

МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ  
РОССИЙСКОЙ ФЕДЕРАЦИИ

федеральное государственное автономное  
образовательное учреждение высшего образования  
«Самарский национальный исследовательский университет  
имени академика С.П. Королева»  
(Самарский университет)

Институт информатики, математики и электроники  
Факультет информатики  
Кафедра суперкомпьютеров и общей информатики

**Отчет по лабораторной работе №2**

Дисциплина: «Развертывание и жизненный цикл программного обеспечения»

Тема: «Git and CI»

Выполнил: Харитонов Н.В.

Группа: 6133-010402D

Самара 2021

## TASK

### Steps

1. Download Gitlab-Bitnami vm image from <https://bitnami.com/stack/gitlab/virtual-machine>
2. Upload <https://github.com/olindata/sample-gitlabci-cpp-project> to your Gitlab server.
3. To unblock SSH <https://docs.bitnami.com/virtual-machine/faq/get-started/enable-ssh/>
4. <https://askubuntu.com/questions/204400/ssh-public-key-no-supported-authentication-methods-available-server-sent-publ>
5. Install GitLab Runner using the official GitLab repositories <https://docs.gitlab.com/runner/install/linux-repository.html>
6. Update `/etc/gitlab/gitlab.rb` to disable https on gitlab (yes, it is not for production)

```
# use here your IP, but is must be HTTP
external_url 'http://192.168.88.228'
nginx['redirect_http_to_https'] = false
nginx['ssl_verify_client'] = "off"
```

7. Reconfigure GitLab for the changes to take effect:  

```
$ sudo gitlab-ctl reconfigure
```
8. Register runner. Choose shell executor type. Use your ip and registration-token for command below:  

```
$ sudo gitlab-runner register --url
http://192.168.88.228/ --registration-token yqjsLYNFrbjaC-
QhmycE
```

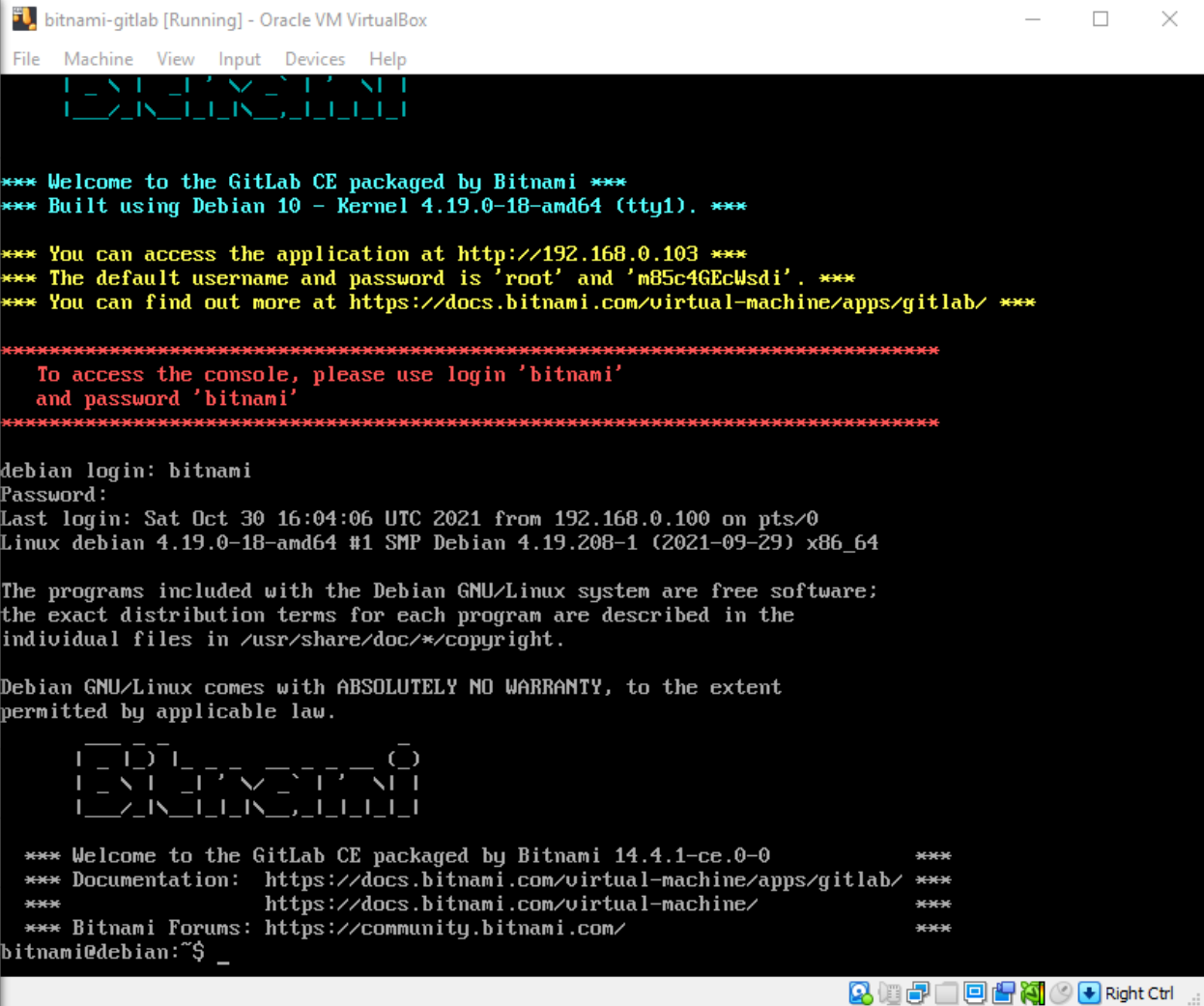
9. Edit `.gitlab-ci.yml` to run runner in shell mode (without Docker)  

```
job:
script:
g++ helloworld.cpp -o helloworld
```

