

Git Immersion

CodeMash 2011 Pre-Compiler

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Saturday, January 15, 2011

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Pragmatic Bookselft Screen Cast



Available at:

[http://pragprog.com/screencasts/
v-jwsceasy/source-control-made-easy](http://pragprog.com/screencasts/v-jwsceasy/source-control-made-easy)

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DOWNLOAD!

- http://onestepback.org/download/git_tutorial.zip
- Or Grab a memory Stick

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Setup

```
git config --global user.name "Jim Weirich"  
git config --global user.email "jim.weirich@gmail.com"
```

also

```
git config --global core.autocrlf true      (Windows)  
git config --global core.autocrlf input    (Unix/Mac)  
git config --global core.safecrlf true
```

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Creating a Git Repo

```
$ cd git_tutorial  
$ cd work  
$ mkdir hello  
$ cd hello  
$ (edit file hello.rb)  
$ git init
```

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Checking In

```
$ git status  
$ git add .  
$ git commit -m "message"
```

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Source Control Made Easy

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Why?

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What we are **not**
going to talk about ...

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Your Mission

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Your Mission

Design and Build A Source Code Control System

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Custom Source Control

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Custom Source Control

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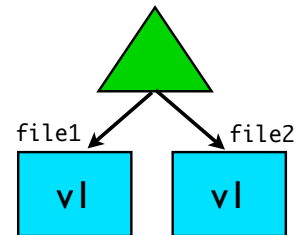
In the *Old Days* ...

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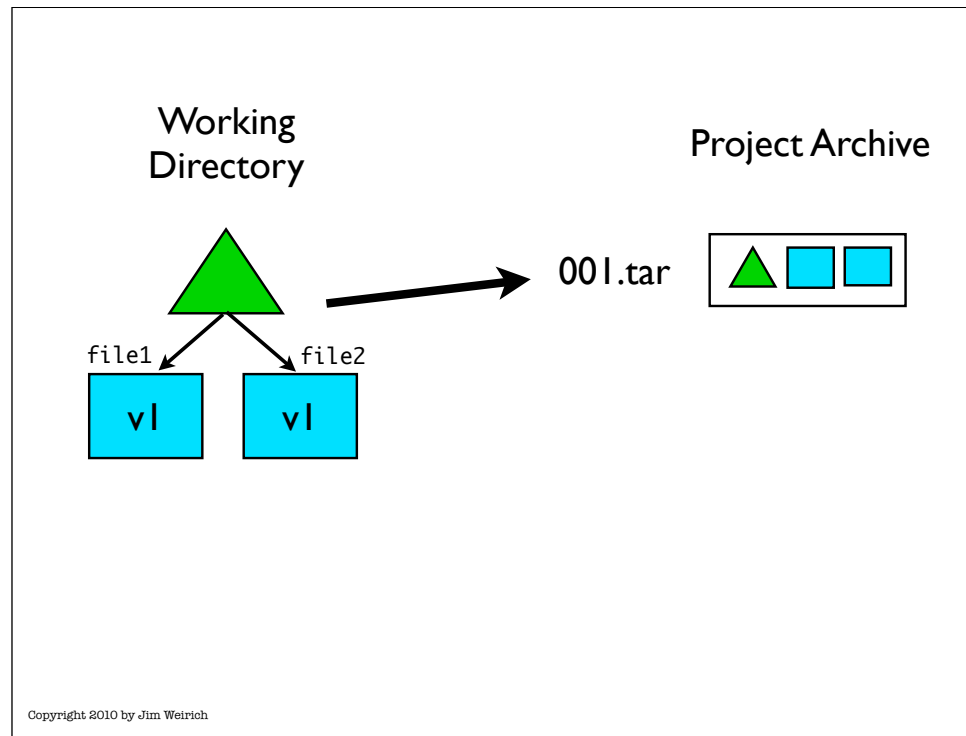
Saturday, January 15, 2011

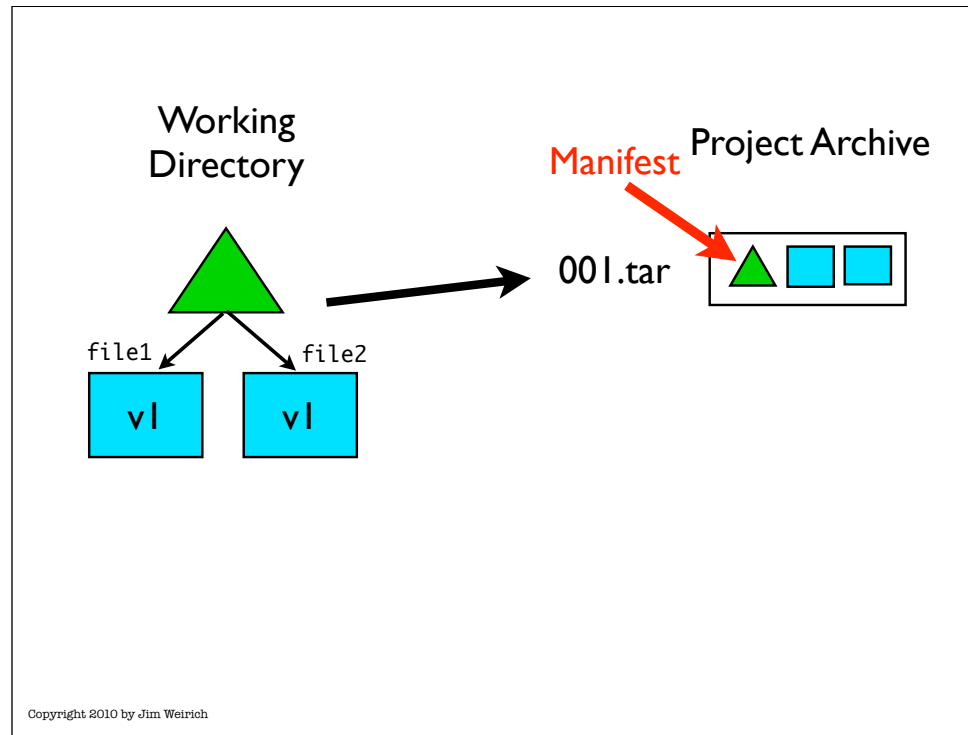
14

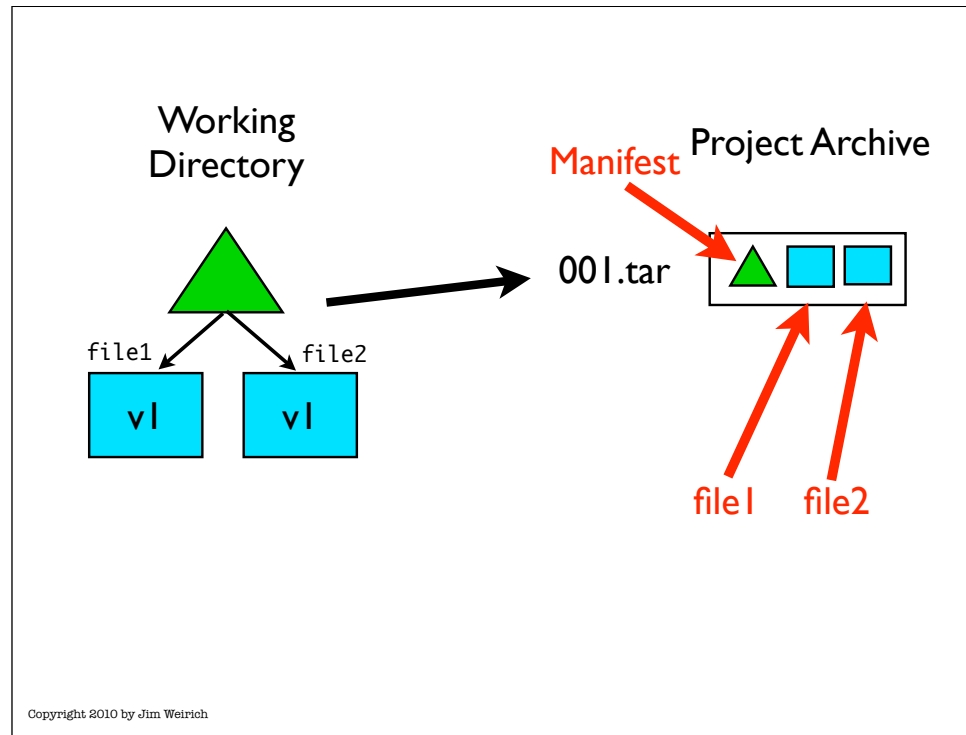
Working
Directory

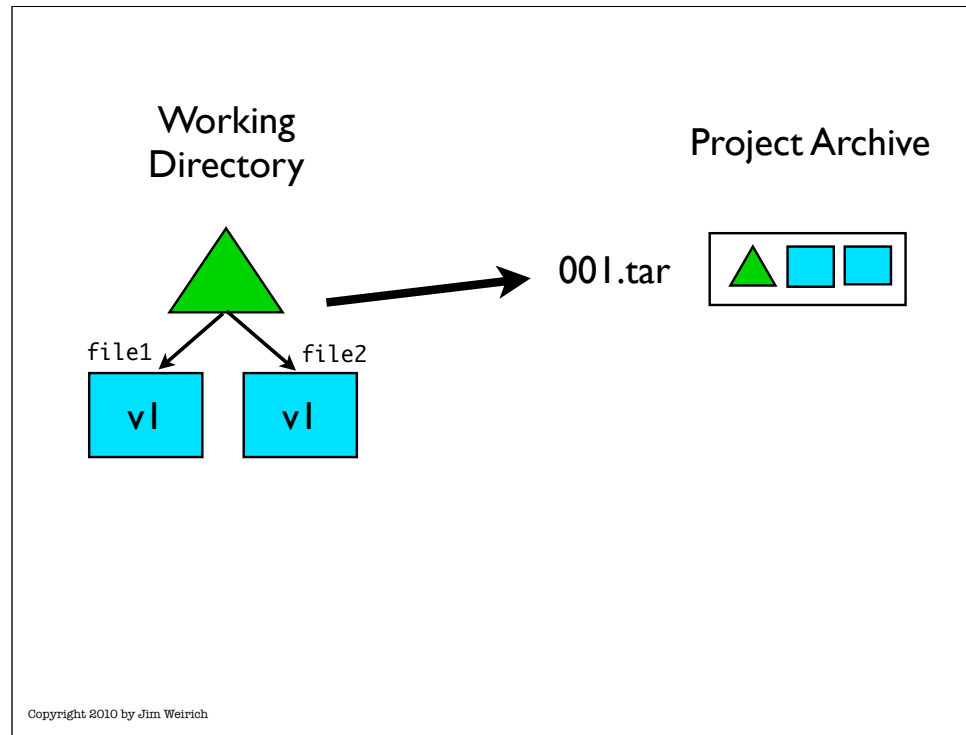


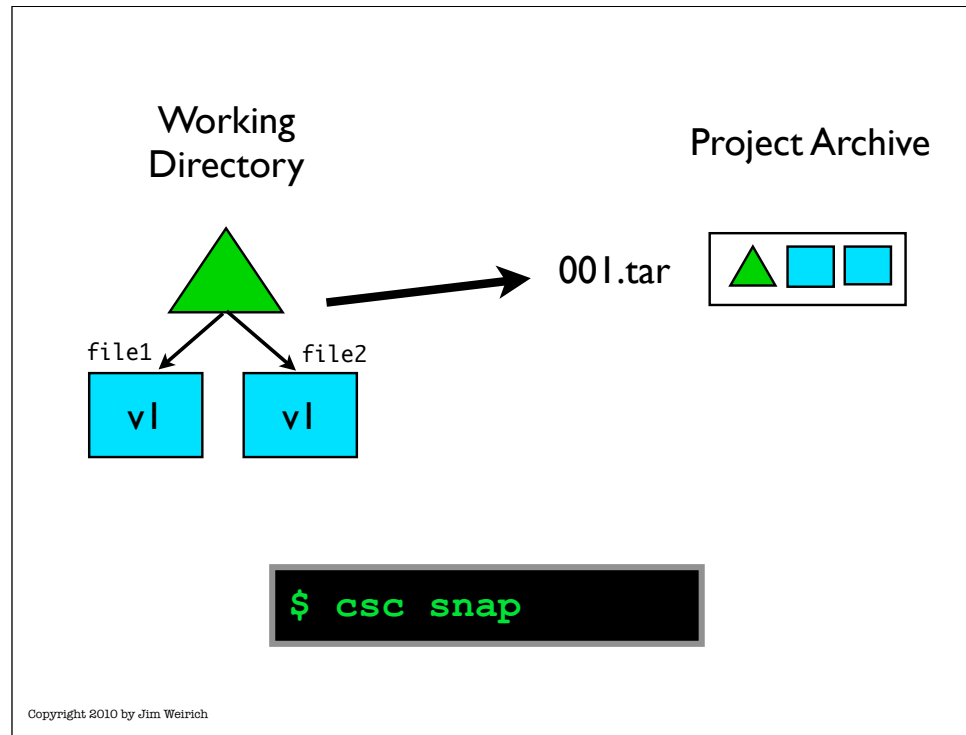
Copyright 2010 by Jim Weirich



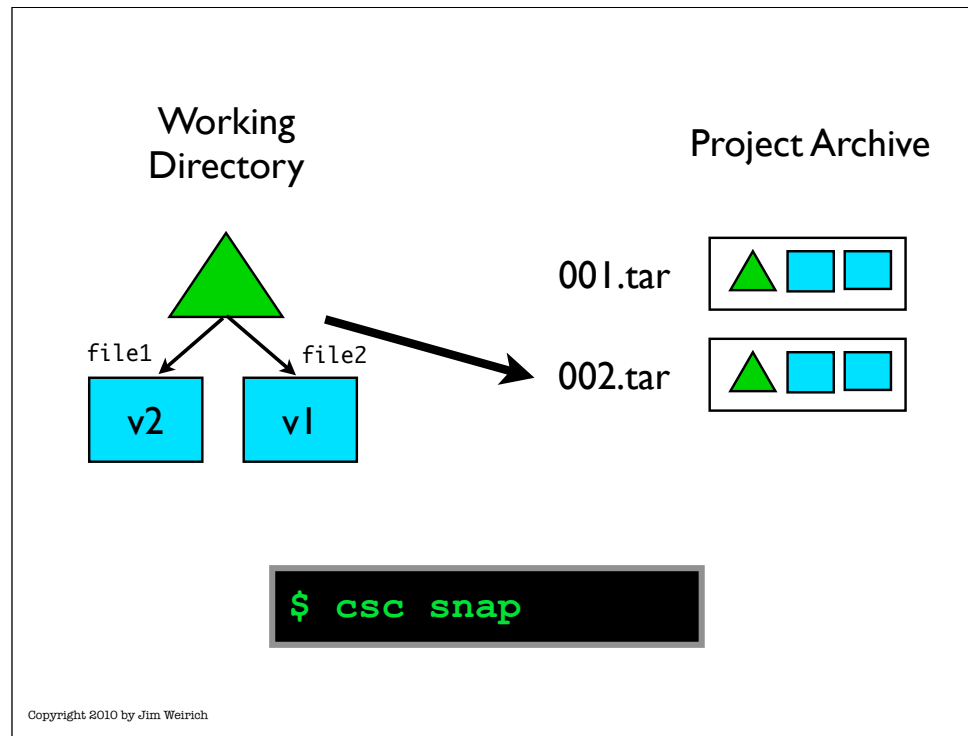


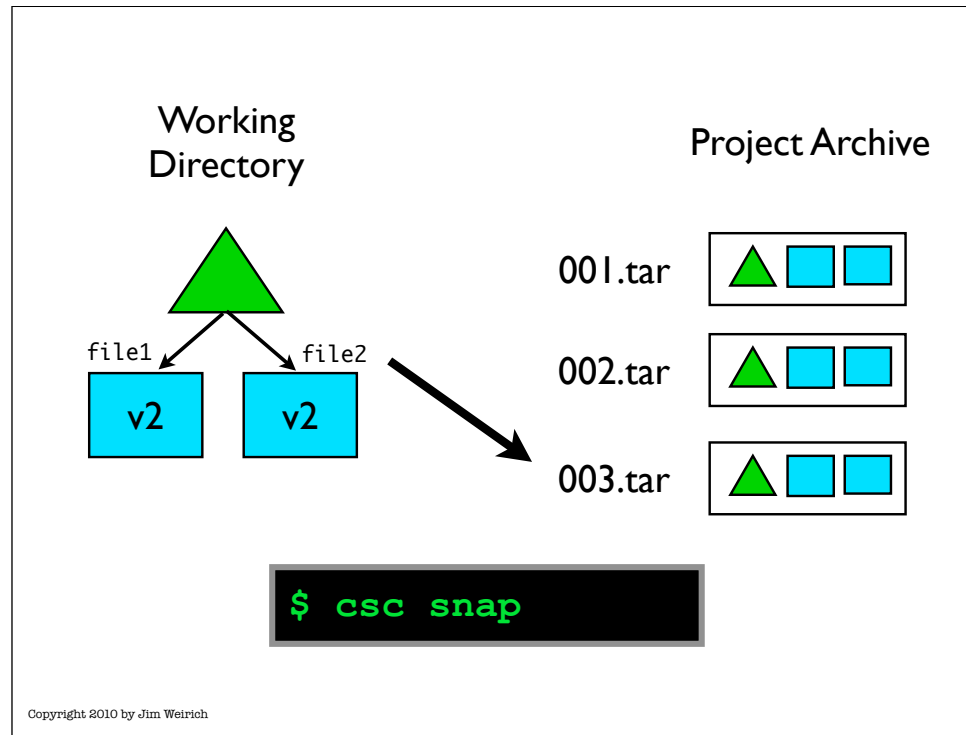


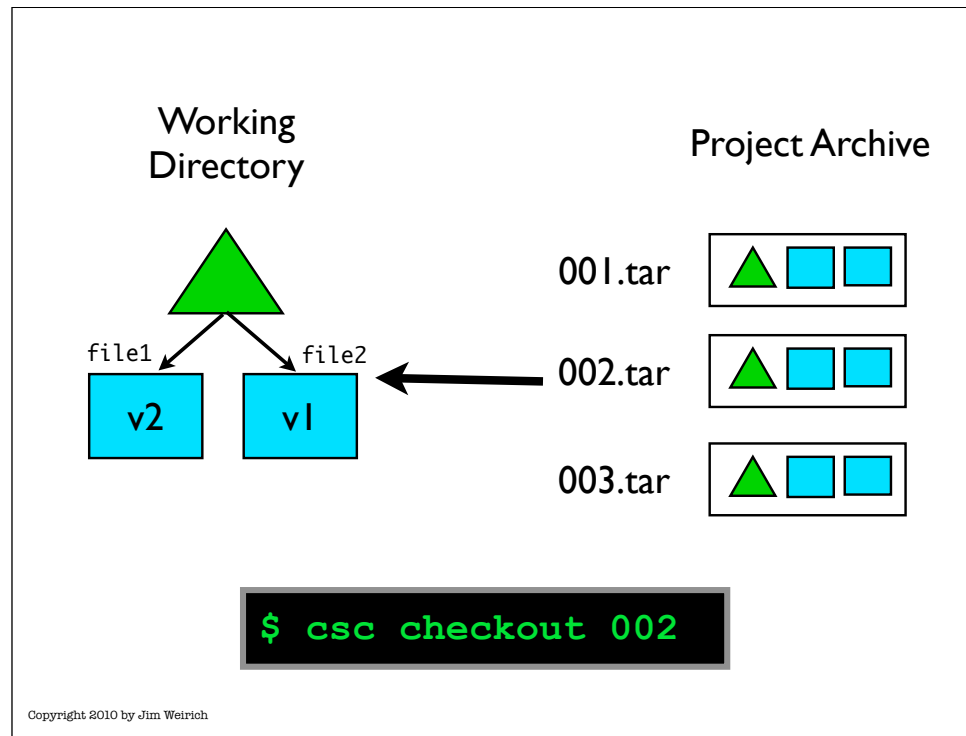




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Two Basic Commands

- Snap
- Checkout

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Very Easy / Very Simple

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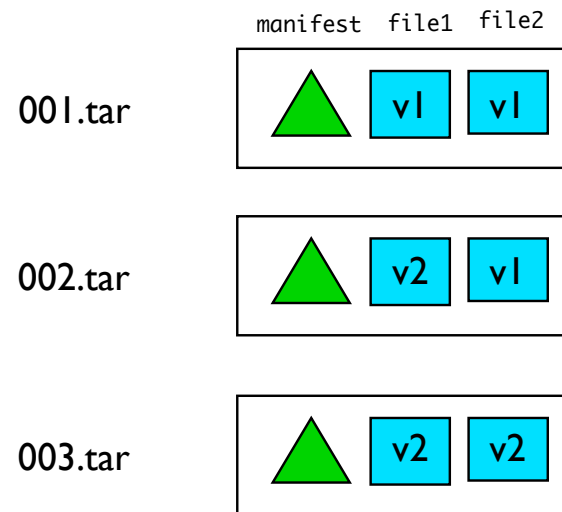
24

Rather Wasteful

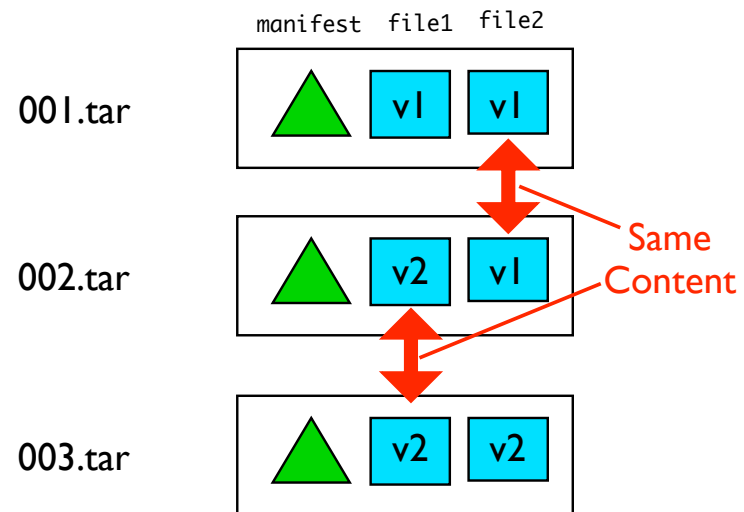
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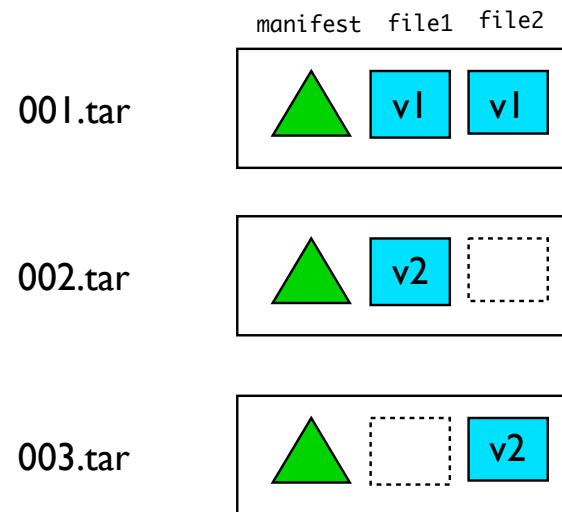
25



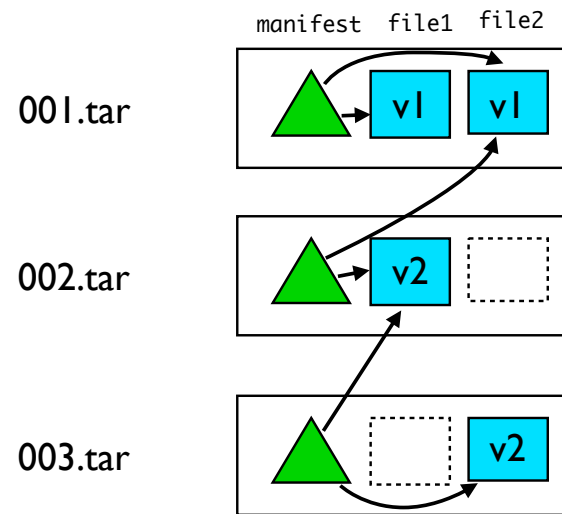
Copyright 2010 by Jim Weirich



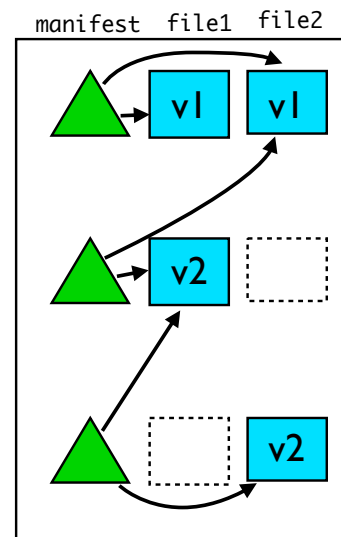
Copyright 2010 by Jim Weirich



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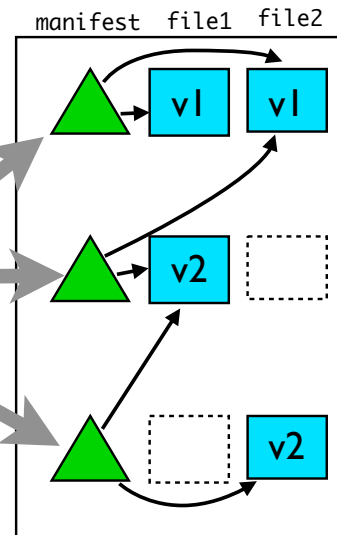


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Note:
Each snapshot is
totally defined by
the manifest file
for that snapshot.



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File Name	Contents
--------------	----------

manifest	▲ / (001)
file1	■ file1 (V1)
file2	■ file2 (V1)
manifest	▲ /
manifest	▲ /
file1	■ file1 (V2)
file2	■ file2 (V2)

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File Name	Contents
manifest	▲ / (001)
file1	■ file1 (V1)
file2	■ file2 (V1)
manifest	▲ /
manifest	▲ /
file1	■ file1 (V2)
file2	■ file2 (V2)

CONFLICT!

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File Name	Contents
--------------	----------

?	▲ / (001)
?	■ file1 (V1)
?	■ file2 (V1)
?	▲ /
?	▲ /
?	■ file1 (V2)
?	■ file2 (V2)

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File Name	Contents
--------------	----------

aaaa	▲ / (001)
aaab	■ file1 (V1)
aaac	■ file2 (V1)
aaad	▲ /
aaae	▲ /
aaaf	■ file1 (V2)
aaag	■ file2 (V2)

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File Name	Contents
--------------	----------

aaaa	▲ / (001)
aaab	■ file1 (V1)
aaac	■ file2 (V1)
aaad	▲ /
aaae	▲ /
aaaf	■ file1 (V2)
aaag	■ file2 (V2)

Note:
The Project Archive is just
a directory with files in it.

