

新的 Nachos4.1 安装教程

前言

原来的教程是上古时期的宝贝了，在下熬了两个通宵也没搞定他，索性自己做个新的。

如果你正常安装发现怎么都不行的话，
我们甚至可以从“重新安装一个虚拟机开始”。安装过程放在另一个文件当中。

1.首先为了方便后续安装我们换一个 apt 安装源

在终端输入：

```
sudo gedit /etc/apt/sources.list
```

换成清华的源

```
# 默认注释了源码镜像以提高 apt update 速度，如有需要可自行取消注释
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy main restri
cted universe multiverse
# deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy main r
estricted universe multiverse
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-updates mai
n restricted universe multiverse
# deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-updat
es main restricted universe multiverse
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backports m
ain restricted universe multiverse
# deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-backp
orts main restricted universe multiverse
deb https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-security ma
in restricted universe multiverse
# deb-src https://mirrors.tuna.tsinghua.edu.cn/ubuntu/ jammy-secur
ity main restricted universe multiverse

# 预发布软件源，不建议启用
```



```
testm@testm-virtual-machine:~/Desktop$ dpkg --print-foreign-architectures  
i386
```

i386 表示支持

不支持的话

输入

`sudo dpkg --add-architecture i386`

开启

3.安装 C, C++ 多平台库

`sudo apt-get install gcc-multilib g++-multilib`

```
testm@testm-virtual-machine:~/Desktop$ sudo apt-get install gcc-multilib g++-multilib  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
The following additional packages will be installed:
```

```
Setting up gcc-multilib (4:11.2.0-1ubuntu1) ...  
Setting up g++-11-multilib (11.3.0-1ubuntu1~22.04) ...  
Setting up g++-multilib (4:11.2.0-1ubuntu1) ...  
Processing triggers for libc-bin (2.35-0ubuntu3.1) ...  
testm@testm-virtual-machine:~/Desktop$
```

安装成功

4.安装 32 位环境库

`sudo apt-get install lib32ncurses5 lib32z1`

```
testm@testm-virtual-machine:~/Desktop$ sudo apt-get install lib32ncurses5 lib32z1  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
E: Unable to locate package lib32ncurses5
```

发现无法定位到包

这是由于不同版本的 Kali Linux, 它的源软件包名字会发生一些局部的变化, 这都是很正常的
将命令换成

`sudo apt-get install lib32ncurses5-dev lib32z1`

```
testm@testm-virtual-machine:~/Desktop$ sudo apt-get install lib32ncurses5-dev lib32z1  
Reading package lists... Done  
Building dependency tree... Done  
Reading state information... Done  
Setting up lib32ncurses5-dev (6.3-2) ...  
Setting up lib32ncurses-dev (6.3-2) ...  
Processing triggers for man-db (2.10.2-1) ...  
Processing triggers for libc-bin (2.35-0ubuntu3.1) ...  
testm@testm-virtual-machine:~/Desktop$
```

完成

sudo apt-get install zlib1g:i386 libstdc++6:i386

```
testm@testm-virtual-machine:~/Desktop$ sudo apt-get install zlib1g:i386 libstdc++6:i386
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:

Setting up libnsl2:i386 (1.3.0-2build2) ...
Setting up libnss-nisplus:i386 (1.3-0ubuntu6) ...
Setting up libnss-nis:i386 (3.1-0ubuntu6) ...
Processing triggers for libc-bin (2.35-0ubuntu3.1) ...
testm@testm-virtual-machine:~/Desktop$
```

完成

sudo apt-get install libc6:i386 libncurses5:i386

```
testm@testm-virtual-machine:~/Desktop$ sudo apt-get install libc6:i386 libncurses5:i386
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done

Setting up libgpm2:i386 (1.20.7-10build1) ...
Setting up libtinfo5:i386 (6.3-2) ...
Setting up libncurses5:i386 (6.3-2) ...
Processing triggers for libc-bin (2.35-0ubuntu3.1) ...
testm@testm-virtual-machine:~/Desktop$
```

