Git the basics

Bart Trojanowski, bart@jukie.net

Jukie Networks Inc.

July 9th, 2008

Concepts
SCM components
SCM operations
Decentralization
GIT History
Repository
Structure
Objects
Using GIT
Commands
Commit
Inspection
Branching
Merging
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GUI tools
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Concepts
- SCM components
- SCM operations
- Decentralization

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Bart Trojanowski, bart@jukie.net

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Concepts

- Source Control Management
  - track changes to files
  - repository / database of changes
  - working directory / current state
- Centralized SCM
  - server: single database
  - client: working directory & state
- Decentralized SCM
  - anyone can be a server
  - repository coupled with working directory
  - complete history
  - disconnected operation

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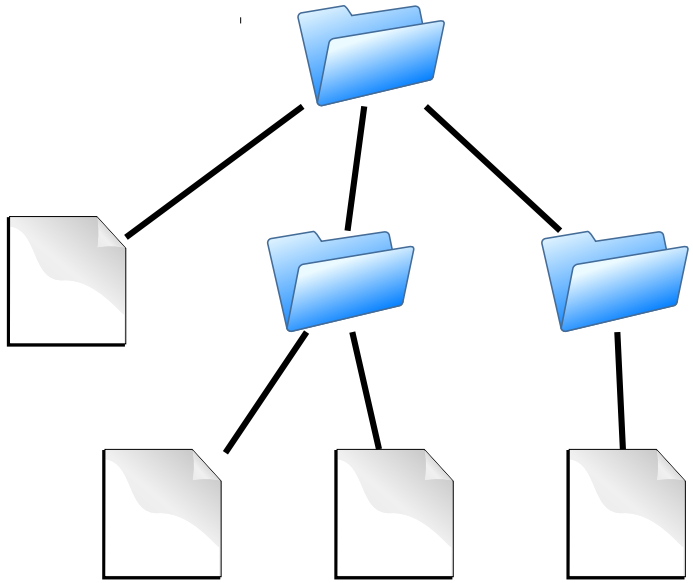
SCM components

Working tree

- directories
- files



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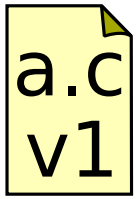
SCM components

Repository contents

- files



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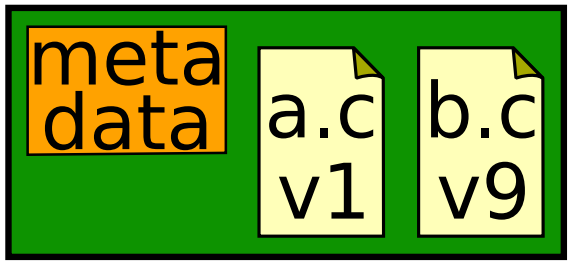
SCM components

Repository contents

- files
- commits



Bart
Trojanowski,
bart@jukie.net

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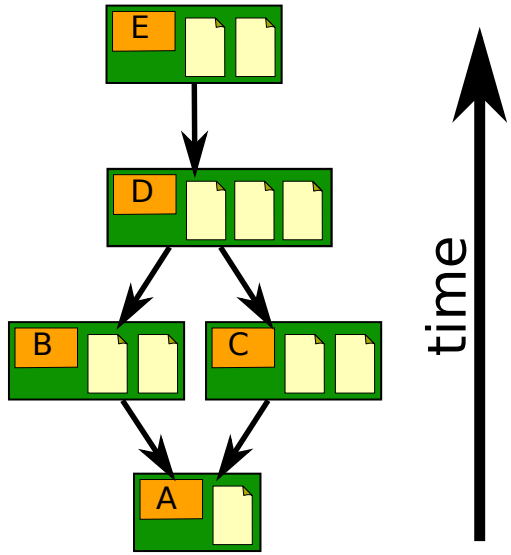
SCM components

Repository contents

- files
- commits
- ancestry



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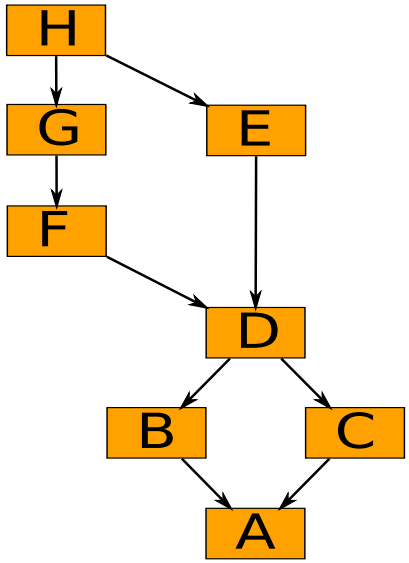
SCM components

directed acyclic graph

"DAG"



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SCM components

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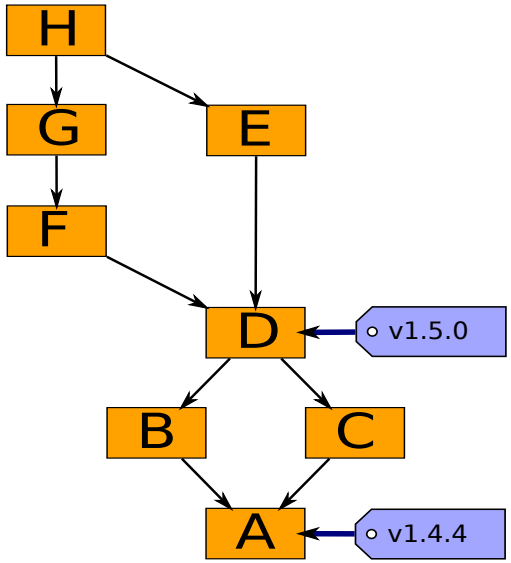
- tags



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SCM components

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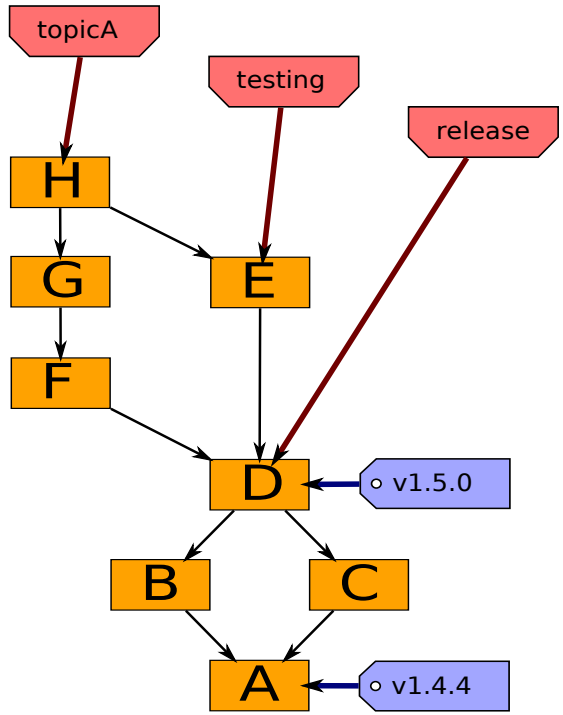
- branches



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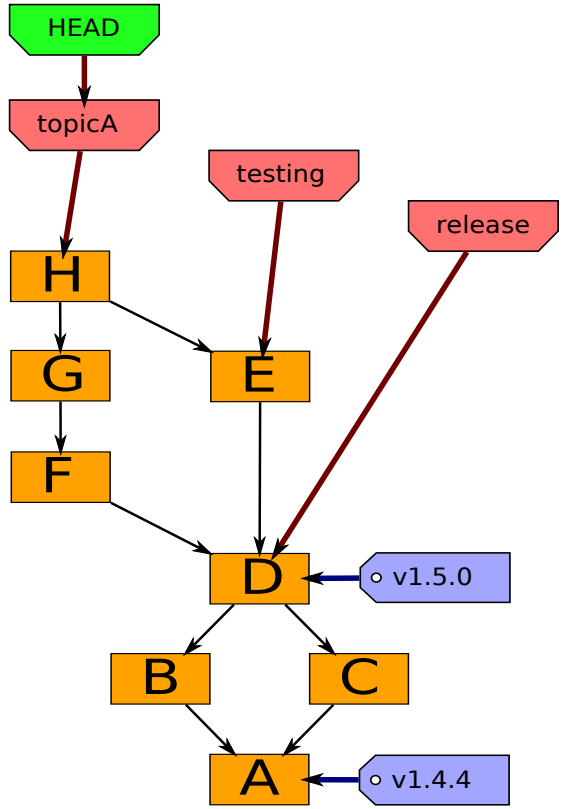
SCM components

HEAD

- current checkout
- points to branch



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SCM components

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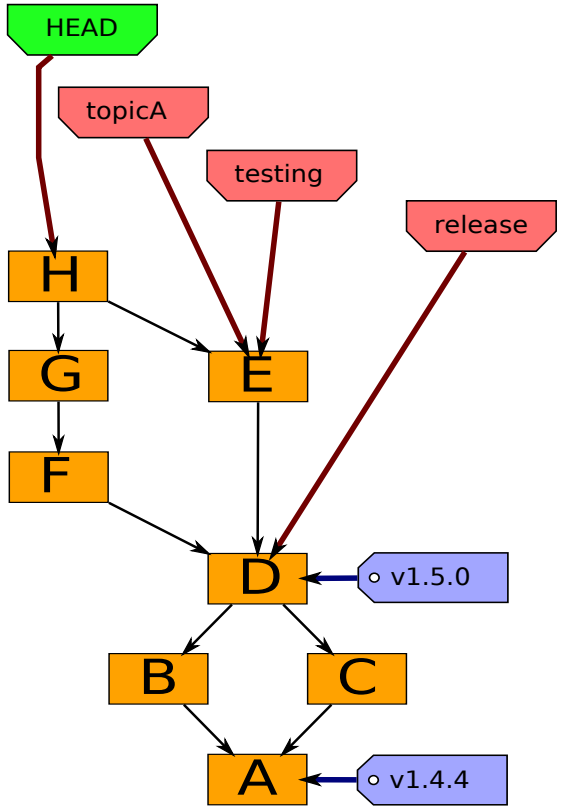
- current checkout
- points to branch
- sometimes detached



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SCM components

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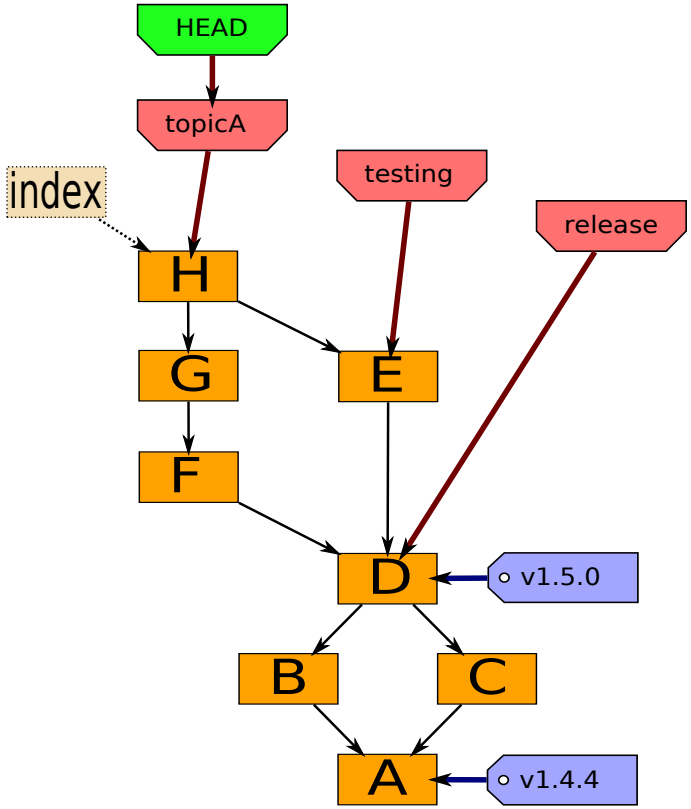
- "staging area"
- what is to be committed



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SCM operations

Bootstrap

- init
- checkout
- switch branch

Modify

- add, delete, rename
- commit

Information

- status
- diff
- log

Reference

- tag
- branch

Bart Trojanowski, bart@jukie.net

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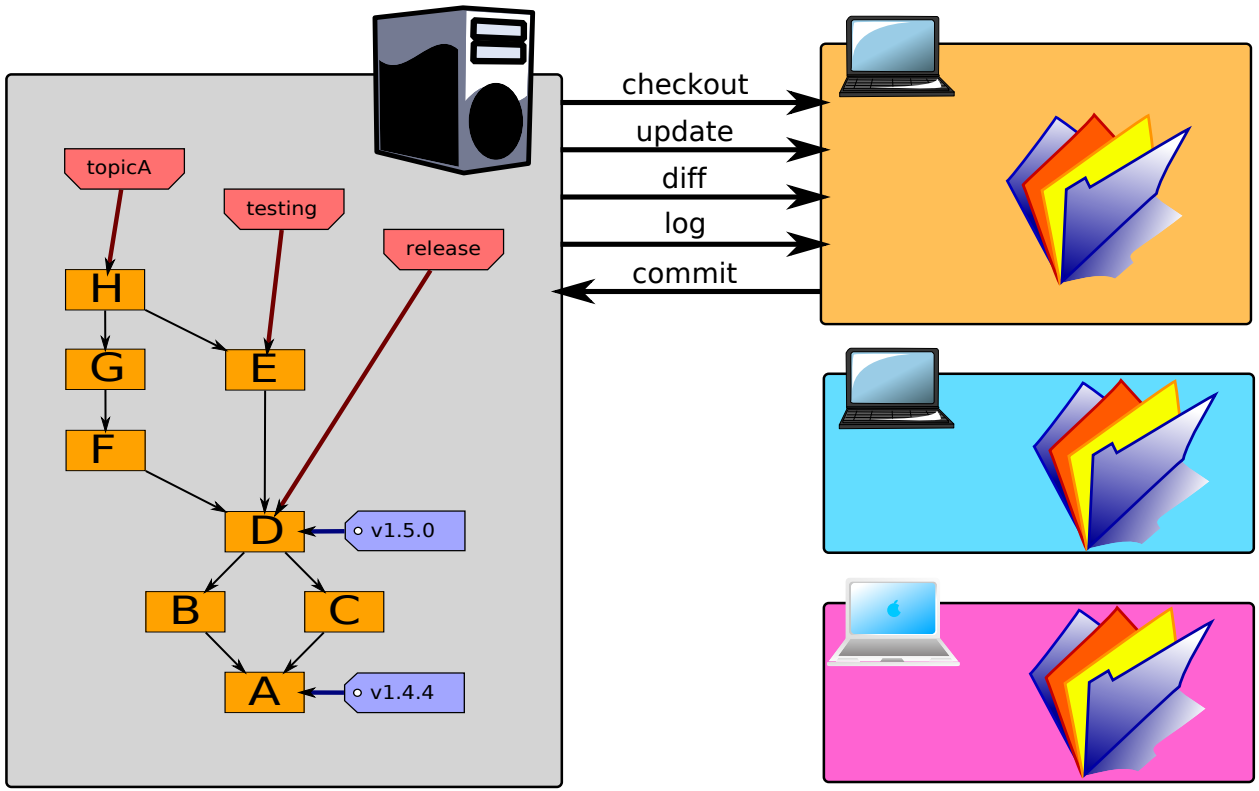
Centralized SCM



- operations require server
  - single point of failure
  - bottleneck

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more SCM operations

Decentralized

- clone
- pull, fetch
- push

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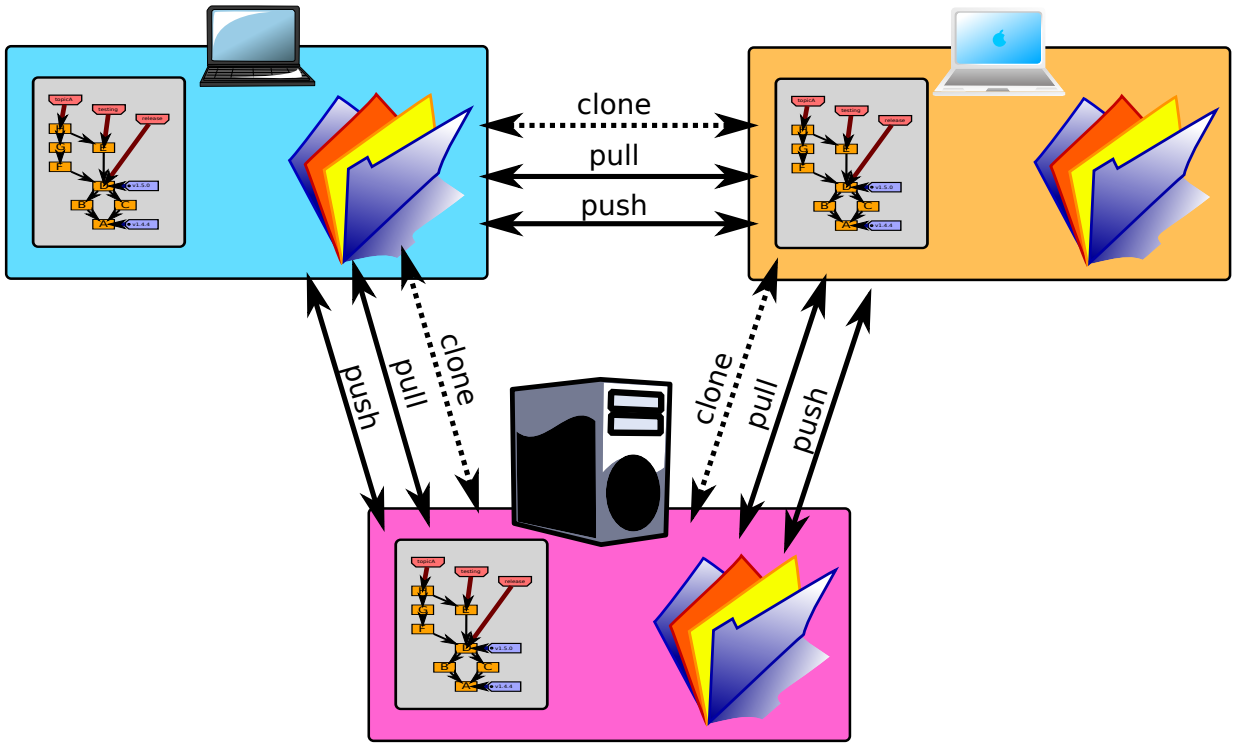
Decentralized SCM



- anyone can be a server

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Decentralization

- public repository

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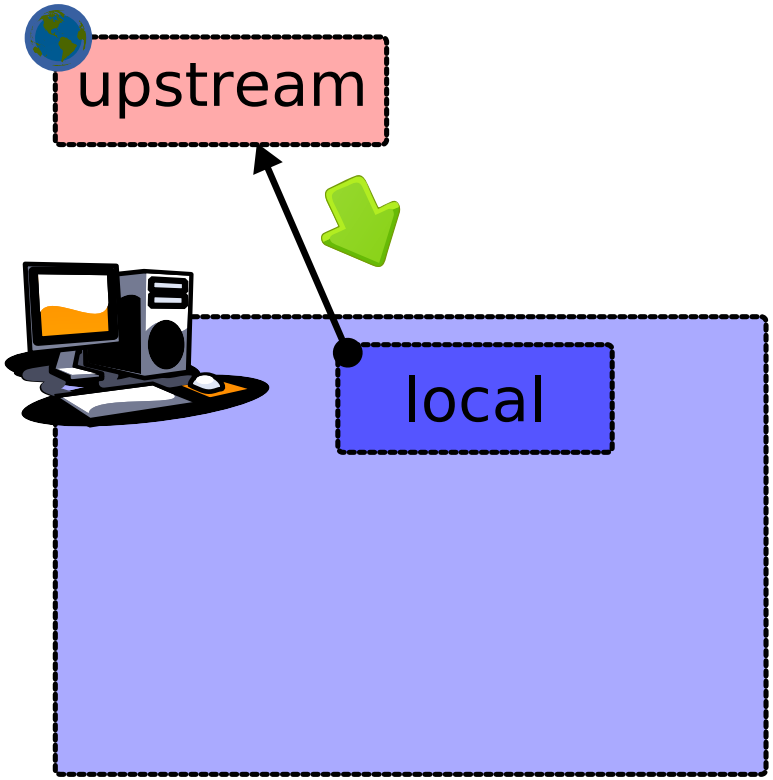
Decentralization



- make a local clone

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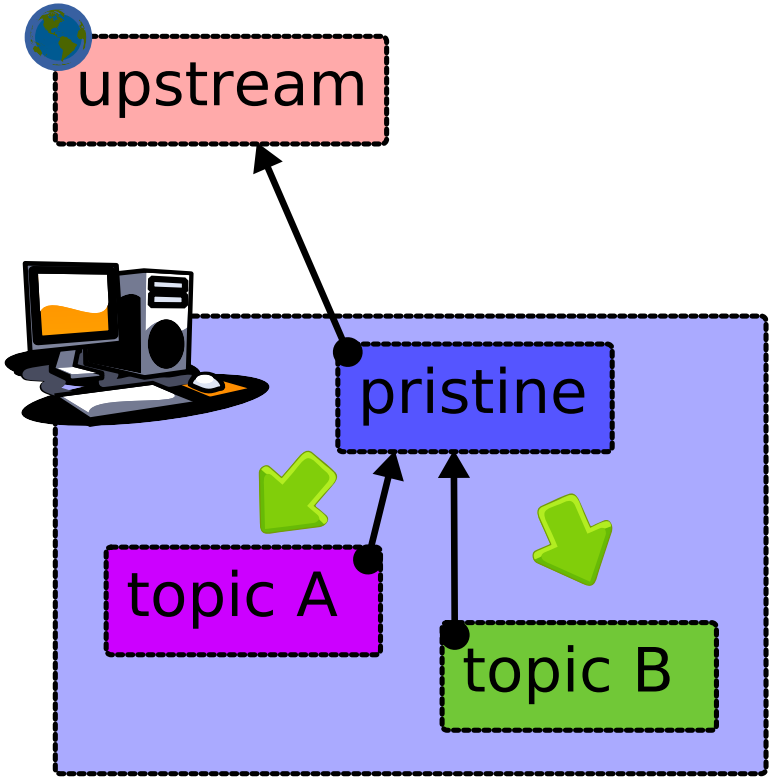
Decentralization



- local cloning is lighweight

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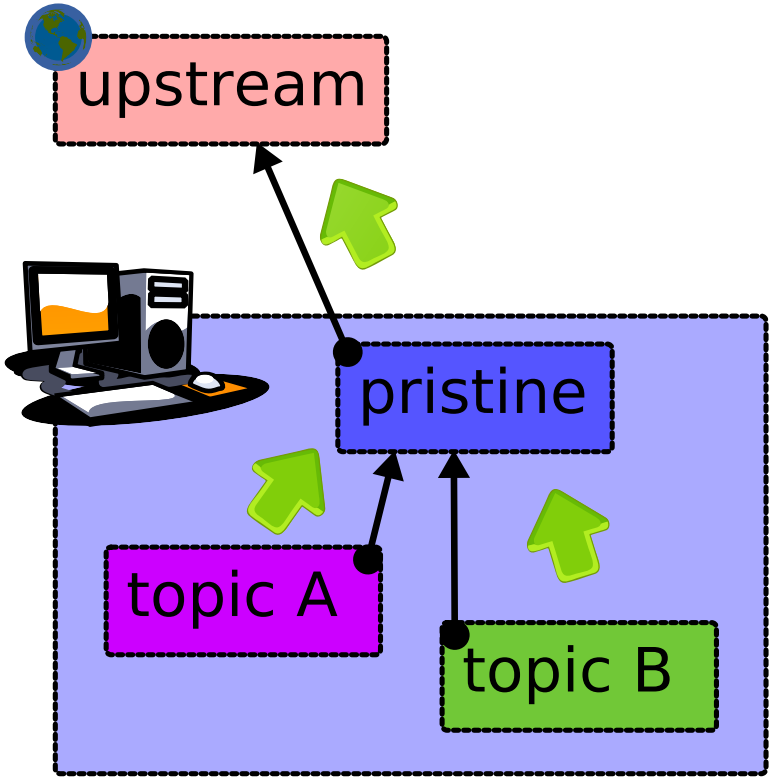
Decentralization



- push changes between any repositories

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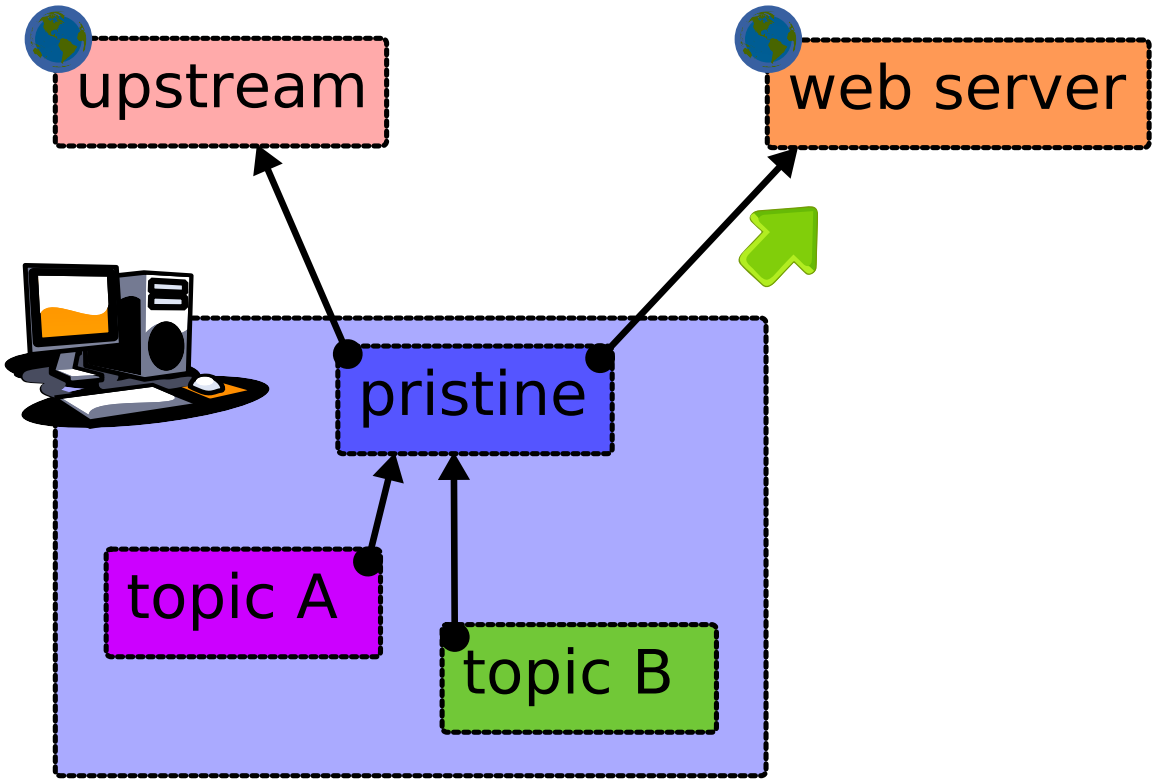
Decentralization



- publish changes to public server

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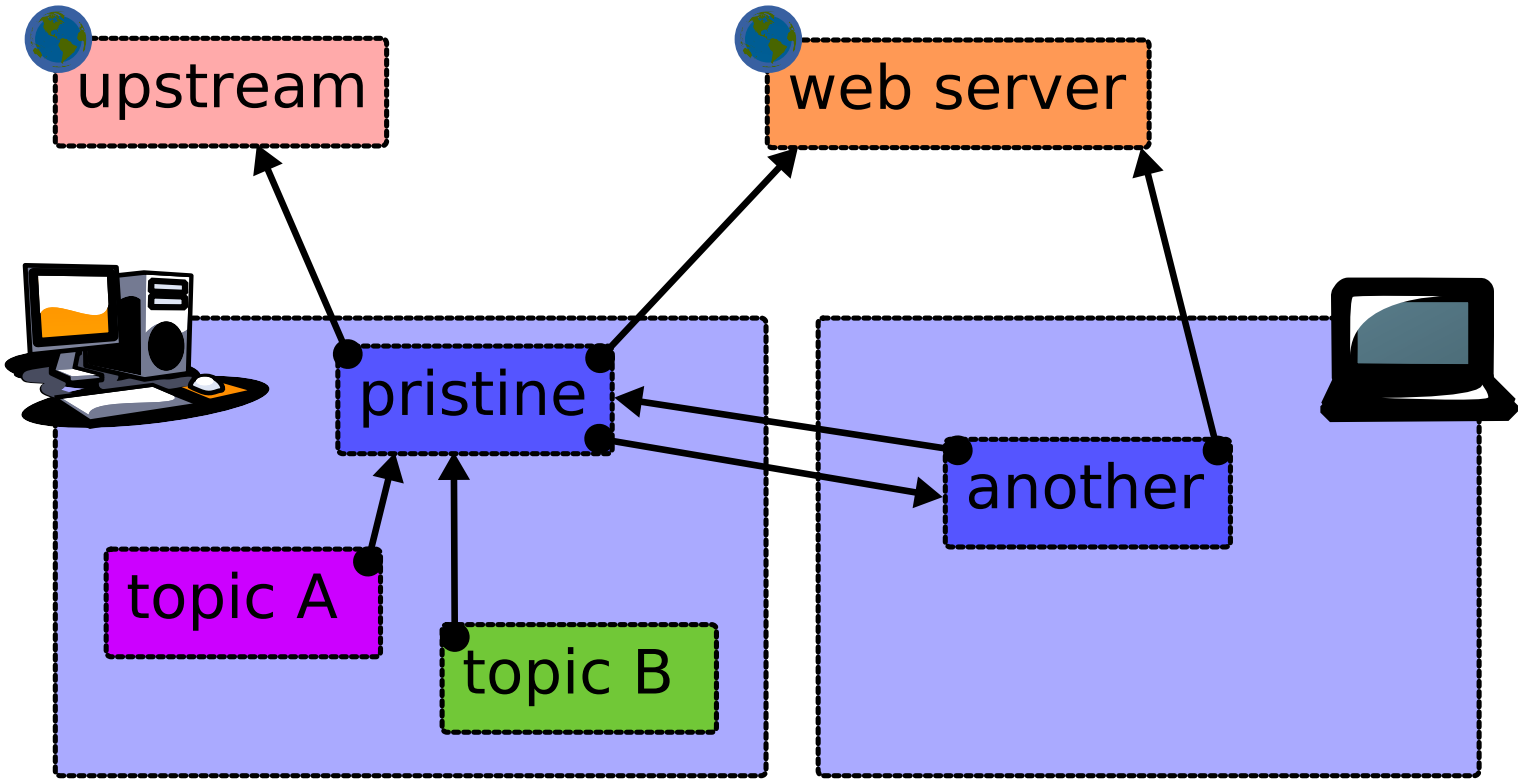
Decentralization



- share changes with trusted peers

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Is Decentralization any good?

- non-intrusive micro-commits
- detached operation
- no single point of failure
- backups are trivial

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Birth of GIT

- 2002
  - Linus uses BitKeeper for tracking Linux
  - BK gets better
  - Linux development scales better
- April 6, 2005
  - BitMover drops free license
  - Linus writes his own SCM, GIT
- April 18, 2005
  - GIT can merge
- June 16, 2005
  - GIT is officially used to track Linux
- Feb 14, 2007
  - GIT 1.5.0 is released
  - major usability effort

Bart Trojanowski, bart@jukie.net

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GIT gets better

*And then realize that nothing is perfect. Git is just *closer* to perfect than any other SCM out there.*
-Linus

Bart Trojanowski, bart@jukie.net

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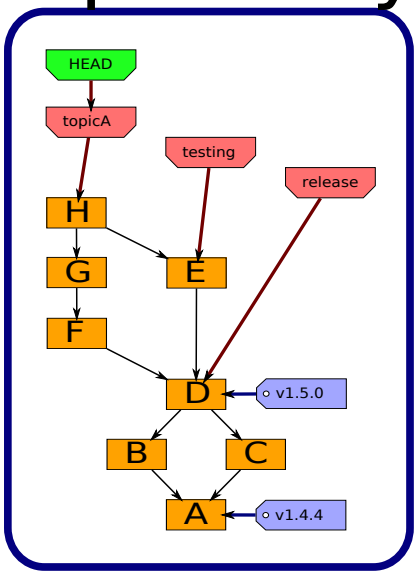
Structure

repository



the history

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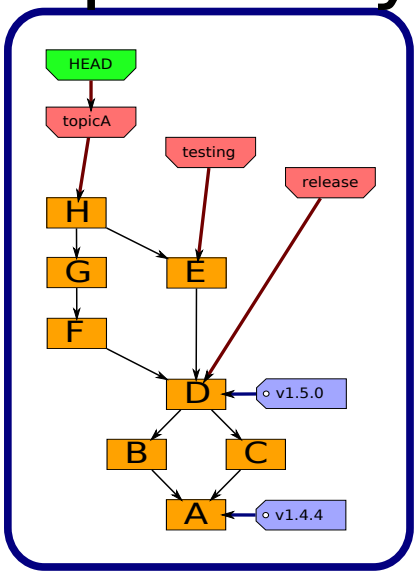
Structure

repository



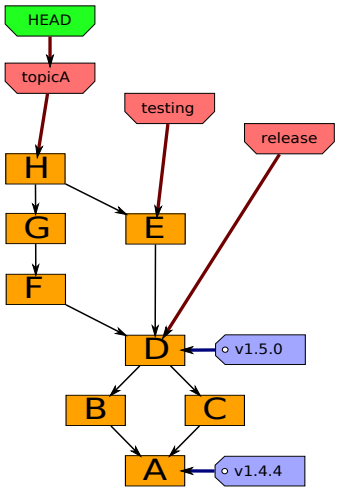
index

```
100644 20b024 0   bar
100644 1d52a6 0   baz
100644 20b024 0   sub/fi
100644 43dbe0 0   sub/foo
```

staging area

Structure

repository



index

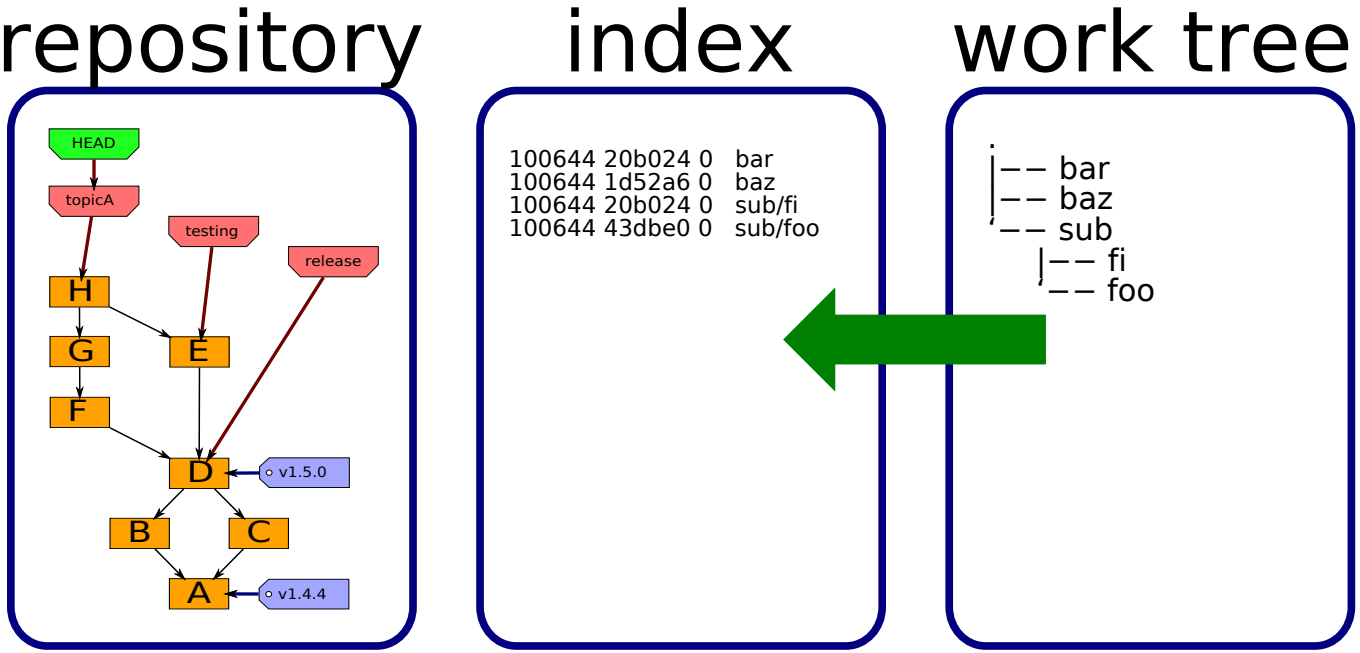
```
100644 20b024 0   bar
100644 1d52a6 0   baz
100644 20b024 0   sub/fi
100644 43dbe0 0   sub/foo
```

work tree

```
.
├── bar
├── baz
└── sub
    ├── fi
    └── foo
```

files you edit

Structure



"staging"

`add`

`remove`

`rename`

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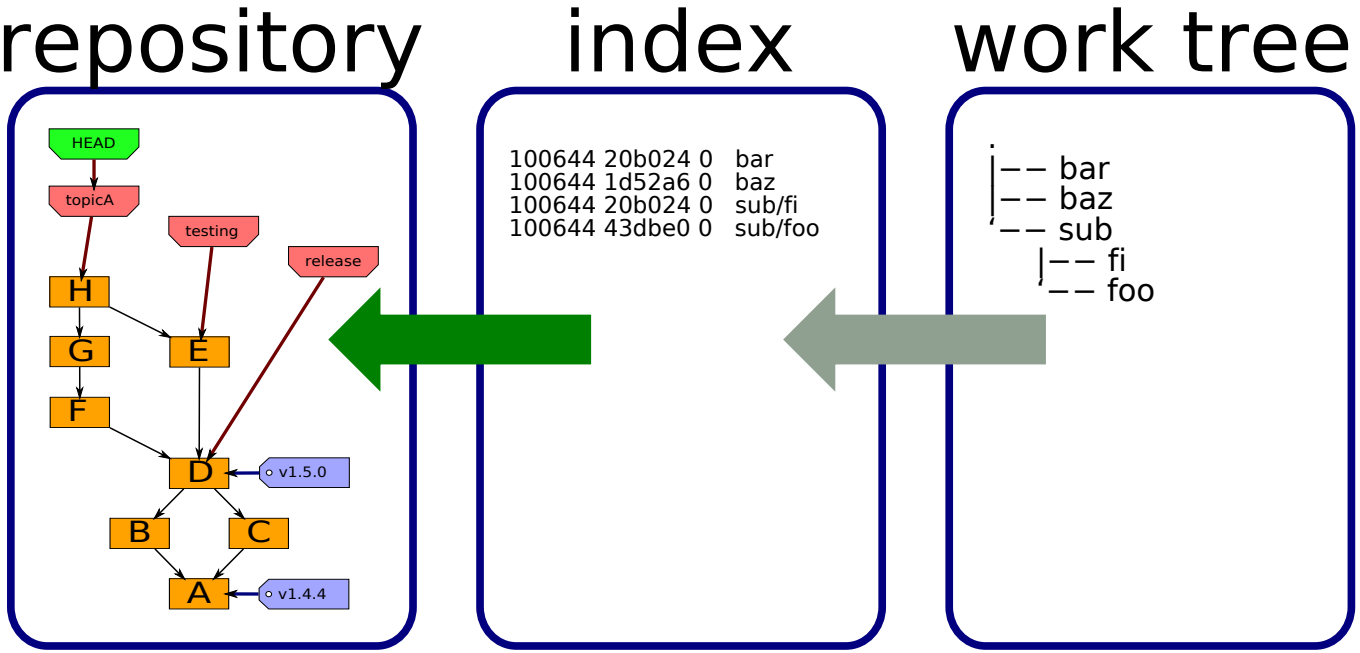
Structure



"committing"

