides features for building them!

Building “complex” Galaxy tools

We'll focus on building a “**complex**” Galaxy tool.

We'll consider a Galaxy tool to be complex if it wraps one or more package dependencies.



Tool Shed features that enable building Galaxy tools

- Bootstrapping a local development Tool Shed to prepare it for importing a repository capsule
- Repositories are associated with owners and categories which must be present in the Tool Shed into which the capsule is imported
- Moving repositories between Tool Sheds with Repository Capsules
- Validating repository contents with the Install and Test Framework

Building the HVIS Galaxy tool

- We'll examine the process used to develop the **HVIS** Galaxy tool contained in the **hgv_hilbertvis** repository owned by **devteam** in the main Galaxy Tool Shed

http://toolshed.g2.bx.psu.edu/view/devteam/hgv_hilbertvis

The HVIS Galaxy tool

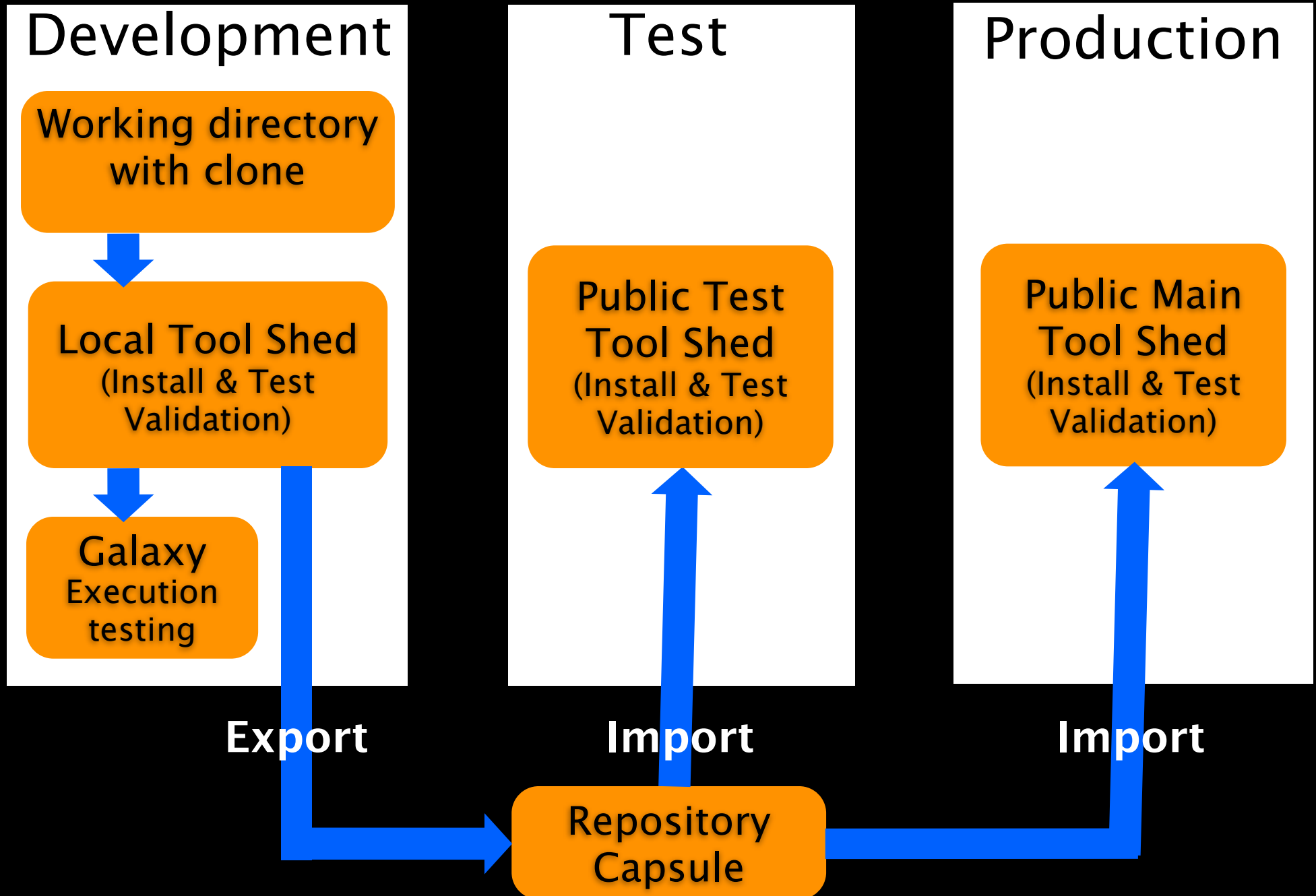
http://toolshed.g2.bx.psu.edu/view/devteam/hgv_hilbertvis

- The HVIS tool requires the [bioc_hilbertvis](#) package, www.ebi.ac.uk/huber-srv/hilbert/, which requires the **R** package.
- Uses the Hilbert space-filling curve to visualize the structure of position-dependent data
- Maps the traditional one-dimensional line visualization onto a two-dimensional square.

