Version Control Systems with GIT

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What is Version Control System

- As name states Version Control System is the **“Management of changes to anything”.**

- Version Control is way of storing files in central location accessible to all team members and enabling them to keep track of changes being done in the source code by whom, when & why. It also help teams to recover from some inevitable circumstances.

A History Lesson

- Before Version Control System
  - File renaming
    - Login001.java
    - Login002.java
    - LoginFinal.java
  - Directories
    - June_Release_Code
    - August_Release_Code
  - Zip Files
    - Package_May.zip
    - Package_June.zip
  - Nothing at all

Version Control helps in

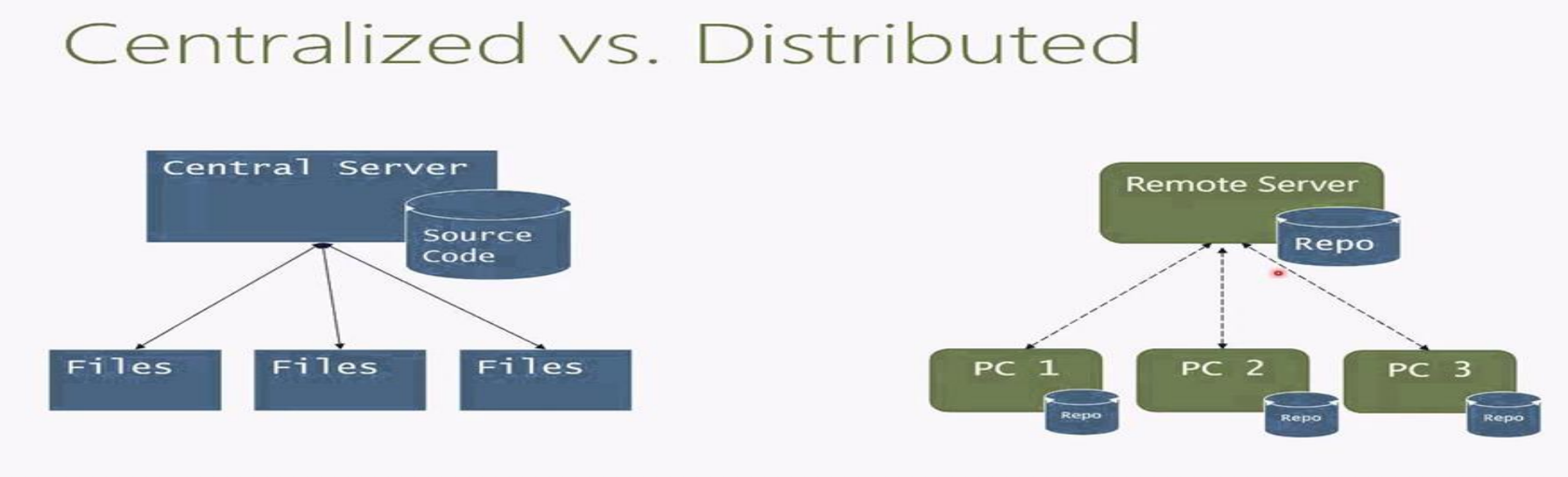
- Its not just for code, it also helps in
  - Backups & Restoration
  - Synchronization
  - Reverts
  - Track Changes
  - Most importantly in Parallel Development

Types of Version Control Systems

- Majorly VCS is divided into two parts:

  - Centralized Version Control System

  - Distributed Version Control System



Centralized Version Control System

- Traditional version control system
  - Server with database
  - Clients have a working version
- Examples
  - CVS
  - Subversion
  - Visual Source Safe
- Challenges
  - Multi-developer conflicts
  - Client/server communication

Distributed Version Control Syetem

- Every working checkout is a repository
- Get version control even when detached
- Backups are trivial
- Other distributed systems include
  - Mercurial
  - BitKeeper
  - Darcs
  - Bazaar

GIT History

- Linus uses BitKeeper to manage Linux code
- Ran into BitKeeper licensing issue
  - Liked functionality
  - Looked at CVS as how not to do things
- April 5, 2005 - Linus sends out email showing first version
- June 15, 2005 - Git used for Linux version control

GIT is not a SCM

Never mind merging. It's not an SCM, it's a distribution and archival mechanism. I bet you could make a reasonable SCM on top of it, though. Another way of looking at it is to say that it's really a content-addressable file system, used to track directory trees.