`commit`

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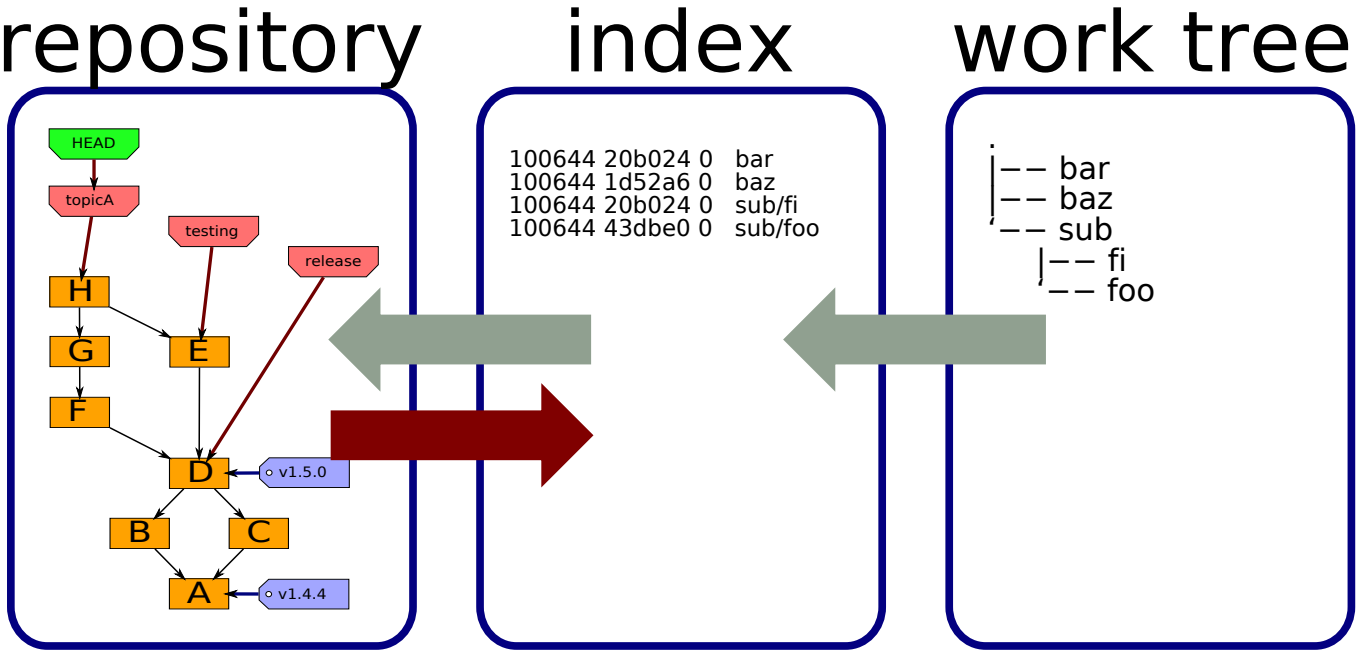

"reading tree"

`checkout`

`read-tree`

`reset`

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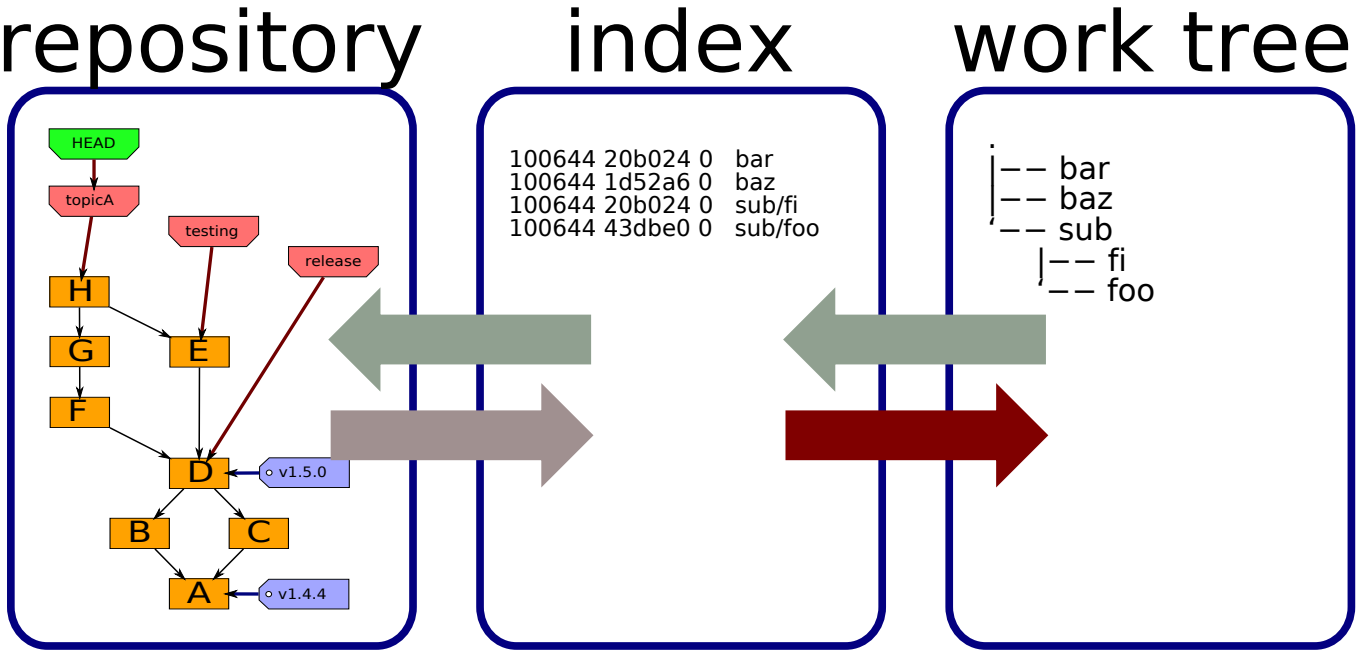

"checking out"

`checkout`

`checkout-index`

`reset`

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The repository

```
.git
|-- HEAD                current checkout reference
|-- config              repo private config
|-- description         repo description
|-- hooks
|   `-- ...             hooking scripts
|-- index               changes to commit
|-- info
|   |-- exclude         repo private
|   `-- refs            refs?
|-- logs
|   `-- ...             "reflog" data
|-- objects
|   |-- XX
|   |   `-- ...         loose objects
|   |-- info
|   |   `-- packs       info about packs
|   `-- pack
|       `-- ...         packs and indexes
`-- refs
    |-- heads
    |   `-- master      master branch
    `-- tags
        `-- ...         tags
```


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The repository

.git/config

- repository config

.git/description

- describes the repository
  useful for gitweb

.git/info/exclude

- patterns to ignore

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The repository

`.git/config`

- repository config

`.git/description`

- describes the repository
  useful for gitweb

`.git/info/exclude`

- patterns to ignore

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The repository

`.git/config`

- repository config

`.git/description`

- describes the repository
  useful for gitweb

`.git/info/exclude`

- patterns to ignore

Bart Trojanowski, bart@jukie.net

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Objects

.git/objects

```
|-- 23
|   `-- d4bd826aba9e29aaace9411cc175b784edc399
|-- 76
|   `-- 49f82d40a98b1ba59057798e47aab2a99a11d3
|-- c4
|   `-- aaefaa8a48ad4ad379dc1002b78f1a3e4ceabc
|-- e7
|   `-- 4be61128eef713459ca4e32398d689fe80864e
|-- info
|   `-- packs
`-- pack
    |-- pack-b7b026b1a0b0f193db9dea0b0d7367d25d3a68cc.idx
    `-- pack-b7b026b1a0b0f193db9dea0b0d7367d25d3a68cc.pack
```


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Objects

.git/objects

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|   `-- d4bd826aba9e29aaace9411cc175b784edc399
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|   `-- 49f82d40a98b1ba59057798e47aab2a99a11d3
|-- c4
|   `-- aaefaa8a48ad4ad379dc1002b78f1a3e4ceabc
|-- e7
|   `-- 4be61128eef713459ca4e32398d689fe80864e
|-- info
|   `-- packs
`-- pack
    |-- pack-b7b026b1a0b0f193db9dea0b0d7367d25d3a68cc.idx
    `-- pack-b7b026b1a0b0f193db9dea0b0d7367d25d3a68cc.pack
```

"loose objects"

Bart Trojanowski, bart@jukie.net

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.git/objects

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|   `-- d4bd826aba9e29aaace9411cc175b784edc399
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|-- c4
|   `-- aaefaa8a48ad4ad379dc1002b78f1a3e4ceabc
|-- e7
|   `-- 4be61128eef713459ca4e32398d689fe80864e
|-- info
|   `-- packs
`-- pack
    |-- pack-b7b026b1a0b0f193db9dea0b0d7367d25d3a68cc.idx
    `-- pack-b7b026b1a0b0f193db9dea0b0d7367d25d3a68cc.pack
```

"pack file"

Bart Trojanowski, bart@jukie.net

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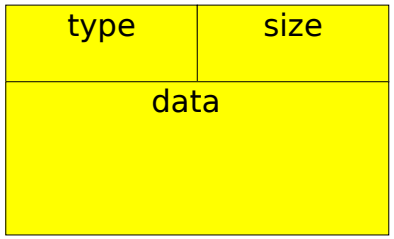
Objects

content addressable



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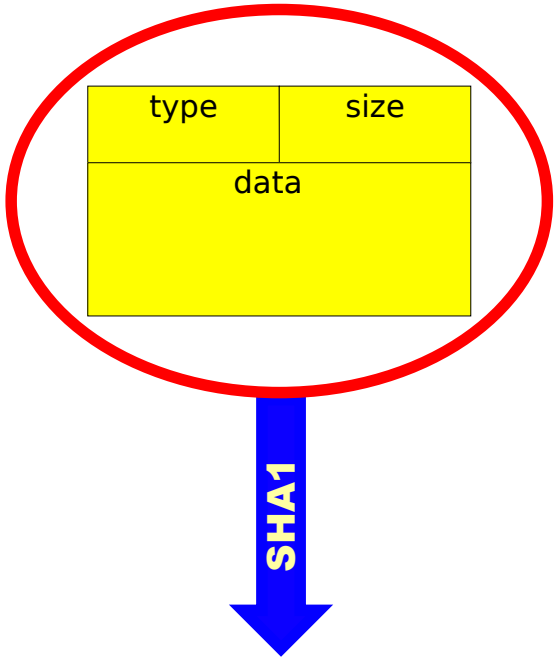
Objects

content addressable



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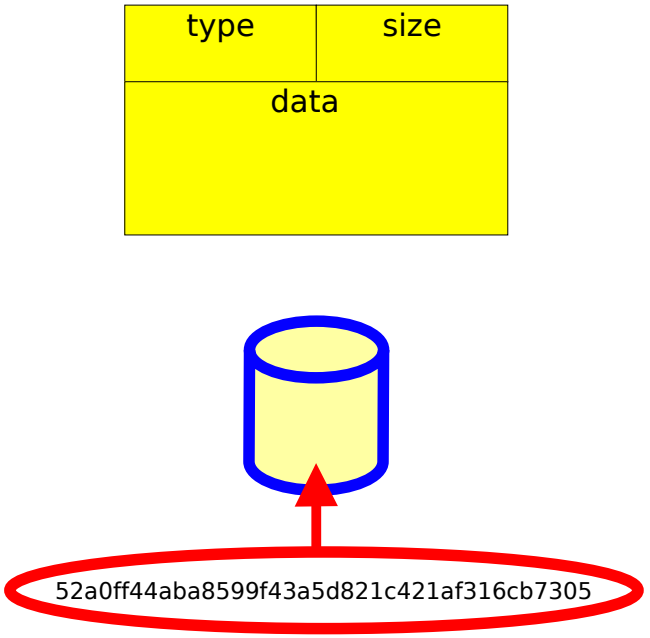
Objects

content addressable



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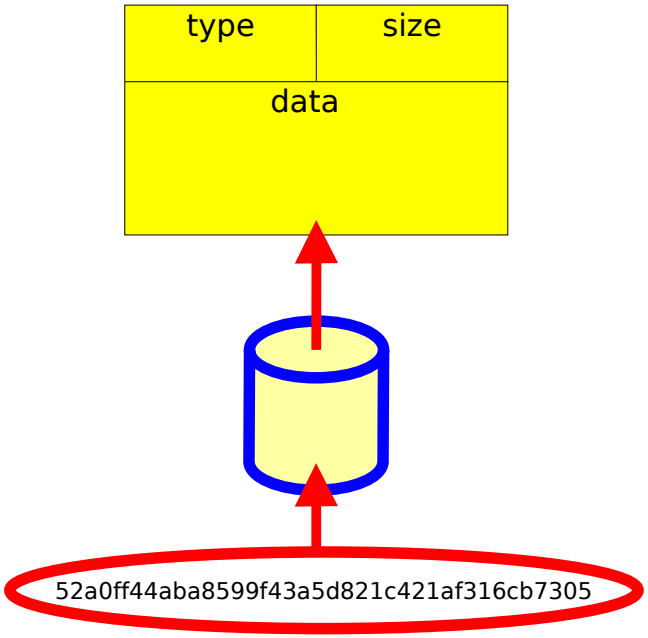

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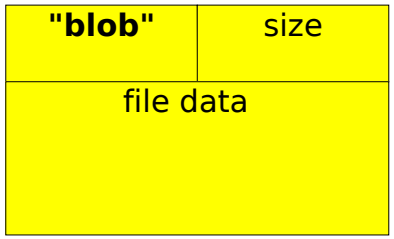
Objects

4 types

- blobs



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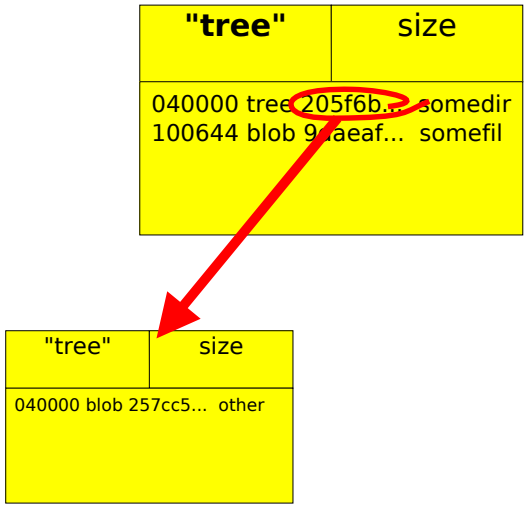
Objects

4 types

- blobs
- trees



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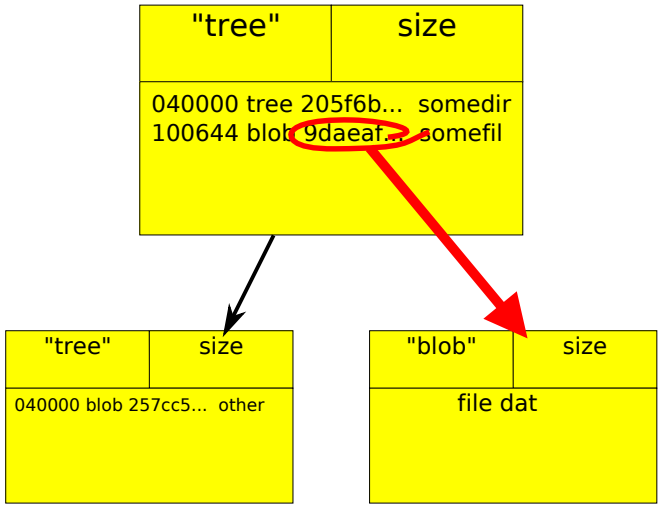

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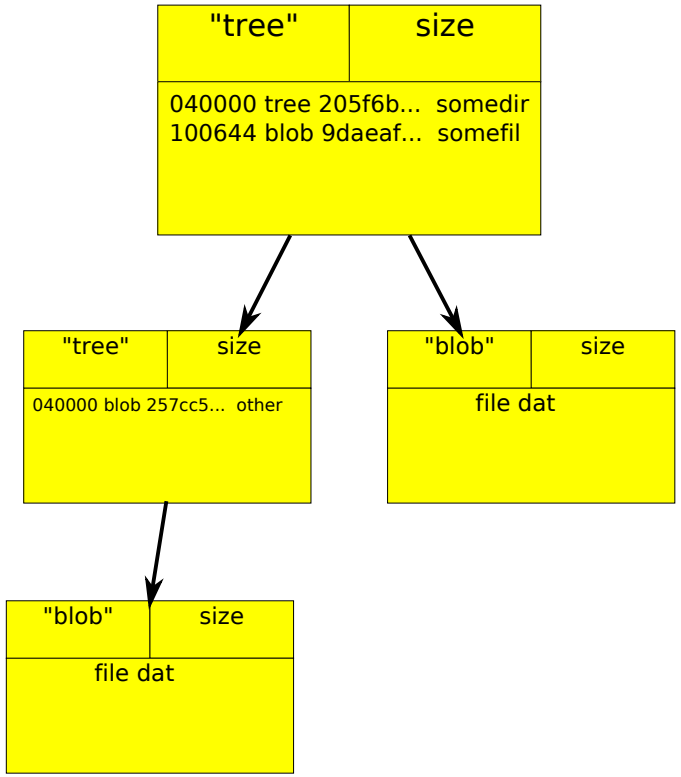

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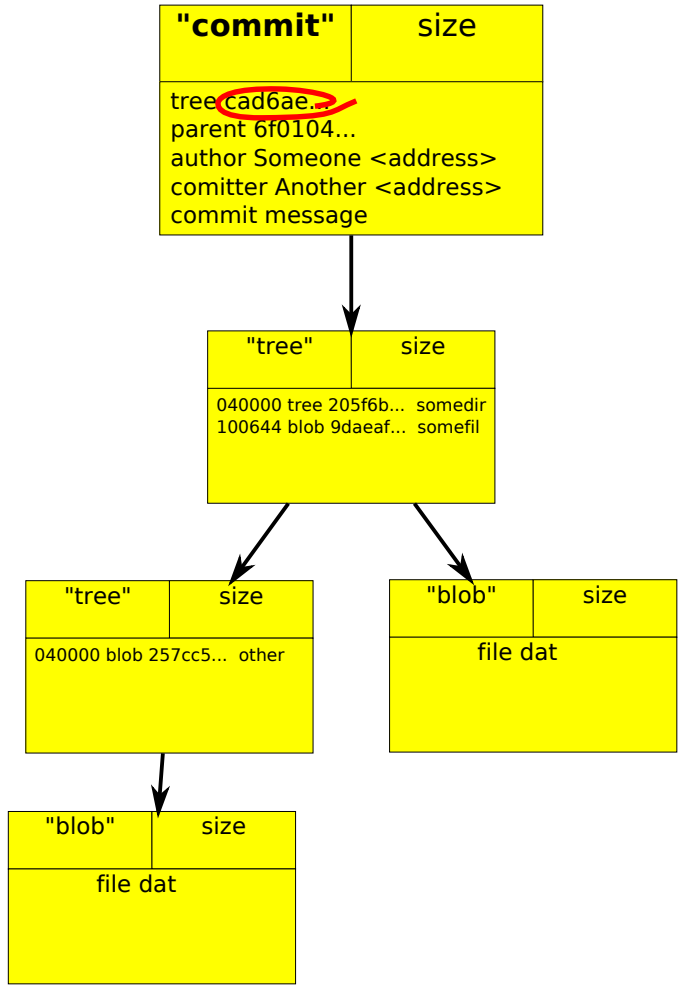
4 types

- blobs
- trees
- commits



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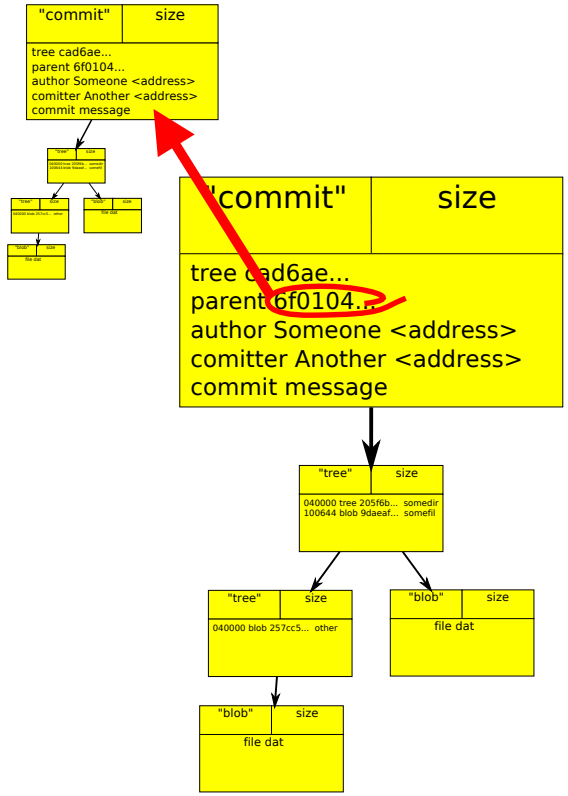

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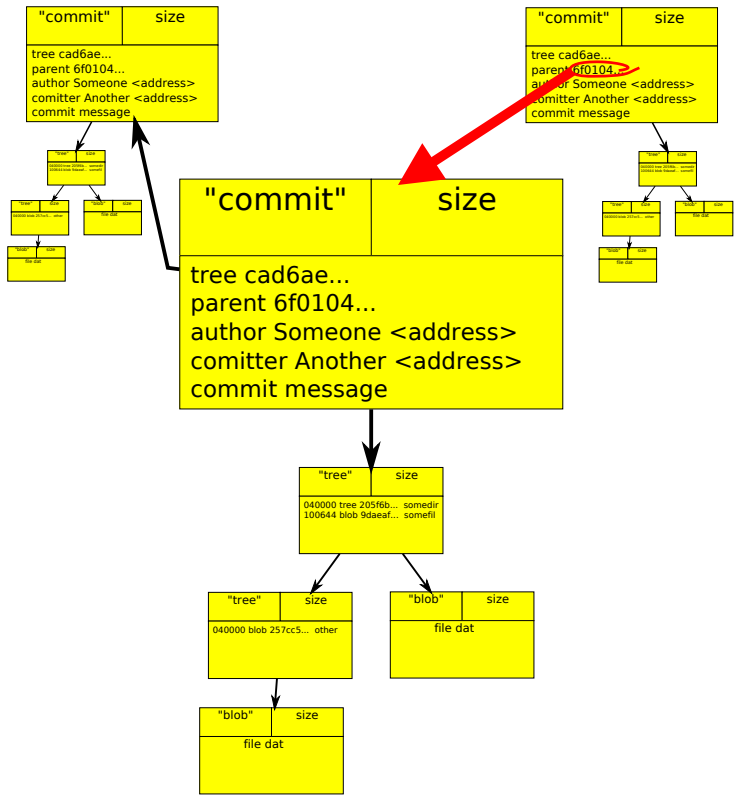

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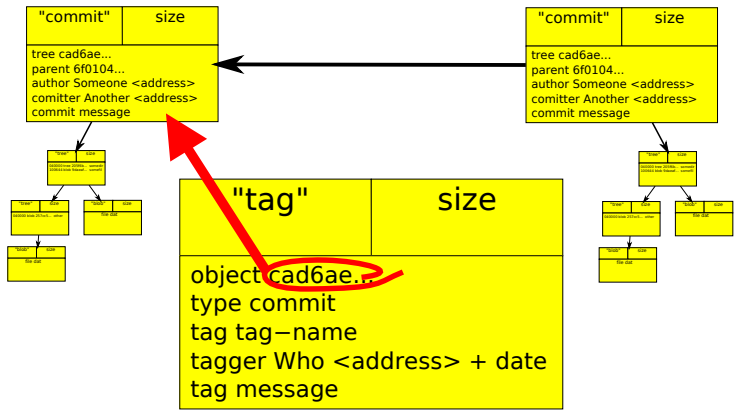
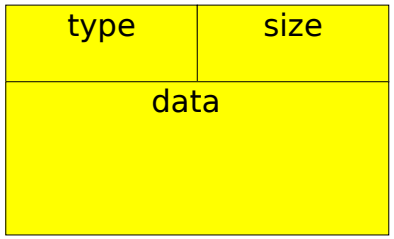


Objects

immutable



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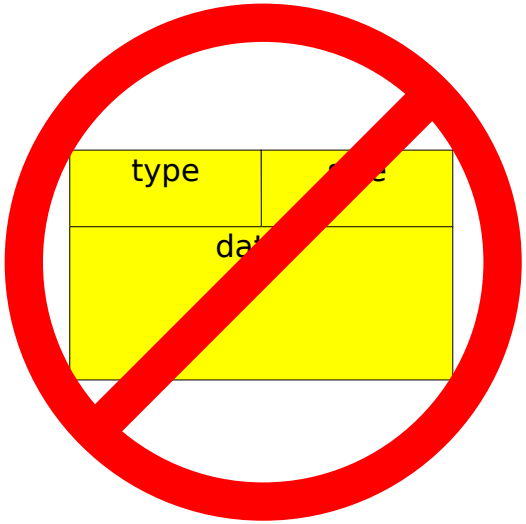
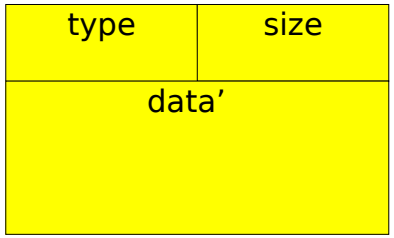
Objects

immutable





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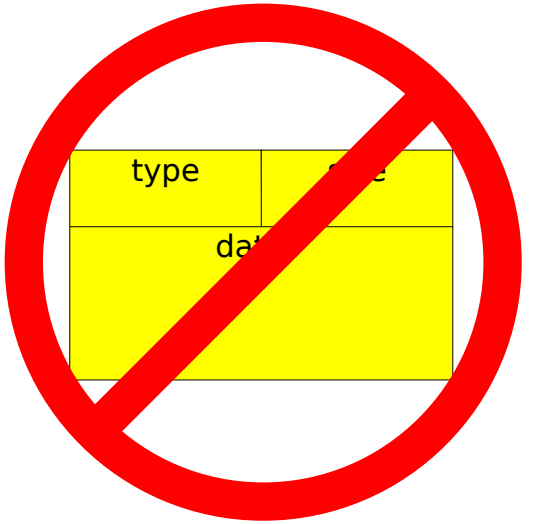
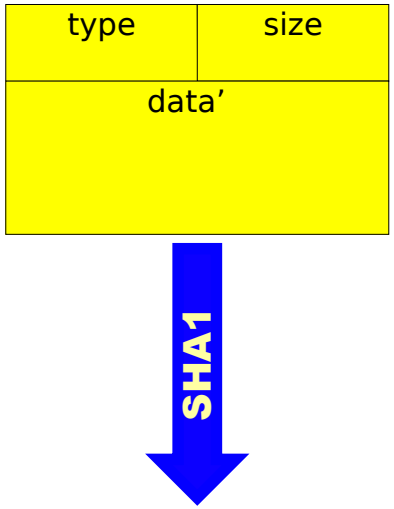
immutable





8a9fd66b8bb939638564ebfdecc23b5d58070fc8

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- Using GIT
  - Commands
  - Commit
  - Inspection
  - Branching
  - Merging
  - Rebasing
  - Remotes
  - GUI tools
  - Loose ends

Bart Trojanowski, bart@jukie.net

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Git commands

```
$ git <options> <command> <options>
```


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Git commands (137)

```
add                 fast-export         merge-one-file      revert
am                  fast-import         merge-resolve       rm
annotate            fetch               merge-subtree       send-email
apply               fetch-pack          merge-tree          send-pack
archimport          filter-branch       mergetool           sh-setup
archive             fmt-merge-msg       mktag               shell
bisect              for-each-ref        mktree              shortlog
blame               format-patch        mv                  show
branch              fsck                name-rev            show-branch
bundle              fsck-objects        pack-objects        show-index
cat-file            gc                  pack-redundant      show-ref
check-attr          get-tar-commit-id   pack-refs           stash
check-ref-format    grep                parse-remote        status
checkout            gui                 patch-id            stripspace
checkout-index      hash-object         peek-remote         submodule
cherry              http-fetch          prune               svn
cherry-pick         http-push           prune-packed        symbolic-ref
citool              imap-send           pull                tag
clean               index-pack          push                tar-tree
clone               init                quiltimport         unpack-file
commit              init-db             read-tree           unpack-objects
commit-tree         instaweb            rebase              update-index
config              log                 receive-pack        update-ref
count-objects       lost-found          reflog              update-server-info
cvsexportcommit     ls-files            relink              upload-archive
cvsimport           ls-remote           remote              upload-pack
cvsserver           ls-tree             repack              var
daemon              mailinfo            repo-config         verify-pack
describe            mailsplit           request-pull        verify-tag
diff                merge               rerere              whatchanged
diff-files          merge-base          reset               write-tree
diff-index          merge-file          rev-list
diff-tree           merge-index         rev-parse           gitk
```


Bart Trojanowski, bart@jukie.net

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Every day use. . .

add			
			rm
	fetch		
		mv	show
branch			
	gc		
			stash
	grep		status
checkout			
		pull	tag
		push	
clone	init		
commit			
		rebase	
config	log		
		remote	
diff	merge		
		reset	

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Some GUI tools. . .

add

branch

checkout

citool

clone
commit

config

diff

fetch

gc

grep
gui

init

log

merge

mergetool

mv

pull
push

rebase

remote

reset

rm

shell

show

stash
status

tag

gitk

Bart Trojanowski, bart@jukie.net

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Occasional use. . .

```
add
am
annotate
apply

archive
bisect
blame
branch
bundle

checkout

cherry
cherry-pick
citool
clean
clone
commit

config
```

```
fetch

format-patch

gc

grep
gui

init

instaweb
log

merge
```

```
mergetool

mv

pull
push
quiltimport

rebase

reflog

remote

reset
```

```
revert
rm
send-email

shell
shortlog
show
show-branch

stash
status

submodule
svn

tag

update-server-info

whatchanged

gitk
```


Bart Trojanowski, bart@jukie.net

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And the plumbing...

add
am
annotate
apply
archimport
archive
bisect
blame
branch
bundle
cat-file
check-attr
check-ref-format
checkout
checkout-index
cherry
cherry-pick
citool
clean
clone
commit
commit-tree
config
count-objects
cvsexportcommit
cvsimport
cvsserver
daemon
describe
diff
diff-files
diff-index
diff-tree
fast-export
fast-import
fetch
fetch-pack
filter-branch
fmt-merge-msg
for-each-ref
format-patch
fsck
fsck-objects
gc
get-tar-commit-id
grep
gui
hash-object
http-fetch
http-push
imap-send
index-pack
init
init-db
instaweb
log
lost-found
ls-files
ls-remote
ls-tree
mailinfo
mailsplit
merge
merge-base
merge-file
merge-index
merge-one-file
merge-resolve
merge-subtree
merge-tree
mergetool
mktag
mktree
mv
name-rev
pack-objects
pack-redundant
pack-refs
parse-remote
patch-id
peek-remote
prune
prune-packed
pull
push
quiltimport
read-tree
rebase
receive-pack
reflog
relink
remote
repack
repo-config
request-pull
rerere
reset
rev-list
rev-parse
revert
rm
send-email
send-pack
sh-setup
shell
shortlog
show
show-branch
show-index
show-ref
stash
status
stripspace
submodule
svn
symbolic-ref
tag
tar-tree
unpack-file
unpack-objects
update-index
update-ref
update-server-info
upload-archive
upload-pack
var
verify-pack
verify-tag
whatchanged
write-tree

gitk

Bart Trojanowski,
bart@jukie.net

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Help

`git help`

- list of common commands

`git <command> -h`

- brief help output

`man git-<command>`
`git help <command>`
`git <command> --help`

- manual page

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`git <command> -h`

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Configuration

$HOME/.gitconfig

```
$ git config --global user.name "Your Name"
$ git config --global user.email you@domain.tld
```

```
$ git config --global color.pager true
$ git config --global color.ui auto
```


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Configuration

```
$ cat .gitconfig
[user]
        name = "Bart Trojanowski"
        email = "bart@jukie.net"
        signingkey = 2289688F

[core]
        pager = less -FRSX
        editor = vim

[color]
        ui = auto

[merge]
        tool = vimdiff
```


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Bootstrapping

```
$ git init
```

- ran in project workspace
- creates `.git` directory

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Staging

What to commit?

- additions

```
$ git add file
$ git add .
```

- removal

```
$ git rm file
```

- renames

```
$ git mv old new
```


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$ git rm file
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Bart Trojanowski, bart@jukie.net

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Staging

```
$ cat .gitignore
*.o
*~
```


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Committing

```
$ git commit -a -m“some comment”
```

- will create a commit of all or only staged items

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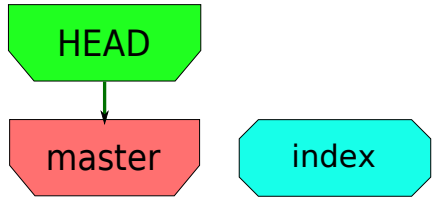
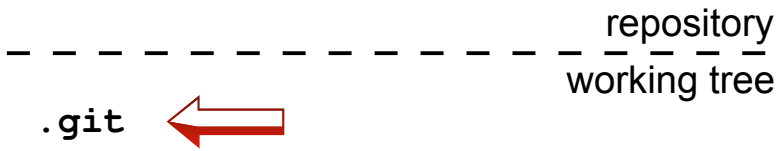
Bootstrapping

```
$ mkdir project
$ cd project
$ git init
```





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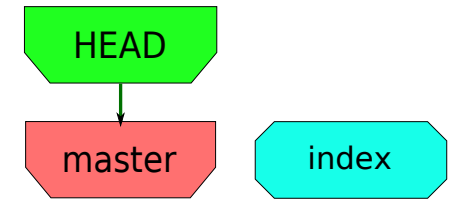
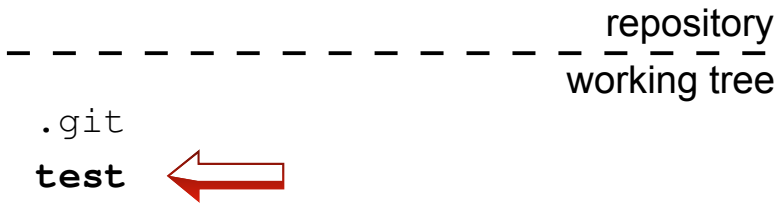
First commit

```
$ echo test > test
```





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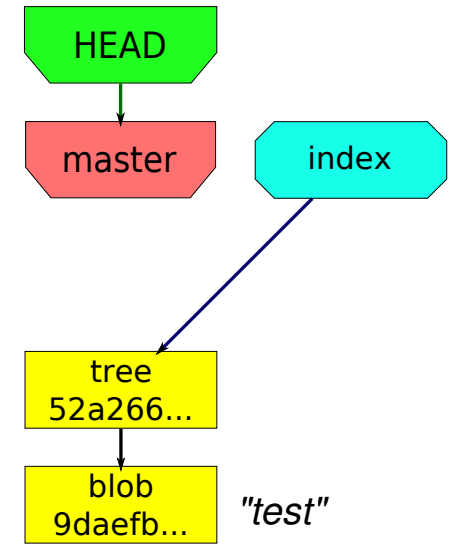
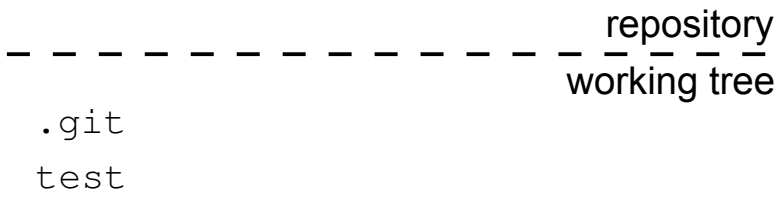
Stage

```
$ echo test > test
$ git add test
```





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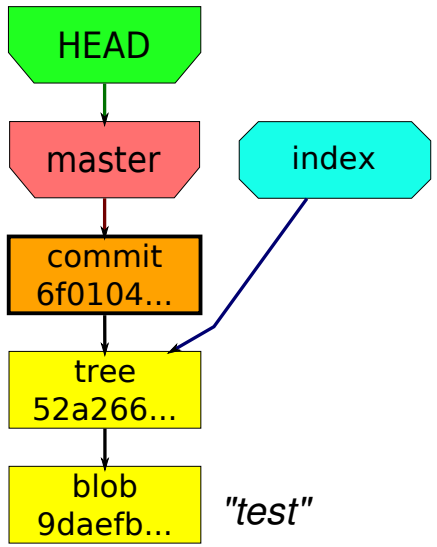
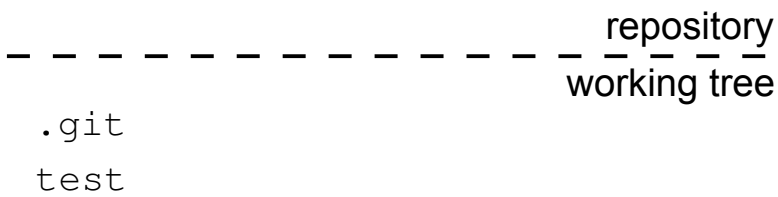
Commit

```
$ echo test > test
$ git add test
```

```
$ git commit -m“test”
Created initial commit 6f01040:  test
1 files changed, 1 insertions(+),
0 deletions(-)

create mode 100644 test
```



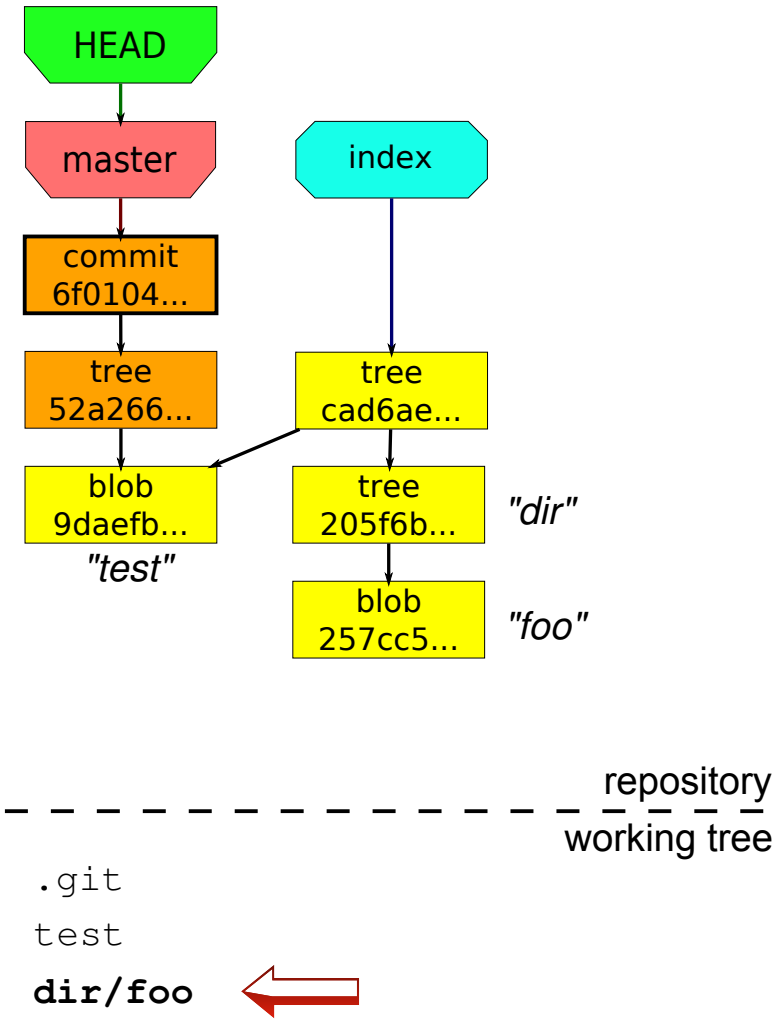


Stage another

```
$ echo test > test
$ git add test
```

```
$ git commit -m“test”
```

```
$ mkdir dir
$ echo foo > dir/foo
$ git add dir/foo
```



Commit another

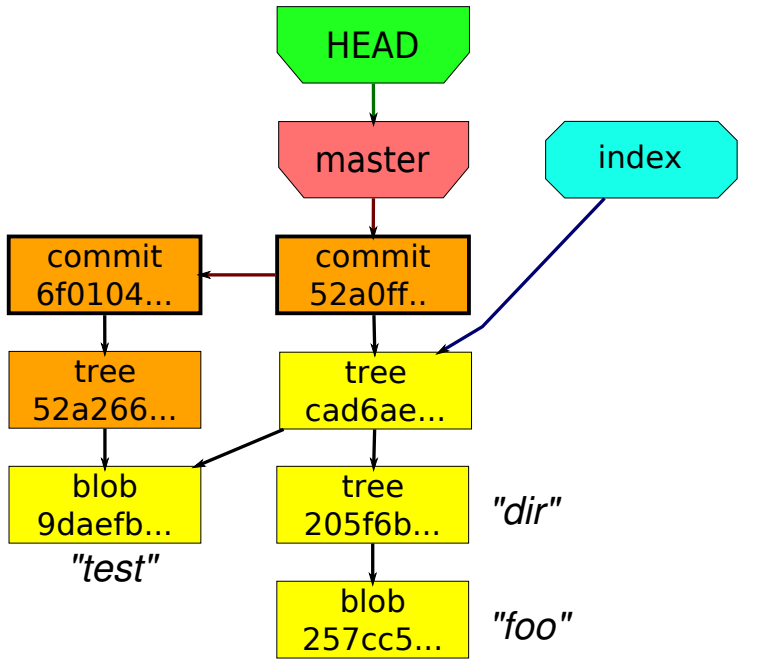
```
$ echo test > test
$ git add test
```

```
$ git commit -m“test”
```

```
$ mkdir dir
$ echo foo > dir/foo
$ git add dir/foo
```

```
$ git commit -m“foo”
Created commit 52a0ff4:  foo
1 files changed, 1 insertions(+),
0 deletions(-)

create mode 100644 dir/foo
```



repository

working tree

```
.git
test
dir/foo
```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Repository status

```
$ git status
```

shows...

