Project Management

Overview

- How to manage a project?
- What is software configuration management?
- Version control systems
- Issue tracking systems

What is Project Management?

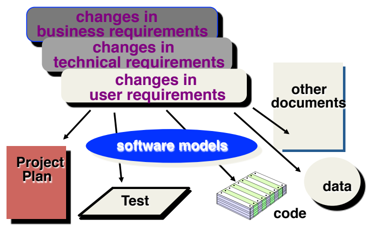
- Effective project management focuses on the 4 P's:
  - People: the most important element
    - recruiting, training, performance management
  - Product: the software to build
    - Project objectives, scope, alternative solutions
  - Process: define activities and tasks involved
    - Milestones, work products, QA points
  - Project: progress control
    - Planning, monitoring, controlling

The "First Law"

- **No matter where you are in the system life cycle, the system will change, and the desire to change it will persist throughout the life cycle.**

Bersoff, et al, 1980

What Are These Changes?


changes in business requirements
changes in technical requirements
changes in user requirements
other documents
software models
Project Plan
Test
code
data

Software Configuration Management (SCM)

- Definition
  - The task of tracking and controlling changes in software
- SCM repository
  - tools that allow developers to effectively manage changes
    - Version control system
    - Issue tracking system

Version Control System

What Is Version Control System?

- VCS, also known as Revision Control System
- To manage changes to documents, programs, large websites, and other collections of information
  – CVS, SVN, Mercurial, GIT

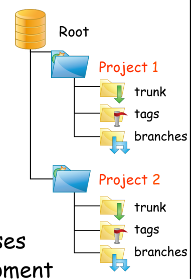
What Do We Mean by "Manage Changes" ?

- What changes have been made?
- Why are the changes made?
- Who makes the changes?
- Can we redo/undo some changes?
- Can we branch the project?

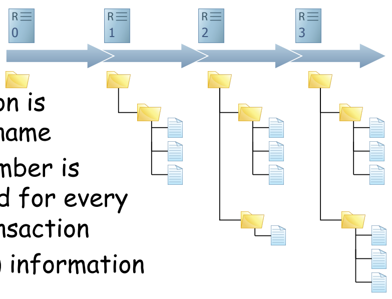
Subversion Version Control System (SVN)

Subversion Repository Layout

- One SVN server can hold many repositories
- One repository can hold many projects
- One project contains
  – Trunk: Main line of development
  – Tags: Markers to highlight notable revisions—major releases
  – Branches: Side lines of development



Each project has multiple revisions

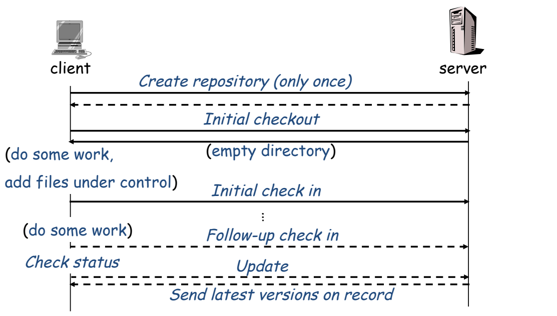


- Each revision is assigned a name
- Revision number is incremented for every commit transaction
- Delta (diff) information is recorded

Basic Features of a Repository

- Keep the history of all changes to files and directories
  - You can add in new versions
  - You can recover any previous version
- Access control
  - Read/write permission for users
- Logging
  - Author, date, and reason for a change

Typical Workflow



Additional Features

- Diff
- Branch
- Merge

Diff

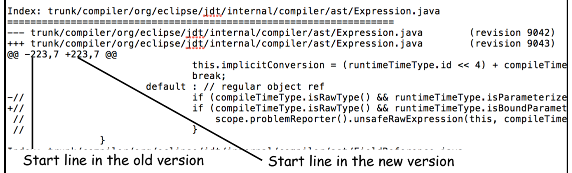
- To display the differences between two revisions
  - What has been changed?
  - Add or delete a line of text
  - No update, or move

```
Version 1:                  Version 2:
    x = 0;                      x = 1;
    y = 1;                      y = 1;
              Diff:
                 - x = 0;
                 + x = 1;
```

Key Points about Diff

- A key operation of version control systems
- A lot of features are based on diff
  - Save new versions
  - Recover a prior version
  - Patch
- We use Diff(v1, v2) to represent changes on v1 for v2
  - Diff(v1, v2) != Diff(v2, v1)

