Department of Computer Science

User System of Astrogeology Technologies(USAT)

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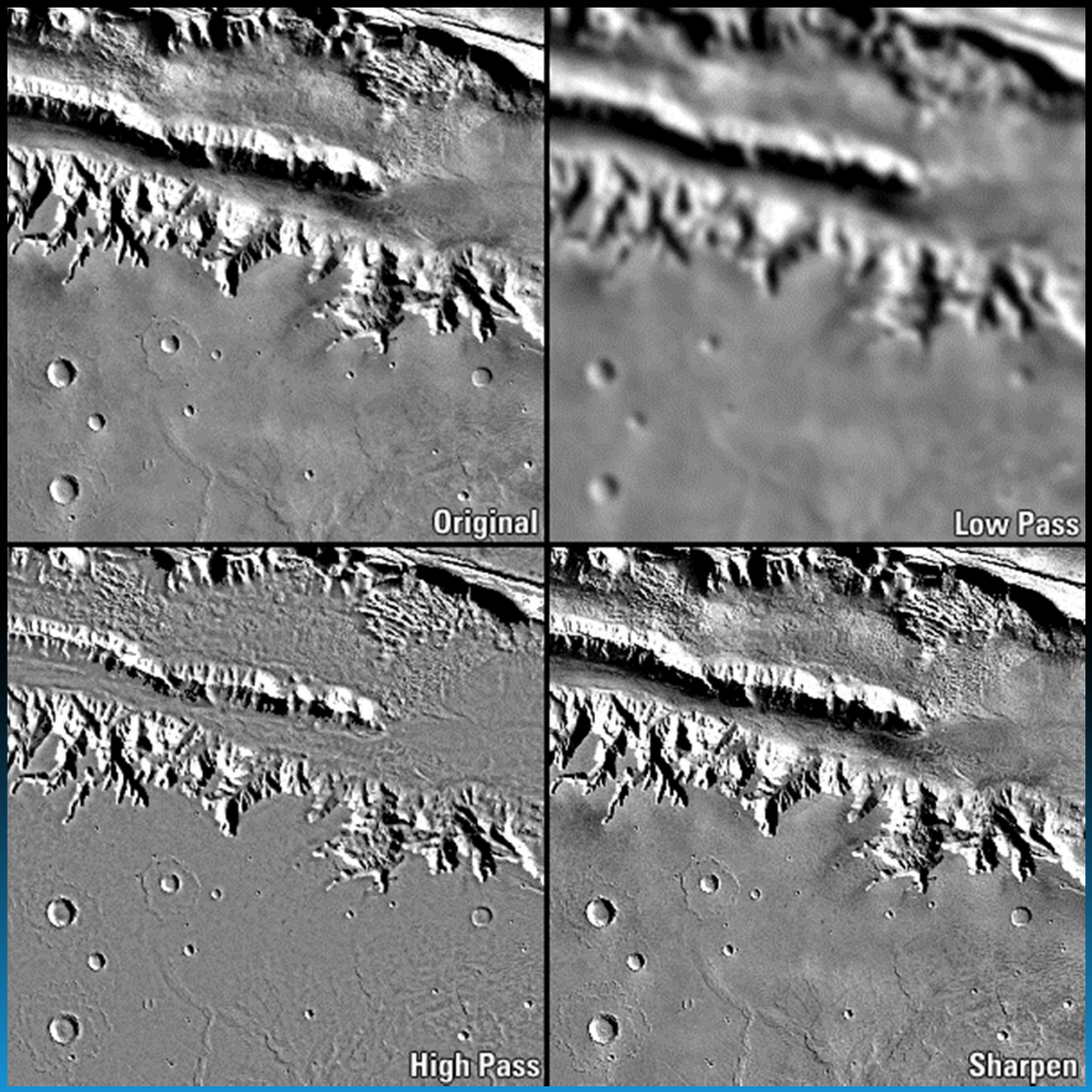
# USER SYSTEM OF ASTROGEOLOGY TECHNOLOGIES

