Understanding Git with Alloy

Milestone 1

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Version Control System

What is a VCS?

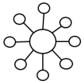
- Records changes on files over time
- Recall old versions of files

Local VCS

No collaboration with others users - RCS

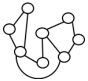
Centralized VCS

All files are stored on a central server - CVS, Subversion, Perfomance



Distributed VCS

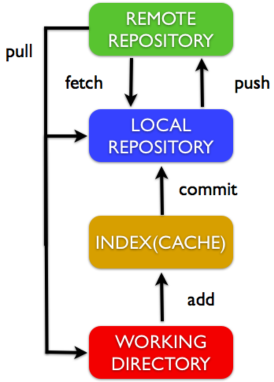
Each client has a mirror of the repository - Git, Mercurial, Bazaar, Darcs



Git in a nutshel

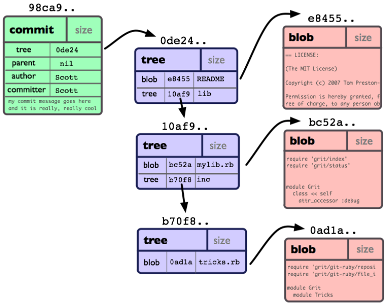
- It was created in 2005 by Linus Torvalds
- Distributed Version Control System
- Simple, Fast, Efficient
- It keeps snapshots, not differences
- Operations with branches are very cheap

Git simplified workflow



The Git Object Model

- Similar to a filesystem
- Each git object is named by a sha
- Blob stores the content of a file
- Tree references a set of others trees and blobs
- Commit points to a single tree
- Commit can have more than one parent



Project Goals

- Build a precise model of how Git works
- Analyze the model
- Check which properties the model does (not) guarantee
- Compare to other systems
- Build a concise user manual based on the model

What has been done so far

First Approach

- Model Working Directory
- Model Index
- Model Object Model
    - Hash is modeled implicitly

First Approach - Object Model

```
sig Sha{}
sig State{}

abstract sig Object {
   namedBy : Sha one -> State
}

sig Blob extends Object{
   blobs: set State
}

sig Tree extends Object {
   references:(Tree+Blob) some-> State,
   trees: set State
}

sig Commit extends Object{
   points : Tree one -> State,
   parent : Commit set -> State,
   commits: set State
}

sig RootCommit extends Commit{}
```

```
abstract sig WDObject{
   wdparent: Dir lone -> State,
   wdobjects: set State
}

sig File extends WDObject{
   content: Sha lone-> State
}

sig Dir extends WDObject{}

one sig Root extends Dir{}

one sig Index{
   stage: Sha lone-> File -> State,
   indexes: set State
}
```

First Approach

Problems of the first approach

- Model got too complex when adding operations
- We need the name of the files and directories
- Some relations are not dynamic

What has been done so far

Second Approach

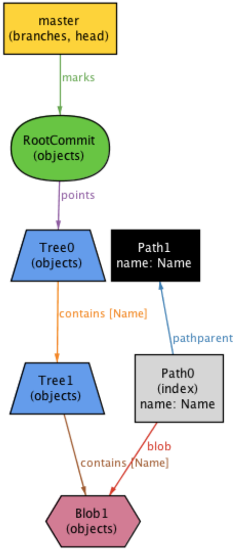
- Focus on Object Model and Index
- Files are associated with a path and a blob
- Object hash are the alloy atom's name

Second Approach - Object Model

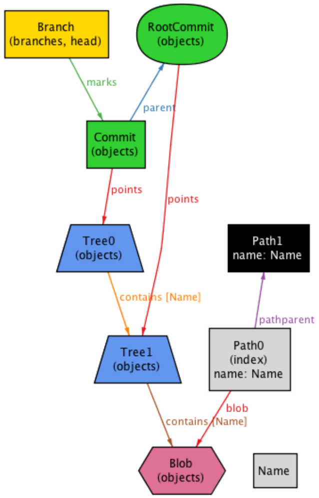
```
sig Name {}
sig State {}

abstract sig Object {
   objects: set State
}

sig Blob extends Object {}

sig Tree extends Object {
   contains: Name -> one(Tree+Blob)
}

sig RootCommit extends Commit {}

sig Commit extends Object {
   points: one Tree,
   parent: set Commit
}
```

```
sig Path {
   pathparent: lone Path,
   name: Name,
   blob:lone Blob,
   index: set State
}
```

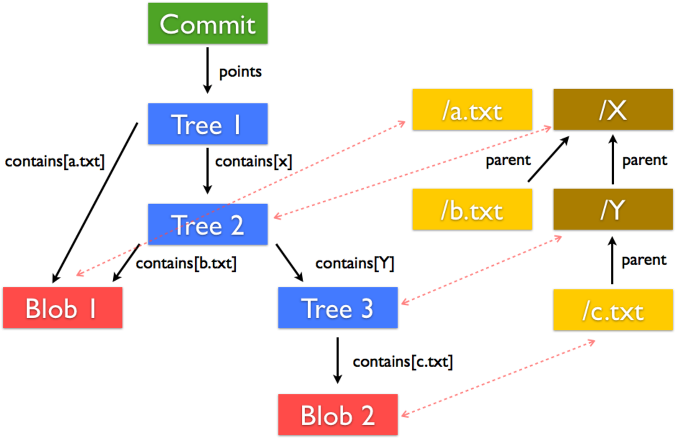
Instance - A single commit corresponding to an index



Instance - Commits sharing objects



Problems we are facing



Possible Solution

```
sig Commit extends Object {
   points : one Tree,
   parent : Commit set,
   abs: Object lone -> some Path
}
```

Future work

- Find a solution for the current problem (Suggestions?)
- Model some operations relatively to the remote repository
- Check some properties

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