- staged
- unstaged
- untracked

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Diffs

```
$ git diff
```

- changes between index and working files

```
$ git diff --staged
```

- changes between HEAD and index

```
$ git diff HEAD
```

- changes between HEAD and working files

```
$ git diff $commit $commit
```

- changes between two commits

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Diffs

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$ git diff
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- changes between index and working files

```
$ git diff --staged
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- changes between HEAD and index

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```

- changes between two commits

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Diffs

`$ git diff`

- changes between index and working files

`$ git diff --staged`

- changes between HEAD and index

`$ git diff HEAD`

- changes between HEAD and working files

`$ git diff $commit $commit`

- changes between two commits

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Diffs

```
$ git diff
```

- changes between index and working files

```
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- changes between HEAD and index

```
$ git diff HEAD
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- changes between two commits

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Object references

specific commit ID...

full hash	`6bb1270ffb60cbfef87266d2d4b4abe4218d9c68`
short hash	`6bb127`
tag	v1.5.6.1
local branch	master
remote branch	origin/master
by message	":/some text"
checkout	HEAD
last fetch	FETCH_HEAD
previous head	ORIG_HEAD

...

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Object references

a commit before HEAD

HEAD^ == HEAD~1

Bart Trojanowski, bart@jukie.net

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Object references

few commits before HEAD

HEAD^^^ == HEAD~3

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Object references

few commits before master

master^^^ == master~3

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Object references

what was it yesterday?

@{yesterday} == HEAD@{yesterday}

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Object references

how about my-other-branch on June 1st?

my-other-branch@{June.1}

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Object references

master a few changes ago?

master@{3}

Show me!

review last commit...

```
$ git show
commit 83b2d051814e884a8e264127ed47552a5dcf6c1d
Author: Bart Trojanowski <bart@jukie.net>
Date:   Thu Jul 3 21:44:39 2008 -0400

    changed one line

diff --git a/test b/test
index 808a2c4..99810fa 100644
--- a/test
+++ b/test
@@ -1,3 +1,3 @@
 Some old text before the change.
-Some text for removal.
+Replacement line.
 Some old text after the change.
```


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Show me!

just the stats...

```
$ git show --stat
commit 83b2d051814e884a8e264127ed47552a5dcf6c1d
Author: Bart Trojanowski <bart@jukie.net>
Date:   Thu Jul 3 21:44:39 2008 -0400

    changed one line

 test |    2 +-
 1 files changed, 1 insertions(+), 1 deletions(-)
```


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Show me!

SVN'esq status information...

```
$ git show --name-status
commit 3d3d2989b817af3fd4fa6d63f200113bd6c94bdb
Author: Bart Trojanowski <bart@jukie.net>
Date:   Thu Jul 3 22:59:13 2008 -0400

    something more interesting

A       sub/bar
D       sub/foo
M       test
```


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Show me!

review any other commit...

```
$ git show HEAD
$ git show HEAD^^^
$ git show master~10
$ git show master@{May.16}
```

...

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Show me!

show a file (or tree) in history...

```
$ git show HEAD:file
contents...
```


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Logs

See commit history. . .

```
$ git log
commit 3d3d2989b817af3fd4fa6d63f200113bd6c94bdb
Author: Bart Trojanowski <bart@jukie.net>
Date:   Thu Jul 3 22:59:13 2008 -0400

    most recent commit

commit 83b2d051814e884a8e264127ed47552a5dcf6c1d
Author: Bart Trojanowski <bart@jukie.net>
Date:   Thu Jul 3 21:44:39 2008 -0400

    second most recent

commit 1cc1b35a611c39f49842e2ca28d40886c1ae9b7c
Author: Bart Trojanowski <bart@jukie.net>
Date:   Thu Jul 3 21:44:05 2008 -0400

    middle commit

commit 411515f51a78d66a27a7d56ebe9f70dbd2bff008
Author: Bart Trojanowski <bart@jukie.net>
Date:   Thu Jul 3 21:43:36 2008 -0400

    second oldest

commit 52a0ff44aba8599f43a5d821c421af316cb73051
Author: Bart Trojanowski <bart@jukie.net>
Date:   Mon Jun 30 21:44:55 2008 -0400

    oldest commit
```


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Logs

`git log` is awesome!

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Logs

limit by range...

```
$ git log tag..branch
$ git log HEAD~10..
$ git log branch1 branch2 ^common

$ git log -10
$ git log -10 master@{yesterday}

$ git log --since="May 1" --until="June 1"
```


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Logs

limit by commit attributes...

```
$ git log --author=fred
$ git log --committer=joe
$ git log --grep="commit.*message.*text"
```


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Logs

search for a change...

```
$ git log -S"some code change"
$ git log --pickaxe-regex -S"some.*code.*change"
```


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Logs

limit by changes to specific path...

```
$ git log -- some/file
```


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Faster grep

another way to search...

```
$ git grep -e "pattern" -- some/file
```

```
$ git grep -e "pattern" branch -- some/file
```


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Faster grep

another way to search...

```
$ git grep -e "pattern" -- some/file
```

```
$ git grep -e "pattern" branch -- some/file
```


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things that point to commits

lightweight

mutable

disposable

3 basic types

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3 basic types

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References

local branches

- `$ git branch -l`

```
  branch1
  branch2
* master
```

- `.git/refs/heads/`<branch>

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References

tags

- `$ git tag -l`

  tag1
  tag2
  tag3

- `.git/refs/tags/<tag>`

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References

remote branches

- `$ git branch -r`

  ```
  fred/master
  joe/master
  joe/another-branch
  ```

- `.git/refs/remotes/`<remote>`/`<branch>

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Creating branches

```
$ git branch name commit
```

- new branch “name” on HEAD or specified commit

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Switching branches

```
$ git checkout -f name
```

- checkout files from “name” branch
- optionally force overwriting changed files

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Create and switch

```
$ git checkout -b name commit
```

- checkout files from “name” branch

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Switching with changes

```
$ git checkout name
error:  You have local changes to 'filename';
cannot switch branches.
```

```
$ git checkout -m name
```

- merge outstanding diff onto branch "name"
- can result in conflict

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Switching with changes

```
$ git checkout name
error:  You have local changes to 'filename';
cannot switch branches.
```

```
$ git checkout -m name
```

- merge outstanding diff onto branch “name”
- can result in conflict

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Working on branches

start at some tree

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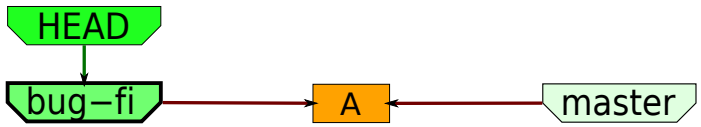
Working on branches

```
$ git checkout -b bug-fix
```



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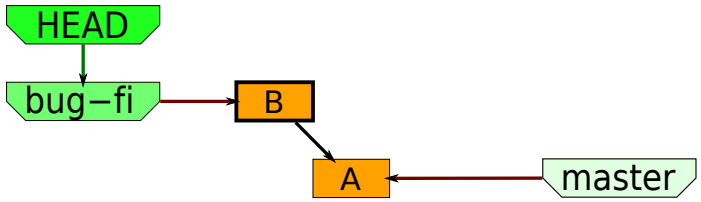
Working on branches

```
$ git commit -a -m“B”
```



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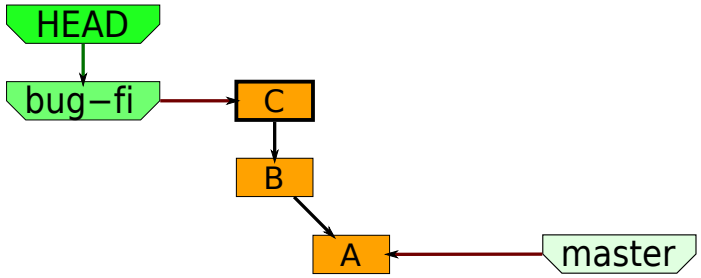
Working on branches

```
$ git commit -a -m“C”
```



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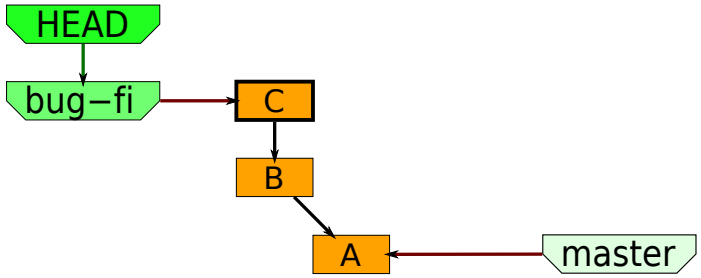
Working on branches

you have a *wicked* idea



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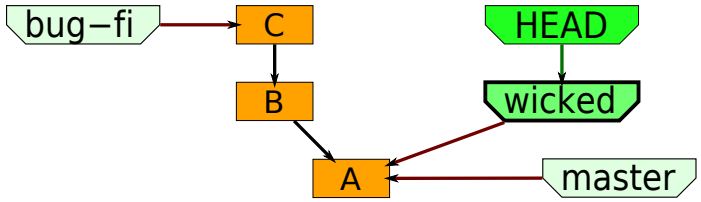
Working on branches

you have a *wicked* idea

```
$ git checkout  -b wicked master
```



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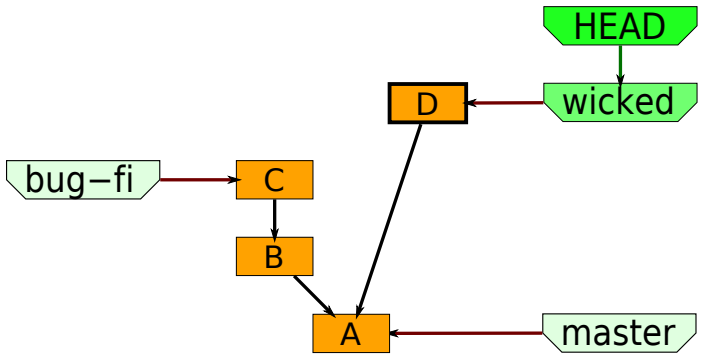
Working on branches

```
$ git commit -a -m“D”
```



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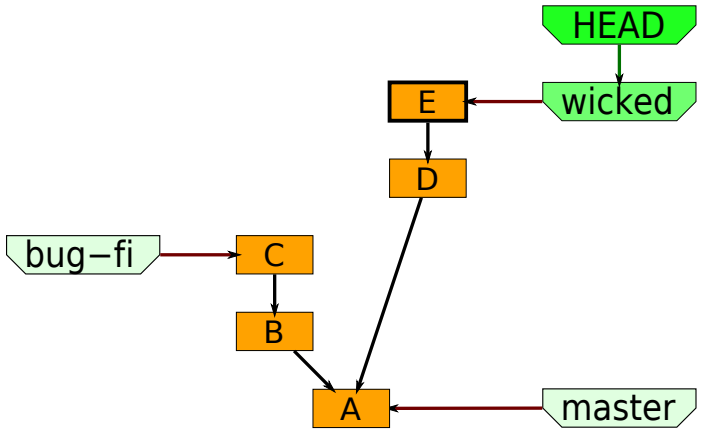
Working on branches

```
$ git commit -a -m“E”
```



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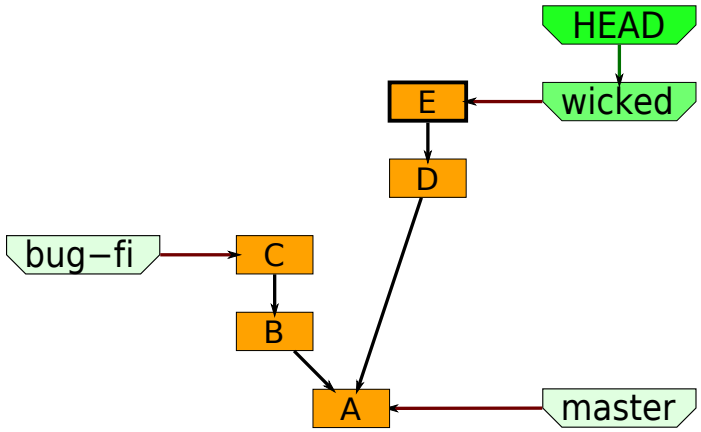
Working on branches

you're getting somewhere



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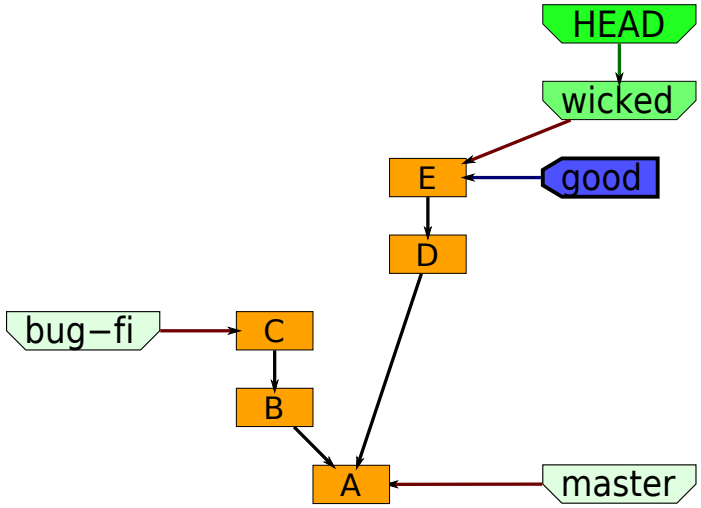
Working on branches

you're getting somewhere

```
$ git tag -a -m‘‘got somewhere’’ good
```



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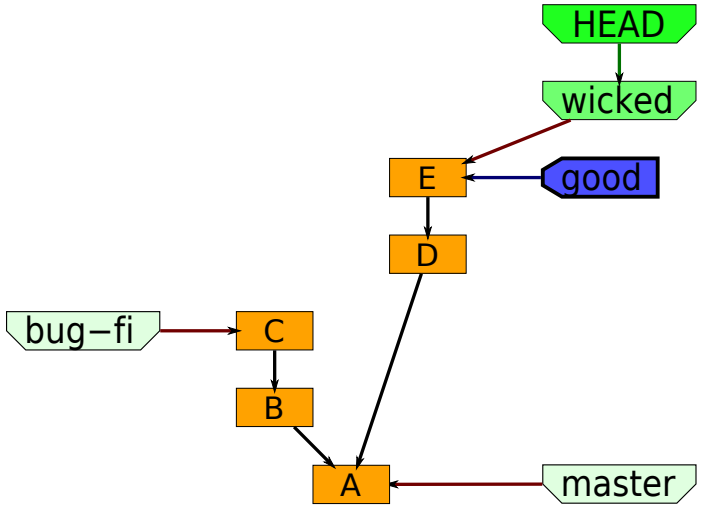
Working on branches

manager asks about the bug



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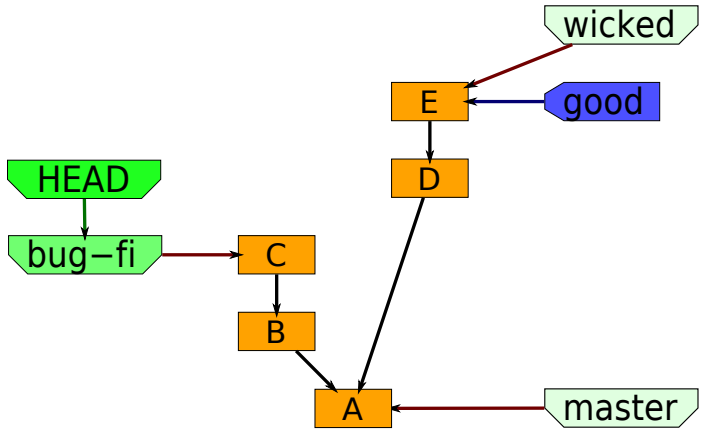
Working on branches

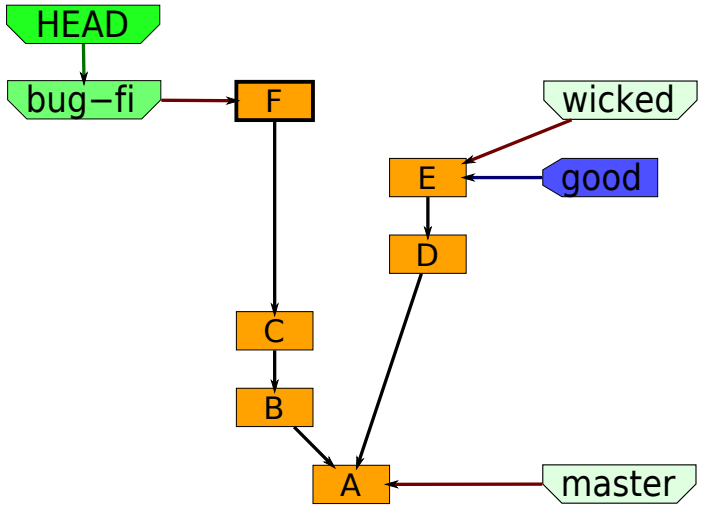
manager asks about the bug

```
$ git checkout bug-fix
```



Working on branches

```
$ git commit -a -m“F”
```



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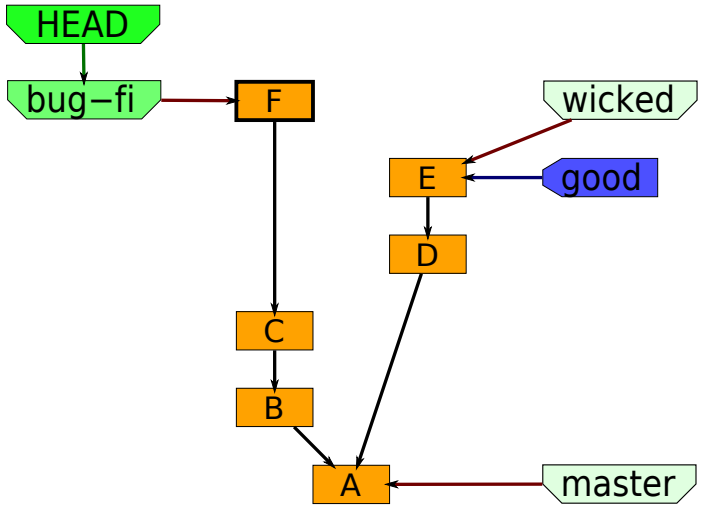
Working on branches

your mind is elsewhere. . .



Bart Trojanowski, bart@jukie.net

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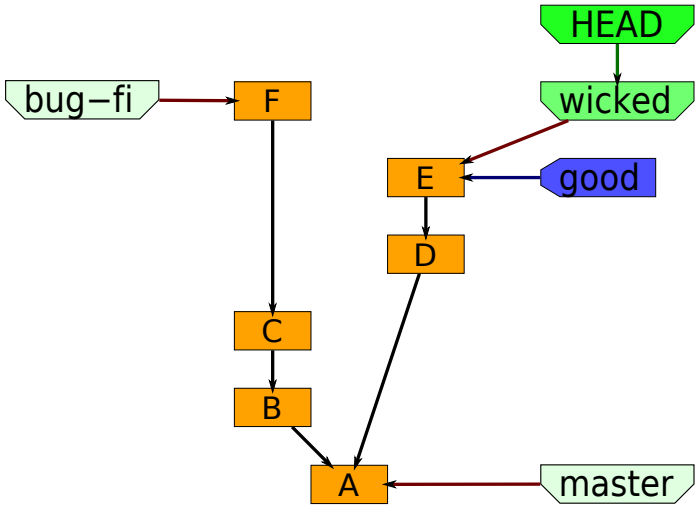
Working on branches

your mind is elsewhere. . .

```
$ git checkout wicked
```



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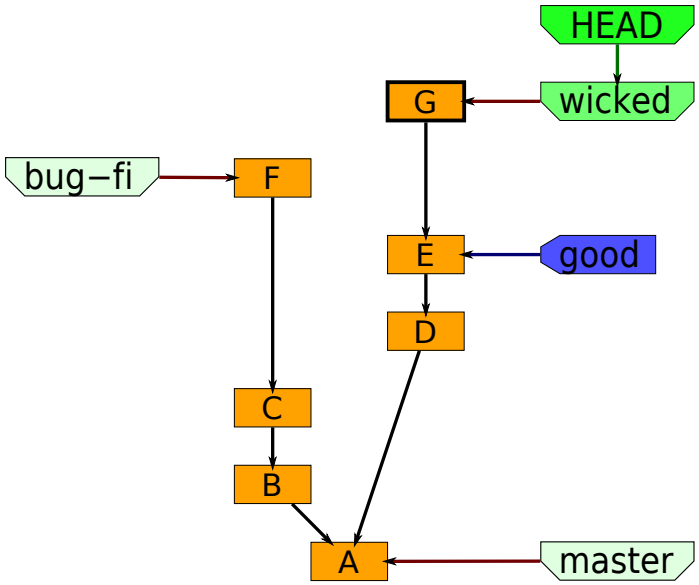
Working on branches

. . . so you finish off the *wicked* feature

```
$ git commit -a -m“G”
```



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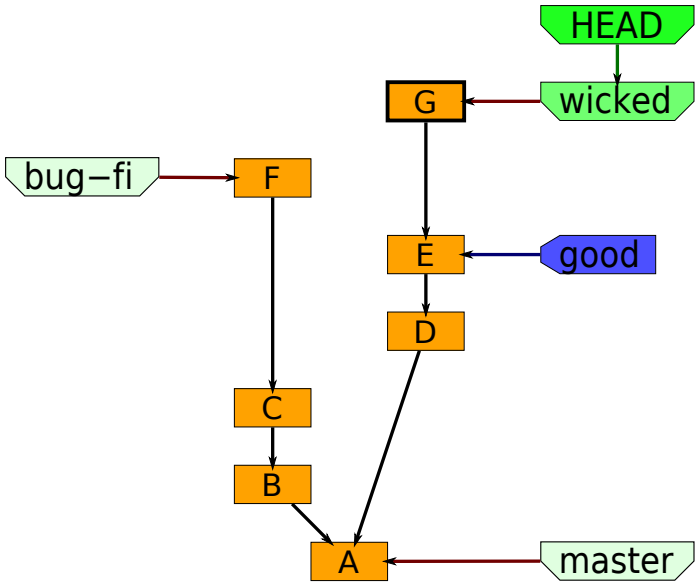
Working on branches

feature's done

bug is fixed

. . . time to merge



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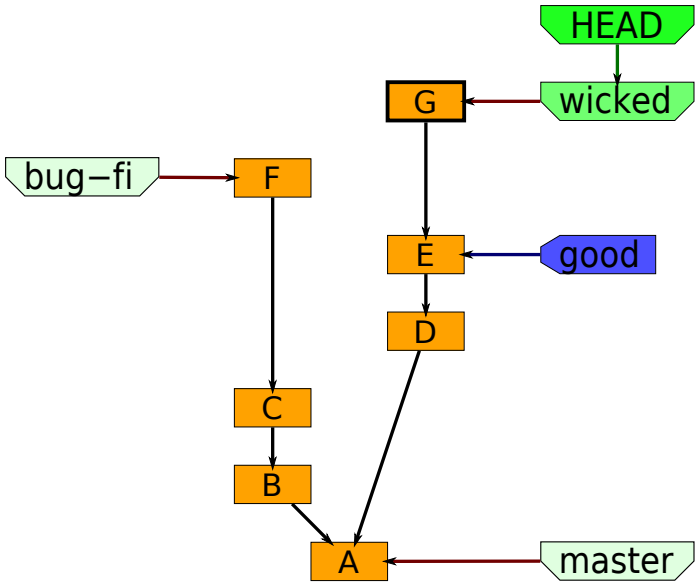
Working on branches

feature's done

bug is fixed

. . . time to merge



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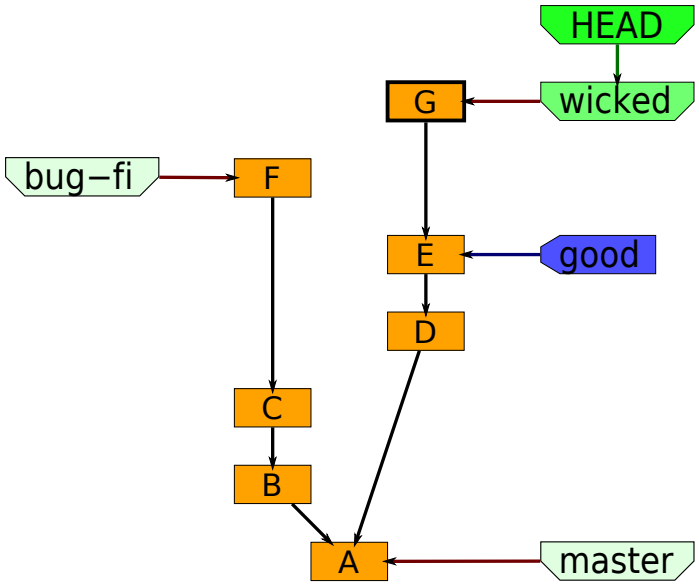
Working on branches

feature's done

bug is fixed

. . . time to merge



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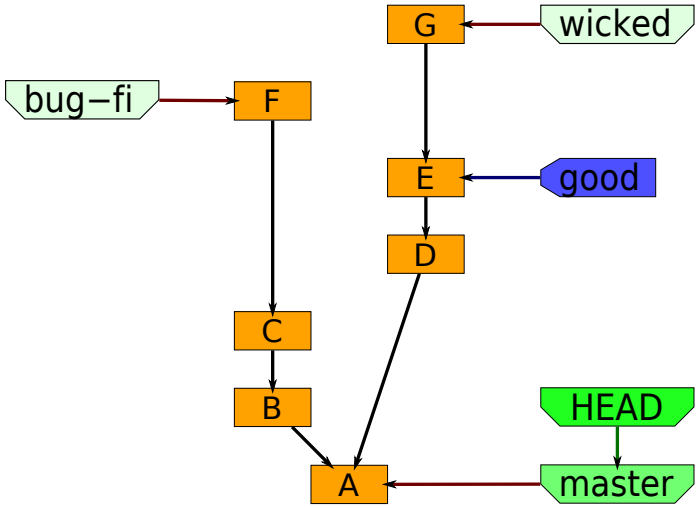
Working on branches

```
$ git checkout master
```



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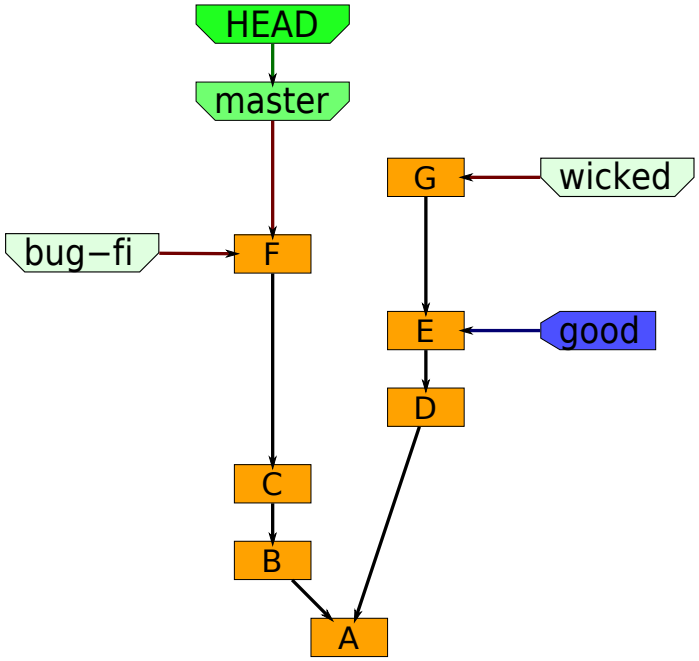
Working on branches

```
$ git reset --hard bug-fix
```



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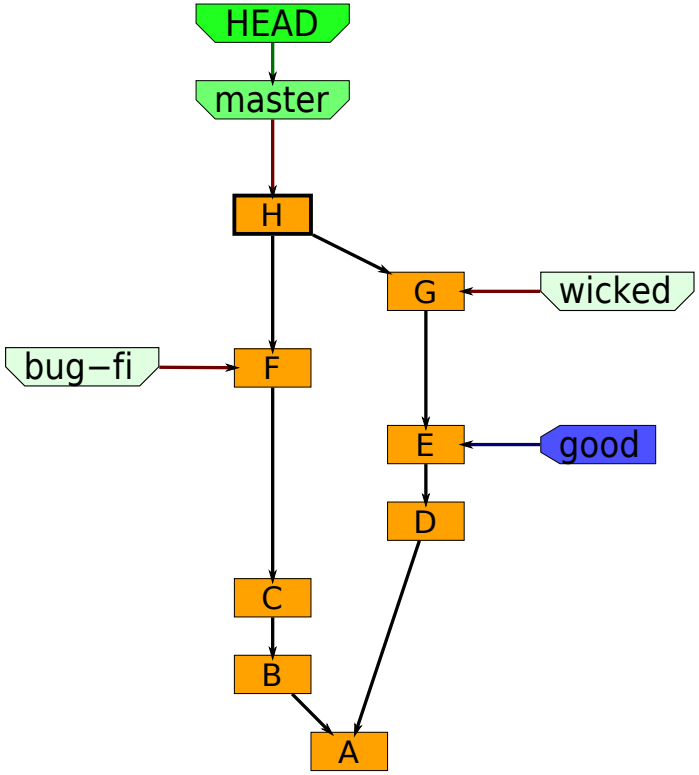
Working on branches

```
$ git merge wicked
```



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Merging

```
$ git merge <branch> ...
```

- merge multiple branches
- creates commit with 2+ parents
- can cause conflicts

  ie: require user intervention

Bart Trojanowski, bart@jukie.net

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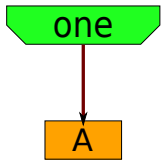
Merging

one more example



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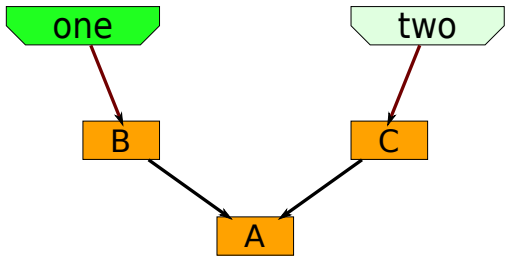
Merging

two topic branches



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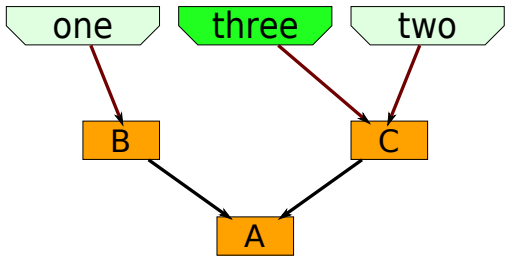
Merging

```
$ git checkout -b three two
```



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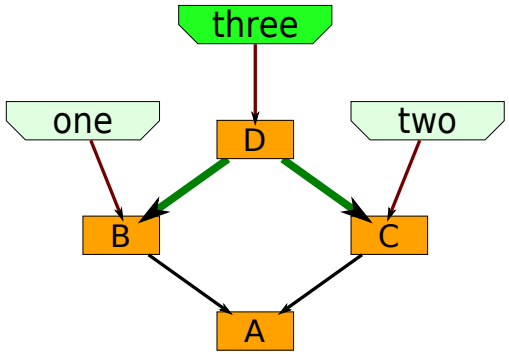
Merging

```
$ git checkout -b three two
$ git merge one
```



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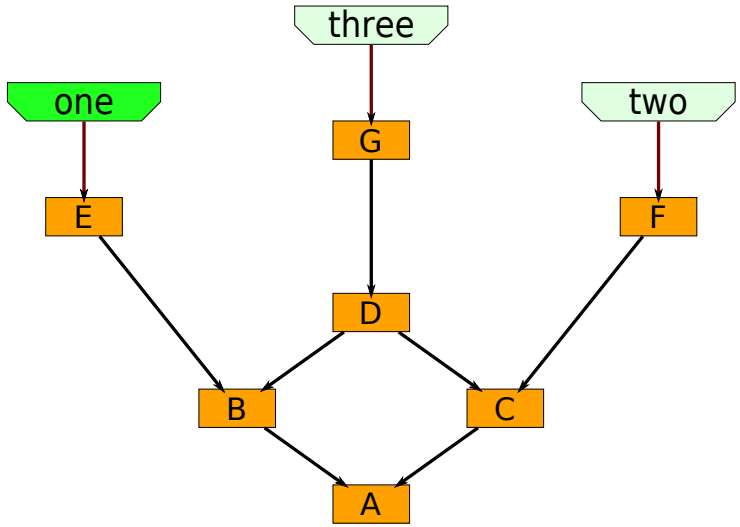

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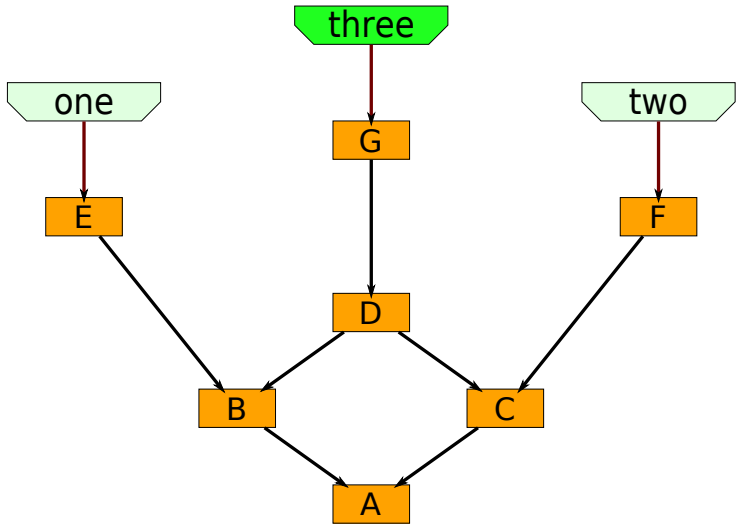
Merging

```
$ git checkout three
```



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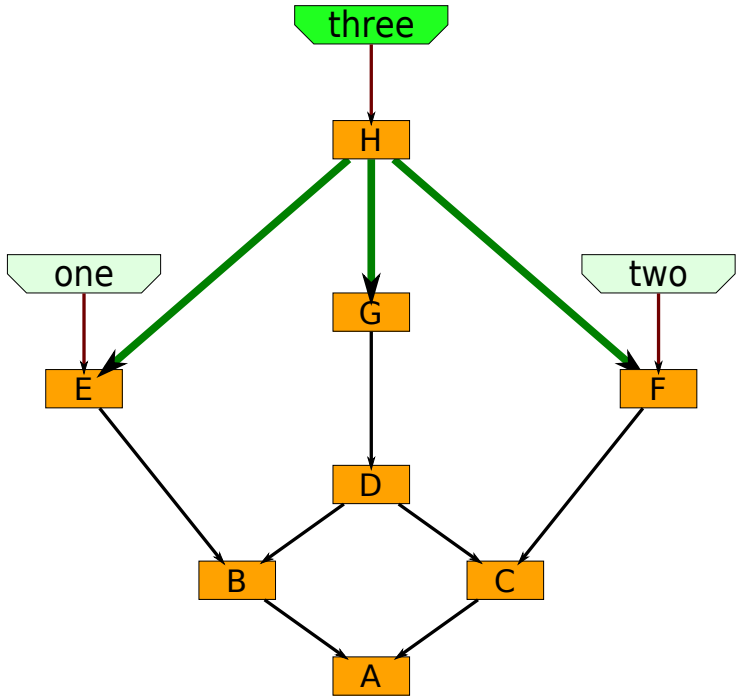
Merging

```
$ git checkout three
$ git merge one two
```



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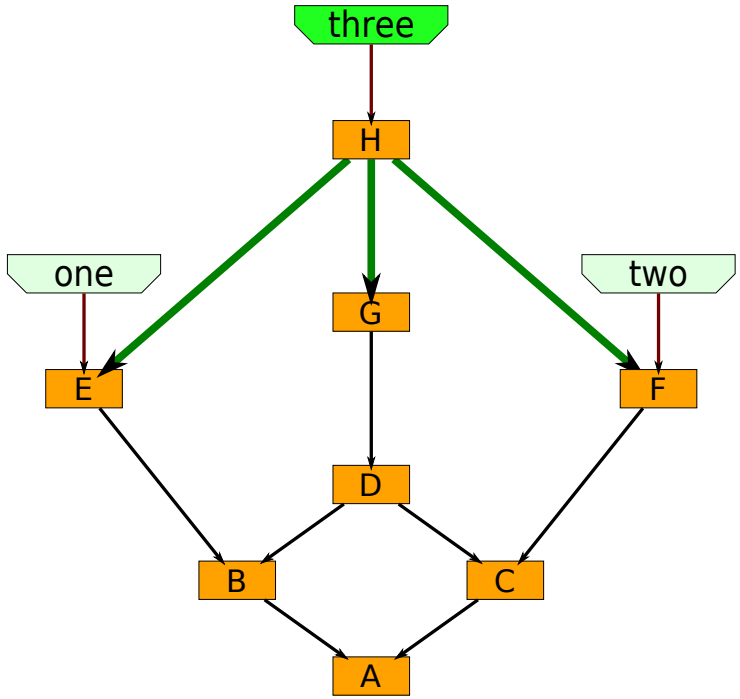
Merging

```
$ git checkout three
$ git merge one two
```

“octopus”



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Rebasing