# Introduction

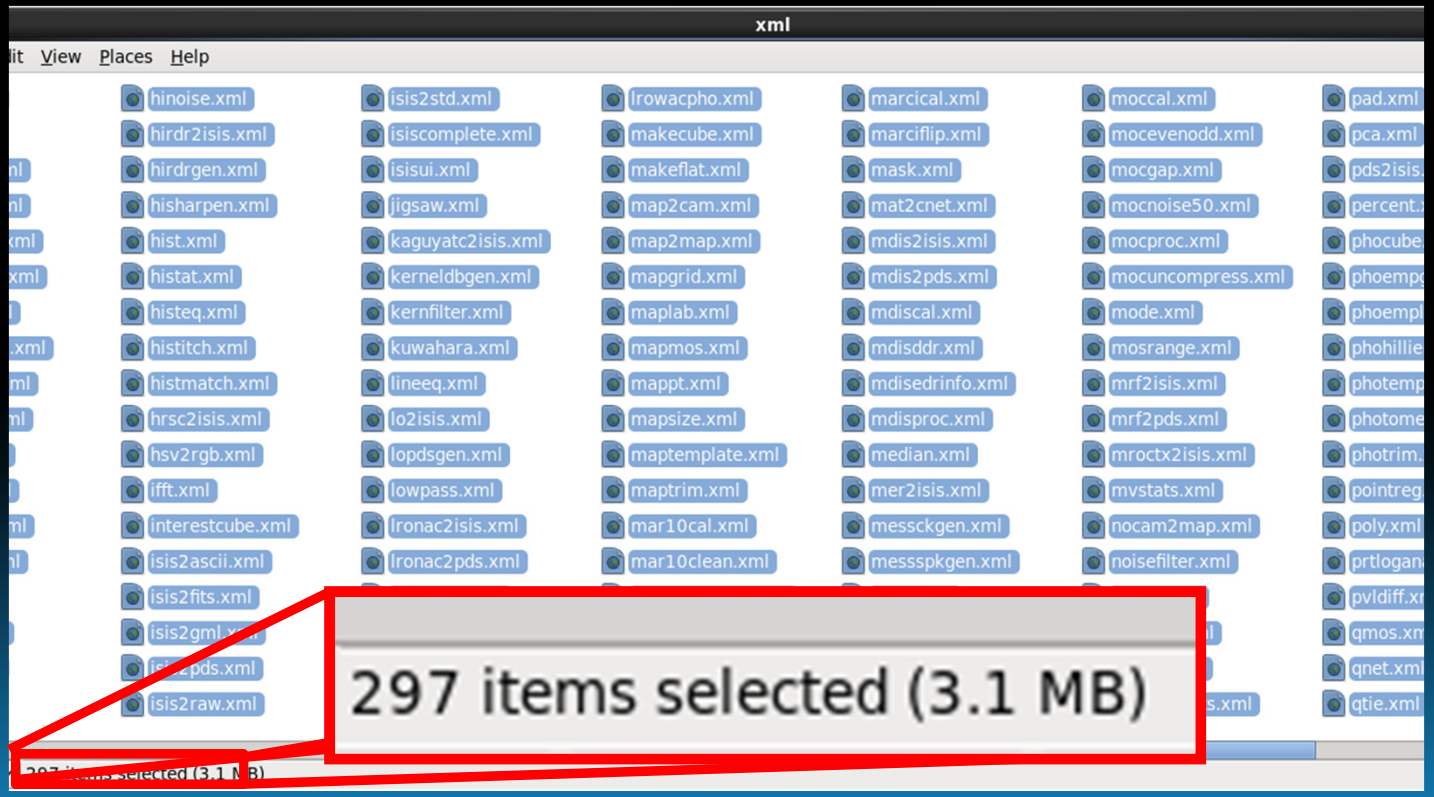
- USGS Astrogeology Research Program
  - Trent Hare and Moses Milazzo
- ISIS (Integrated Software for Imagers & Spectrometers)
  - A tool used in analyzing images from planetary missions

# Example Filters of ISIS3



# Problem

- ≈ 300 different programs



# Problem Continued

- Command-line interface
- Hand-written scripts

```
if ($#argv != 2) then
    echo "Usage: $0 maptemplate.map[0|1]"
    echo "0 = keep all files as you go"
    echo "1 = delete old files as you go"
    goto done
endif

set map=$1
set del=$2

foreach i ( *.IMG )
    set base = `basename $i .IMG`
    set new = "$base.cub"
    echo mroctx2isis "from=$i to=$new"
    mroctx2isis from=$i to=$new
    if (=e $new && $del) then
        /bin/rm $i
    endif
end

foreach i (*.cub)
    echo spiceinit "from=$i"
    spiceinit from=$i
end
```