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File Name	Contents
--------------	----------

aaaa	▲ / (001)
aaab	■ file1 (V1)
aaac	■ file2 (V1)
aaad	▲ / (002)
aaae	▲ / (003)
aaaf	■ file1 (V2)
aaag	■ file2 (V2)

```
$ ls
aaaa aaab aaac aaad aae aaaf aaag
```

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Project Archive

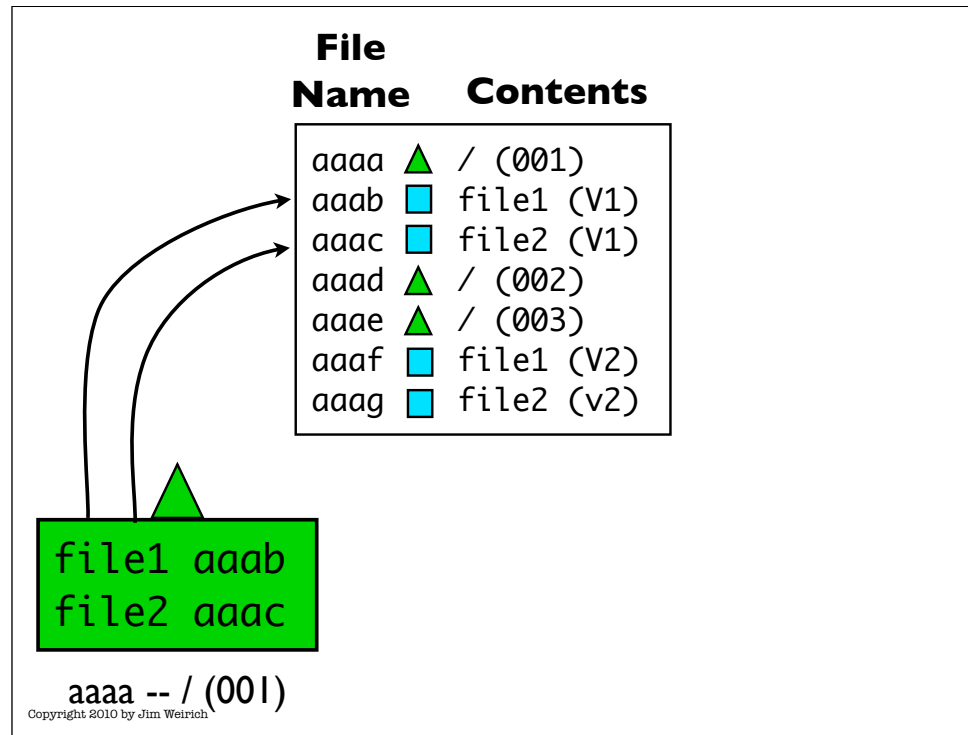
- Is just a **directory with files** in it
- The archive files have **arbitrary** names.
 - The file names can be anything as long as they are **unique**
- We track the **real file** names in the manifest files.

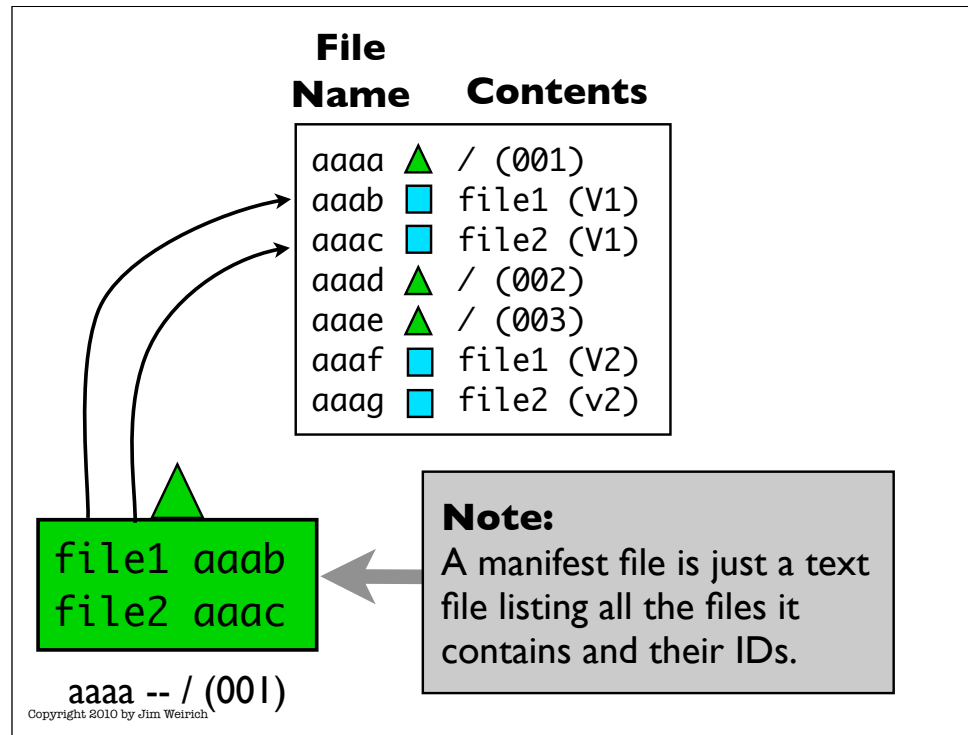
Copyright 2010 by Jim Weirich

**File
Name Contents**

aaaa	▲	/ (001)
aaab	■	file1 (V1)
aaac	■	file2 (V1)
aaad	▲	/ (002)
aaae	▲	/ (003)
aaaf	■	file1 (V2)
aaag	■	file2 (v2)

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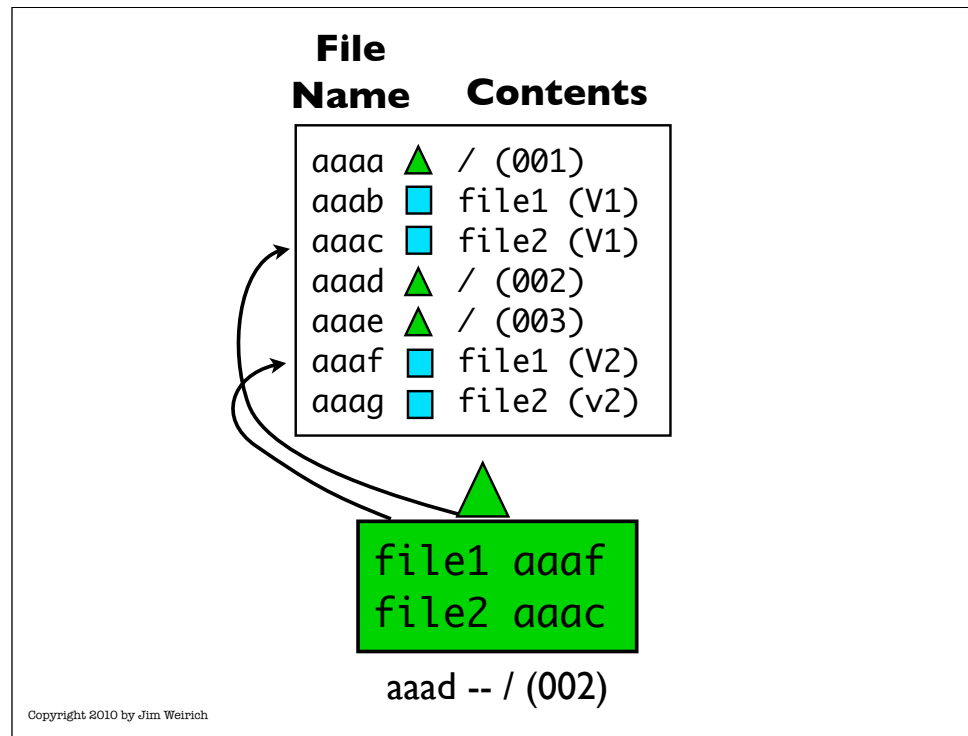




**File
Name Contents**

aaaa	▲	/ (001)
aaab	■	file1 (V1)
aaac	■	file2 (V1)
aaad	▲	/ (002)
aaae	▲	/ (003)
aaaf	■	file1 (V2)
aaag	■	file2 (v2)

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**File
Name Contents**

aaaa	▲	/ (001)
aaab	■	file1 (V1)
aaac	■	file2 (V1)
aaad	▲	/ (002)
aaae	▲	/ (003)
aaaf	■	file1 (V2)
aaag	■	file2 (v2)

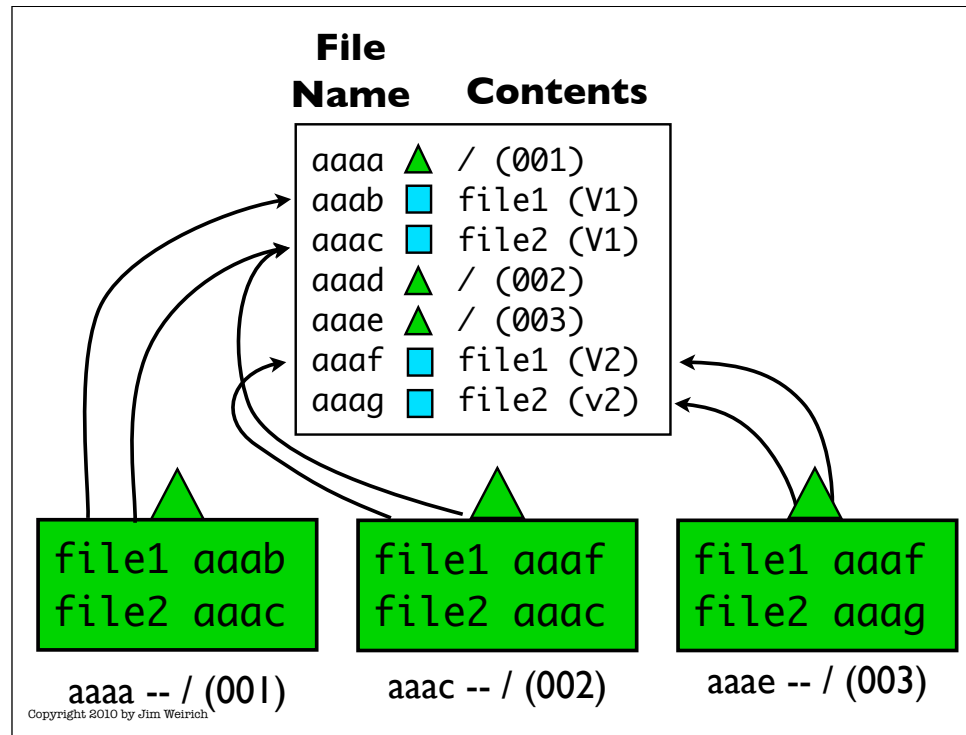
Copyright 2010 by Jim Weirich

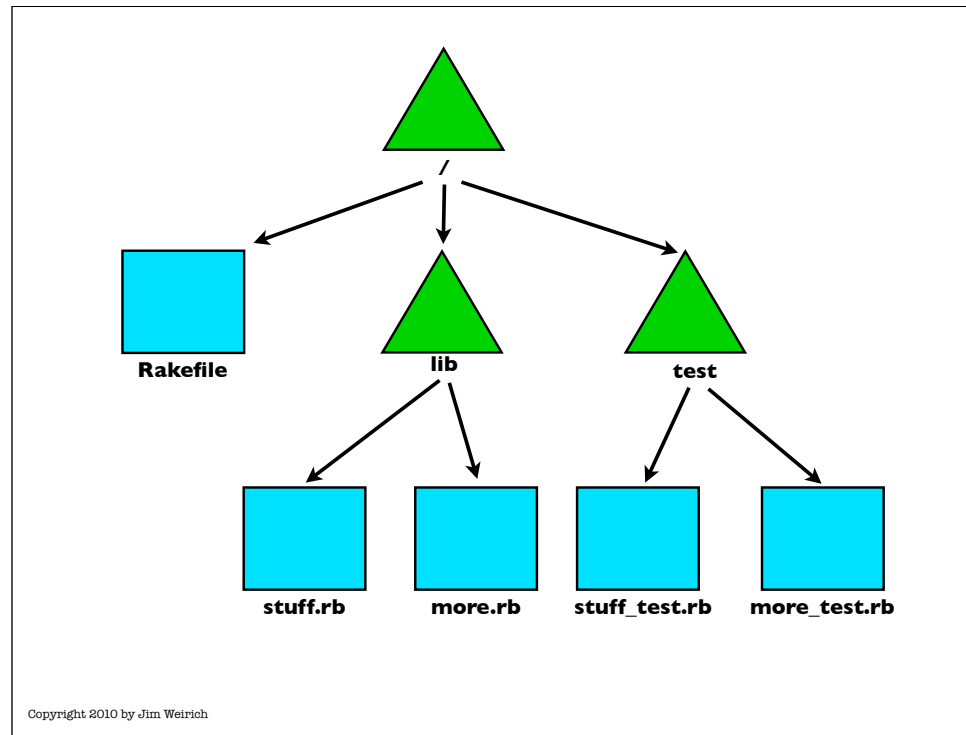
File Name Contents

aaaa	▲	/ (001)
aaab	■	file1 (V1)
aaac	■	file2 (V1)
aaad	▲	/ (002)
aaae	▲	/ (003)
aaaf	■	file1 (V2)
aaag	■	file2 (v2)

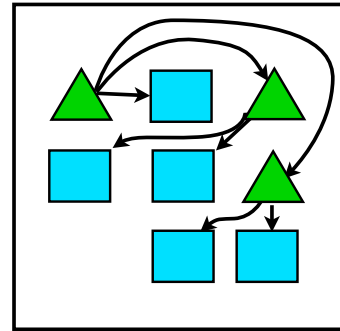
file1 aaaf
file2 aaag
aaae -- / (003)

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Project Archive



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Metadata would
be nice

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What Metadata?

- The Root manifest of the snapshot
- Name/EMail of the person committing the snapshot
- Date/Time of the snapshot
- Some comments describing the snapshot

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tree aaae
author Jim <me@email.com> 1246996320 -0400

Comments describing this snapshot.

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Root Manifest
for Snapshot






```
tree aaaa  
author Jim <me@email.com> 1246996320 -0400
```

Comments describing this snapshot.

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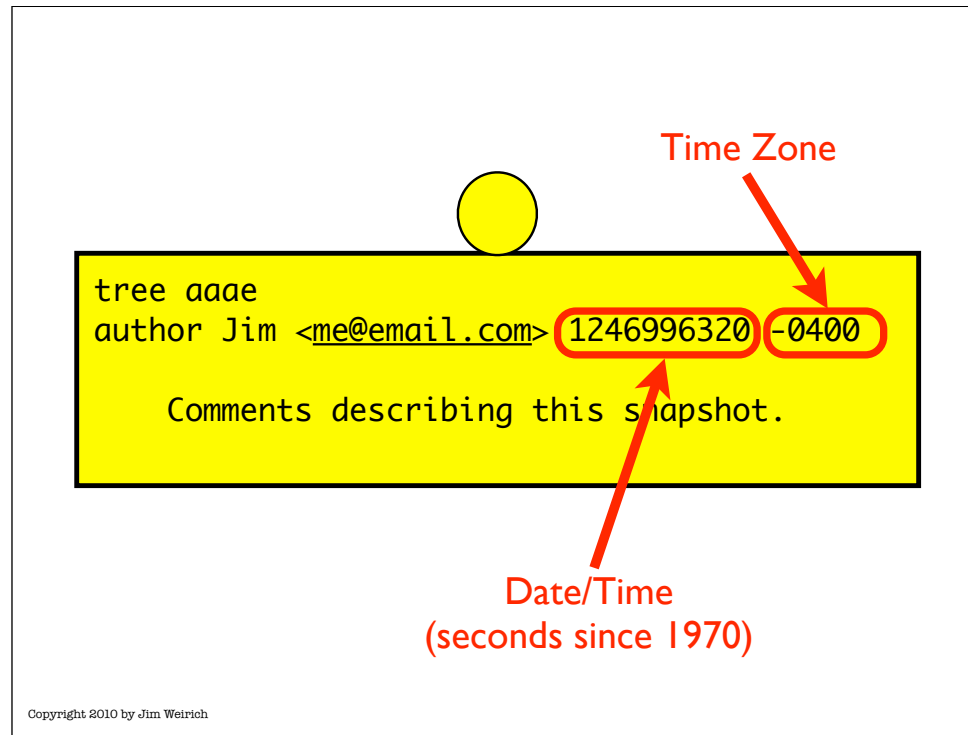
Author & EMail



```
tree daae
author Jim <me@email.com> 1246996320 -0400

Comments describing this snapshot.
```

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The diagram shows a yellow rectangular box representing a snapshot. Above the box is a yellow circle. Inside the box, the text is as follows:

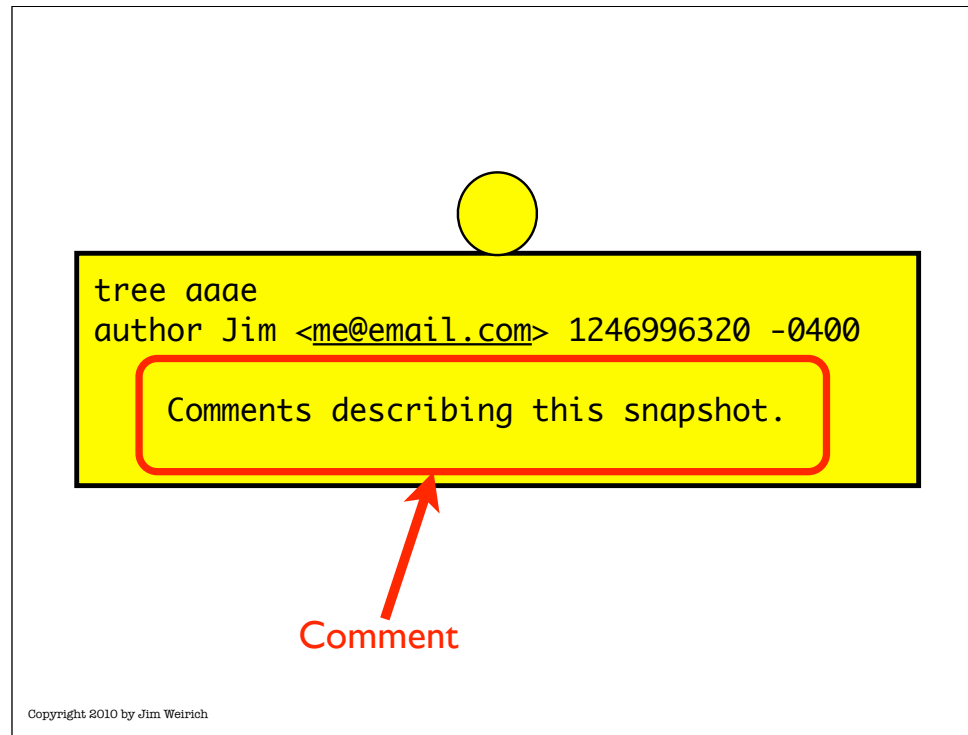
```
tree aaae  
author Jim <me@email.com> 1246996320 -0400  
  
Comments describing this snapshot.
```

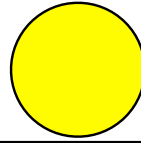
Two red annotations with arrows point to specific parts of the snapshot:

- A red arrow labeled "Time Zone" points to the "-0400" value.
- A red arrow labeled "Date/Time (seconds since 1970)" points to the "1246996320" value.

Both the "1246996320" and "-0400" values are circled in red in the original image.

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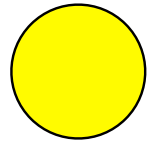




tree aaae
author Jim <me@email.com> 1246996320 -0400

Comments describing this snapshot.

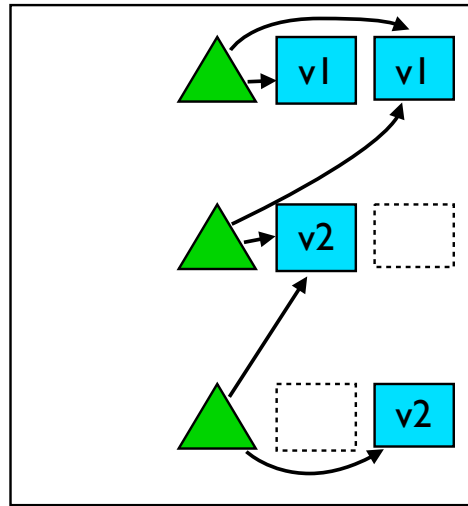
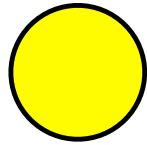
Copyright 2010 by Jim Weirich



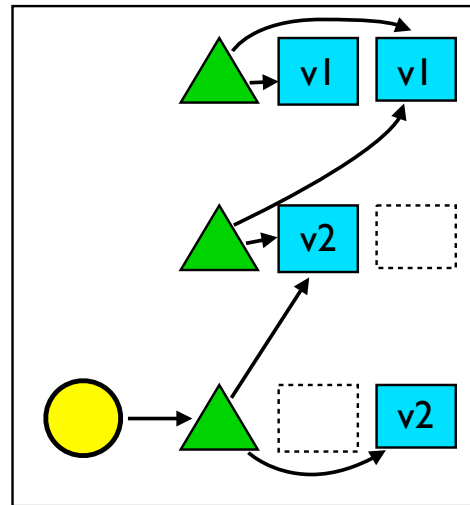
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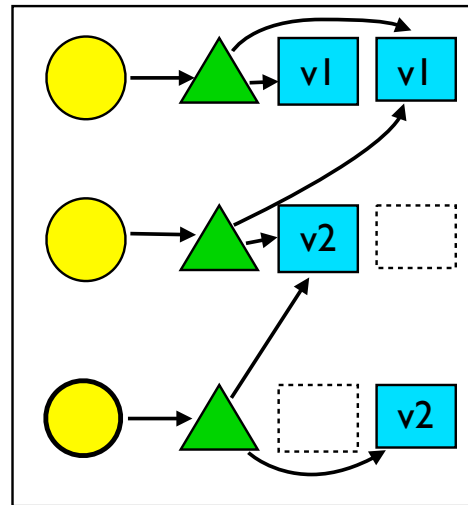
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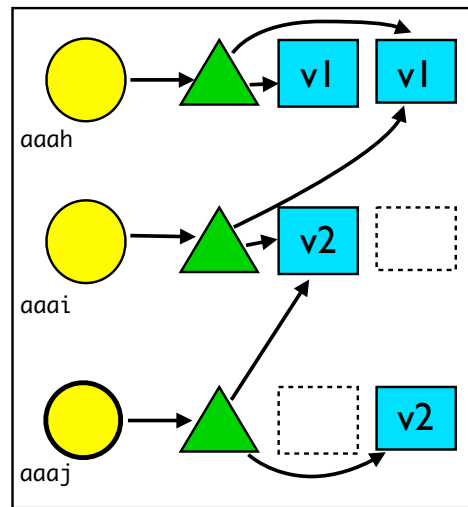
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```
tree aaae  
author Jim <me@email.com> 1246996320 -0400
```

Comments describing this snapshot.

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```
tree aaae  
parent aaai  
author Jim <me@email.com> 1246996320 -0400
```

Comments describing this snapshot.

Copyright 2010 by Jim Weirich

previous snapshot

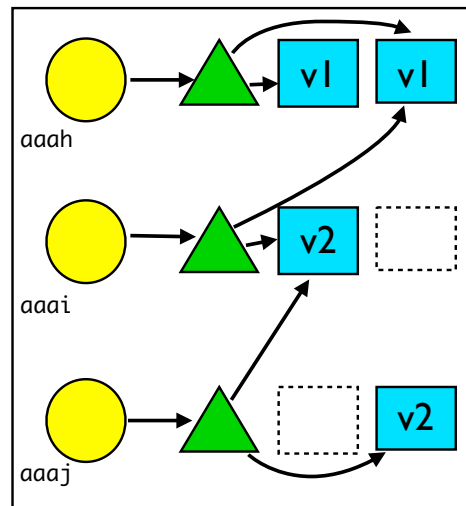


```
tree aaae  
parent aaai  
author Jim <me@email.com> 1246996320 -0400
```

Comments describing this snapshot.

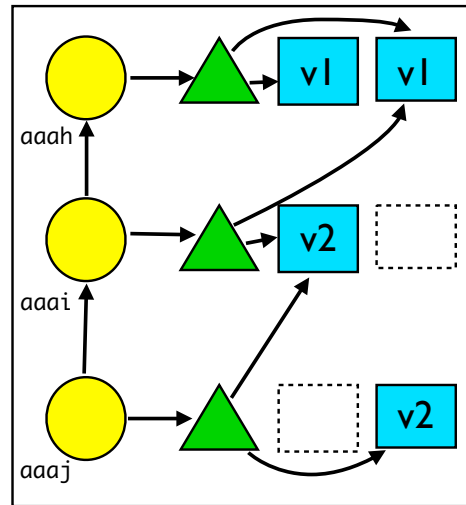
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Project Archive

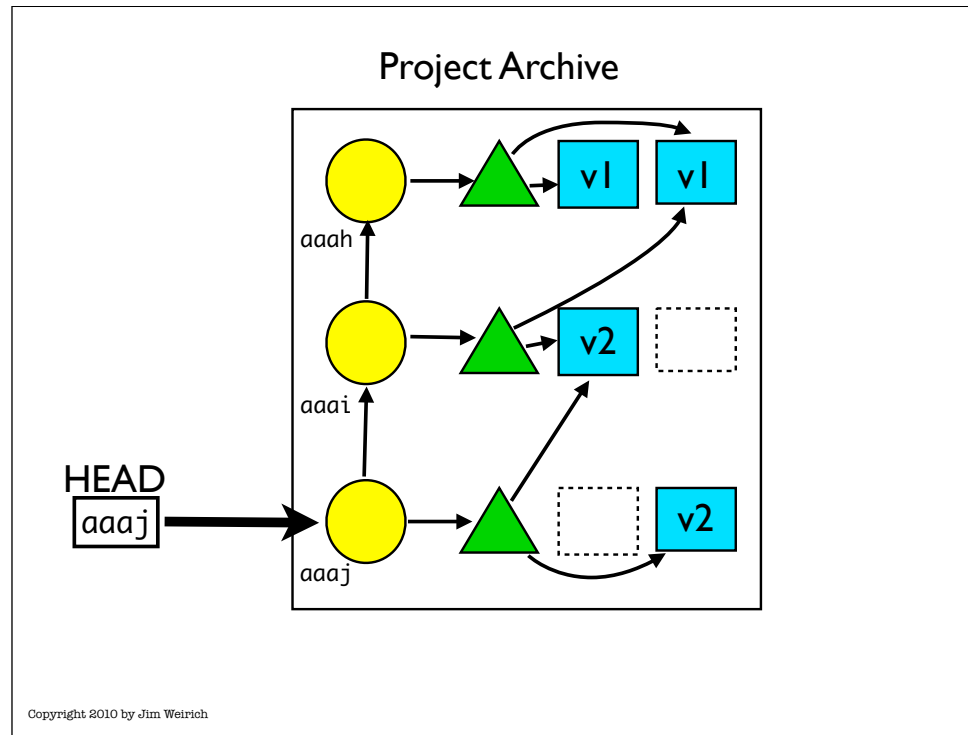


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Project Archive



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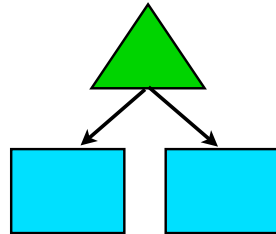
Summary So Far ...

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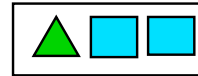
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Working
Directory

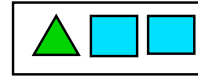


Project Archive

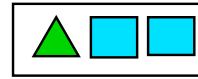
001.tar



002.tar

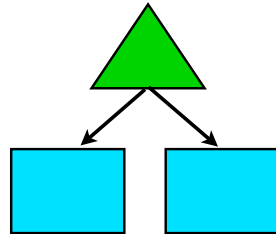


003.tar

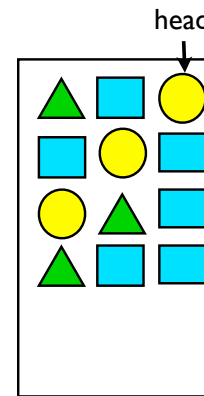


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Working Directory



Project Archive



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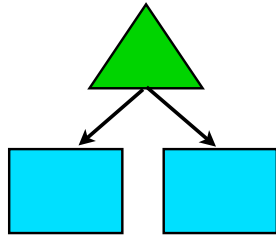
How do we create a
snapshot now?