10. Run Pipeline: CI/CD > Pipelines > Run pipeline

## PROCEDURE

Download and open the Gitlab-Bitnami VM:



```
bitnami-gitlab [Running] - Oracle VM VirtualBox
File Machine View Input Devices Help

*** Welcome to the GitLab CE packaged by Bitnami ***
*** Built using Debian 10 - Kernel 4.19.0-18-amd64 (tty1). ***

*** You can access the application at http://192.168.0.103 ***
*** The default username and password is 'root' and 'm85c4GEcWsdI'. ***
*** You can find out more at https://docs.bitnami.com/virtual-machine/apps/gitlab/ ***

*****
  To access the console, please use login 'bitnami'
  and password 'bitnami'
*****

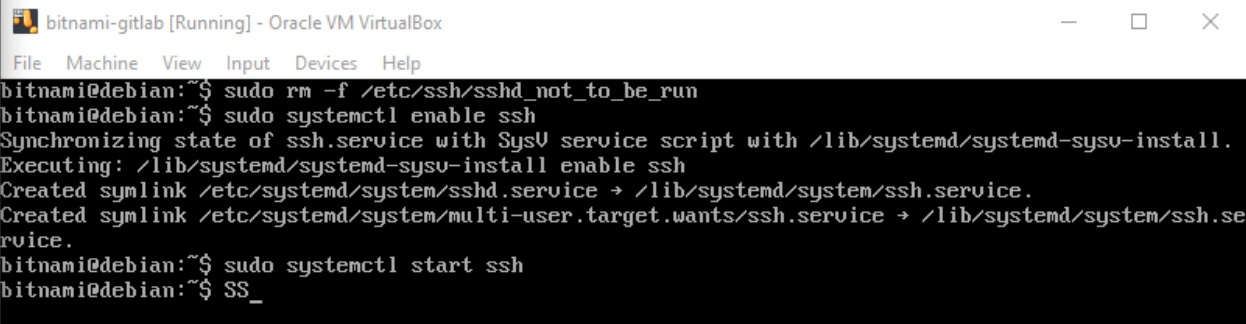
debian login: bitnami
Password:
Last login: Sat Oct 30 16:04:06 UTC 2021 from 192.168.0.100 on pts/0
Linux debian 4.19.0-18-amd64 #1 SMP Debian 4.19.208-1 (2021-09-29) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.

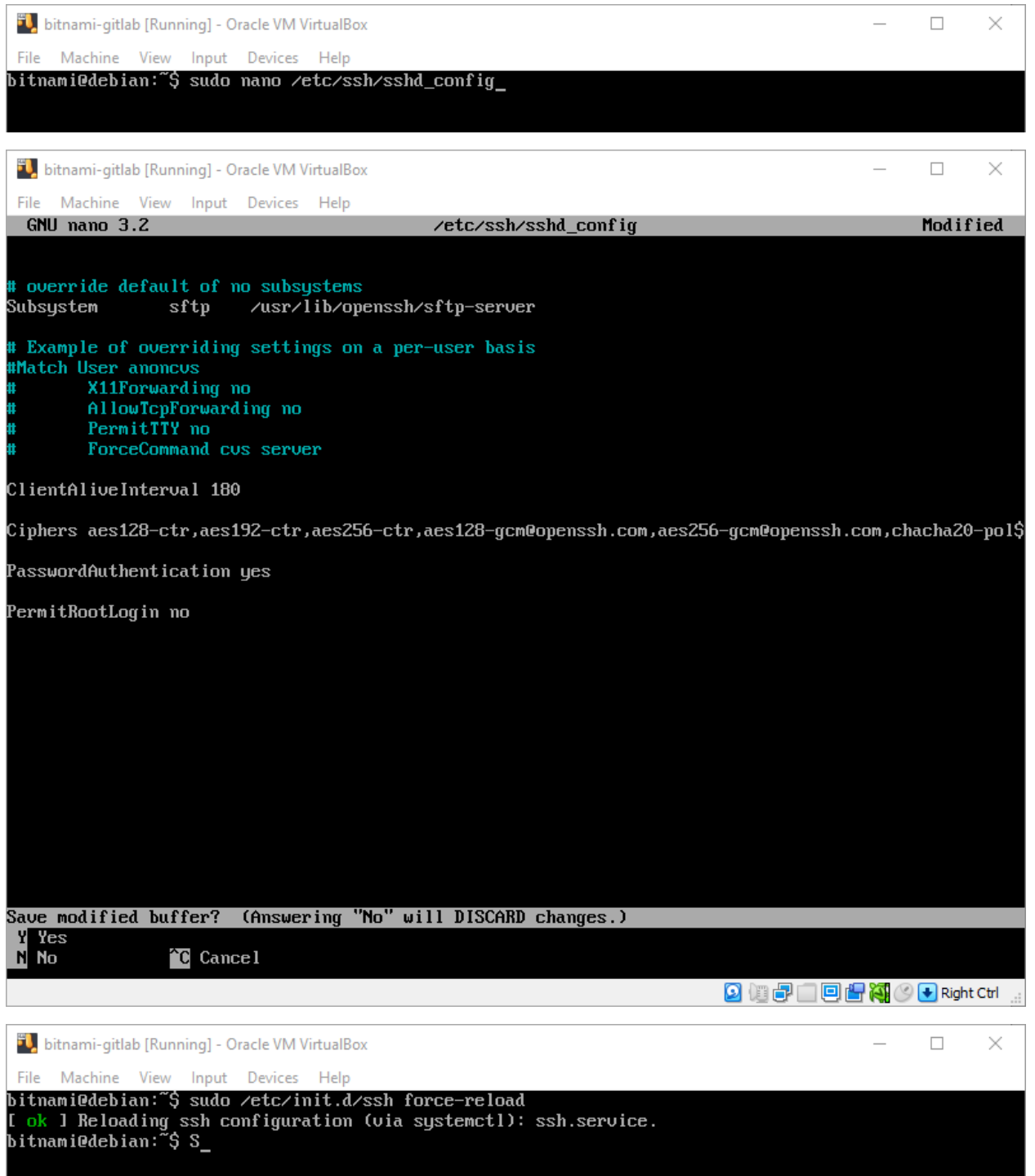