Linus Torvalds, 7 Apr 2005

Why GIT

- **Why Git:**

- **Branching:** gives developers a great flexibility to work on a replica of master branch.

- **Distributed Architecture:** The main advantage of DVCS is **“no requirement of network connections to central repository”** while development of a product.

- **Open-Source:** Free to use.

- **Integration with CI:** Gives faster product life cycle with even more faster minor changes.

GIT Installation

- GIT comes as default offering for all major Linux flavors
- Though you can download the installers from below link for Windows, Mac OS X, Linux, Solaris
  - https://git-scm.com/downloads
  - you can install same with yum too:
    - yum install git
- Installing GIT Bash on Windows

GIT Installation on Linux

- yum install autoconf libcurl-devel expat-devel gcc gettext-devel kernel-headers openssl-devel perl-devel zlib-devel –y

- Visit git release page - https://github.com/git/git/releases and pick desired version.

- curl -O -L https://github.com/git/git/archive/v2.14.0.tar.gz

- tar -zxvf v2.14.2.tar.gz

- cd git-v2.14.0
- make clean
- make configure
- ./configure --prefix=/usr/local
- make

- make install
- rm –rf /usr/bin/git
- ln -s /usr/local/bin/git /usr/bin/git

GIT VERSION

```
[root@user20-master plays]# git --version
git version 1.8.3.1
[root@user20-master plays]#
```

GIT HELP

```
kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (master)
$ git --help
usage: git [--version] [--help] [-C <path>] [-c name=value]
           [--exec-path[=<path>]] [--html-path] [--man-path] [--info-path]
           [-p | --paginate | --no-pager] [--no-replace-objects] [--bare]
           [--git-dir=<path>] [--work-tree=<path>] [--namespace=<name>]
           <command> [<args>]

These are common Git commands used in various situations:

start a working area (see also: git help tutorial)
   clone      Clone a repository into a new directory
   init       Create an empty Git repository or reinitialize an existing one

work on the current change (see also: git help everyday)
   add        Add file contents to the index
   mv         Move or rename a file, a directory, or a symlink
   reset      Reset current HEAD to the specified state
   rm         Remove files from the working tree and from the index

examine the history and state (see also: git help revisions)
   bisect     Use binary search to find the commit that introduced a bug
   grep       Print lines matching a pattern
   log        Show commit logs
   show       Show various types of objects
   status     Show the working tree status

grow, mark and tweak your common history
   branch     List, create, or delete branches
   checkout   Switch branches or restore working tree files
   commit     Record changes to the repository
   diff       Show changes between commits, commit and working tree, etc
   merge      Join two or more development histories together
   rebase     Reapply commits on top of another base tip
   tag        Create, list, delete or verify a tag object signed with GPG

collaborate (see also: git help workflows)
   fetch      Download objects and refs from another repository
   pull       Fetch from and integrate with another repository or a local branch
   push       Update remote refs along with associated objects

'git help -a' and 'git help -g' list available subcommands and some
concept guides. See 'git help <command>' or 'git help <concept>'
to read about a specific subcommand or concept.
```

Setting Identity in GIT

```
[root@Techlanders ~]# git config --global  user.email “raman.khanna@Techlanders.com”
[root@Techlanders ~]# git config --global  user.name “raman.khanna”
[root@Techlanders ~]# git config --global -l
user.name=Gagandeep Singh
user.email=Gagandeep.singh@Techlanders.com
[root@Techlanders ~]#
```

GIT Repository

- A **repository** is usually used to organize a single project.
- Repositories can contain folders and files, images, videos, spreadsheets, and data sets – anything your project needs.
- Repository is like a unique shared file system for a project.