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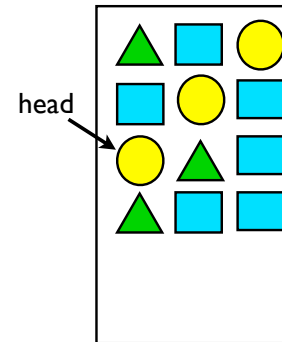
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Working
Directory

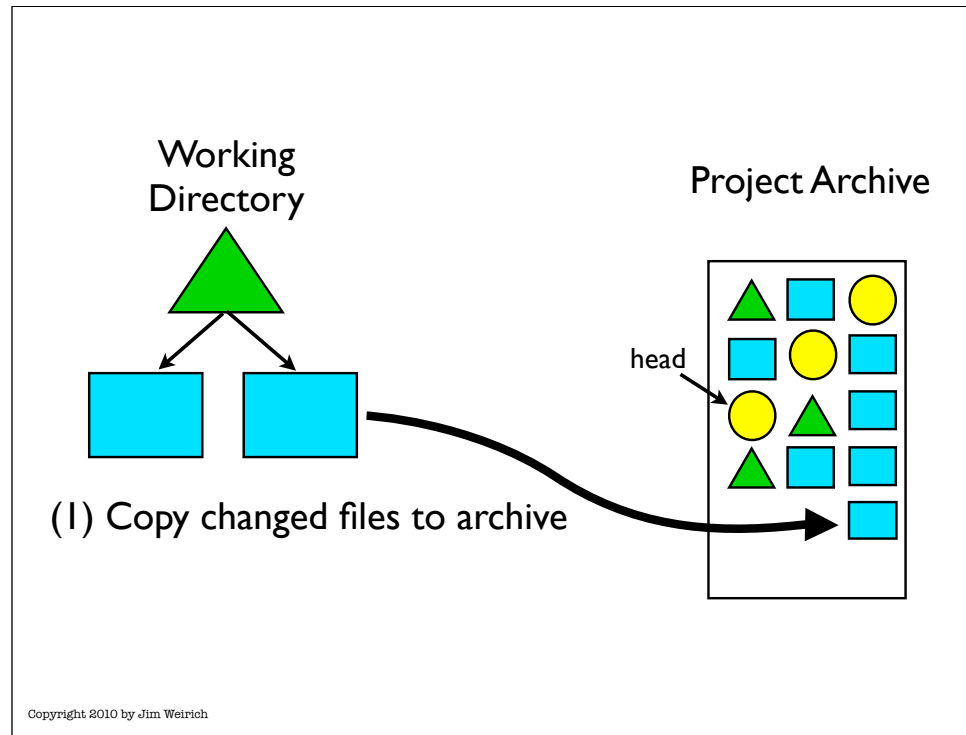


(I) Copy changed files to archive

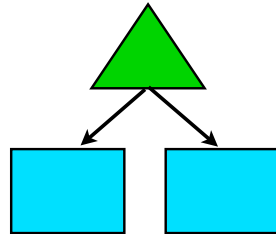
Project Archive



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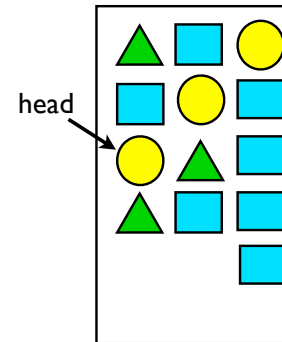


Working
Directory

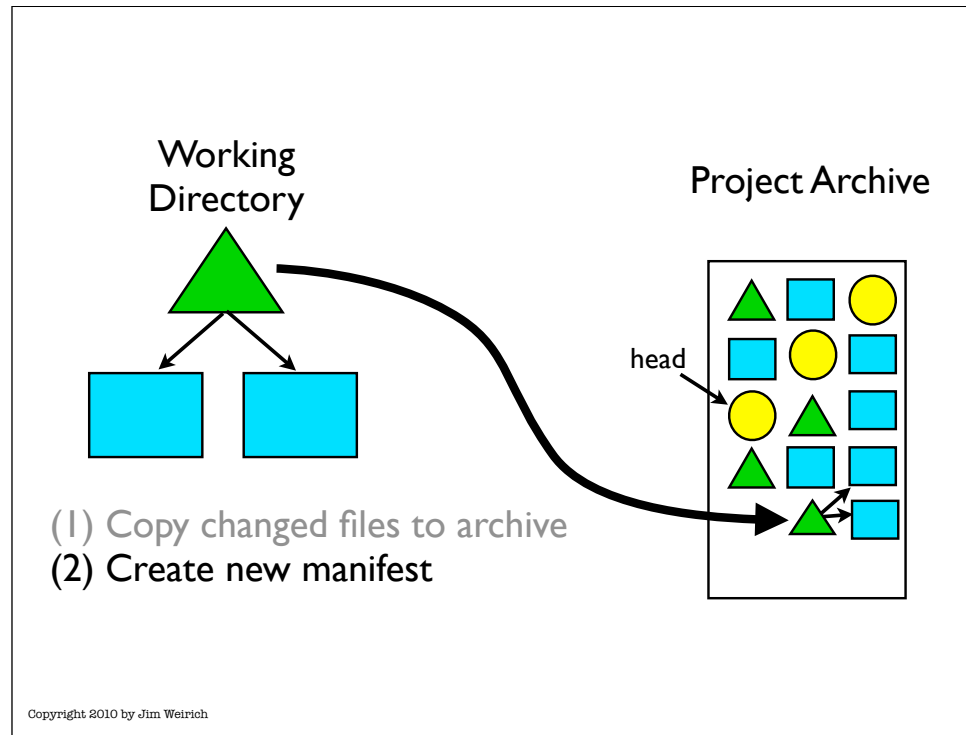


- (1) Copy changed files to archive
- (2) Create new manifest

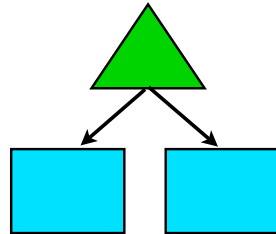
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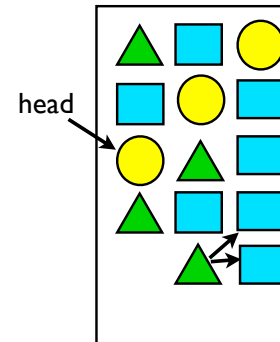


Working
Directory



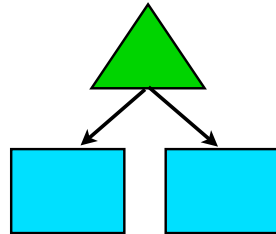
- (1) Copy changed files to archive
- (2) Create new manifest
- (3) Create new snapshot record

Project Archive



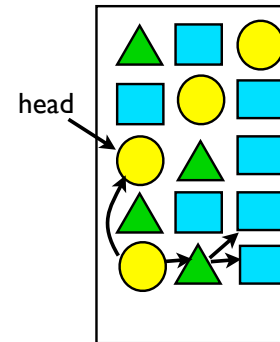
Copyright 2010 by Jim Weirich

Working
Directory



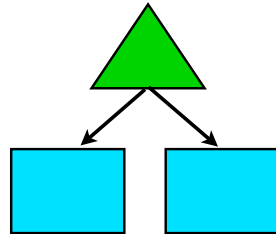
- (1) Copy changed files to archive
- (2) Create new manifest
- (3) Create new snapshot record

Project Archive



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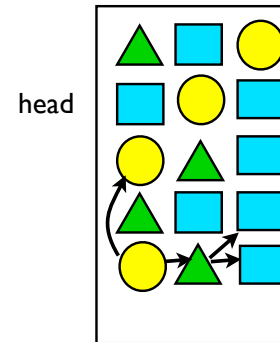
Working Directory



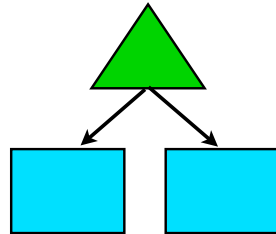
- (1) Copy changed files to archive
- (2) Create new manifest
- (3) Create new snapshot record
- (4) Readjust HEAD

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Project Archive



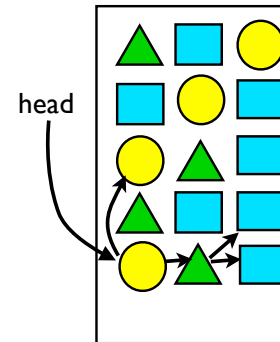
Working
Directory

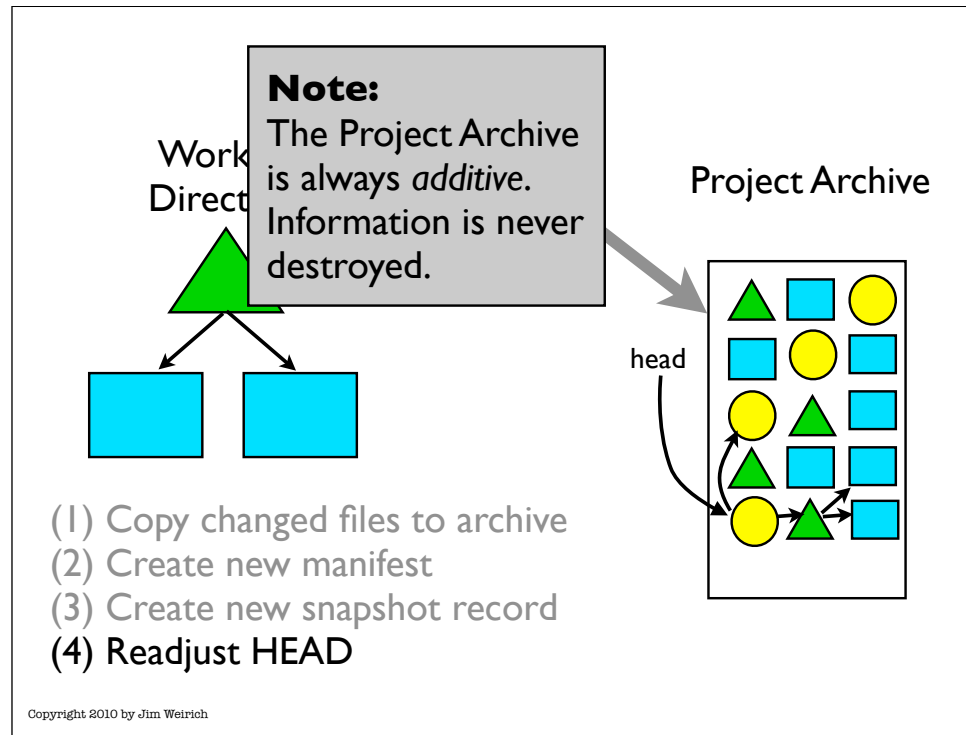


- (1) Copy changed files to archive
- (2) Create new manifest
- (3) Create new snapshot record
- (4) Readjust HEAD

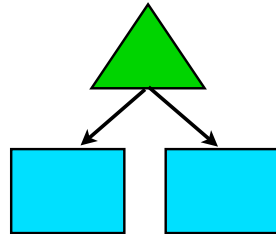
Copyright 2010 by Jim Weirich

Project Archive





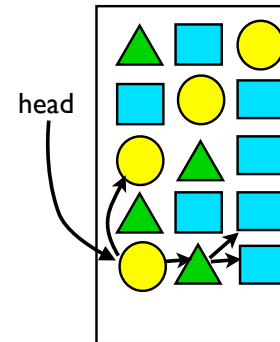
Working Directory

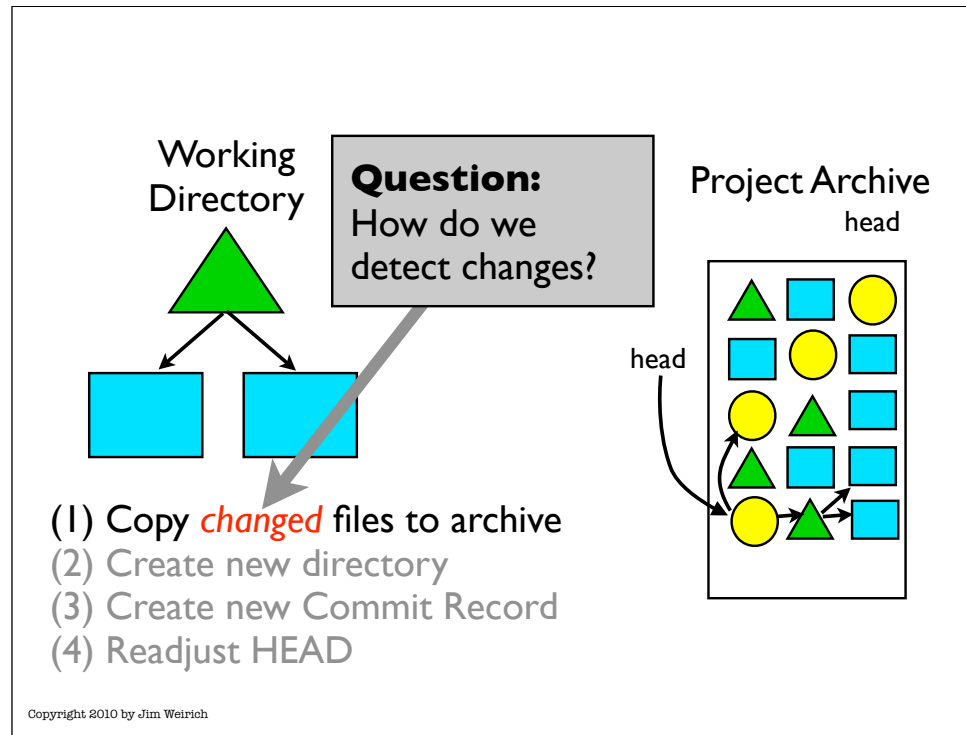


- (1) Copy changed files to archive
- (2) Create new manifest
- (3) Create new snapshot record
- (4) Readjust HEAD

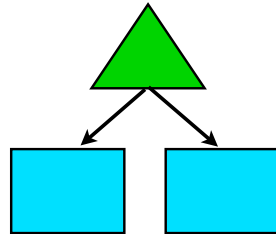
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Project Archive





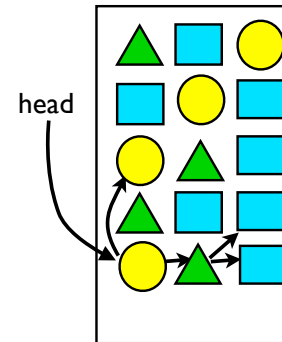
Working
Directory



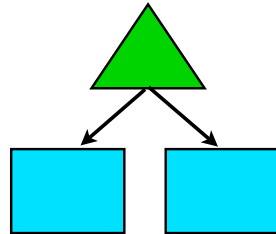
- (1) Copy *changed* files to archive
- (2) Create new directory
- (3) Create new Commit Record
- (4) Readjust HEAD

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Project Archive
head



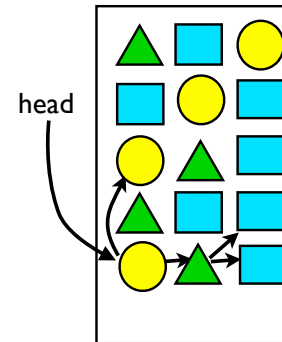
Working
Directory



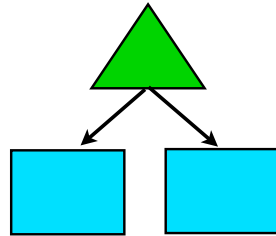
- (1) Copy *changed* files to archive
- (2) Create new directory
- (3) Create new Commit Record
- (4) Readjust HEAD

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Project Archive
head



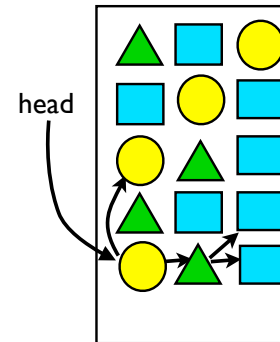
Working
Directory



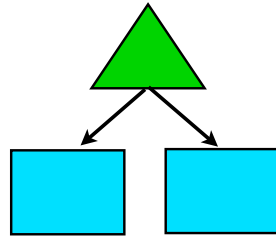
- (1) Copy *changed* files to archive
- (2) Create new directory
- (3) Create new Commit Record
- (4) Readjust HEAD

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Project Archive



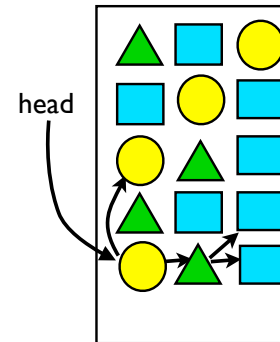
Working
Directory



- (1) Copy *changed* files to archive
- (2) Create new directory
- (3) Create new Commit Record
- (4) Readjust HEAD

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Project Archive



Detecting Duplication

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file.txt

Hi, my name is Bob.

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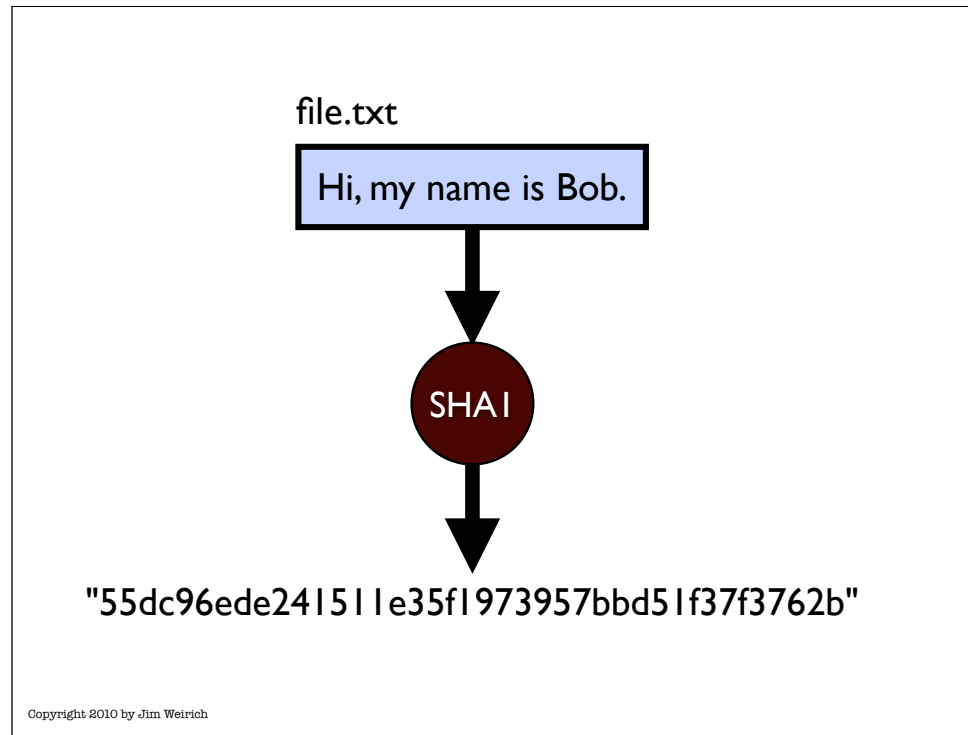
file.txt

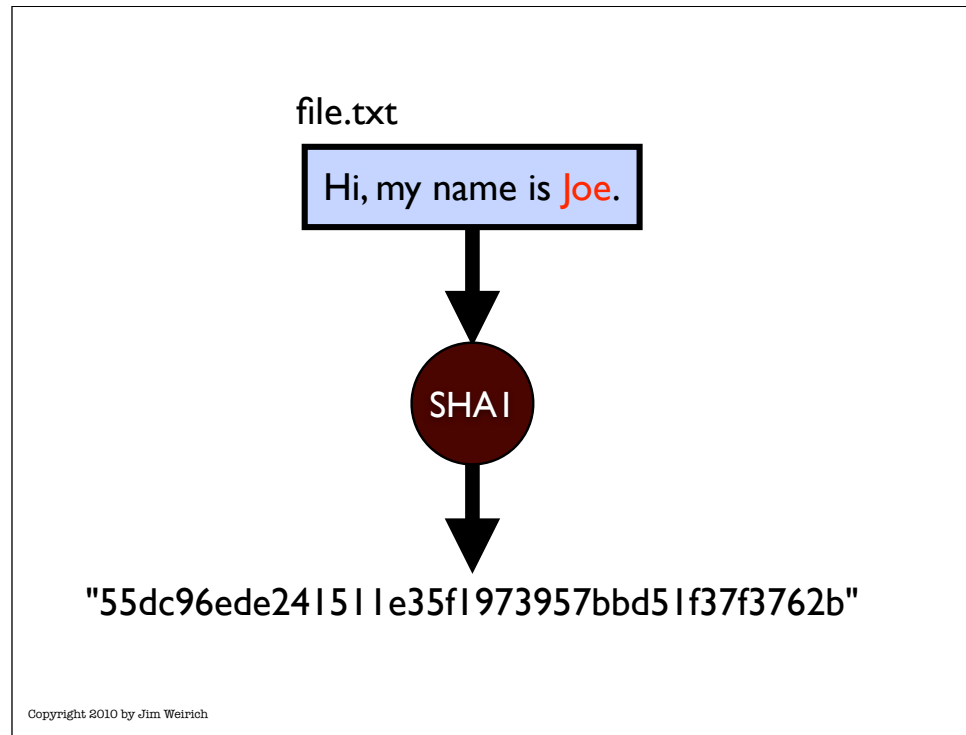
Hi, my name is Bob.

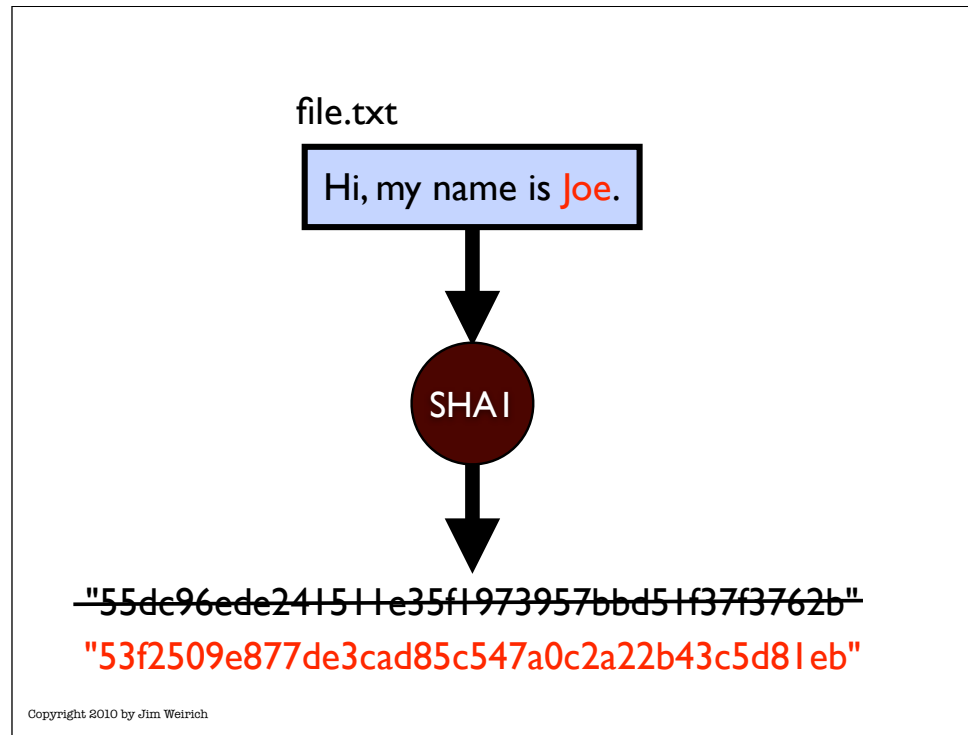


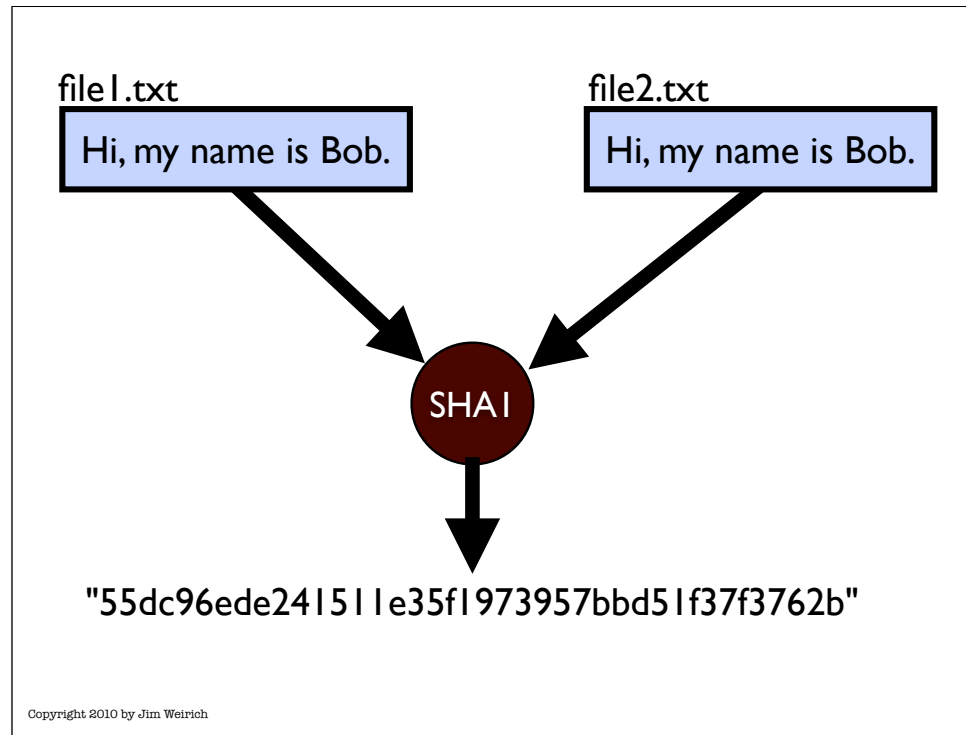
SHAI

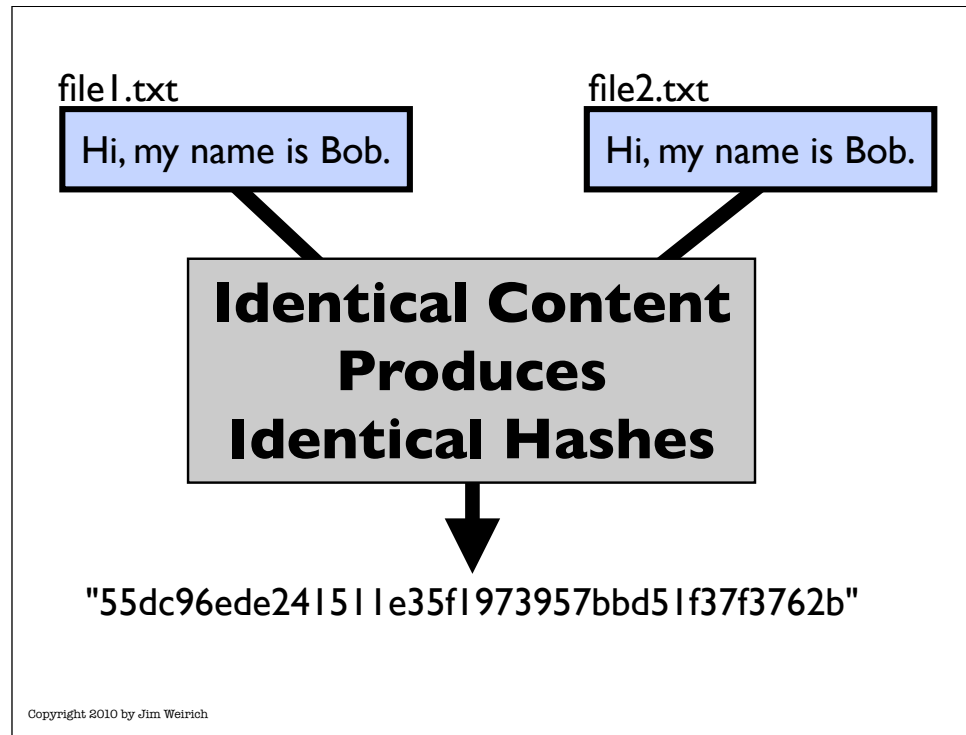
Copyright 2010 by Jim Weirich











File Names in the Archive

aaaa	▲ / (001)
aaab	■ file1 (V1)
aaac	■ file2 (V1)
aaad	▲ /
aaae	▲ /
aaaf	■ file1 (V2)
aaag	■ file2 (V2)

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File Names in the Archive

- Arbitrary
- Unique

aaaa	▲ / (001)
aaab	■ file1 (V1)
aaac	■ file2 (V1)
aaad	▲ /
aaae	▲ /
aaaf	■ file1 (V2)
aaag	■ file2 (V2)

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Idea:

Use the SHA1 Hash
for the File Name

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Project Archive

aaaa	●
aaab	■
aaac	■
aaad	▲
aaae	●
aaaf	■
aaag	▲
aaah	■
aaai	■

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Project Archive










75e3dee3503e7ad5...	●
1586ad8975e3dee3...	■
f6da34481586ad89...	■
f99b89d6f6da3448...	▲
503d6749f99b89d6...	●
2b436957503d6749...	■
944ff522944ff522...	▲
6c024e25944ff522...	■
503e7ad56c024e25...	■

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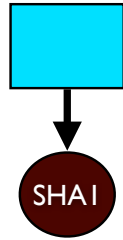
Project Archive

HEAD

75e3dee3503e7ad5...