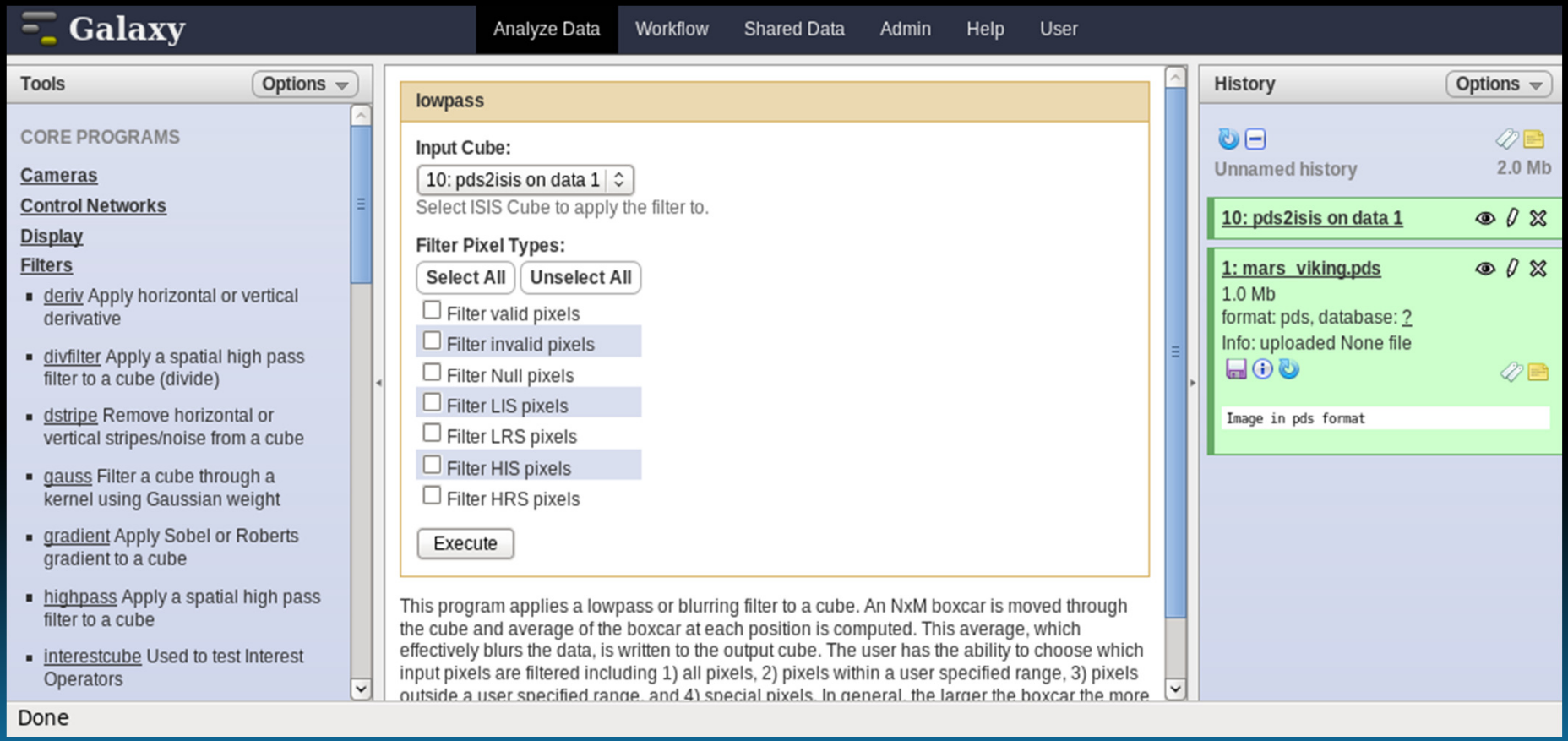
# The Task

- Create a centralized GUI
  - Organized and easy to use
  - Workflow creation
- Help Center
  - Documentation within the GUI

# Requirements & Specifications

- Expandability
  - Integrate new ISIS programs
  - Adapt to future environments
- Ease of Use
  - Everything needed to make a workflow at one's fingertips
- Design for Unix/Linux environments