完成

sudo apt-get install libgcc1:i386 libstdc++5:i386

```
testm@testm-virtual-machine:~/Desktop$ sudo apt-get install libgcc1:i386 libstdc++5:i386
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done

Unpacking libstdc++5:i386 (1:3.3.6-30ubuntu2) ...
Setting up libstdc++5:i386 (1:3.3.6-30ubuntu2) ...
Processing triggers for libc-bin (2.35-0ubuntu3.1) ...
testm@testm-virtual-machine:~/Desktop$
```

完成

5.安装低于 gcc5.0 的版本

sudo apt-get install gcc-4.8 gcc-4.8-multilib g++-4.8 g++-4.8-multilib

```
testm@testm-virtual-machine:~/Desktop$ sudo apt-get install gcc-4.8 gcc-4.8-multilib g++-4.8 g++-4.8-multilib
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Note, selecting 'gcc-4.8-hppa64' for regex 'gcc-4.8'
E: Unable to locate package gcc-4.8-multilib
E: Couldn't find any package by glob 'gcc-4.8-multilib'
E: Couldn't find any package by regex 'gcc-4.8-multilib'
E: Unable to locate package g++-4.8
E: Couldn't find any package by glob 'g++-4.8'
E: Couldn't find any package by regex 'g++-4.8'
E: Unable to locate package g++-4.8-multilib
E: Couldn't find any package by glob 'g++-4.8-multilib'
E: Couldn't find any package by regex 'g++-4.8-multilib'
```

发现定位不到这些包

我们安装 aptitude

sudo apt-get install aptitude

```
testm@testm-virtual-machine:~/Desktop$ sudo apt-get install aptitude
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
```

之后使用 aptitude 安装

并且因为这些包版本太老了，我们需要换源

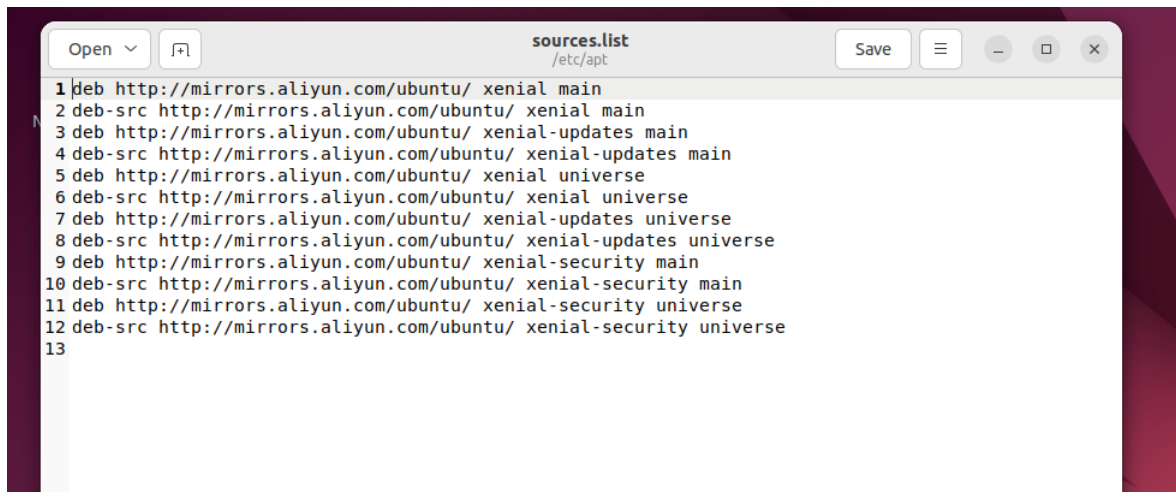
在终端输入：

sudo gedit /etc/apt/sources.list

打开文件

换成下列内容

```
deb http://mirrors.aliyun.com/ubuntu/ xenial main
deb-src http://mirrors.aliyun.com/ubuntu/ xenial main
deb http://mirrors.aliyun.com/ubuntu/ xenial-updates main
deb-src http://mirrors.aliyun.com/ubuntu/ xenial-updates main
deb http://mirrors.aliyun.com/ubuntu/ xenial universe
deb-src http://mirrors.aliyun.com/ubuntu/ xenial universe
deb http://mirrors.aliyun.com/ubuntu/ xenial-updates universe
deb-src http://mirrors.aliyun.com/ubuntu/ xenial-updates universe
deb http://mirrors.aliyun.com/ubuntu/ xenial-security main
deb-src http://mirrors.aliyun.com/ubuntu/ xenial-security main
deb http://mirrors.aliyun.com/ubuntu/ xenial-security universe
deb-src http://mirrors.aliyun.com/ubuntu/ xenial-security universe
```