```
$ git rebase <branch>
```

- moves new work onto a new baseline
- can cause conflicts
  ie: require user intervention

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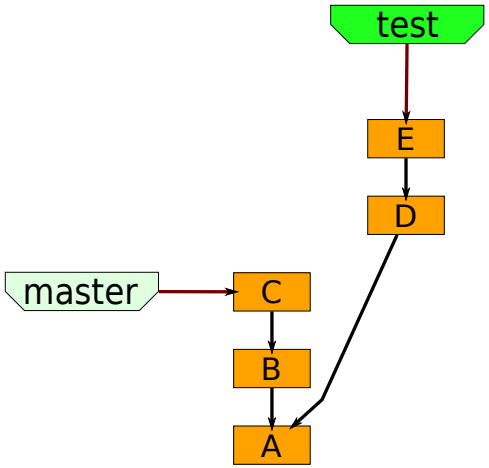
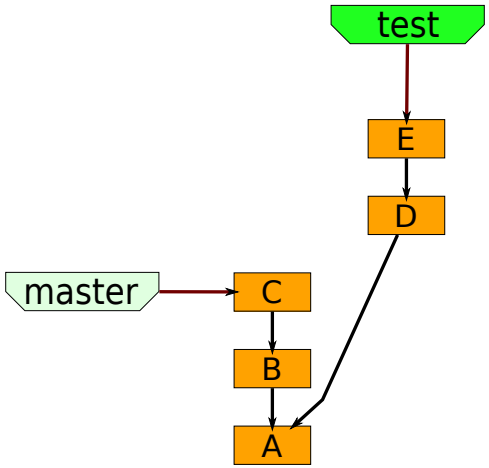
Rebasing

merge



rebase



take two identical trees

Bart Trojanowski, bart@jukie.net

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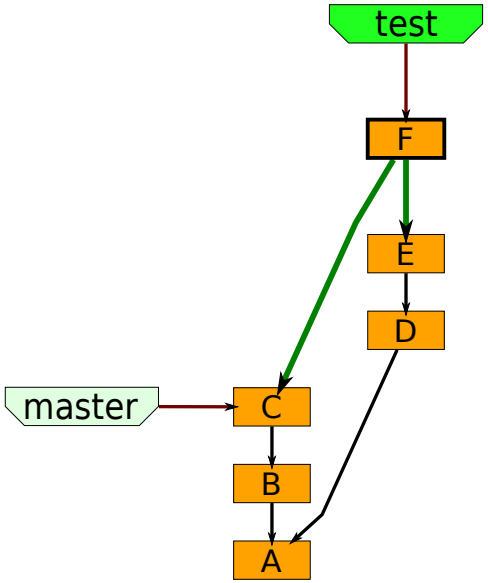
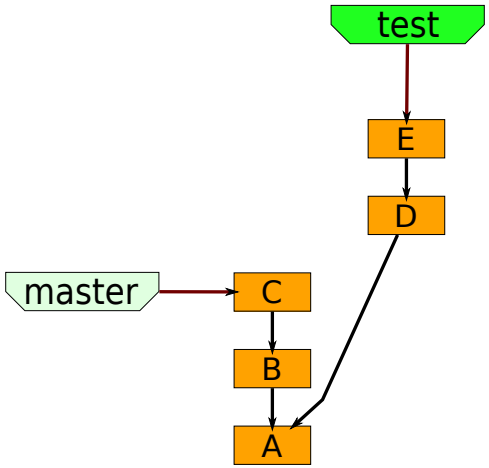
Rebasing

merge



rebase




```
$ git merge master
```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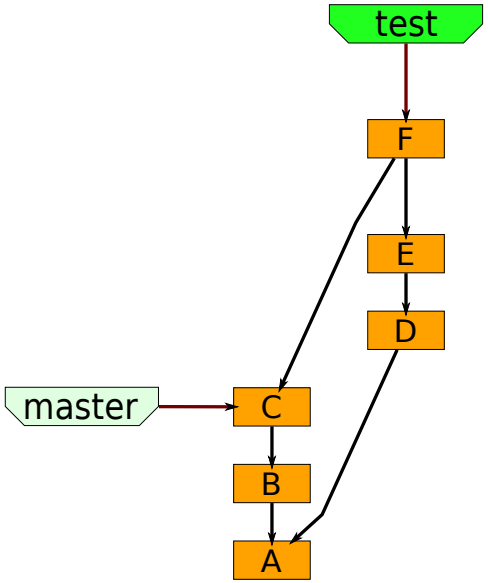
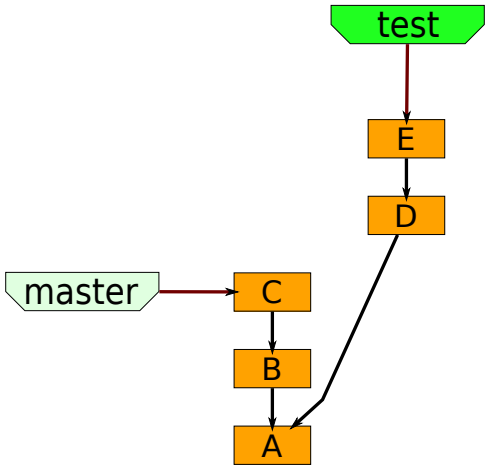
Rebasing

merge



rebase



that's easy

Bart Trojanowski, bart@jukie.net

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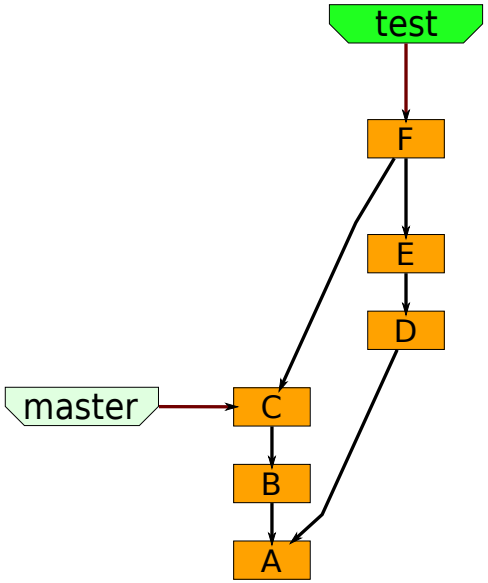
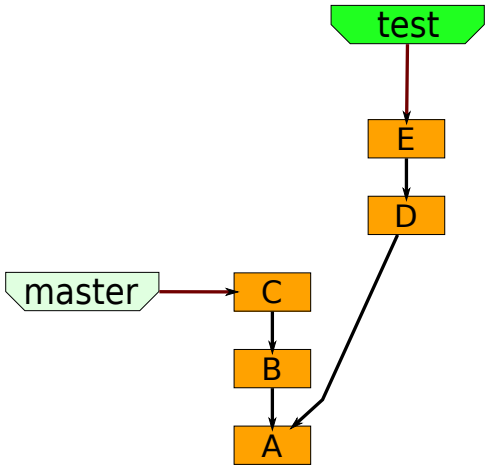
merge



rebase




```
$ git rebase master
```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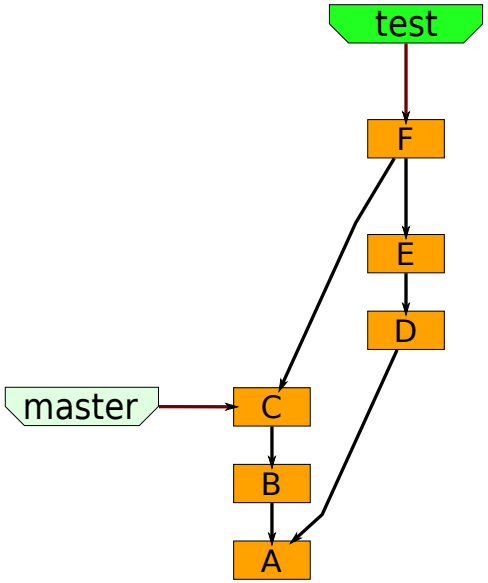
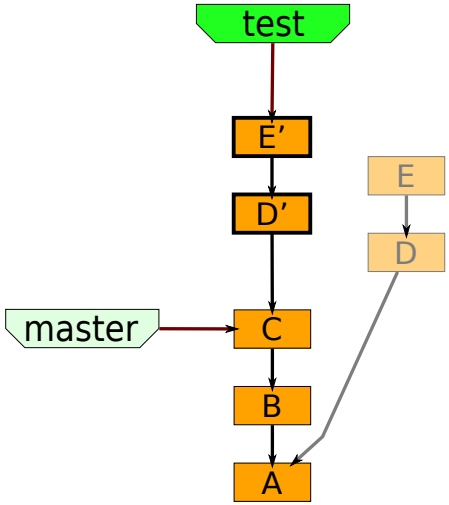
Rebasing

merge



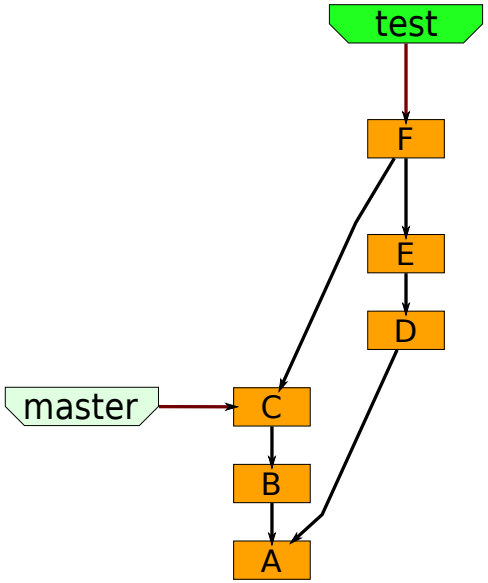
rebase



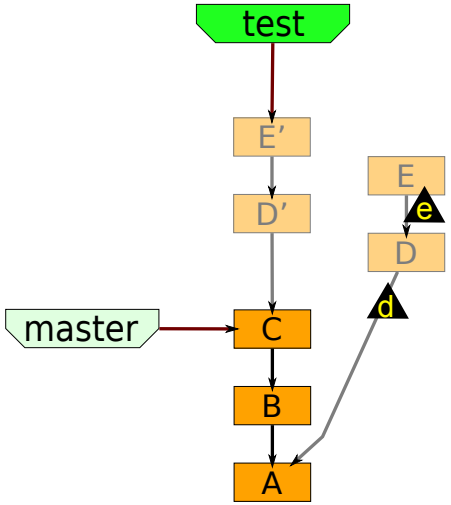

```
$ git rebase master
```

Rebasing

merge



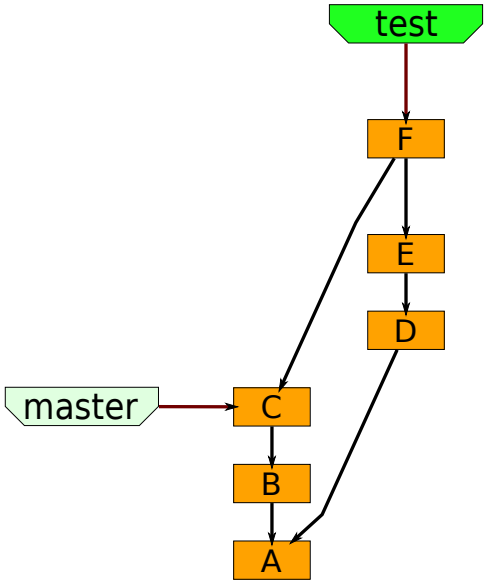
rebase



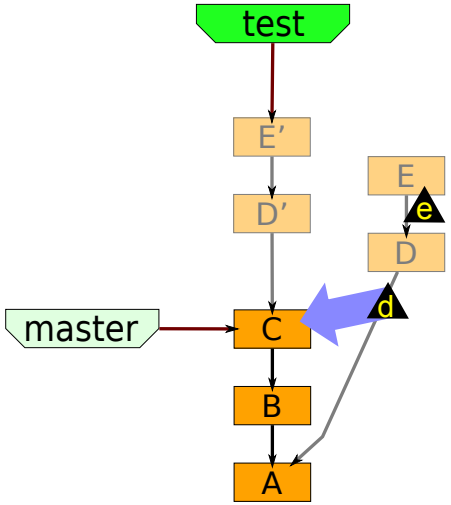

```
$ git rebase master
```

Rebasing

merge



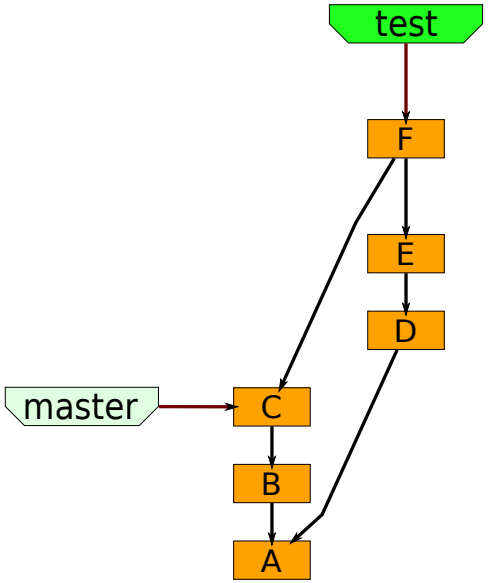
rebase



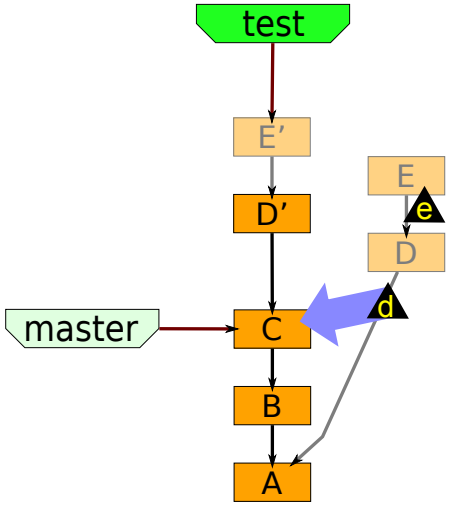

```
$ git rebase master
```

Rebasing

merge



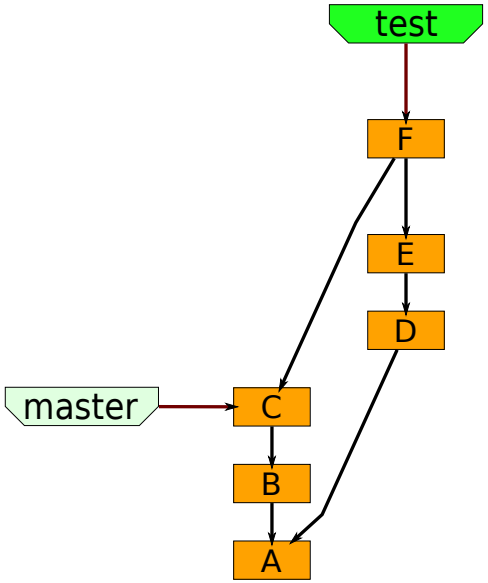
rebase



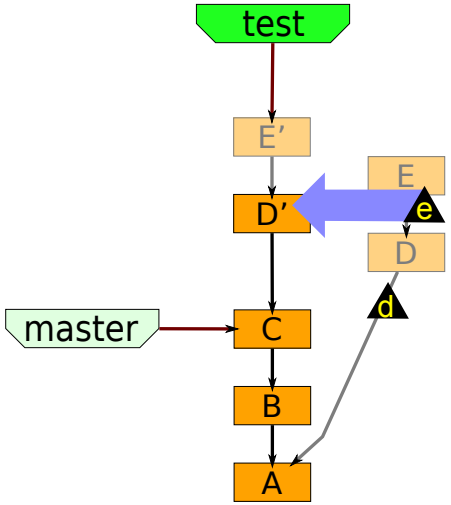

```
$ git rebase master
```

Rebasing

merge



rebase




```
$ git rebase master
```


Bart Trojanowski, bart@jukie.net

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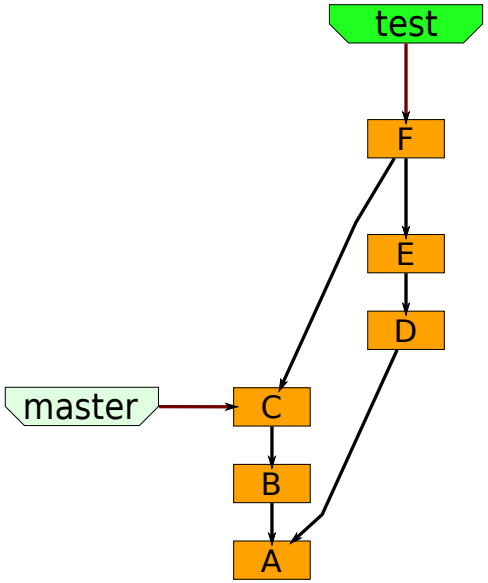
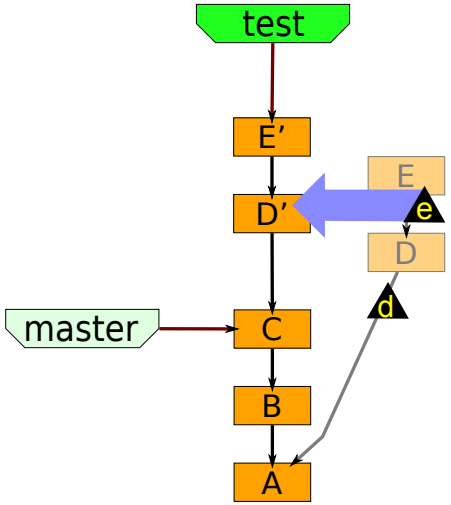
Rebasing

merge



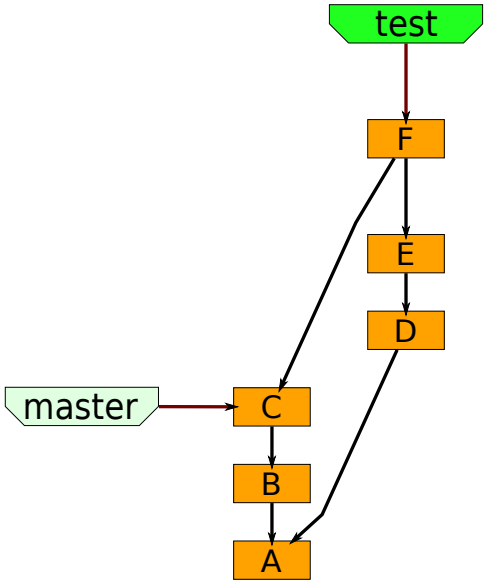
rebase



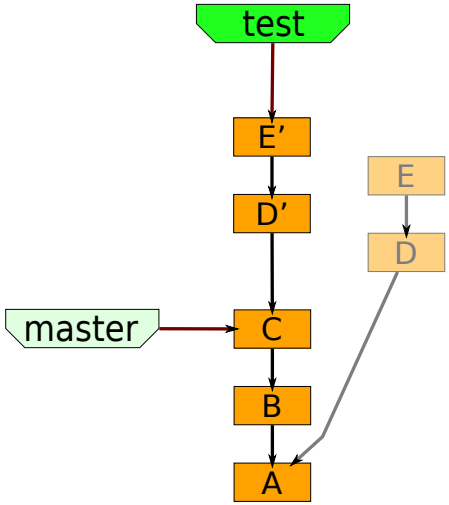

```
$ git rebase master
```

Rebasing

merge



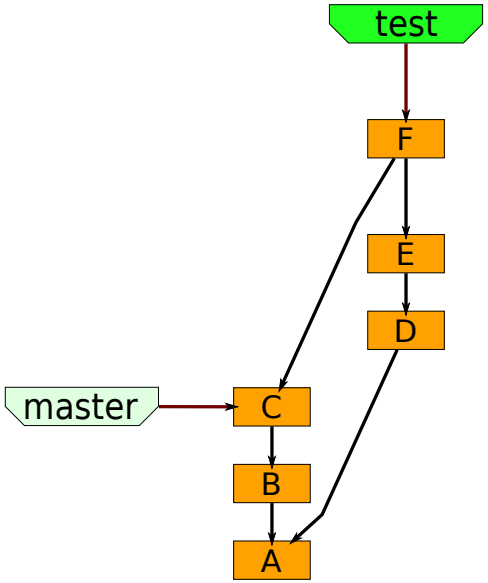
rebase



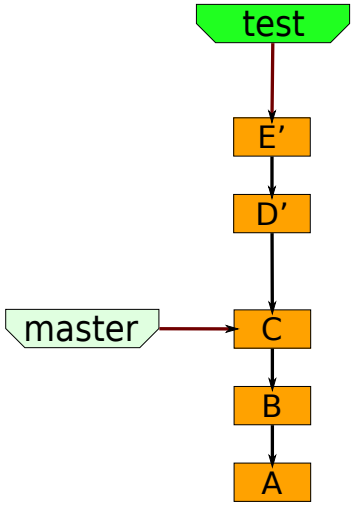

```
$ git rebase master
```

Rebasing

merge



rebase



Bart Trojanowski, bart@jukie.net

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Cloning

```
$ git clone <remote>
```

- replicates remote repository
- populates new repository
- checksout new working tree

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Git URLs

- local repo

  `/home/git/project.git/`
  `file:///home/git/project.git/`

- http protocol

  `http://repo.or.cz/r/git.git`

- native git protocol

  `git://repo.or.cz/git.git`

- ssh protocol

  `ssh://bart@jukie.net/~git/project.git/`
  `bart@jukie.net/~git/project.git/`

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Git URLs

- local repo

  `/home/git/project.git/`
  `file:///home/git/project.git/`

- http protocol

  `http://repo.or.cz/r/git.git`

- native git protocol

  `git://repo.or.cz/git.git`

- ssh protocol

  `ssh://bart@jukie.net/~git/project.git/`
  `bart@jukie.net/~git/project.git/`

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Git URLs

- local repo

  `/home/git/project.git/`
  `file:///home/git/project.git/`

- http protocol

  `http://repo.or.cz/r/git.git`

- native git protocol

  `git://repo.or.cz/git.git`

- ssh protocol

  `ssh://bart@jukie.net/~git/project.git/`
  `bart@jukie.net/~git/project.git/`

Bart Trojanowski, bart@jukie.net

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Git URLs

- local repo

  `/home/git/project.git/`
  `file:///home/git/project.git/`

- http protocol

  `http://repo.or.cz/r/git.git`

- native git protocol

  `git://repo.or.cz/git.git`

- ssh protocol

  `ssh://bart@jukie.net/~git/project.git/`
  `bart@jukie.net/~git/project.git/`

Bart Trojanowski, bart@jukie.net

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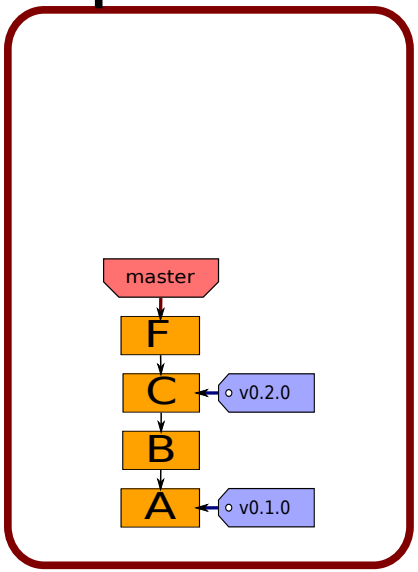
Working with remotes

repo.or.cz



git://repo.or.cz/project.git

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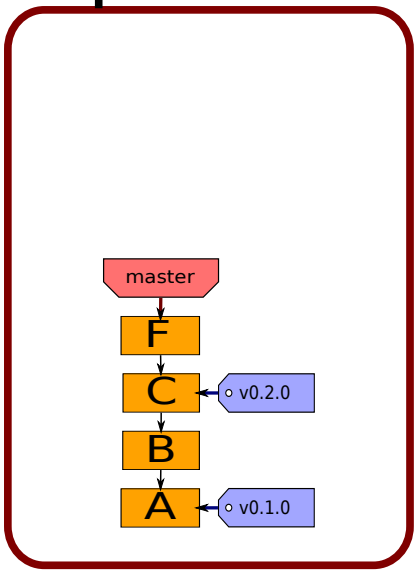
Working with remotes

repo.or.cz




```
$ git clone ssh+git://repo.or.cz/project.git
```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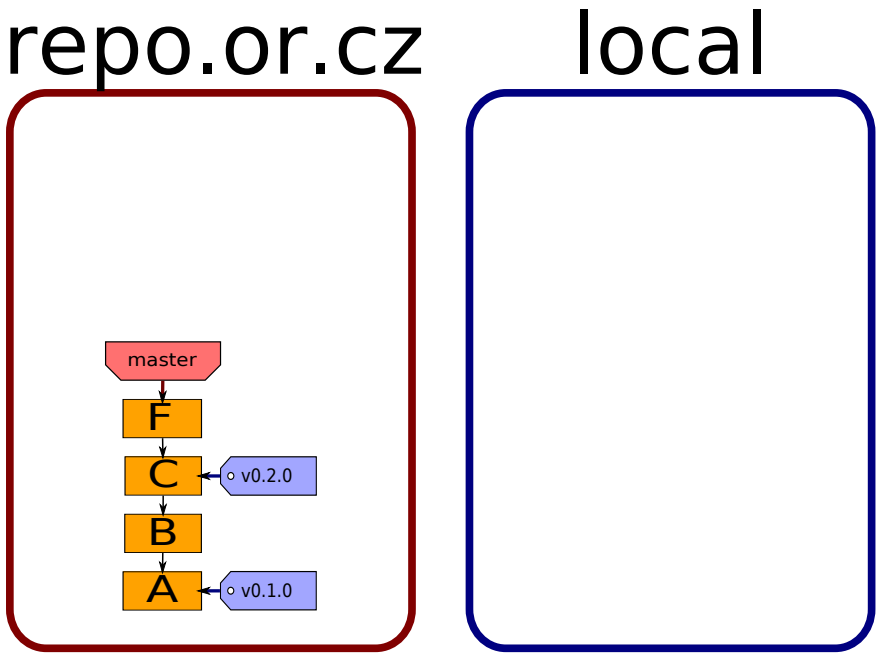
Working with remotes




```
$ git clone ssh+git://repo.or.cz/project.git
Initialize project/.git
Initialized empty Git repository in /tmp/project/.git/
remote: Counting objects: 77575, done.
remote: Compressing objects: 100% (26407/26407), done.
remote: Total 77575 (delta 55750), reused 71007 (delta 49775)
Receiving objects: 100% (77575/77575), 22.87 MiB | 798 KiB/s, done.
Resolving deltas: 100% (55750/55750), done.
Checking out files: 100% (1396/1396), done.
```


Bart Trojanowski, bart@jukie.net

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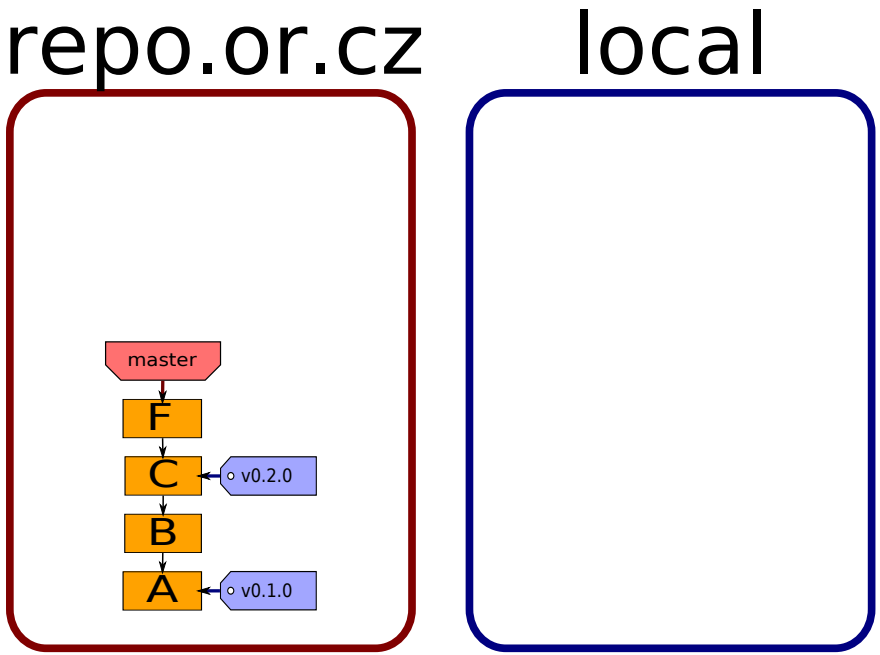
Working with remotes

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Checking out files: 100% (1396/1396), done.
```


Bart Trojanowski, bart@jukie.net

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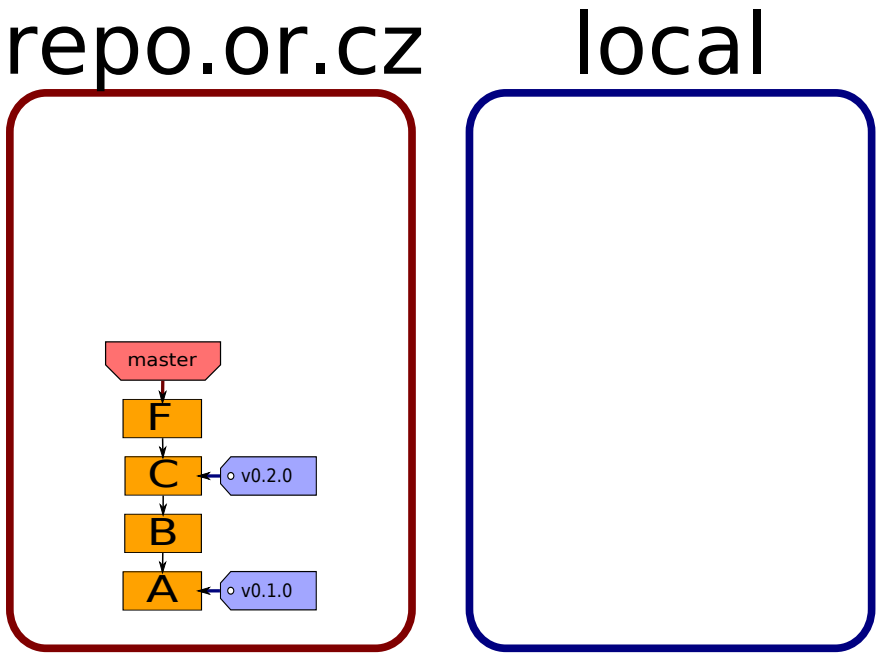
Working with remotes




```
$ git clone ssh+git://repo.or.cz/project.git build-tree
Initialize build-tree/.git
Initialized empty Git repository in /tmp/build-tree/.git/
remote: Counting objects: 77575, done.
remote: Compressing objects: 100% (26407/26407), done.
remote: Total 77575 (delta 55750), reused 71007 (delta 49775)
Receiving objects: 100% (77575/77575), 22.87 MiB | 798 KiB/s, done.
Resolving deltas: 100% (55750/55750), done.
Checking out files: 100% (1396/1396), done.
```


Bart Trojanowski, bart@jukie.net

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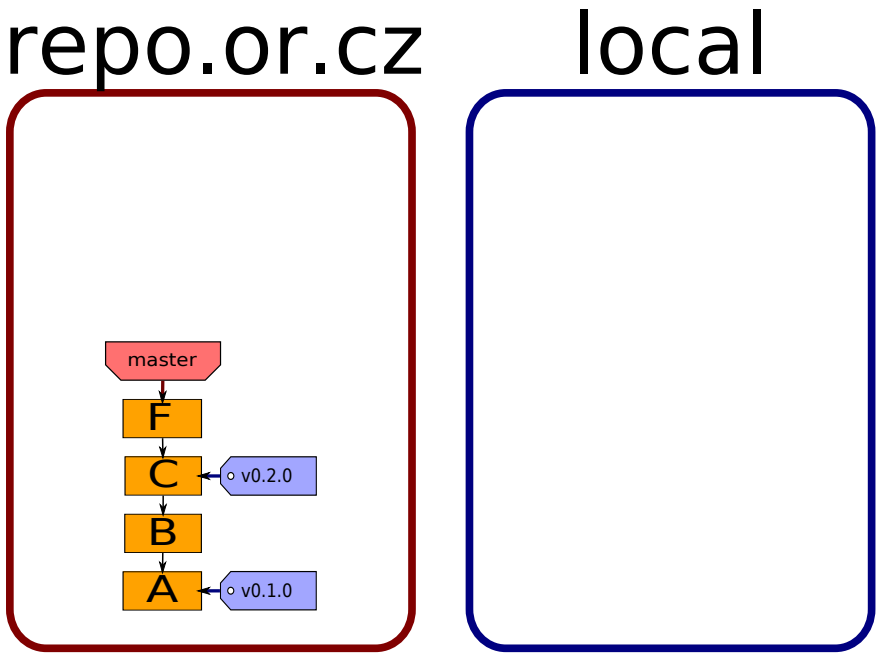
Working with remotes




```
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Initialize project/.git
Initialized empty Git repository in /tmp/project/.git/
remote: Counting objects: 77575, done.
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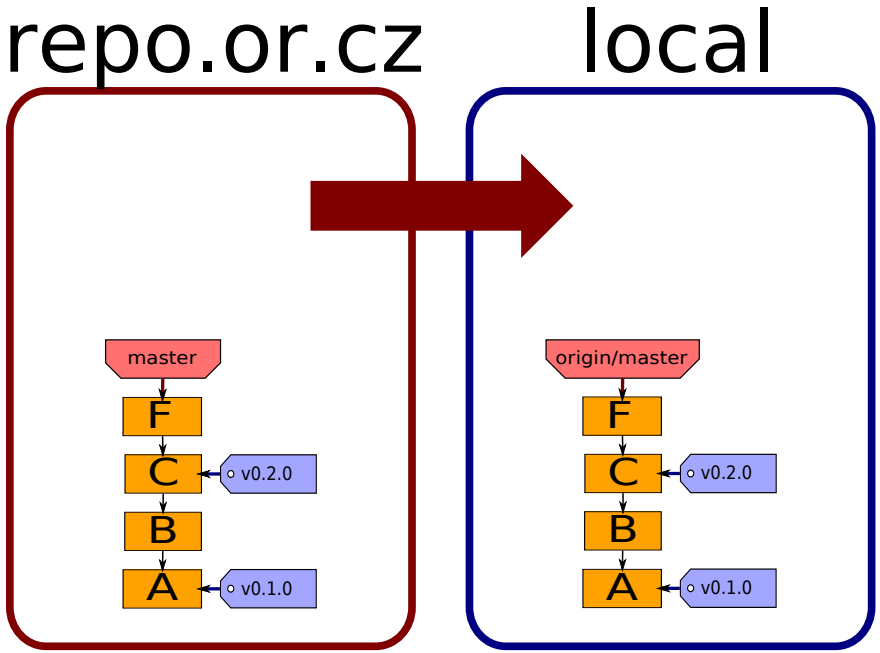


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```


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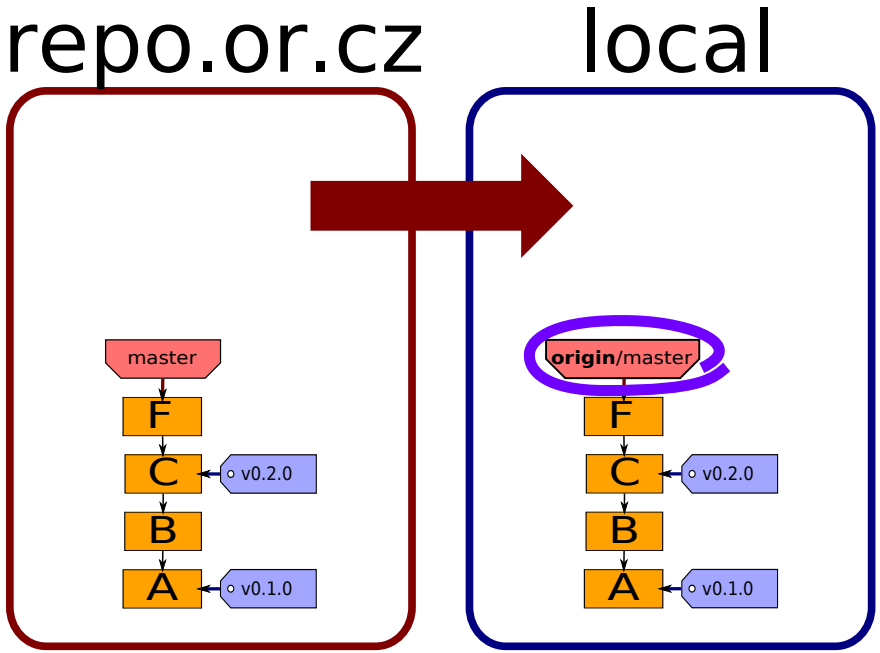


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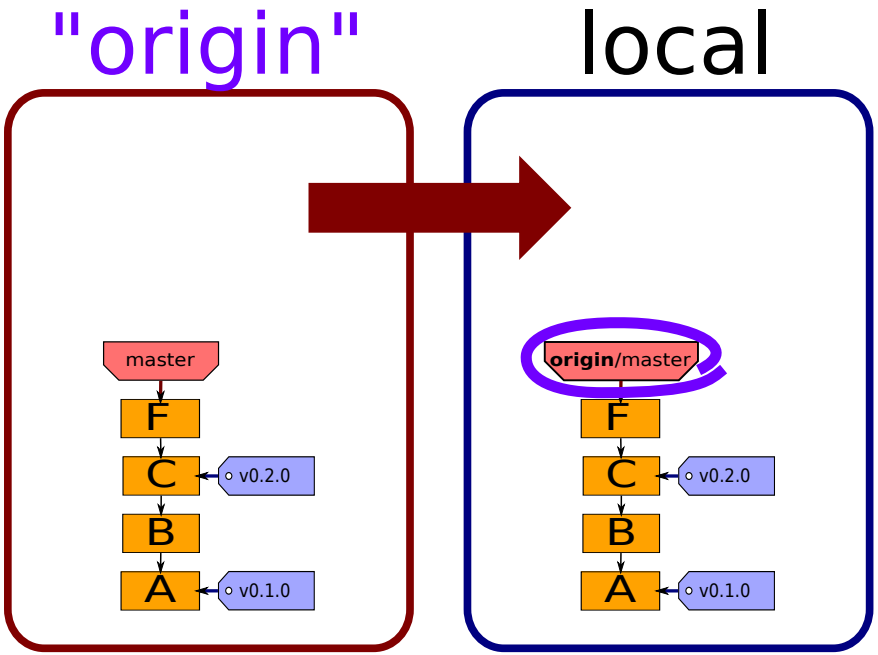


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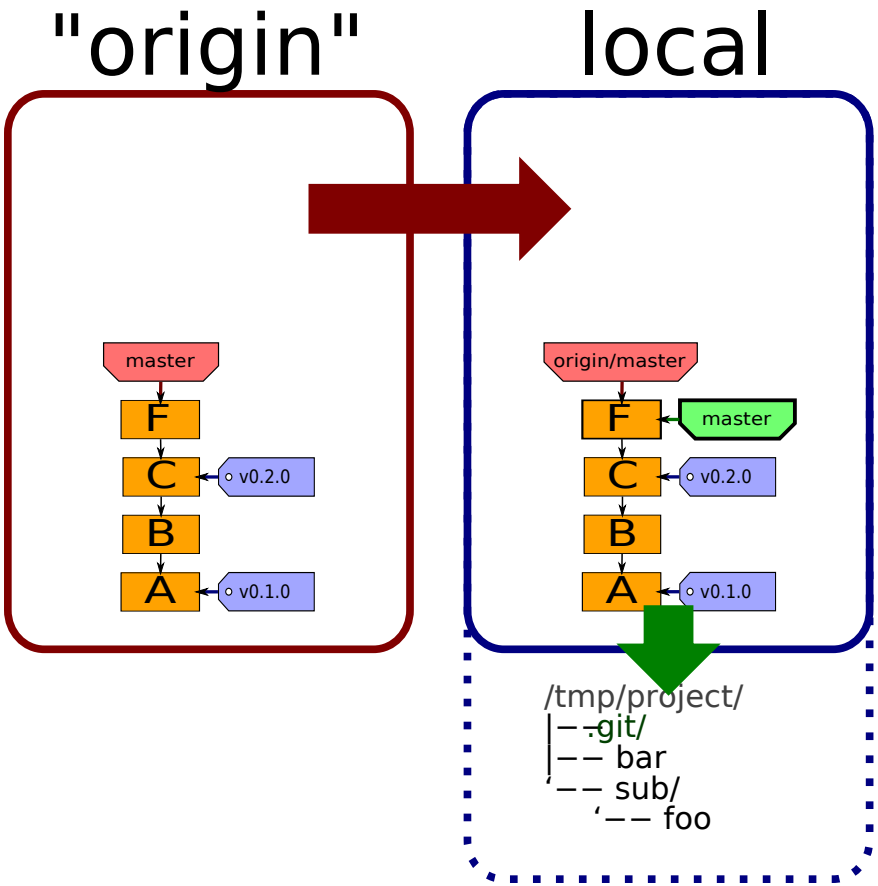


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Bart Trojanowski, bart@jukie.net

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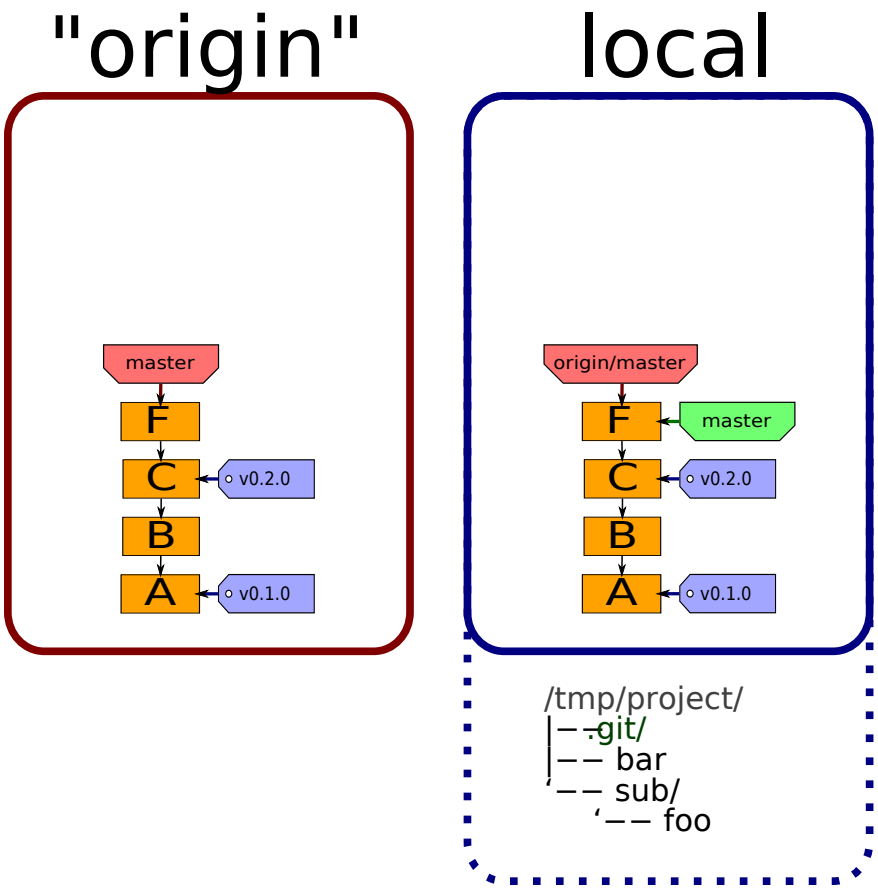
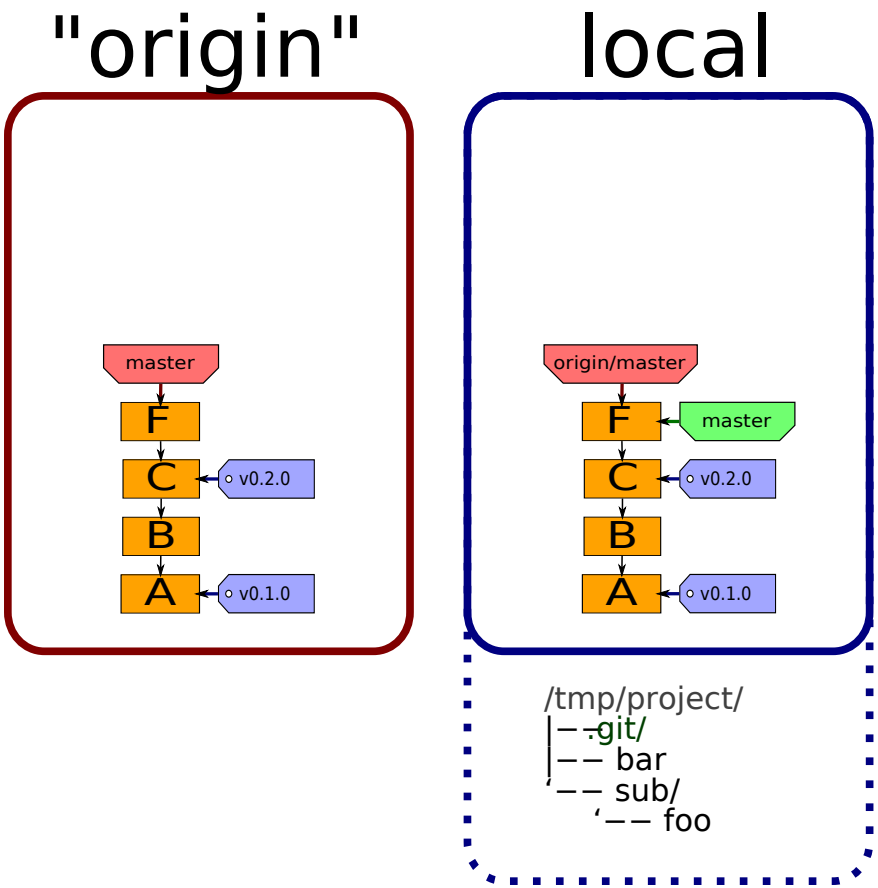