*** Welcome to the GitLab CE packaged by Bitnami 14.4.1-ce.0-0 ***
*** Documentation: https://docs.bitnami.com/virtual-machine/apps/gitlab/ ***
*** https://docs.bitnami.com/virtual-machine/ ***
*** Bitnami Forums: https://community.bitnami.com/ ***
bitnami@debian:~$
```

Enable SSH on that VM:



```
bitnami@debian:~$ sudo rm -f /etc/ssh/sshd_not_to_be_run
bitnami@debian:~$ sudo systemctl enable ssh
Synchronizing state of ssh.service with SysV service script with /lib/systemd/systemd-sysv-install.
Executing: /lib/systemd/systemd-sysv-install enable ssh
Created symlink /etc/systemd/system/ssh.service → /lib/systemd/system/ssh.service.
Created symlink /etc/systemd/system/multi-user.target.wants/ssh.service → /lib/systemd/system/ssh.service.
bitnami@debian:~$ sudo systemctl start ssh
bitnami@debian:~$ SS_
```

Edit the SSH configuration file to support password authentication:



The first screenshot shows a terminal window titled "bitnami-gitlab [Running] - Oracle VM VirtualBox". The prompt is "bitnami@debian:~\$" and the command entered is "sudo nano /etc/ssh/sshd\_config\_".