75e3dee3503e7ad5... 
1586ad8975e3dee3... 
f6da34481586ad89... 
f99b89d6f6da3448... 
503d6749f99b89d6... 
2b436957503d6749... 
944ff522944ff522... 
6c024e25944ff522... 
503e7ad56c024e25... 

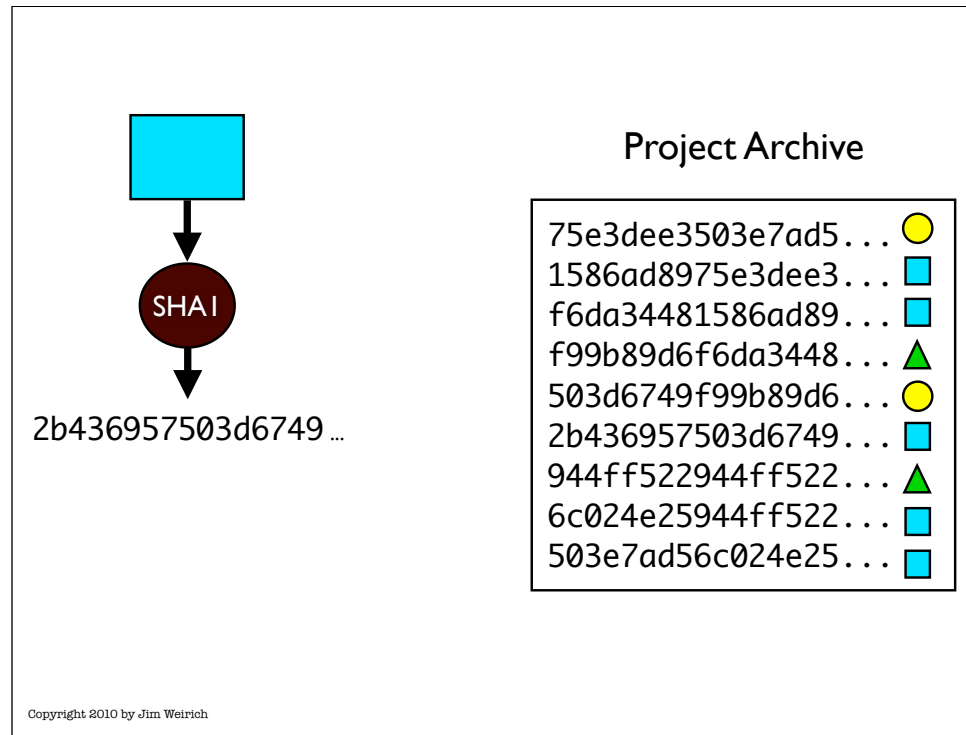
Copyright 2010 by Jim Weirich

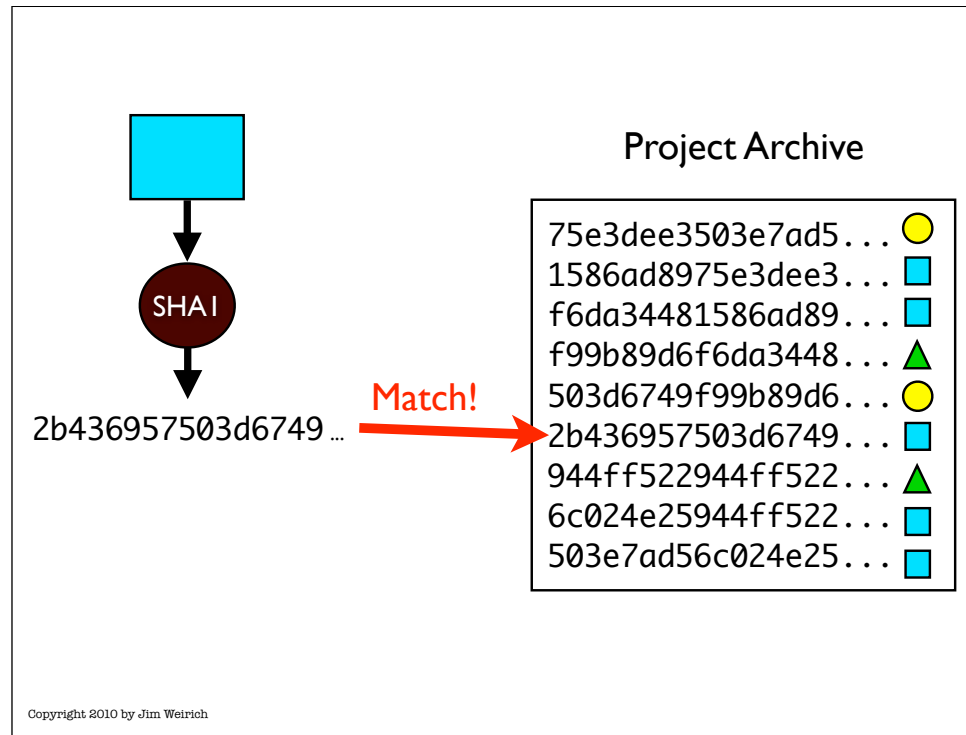


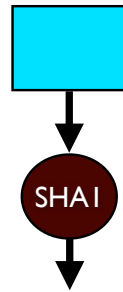
Project Archive

75e3dee3503e7ad5...	●
1586ad8975e3dee3...	■
f6da34481586ad89...	■
f99b89d6f6da3448...	▲
503d6749f99b89d6...	●
2b436957503d6749...	■
944ff522944ff522...	▲
6c024e25944ff522...	■
503e7ad56c024e25...	■

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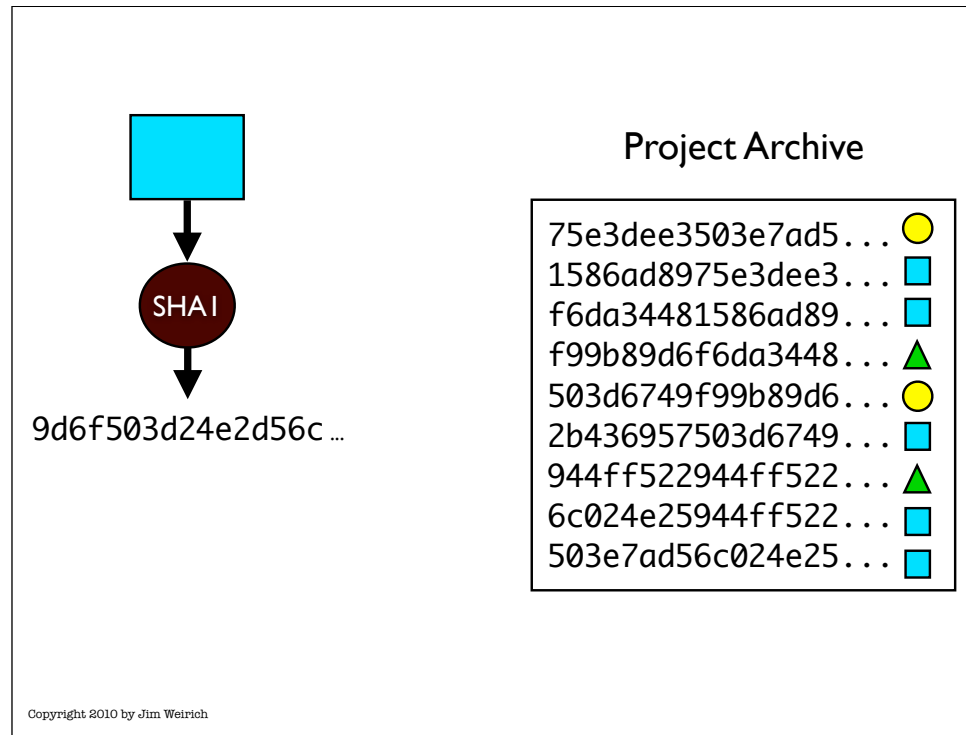


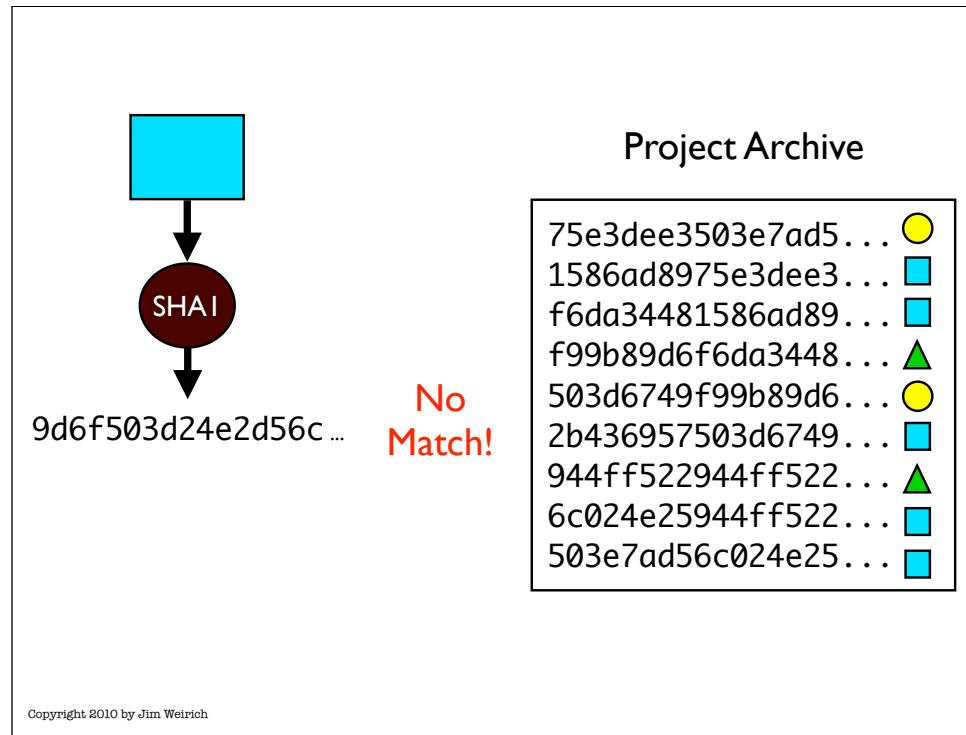


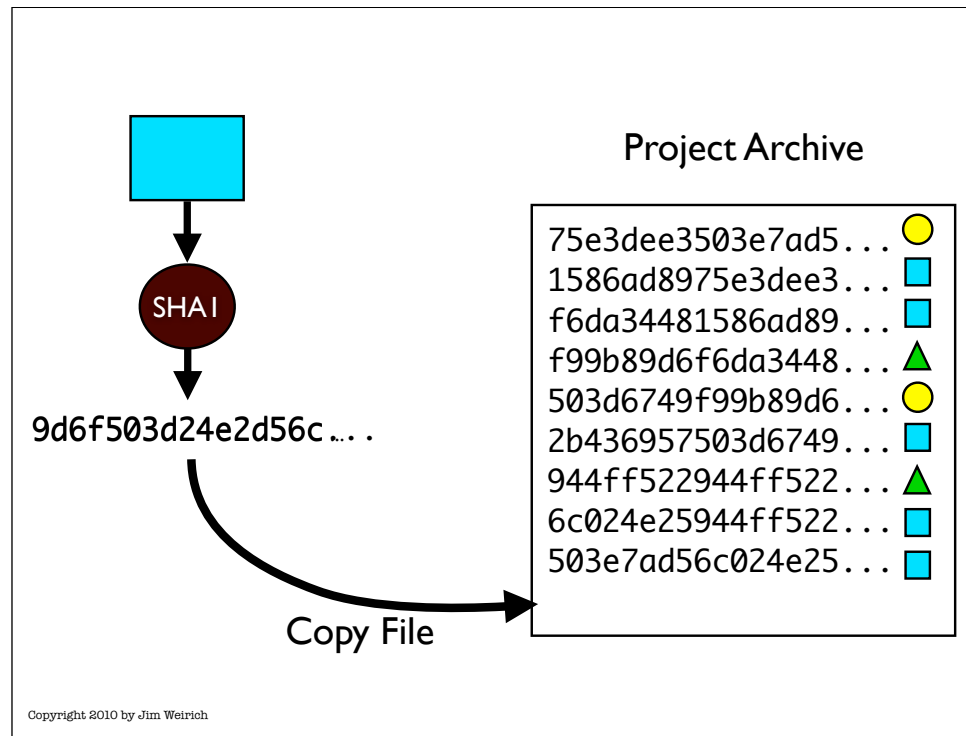
Project Archive

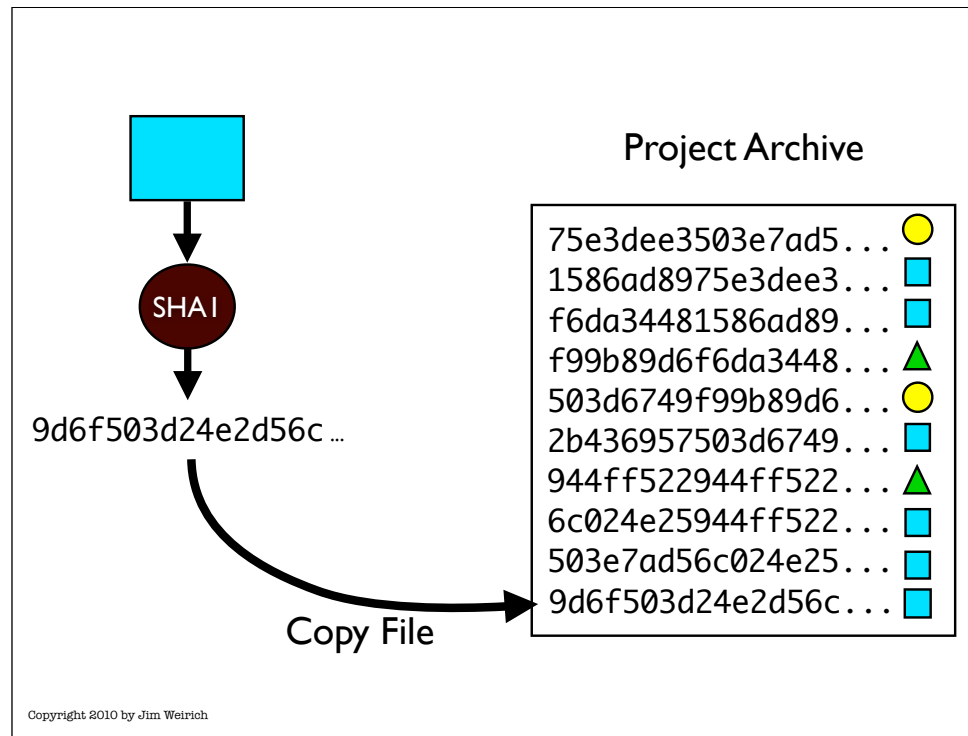
75e3dee3503e7ad5...	●
1586ad8975e3dee3...	■
f6da34481586ad89...	■
f99b89d6f6da3448...	▲
503d6749f99b89d6...	●
2b436957503d6749...	■
944ff522944ff522...	▲
6c024e25944ff522...	■
503e7ad56c024e25...	■

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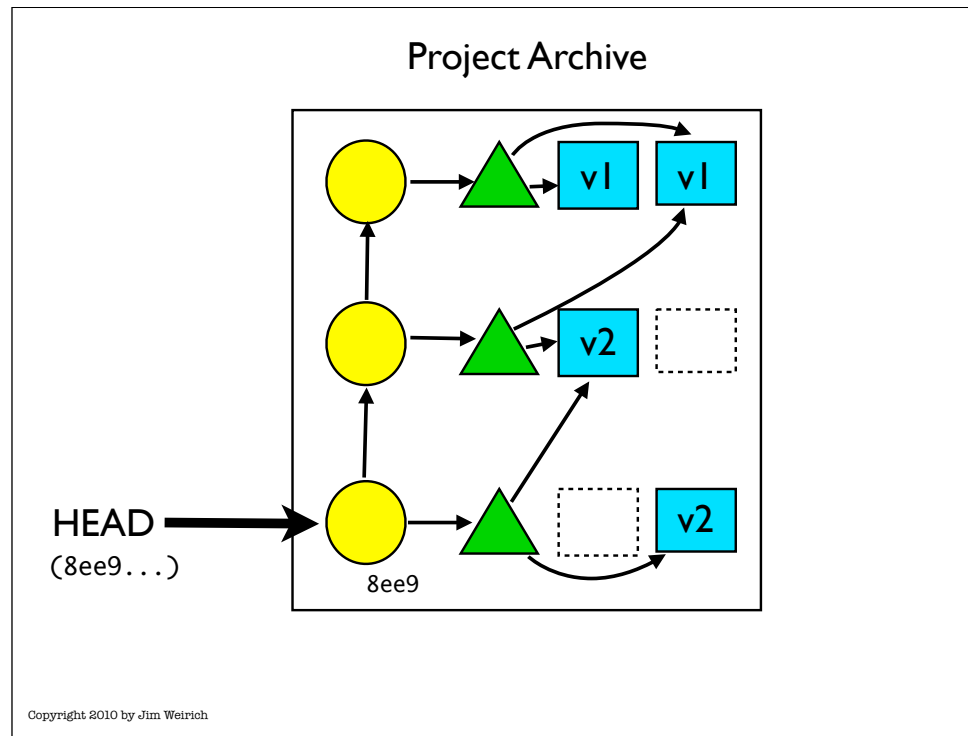


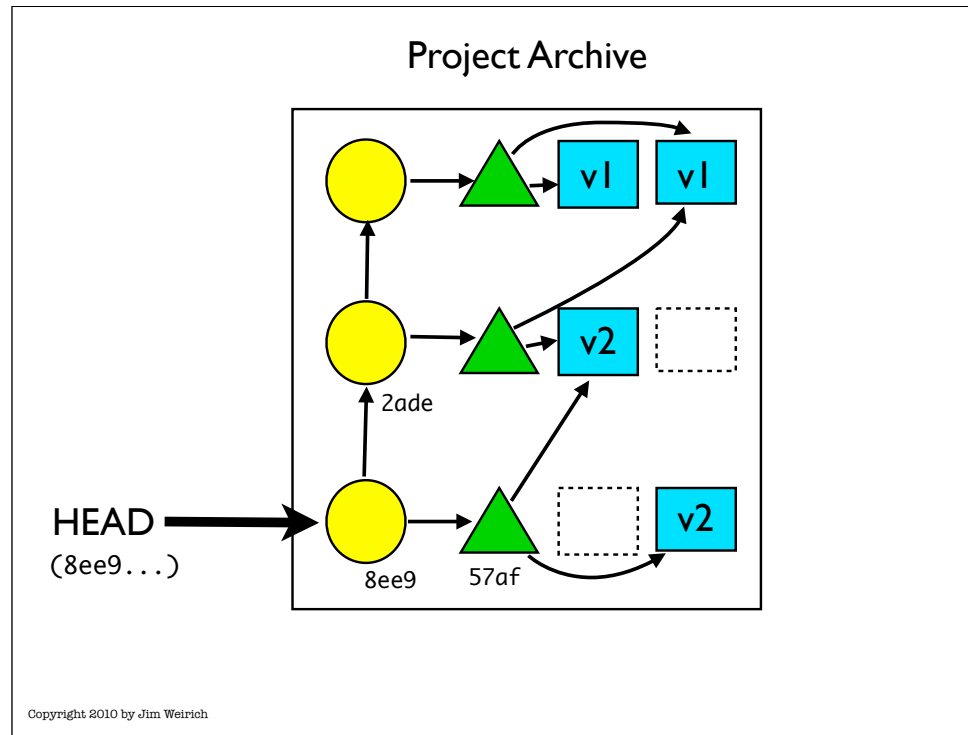
Project Archive Integrity

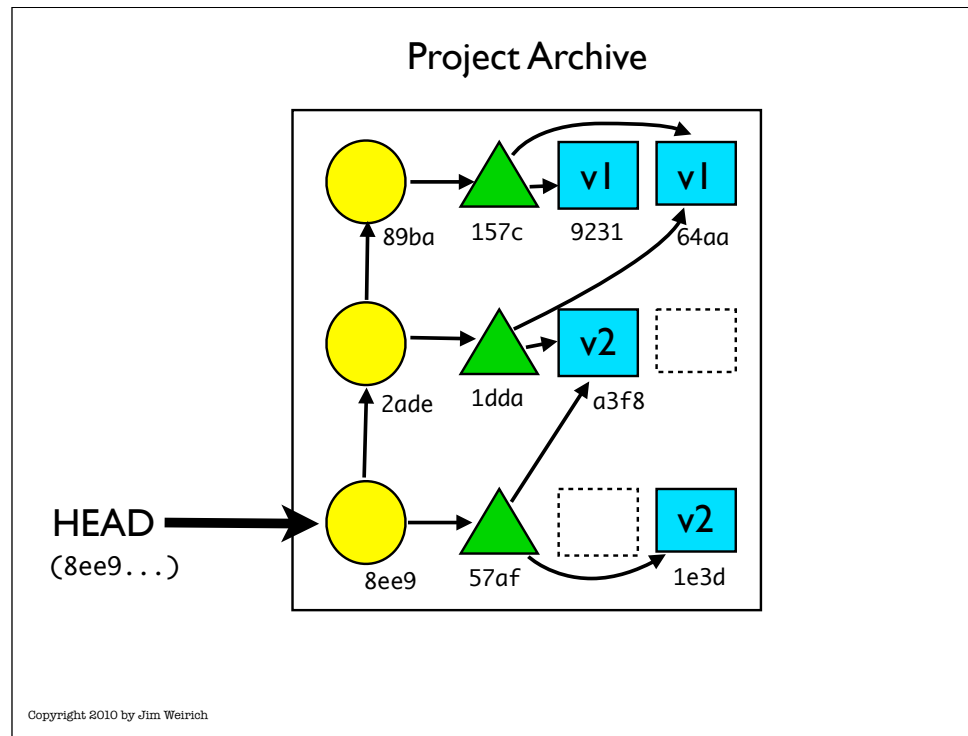
Copyright 2010 by Jim Weirich

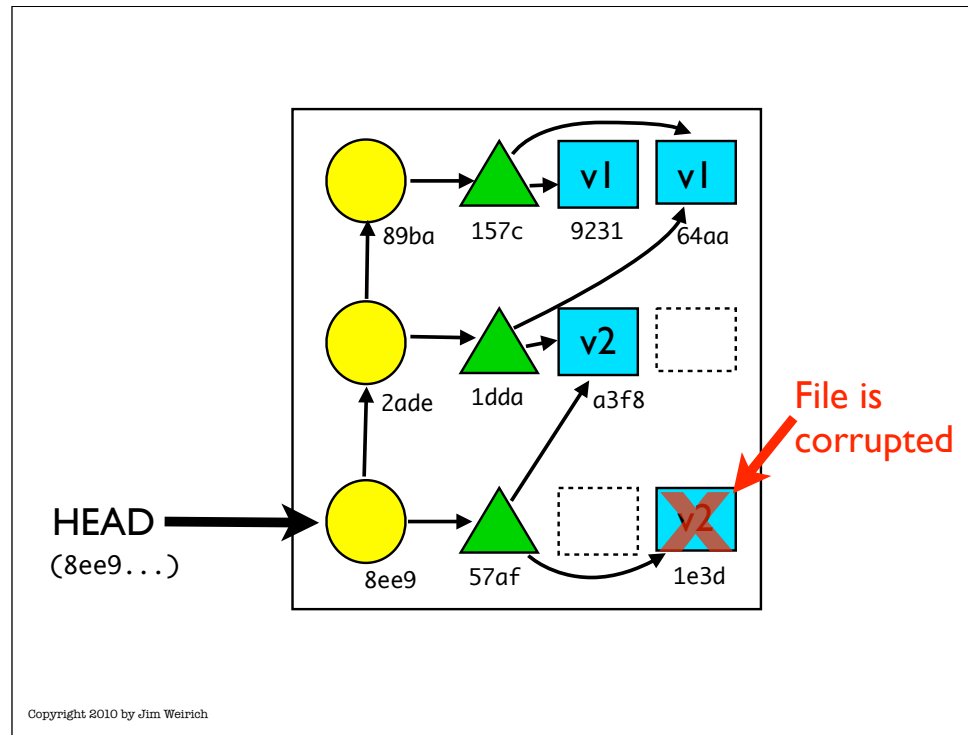
Saturday, January 15, 2011

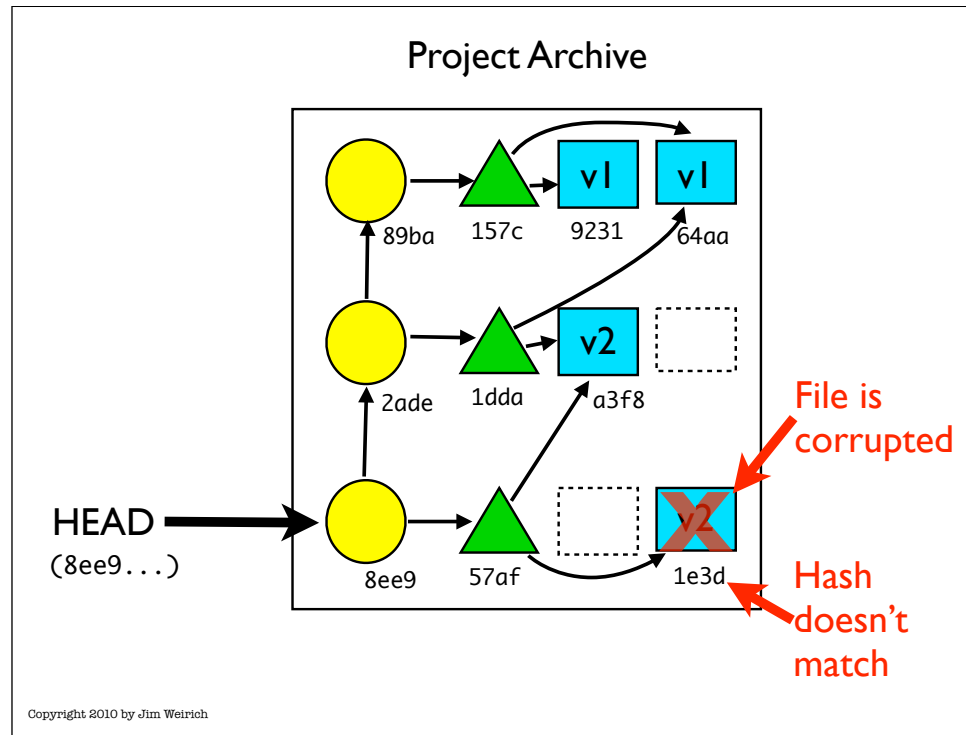
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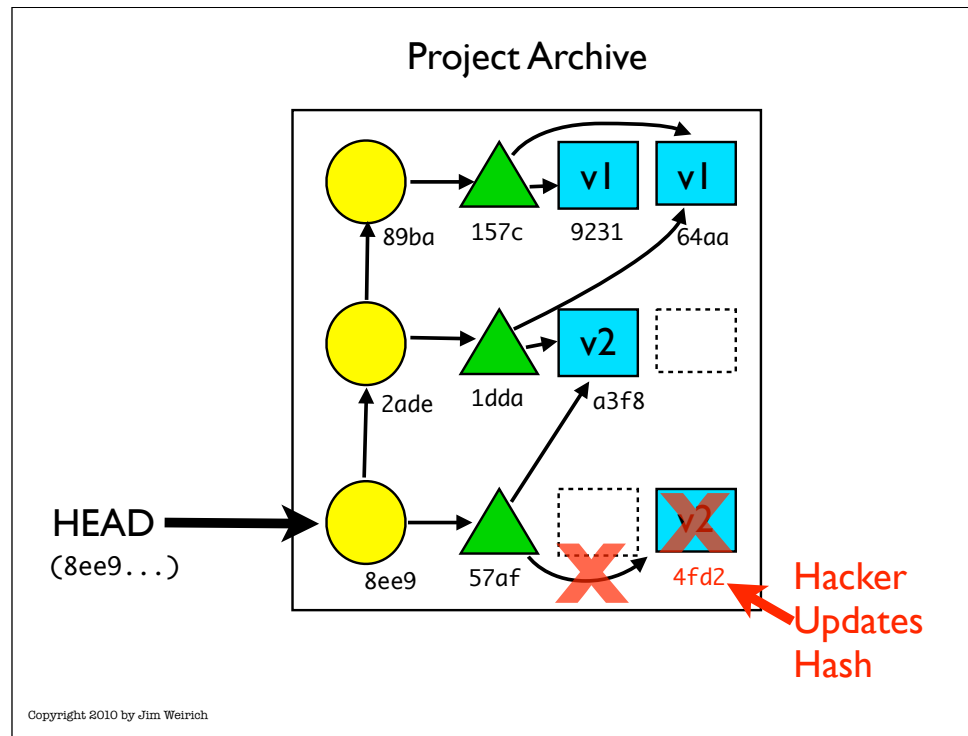