```
$ git branch -a
* master
  origin/master
```

```
$ git tag -l
v0.1.0
v0.2.0
```

Working with remotes

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$ git branch -a
* master
  origin/master
```
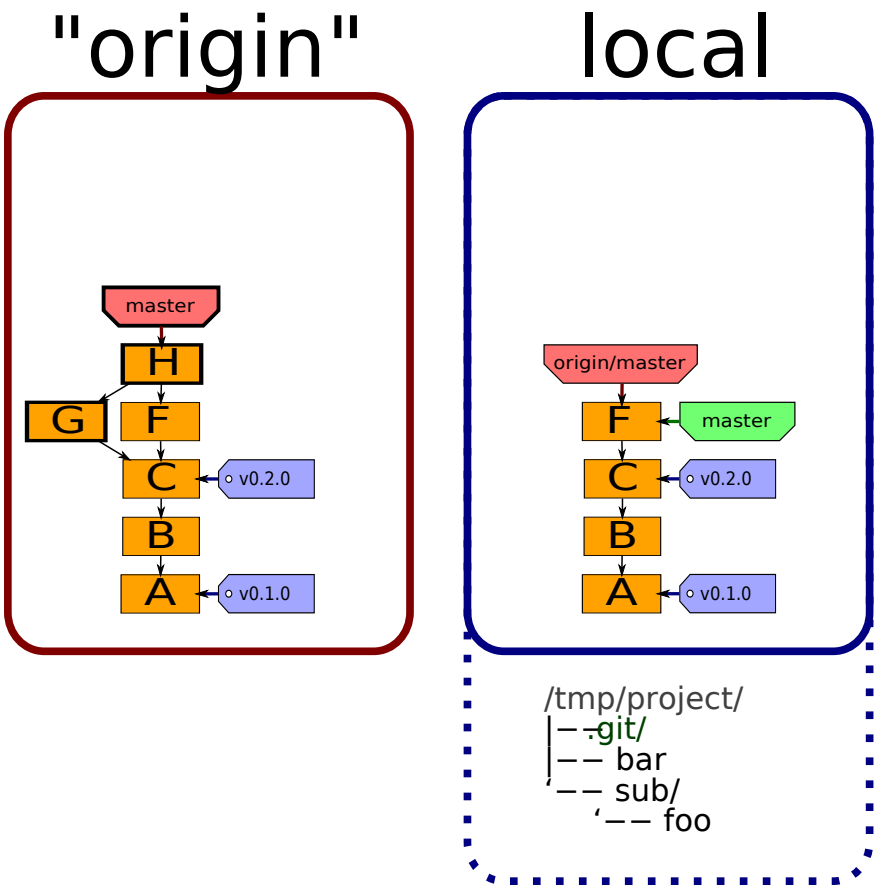

```
$ git tag -l
v0.1.0
v0.2.0
```

Working with remotes



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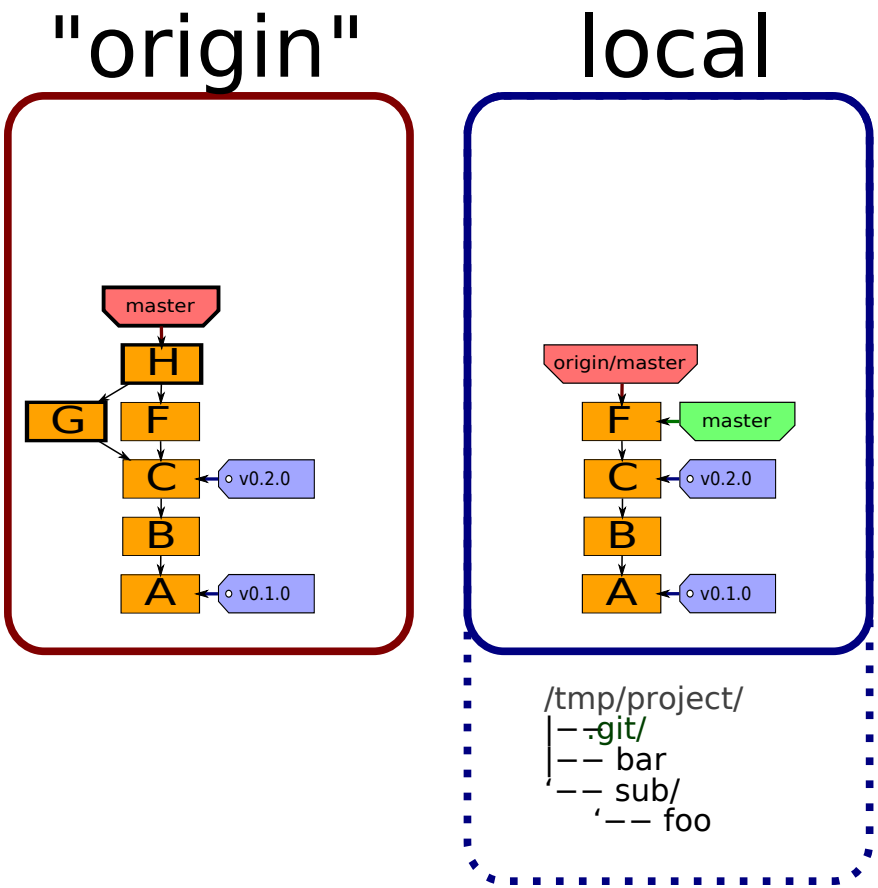
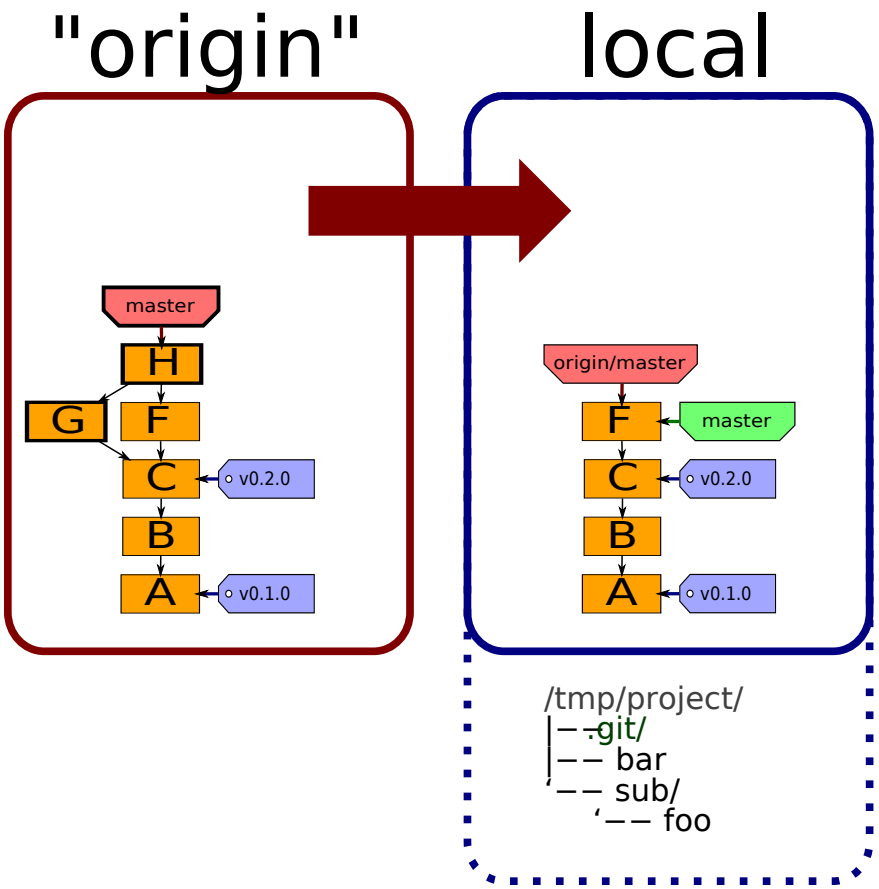


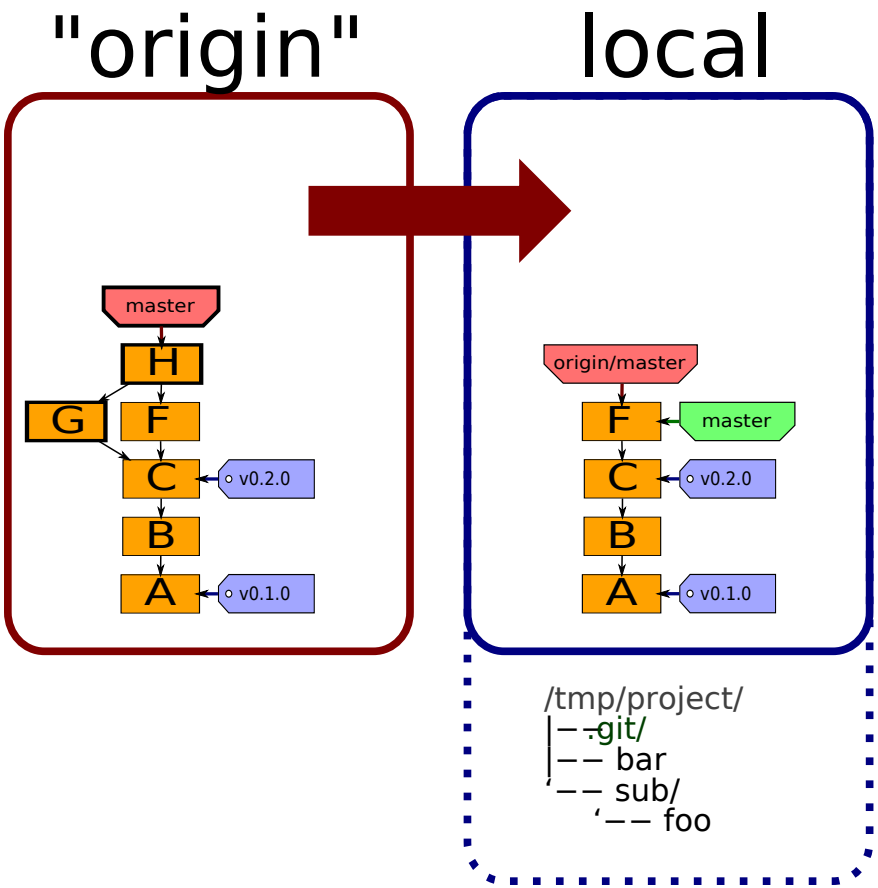

```
$ git fetch
```

Working with remotes



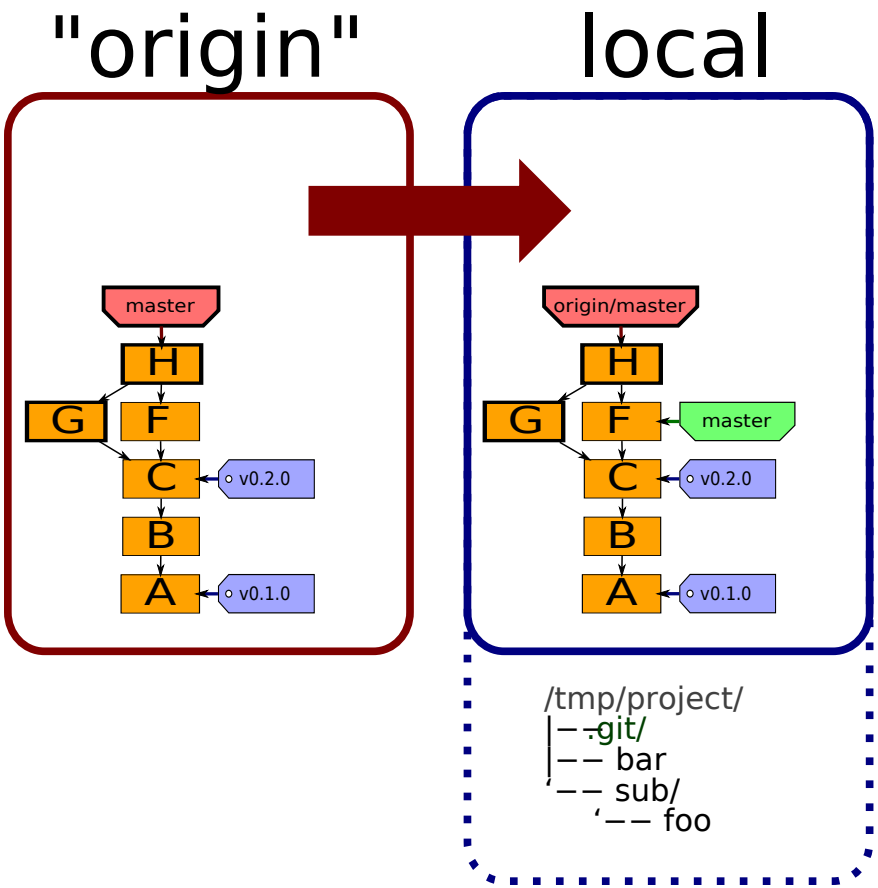

```
$ git fetch
remote: Counting objects: 236, done.
remote: Compressing objects: 100% (190/190), done.
remote: Total 190 (delta 170), reused 0 (delta 0)
Receiving objects: 100% (190/190), 69.53 KiB, done.
Resolving deltas: 100% (170/170), completed with 40 local objects.
From mail.jukie.net:work/oclug/intro-to-git
   573ff80..06e3703  master     -> origin/master
```

Working with remotes




```
$ git fetch
remote: Counting objects: 236, done.
remote: Compressing objects: 100% (190/190), done.
remote: Total 190 (delta 170), reused 0 (delta 0)
Receiving objects: 100% (190/190), 69.53 KiB, done.
Resolving deltas: 100% (170/170), completed with 40 local objects.
From mail.jukie.net:work/oclug/intro-to-git
   573ff80..06e3703  master     -> origin/master
```

Working with remotes




```
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remote: Counting objects: 236, done.
remote: Compressing objects: 100% (190/190), done.
remote: Total 190 (delta 170), reused 0 (delta 0)
Receiving objects: 100% (190/190), 69.53 KiB, done.
Resolving deltas: 100% (170/170), completed with 40 local objects.
From mail.jukie.net:work/oclug/intro-to-git
   573ff80..06e3703  master     -> origin/master
```
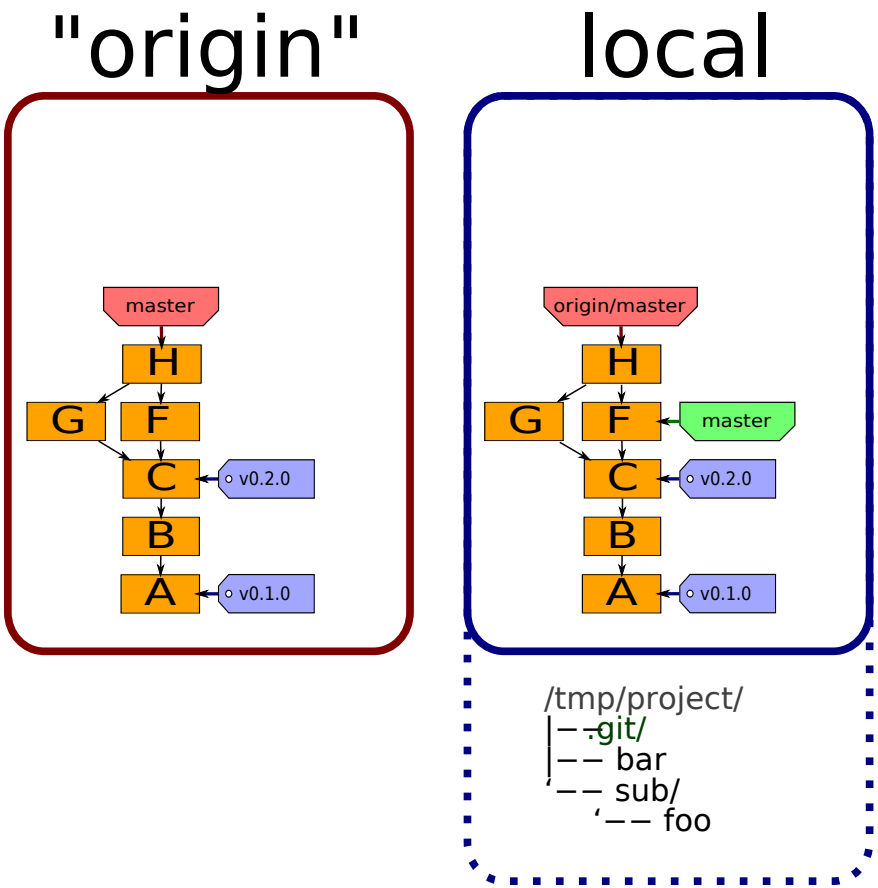

Working with remotes



. . . no disk changes?

Bart Trojanowski, bart@jukie.net

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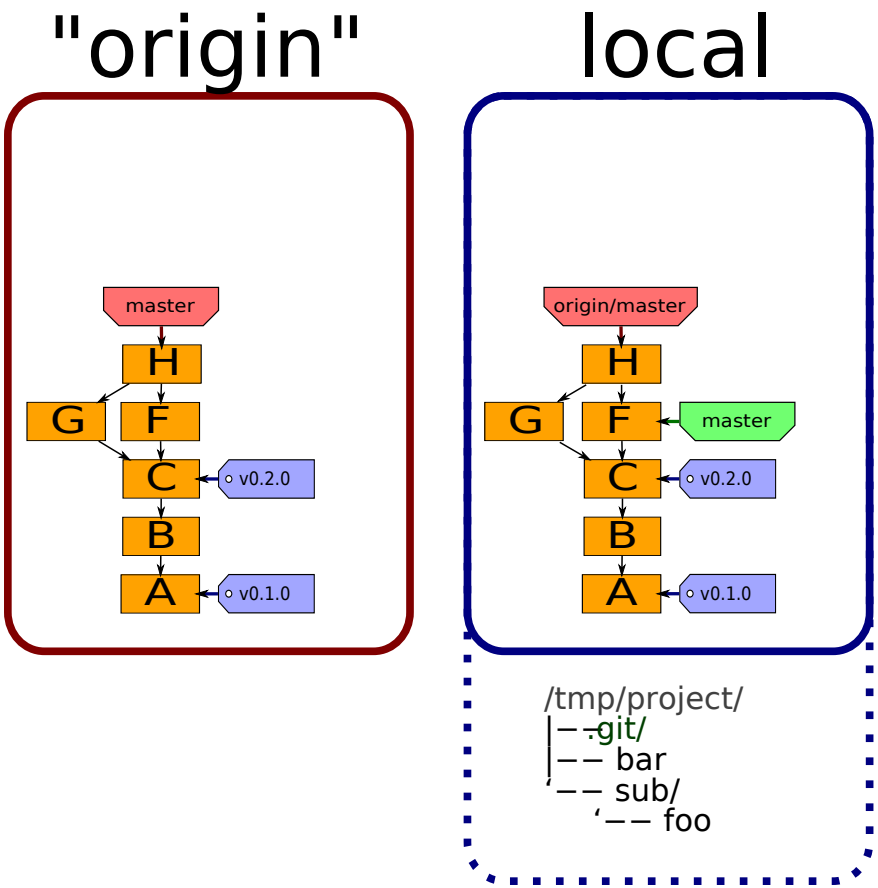

`git fetch` only updates *DAG*

Bart Trojanowski, bart@jukie.net

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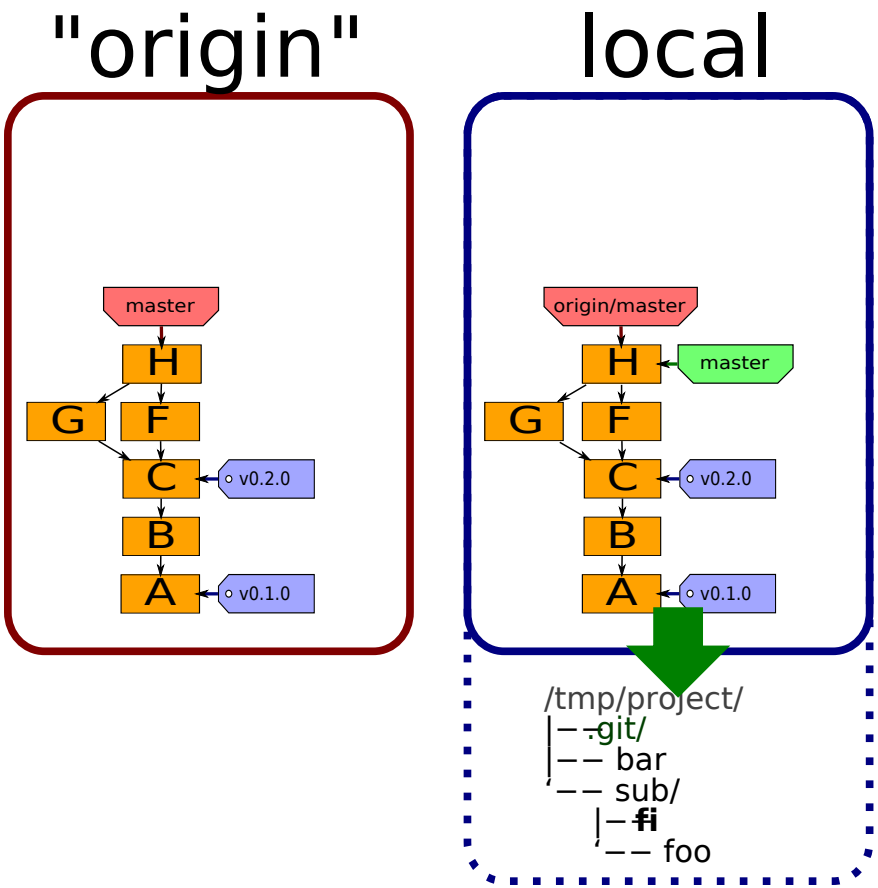
Working with remotes



`git merge origin/master`

fast-forwards master to match origin/master
and updates the working tree

Bart Trojanowski, bart@jukie.net

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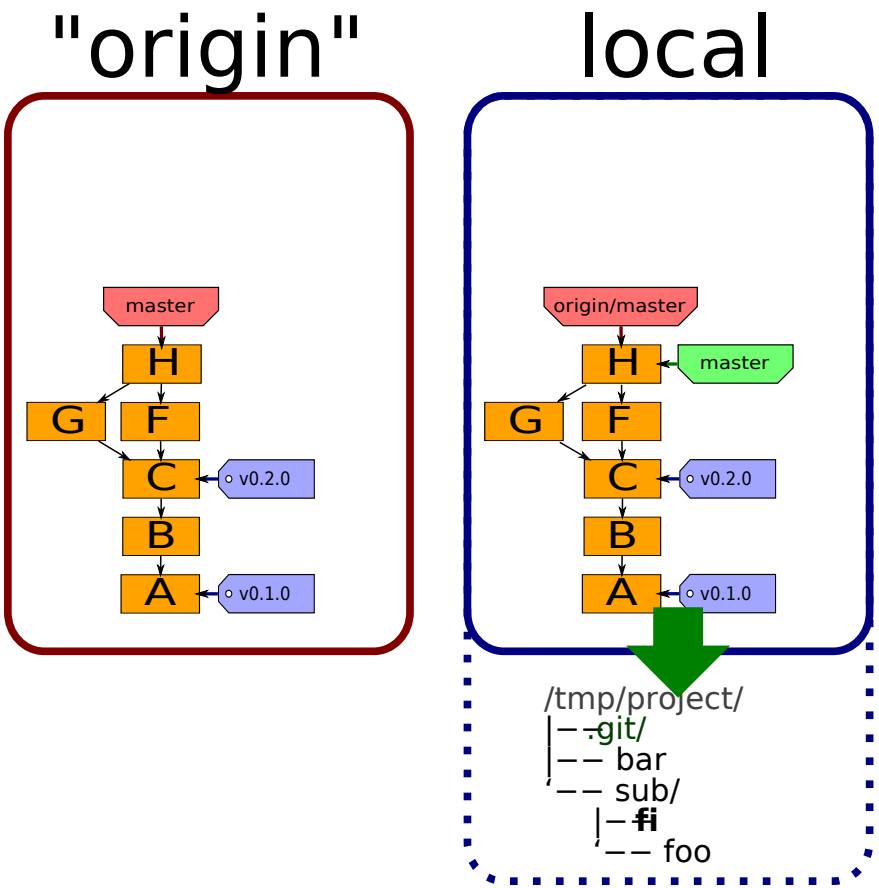
Working with remotes



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Bart Trojanowski, bart@jukie.net

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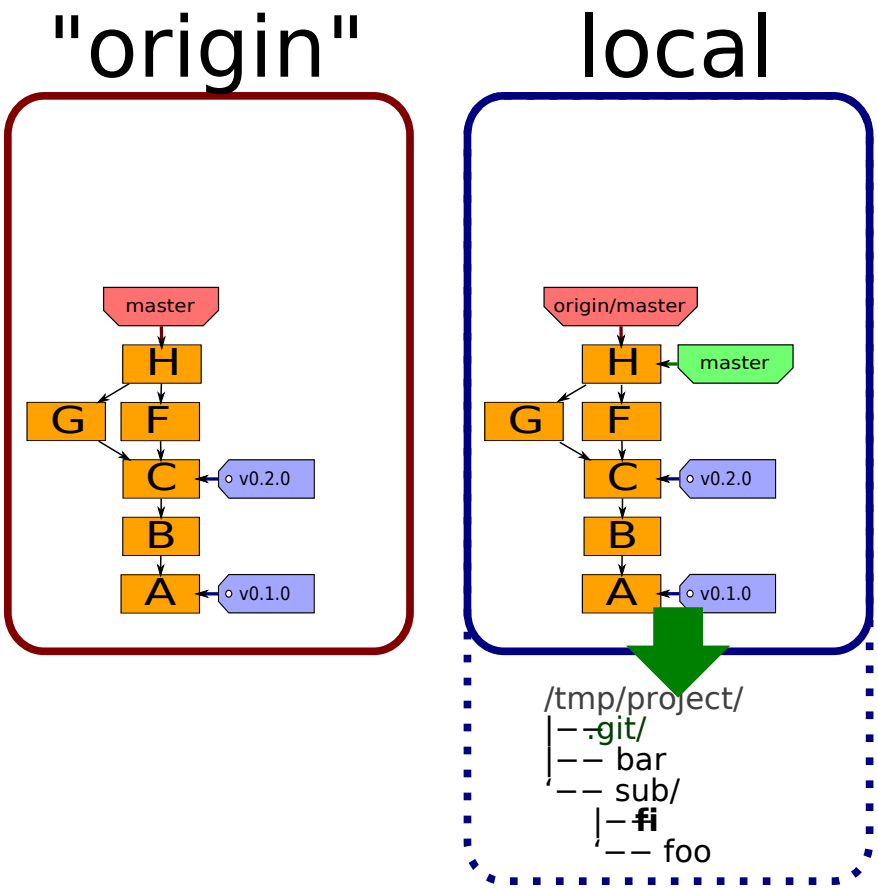
Working with remotes



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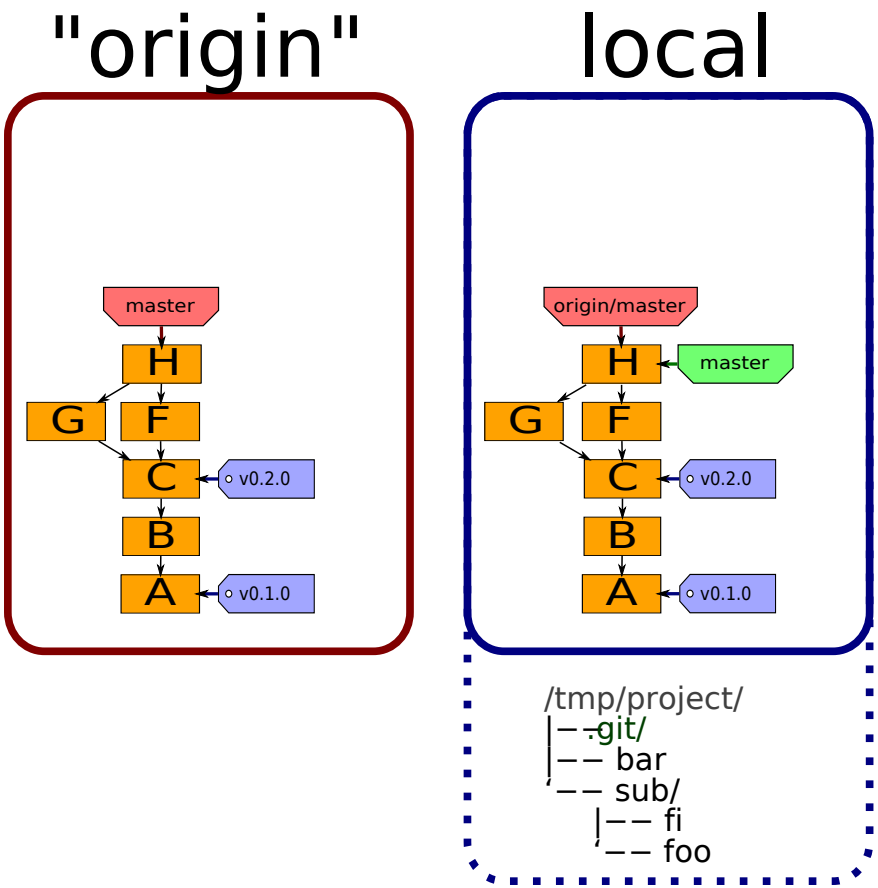
Working with remotes



`git fetch` + `git merge`

=

`git pull`

Bart Trojanowski, bart@jukie.net

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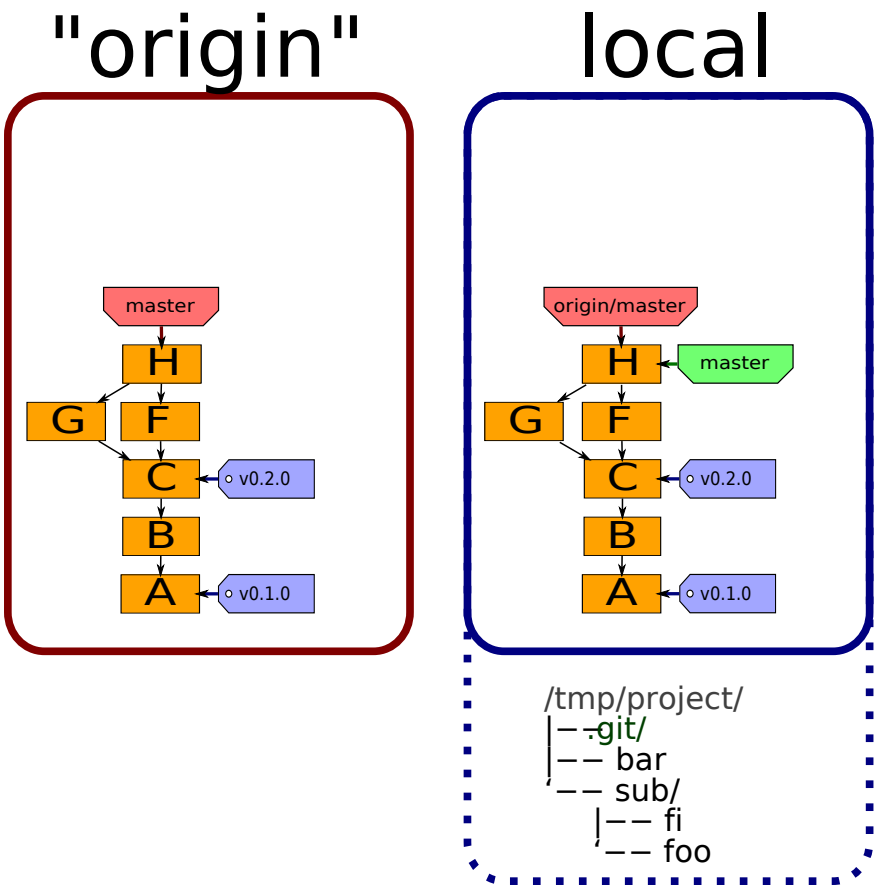
Working with remotes



`git fetch` + `git merge`

=

`git pull`

Bart Trojanowski, bart@jukie.net

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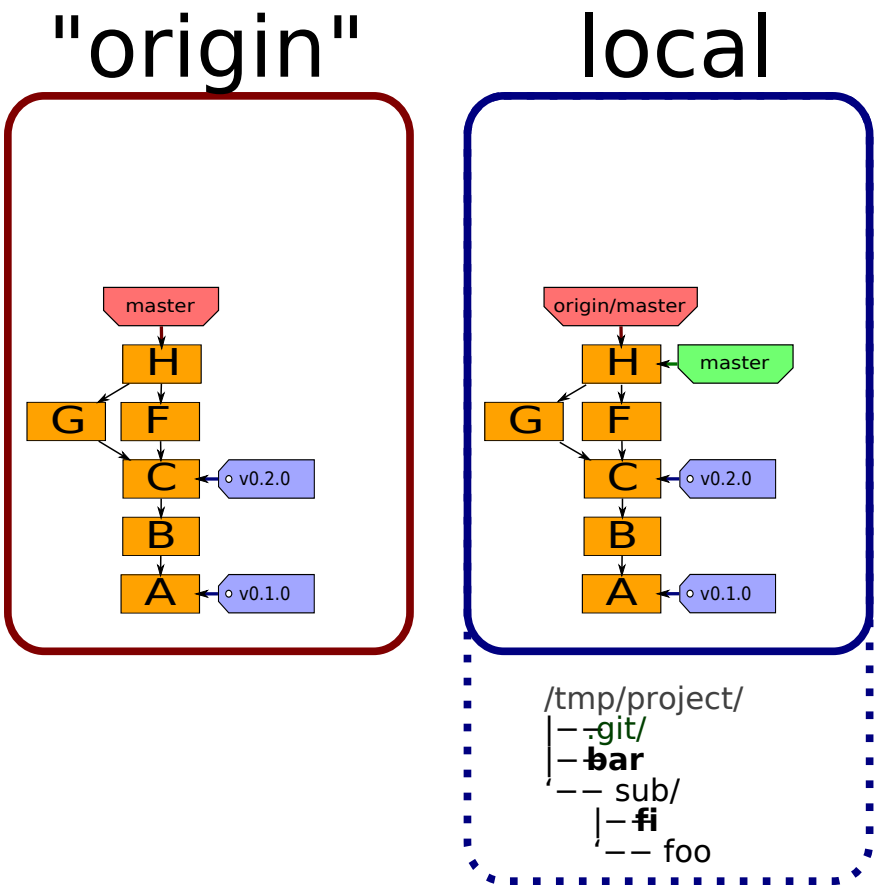
Working with remotes



let's make some local commits

Bart Trojanowski, bart@jukie.net

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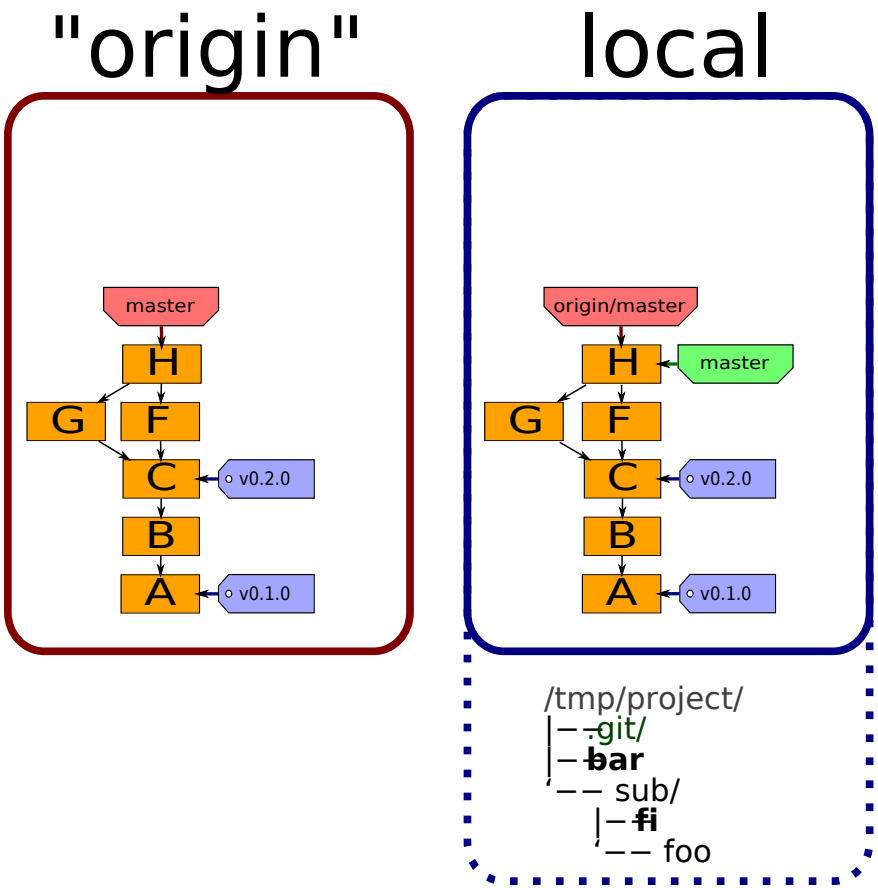
Working with remotes




```
$ git commit -a -m‘‘I’’
```