The second screenshot shows the "GNU nano 3.2" editor editing the file "/etc/ssh/sshd\_config". The configuration file content is as follows:

```
# override default of no subsystems
Subsystem sftp /usr/lib/openssh/sftp-server

# Example of overriding settings on a per-user basis
#Match User anoncvs
#    X11Forwarding no
#    AllowTcpForwarding no
#    PermitTTY no
#    ForceCommand cvs server

ClientAliveInterval 180

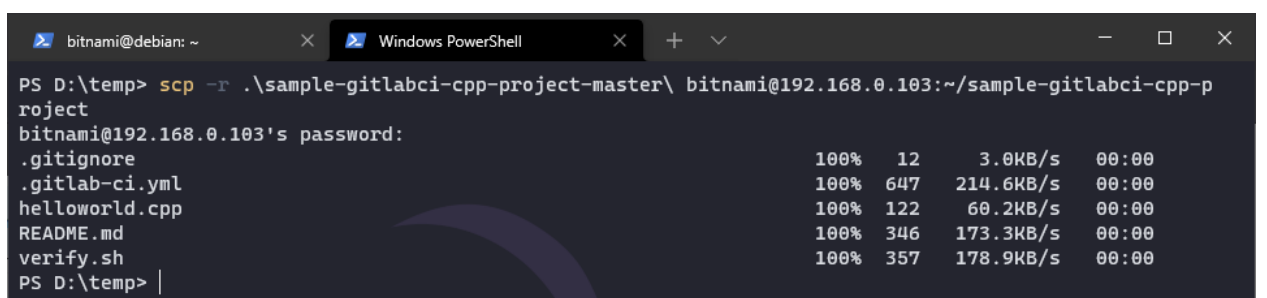
Ciphers aes128-ctr,aes192-ctr,aes256-ctr,aes128-gcm@openssh.com,aes256-gcm@openssh.com,chacha20-poly1305@openssh.com

PasswordAuthentication yes

PermitRootLogin no
```

The third screenshot shows the same terminal window with the command "sudo /etc/init.d/ssh force-reload" entered. The output is "[ ok ] Reloading ssh configuration (via systemctl): ssh.service." and the prompt is "bitnami@debian:~\$".

Clone the project to the host machine and then copy it to the VM via SSH:



The screenshot shows a Windows PowerShell window with the following commands and output:

```
PS D:\temp> scp -r .\sample-gitlabci-cpp-project-master\ bitnami@192.168.0.103:~/sample-gitlabci-cpp-p
project
bitnami@192.168.0.103's password:
.gitignore 100% 12 3.0KB/s 00:00
.gitlab-ci.yml 100% 647 214.6KB/s 00:00
helloworld.cpp 100% 122 60.2KB/s 00:00
README.md 100% 346 173.3KB/s 00:00
verify.sh 100% 357 178.9KB/s 00:00
PS D:\temp> |
```

## Connect to the VM via SSH:

```

bitnami@debian: ~
Windows PowerShell
PS D:\temp> ssh bitnami@192.168.0.103
bitnami@192.168.0.103's password:
Linux debian 4.19.0-18-amd64 #1 SMP Debian 4.19.208-1 (2021-09-29) x86_64

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.

  ____ _
 |  _ \| | | | | |
 | |_) | |_| |
 |  _ <|  _ <|
 | |_) | |_| |
 |____|_|_|_|

*** Welcome to the GitLab CE packaged by Bitnami 14.4.1-ce.0-0 ***
*** Documentation: https://docs.bitnami.com/virtual-machine/apps/gitlab/ ***
*** https://docs.bitnami.com/virtual-machine/ ***
*** Bitnami Forums: https://community.bitnami.com/ ***
Last login: Sat Oct 30 16:27:10 2021 from 192.168.0.100
bitnami@debian:~$