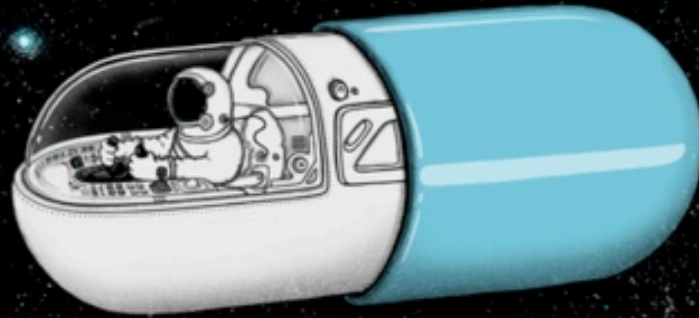
Our development environment consists of three components

- A local development Tool Shed
- A local development Galaxy instance
- A tool development working directory

Our development and release model



What are repository capsules?



- The mechanism for moving repositories between Tool Sheds.
- Any installable revision of the selected repository can be exported into a capsule.
- A complete repository hierarchy consisting of any number of dependencies can be exported.

Tool development process

- Prepare the local development Tool Shed
- Prepare the local development Galaxy instance
- Prepare the tool development working directory
- Finish developing the HVIS tool
- Validate the HVIS tool
- Share the HVIS tool with the Galaxy community

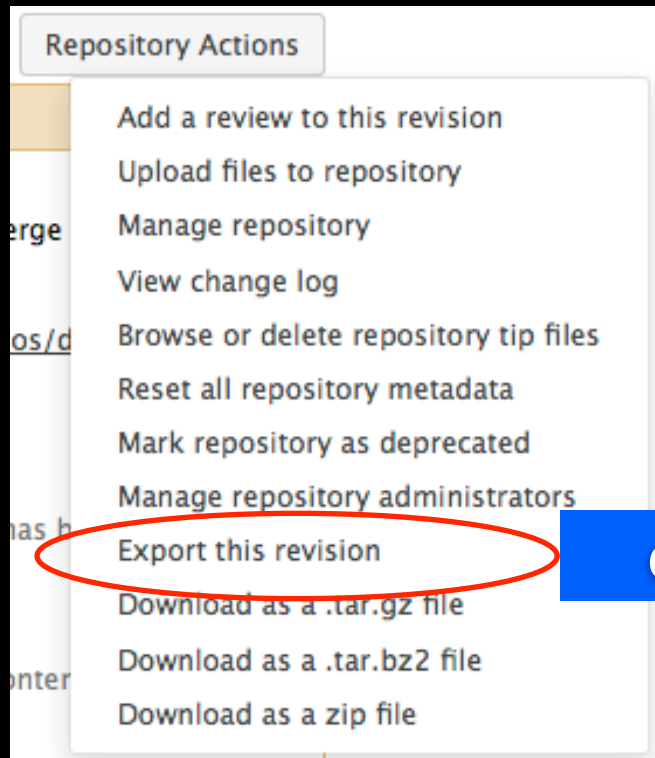
Bootstrapping the local development Tool Shed

- Make sure our development Tool Shed environment is pristine: a new database that has not yet been migrated, and an empty hgweb.config file.
- Make sure the information in `~/lib/tool_shed/scripts/bootstrap_tool_shed/user_info.xml` is the devteam account since it is the account we'll use in the test and main Tool Sheds.



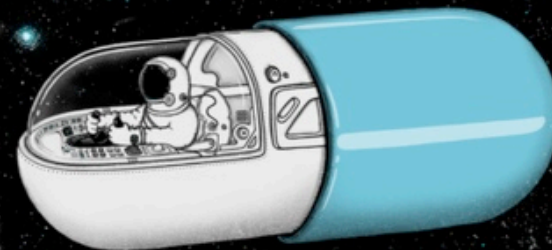
```
sh run_tool_shed.sh -bootstrap_from_tool_shed  
http://toolshed.g2.bx.psu.edu
```