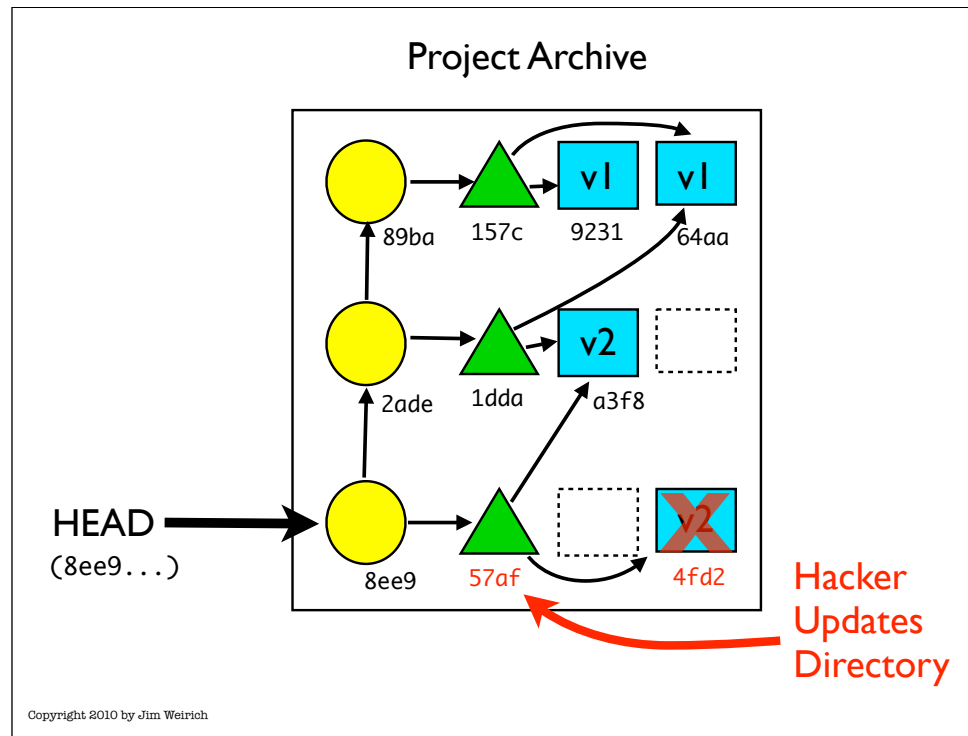


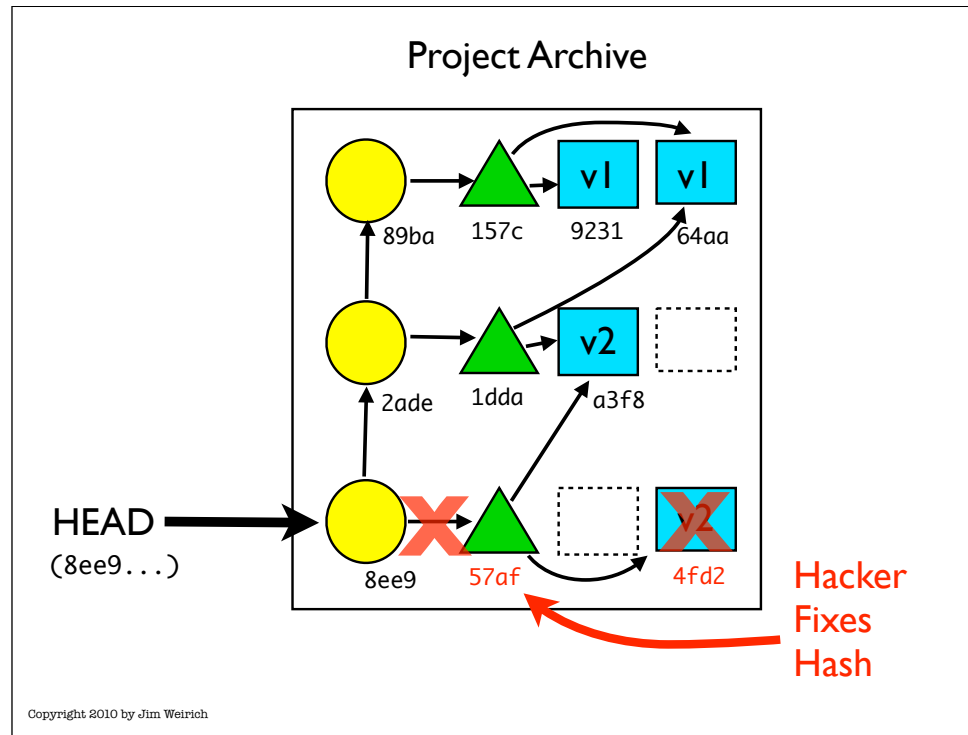


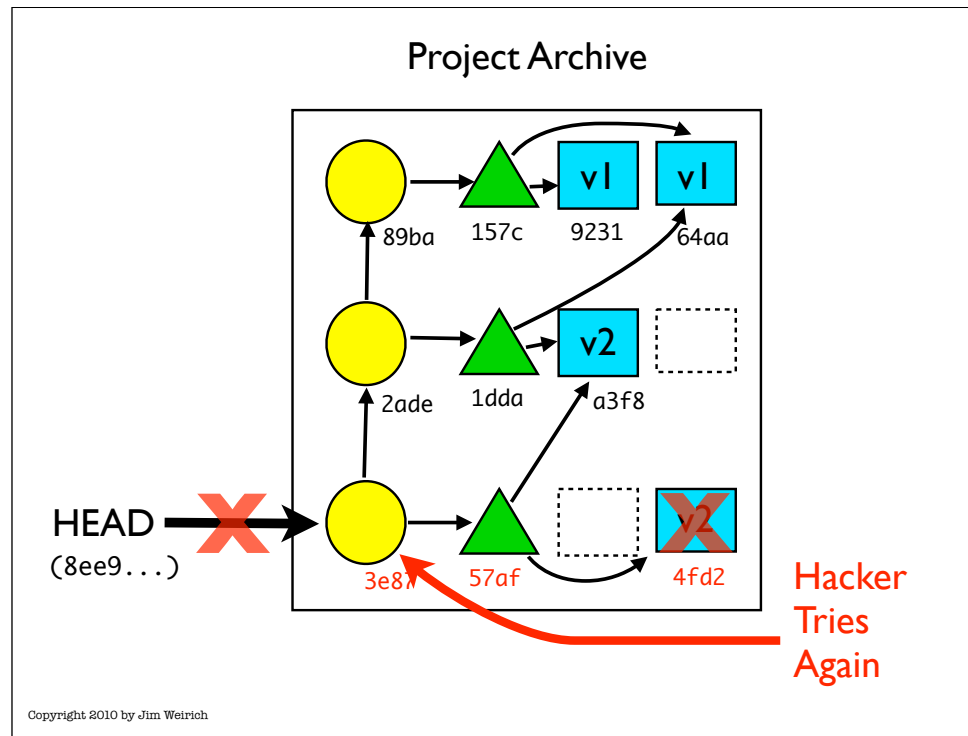












Tracking Snapshots

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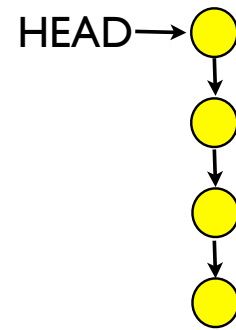
Saturday, January 15, 2011

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Need to keep track of
versions by name.

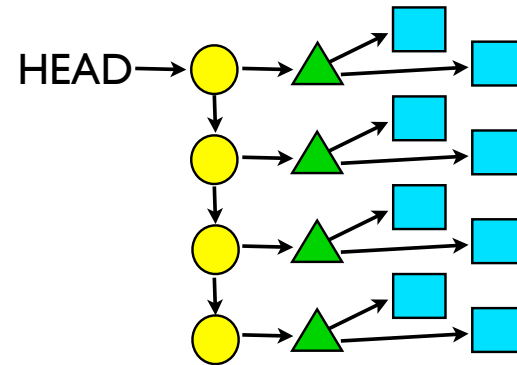
Copyright 2010 by Jim Weirich

Project Archive
(snapshots only)



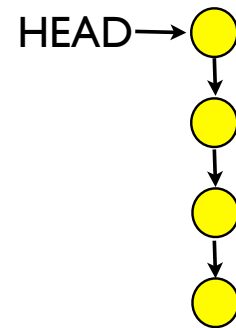
Copyright 2010 by Jim Weirich

Project Archive



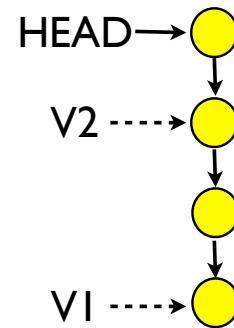
Copyright 2010 by Jim Weirich

Project Archive
(snapshots only)



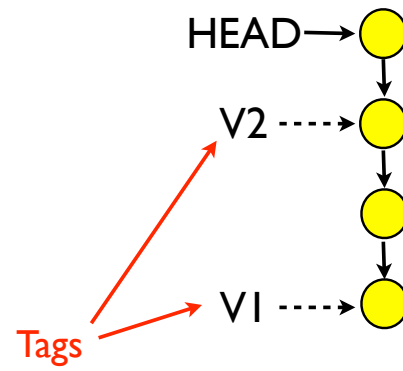
Copyright 2010 by Jim Weirich

Project Archive
(snapshots only)



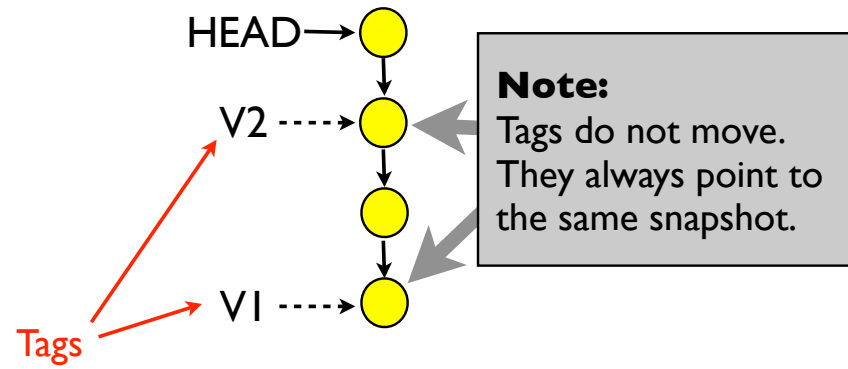
Copyright 2010 by Jim Weirich

Project Archive
(snapshots only)



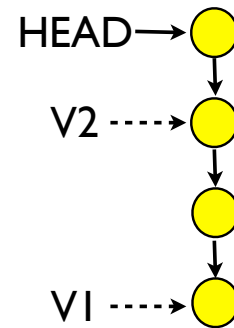
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Project Archive (snapshots only)



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Project Archive
(snapshots only)

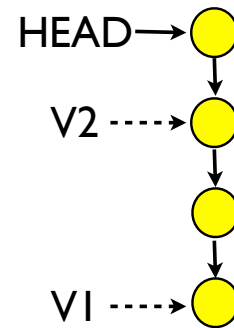


Copyright 2010 by Jim Weirich

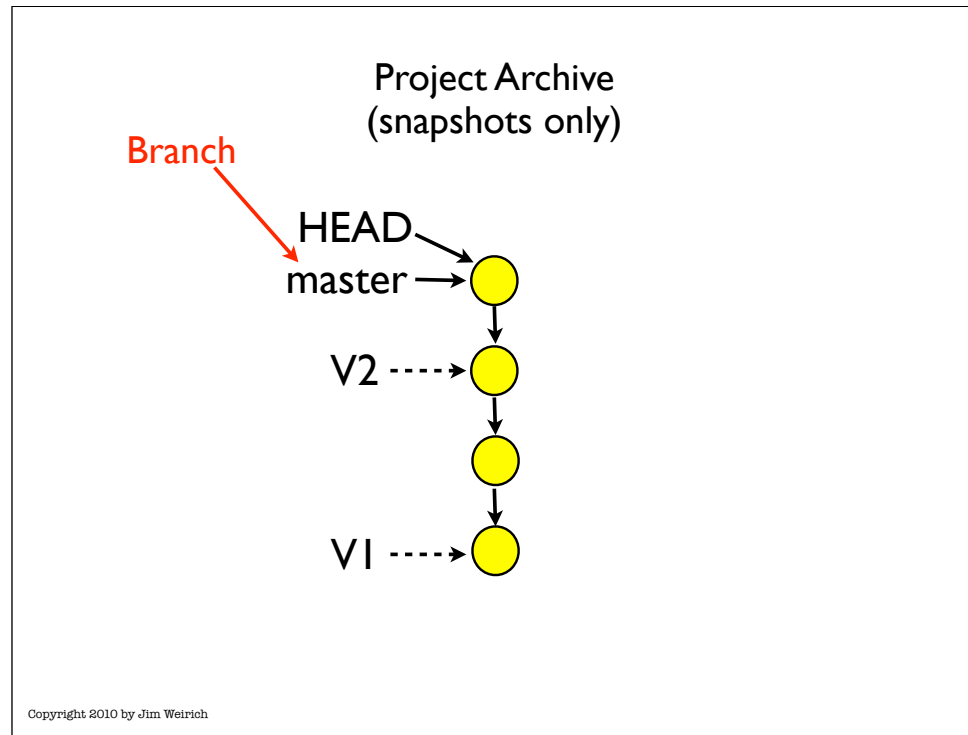
Need to handle
changes to older
versions while
allowing
development on
the latest version.

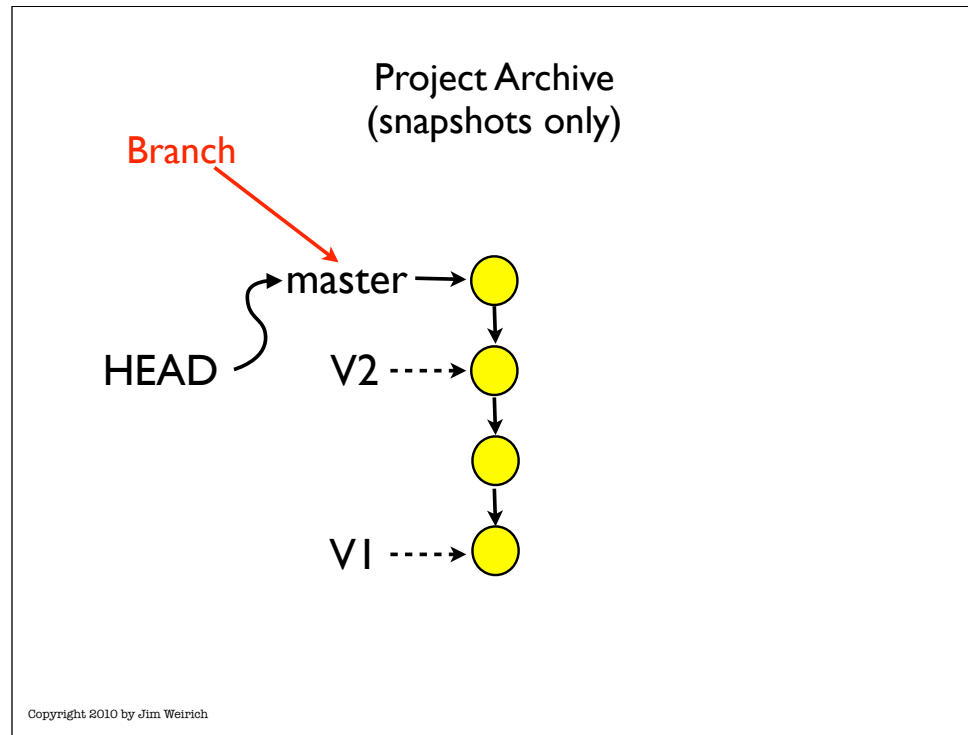
Copyright 2010 by Jim Weirich

Project Archive
(snapshots only)

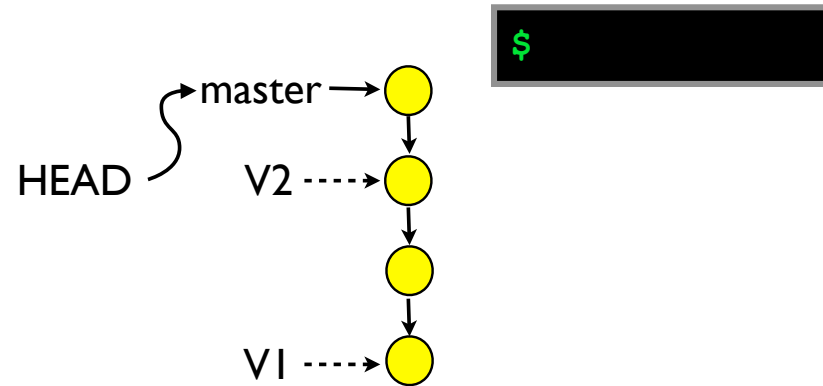


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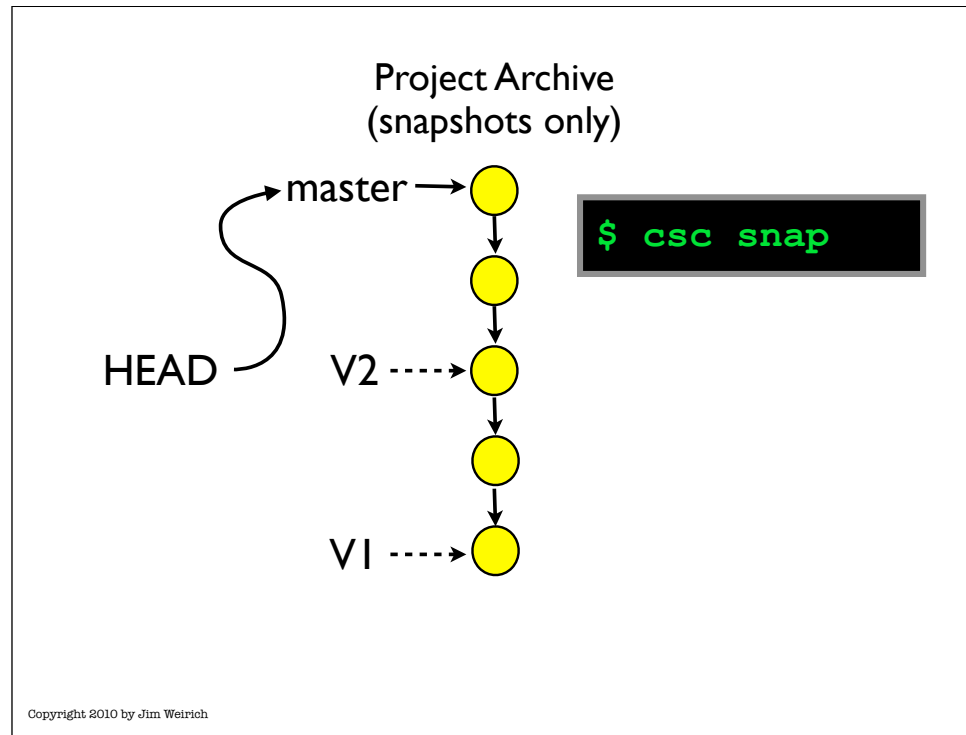


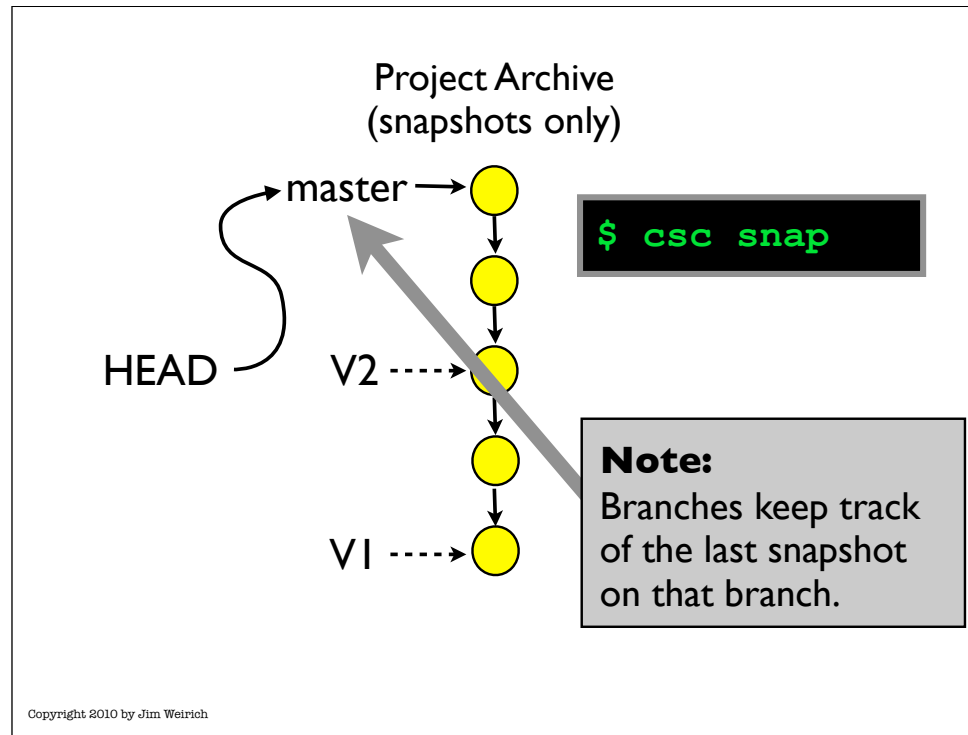


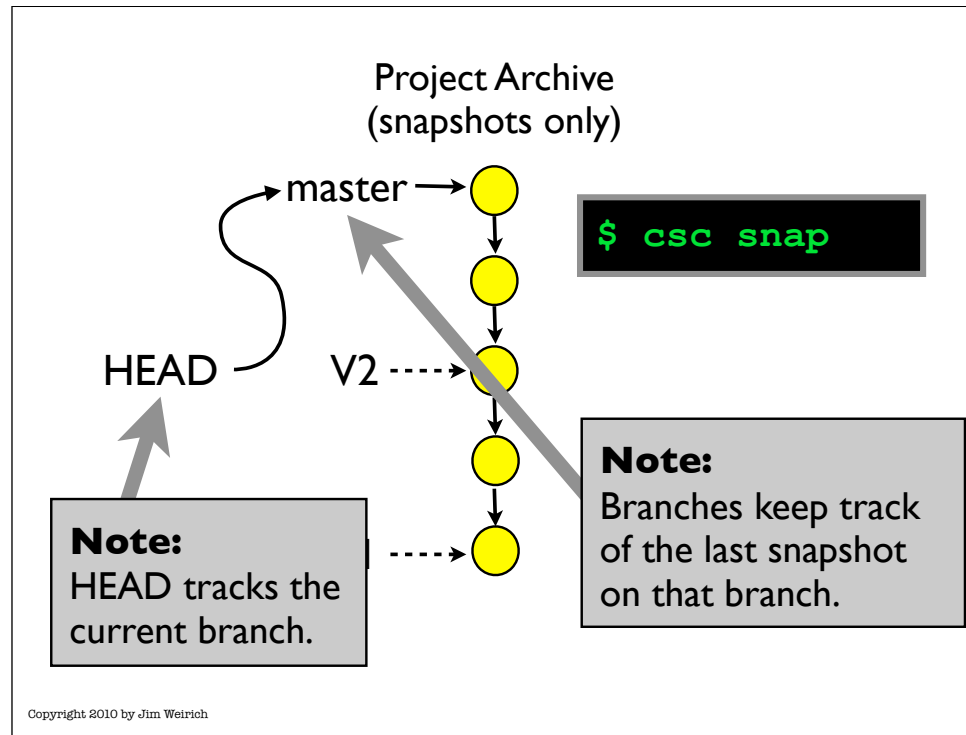
Project Archive
(snapshots only)



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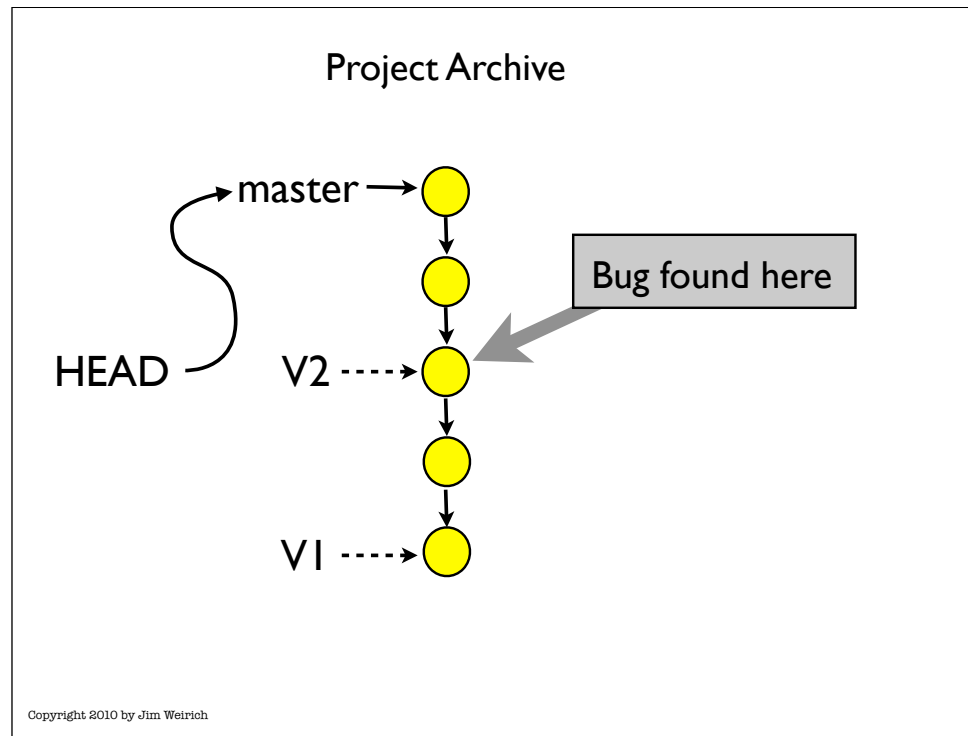


Oops! We found a bug

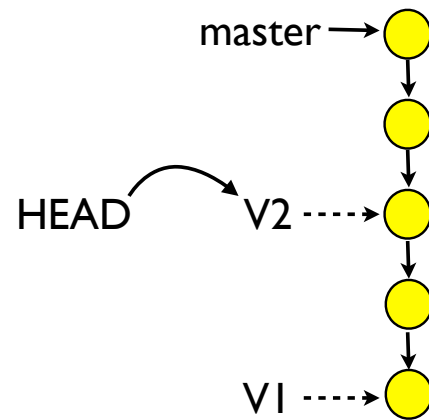
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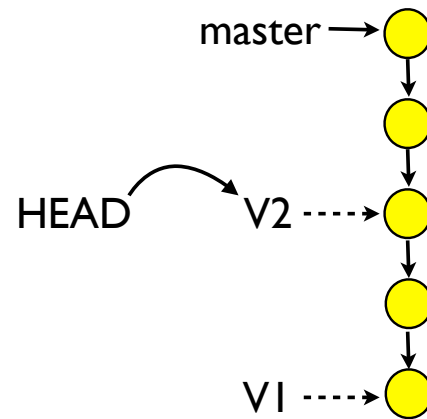
Project Archive



```
$ csc checkout V2
```