```

Once connected, go to the project directory and initialize the Git repository in it. Then push it to the GitLab repository.

```

bitnami@debian: ~/sample-gitl  x  Windows PowerShell  x | + v
bitnami@debian:~/sample-gitlabci-cpp-project$ ls -a
. . . .gitignore .gitlab-ci.yml helloworld.cpp README.md verify.sh
bitnami@debian:~/sample-gitlabci-cpp-project$ git init
Initialized empty Git repository in /home/bitnami/sample-gitlabci-cpp-project/.git/
bitnami@debian:~/sample-gitlabci-cpp-project$ git add .
bitnami@debian:~/sample-gitlabci-cpp-project$ git commit -m "initial commit"
[master (root-commit) 7e7e8e4] initial commit
 5 files changed, 66 insertions(+)
 create mode 100644 .gitignore
 create mode 100644 .gitlab-ci.yml
 create mode 100644 README.md
 create mode 100644 helloworld.cpp
 create mode 100644 verify.sh
bitnami@debian:~/sample-gitlabci-cpp-project$ git remote add origin http://192.168.0.103/root/sample-g
itlabci-cpp-project.git
bitnami@debian:~/sample-gitlabci-cpp-project$ git push -u origin --all
Username for 'http://192.168.0.103': root
Password for 'http://root@192.168.0.103':
Enumerating objects: 7, done.
Counting objects: 100% (7/7), done.
Delta compression using up to 2 threads
Compressing objects: 100% (6/6), done.
Writing objects: 100% (7/7), 1.28 KiB | 1.28 MiB/s, done.
Total 7 (delta 0), reused 0 (delta 0)
To http://192.168.0.103/root/sample-gitlabci-cpp-project.git
 * [new branch]      master -> master
Branch 'master' set up to track remote branch 'master' from 'origin'.
bitnami@debian:~/sample-gitlabci-cpp-project$ git push -u origin --tags
Username for 'http://192.168.0.103': root
Password for 'http://root@192.168.0.103':
Everything up-to-date
bitnami@debian:~/sample-gitlabci-cpp-project$ |

```

## Install GitLab Runner:

```
Windows PowerShell bitnami@debian: ~
bitnami@debian:~$ curl -L "https://packages.gitlab.com/install/repositories/runner/gitlab-runner/script.deb.sh" | sudo bash
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left   Speed
100 5945  100 5945    0     0  15441      0 --:--:-- --:--:-- --:--:-- 15441
Detected operating system as debian/buster.
Checking for curl...
Detected curl...
Checking for gpg...
Detected gpg...
Running apt-get update... done.
Installing debian-archive-keyring which is needed for installing
apt-transport-https on many Debian systems.
Installing apt-transport-https... done.
Installing /etc/apt/sources.list.d/runner-gitlab-runner.list...done.
Importing packagecloud gpg key... done.
Running apt-get update... done.

The repository is setup! You can now install packages.
bitnami@debian:~$
```

```
Windows PowerShell bitnami@debian: ~
bitnami@debian:~$ sudo apt-get install gitlab-runner
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  git git-man libcurl3-gnutls liberror-perl
Suggested packages:
  git-daemon-run | git-daemon-sysvinit git-doc git-el git-email git-gui gitk gitweb git-cvs
  git-mediawiki git-svn docker-engine
The following NEW packages will be installed:
  git git-man gitlab-runner libcurl3-gnutls liberror-perl
0 upgraded, 5 newly installed, 0 to remove and 0 not upgraded.
Need to get 462 MB of archives.
After this operation, 533 MB of additional disk space will be used.
Do you want to continue? [Y/n] Y
Get:1 http://deb.debian.org/debian buster/main amd64 libcurl3-gnutls amd64 7.64.0-4+deb10u2 [330 kB]
Get:3 http://deb.debian.org/debian buster/main amd64 liberror-perl all 0.17027-2 [30.9 kB]
Get:4 http://deb.debian.org/debian buster/main amd64 git-man all 1:2.20.1-2+deb10u3 [1,620 kB]
Get:5 http://deb.debian.org/debian buster/main amd64 git amd64 1:2.20.1-2+deb10u3 [5,633 kB]
Get:2 https://packages.gitlab.com/runner/gitlab-runner/debian buster/main amd64 gitlab-runner amd64 14
.3.2 [455 MB]
Fetched 462 MB in 1min 22s (5,639 kB/s)
debconf: delaying package configuration, since apt-utils is not installed
Selecting previously unselected package libcurl3-gnutls:amd64.
```

