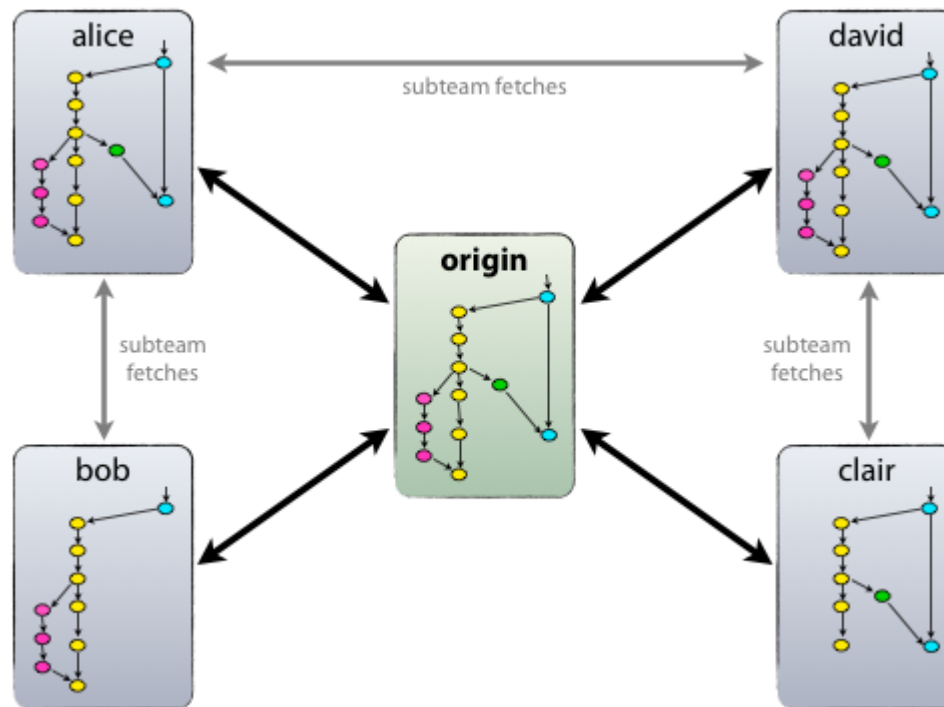


# Basic Git Tutorial

Ding Qian

# Version Control System

- Similar with SVN but more flexible for project involving multiple developers



# Version Control System

- Better control of your source code with Git
  - Clear picture of your development
  - Never worried about writing wrong code
  - Easier coordination with others
  - <http://git-scm.com/>

# Installation

- Linux (Ubuntu)
  - `sudo apt-get install git-core`
- Mac
  - Install `homebrew` first from <http://brew.sh>
  - `brew install git`
- Windows
  - Install `Cygwin` first, then you have a UNIX shell
  - Check supplementary notes
- Your own way...

# Initialization

- Create a local git repository : **git init**

```
qding at shb118 in ~/Workspace/csci4140
$ git init demo
Initialized empty Git repository in /home/qding/Workspace/csci4140/demo/.git/

qding at shb118 in ~/Workspace/csci4140
$ cd demo

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ █
```

same as

```
qding at shb118 in ~/Workspace/csci4140
$ mkdir demo

qding at shb118 in ~/Workspace/csci4140
$ cd demo

qding at shb118 in ~/Workspace/csci4140/demo
$ git init
Initialized empty Git repository in /home/qding/Workspace/csci4140/demo/.git/
```

# Working with Git

- **git status**

- Check the status of your git repository
- Use this command before critical changes like commit or push!!!