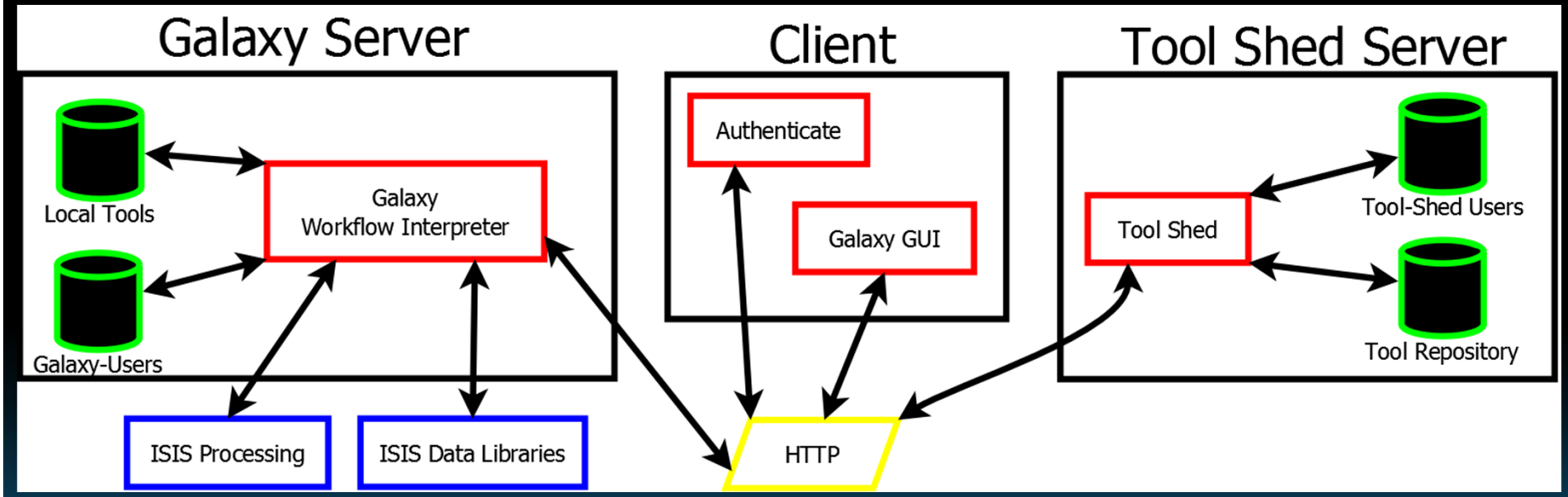
# Solution Overview



# Galaxy

- What is it?
  - Open source software
  - Workflow creator
  - Uses XML, Javascript and Python
- Why use it?
  - Preexisting foundation vs. recreating the wheel

# Architecture Overview



# Basic Features

# Galaxy - Tool Shed

- Upload tools
- Keep track of tool versions

**Preview tools and inspect metadata by tool version**

**Tools** - *click the name to preview the tool and use the pop-up menu to inspect all metadata*

| name | description | version | requirements |
|---|---|---|---|
| pds2isis | Convert PDS formatted image to a ISIS Cube. | 1.0.0 | none |
| minmax | Apply a minimum or maximum filter to a cube | 1.0.0 | none |
| median | Set pixels to median of surrounding pixel values | 1.0.0 | none |
| kernfilter | Filter a cube through a kernel | 1.0.0 | none |
| kuwahara | Filter a cube, smoothing but preserving edges | 1.0.0 | none |
| isis2pds | Convert an ISIS Cube to a PDS formatted image. | 1.0.0 | none |
| interestcube | Used to test Interest Operators | 1.0.0 | none |
| lowpass | Apply lowpass or blurring filter to a cube | 1.0.0 | none |
| gauss | Filter a cube through a kernel using Gaussian weight | 1.0.0 | none |
| highpass | Apply a spatial high pass filter to a cube | 1.0.0 | none |
| deriv | Apply horizontal or vertical derivative | 1.0.0 | none |
| gradient | Apply Sobel or Roberts gradient to a cube | 1.0.0 | none |
| dstripe | Remove horizontal or vertical stripes/noise from a cube | 1.0.0 | none |
| divfilter | Apply a spatial high pass filter to a cube (divide) | 1.0.0 | none |
| qview | Open qview and view images | 1.0.0 | none |