## Update the /etc/gitlab/gitlab.rb file to disable HTTPS on GitLab:

```
Windows PowerShell bitnami@debian: ~
bitnami@debian:~$ sudo nano /etc/gitlab/gitlab.rb|
```

```
Windows PowerShell bitnami@debian: ~
GNU nano 3.2 /etc/gitlab/gitlab.rb

##! running 'gitlab-ctl reconfigure'

##! In general, the values specified here should reflect what the default value of the attribute will$
##! There are instances where this behavior is not possible or desired. For example, when providing p$
##! or connecting to third party services.
##! In those instances, we endeavour to provide an example configuration.

## GitLab URL
##! URL on which GitLab will be reachable.
##! For more details on configuring external_url see:
##! https://docs.gitlab.com/omnibus/settings/configuration.html#configuring-the-external-url-for-gitl$
##!
##! Note: During installation/upgrades, the value of the environment variable
##! EXTERNAL_URL will be used to populate/replace this value.
##! On AWS EC2 instances, we also attempt to fetch the public hostname/IP
##! address from AWS. For more details, see:
##! https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/instancedata-data-retrieval.html
external_url 'http://192.168.0.103'

^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos M-U Undo
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^_ Go To Line M-E Redo
```

```
Windows PowerShell bitnami@debian: ~
GNU nano 3.2 /etc/gitlab/gitlab.rb Modified

# web_server['home'] = '/var/opt/gitlab/nginx'

#####
## GitLab NGINX
##! Docs: https://docs.gitlab.com/omnibus/settings/nginx.html
#####

# nginx['enable'] = true
# nginx['client_max_body_size'] = '250m'
nginx['redirect_http_to_https'] = false
# nginx['redirect_http_to_https_port'] = 80

##! Most root CA's are included by default
# nginx['ssl_client_certificate'] = "/etc/gitlab/ssl/ca.crt"

##! enable/disable 2-way SSL client authentication
nginx['ssl_verify_client'] = "off"

##! if ssl_verify_client on, verification depth in the client certificates chain

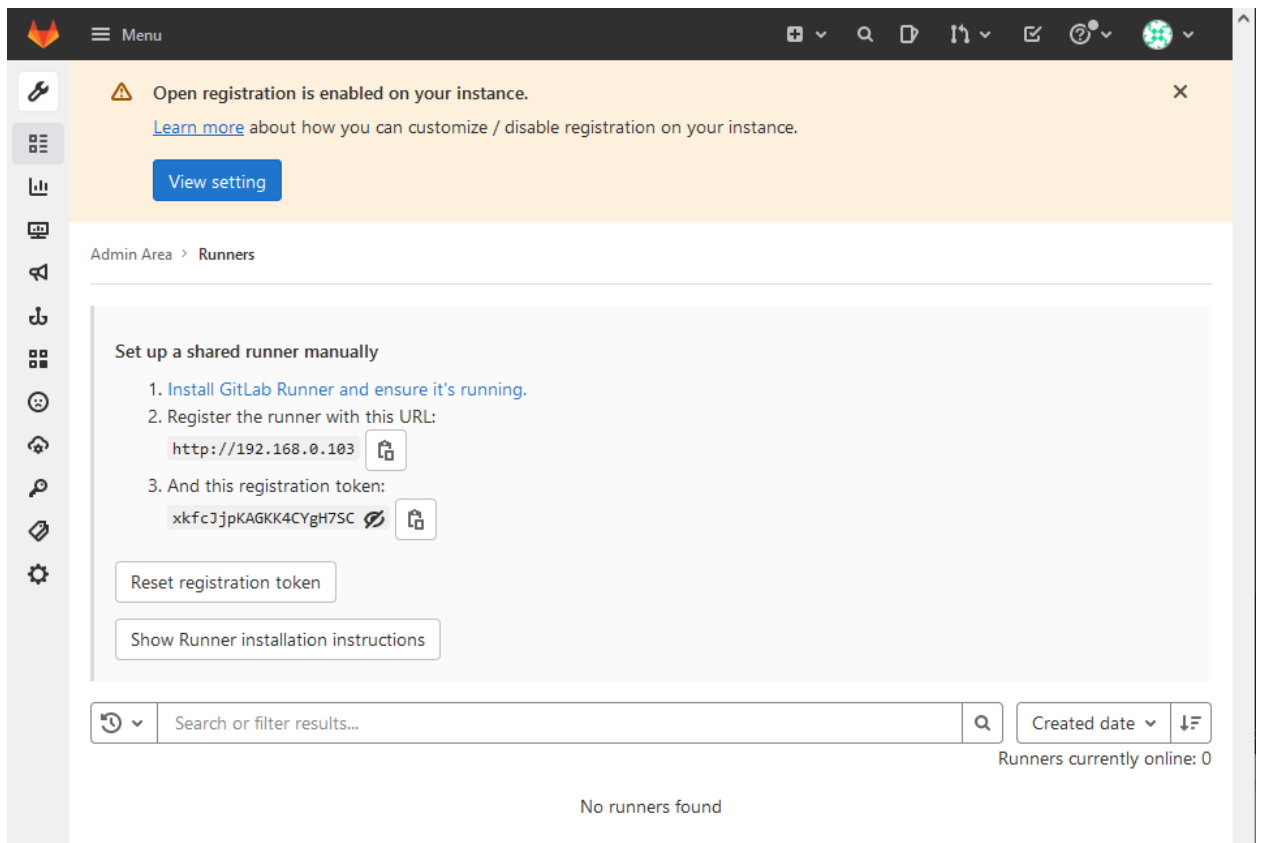
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos M-U Undo
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^_ Go To Line M-E Redo
```