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git status
# On branch master
#
# Initial commit
#
nothing to commit (create/copy files and use "git add" to track)
```

# Working with Git

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ vim hello.c

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ ls
hello.c

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ make hello
cc      hello.c      -o hello

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ ls
hello hello.c

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ ./hello
Hello World
```

```
// hello.c
#include <stdlib.h>
#include <stdio.h>

int main()
{
    printf ("Hello World\n");
    return 0;
}
```

# Working with Git

- The status of each file
  - unstaged/untracked: file change not tracked by git
  - tracked/staged: file change tracked by git

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git status
# On branch master
#
# Initial commit
#
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#       hello
#       hello.c
nothing added to commit but untracked files present (use "git add" to track)
```



# Working with Git

- `git add <file_path>`
  - To add `unstaged/untracked` file to git repository
  - `hello.c` become `tracked/staged` now

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git add hello.c

qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git status
# On branch master
#
# Initial commit
#
# Changes to be committed:
#   (use "git rm --cached <file>..." to unstage)
#
#       new file:   hello.c
#
# Untracked files:
#   (use "git add <file>..." to include in what will be committed)
#
#       hello
```

# Working with Git

- `git add <dir_path>`
  - Add all file (recursively) in the directory to git repository
  - hello.c and hello become **tracked/staged now**

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git add .

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git status
# On branch master
#
# Initial commit
#
# Changes to be committed:
#   (use "git rm --cached <file>..." to unstage)
#
#       new file:   hello
#       new file:   hello.c
#
```

# Working with Git

- `git commit -m "commit message"`
  - Make the changes persistent as a commit

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git commit -m "this is the first commit"
[master (root-commit) 05247e3] this is the first commit
2 files changed, 9 insertions(+)
create mode 100755 hello
create mode 100644 hello.c

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git status
# On branch master
nothing to commit, working directory clean
```

# Working with Git

- **git log**
  - Check your commit history

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git log
commit 05247e3272450e5e22a8d91c46de26fd85cd9b1f
Author: DING QIAN <qding@cse.cuhk.edu.hk>
Date: Tue Jan 7 11:53:58 2014 +0800

    this is the first commit
```

commit  
hash key

author and  
date info

commit  
message

# Working with Git

- `git mv <old_file> <new_file>`
  - Rename `tracked` file or move to another directory
- `git rm <file_path>`
  - Delete `tracked` file

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git mv hello.c sample.c

qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git rm hello
rm 'hello'

qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git status
# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#       deleted:      hello
#       renamed:      hello.c -> sample.c
#
```

Similar to `git add`, the changes made by `git mv/rm` is `staged` by default, you can commit them directly

# Working with Git

- Commit again, now we have two commits

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git commit -m "rename srouce and delete exec"
[master 7934b48] rename srouce and delete exec
2 files changed, 0 insertions(+), 0 deletions(-)
delete mode 100755 hello
rename hello.c => sample.c (100%)

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git log
commit 7934b483a721aa649810b6ec00822f0f086688a1
Author: DING QIAN <qding@cse.cuhk.edu.hk>
Date: Tue Jan 7 12:05:06 2014 +0800

    rename srouce and delete exec

commit 05247e3272450e5e22a8d91c46de26fd85cd9b1f
Author: DING QIAN <qding@cse.cuhk.edu.hk>
Date: Tue Jan 7 11:53:58 2014 +0800

    this is the first commit
```

# Working with Git

- Let's modify sample.c

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ vim sample.c

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ 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:   sample.c
#
no changes added to commit (use "git add" and/or "git commit -a")
```

```
// hello.c
#include <stdlib.h>
#include <stdio.h>

int main()
{
    printf ("Hello World\n");
    printf ("Hello CUHK\n");
    return 0;
}
```

Similar to create a new file, after modifying a existing file in the repository, the change is **unstaged** by default, you need to use **git add** again to let git know you want to stage the change.