Initializing a Repository

```
[root@master git]# mkdir /Repo1
[root@master git]# cd /Repo1/
[root@master Repo1]# git init
Initialized empty Git repository in /Repo1/.git/
[root@master Repo1]# ls -lrt /Repo1/.git/
total 12
drwxr-xr-x. 4 root root  31 Dec 19 19:32 refs
drwxr-xr-x. 2 root root  21 Dec 19 19:32 info
drwxr-xr-x. 2 root root 242 Dec 19 19:32 hooks
-rw-r--r--. 1 root root  73 Dec 19 19:32 description
drwxr-xr-x. 2 root root   6 Dec 19 19:32 branches
drwxr-xr-x. 4 root root  30 Dec 19 19:32 objects
-rw-r--r--. 1 root root  23 Dec 19 19:32 HEAD
-rw-r--r--. 1 root root  92 Dec 19 19:32 config
[root@master Repo1]#
```

Adding file to a Repository

```
[root@master Repo1]# git status
# On branch master
# Initial commit - nothing to commit (create/copy files and use "git add" to
track)
[root@master Repo1]# echo "File1 content" >> file1
[root@master Repo1]# ll
-rw-r--r--. 1 root root 14 Dec 19 19:35 file1
[root@master Repo1]# git add file1
[root@master Repo1]# git status
# On branch master
# Initial commit
# Changes to be committed:
#   (use "git rm --cached <file>..." to unstage)
#       new file:   file1
#
[root@master Repo1]#
```

Checking Repository Status

```
[root@user20-master Repo1]# touch file2
[root@user20-master Repo1]# git status
# On branch master
#
# Initial commit
#
# Changes to be committed:
#   (use "git rm --cached <file>..." to unstage)
#
#       new file:   file1
#
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#       file2
[root@user20-master Repo1]#
```

Committing changes to a Repository

```
[root@user20-master Repo1]# git add --all
[root@user20-master Repo1]# git status
# On branch master
#
# Initial commit
#
# Changes to be committed:
#   (use "git rm --cached <file>..." to unstage)
#
#       new file:   file1
#       new file:   file2
#
[root@user20-master Repo1]# git commit -m "Commit one - Added File1 & File2"
[master (root-commit) 9c301cb] Commit one - Added File1 & File2
 2 files changed, 1 insertion(+)
 create mode 100644 file1
 create mode 100644 file2
[root@user20-master Repo1]#
```

Committing changes to a Repository

```
[root@master Repo1]#echo "File2 content added" > file2
[root@master Repo1]#git status
# On branch master
# Changes not staged for commit:
#   (use "git add <file>..." to update what will be committed)
#   (use "git checkout -- <file>..." to discard changes in working directory)
#
#       modified:   file2
#
no changes added to commit (use "git add" and/or "git commit -a")
[root@master Repo1]#git commit -am "second commit - Changes done in File2"
[master 77de849] second commit - Changes done in File2
 1 file changed, 1 insertion(+)
[root@master Repo1]#
```