Exporting required repositories from the main Tool Shed



We'll export revision **ce15999e50b1** of repository **package_hilbertvis_1_18_0** owned by **devteam** from the main Galaxy Tool Shed

download

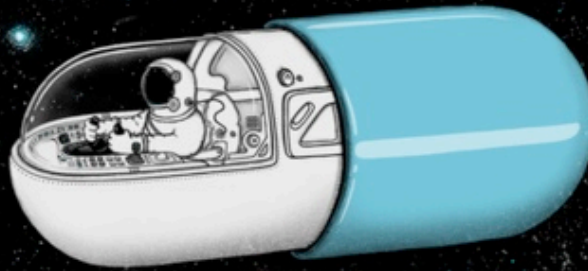


**capsule_with_dependencies_toolshed.g2.bx.psu.edu_
package_bioc_hilbertvis_1_18_0_devteam_ce15999e5
0b1.tar.gz**

Importing the repository capsule into the local Tool Shed

Available Actions

- Create new repository
- Import repository capsule



capsule_with_dependencies_toolshed.g2.bx.psu.edu_package_bioc_hilbertvis_1_18_0_devteam_ce15999e50b1.tar.gz

Upload



- package_bioc_hilbertvis_1_18_0
- package_r_2_11_0

Create the basic hilbertvis.xml file

```
<tool id="hgv_hilbertvis" name="HVIS" version="1.0.0">
  <description>visualization of genomic data with the Hilbert curve</description>
  <requirements>
    <requirement type="package" version="2.11.0">R</requirement>
    <requirement type="package" version="1.18.0">bioc_hilbertvis</requirement>
  </requirements>
  <command interpreter="bash">
  </command>
  <inputs>
  </inputs>
  <outputs>
  </outputs>
  <tests>
    <test>
    </test>
  </tests>
  <help>
  </help>
</tool>
```

Create the tool_dependencies.xml file

```
<?xml version="1.0"?>
<tool_dependency>
  <package name="R" version="2.11.0">
    <repository name="package_r_2_11_0" owner="devteam" />
  </package>
  <package name="bioc_hilbertvis" version="1.18.0">
    <repository name="package_bioc_hilbertvis_1_18_0" owner="devteam" />
  </package>
</tool_dependency>
```

Upload the files to our Tool Shed

```
tar -cvf hilbertvis.tar *  
a hilbertvis.xml  
a tool_dependencies.xml
```

Upload

Archive



Local

Galaxy
Tool Shed

Repositories:

- hgv_hilbertvis
 - package_bioc_hilbertvis_1_18_0
 - package_r_2_11_0

Tool development process

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Repositories:

- hgv_hilbertvis
 - package_bioc_hilbertvis_1_18_0
 - package_r_2_11_0

Install

Repositories

Install the hgv_hilbertvis repository along with its defined repository dependencies



Repositories:

- hgv_hilbertvis
 - package_bioc_hilbertvis_1_18_0
 - package_r_2_11_0

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Local
Galaxy
Tool Shed

Clone

hgv_hilbertvis Repository

Tool Development Working Directory

```
hg clone http://devteam@localhost:9009/repos/devteam/
hgv_hilbertvis
destination directory: hgv_hilbertvis
requesting all changes
adding changesets
adding manifests
adding file changes
added 1 changesets with 2 changes to 2 files
updating to branch default
2 files updated, 0 files merged, 0 files removed, 0
files unresolved
lily:tool_development gvk$ ls -l
total 0
drwxr-xr-x 3 gvk staff 102 Jun 24 14:19 .
drwxr-xr-x 17 gvk staff 578 Jun 24 13:21 ..
drwxr-xr-x 5 gvk staff 170 Jun 24 14:19 hgv_hilbertvis
```

Tool development working directory

- Tool development takes place here
- Contains a clone of the **hgv_hilbertvis** repository from our local Tool Shed
- Tool changes are committed to the cloned **hgv_hilbertvis** repository and pushed to the same repository in the local Tool Shed

Tool development process

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Tool development working directory

Our hgv_hilbertvis repository is cloned here which initially contains these files

- hilbertvis.xml
- tool_dependencies.xml

Changes to these files and all additional files are committed to this cloned repository

“hg push” from the command line or using your favorite IDE for each change committed to the cloned **hgv_hilbertvis** repository in the tool development working directory



Local development Tool Shed

Contains the following installed repositories

- hgv_hilbertvis
- package_bioc_hilbertvis_1_18_0
- package_r_2_11_0

Local development Galaxy instance

Contains the following installed repositories

- hgv_hilbertvis
- package_bioc_hilbertvis_1_18_0
- package_r_2_11_0

Changes to the HVIS tool are tested here throughout the development process



“Get updates” for the installed **hgv_hilbertvis** repository using the Galaxy user interface feature

Tool development process

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- **Validate the HVIS tool**
- Share the HVIS tool with the Galaxy community

The Install and Test Framework

- Validates **installation of packages** and **execution of tools** contained in repositories from a selected Tool Shed.
- Runs in an EC2 environment, setting up a Galaxy instance into which repositories from the selected Tool Shed will be installed.
- Installs all appropriate repositories into the Galaxy instance and uploads installation results into the Tool Shed for each repository.
- For those repositories that contain tools with functional test definitions and test data, the functional tests are executed with the results uploaded to the Tool Shed for each repository.