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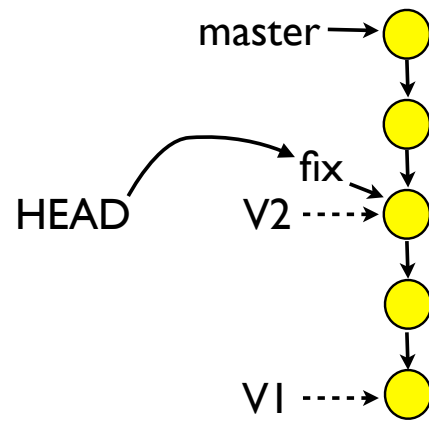
Project Archive



```
$ csc checkout V2  
$ edit files
```

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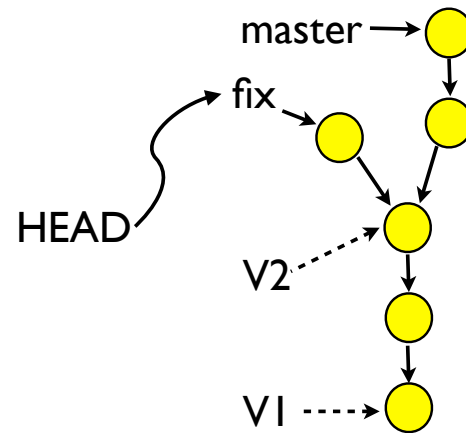
Project Archive



```
$ csc checkout V2  
$ edit files  
$ csc branch fix
```

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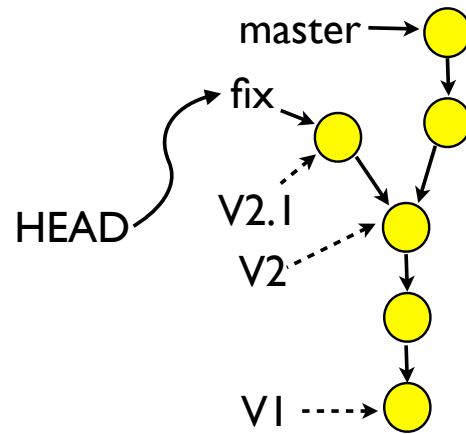
Project Archive



```
$ csc checkout V2  
$ edit files  
$ csc branch fix  
$ csc snap
```

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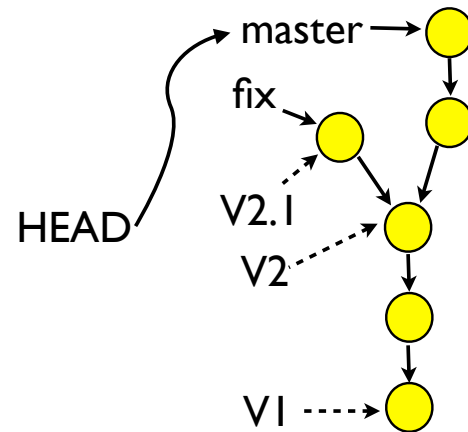
Project Archive



```
$ csc checkout V2  
$ edit files  
$ csc branch fix  
$ csc snap  
$ csc tag V2.1
```

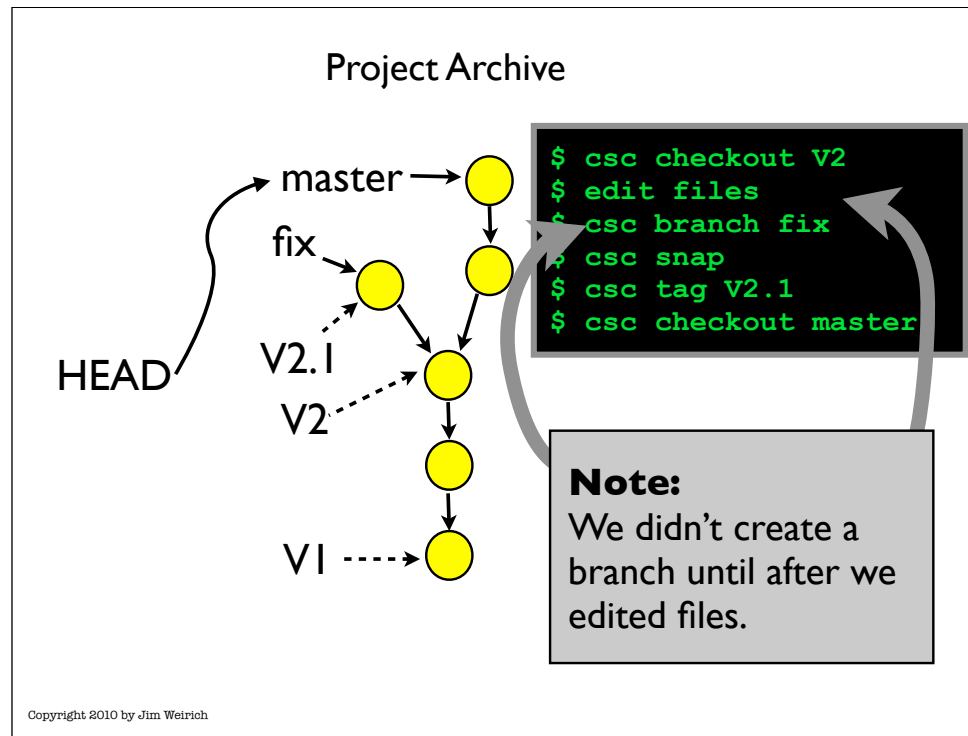
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Project Archive



```
$ csc checkout V2  
$ edit files  
$ csc branch fix  
$ csc snap  
$ csc tag V2.1  
$ csc checkout master
```

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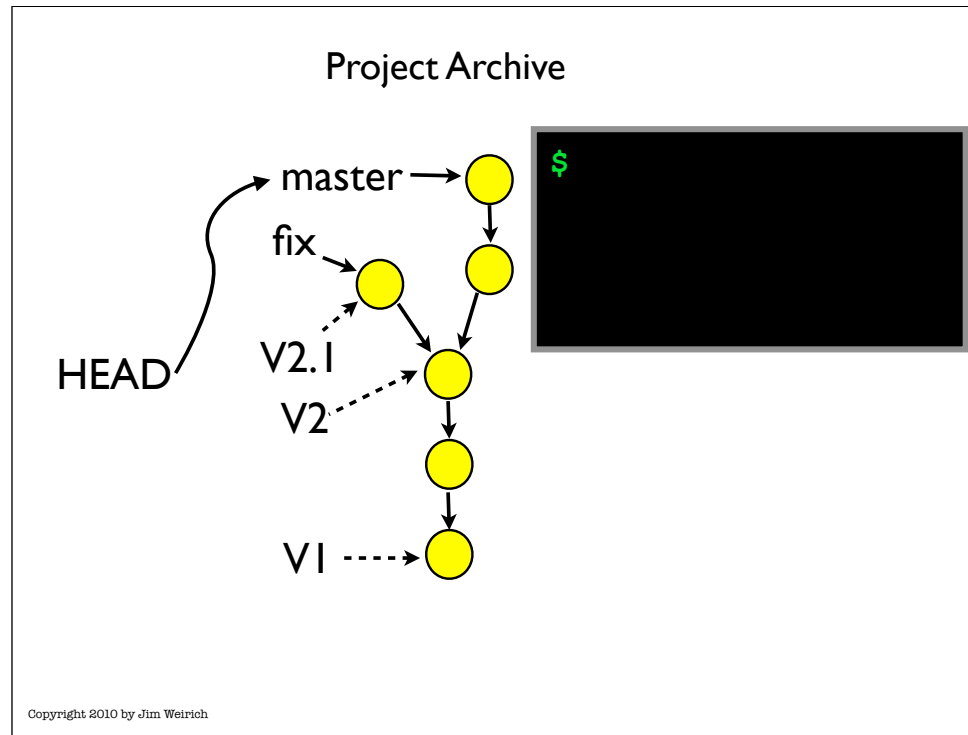


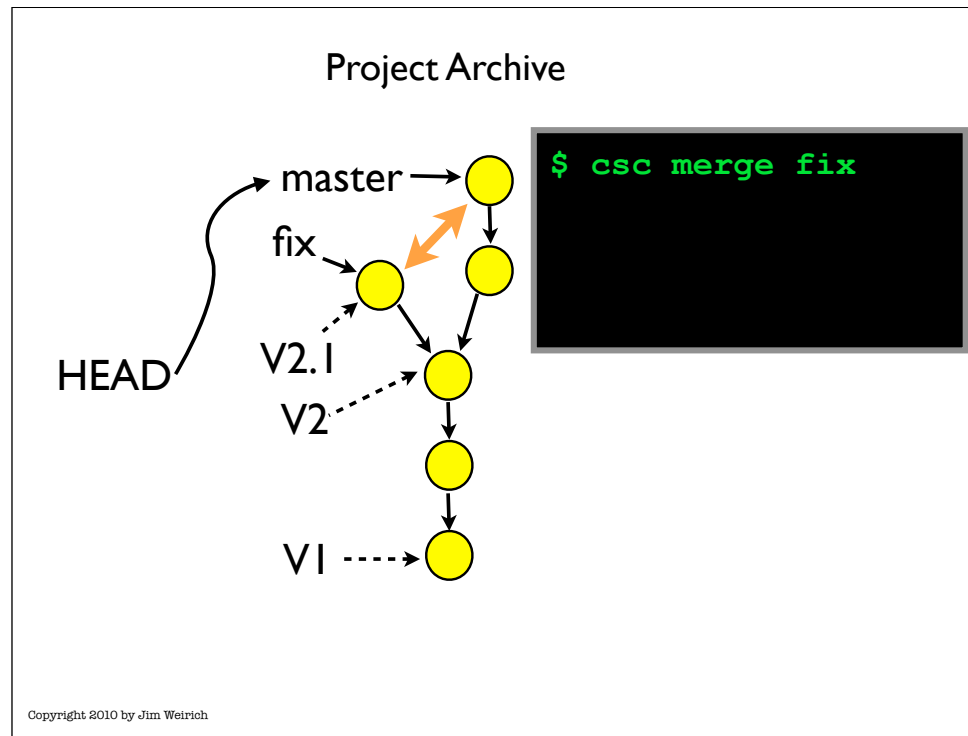
Merge Bug Fixes to Master

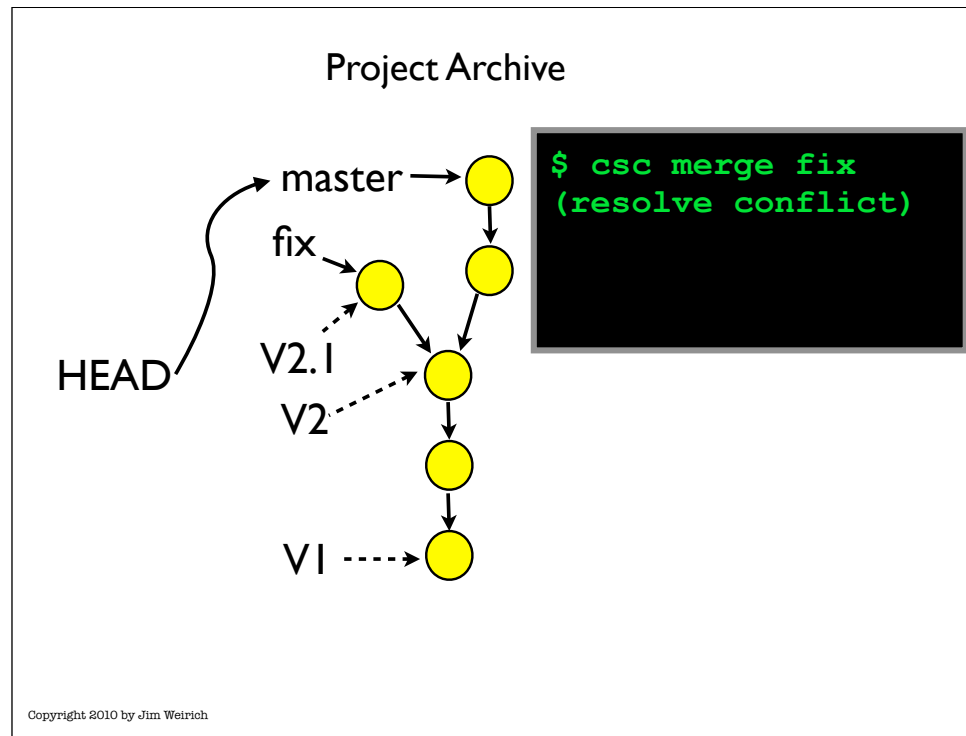
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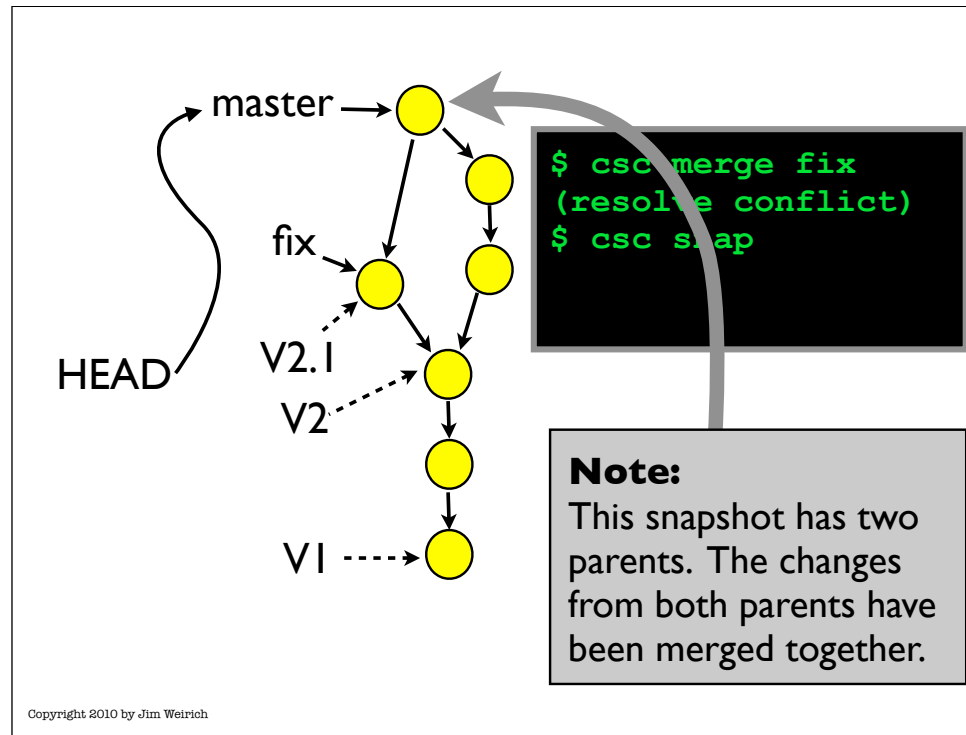
111











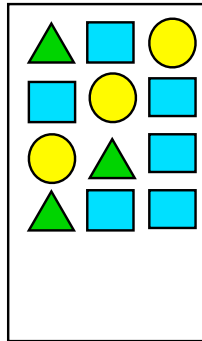
Sharing Code

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My Archive

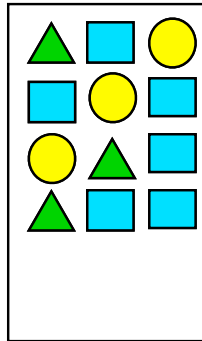


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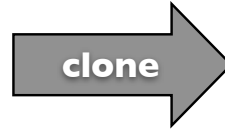
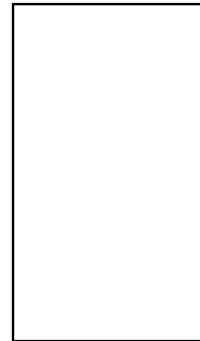
Saturday, January 15, 2011

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My Archive



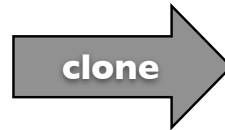
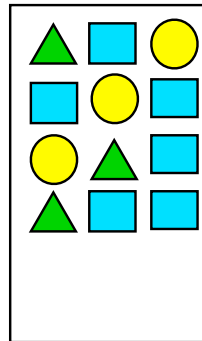
Your Archive



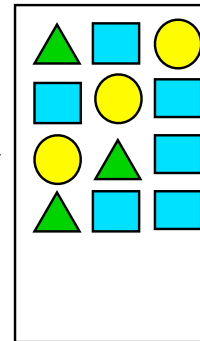
```
you$ csc clone url_for_my_repo
```

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My Archive



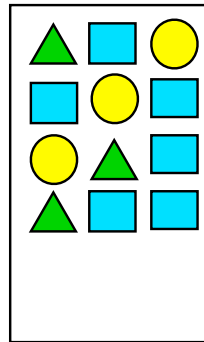
Your Archive



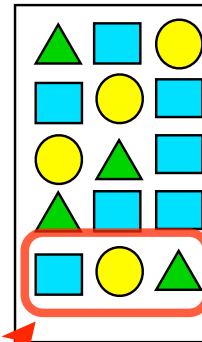
```
you$ csc clone url_for_my_repo
```

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My Archive



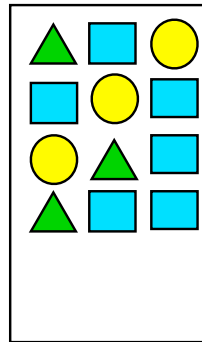
Your Archive



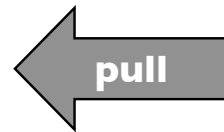
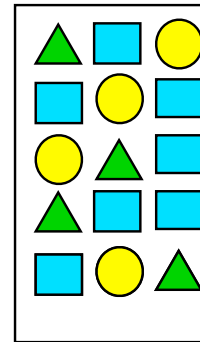
You make changes

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My Archive

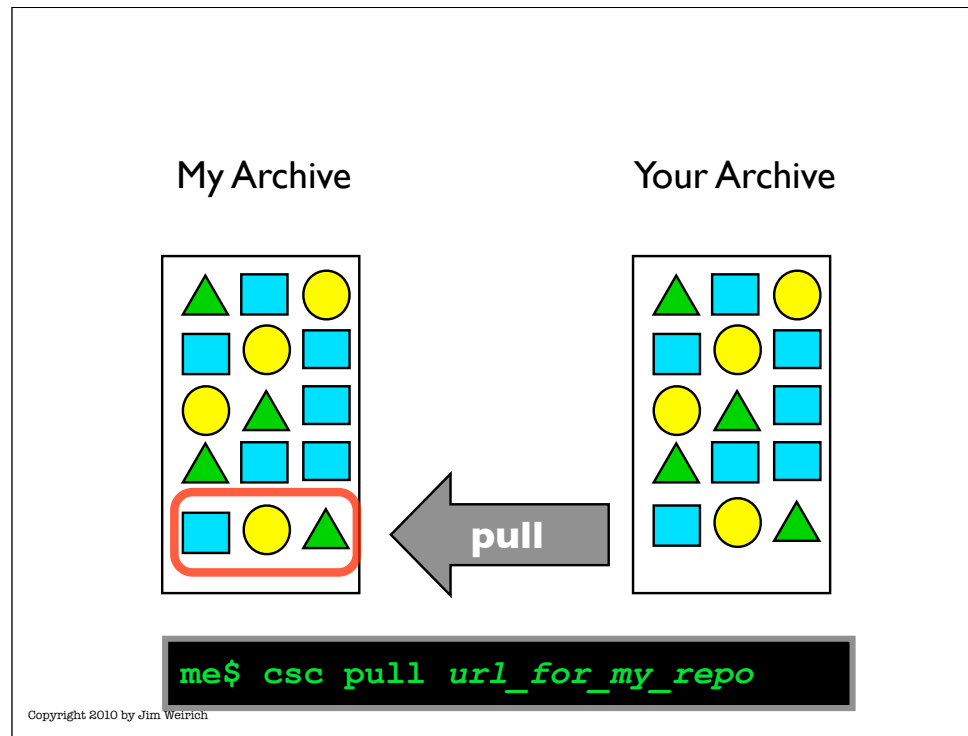


Your Archive

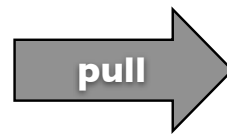
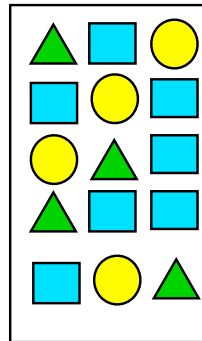


```
me$ csc pull url_for_my_repo
```

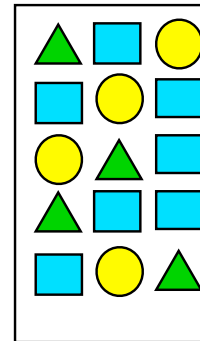
Copyright 2010 by Jim Weirich



My Archive



Your Archive



```
you$ csc pull url_for_my_repo
```

Copyright 2010 by Jim Weirich

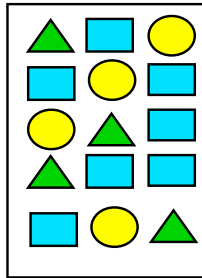
Common Remote Uses

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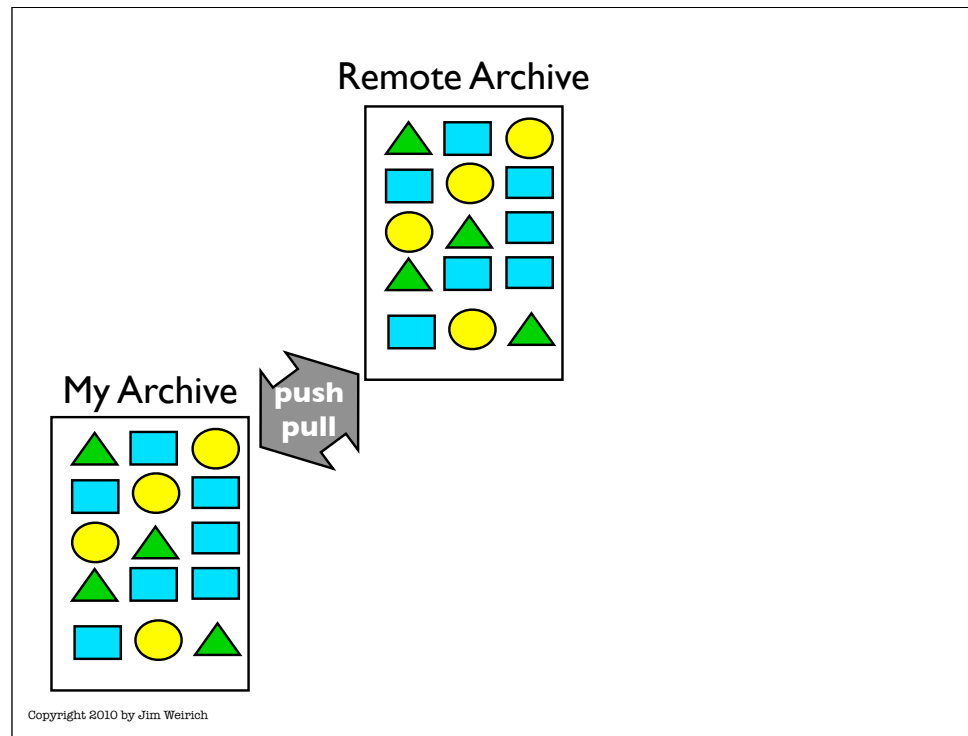
My Archive

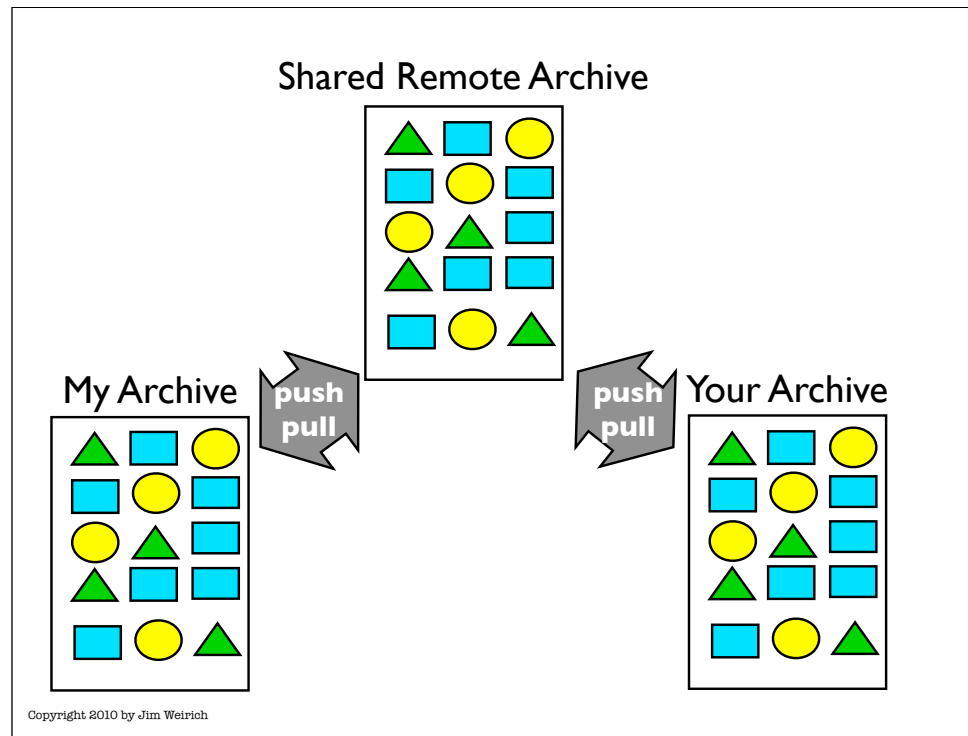


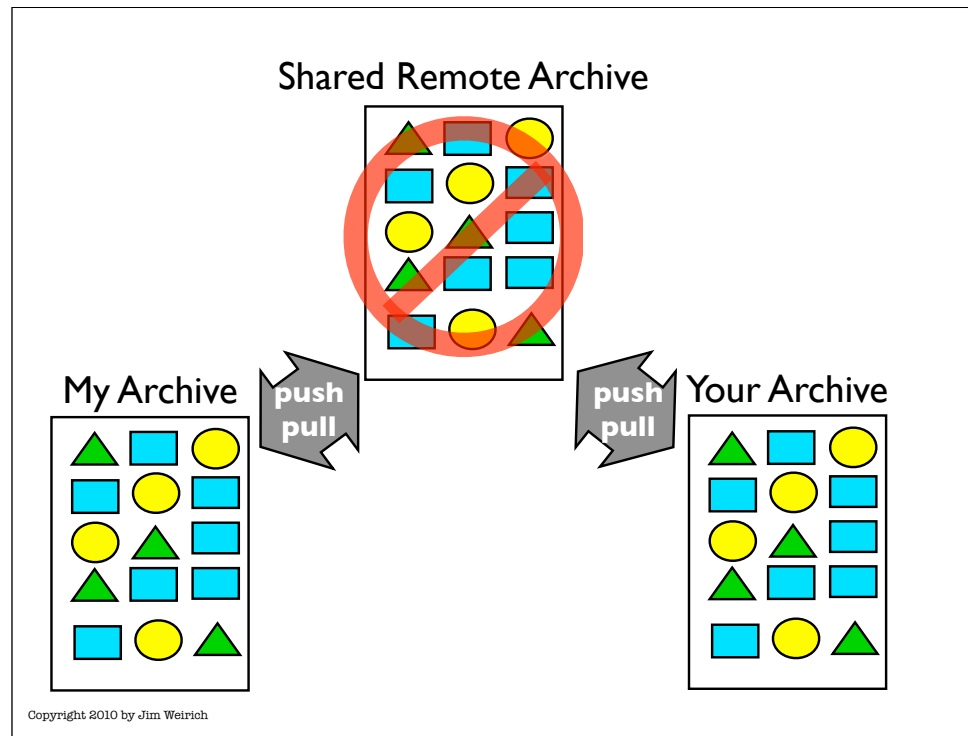
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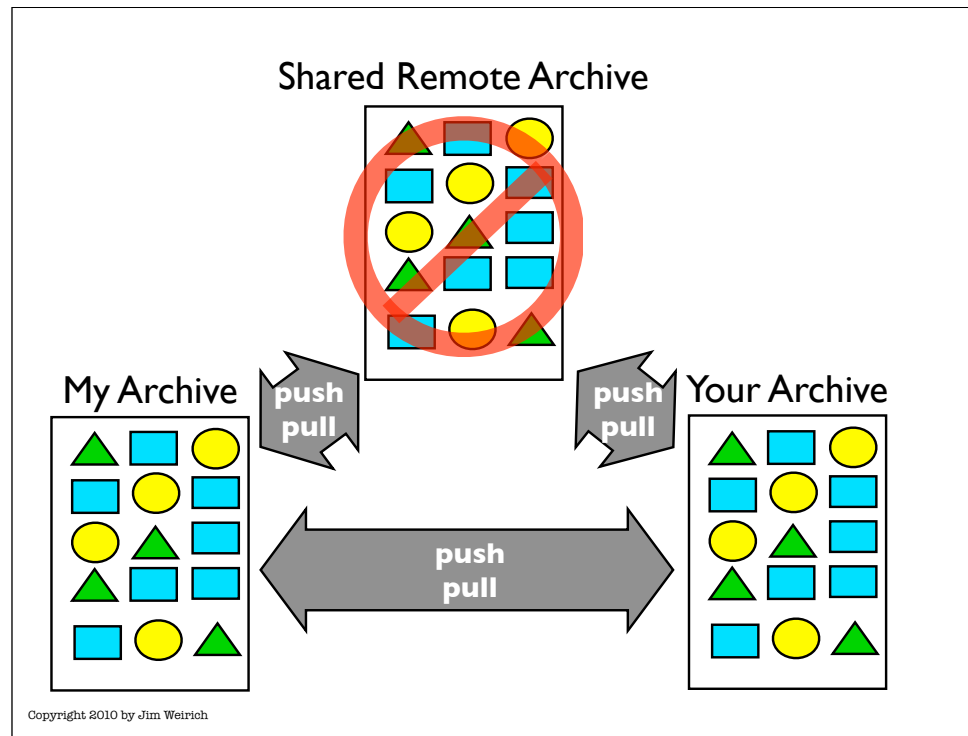
Saturday, January 15, 2011