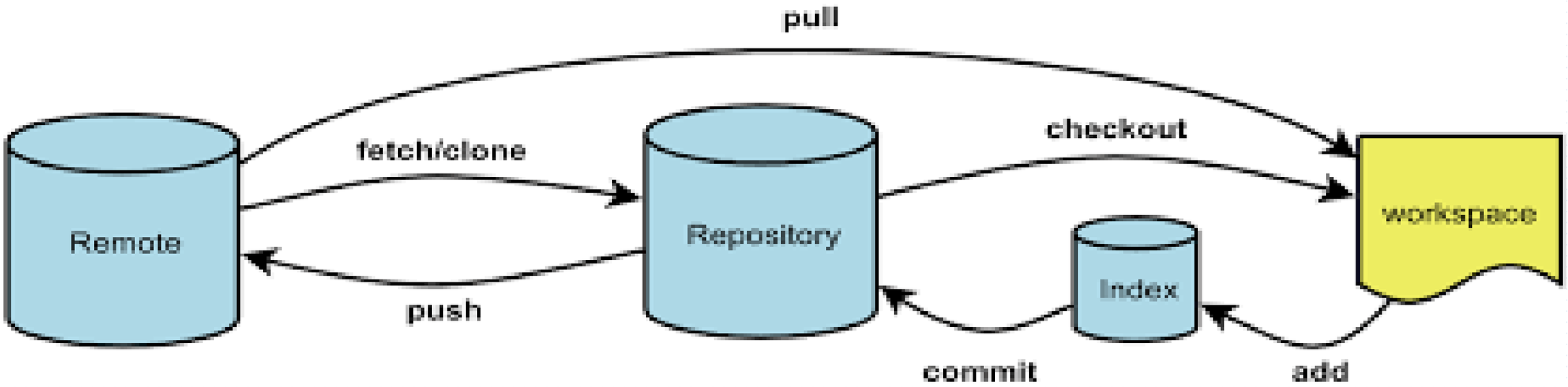
Git Log

```
[root@master Repo1]#git log
commit 77de8496c39c8d442d8e1212f9f3879a33253a1c
Author: admin.gagan@gmail.com <admin.gagan@gmail.com>
Date:   Wed Dec 19 19:48:56 2018 +0000

    second commit - Changes done in File2

commit 9c301cb93733f666e959a87c7a3f61142d1d9f48
Author: admin.gagan@gmail.com <admin.gagan@gmail.com>
Date:   Wed Dec 19 19:43:25 2018 +0000

    Commit one - Added File1 & File2
[root@master Repo1]#
```

Git Diff- Comparing two commits

```
[root@master Repo1]#git diff 9c301cb93733f666e959a87c7a3f61142d1d9f48
77de8496c39c8d442d8e1212f9f3879a33253a1c
diff --git a/file2 b/file2
index e69de29..de51b99 100644
--- a/file2
+++ b/file2
@@ -0,0 +1 @@
+File2 content added
[root@master Repo1]#
```

Git Flow



Initializing a Remote Repository

```
[root@master Repo1]#git remote add origin https://github.com/admingagan/repo1.git
[root@master Repo1]#
[root@master Repo1]#git pull origin master
From https://github.com/admingagan/repo1
 * branch            master     -> FETCH_HEAD
Merge made by the 'recursive' strategy.
 README.md |  1 +
 abc       |  0
 ntp.yaml  | 13 +++++++++++++
 3 files changed, 14 insertions(+)
 create mode 100644 README.md
 create mode 100644 abc
 create mode 100644 ntp.yaml
[root@master Repo1]#
```

Git Push

```
[root@master Repo1]#git push origin master
Username for 'https://github.com': admin.gagan@gmail.com
Password for 'https://admin.gagan@gmail.com@github.com':
Counting objects: 14, done.
Delta compression using up to 2 threads.
Compressing objects: 100% (9/9), done.
Writing objects: 100% (12/12), 1.22 KiB | 0 bytes/s, done.
Total 12 (delta 2), reused 0 (delta 0)
remote: Resolving deltas: 100% (2/2), completed with 1 local object.
To https://github.com/admingagan/ansibleplaybooks.git
   d9b5ae7..64bad4d  master -> master
[root@master Repo1]#
```

Git Pull

```
[root@master Repo1]#ls
abc  file1  file2  ntp.yaml  readme5 README.md

[root@master Repo1]#git pull origin dev
remote: Enumerating objects: 4, done.
remote: Counting objects: 100% (4/4), done.
remote: Compressing objects: 100% (2/2), done.
remote: Total 3 (delta 1), reused 0 (delta 0), pack-reused 0
Unpacking objects: 100% (3/3), done.
From https://github.com/admingagan/ansibleplaybooks
 * branch            dev        -> FETCH_HEAD
Merge made by the 'recursive' strategy.
 readme6 | 1 +
 1 file changed, 1 insertion(+)
 create mode 100644 readme6
[root@master Repo1]#ls
abc  file1  file2  ntp.yaml  readme5  readme6  README.md
[root@master Repo1]#
```