Bart Trojanowski, bart@jukie.net

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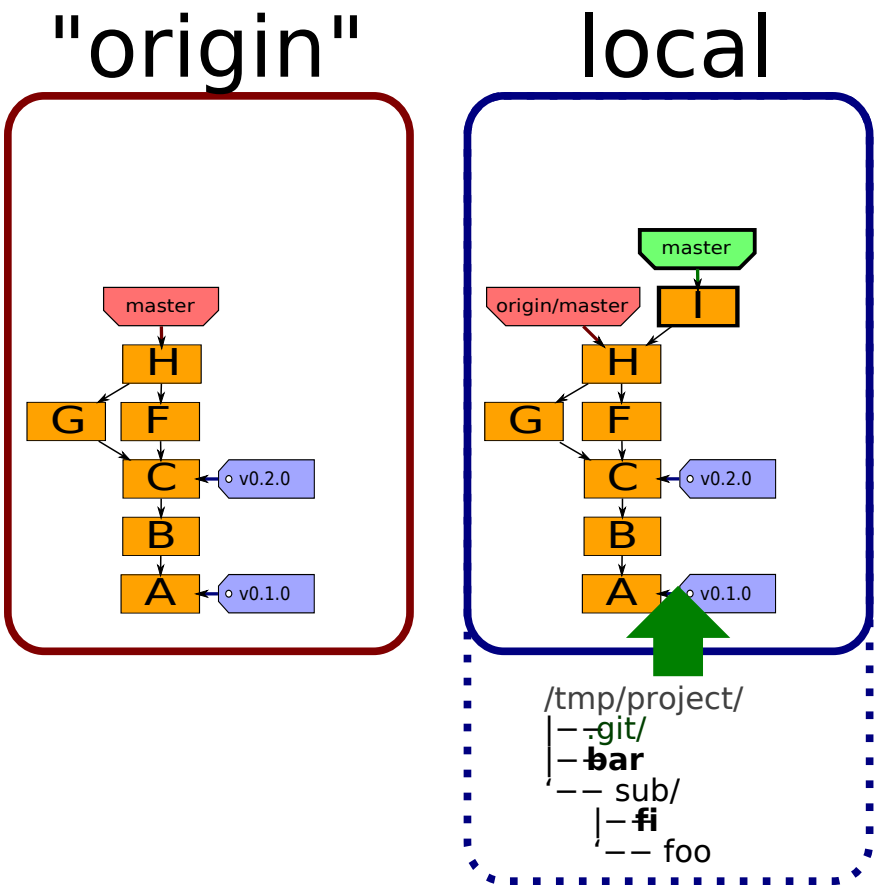
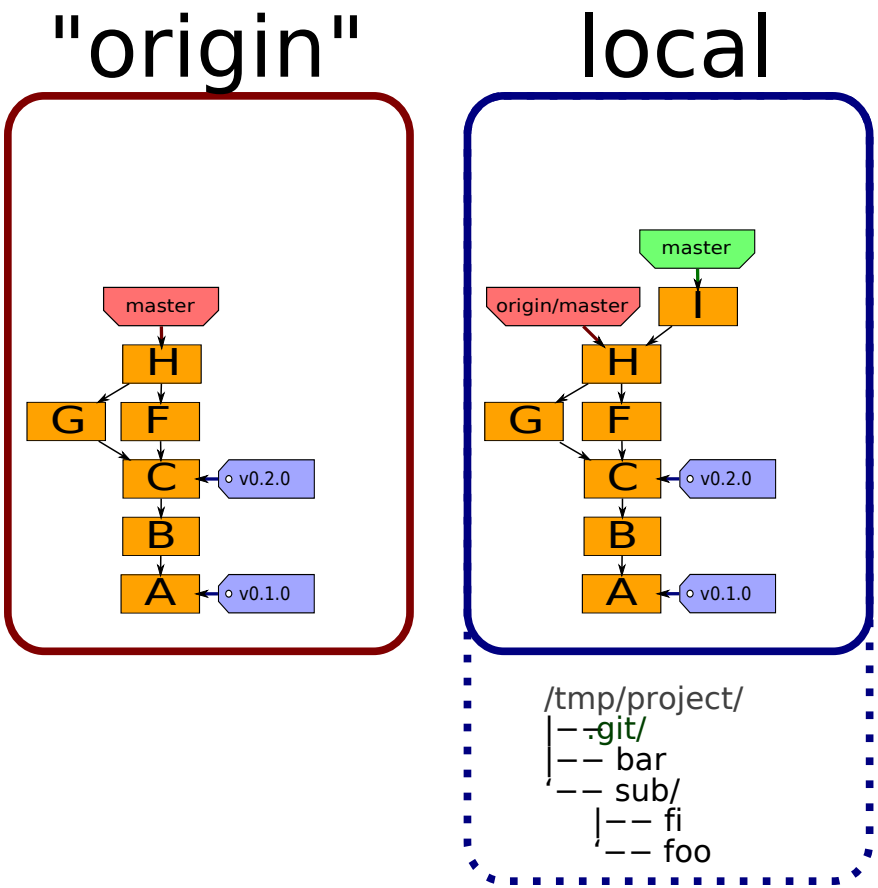
Working with remotes




```
$ git commit -a -m''I''
Created commit b618aed: I
 2 files changed, 11 insertions(+), 20 deletions(-)
```

Working with remotes



Bart Trojanowski, bart@jukie.net

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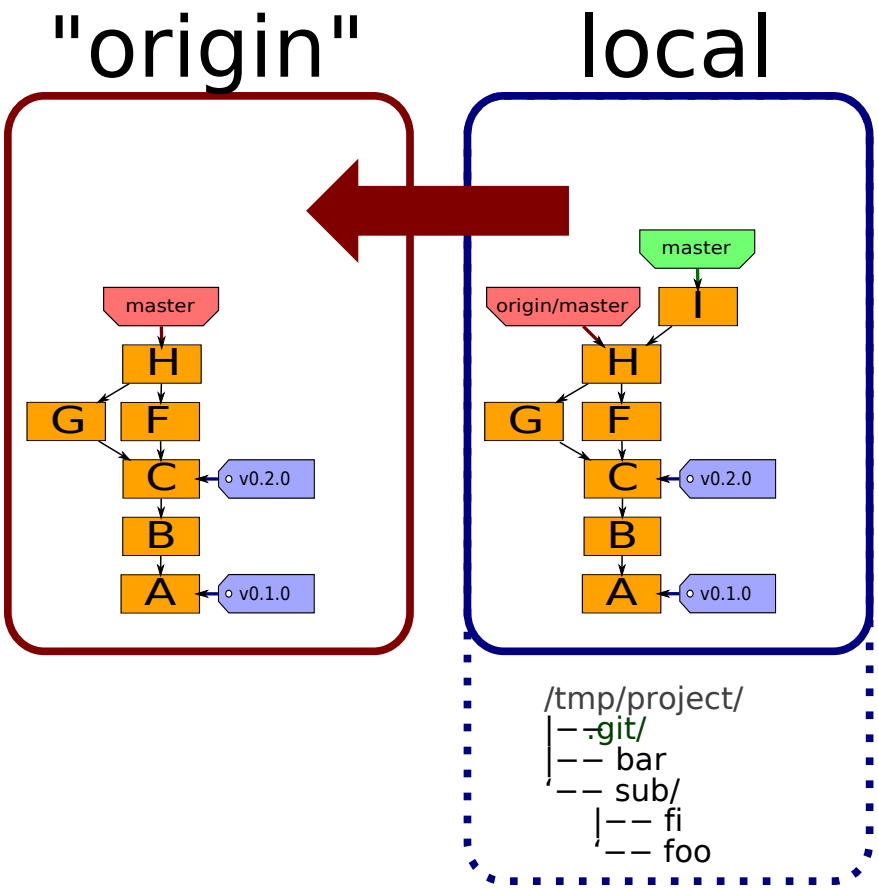
Working with remotes




```
$ git push
```


Bart Trojanowski, bart@jukie.net

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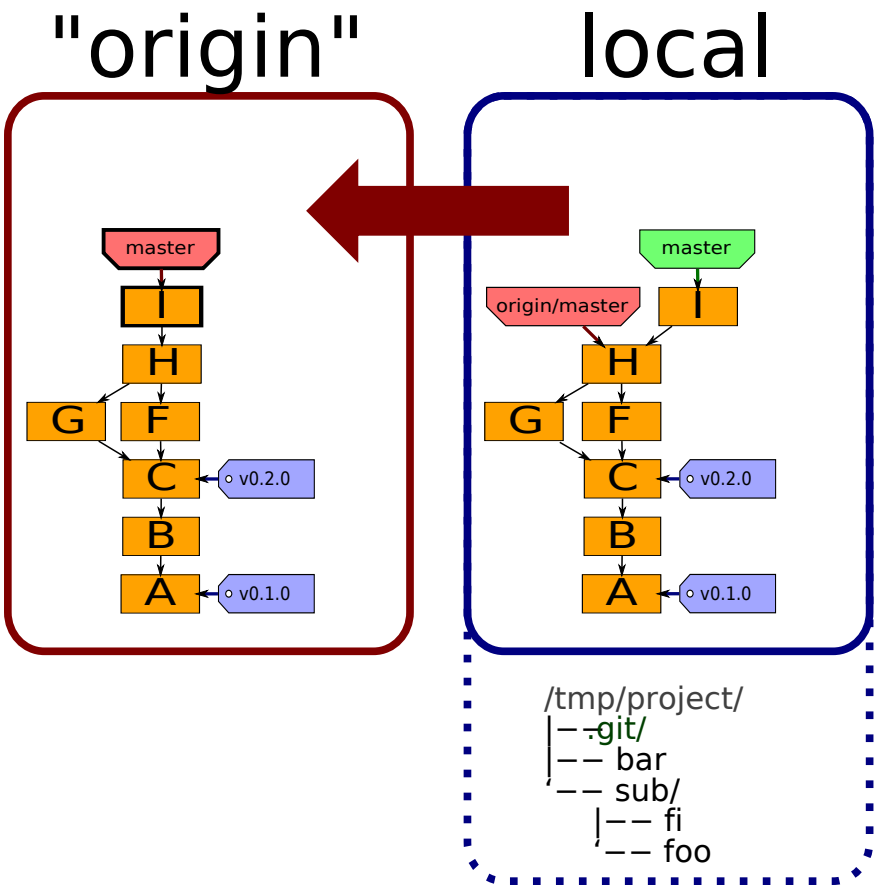
Working with remotes




```
$ git push
Counting objects: 9, done.
Compressing objects: 100% (5/5), done.
Writing objects: 100% (5/5), 810 bytes, done.
Total 5 (delta 4), reused 0 (delta 0)
refs/heads/master: 9ddc135 -> 15b67c0
To ssh+git://repo.or.cz/project.git
   9ddc135..15b67c0  master -> master
```


Bart Trojanowski, bart@jukie.net

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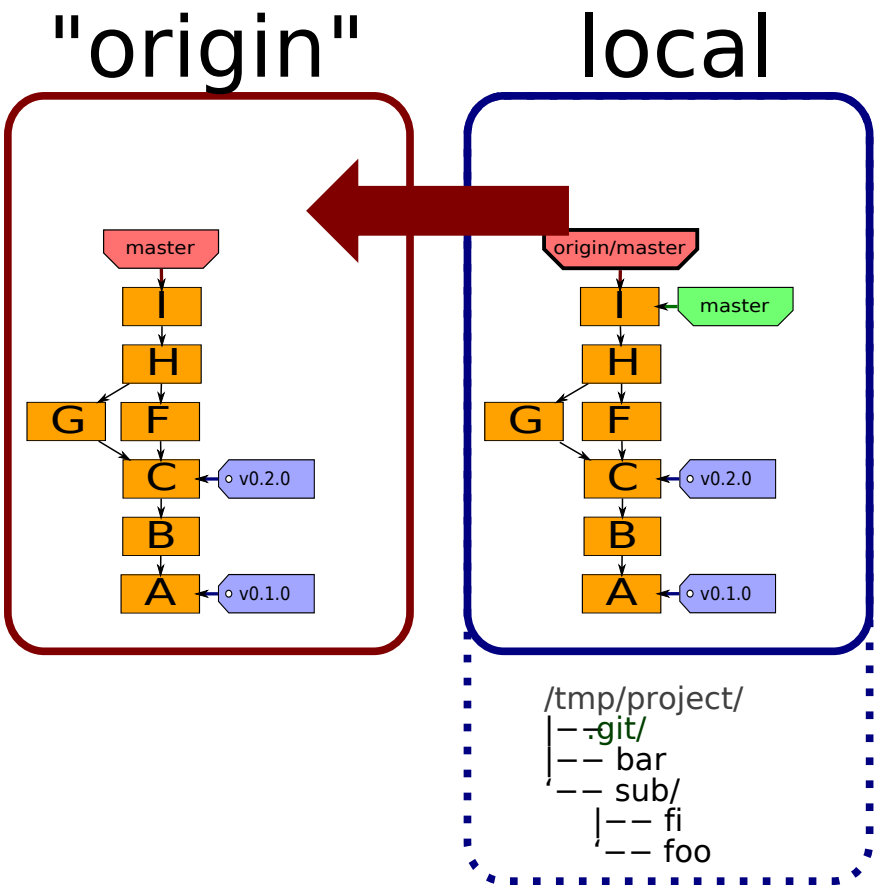
Working with remotes

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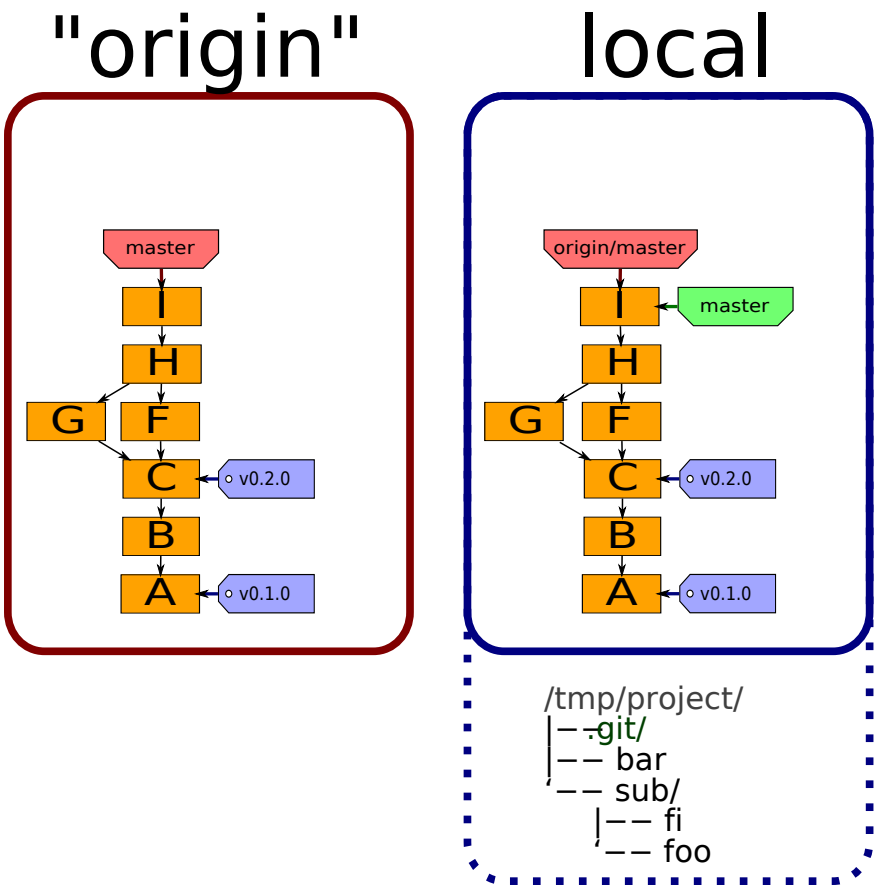
Working with remotes



Bart Trojanowski, bart@jukie.net

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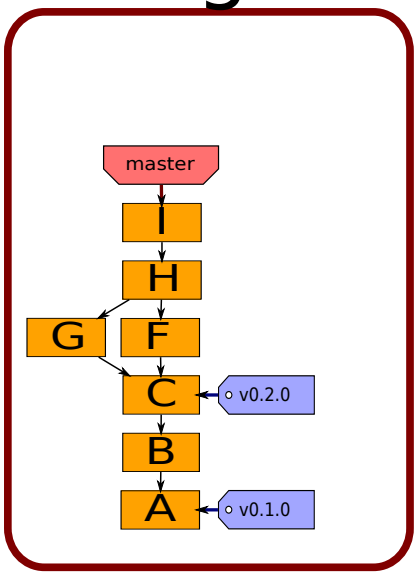
Working with remotes

"origin"



foo.com

. . . meanwhile, elsewhere on the internet . . .

Bart Trojanowski, bart@jukie.net

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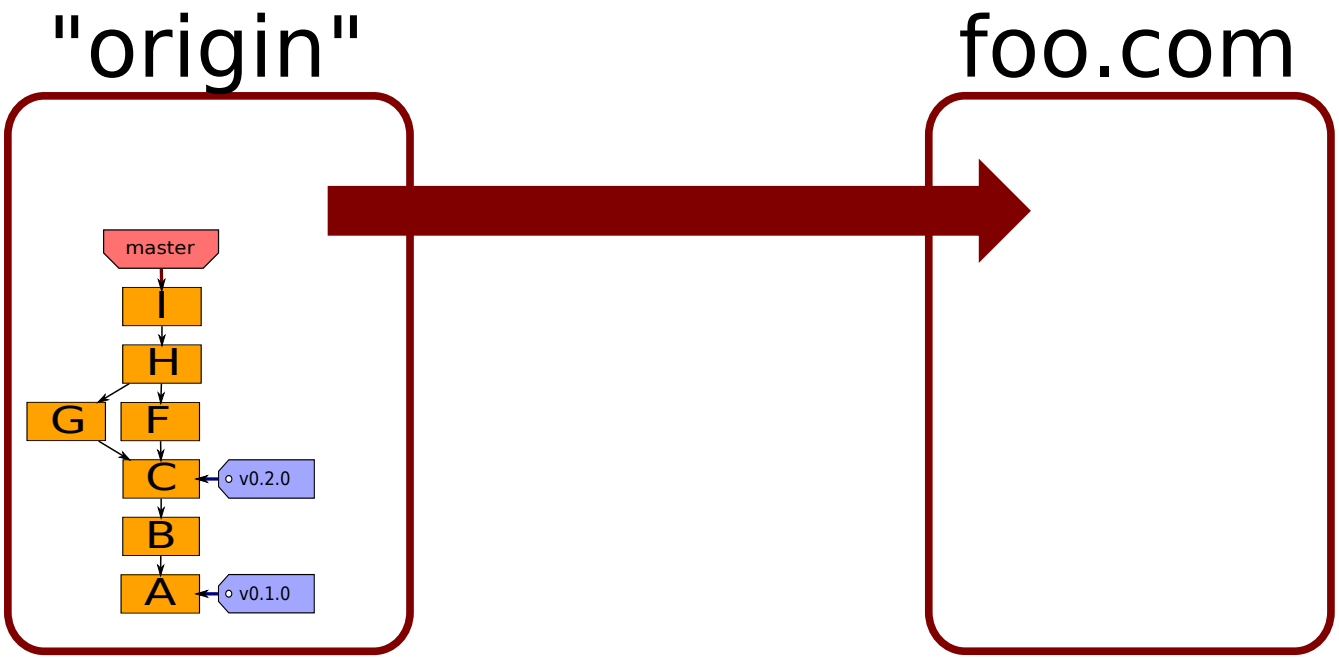
Working with remotes



Fred clones the project.

Bart Trojanowski, bart@jukie.net

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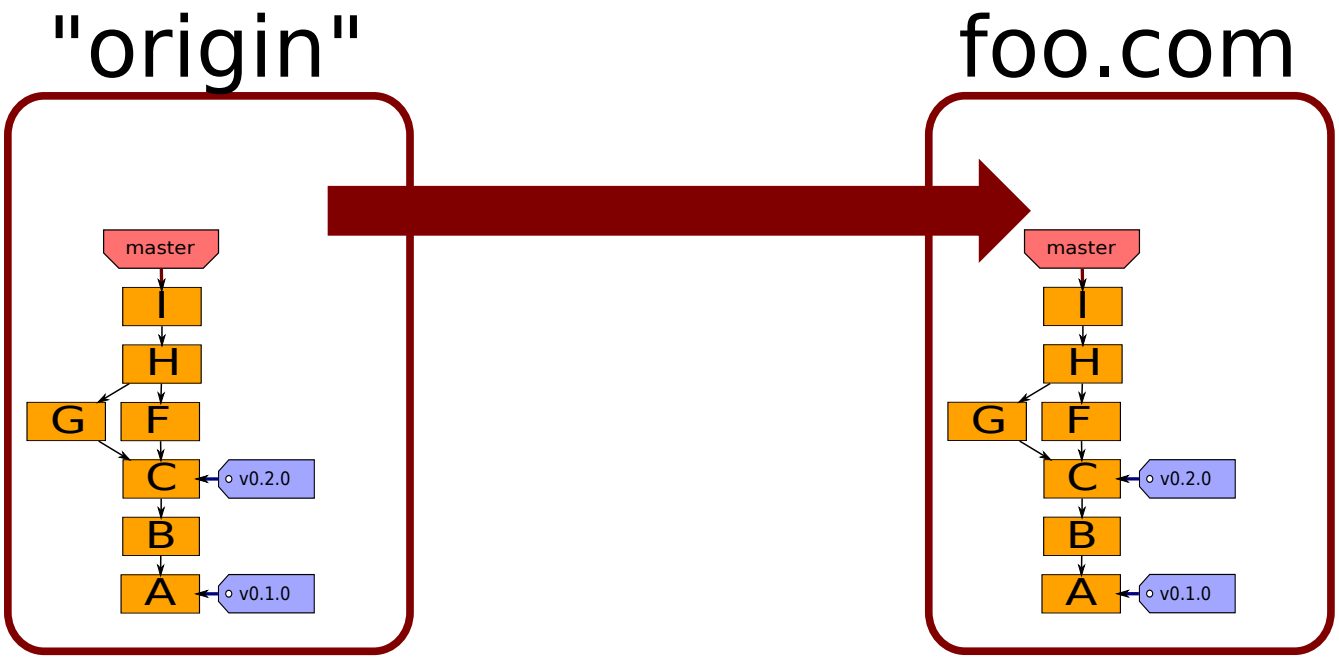
Working with remotes



Fred clones the project.

Bart Trojanowski, bart@jukie.net

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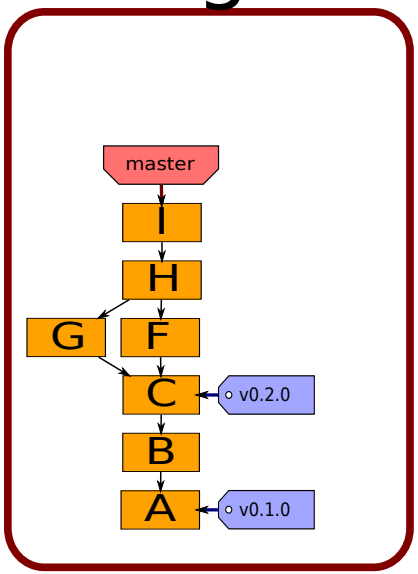
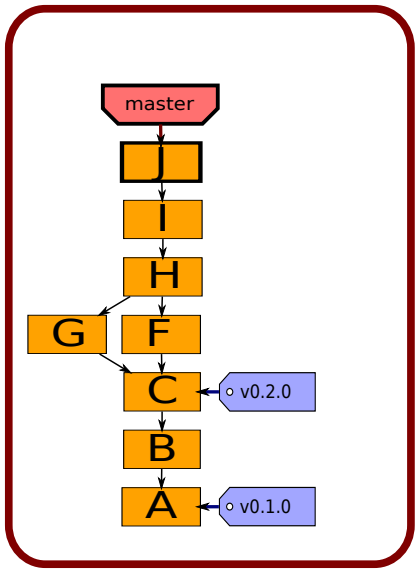
Working with remotes

"origin"



foo.com



. . . and makes some changes.

Bart Trojanowski, bart@jukie.net

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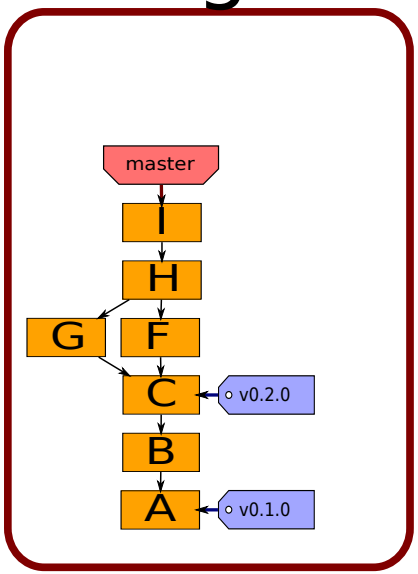
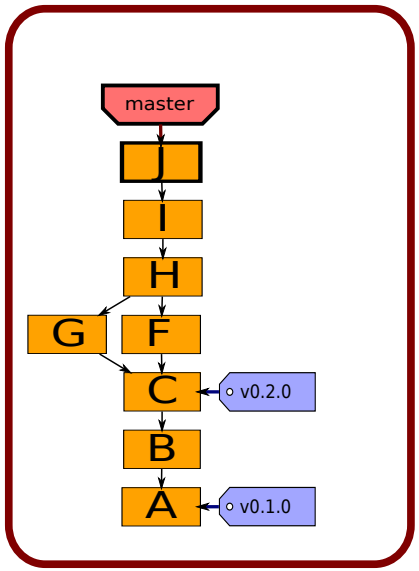
"origin"



foo.com



Fred cannot push.

Bart Trojanowski, bart@jukie.net

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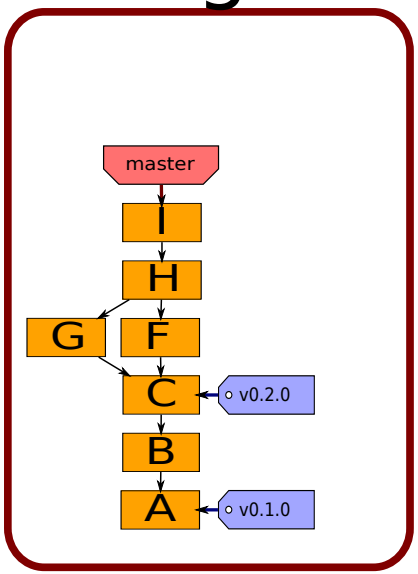
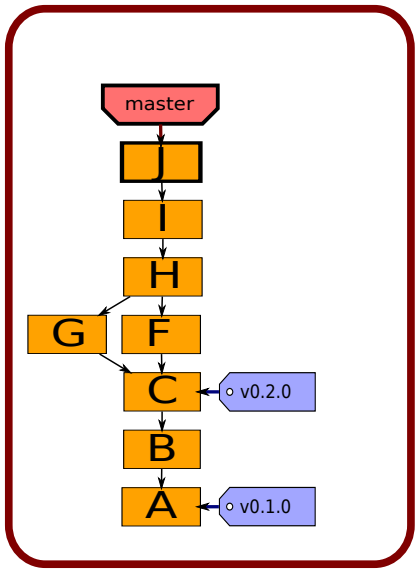
Working with remotes

"origin"



foo.com




```
From: fred@foo.com
Subject: I fixed a bug

Please pull from

    http://foo.com/project.git/

-Fred
```


Bart Trojanowski, bart@jukie.net

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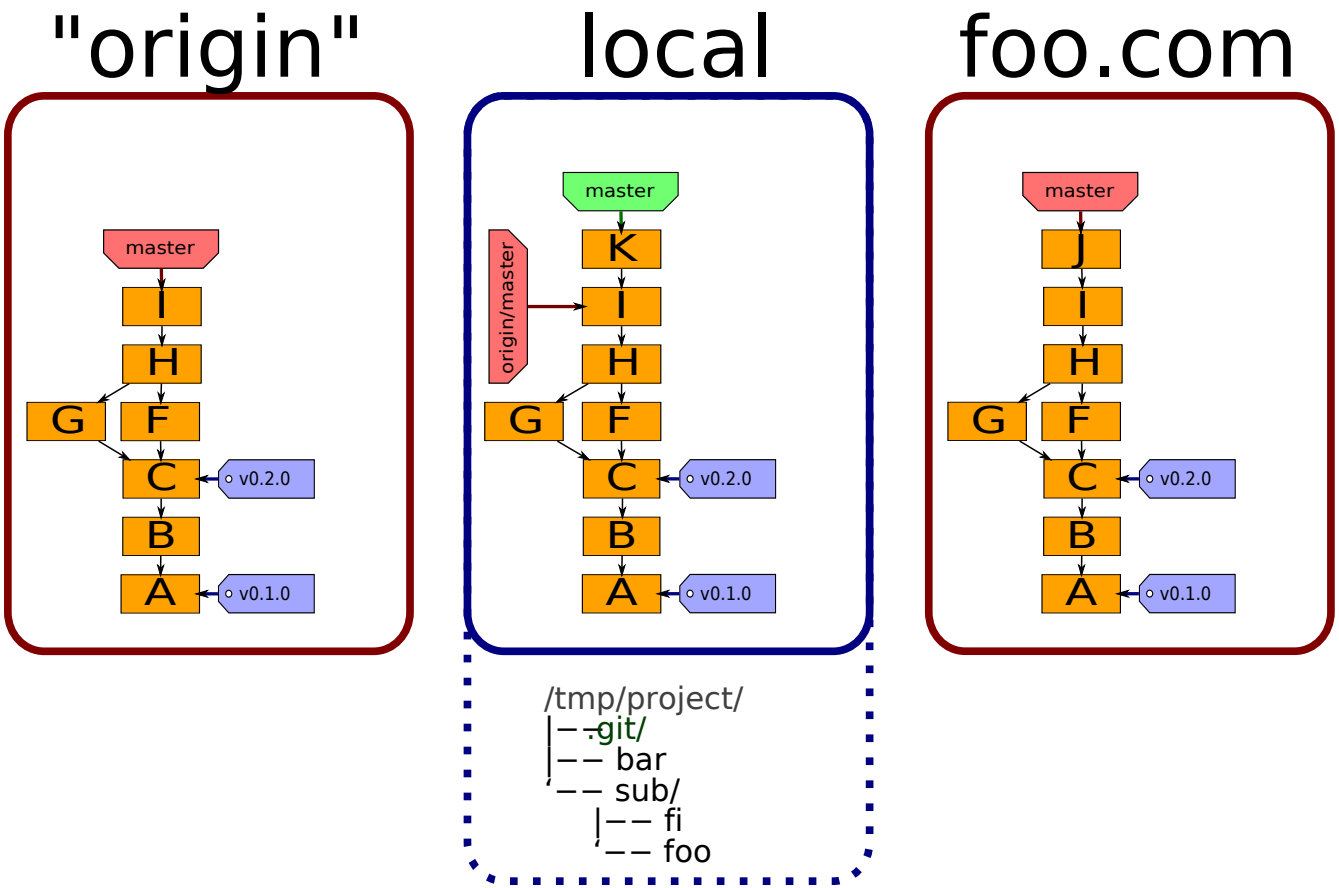
Working with remotes

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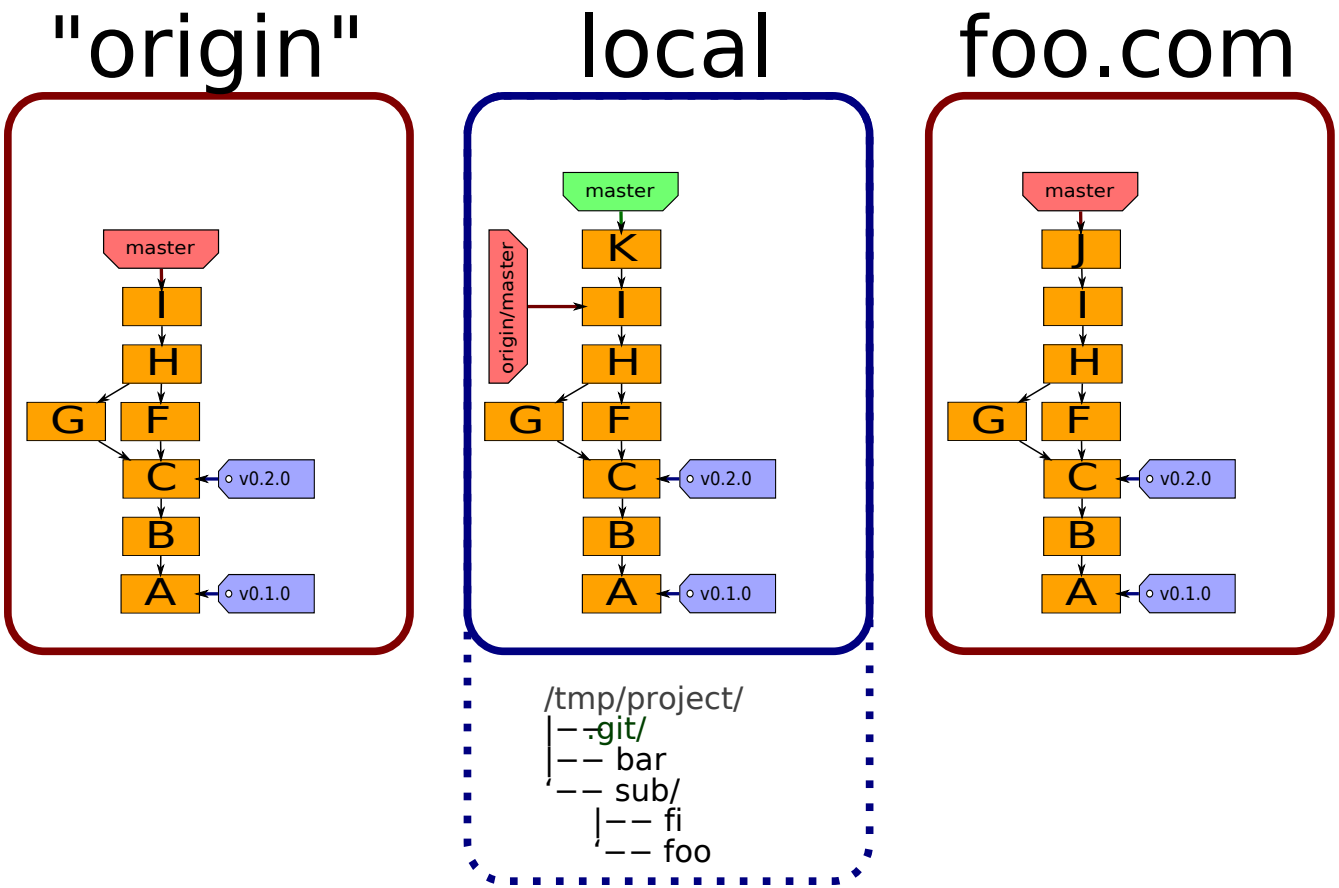
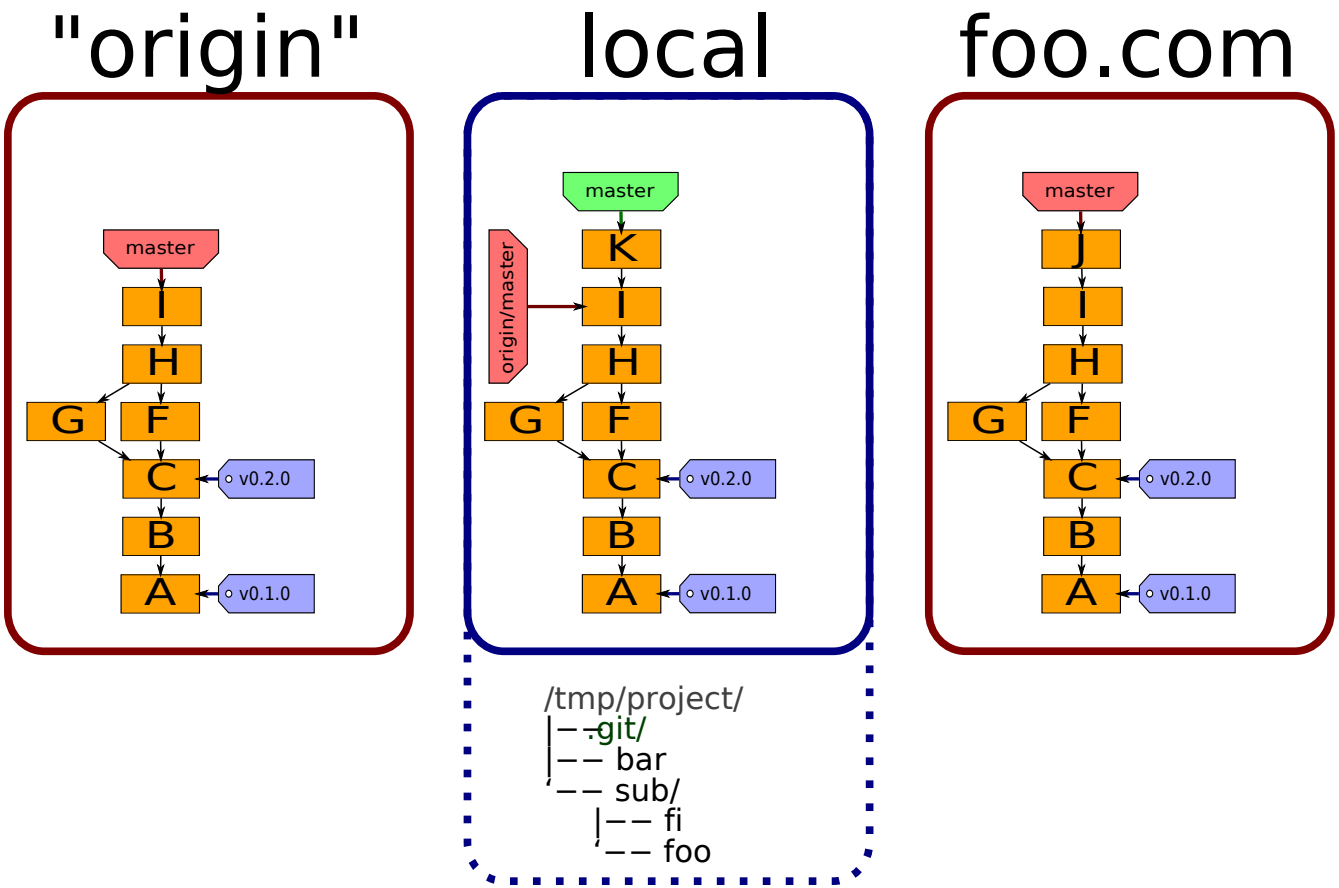
Working with remotes




```
$ git remote add fred http://foo.com/project.git/
```