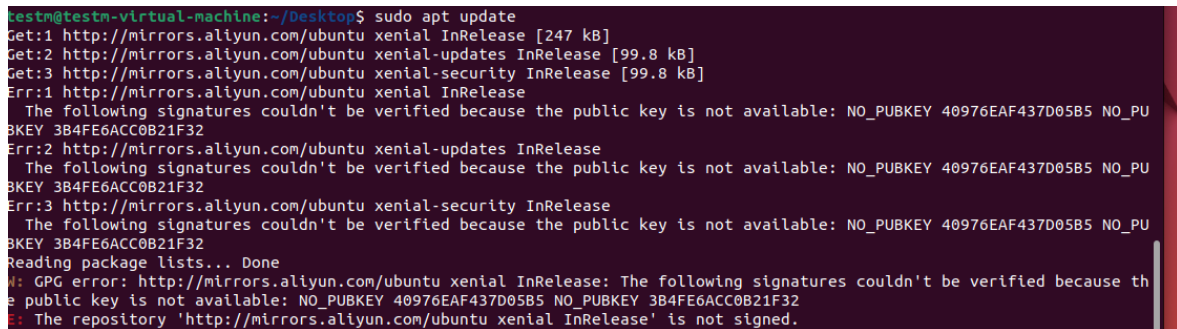
```
sources.list
/etc/apt

1 deb http://mirrors.aliyun.com/ubuntu/ xenial main
2 deb-src http://mirrors.aliyun.com/ubuntu/ xenial main
3 deb http://mirrors.aliyun.com/ubuntu/ xenial-updates main
4 deb-src http://mirrors.aliyun.com/ubuntu/ xenial-updates main
5 deb http://mirrors.aliyun.com/ubuntu/ xenial universe
6 deb-src http://mirrors.aliyun.com/ubuntu/ xenial universe
7 deb http://mirrors.aliyun.com/ubuntu/ xenial-updates universe
8 deb-src http://mirrors.aliyun.com/ubuntu/ xenial-updates universe
9 deb http://mirrors.aliyun.com/ubuntu/ xenial-security main
10 deb-src http://mirrors.aliyun.com/ubuntu/ xenial-security main
11 deb http://mirrors.aliyun.com/ubuntu/ xenial-security universe
12 deb-src http://mirrors.aliyun.com/ubuntu/ xenial-security universe
13
```