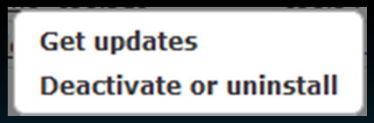
Reset metadata

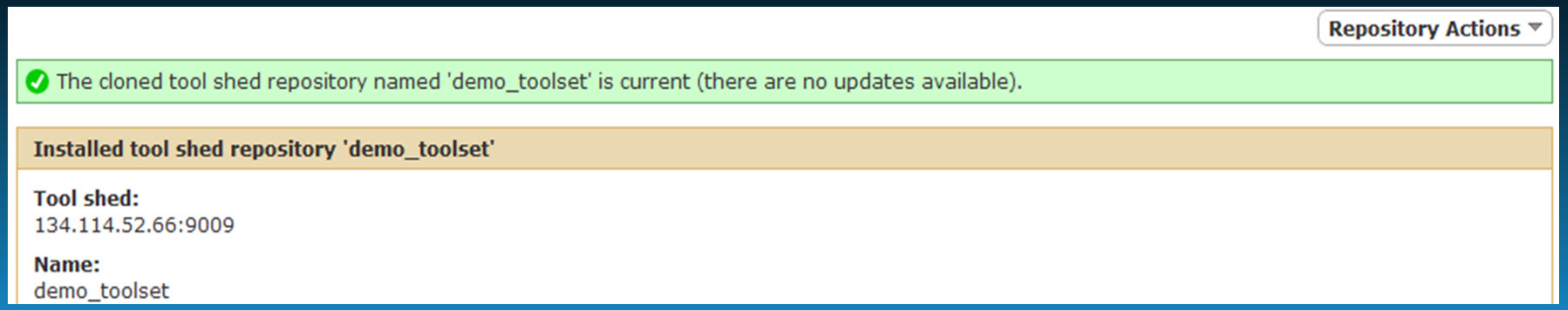
Inspect the repository and reset the above attributes for the repository tip.