Working with remotes




```
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```
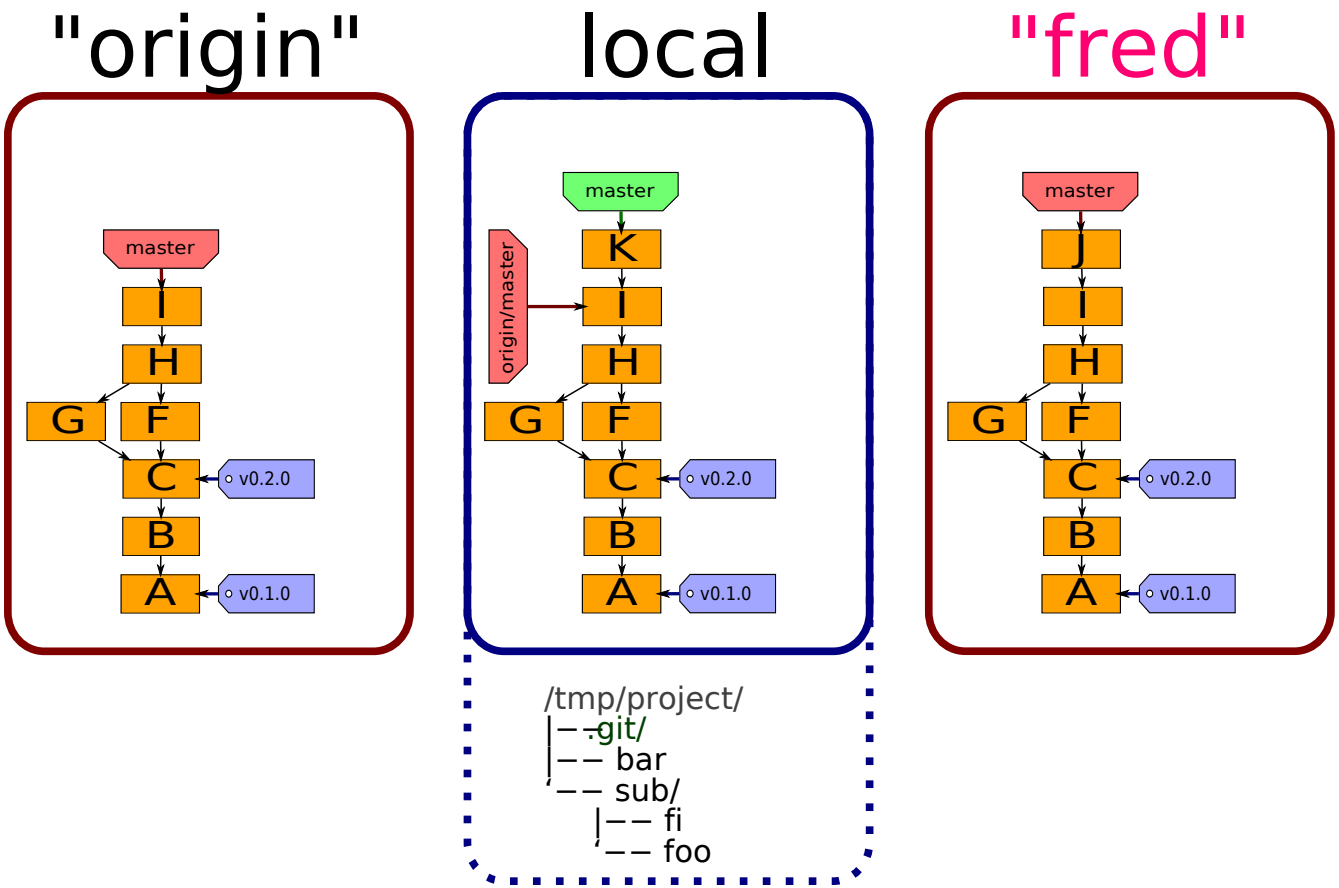
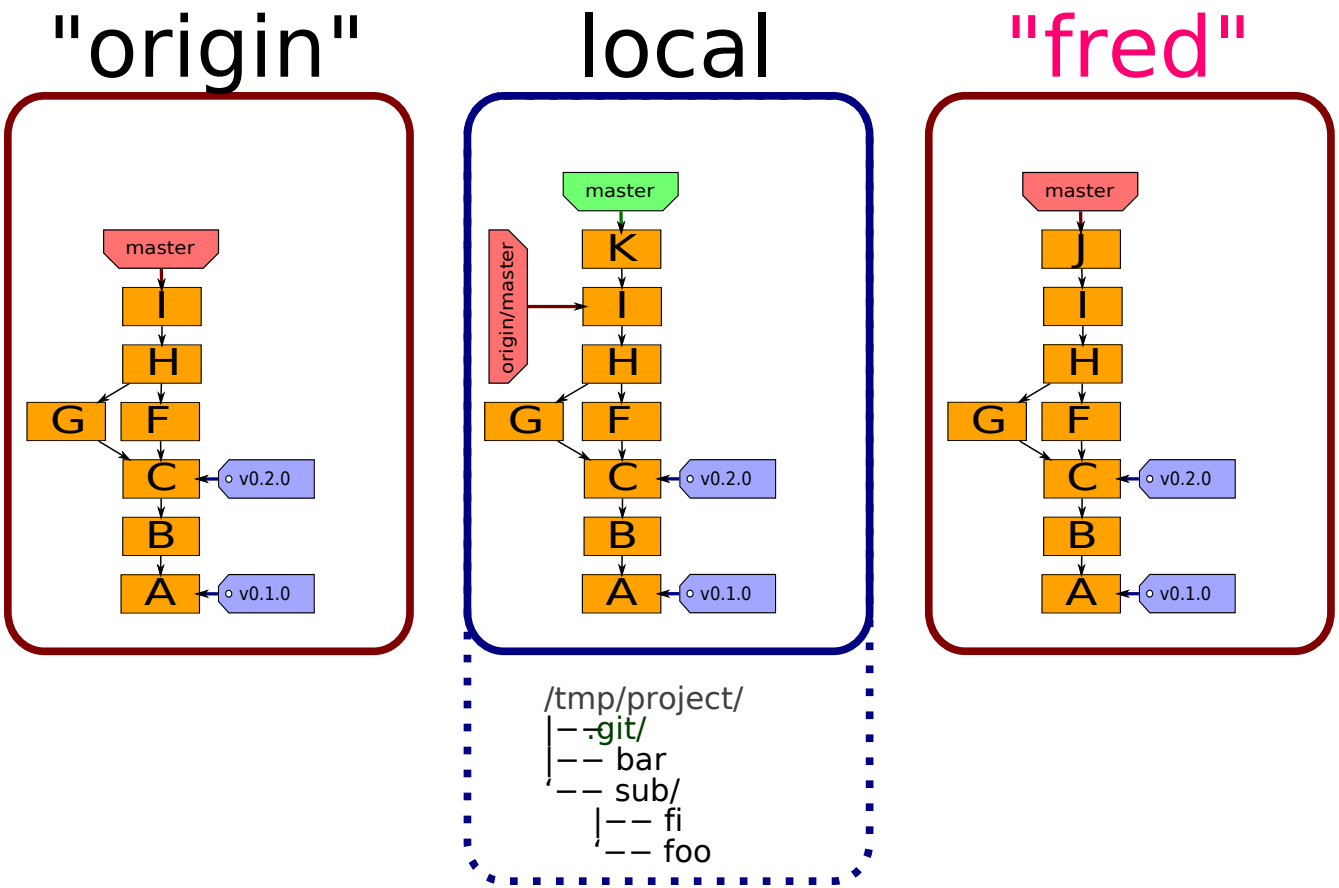

Working with remotes



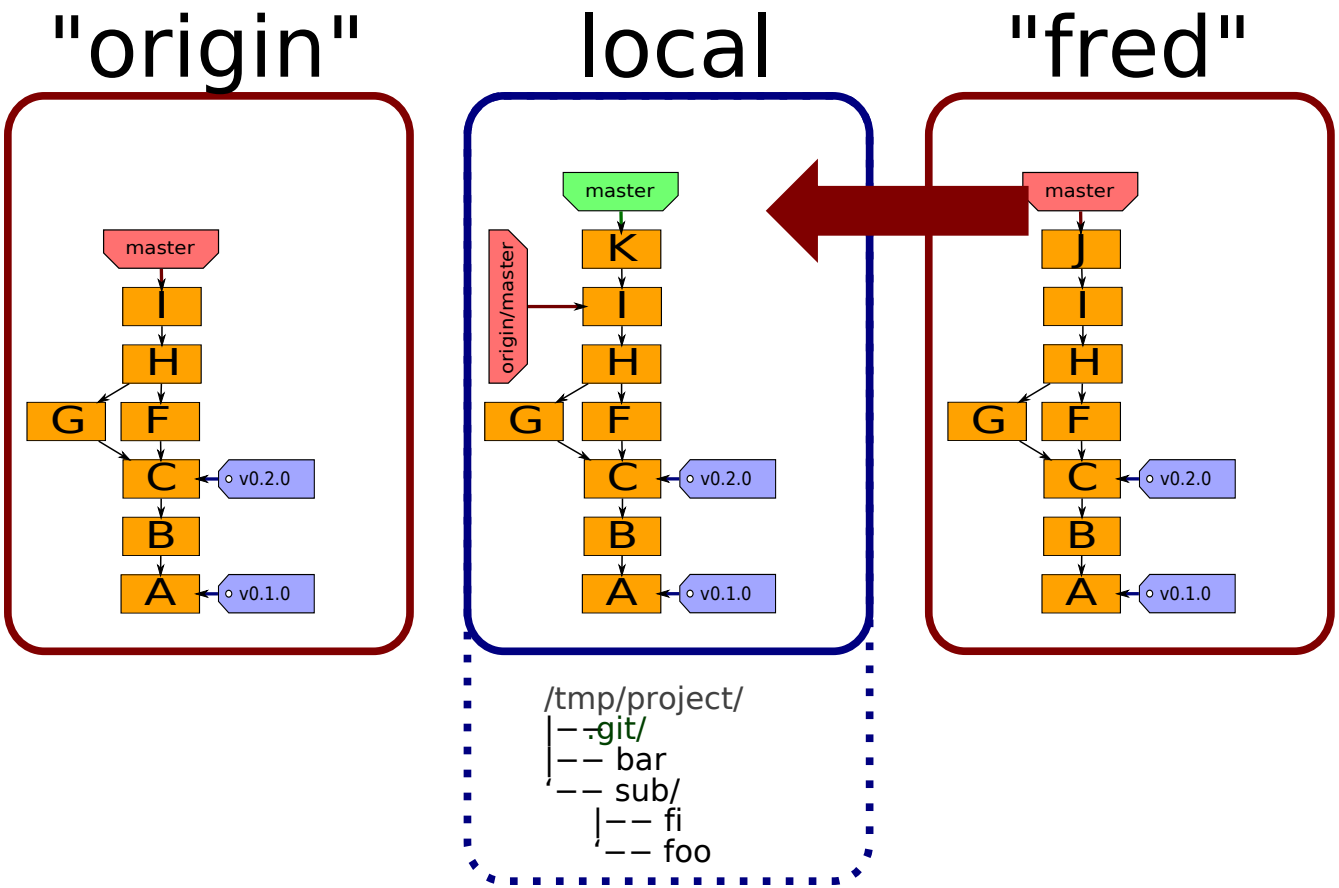

```
$ git remote add fred http://foo.com/project.git/
```

Working with remotes



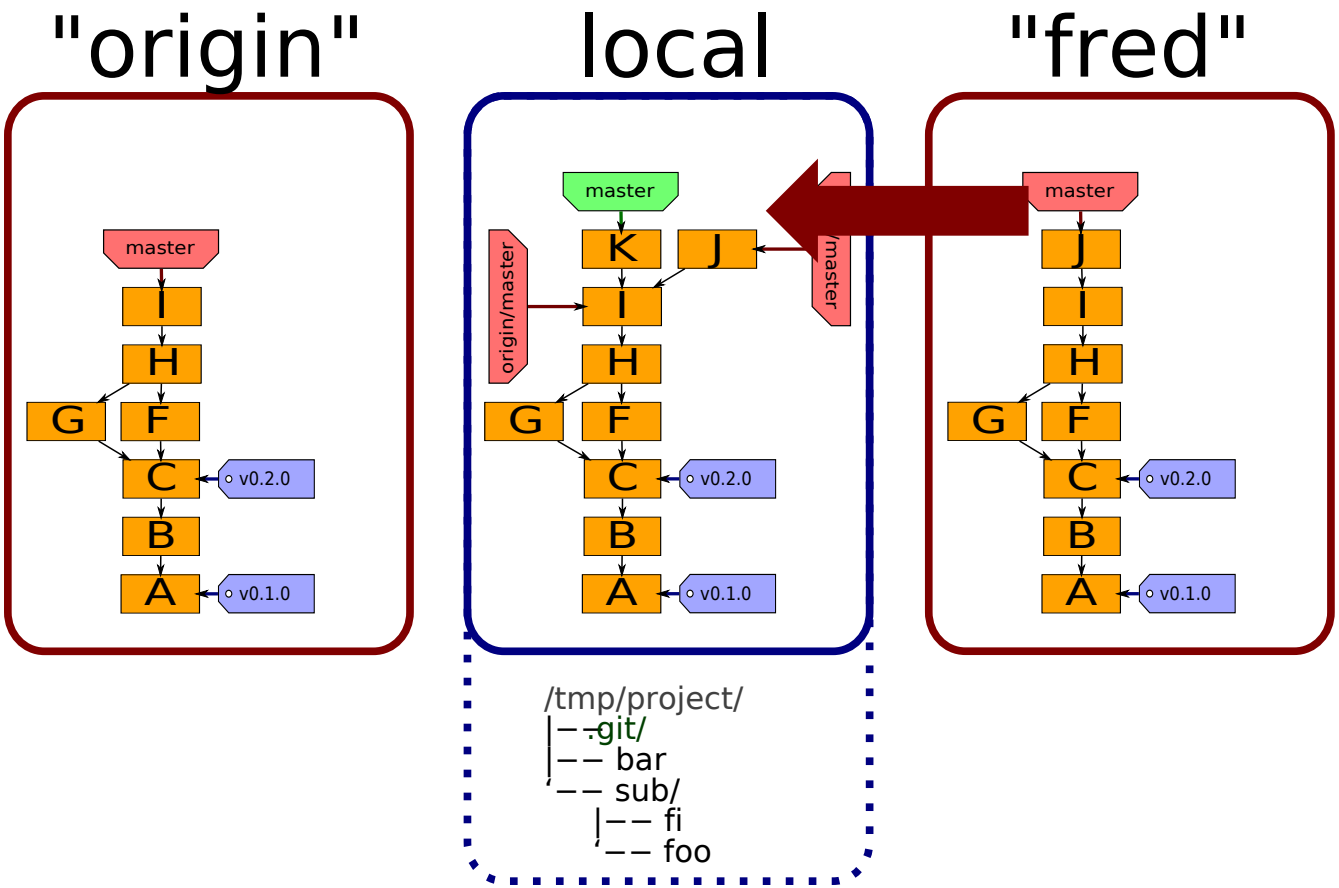

```
$ git fetch fred
```

Working with remotes



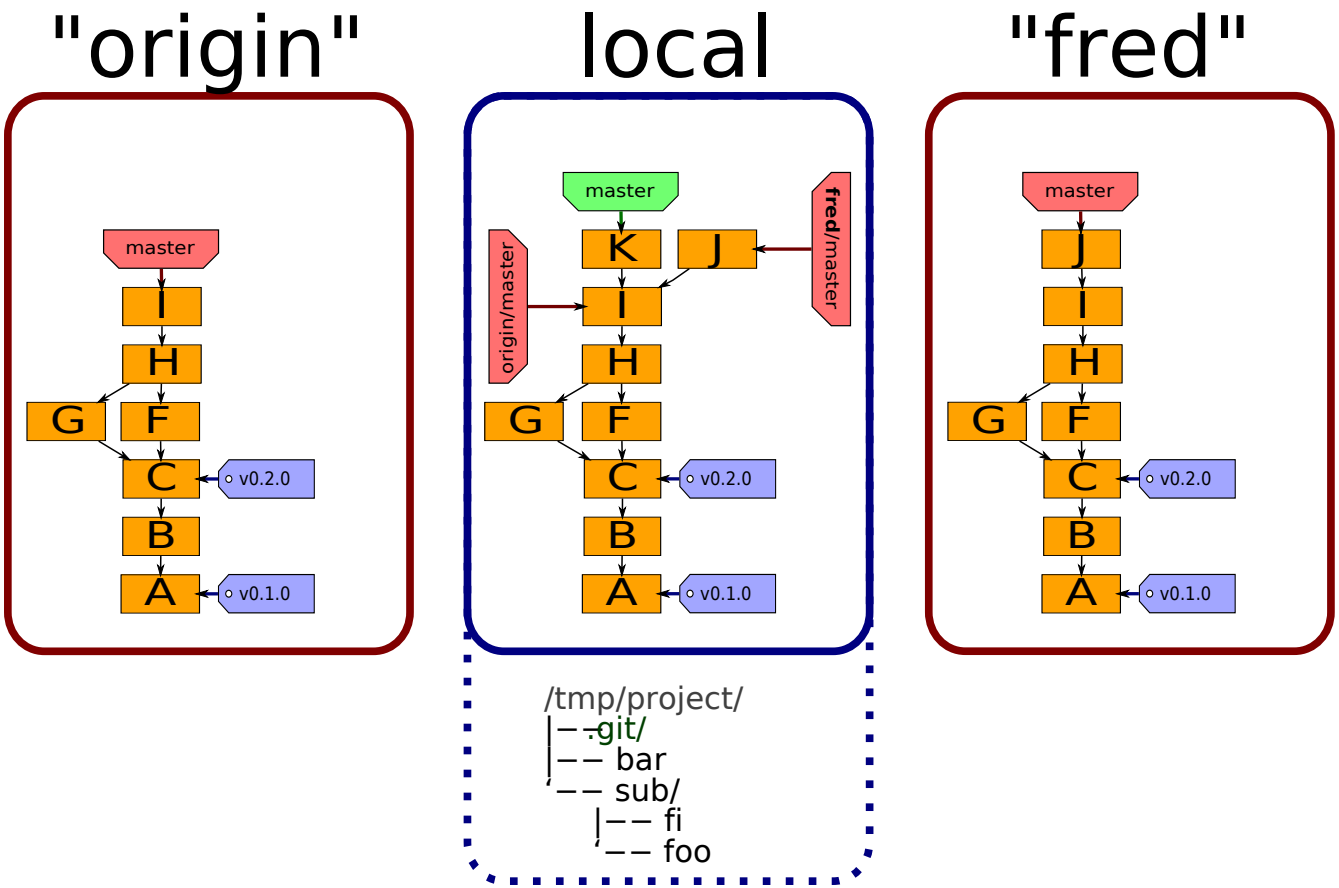

```
$ git fetch fred
```

Working with remotes




```
$ git fetch fred
```

Working with remotes



Bart Trojanowski, bart@jukie.net

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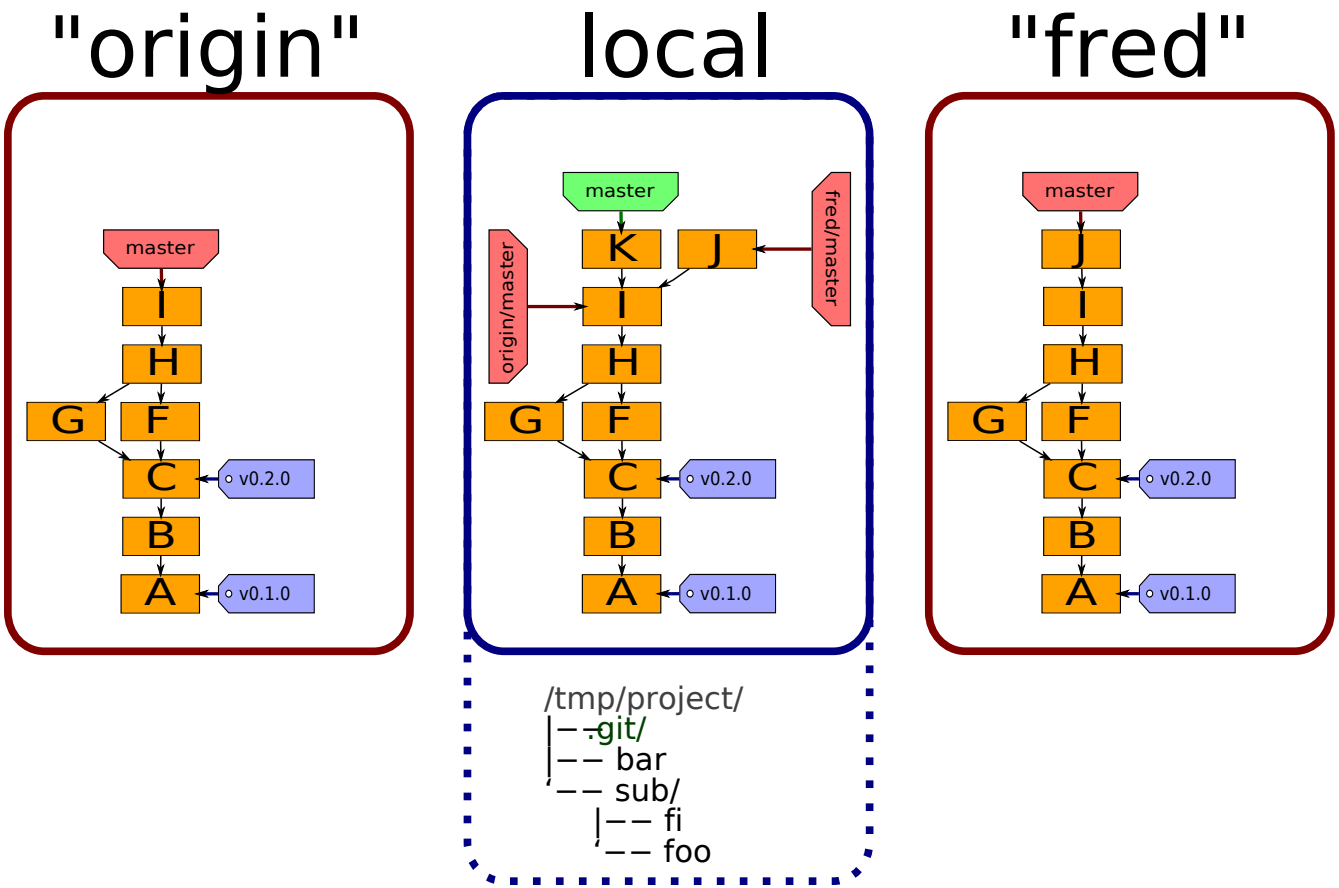
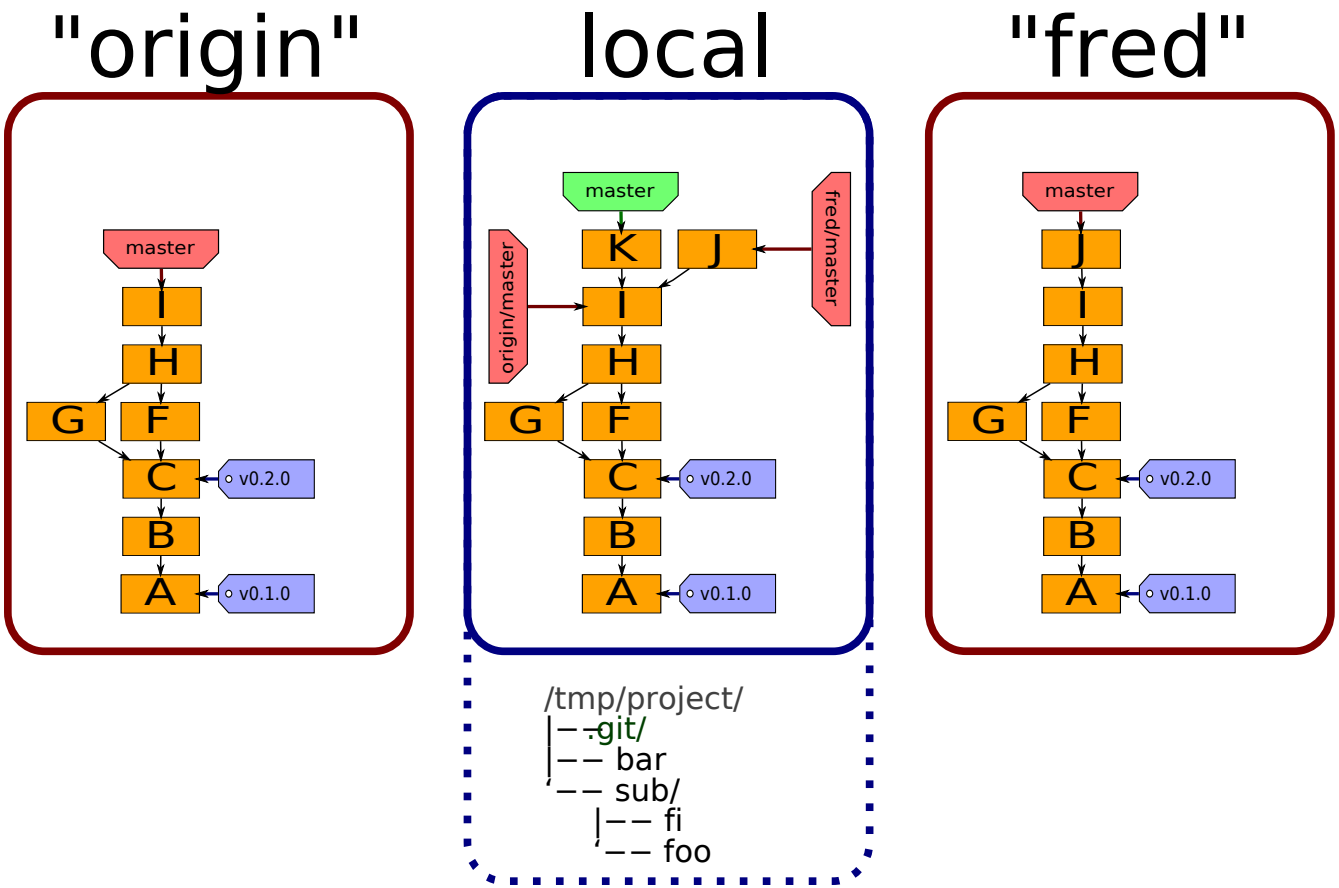


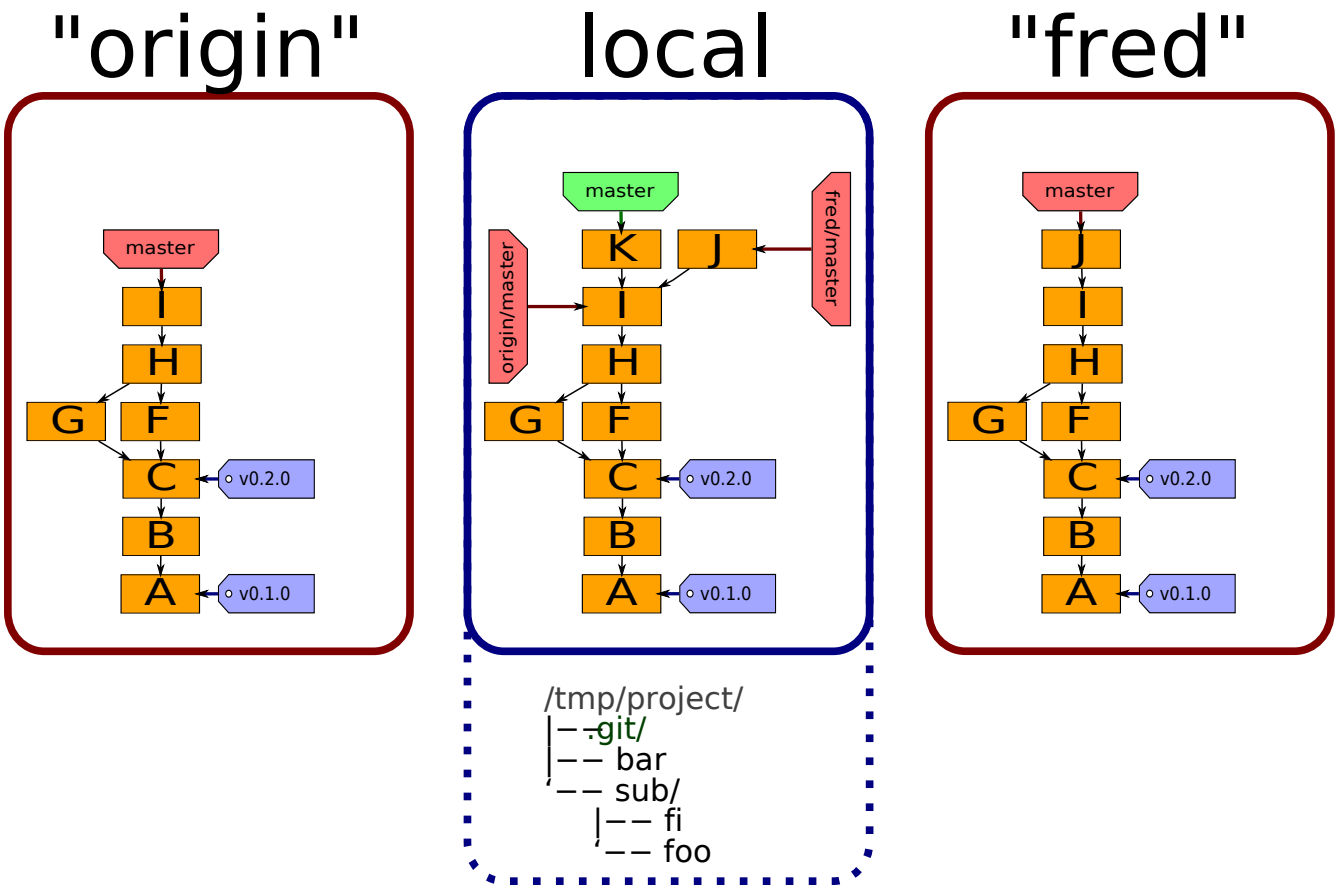

```
$ git log fred/master
```

Working with remotes



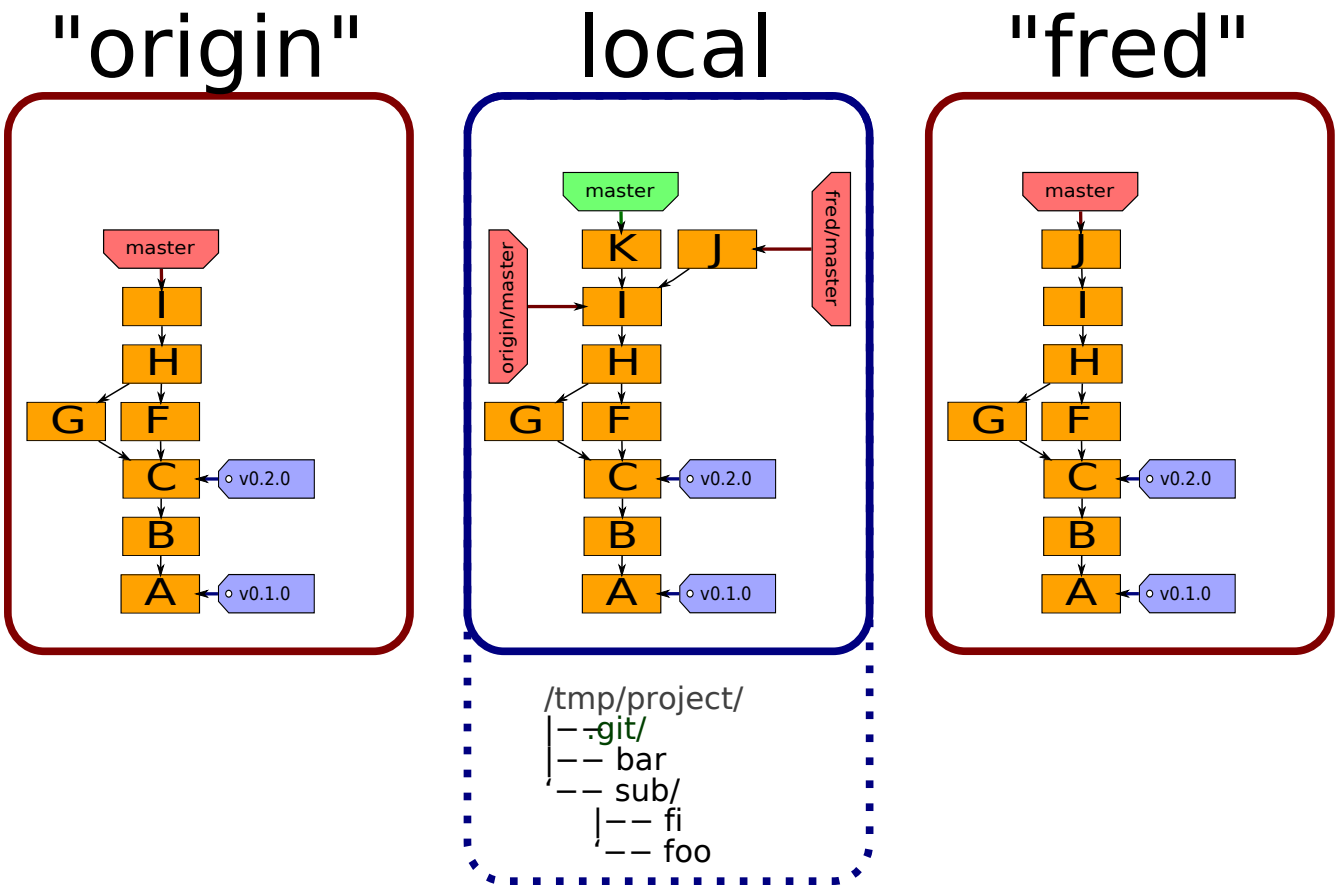

```
$ git log fred/master
$ git log fred/master ^master
```

Working with remotes



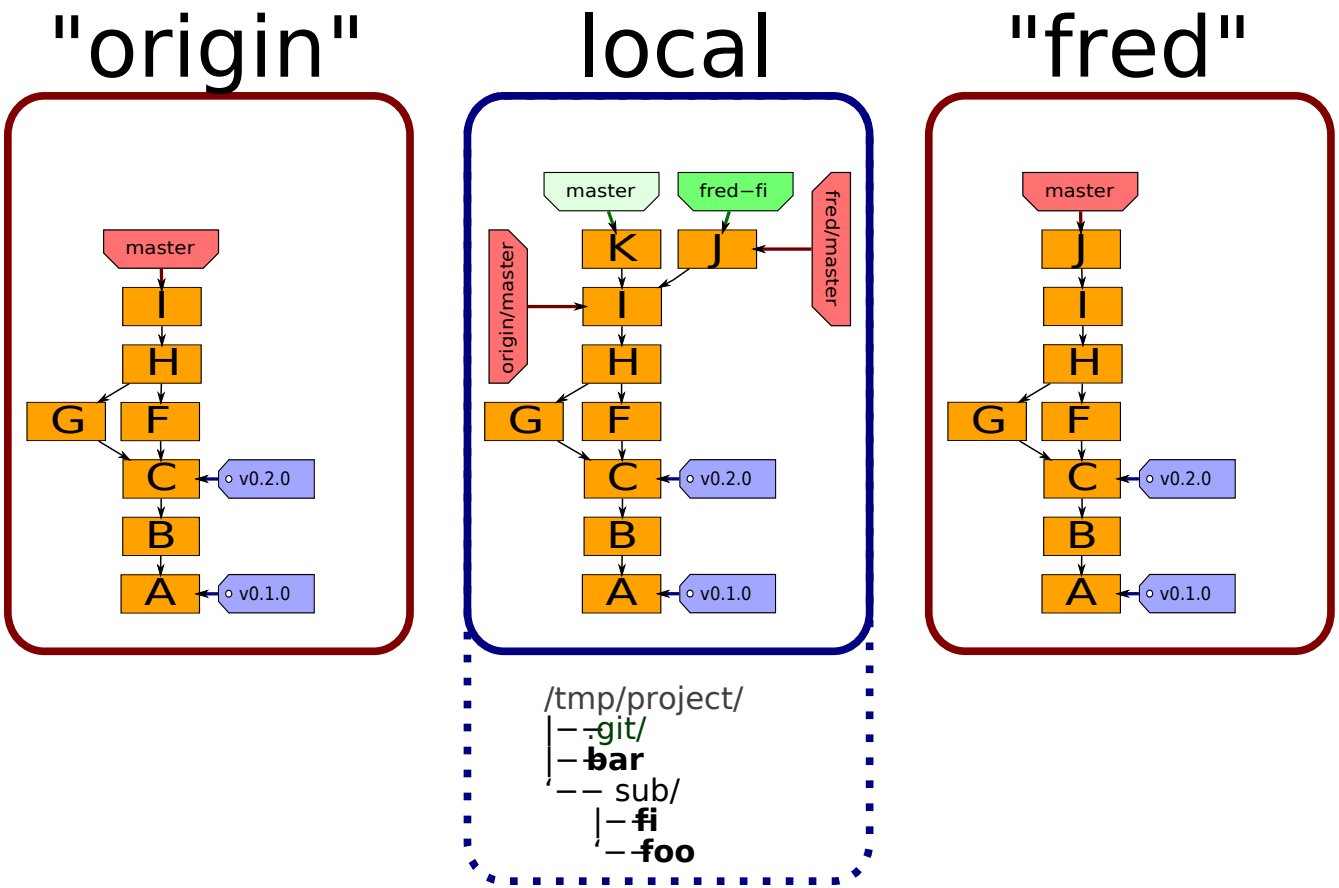

```
$ git log fred/master
$ git log fred/master ^master
$ git log -p fred/master ^master
```

Working with remotes