保存后关闭

添加源后更新，输入

sudo apt update



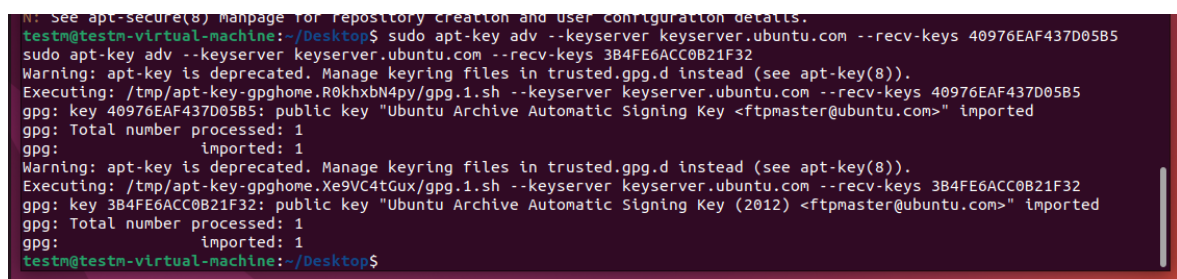
```
testm@testm-virtual-machine:~/Desktop$ sudo apt update
Get:1 http://mirrors.aliyun.com/ubuntu xenial InRelease [247 kB]
Get:2 http://mirrors.aliyun.com/ubuntu xenial-updates InRelease [99.8 kB]
Get:3 http://mirrors.aliyun.com/ubuntu xenial-security InRelease [99.8 kB]
Err:1 http://mirrors.aliyun.com/ubuntu xenial InRelease
  The following signatures couldn't be verified because the public key is not available: NO_PUBKEY 40976EAF437D05B5 NO_PUBKEY 3B4FE6ACC0B21F32
Err:2 http://mirrors.aliyun.com/ubuntu xenial-updates InRelease
  The following signatures couldn't be verified because the public key is not available: NO_PUBKEY 40976EAF437D05B5 NO_PUBKEY 3B4FE6ACC0B21F32
Err:3 http://mirrors.aliyun.com/ubuntu xenial-security InRelease
  The following signatures couldn't be verified because the public key is not available: NO_PUBKEY 40976EAF437D05B5 NO_PUBKEY 3B4FE6ACC0B21F32
Reading package lists... Done
W: GPG error: http://mirrors.aliyun.com/ubuntu xenial InRelease: The following signatures couldn't be verified because the public key is not available: NO_PUBKEY 40976EAF437D05B5 NO_PUBKEY 3B4FE6ACC0B21F32
E: The repository 'http://mirrors.aliyun.com/ubuntu xenial InRelease' is not signed.
```

发现报错，我们缺少那个公钥

那就添加，输入

sudo apt-key adv --keyserver keyserver.ubuntu.com --recv-keys 40976EAF437D05B5

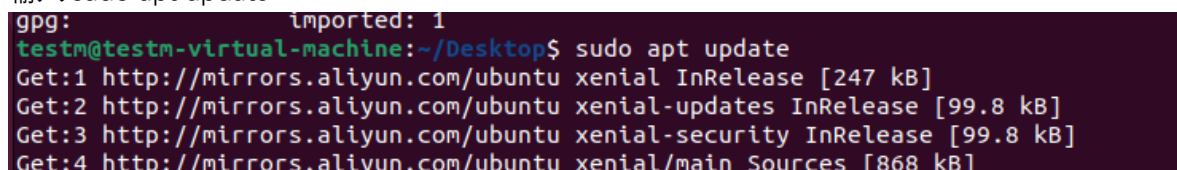
sudo apt-key adv --keyserver keyserver.ubuntu.com --recv-keys 3B4FE6ACC0B21F32



```
testm@testm-virtual-machine:~/Desktop$ sudo apt-key adv --keyserver keyserver.ubuntu.com --recv-keys 40976EAF437D05B5
Warning: apt-key is deprecated. Manage keyring files in trusted.gpg.d instead (see apt-key(8)).
Executing: /tmp/apt-key-gpghome.R0kxhN4py/gpg.1.sh --keyserver keyserver.ubuntu.com --recv-keys 40976EAF437D05B5
gpg: key 40976EAF437D05B5: public key "Ubuntu Archive Automatic Signing Key <ftpmaster@ubuntu.com>" imported
gpg: Total number processed: 1
gpg: imported: 1
Warning: apt-key is deprecated. Manage keyring files in trusted.gpg.d instead (see apt-key(8)).
Executing: /tmp/apt-key-gpghome.Xe9VC4tGux/gpg.1.sh --keyserver keyserver.ubuntu.com --recv-keys 3B4FE6ACC0B21F32
gpg: key 3B4FE6ACC0B21F32: public key "Ubuntu Archive Automatic Signing Key (2012) <ftpmaster@ubuntu.com>" imported
gpg: Total number processed: 1
gpg: imported: 1
testm@testm-virtual-machine:~/Desktop$
```

