

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 other users - RCS

Centralized VCS

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



Distributed VCS

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

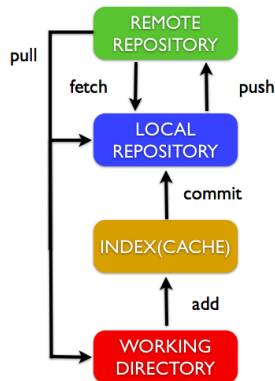


Git in a nutshell

- 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

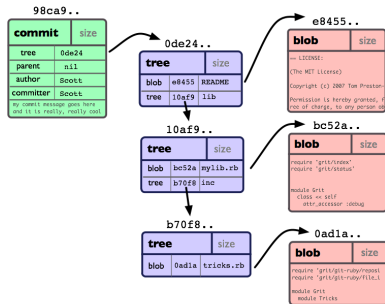


Git simplified workflow



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
 - Object's 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 WDBObject{
  wdparent: Dir lone → State,
  wdobjects: set State
}
```

```
sig File extends WDBObject{
  content: Sha lone→ State
}
```

```
sig Dir extends WDBObject{
  one sig Root extends Dir{}
```

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



First Approach

First approach problems

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



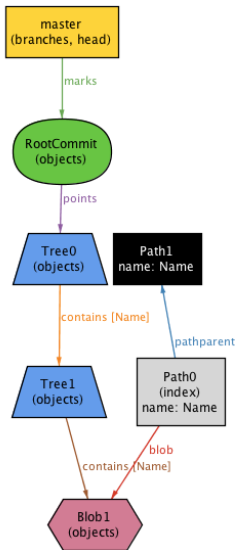
Second Approach - Object Model

```
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  
}
```

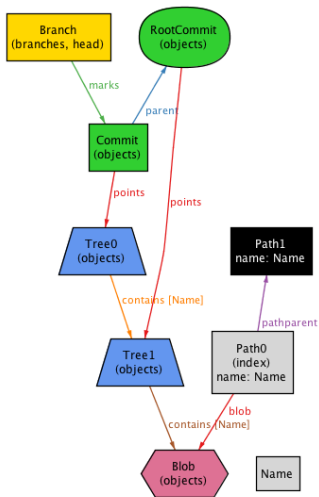
```
sig Path {  
  pathparent: lone Path,  
  name: Name,  
  blob: lone Blob,  
  index: set State  
}
```



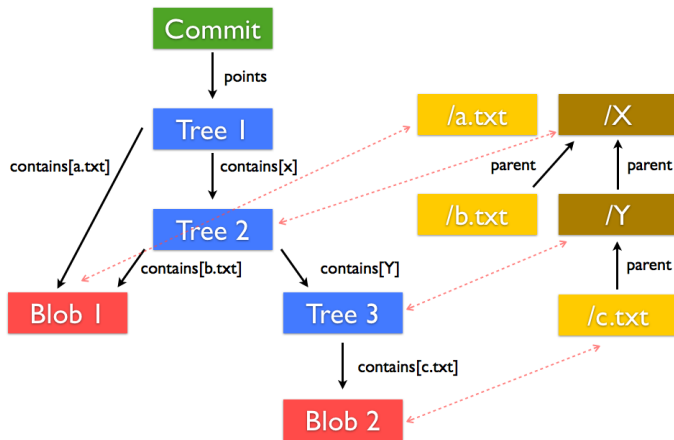
Instance - A single commit corresponding to an index



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 on the model

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



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