```
$ git checkout -b fred-fix fred/master
```

Working with remotes




```
$ git checkout -b fred-fix fred/master
```


Bart Trojanowski, bart@jukie.net

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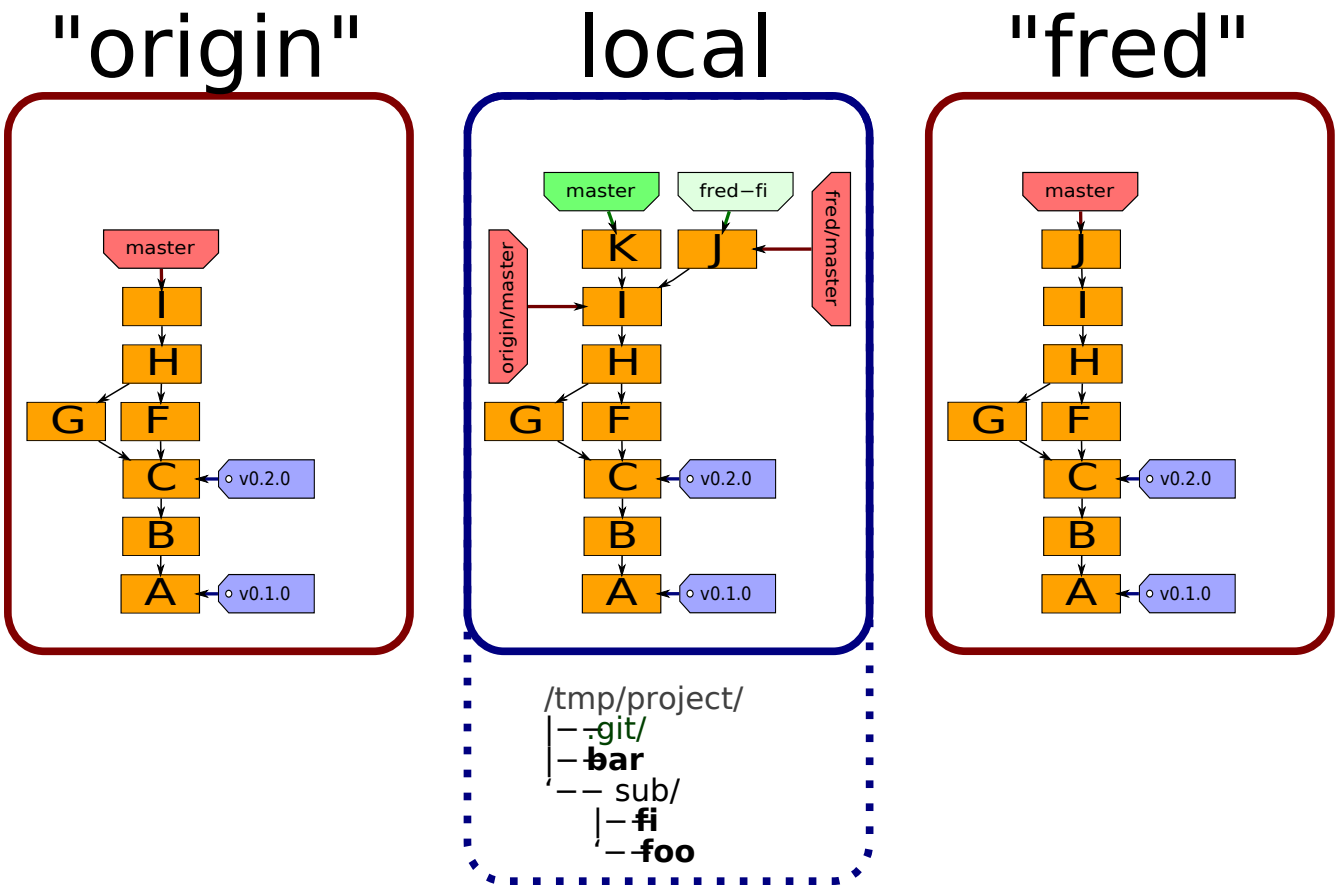
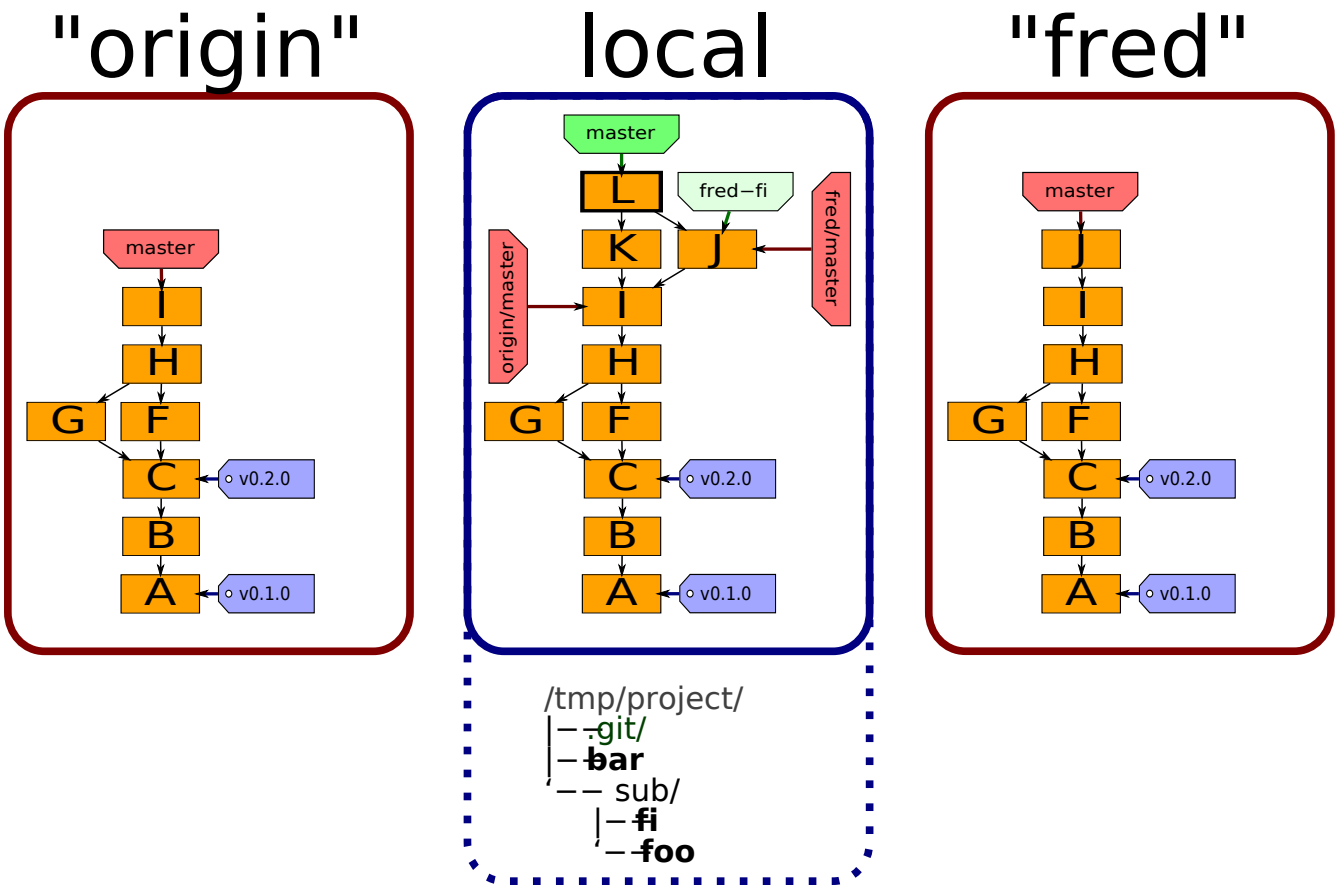
Working with remotes



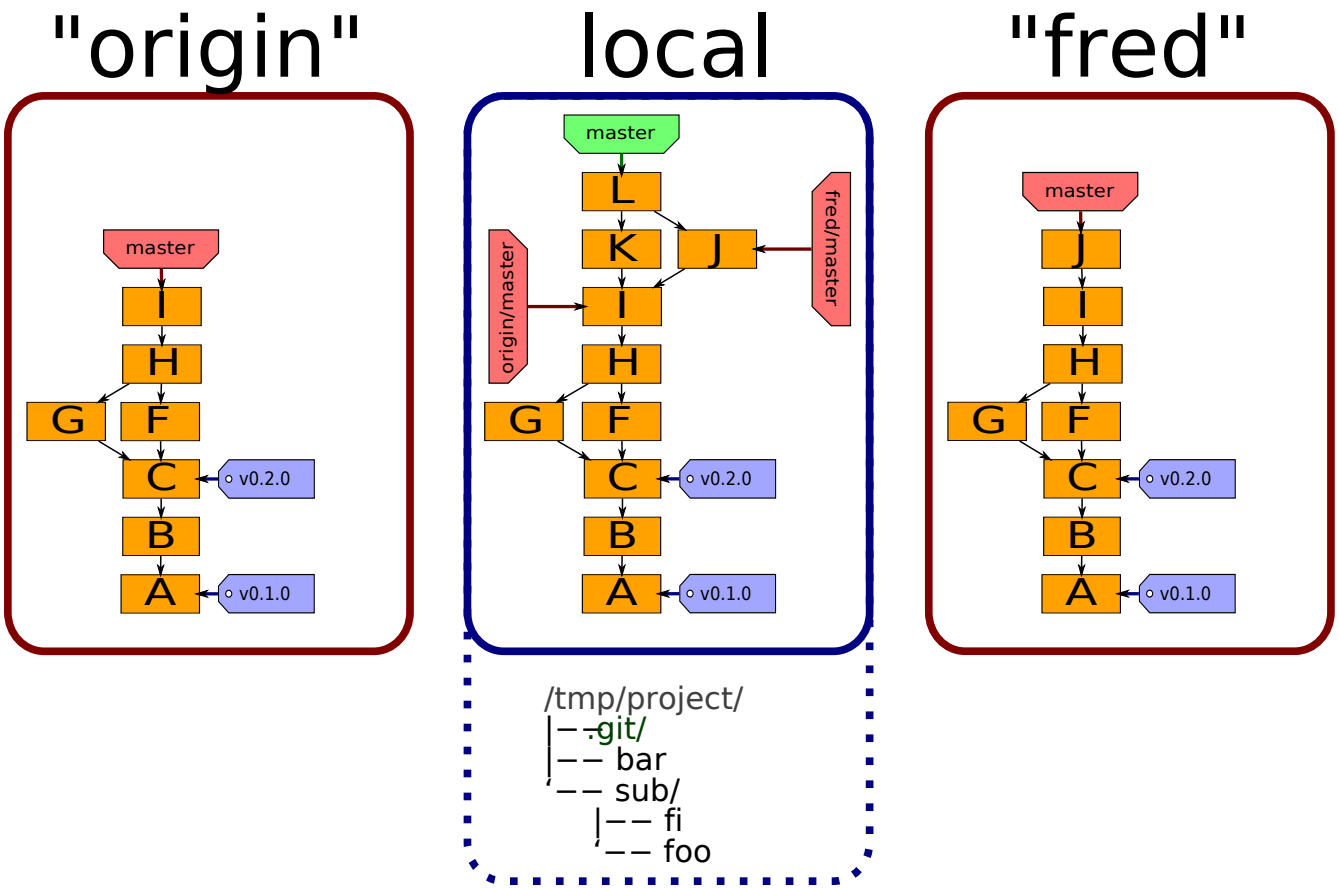

```
$ git checkout master
```

Working with remotes



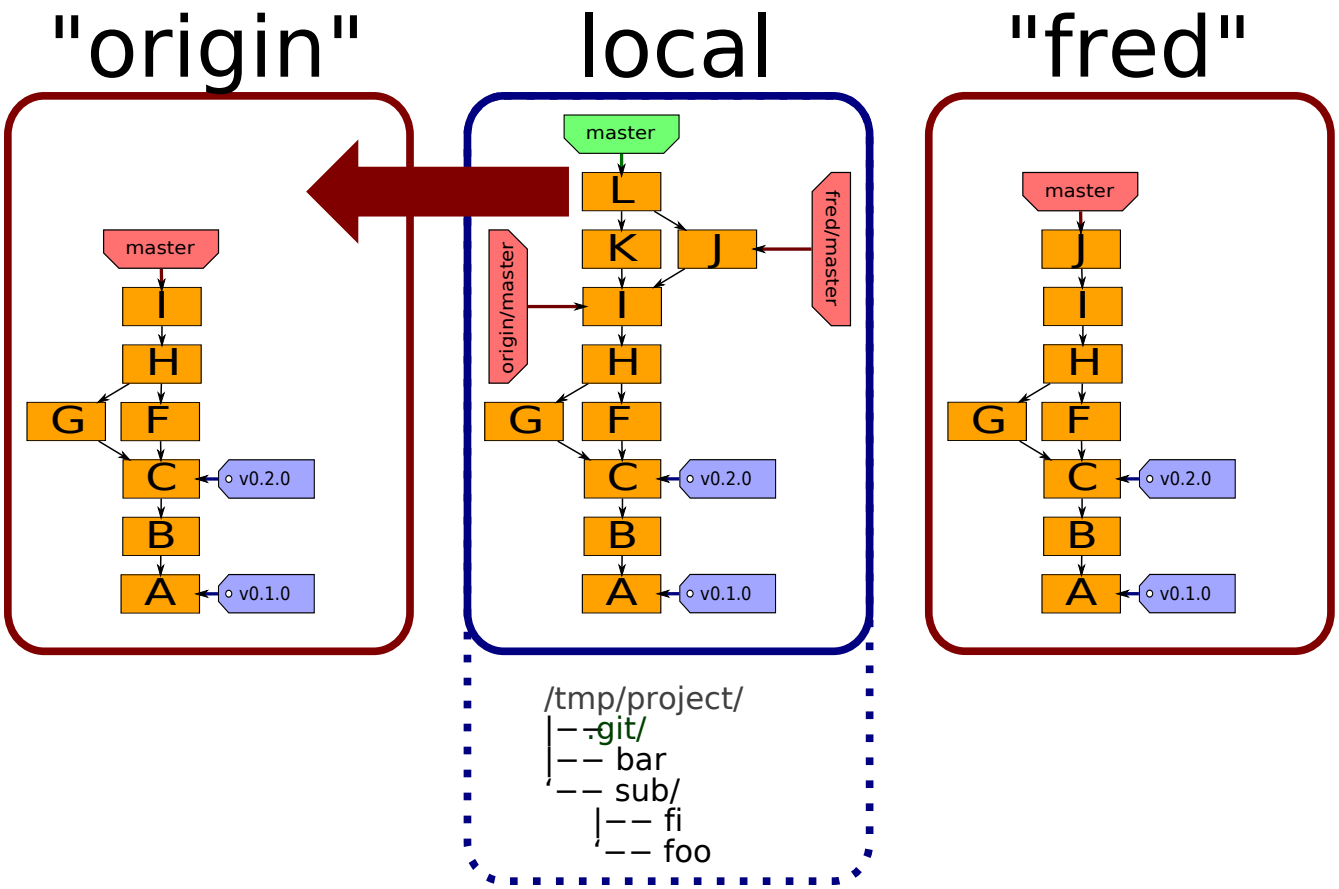

```
$ git checkout master
$ git merge fred-fix
```

Working with remotes




```
$ git checkout master
$ git merge fred-fix
$ git branch -d fred-fix
```

Working with remotes




```
$ git push
```


Bart Trojanowski, bart@jukie.net

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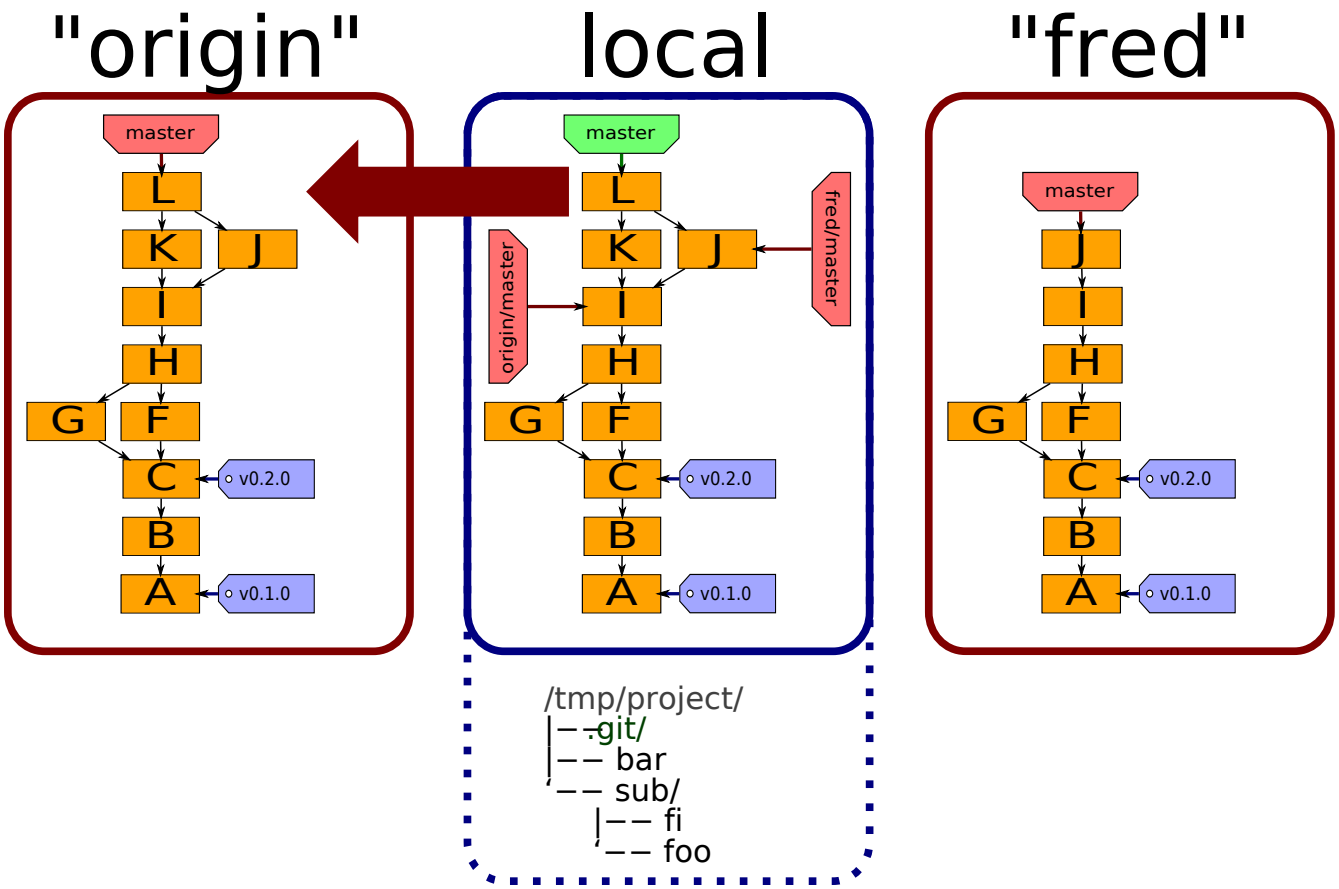
Working with remotes




```
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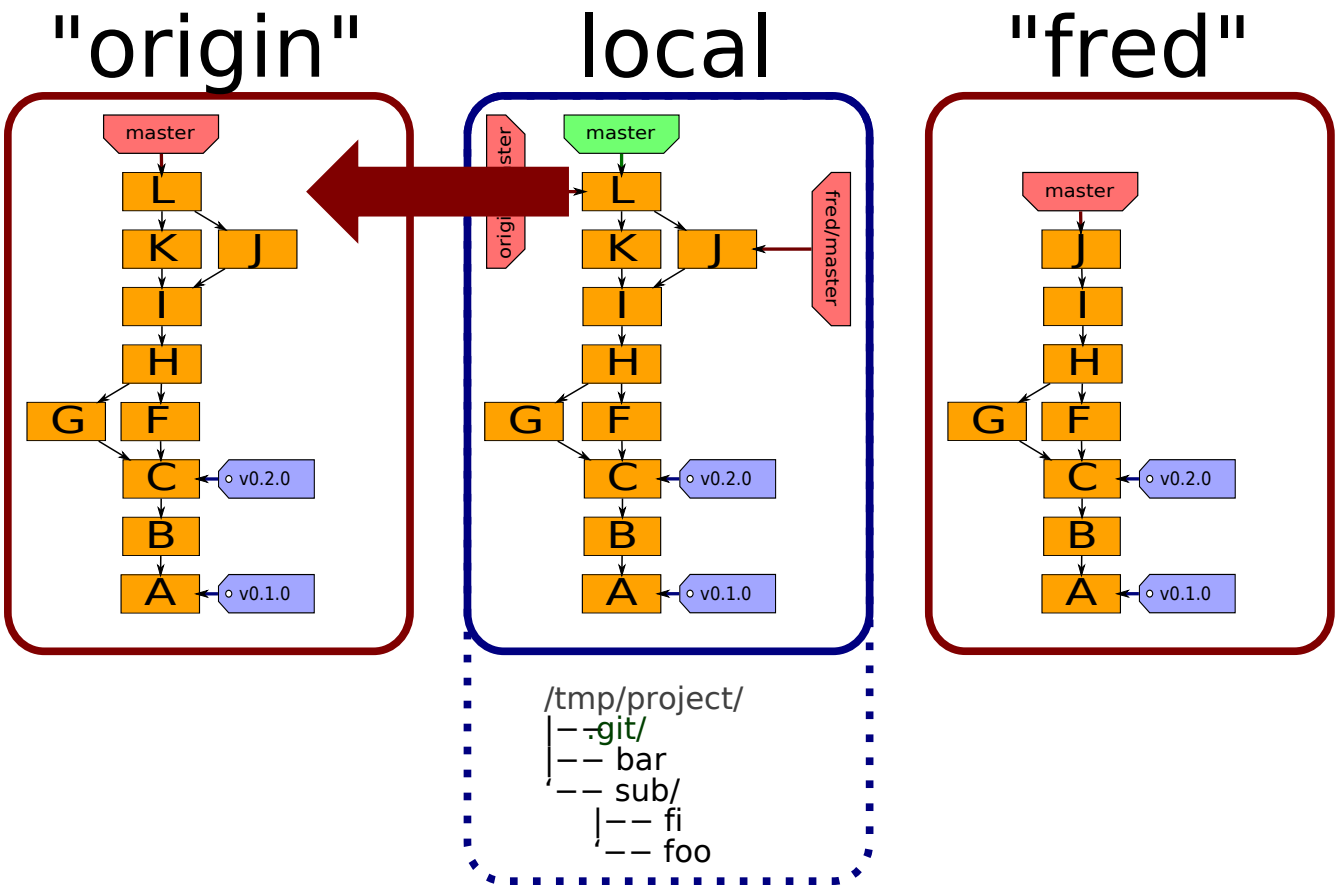
Working with remotes




```
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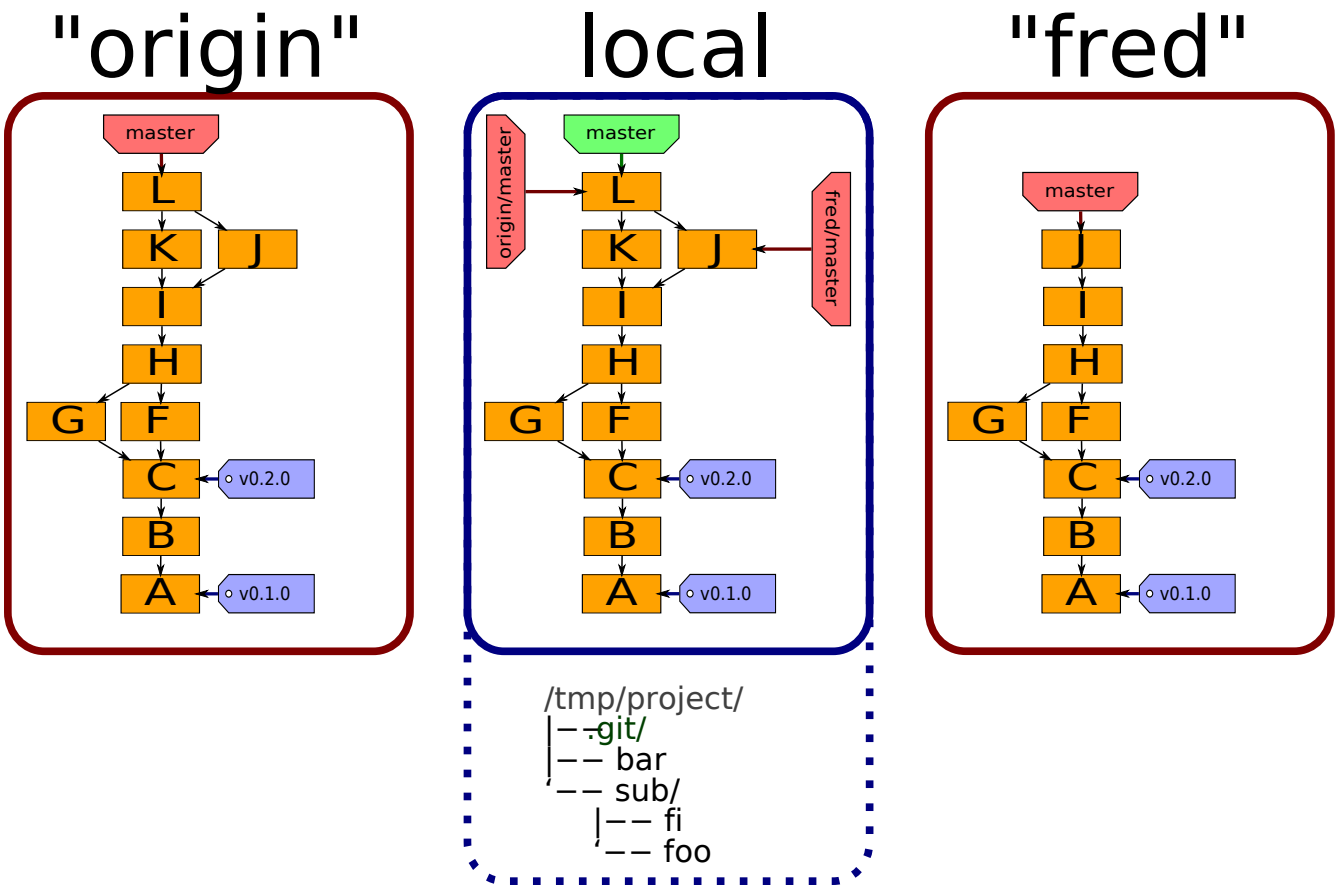
```

Working with remotes



Bart Trojanowski, bart@jukie.net

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Bart Trojanowski, bart@jukie.net

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GUI tools

- `gitk`
  sexy view of your revision tree
- `git gui`
  perform trivial tasks from a GUI
  ex: add/rm files, make commits, branch, etc

Bart Trojanowski, bart@jukie.net

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Bart Trojanowski, bart@jukie.net

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gitk

how sexy?

Bart Trojanowski, bart@jukie.net

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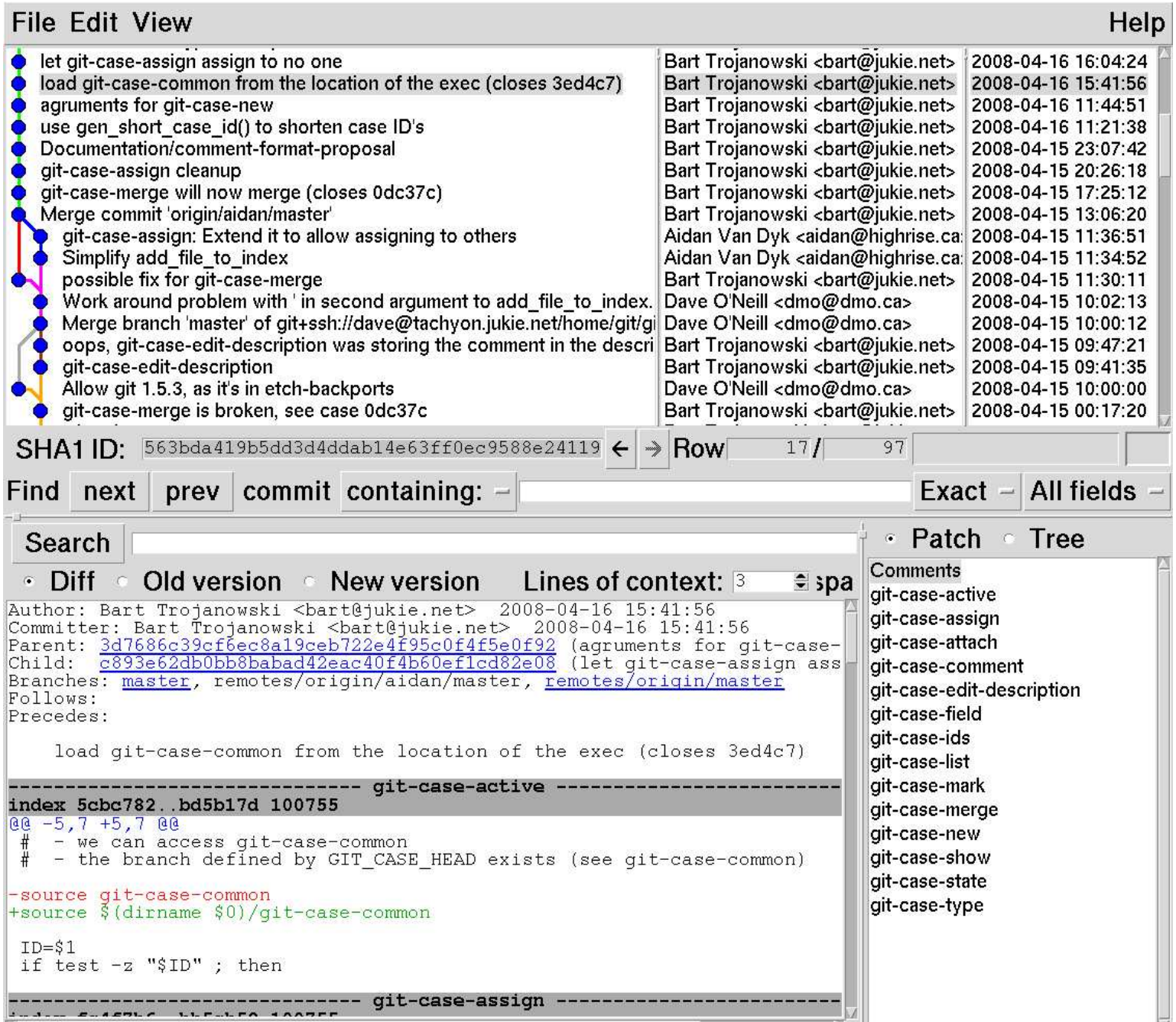
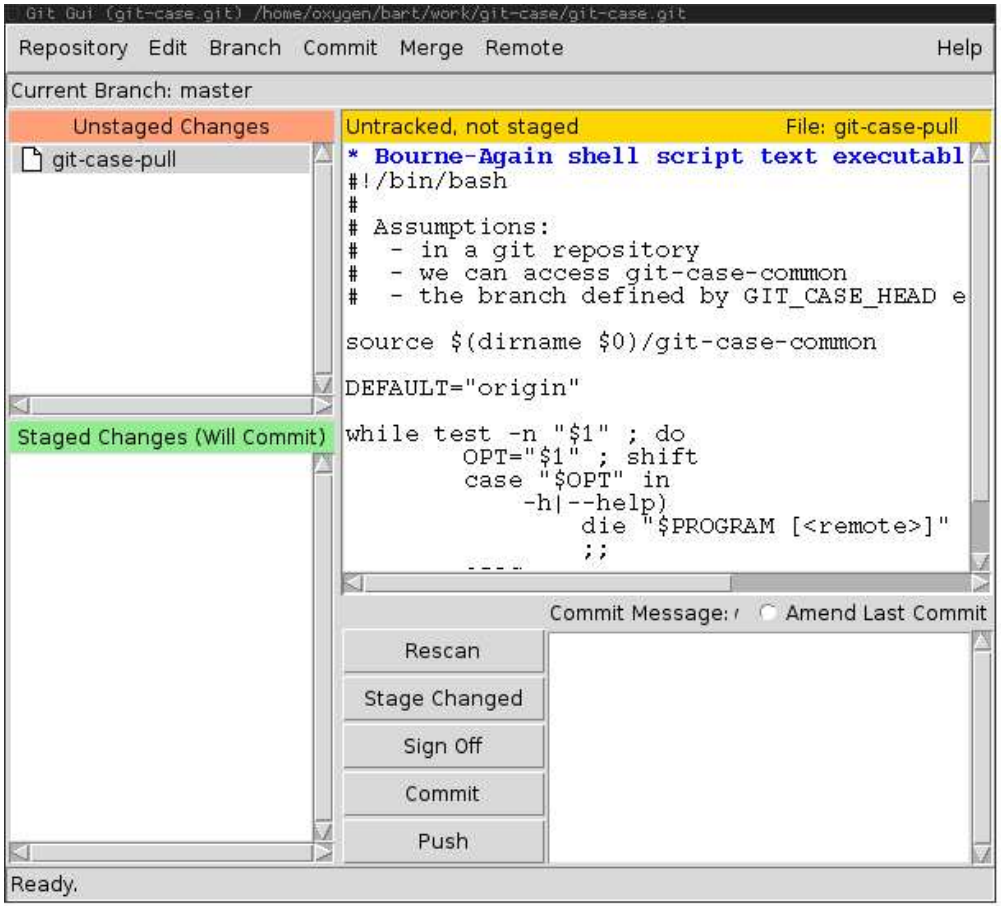
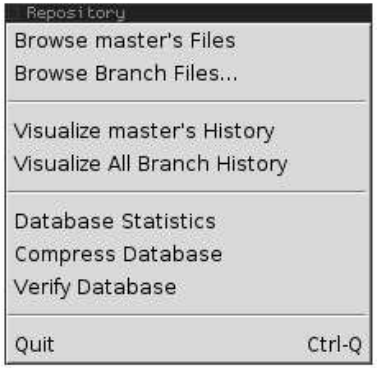
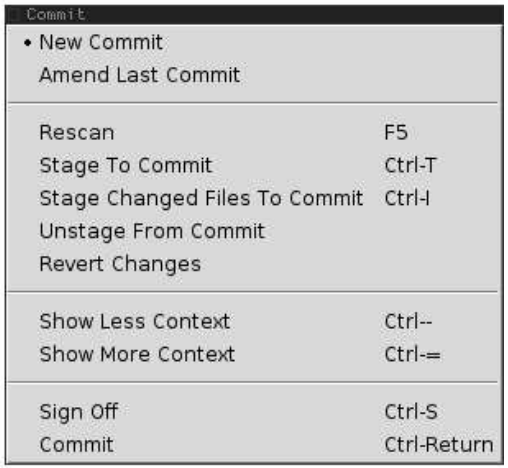
gitk

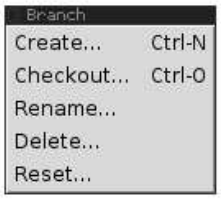

File Edit View
Help
let git-case-assign assign to no one
load git-case-common from the location of the exec (closes 3ed4c7)
agruments for git-case-new
use gen_short_case_id() to shorten case ID's
Documentation/comment-format-proposal
git-case-assign cleanup
git-case-merge will now merge (closes 0dc37c)
Merge commit 'origin/aidan/master'
git-case-assign: Extend it to allow assigning to others
Simplify add_file_to_index
possible fix for git-case-merge
Work around problem with ' in second argument to add_file_to_index.
Merge branch 'master' of git+ssh://dave@tachyon.jukie.net/home/git/gi
oops, git-case-edit-description was storing the comment in the descri
git-case-edit-description
Allow git 1.5.3, as it's in etch-backports
git-case-merge is broken, see case 0dc37c
Bart Trojanowski <bart@jukie.net> 2008-04-16 16:04:24
Bart Trojanowski <bart@jukie.net> 2008-04-16 15:41:56
Bart Trojanowski <bart@jukie.net> 2008-04-16 11:44:51
Bart Trojanowski <bart@jukie.net> 2008-04-16 11:21:38
Bart Trojanowski <bart@jukie.net> 2008-04-15 23:07:42
Bart Trojanowski <bart@jukie.net> 2008-04-15 20:26:18
Bart Trojanowski <bart@jukie.net> 2008-04-15 17:25:12
Bart Trojanowski <bart@jukie.net> 2008-04-15 13:06:20
Aidan Van Dyk <aidan@highrise.ca> 2008-04-15 11:36:51
Aidan Van Dyk <aidan@highrise.ca> 2008-04-15 11:34:52
Bart Trojanowski <bart@jukie.net> 2008-04-15 11:30:11
Dave O'Neill <dmo@dmo.ca> 2008-04-15 10:02:13
Dave O'Neill <dmo@dmo.ca> 2008-04-15 10:00:12
Bart Trojanowski <bart@jukie.net> 2008-04-15 09:47:21
Bart Trojanowski <bart@jukie.net> 2008-04-15 09:41:35
Dave O'Neill <dmo@dmo.ca> 2008-04-15 10:00:00
Bart Trojanowski <bart@jukie.net> 2008-04-15 00:17:20
SHA1 ID: 563bda419b5dd3d4ddab14e63ff0ec9588e24119
Row 17 / 97
Find next prev commit containing:
Exact
All fields
Search
Diff
Old version
New version
Lines of context: 3
Patch
Tree
Author: Bart Trojanowski <bart@jukie.net> 2008-04-16 15:41:56
Committer: Bart Trojanowski <bart@jukie.net> 2008-04-16 15:41:56
Parent: 3d7686c39cf6ec8a19ceb722e4f95c0f4f5e0f92 (agruments for git-case-
Child: c893e62db0bb8babad42eac40f4b60ef1cd82e08 (let git-case-assign ass
Branches: master, remotes/origin/aidan/master, remotes/origin/master
Follows:
Precedes:
load git-case-common from the location of the exec (closes 3ed4c7)
git-case-active
index 5cbc782..bd5b17d 100755
@@ -5,7 +5,7 @@
# - we can access git-case-common
# - the branch defined by GIT_CASE_HEAD exists (see git-case-common)
-source git-case-common
+source $(dirname $0)/git-case-common
ID=$1
if test -z "$ID" ; then
git-case-assign
Comments
git-case-active
git-case-assign
git-case-attach
git-case-comment
git-case-edit-description
git-case-field
git-case-ids
git-case-list
git-case-mark
git-case-merge
git-case-new
git-case-show
git-case-state
git-case-type

git-gui









Bart Trojanowski, bart@jukie.net

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Bart Trojanowski, bart@jukie.net

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Remember *loose objects ?*

Bart Trojanowski, bart@jukie.net

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Loose objects

.git/objects

```
|-- 23
|   `-- d4bd826aba9e29aaace9411cc175b784edc399
|-- 76
|   `-- 49f82d40a98b1ba59057798e47aab2a99a11d3
|-- c4
|   `-- aaefaa8a48ad4ad379dc1002b78f1a3e4ceabc
|-- e7
|   `-- 4be61128eef713459ca4e32398d689fe80864e
|-- info
|   `-- packs
`-- pack
    |-- pack-b7b026b1a0b0f193db9dea0b0d7367d25d3a68cc.idx
    `-- pack-b7b026b1a0b0f193db9dea0b0d7367d25d3a68cc.pack
```


Bart Trojanowski, bart@jukie.net

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Loose objects

```
$ git gc
Counting objects: 636, done.
Compressing objects: 100% (635/635), done.
Writing objects: 100% (636/636), done.
Total 636 (delta 486), reused 0 (delta 0)
Removing duplicate objects: 100% (256/256), done.
```

- GC happens automatically when you get to 6700 objects (configurable)

Bart Trojanowski, bart@jukie.net

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Loose objects

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Removing duplicate objects: 100% (256/256), done.
```

- GC happens automatically
  when you get to 6700 objects
  (configurable)

Bart
Trojanowski,
bart@jukie.net

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Stash

Bart Trojanowski, bart@jukie.net

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Stashing

- you're hacking
- got debug code you don't want to commit
- need to work on something else

Bart Trojanowski, bart@jukie.net

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Bart Trojanowski, bart@jukie.net

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Stashing

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- got debug code you don't want to commit
- need to work on something else

Bart Trojanowski, bart@jukie.net

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Stashing

- `git stash “description”`
- do that other thing
- `git stash apply`

Bart Trojanowski, bart@jukie.net

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Bart Trojanowski, bart@jukie.net

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Bart Trojanowski, bart@jukie.net

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Git the basics

Bart Trojanowski, bart@jukie.net

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Further reading

git.or.cz

git.or.cz/gitwiki

GitCasts.com

(Scott Chacon)

Bart Trojanowski, bart@jukie.net

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git.or.cz/gitwiki

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Bart Trojanowski, bart@jukie.net

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Further reading

http://www.jukie.net/~bart/blog/

git://tachyon.jukie.net/intro-to-git.git/

Bart Trojanowski, bart@jukie.net

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Bart Trojanowski, bart@jukie.net

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Thank you.

Bart Trojanowski, bart@jukie.net

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Q & A

Bart Trojanowski, bart@jukie.net

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