# Galaxy – Tool Administration

- Easy installation from Tool Shed

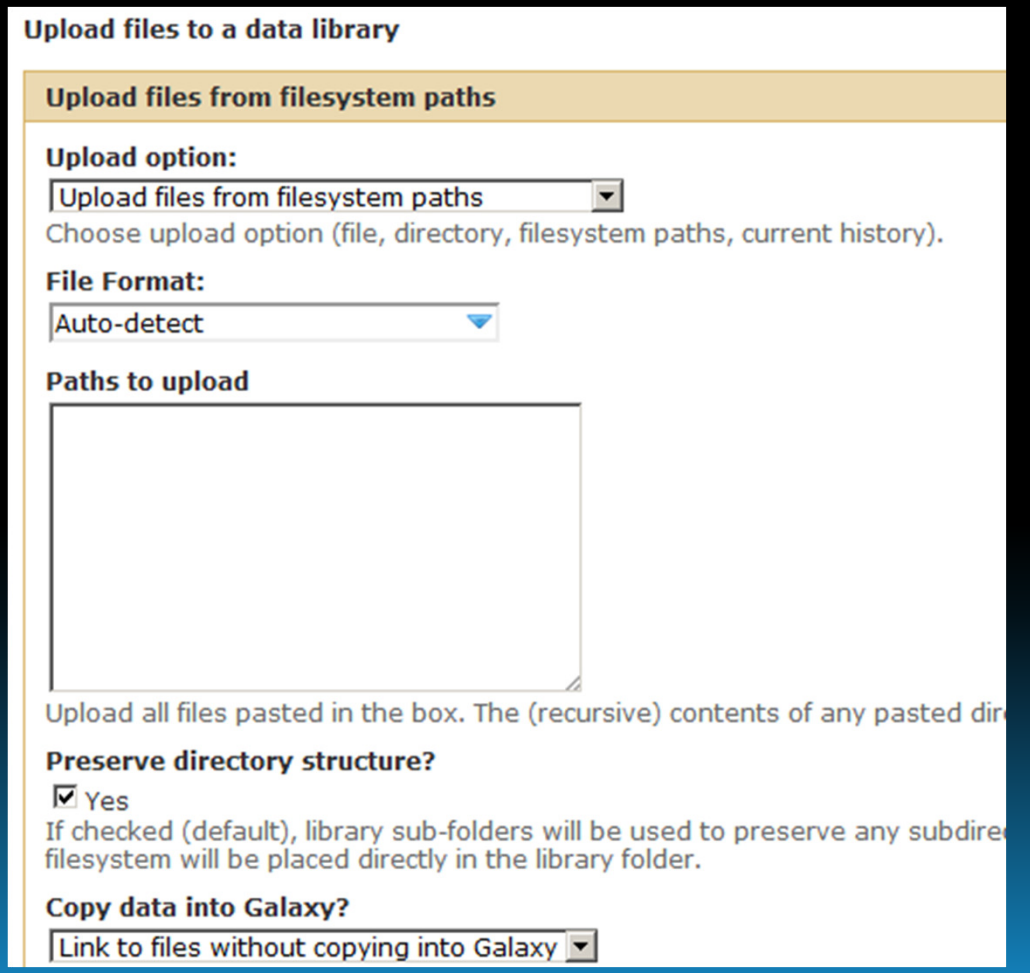

- Tool Management



# Galaxy – ISIS Image Data

- Link Data:
  - Remote server file Directory
  - Current server history
- Upload from:
  - Website(FTP) URL
  - Local single file
  - Local directory
- Job Queues



# Galaxy – Data Library

- Data link complete

**Data Library "Mars Rover Data"**

Add datasets | Add folder | Library Actions

Pres Data

| Name | Message | Data type | Date uploaded | File size |
|---|---|---|---|---|
| calibration | Automatically created by upload tool | | | |
| marci | Automatically created by upload tool | | | |
| files.txt | | txt | 2012-04-24 | 1.4 Kb |
| marciCoefficients_v001.pvl | | txt | 2012-04-24 | 1.7 Kb |
| uvflat_band6_summing8_v001.cub | | data | 2012-04-24 | 129.0 Kb |
| uvflat_band6_summing8_v002.cub | | data | 2012-04-24 | 129.8 Kb |
| uvflat_band7_summing8_v001.cub | | data | 2012-04-24 | 129.0 Kb |
| uvflat_band7_summing8_v002.cub | | data | 2012-04-24 | 129.8 Kb |
| visflat_band1_summing1_v001.cub | | data | 2012-04-24 | 577.0 Kb |
| visflat_band1_summing1_v002.cub | | data | 2012-04-24 | 577.8 Kb |
| visflat_band1_summing2_v001.cub | | data | 2012-04-24 | 577.6 Kb |

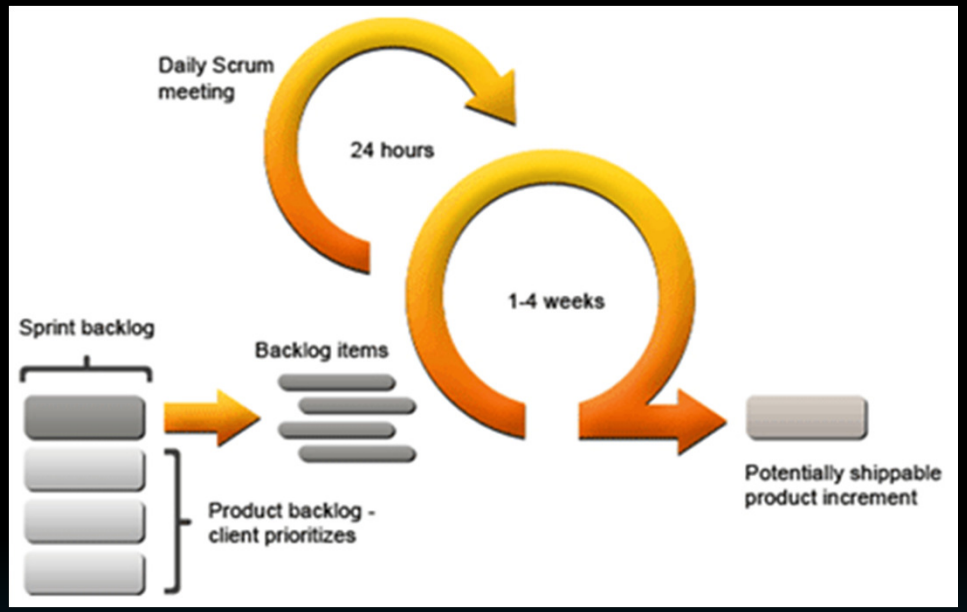
- Public data or restrict permissions to a few