Reconfigure GitLab for the changes to take effect:

```
Windows PowerShell
bitnami@debian: ~
bitnami@debian:~$ sudo gitlab-ctl reconfigure
Starting Chef Infra Client, version 15.17.4
resolving cookbooks for run list: ["gitlab"]
Synchronizing Cookbooks:
- gitlab (0.0.1)
- logrotate (0.1.0)
- redis (0.1.0)
- registry (0.1.0)
- consul (0.1.0)
- gitaly (0.1.0)
- praefect (0.1.0)
- gitlab-kas (0.1.0)
- letsencrypt (0.1.0)
- runit (5.1.3)
- acme (4.1.3)
- crond (0.1.0)
- nginx (0.1.0)
- monitoring (0.1.0)
- package (0.1.0)
- postgresql (0.1.0)
- gitlab-pages (0.1.0)
- mattermost (0.1.0)
Installing Cookbook Gems:
Compiling Cookbooks...
```

Open the GitLab server to get the runner registration token:



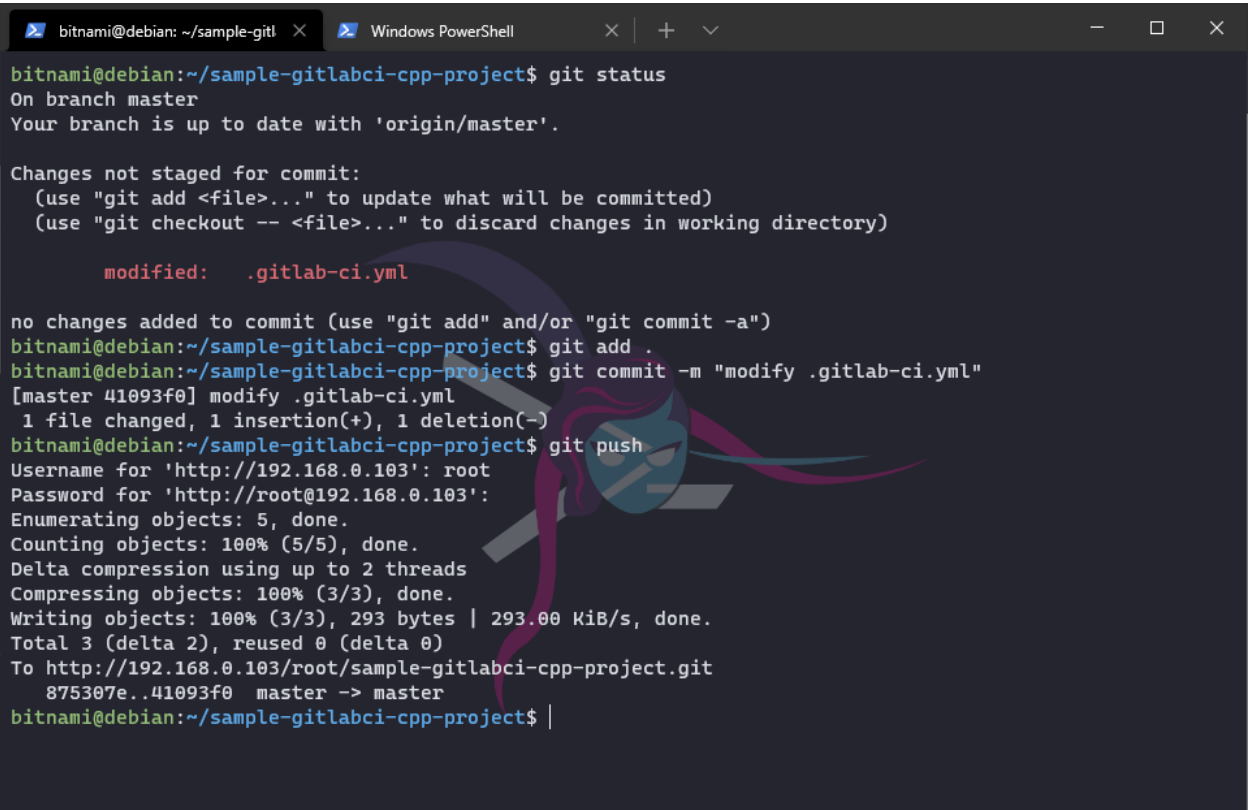
Register a runner:

```
bitnami@debian: ~  
bitnami@debian:~$ sudo gitlab-runner register --url http://192.168.0.103 --registration-token xkfcJjpKAGKK4CYgH7SC  
Runtime platform arch=amd64 os=linux pid=1091 revision=4b9e985a version=14.4.0  
Running in system-mode.  
  
Enter the GitLab instance URL (for example, https://gitlab.com/):  
[http://192.168.0.103]:  
Enter the registration token:  
[xkfcJjpKAGKK4CYgH7SC]:  
Enter a description for the runner:  
[debian]:  
Enter tags for the runner (comma-separated):  
  
Registering runner... succeeded runner=xkfcJjpK  
Enter an executor: docker-ssh+machine, docker, docker-ssh, parallels, shell, ssh, virtualbox, docker+machine, custom, kubernetes:  
  
ERROR: Invalid executor specified  
Enter an executor: shell, ssh, virtualbox, docker+machine, docker-ssh+machine, docker, docker-ssh, parallels, custom, kubernetes:  
shell  
Runner registered successfully. Feel free to start it, but if it's running already the config should be automatically reloaded!  
bitnami@debian:~$
```

