Modelling the Git core system with Alloy

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1 Introduction

1.1 Git

A version control system is a tool that records changes on your files over time. The main idea is to keep track of the changes on your files and to retrieve them later. There are mainly three kinds of version control system, local, centralized and distributed. On a local VCS it is not possible to collaborate with other users and the structure that keeps track of the files is kept only locally. The need for collaborations with other users brought the centralized VCS. On the centralized version control systems there exists a server that keeps track of the changes on the files and each user pulls and checks out files from this server. This approach has mainly two problems. The first is to have a single point of failure, if a server goes down during a certain time, nobody can check out or pull updates. The second problem is when you are not connected to the network, you cannot pull or commit your changes. To solve this problems, the distributed VCS appear. Here each user keeps a mirror of the repository and there is not a central server. An user can always commit and when connected can pull/checkout the changes.

Git is a distributed VCS. It was created in 2005 by Linus Torvalds, for the Linux kernel development. The main difference when comparing to others distributed VCS is that *git* keeps snapshots of how your system looks likes on a certain moment in time instead of keeping track of changes.

1.2 Motivation

Nowadays *git* is having great success, it is efficient, fast and in the begin it looks easy to understand and to use. When the users start diving into git, they are faced with a behavior that nobody can explain very well. There are not any formal or even informal specification of the operations, like what are the pre-requisites and what is the result of performing an operation. So normally the users when fronted with something they do not understand, they avoid it.

The purpose of this project is to formally model the *git* core using a tool called Alloy, analyse and model some *git* operations and then check which properties the model does (not) guarantee. This manual presents to