**Make public**

**Edit permissions**

# Design Process

- Initially Waterfall Method
- Scrum
  - Weekly Sprints
  - Rapid Prototyping



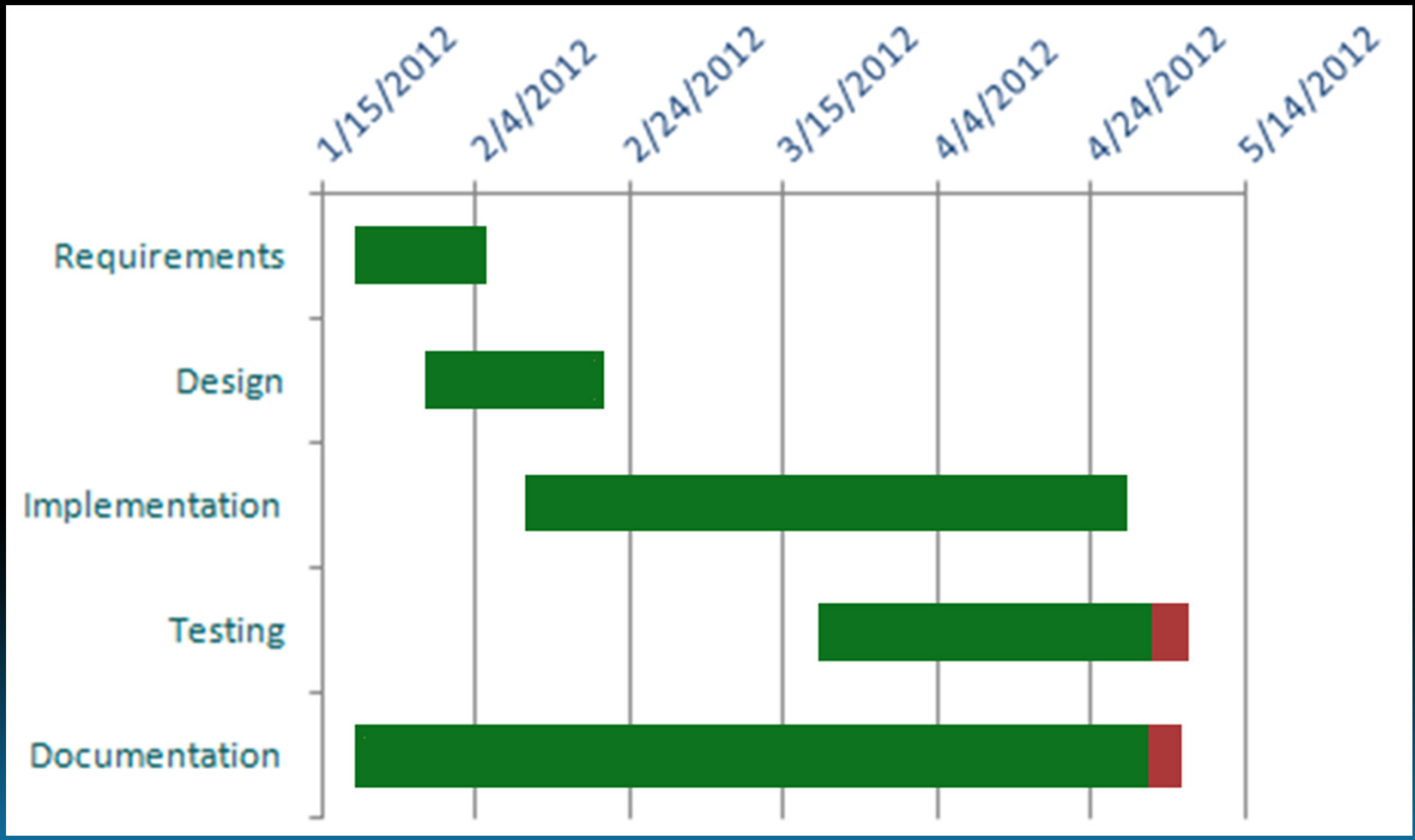
# Difficulties

- Tool Builder
  - ISIS XML to Galaxy XML
- Galaxy
  - Bioinformatics
  - File extensions
  - Tool configuration
- Framework
  - ISIS Data Library

# Successes

- Knowledge of problem
  - A Successful Solution
- Sponsor collaboration
- Estimated Year long project
  - Completed in less than 4 months

# Schedule


1/15/2012
2/4/2012
2/24/2012
3/15/2012
4/4/2012
4/24/2012
5/14/2012
Requirements
Design
Implementation
Testing
Documentation

# End Result

- Completed project requirements
  - Including many secondary goals
- Ground-work for future development in Astrogeology research
  - Cluster Computing (Amazon Ec2)
  - Web based image viewer
  - Mobile Access
- Expansion of Galaxy into new domains

POSTER # 235

POSTER TIME = 1:30P TO 3:00P

ROOM = IIA-B

# QUESTIONS?