添加成功，我们再次更新

输入 sudo apt update



```
testm@testm-virtual-machine:~/Desktop$ sudo apt update
gpg: Total number processed: 1
gpg: imported: 1
Get:1 http://mirrors.aliyun.com/ubuntu xenial InRelease [247 kB]
Get:2 http://mirrors.aliyun.com/ubuntu xenial-updates InRelease [99.8 kB]
Get:3 http://mirrors.aliyun.com/ubuntu xenial-security InRelease [99.8 kB]
Get:4 http://mirrors.aliyun.com/ubuntu xenial/main Sources [868 kB]
```



```

Fetched 57.9 MB in 1min 59s (487 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
1 package can be upgraded. Run 'apt list --upgradable' to see it.
W: http://mirrors.aliyun.com/ubuntu/dists/xenial/InRelease: Key is stored in legacy trusted.gpg keyring (/etc/apt/trusted
.gpg), see the DEPRECATION section in apt-key(8) for details.
W: http://mirrors.aliyun.com/ubuntu/dists/xenial-updates/InRelease: Key is stored in legacy trusted.gpg keyring (/etc/ap
t/trusted.gpg), see the DEPRECATION section in apt-key(8) for details.
W: http://mirrors.aliyun.com/ubuntu/dists/xenial-security/InRelease: Key is stored in legacy trusted.gpg keyring (/etc/ap
t/trusted.gpg), see the DEPRECATION section in apt-key(8) for details.
testm@testm-virtual-machine:~/Desktop$

```

可以看到完成更新了，有 3 个警告，无所谓~

输入

```
sudo aptitude install gcc-4.8 gcc-4.8-multilib g++-4.8 g++-4.8-multilib
```

```
sudo apt-get install gcc-4.8-multilib g++-4.8-multilib
```

他提供了方案

```

Keep the following packages at their current version:
17) g++-4.8-multilib [Not Installed]
18) lib32stdc++-4.8-dev [Not Installed]
19) libx32stdc++-4.8-dev [Not Installed]

Leave the following dependencies unresolved:
20) libc6-dev-i386 recommends gcc-multilib
21) libc6-dev-x32 recommends gcc-multilib

Accept this solution? [Y/n/q/?] y

```

```

Setting up libc6-dev:amd64 (2.23-0ubuntu1) ...
Setting up gcc-6-base:amd64 (6.0.1-0ubuntu1) ...
Setting up libcloog-isl4:amd64 (0.18.4-1) ...
Setting up libx32gcc1 (1:6.0.1-0ubuntu1) ...
Setting up libgcc-4.8-dev:amd64 (4.8.5-4ubuntu2) ...
Setting up cpp-4.8 (4.8.5-4ubuntu2) ...
Setting up lib32gcc1 (1:6.0.1-0ubuntu1) ...
Setting up gcc-4.8 (4.8.5-4ubuntu2) ...
Setting up libstdc++-4.8-dev:amd64 (4.8.5-4ubuntu2) ...
Setting up libx32asan0 (4.8.5-4ubuntu2) ...
Setting up lib32asan0 (4.8.5-4ubuntu2) ...
Setting up lib32gcc-4.8-dev (4.8.5-4ubuntu2) ...
Setting up g++-4.8 (4.8.5-4ubuntu2) ...
Setting up libx32gcc-4.8-dev (4.8.5-4ubuntu2) ...
Setting up gcc-4.8-multilib (4.8.5-4ubuntu2) ...
Processing triggers for man-db (2.10.2-1) ...
Processing triggers for libc-bin (2.23-0ubuntu1) ...

testm@testm-virtual-machine:~/Desktop$

```

成功!

查看安装的 gcc 和 g++

```
ls /usr/bin/gcc*
```

```
ls /usr/bin/g++*
```

```
testm@testm-virtual-machine:~/Desktop$ ls /usr/bin/gcc*
/usr/bin/gcc      /usr/bin/gcc-4.8  /usr/bin/gcc-ar-11  /usr/bin/gcc-nm    /usr/bin/gcc-nm-4.8  /usr/bin/gcc-ranlib-11
/usr/bin/gcc-11   /usr/bin/gcc-ar  /usr/bin/gcc-ar-4.8  /usr/bin/gcc-nm-11  /usr/bin/gcc-ranlib  /usr/bin/gcc-ranlib-4.8
testm@testm-virtual-machine:~/Desktop$ ls /usr/bin/g++*
/usr/bin/g++      /usr/bin/g++-11  /usr/bin/g++-4.8
testm@testm-virtual-machine:~/Desktop$
```