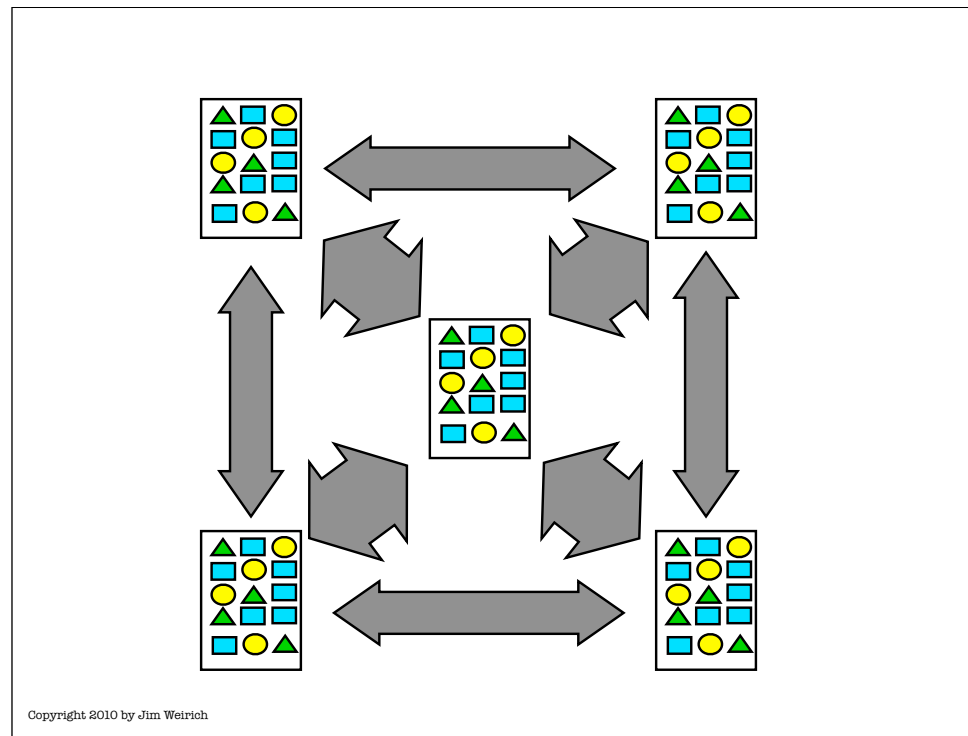
125





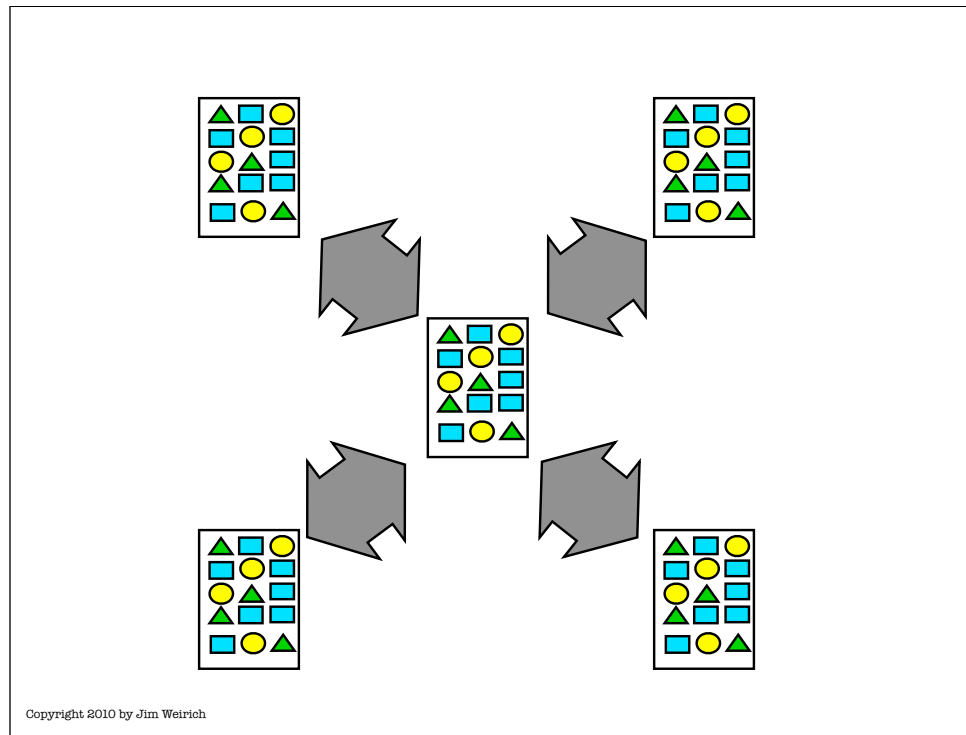






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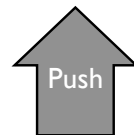
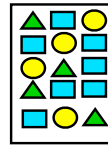
130



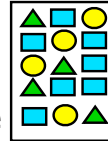
Saturday, January 15, 2011

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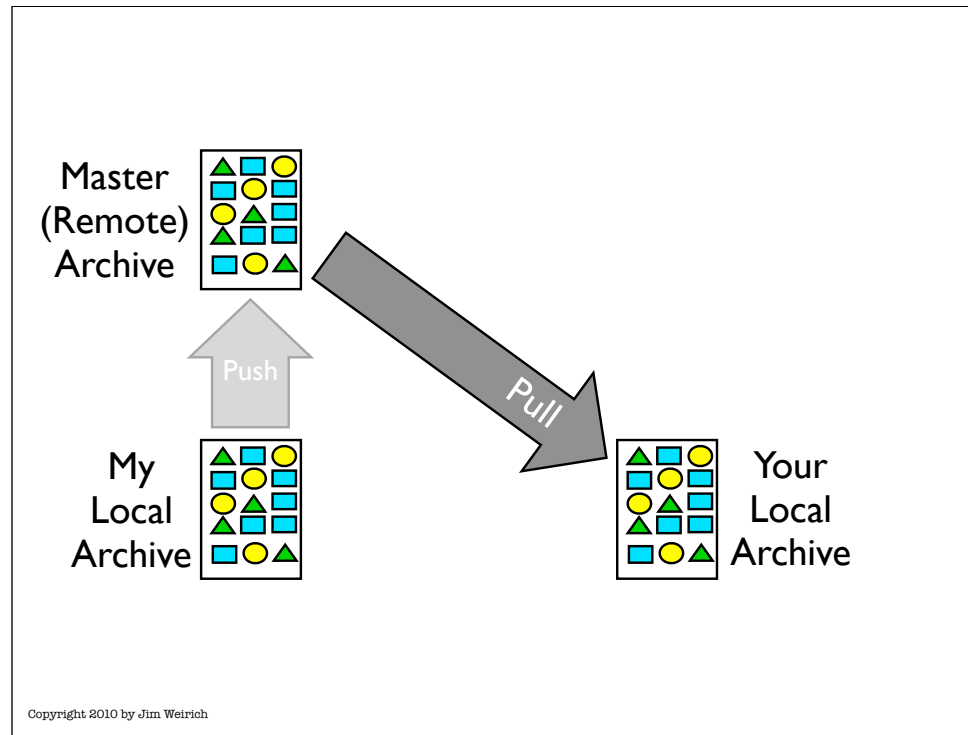
Master
(Remote)
Archive

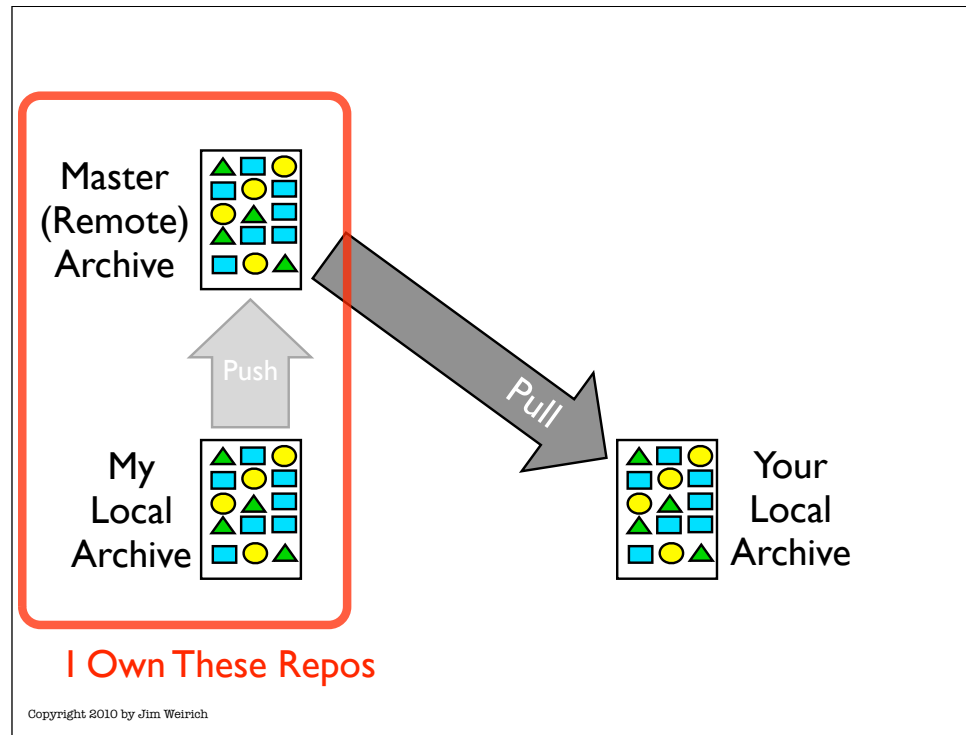


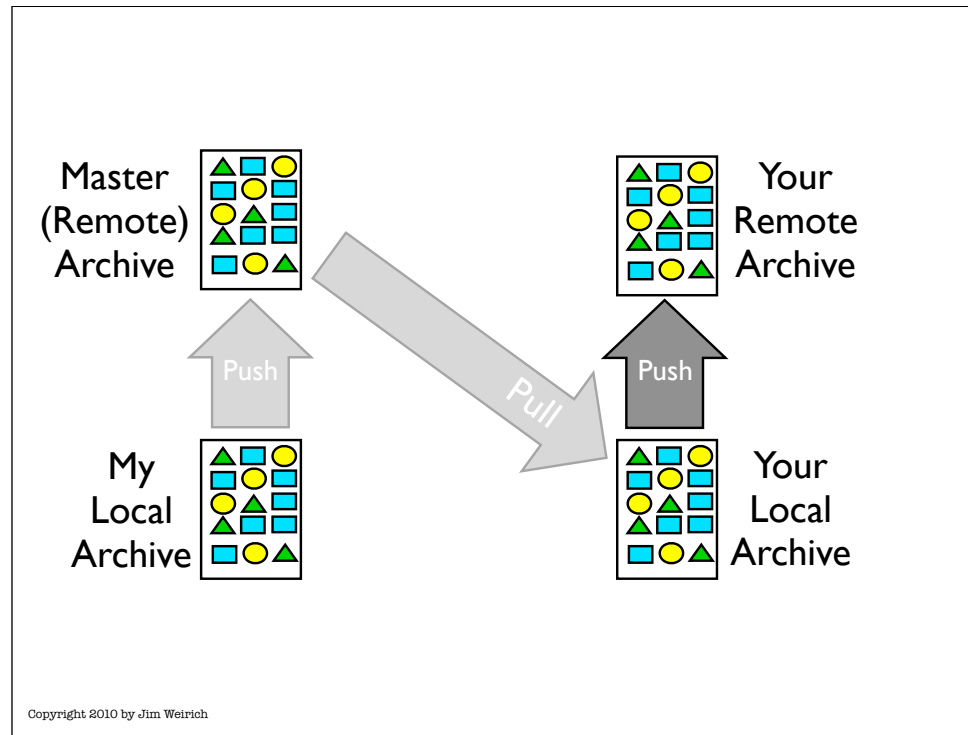
My
Local
Archive

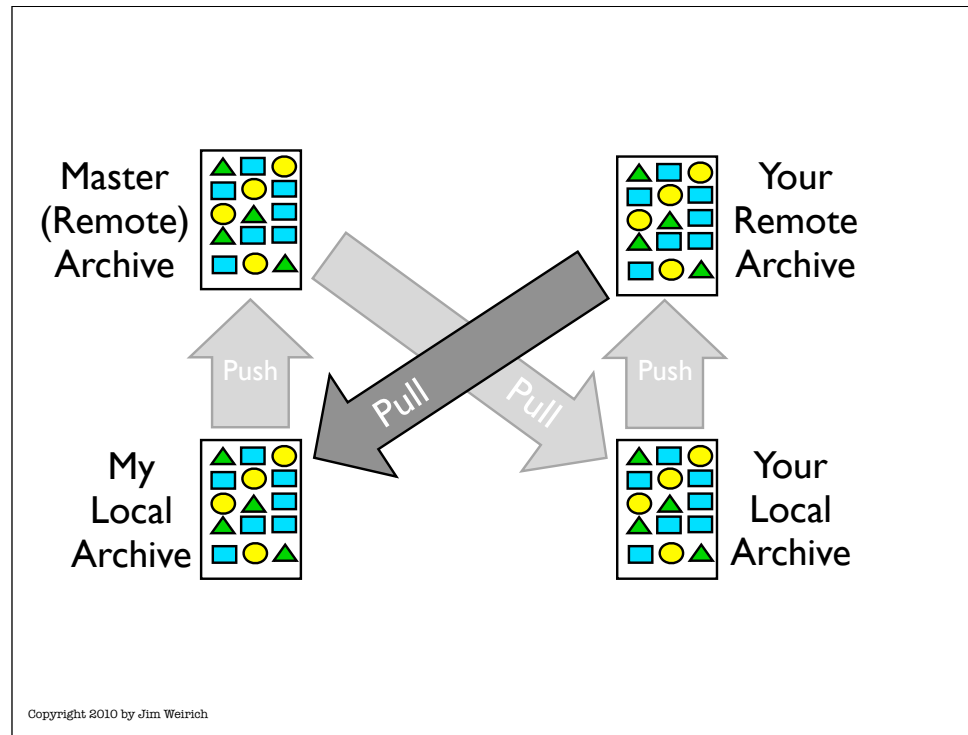


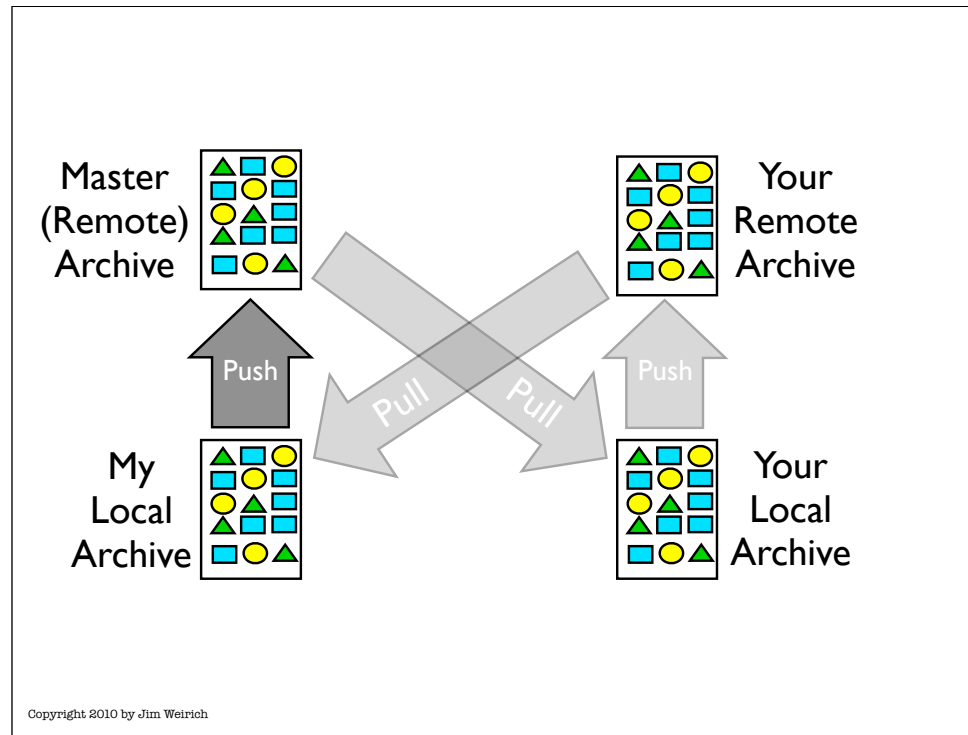
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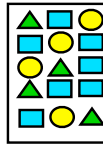








Master
Project
Archive

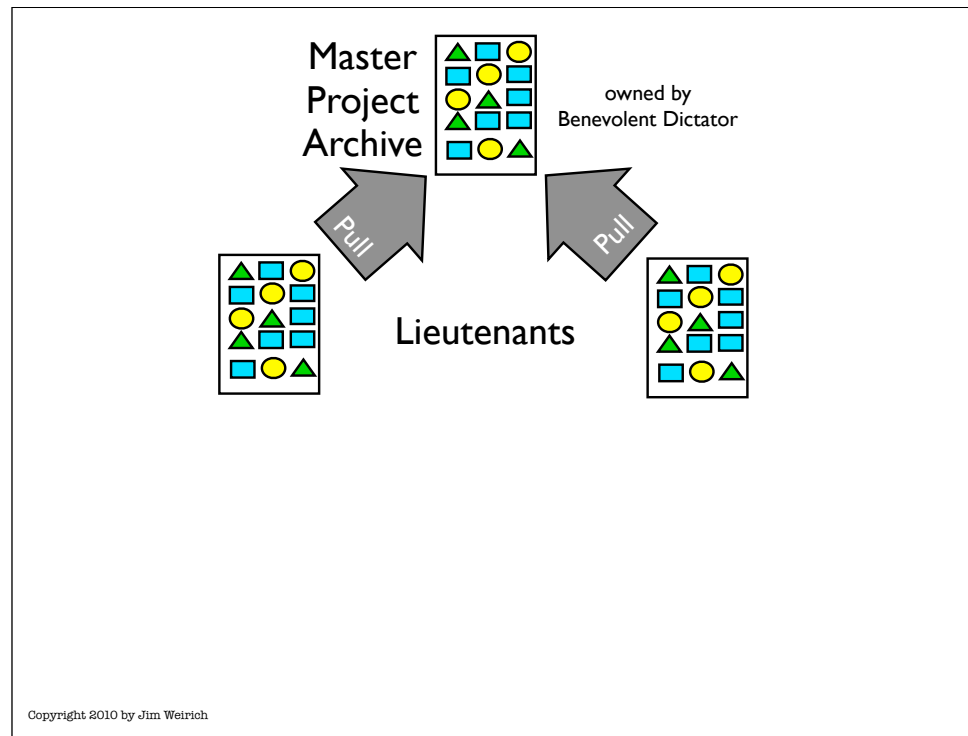


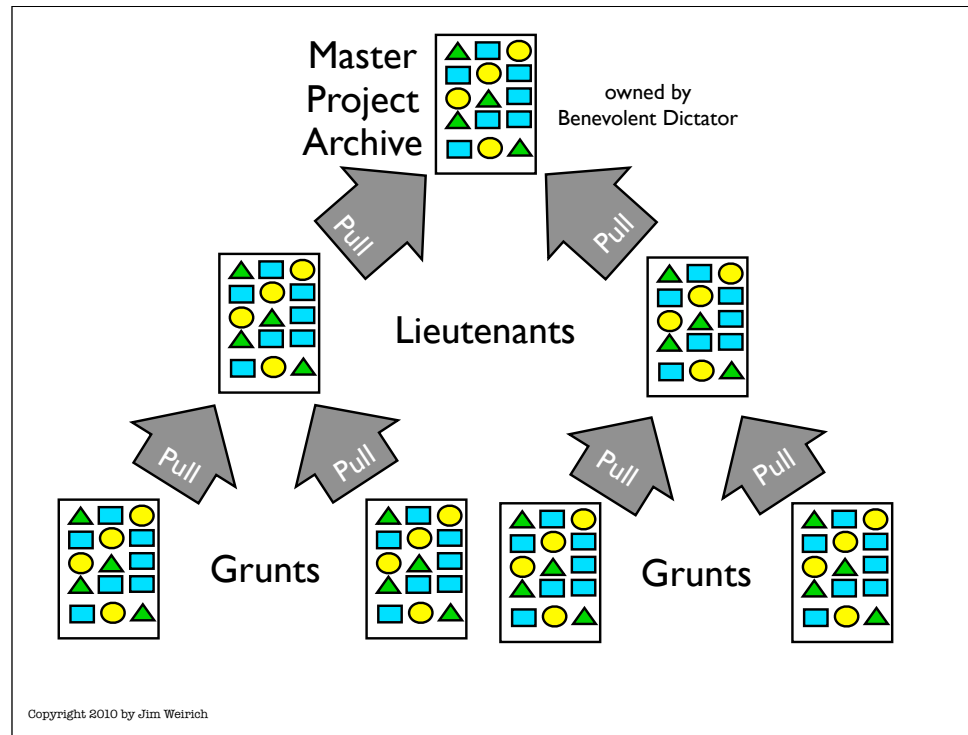
owned by
Benevolent Dictator

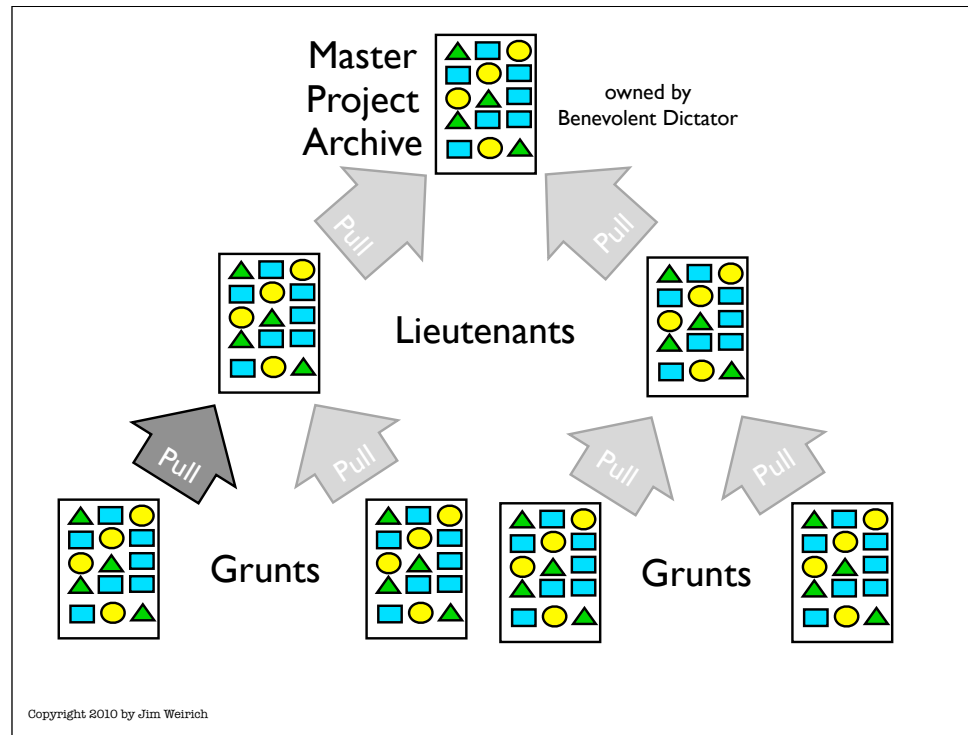
Copyright 2010 by Jim Weirich

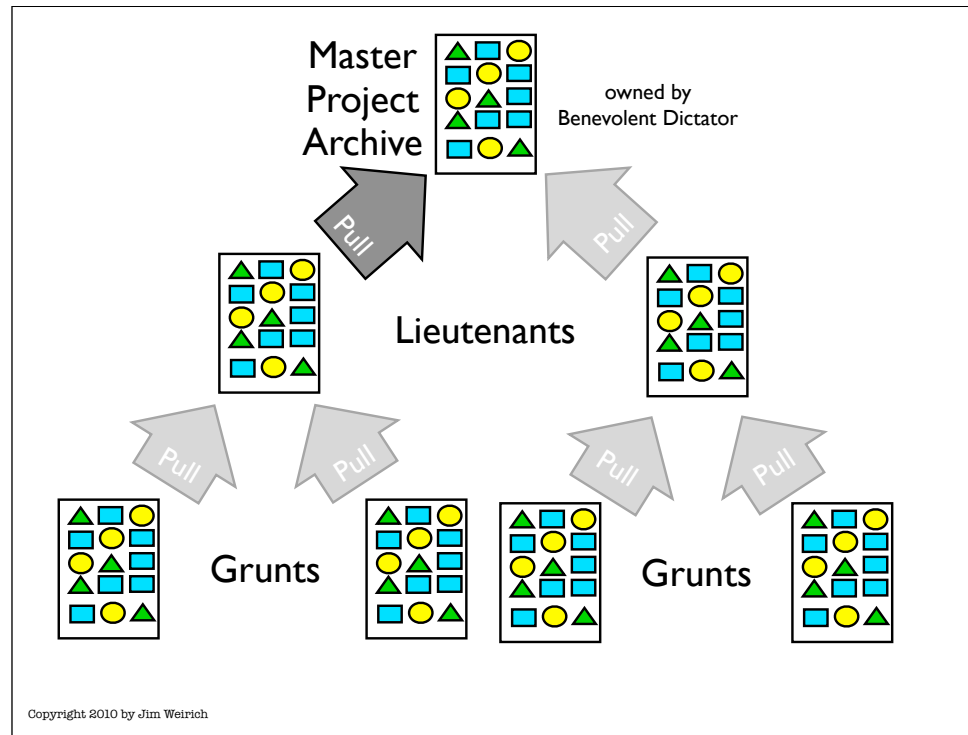
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Wrap Up

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CSC Features

- Complete revision history
- Efficient Storage
 - very lightweight project archives
- Guaranteed integrity
- Flexible Sharing
- Cheap Branching
- Easy Tagging

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CSC Features

- Complete revision history
- Efficient Storage
 - very lightweight project archives
- Guaranteed integrity
- Flexible Sharing
- **Cheap Branching**
- Easy Tagging

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Sounds Like ...