In the project directory, edit `.gitlab-ci.yml` to run runner in shell mode:

```
bitnami@debian: ~/sample-gitlab-ci-cpp-project$ nano .gitlab-ci.yml  
  
GNU nano 3.2 .gitlab-ci.yml Modified  
job:  
  script:  
    - g++ helloworld.cpp -o helloworld  
  
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos M-U Undo  
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^_ Go To Line M-E Redo
```

Commit and push the changes to the server:



```
bitnami@debian: ~/sample-gitlabci-cpp-project$ git status
On branch master
Your branch is up to date with 'origin/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:   .gitlab-ci.yml

no changes added to commit (use "git add" and/or "git commit -a")
bitnami@debian:~/sample-gitlabci-cpp-project$ git add .
bitnami@debian:~/sample-gitlabci-cpp-project$ git commit -m "modify .gitlab-ci.yml"
[master 41093f0] modify .gitlab-ci.yml
1 file changed, 1 insertion(+), 1 deletion(-)
bitnami@debian:~/sample-gitlabci-cpp-project$ git push
Username for 'http://192.168.0.103': root
Password for 'http://root@192.168.0.103':
Enumerating objects: 5, done.
Counting objects: 100% (5/5), done.
Delta compression using up to 2 threads
Compressing objects: 100% (3/3), done.
Writing objects: 100% (3/3), 293 bytes | 293.00 KiB/s, done.
Total 3 (delta 2), reused 0 (delta 0)
To http://192.168.0.103/root/sample-gitlabci-cpp-project.git
875307e..41093f0 master -> master
bitnami@debian:~/sample-gitlabci-cpp-project$ |
```

Check if the pipeline runs successfully or not:

The screenshot displays the GitLab CI/CD interface. The top navigation bar includes the GitLab logo, a menu icon, and various utility icons. The breadcrumb trail shows the path: Administrator > sample-gitlabci-cpp-project > Jobs > #20. The main content area is divided into two panels. The left panel, titled 'Job job', shows a green checkmark and the text 'passed Job job triggered 57 seconds ago by Administrator'. Below this is a terminal window with a dark background and green text, displaying the following log entries:

```
1 Running with gitlab-runner 14.4.0 (4b9e985a)
2 on debian _Biv1HGK
3 Preparing the "shell" executor 00:00
4 Using Shell executor...
6 Preparing environment 00:00
7 Running on debian...
9 Getting source from Git repository 00:01
10 Fetching changes with git depth set to 50...
11 Reinitialized existing Git repository in /home/gitlab-runner/builds/_Biv1HGK/0/root/sample-gitlabci-cpp-project/.git/
12 Checking out 6f18f59b as master...
13 Removing helloworld
14 Skipping Git submodules setup
16 Executing "step_script" stage of the job script 00:00
17 $ g++ helloworld.cpp -o helloworld
19 Job succeeded
```

The right panel, titled 'job', contains a 'Retry' button and the following information: 'Duration: 0 seconds', 'Timeout: 1h (from project)', and 'Runner: #1 (\_Biv1HGK) debian'. Below this, it shows the commit '6f18f59b' with the message 'modify .gitlab-ci.yml'. A green checkmark indicates 'Pipeline #9 for master' is successful. At the bottom, a dropdown menu shows 'test' and a link to the job.

The pipeline runs successfully.

## **CONCLUSION**

In the conclusion of the laboratory work, the basic utilities of Git and CI were studied for working with repositories, runners and pipelines; all steps completed successfully.