# Working with Git

- Let's commit the modified sample.c

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git add sample.c

qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git status
# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#       modified:   sample.c
#

qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git commit -m "add one more printf in sample.c"
[master 0d4d4fe] add one more printf in sample.c
1 file changed, 1 insertion(+)
```



# Working with Git

- Sometimes, you made some changes to your code, but you regretted. So how to rollback?
  - Case 1: the changed is **unstaged**

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ vim sample.c

qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ 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:   sample.c
#
no changes added to commit (use "git add" and/or "git commit -a")
```

# Working with Git

- Sometimes, you made some changes to your code, but you regretted. So how to rollback?
  - Case 1: the changed is **unstaged**
    - **git checkout -- <file\_path>**
  - This let you rollback to the lastest commit

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git checkout -- sample.c

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git status
# On branch master
nothing to commit, working directory clean
```

# Working with Git

- Sometimes, you made some changes to your code, but you regretted. So how to rollback?
  - Case 2: the changed is **staged**

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ vim sample.c

qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git add sample.c

qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git status
# On branch master
# Changes to be committed
#   (use "git reset HEAD <file>..." to unstage)
#
#       modified:   sample.c
#
```

# Working with Git

- Sometimes, you made some changes to your code, but you regretted. So how to rollback?
  - Case 2: the changed is **staged**
    1. `git reset HEAD <file_path>`
    2. `git checkout -- <file_path>`
  - You need one additional step to **unstage** first

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git reset HEAD sample.c
Unstaged changes after reset:
M      sample.c

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git checkout -- sample.c

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git status
# On branch master
nothing to commit, working directory clean
```

What if I don't  
unstage???

Try it yourself.

# Working with Git

- Sometimes, you made some changes to your code, but you regretted. So how to rollback?
  - Case 3: You want to rollback to previous commit, not the latest one

1. `git checkout <commit_hash> <file_path>`

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git log
commit 0d4d4fe6bc18ea95641232528faf4c7eea5944cb
Author: DING QIAN <qding@cse.cuhk.edu.hk>
Date: Tue Jan 7 13:04:48 2014 +0800
```

add one more printf in sample.c

```
commit 7934b483a721aa649810b6ec00822f0f086688a1
Author: DING QIAN <qding@cse.cuhk.edu.hk>
Date: Tue Jan 7 12:05:06 2014 +0800
```

rename srouce and delete exec

```
commit 05247e3272450e5e22a8d91c46de26fd85cd9b1f
Author: DING QIAN <qding@cse.cuhk.edu.hk>
Date: Tue Jan 7 11:53:58 2014 +0800
```

this is the first commit

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git checkout 7934b483a721aa649810b6ec00822f0f086688a1 sample.c
```

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
```

```
$ cat sample.c
#include <stdlib.h>
#include <stdio.h>
```

```
int main()
{
    printf ("Hello World\n");
    return 0;
}
```


# Working with Git

- Sometimes, you made some changes to your code, but you regretted. So how to rollback?
  - Case 3: You want to rollback to previous commit, not the latest one
  - By checkout, the changes are staged already

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git checkout 7934b483a721aa649810b6ec00822f0f086688a1 sample.c
```

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ cat sample.c
#include <stdlib.h>
#include <stdio.h>
```

```
int main()
{
    printf ("Hello World\n");
    return 0;
}
```