Diff: a Real Example



```
Index: trunk/compiler/org/eclipse/jdt/internal/compiler/ast/Expression.java
===================================================================
--- trunk/compiler/org/eclipse/jdt/internal/compiler/ast/Expression.java	(revision 9042)
+++ trunk/compiler/org/eclipse/jdt/internal/compiler/ast/Expression.java	(revision 9043)
@@ -223,7 +223,7 @@
 						this.implicitConversion = (runtimeTimeType.id << 4) + compileTime
 						break;
 					default : // regular object ref
-//						if (compileTimeType.isRawType() && runtimeTimeType.isParameterize
+//						if (compileTimeType.isRawType() && runtimeTimeType.isBoundParamet
 //						    scope.problemReporter().unsafeRawExpression(this, compileTime
 //						}
 				}
```

- svn diff –r v1:v2 filename
- "+": added lines, "-": deleted lines
- Some unchanged lines are shown to indicate program context

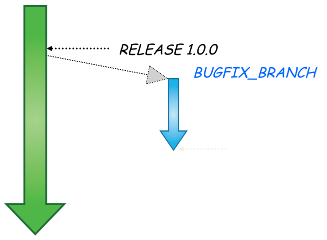
Changes Detected by Diff

- Addition/Deletion of directories
- Addition/Deletion of files
- A renamed file is reported as a separate addition and a separate deletion
- Addition/Deletion of lines

Branch

- Scenario
  - You deliver a great product to your customers: REL-1.0.0
  - Your development team continue adding new features on the trunk
  - Customers report a major bug in the product and ask for a fix
  - What do you do?

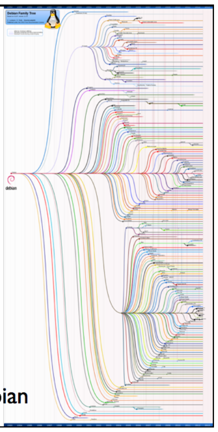
Branch and patch separately!



- svn copy path/to/trunk path/to/branch

Other reasons to branch

- Separate branches for
  - Tentative new features
  - Different products
  - Different teams
  - Different releases
- Where to put the major development, branch, trunk, both?


Debian

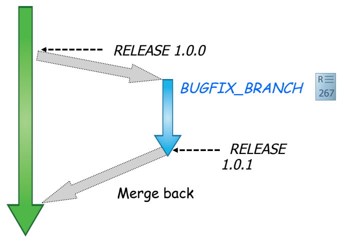
Pros and Cons of Branch

- Pros
  - Separation of concerns among teams and developers
  - Parallel version history without interference between branches
- Cons
  - Branches may diverge a lot
  - Hard to propagate changes across branches

Merge

- Scenario
  - After fixing the major bug on a branch, you have to apply the same/similar changes to the trunk
  - What do you do?

Merge back the patch!



- svn merge –reintegrate path/to/branch

What can happen when merging?

- Conflict
  - Two people edit the same file

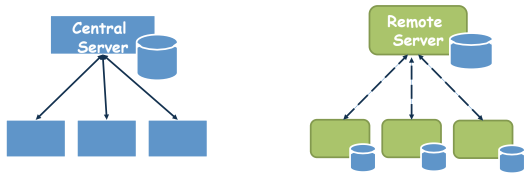
```
void f(int i) {
<<<<<<<< .mine
int j = 3;
========
int j = 4;
>>>>>>>> .r13
```

  - Resolve the conflict manually and checked in again

Distributed Version Control: GIT

- Everyone has their own local version control repository
  - Like a local branch of the project
  - Remote updates and commits are like branch merge
  - Local commits used to backup projects
  - Github allows developers to contribute by working on branches

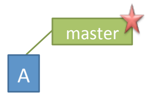
Centralized VC vs. Distributed VC[1]



Git Initialization [1]

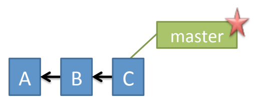
```
C:\> mkdir CoolProject
C:\> cd CoolProject
C:\CoolProject > git init
Initialized empty Git repository in C:/
CoolProject/.git
C:\CoolProject > notepad README.txt
C:\CoolProject > git add .
C:\CoolProject > git commit -m 'my first commit'
[master (root-commit) 7106a52] my first commit
 1 file changed, 1 insertion(+)
 create mode 100644 README.txt
C:\CoolProject > git remote add origin remote
repository URL
# Sets the new remote
C:\CoolProject > git push origin master
# Pushes the changes in your local repository to
the remote repository
```

Git Branch & Merge [1]



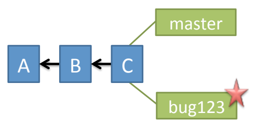
```
> git commit –m ‘my first commit’
```

Branches Illustrated [1]