Executing the Install and Test Framework

```
export GALAXY_INSTALL_TEST_TOOL_SHED_API_KEY=<the API key>  
export GALAXY_INSTALL_TEST_TOOL_SHED_URL=<local Tool Shed URL>  
export GALAXY_INSTALL_TEST_TOOL_SHEDS_CONF=tool_sheds_conf.xml  
export GALAXY_INSTALL_TEST_TOOL_DEPENDENCY_DIR=../tool_dependencies  
export GALAXY_TOOL_DEPENDENCY_DIR=$GALAXY_INSTALL_TEST_TOOL_DEPENDENCY_DIR
```

```
python check_tool_dependency_definition_repositories.py  
python check_repositories_for_functional_tests.py
```

```
sh install_and_test_tool_shed_repositories.sh
```

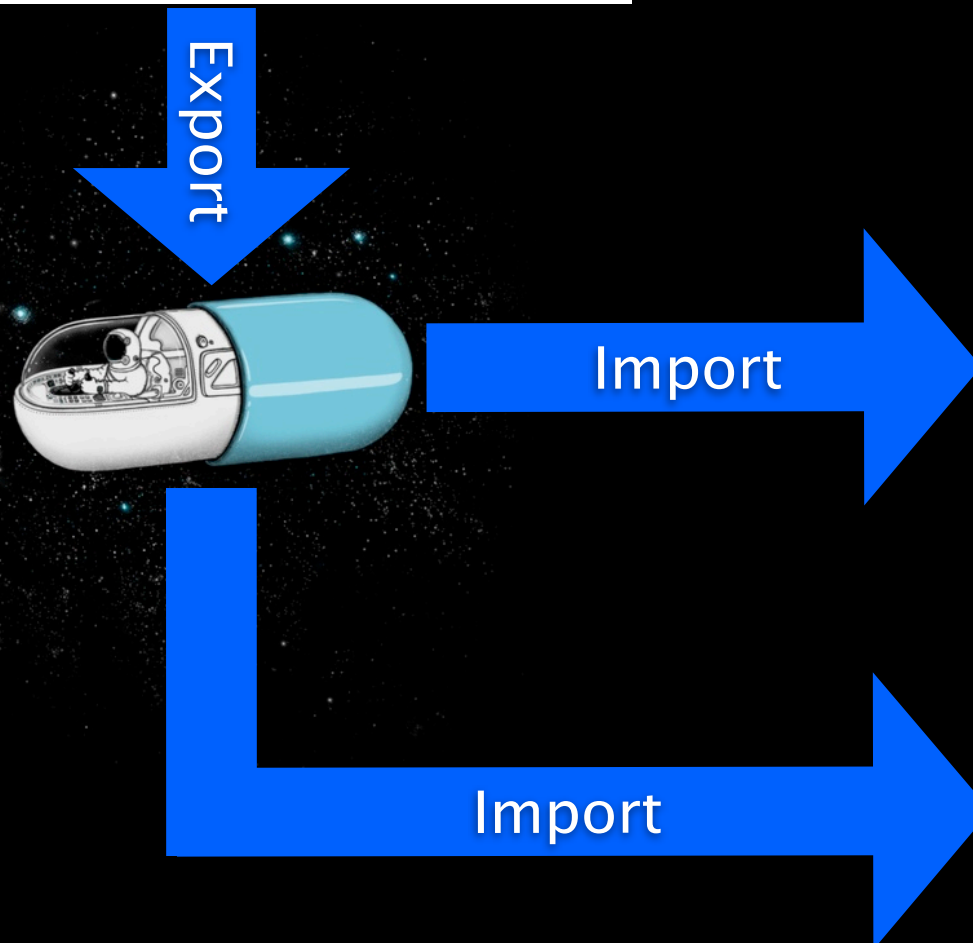
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hgv_hilbertvis repository

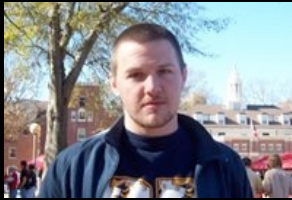
The Install and Test Framework runs every 48 hours in both the test and main Galaxy Tool Sheds



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