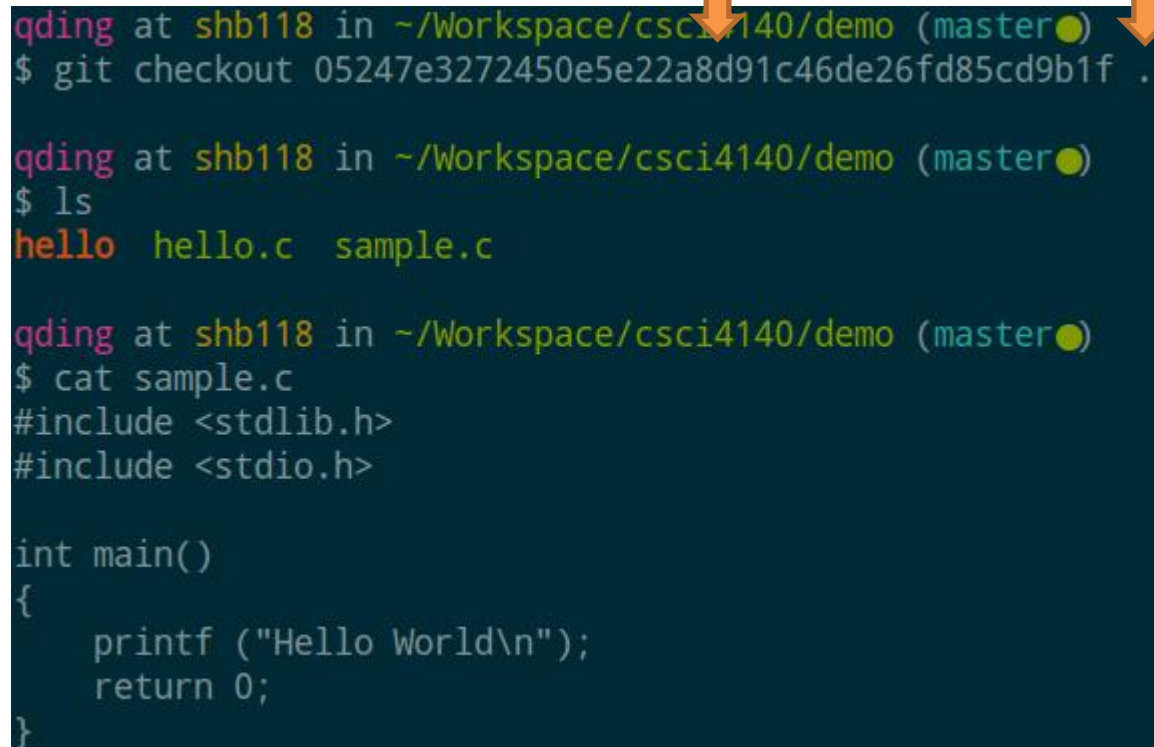


```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git status
# On branch master
# Changes to be committed:
#   (use "git reset HEAD <file>..." to unstage)
#
#       modified:   sample.c
#
```

# Working with Git

- Sometimes, you want to rollback your entire directory to a previous commit

– `git checkout <commit_hash> <dir>`



A terminal window showing a git checkout command being executed. The command is `git checkout 05247e3272450e5e22a8d91c46de26fd85cd9b1f .`. The output shows the directory listing and the content of the `sample.c` file. Two orange arrows point from the `<commit_hash>` and `<dir>` placeholders in the command above to the corresponding parts of the command in the terminal. A green arrow points from the explanatory text on the right to the dot in the command.

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git checkout 05247e3272450e5e22a8d91c46de26fd85cd9b1f .

qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ ls
hello hello.c sample.c

qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ cat sample.c
#include <stdlib.h>
#include <stdio.h>

int main()
{
    printf ("Hello World\n");
    return 0;
}
```

Don't forget  
this dot, it  
specifies the  
directory you  
want to rollback

# Synchronize with remote server

- Clone a remote git repository tracking central server: **git clone <url>**

```
qding at shb118 in ~/Workspace/csci4140
$ git clone ssh://52ca85355973ca990000042e@php-zie.rhcloud.com/~/.git/php.git/
Cloning into 'php'...
remote: Counting objects: 25, done.
remote: Compressing objects: 100% (20/20), done.
remote: Total 25 (delta 1), reused 20 (delta 0)
Receiving objects: 100% (25/25), 19.48 KiB, done.
Resolving deltas: 100% (1/1), done.

qding at shb118 in ~/Workspace/csci4140
$ cd php

qding at shb118 in ~/Workspace/csci4140/php (master)
$ ls
libs  misc  php  deplist.txt  README

qding at shb118 in ~/Workspace/csci4140/php (master)
$ █
```



# Synchronize with remote server

- Once you commit your changes, you can push your local commits to the remote server by  
– **git push**

```
qding at shb118 in ~/Workspace/csci4140/php (master)
$ git push
Counting objects: 7, done.
Delta compression using up to 4 threads.
Compressing objects: 100% (3/3), done.
Writing objects: 100% (4/4), 372 bytes, done.
Total 4 (delta 1), reused 0 (delta 0)
remote: Not stopping cartridge zend because hot deploy is enabled
remote: Building git ref 'master', commit bcef8a4
remote: Preparing build for deployment
remote: Deployment id is 719a42d6
remote: Activating deployment
remote: Not starting cartridge zend because hot deploy is enabled
remote: Result: success
remote: Activation status: success
remote: Deployment completed with status: success
To ssh://52ca85355973ca990000042e@php-zie.rhcloud.com/~/.git/php.git/
a84e249..bcef8a4  master -> master
```

# Synchronize with remote server

- If another developer also tracking this repo, he can get your update via

– **git pull**