Git Clone

```
[root@user20-master git]# git clone https://github.com/admingagan/test.git
Cloning into 'test'...
remote: Enumerating objects: 23, done.
remote: Counting objects: 100% (23/23), done.
remote: Compressing objects: 100% (17/17), done.
remote: Total 23 (delta 5), reused 0 (delta 0), pack-reused 0
Unpacking objects: 100% (23/23), done.
[root@user20-master git]# cd test
[root@user20-master test]# ll
total 16
-rw-r--r--. 1 root root 10 Dec 20 07:45 Readme
-rw-r--r--. 1 root root 24 Dec 20 07:45 Readme2
-rw-r--r--. 1 root root 57 Dec 20 07:45 readme3
-rw-r--r--. 1 root root  9 Dec 20 07:45 README4
[root@user20-master test]#
```

GIT BRANCH

```
kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (master)
$ git branch
* master
```

```
kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (master)
$ git branch training

kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (master)
$ git branch
* master
  training
```

```
kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (master)
$ git branch -d training
Deleted branch training (was 74e76df).

kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (master)
$ git branch
* master
```

GIT CHECKOUT

```
kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (master)
$ git checkout training
Switched to branch 'training'

kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (training)
$ git checkout -b training_checkout
Switched to a new branch 'training_checkout'

kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (training_checkout)
$ git branch
  master
  training
* training_checkout
```

```
kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (training_checkout)
$ git log
commit 76e137f900eb33b7eb4a4ac7c81f160af8124697 (HEAD -> training_checkout)
Author: Kulbhushan Mayer <kulbhushan.mayer@thinknyx.com>
Date:   Fri Jun 9 20:38:59 2017 +0530

    commit in branch

commit 74e76dfcaf297ae9b63f950988907cdce8d275de (training, master)
Author: Kulbhushan Mayer <kulbhushan.mayer@thinknyx.com>
Date:   Thu Jun 8 23:16:16 2017 +0530

    second commit

commit 3eaadebb9972b29b7463822e99b485b9d9b490eb
Author: Kulbhushan Mayer <kulbhushan.mayer@thinknyx.com>
Date:   Thu Jun 8 23:14:06 2017 +0530

    my initial commit
```

GIT MERGE

```
kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (training_checkout)
$ git checkout master
Switched to branch 'master'

kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (master)
$

kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (master)
$ git merge training_checkout
Updating 74e76df..76e137f
Fast-forward
 file.txt | 2 ++
 1 file changed, 2 insertions(+)
```

- Make some changes in file.txt available in master and training
- Run git checkout master
- Run git merge training

```
kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (master)
$ git merge training
Auto-merging file.txt
CONFLICT (content): Merge conflict in file.txt
Automatic merge failed; fix conflicts and then commit the result.

kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (master|MERGING)
$ ls -ltr
total 2
-rw-r--r-- 1 kmayer 197121  30 Jun  9 20:51 file-in-training-branch.txt
-rw-r--r-- 1 kmayer 197121 238 Jun 12 20:47 file.txt
```

```
kmayer@mayer MINGW64 ~/thinknyx-repositories/repository-1 (master|MERGING)
$ git status
On branch master
You have unmerged paths.
  (fix conflicts and run "git commit")
  (use "git merge --abort" to abort the merge)

Unmerged paths:
  (use "git add <file>..." to mark resolution)

        both modified:   file.txt
```

GIT MERGE – Resolving Conflicts

```
1   Adding dummy data - Kulbhushan Mayer
2   Second Update
3
4   <<<<<<<< HEAD
5   Making changes in branch for demo
6
7   Making one more change - 09/06/2017 08:44
8
9   Making change at 08:46 PM
10  ==========
11  Making change to check merging - 12/06/2017
12  >>>>>>>> training
13
```