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CSC

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GIT

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csc == git
snapshot == commit
project archive == repository
manifest == tree (or directory)

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```
csc snap == git commit -a  
csc checkout name == git checkout name  
csc branch name == git checkout -b name  
csc tag tagname == git tag tagname
```

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Differences from Git

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Differences

Csc

- We have only:
 - Working Directory
 - Repository (project archive)

Git

- Git Uses
 - Working Directory
 - Staging Area
 - Repository

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Differences

Csc

- We have only:
 - Working Directory
 - Repository (project archive)
- File Based

Git

- Git Uses
 - Working Directory
 - Staging Area
 - Repository
- Content Based

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Differences

Csc

- One level object file storage

Git

- Files stored in `.git/objects`
- Uses a 2-level directory
- SHA1 hash is the directory/file name

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Differences

Csc

- One level object file storage
- Plain Files

Git

- Files stored in `.git/objects`
 - Uses a 2-level directory
 - SHA1 hash is the directory/file name
- Encoded/Compressed files

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Differences

Csc

- Just the basic features

Git

- init/log/status/diff
- reset/rebase
- cherry-pick
- bisect
- ... lots of others

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References

- Git from the Bottom Up (John Wiegley)
 - <http://ftp.newartisans.com/pub/git.from.bottom.up.pdf>
- Git Internals -- PeepCode PDF (Scott Chacon)
 - <http://peepcode.com/products/git-internals-pdf>
- Any presentation by Scott Chacon
 - <http://github.com/schacon/git-presentations>

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Questions?

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Labs

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Labs Can be found at ...

http://onestepback.org/download/git_tutorial.zip

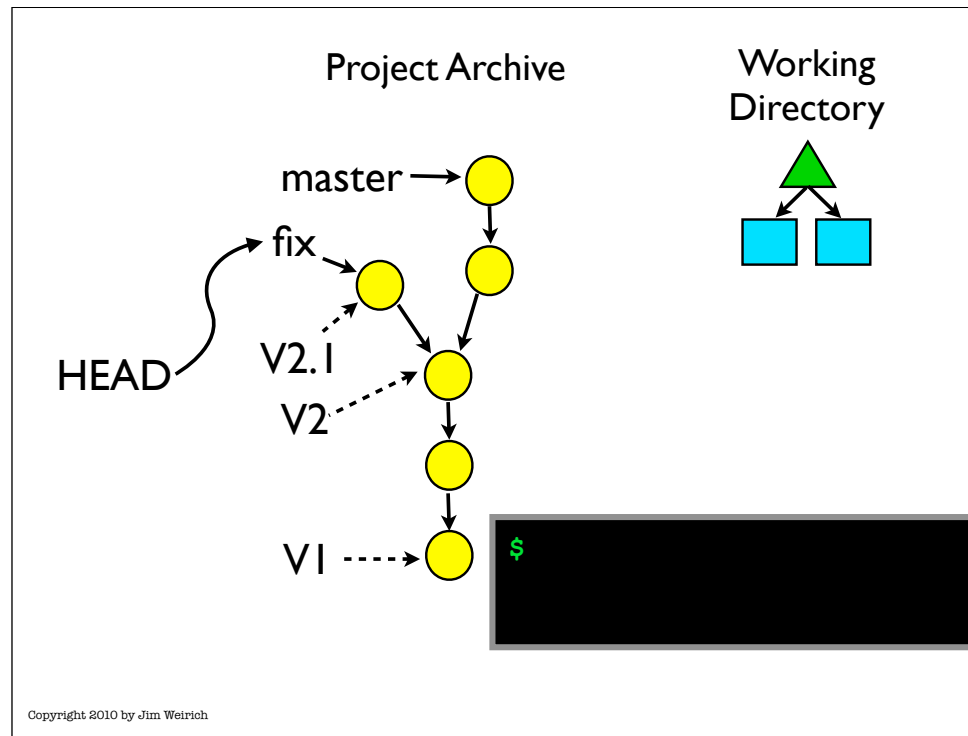
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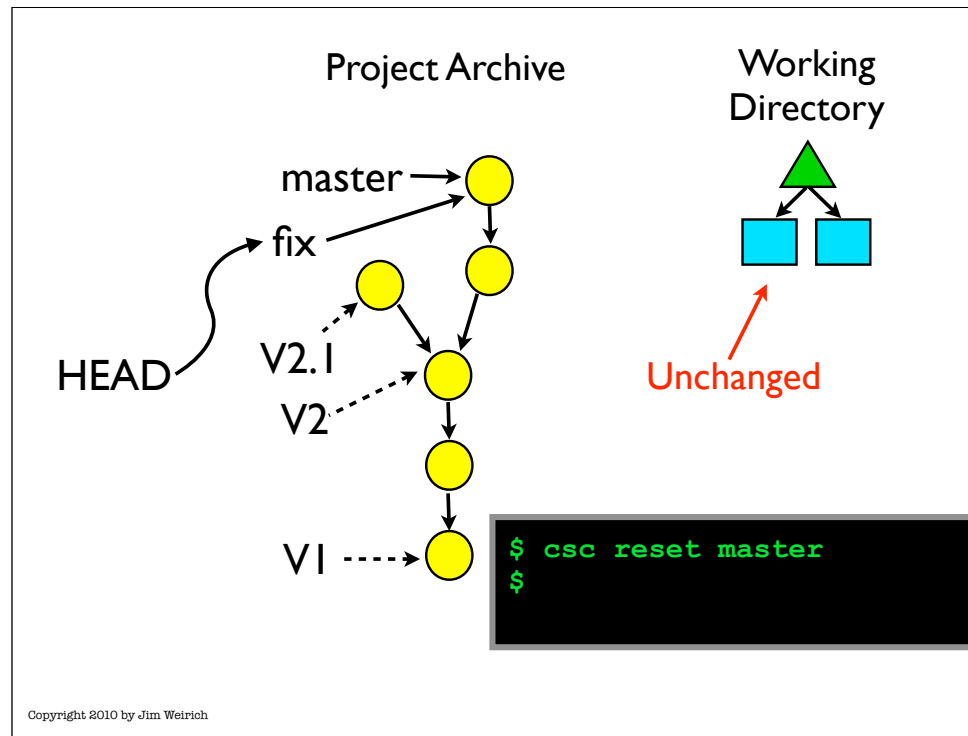
Appendix A -- Reset

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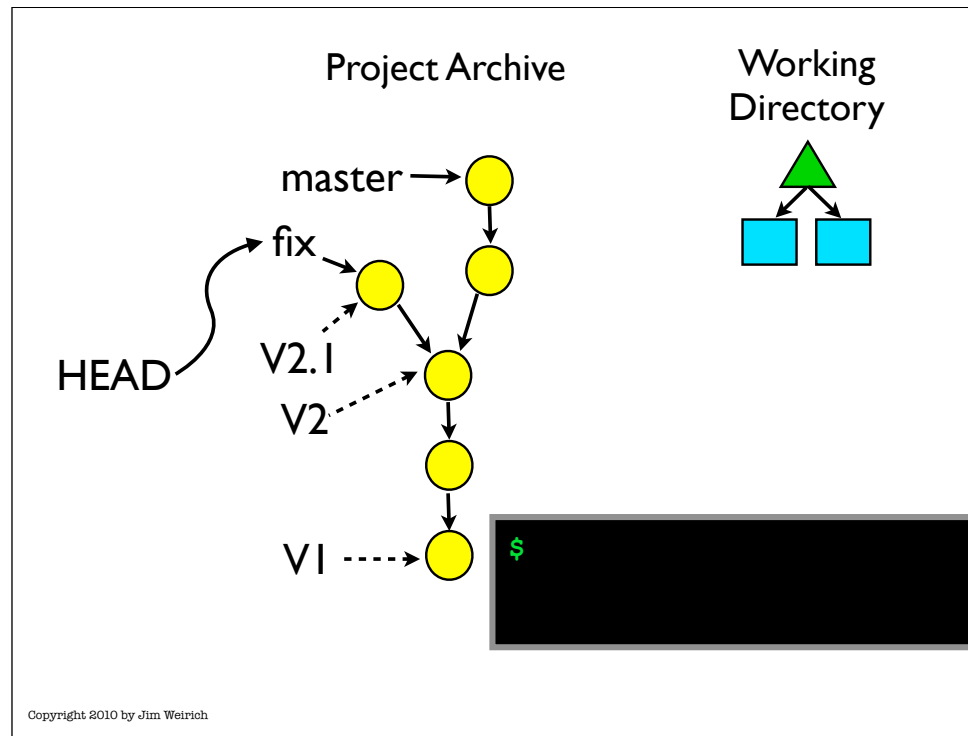


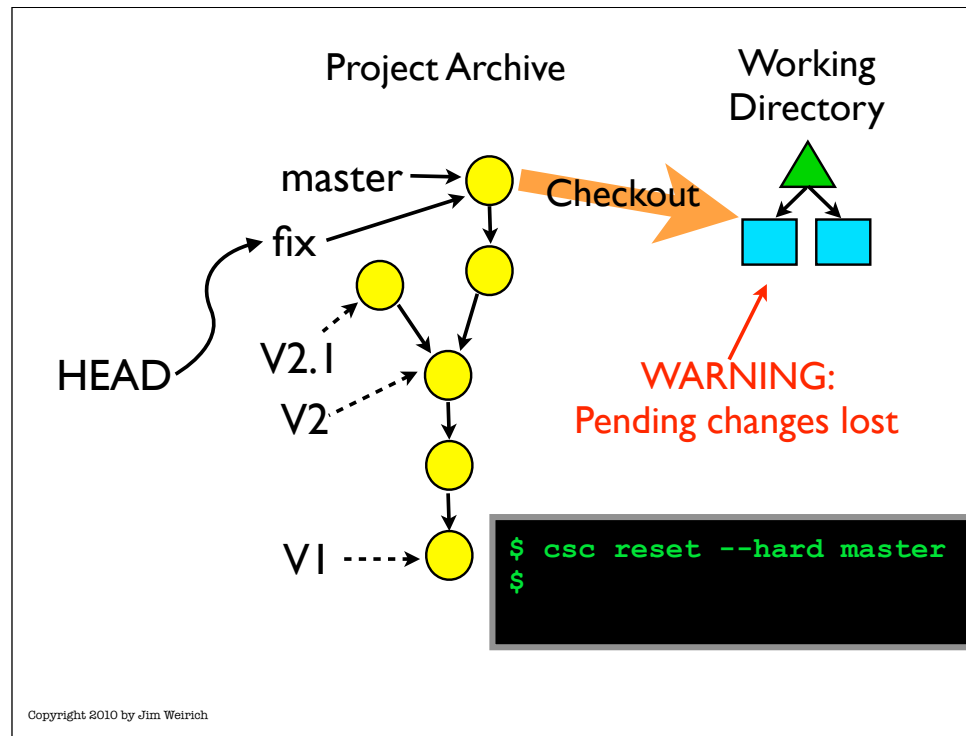
Now the --hard way

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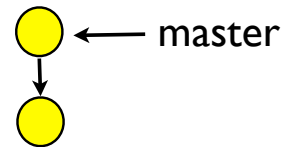
Appendix B -- Rebase

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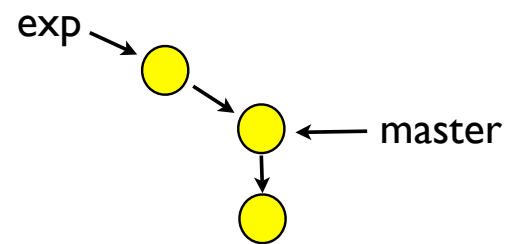
169

Rebase (setup)



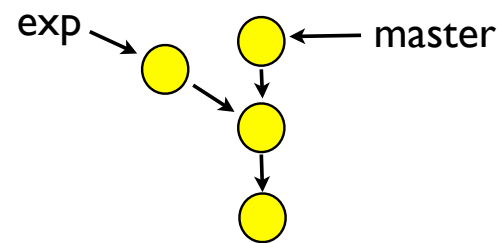
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Rebase (setup)



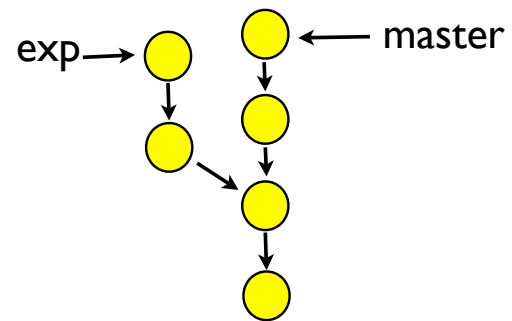
Copyright 2010 by Jim Weirich

Rebase (setup)



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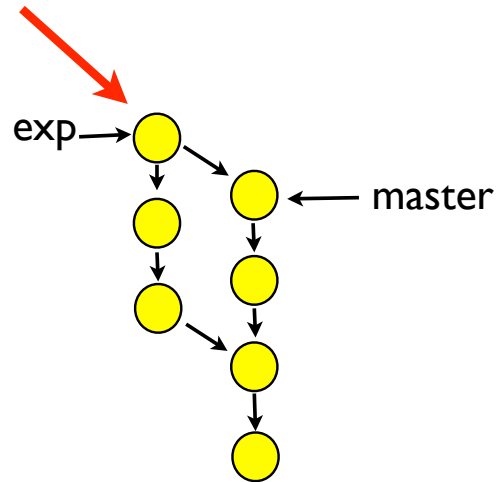
Rebase (setup)



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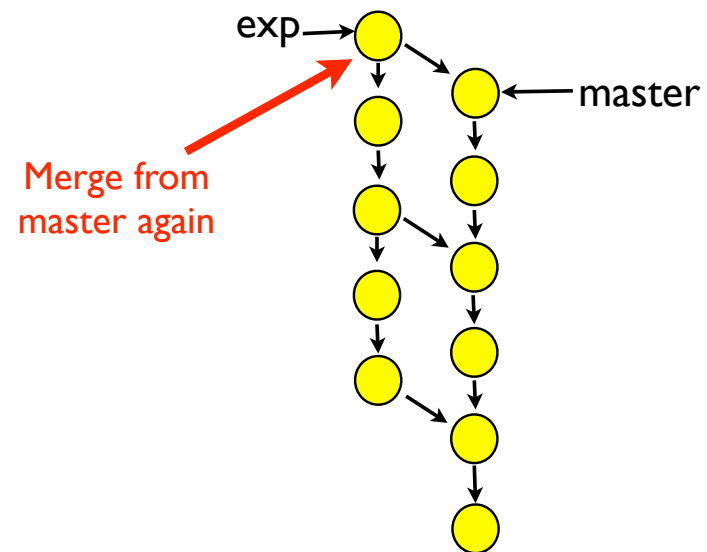
Rebase (merging option)

Merge changes on
master to exp

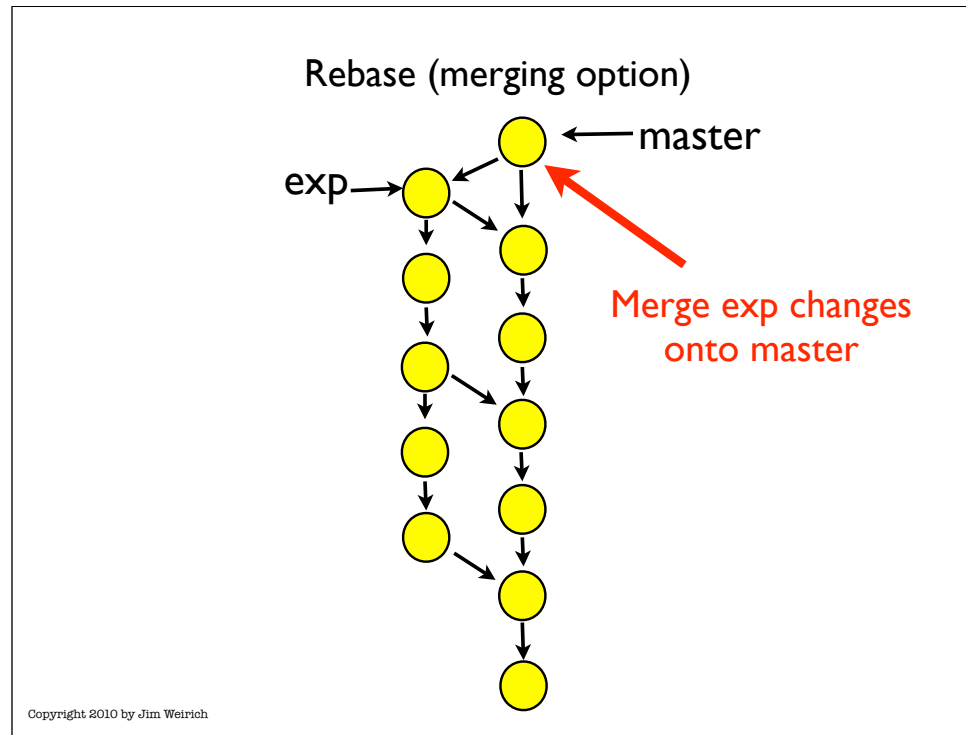


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Rebase (merging option)



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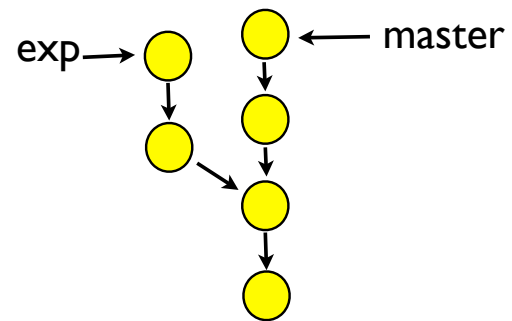
Rewind !

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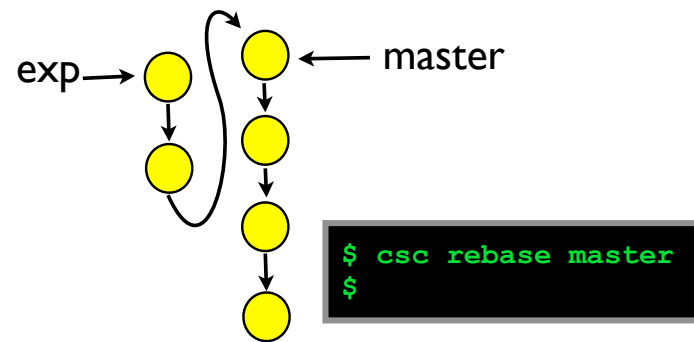
177

Rebase



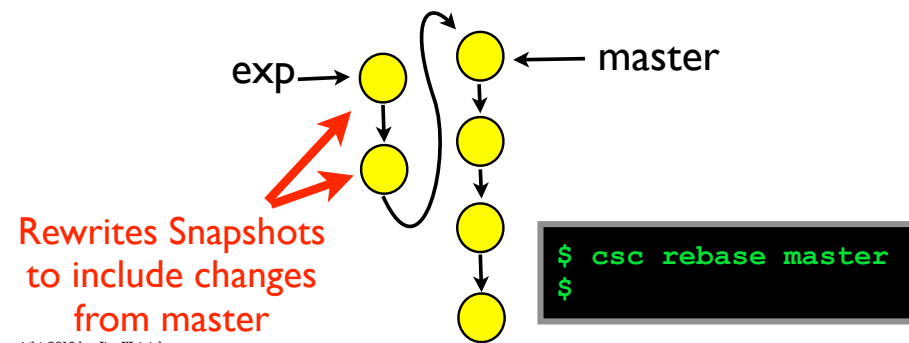
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Rebase



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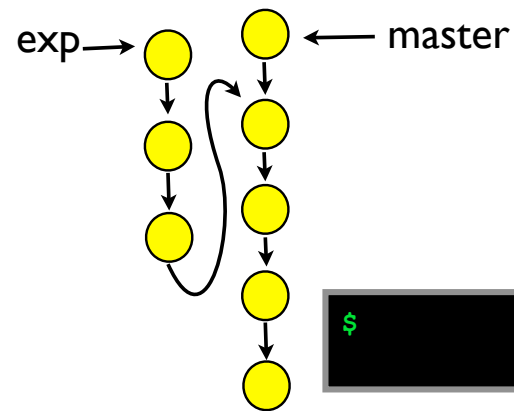
Rebase



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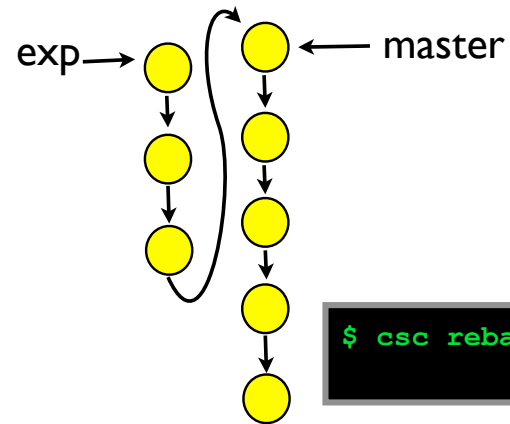
179

Rebase



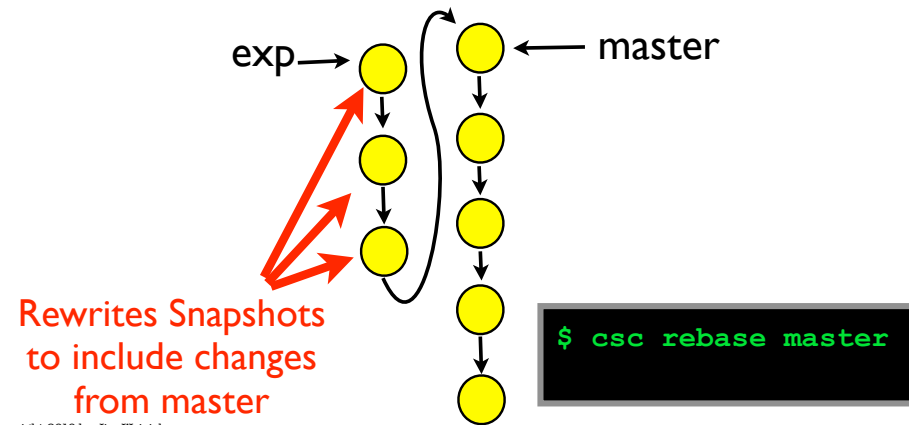
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Rebase

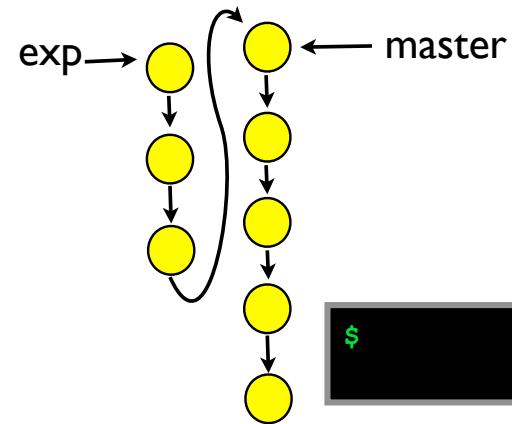


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Rebase

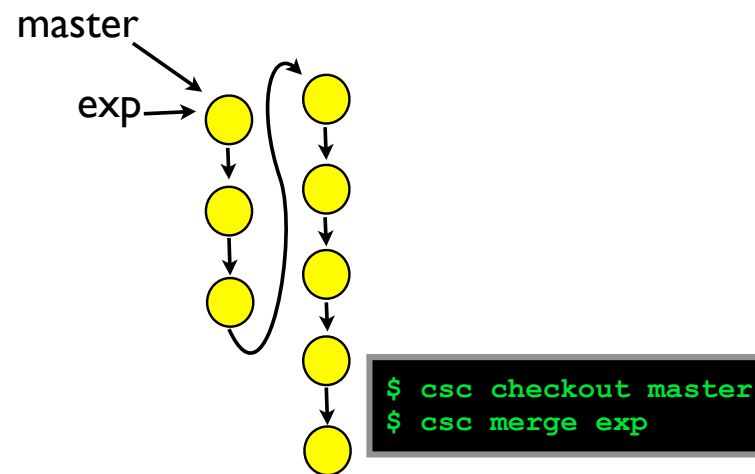


Rebase



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Rebase



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WARNING:

Conflicts may occur during rebase

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WAIT!

Rebase rewrites history?
Isn't that dangerous?

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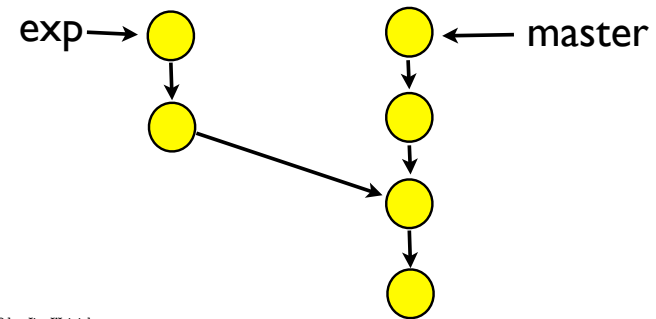
Yes and No

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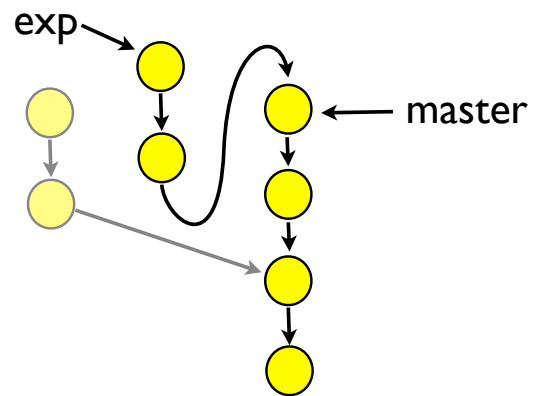
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Rebase



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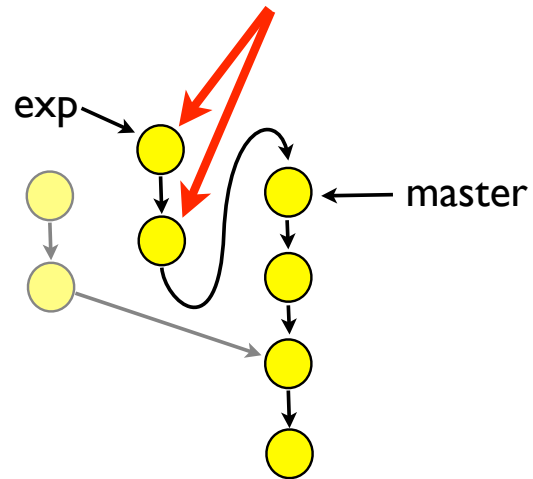
Rebase



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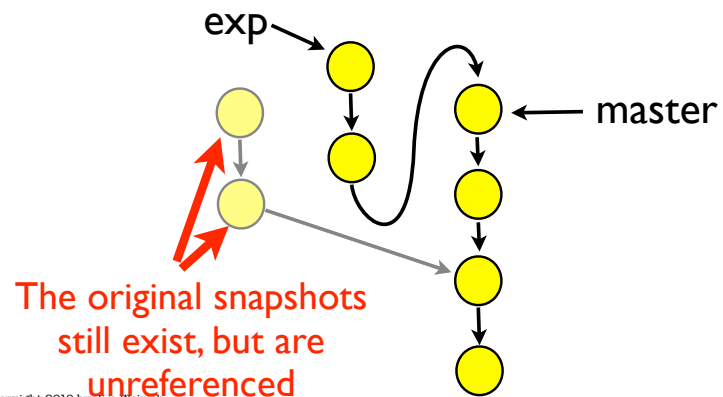
Rebase

These snapshots are
rewritten from scratch

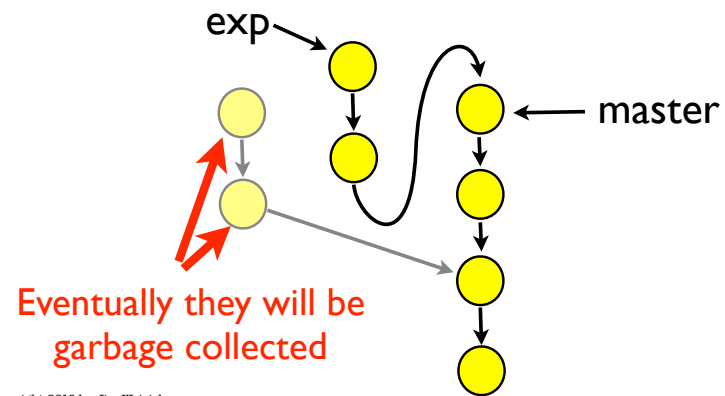


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Rebase



Rebase



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WARNING:

Do **not** rebase shared branches!

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