```
qding at shb118 in /tmp/php (master)
$ git pull
remote: Counting objects: 7, done.
remote: Compressing objects: 100% (4/4), done.
Unpacking objects: 100% (4/4), done.
remote: Total 4 (delta 1), reused 0 (delta 0)
From ssh://php-zie.rhcloud.com/~git/php
     bcef8a4..62ca251  master      -> origin/master
Updating bcef8a4..62ca251
Fast-forward
 php/index.php | 2 ++
 1 file changed, 2 insertions(+)
```

# Advanced Techniques

- `git diff <file_path>`
  - Get the difference between your working copy and the latest commit

```
qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git diff sample.c
diff --git a/sample.c b/sample.c
index 481e18e..3923151 100644
--- a/sample.c
+++ b/sample.c
@@ -4,7 +4,7 @@
 int main()
 {
     printf ("Hello World\n");
-    printf ("Hello CUHK\n");
+    printf ("Hello CUHK CSE\n");
     return 0;
 }
```

# Advanced Techniques

- **.gitignore file**
  - Let git ignores and never tracks particular file types or files
  - create a hidden file named “.gitignore” under your repository
  - Each line in the .gitignore file named a type or a file that will be ignored

# Advanced Techniques

- **.gitignore file**

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
```

```
$ ls
```

```
sample  sample.c
```

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
```

```
$ git status
```

```
# On branch master
```

```
# Untracked files:
```

```
#   (use "git add <file>..." to include in what will be committed)
```

```
#
```

```
#       sample
```

```
nothing added to commit but untracked files present (use "git add" to track)
```

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
```

```
$ echo "sample" > .gitignore
```

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
```

```
$ git status
```

```
# On branch master
```

```
# Untracked files:
```

```
#   (use "git add <file>..." to include in what will be committed)
```

```
#
```

```
#       .gitignore
```

```
nothing added to commit but untracked files present (use "git add" to track)
```

# Advanced Techniques

- **.gitignore file**

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git add .gitignore

qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git commit -m "add .gitignore file"
[master 58f2118] add .gitignore file
1 file changed, 1 insertion(+)
create mode 100644 .gitignore

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ ls
sample sample.c

qding at shb118 in ~/Workspace/csci4140/demo (master)
$ git status
# On branch master
nothing to commit, working directory clean
```

```
./.gitignore file
*.o
img/
sample
*.c
```

# Advanced Techniques

- Config your git with your username, email, customized log style
  - `git config --global user.name "John"`
  - `git config --global user.email "abc@example.com"`
  - `git config --global alias.lg "log --color --graph --pretty=format:'%Cred%h%Creset -%C(yellow)%d%Creset %s %Cgreen(%cr) %C(bold blue)<%an>%Creset' --abbrev-commit --"`

```
qding at shb118 in ~/Workspace/csci4140/demo (master●)
$ git lg
* 0d4d4fe - (HEAD, master) add one more printf in sample.c (66 minutes ago) <DING QIAN>
* 7934b48 - rename srouce and delete exec (2 hours ago) <DING QIAN>
* 05247e3 - this is the first commit (2 hours ago) <DING QIAN>
```

These short hash values can also  
be used with `git checkout`

# Advanced Techniques

- A successful Git branching model
  - <http://nvie.com/posts/a-successful-git-branching-model/>
- Basic branch and merge operation
  - <http://git-scm.com/book/en/Git-Branching-Basic-Branching-and-Merging>
- Git tutorial reference
  - <http://www.cs.columbia.edu/~sedwards/classes/2013/4840/git-tutorial.pdf>