- <<<<<<< depicts changes from the HEAD or BASE branch
- ======= divides your changes form the other branch
- >>>>>>> depicts the end of changes
- Remove <<<<<<<, =======, >>>>>>> from the file and make then necessary changes
- Now you have to commit the changes explictly

```
1   Adding dummy data - Kulbhushan Mayer
2   Second Update
3
4
5   Making changes in branch for demo
6
7   Making one more change - 09/06/2017 08:44
8
9   Making change at 08:46 PM
10
11  Making change to check merging - 12/06/2017
12
```

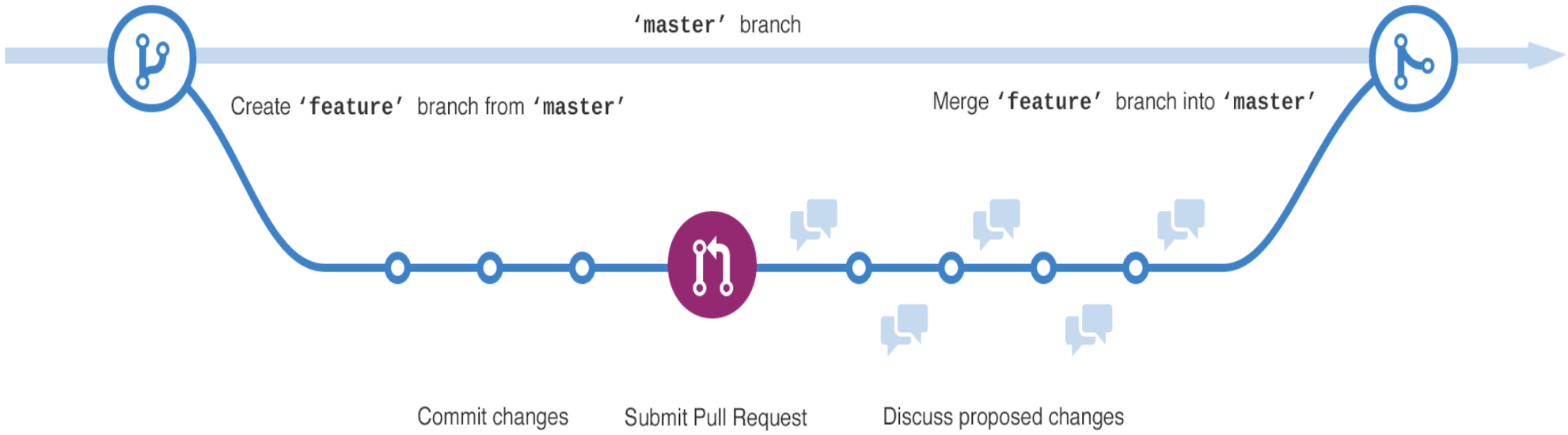
GIT Branch

- Branching is the way to work on different versions of a repository at one time.
- By default your repository has one branch named master which is considered to be the definitive branch.
- We use branches to experiment and make edits before committing them to master.
- When you create a branch off the master branch, you're making a copy, or snapshot, of master as it was at that point in time.
- If someone else made changes to the master branch while you were working on your branch, you could pull in those updates.

GIT Branch

Here you have:

- The master branch
- A new branch called feature (because we'll be doing 'feature work' on this branch)
- The journey that feature takes before it's merged into master



BitBucket/GitHub/GitLab

- **What is Bitbucket /GitHub/Gitlab?.**

- Bitbucket is a Git solution for professional teams. In simple layman language its a UI for Git, offered by Atlassian, similarly we have different available UI solutions from Github (most famous) and Gitlab.

- GitHub is a code hosting platform for version control and collaboration. It lets you and others work together on projects from anywhere.

- **Host in the cloud**: free for small teams (till 5 users) and paid for larger teams.

- **Host on Your server**: One-Time pay for most solutions.

- Visit "https://bitbucket.org/" and click "Get Started" to sign up for free account.
- Visit "https://github.com/" for Github details