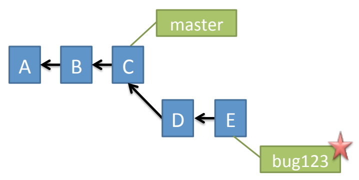
```
> git commit (x2)
```

Branches Illustrated [1]



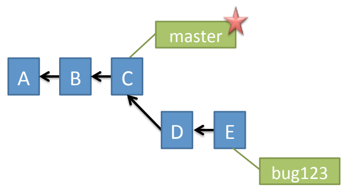
```
> git checkout -b bug123
```

Branches Illustrated



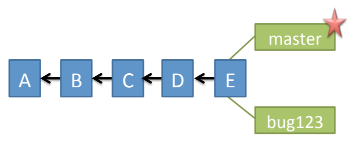
```
> git commit (x2)
```

Branches Illustrated



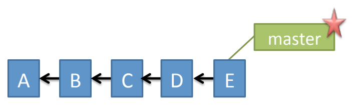
```
> git checkout master
```

Branches Illustrated



```
> git merge bug123
```

Branches Illustrated



Tips for Version Control

- Small commits
  - Check in logically relevant changes as a commit
- Write meaningful commit messages
  - Facilitate change understanding, applying, and reverting
- Avoid commit noise
  - Commit compliable or even deliverable code

Issue Tracking System

What Is Issue Tracking System?

- ITS, also known as trouble ticket system, support ticket, request management, or incident ticket system
- Manages and maintains lists of issues, as needed by an organization
  - To create, update, and resolve reported issues by customers or developers
  - Bugzilla, JIRA

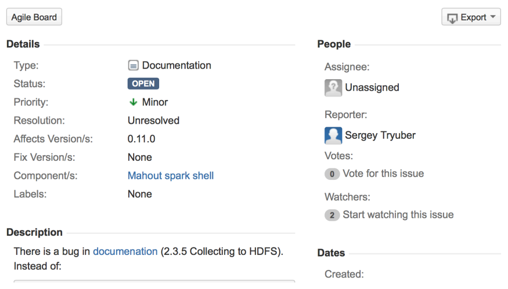
What Do We Mean by "Issues"?

- A unit of work to accomplish an improvement in a system
- It could be
  - a bug
  - a requested feature
  - a patch
  - missing documentation, …

Why Do We Need Issue Tracking?

- Developers need communication while making changes
  - Mailing List
    - Hard to manage, come with all other mails
    - Not well organized
  - Forum
    - Categorized by topic
    - Notify people when a reply is posted
    - No track to code and issue status

What Is Included in An Issue?



Details

Type:	Documentation
Status:	OPEN
Priority:	Minor
Resolution:	Unresolved
Affects Version/s:	0.11.0
Fix Version/s:	None
Component/s:	Mahout spark shell
Labels:	None

Description

There is a bug in documenation (2.3.5 Collecting to HDFS). Instead of:

People

Assignee:
Unassigned

Reporter:
Sergey Tryuber

Votes:
0 Vote for this issue

Watchers:
2 Start watching this issue

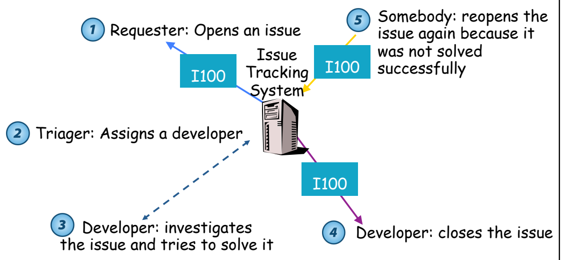
Dates

Created:

Basic Features

- Structurally describe issues
  - Solving status, severity levels
- Track status of the issue
- Assign a unique ID to each issue
  - Some system automates connection between commit and issue via issue ID

Typical Workflow


1 Requester: Opens an issue
5 Somebody: reopens the issue again because it was not solved successfully
I100
Issue Tracking System
I100
2 Triager: Assigns a developer
I100
3 Developer: investigates the issue and tries to solve it
4 Developer: closes the issue

Resolution of An Issue

- Fixed
  - A bug is fixed, a feature is added, a patch is applied
- Invalid
  - Bug cannot be reproduced, features do not make sense, patch is not correct
- Duplicate
  - It is a duplicate of an existing issue
  - Get merged with the other issue

Resolution of An Issue

- Won’t fix
  - The developers decide not to fix the bug or accommodate the new feature
  - Limited human resource, lack of essential information to reproduce a bug, lack of expertise

Issue Tracking & Version Control

- Many project hosting websites include issue tracking systems
  - Google Code
  - Github
  - BitBucket
  - Sourceforge

Reference

[1] Mark Groves, Introducing Git version control into your system, PPT