将低版本 gcc 与 g++切换为当前活跃版本

```
sudo update-alternatives --install /usr/bin/gcc gcc /usr/bin/gcc-4.8 40
```

```
sudo update-alternatives --install /usr/bin/g++ g++ /usr/bin/g++-4.8 40
```

最后那个数字是优先级 越大越优先

```
testm@testm-virtual-machine:~/Desktop$ sudo update-alternatives --install /usr/bin/gcc gcc /usr/bin/gcc-4.8 40
sudo update-alternatives --install /usr/bin/g++ g++ /usr/bin/g++-4.8 40
update-alternatives: using /usr/bin/gcc-4.8 to provide /usr/bin/gcc (gcc) in auto mode
update-alternatives: using /usr/bin/g++-4.8 to provide /usr/bin/g++ (g++) in auto mode
testm@testm-virtual-machine:~/Desktop$
```

查看当前 gcc, g++ 版本

qcc -v

g++ -v

```
testm@testm-virtual-machine:~/Desktop$ gcc -v
Using built-in specs.
COLLECT_GCC=gcc
COLLECT_LTO_WRAPPER=/usr/lib/gcc/x86_64-linux-gnu/4.8/lto-wrap
Target: x86_64-linux-gnu
Configured with: ../src/configure -v --with-pkgversion='Ubuntu
8/README.Bugs --enable-languages=c,c++,java,go,d,fortran,objc,
--enable-linker-build-id --libexecdir=/usr/lib --without-incl
/usr/include/c++/4.8 --libdir=/usr/lib --enable-nls --with-sys
le-libstdcxx-time=yes --enable-gnu-unique-object --disable-lib
r-plugin --enable-java-awt=gtk --enable-gtk-cairo --with-java-
a-home --with-jvm-root-dir=/usr/lib/jvm/java-1.5.0-gcj-4.8-amd
.8-amd64 --with-arch-directory=amd64 --with-ecj-jar=/usr/share
-disable-werror --with-arch-32=i686 --with-abi=m64 --with-mult
g=release --build=x86_64-linux-gnu --host=x86_64-linux-gnu --t
Thread model: posix
gcc version 4.8.5 (Ubuntu 4.8.5-4ubuntu2)
```



```

testm@testm-virtual-machine:~/Desktop$ g++ -v
Using built-in specs.
COLLECT_GCC=g++
COLLECT_LTO_WRAPPER=/usr/lib/gcc/x86_64-linux-gnu/4.8/lto-wrapper
Target: x86_64-linux-gnu
Configured with: ../src/configure -v --with-pkgversion='Ubuntu 4.8.5-4ubuntu8/README.Bugs --enable-languages=c,c++,java,go,d,fortran,objc,obj-c++ --prefix=/usr --enable-linker-build-id --libexecdir=/usr/lib --without-included-gettext --with-include/c++/4.8 --libdir=/usr/lib --enable-nls --with-sysroot=/ --enable-libstdcxx-time=yes --enable-gnu-unique-object --disable-libmudflap --enable-plugin --enable-java-awt=gtk --enable-gtk-cairo --with-java-home=/usr/lib/java-home --with-jvm-root-dir=/usr/lib/jvm/java-1.5.0-gcj-4.8-amd64 --with-jvm-arch=amd64 --with-arch-directory=amd64 --with-ecj-jar=/usr/share/java/eclipse-ecj.jar --disable-werror --with-arch-32=i686 --with-abi=m64 --with-multilib-list=m32,m64,mips32 --with-build=x86_64-linux-gnu --host=x86_64-linux-gnu --target=x86_64-linux-gnu
Thread model: posix
gcc version 4.8.5 (Ubuntu 4.8.5-4ubuntu2)

```

好的我们已经完成最麻烦的一步了(好累!)

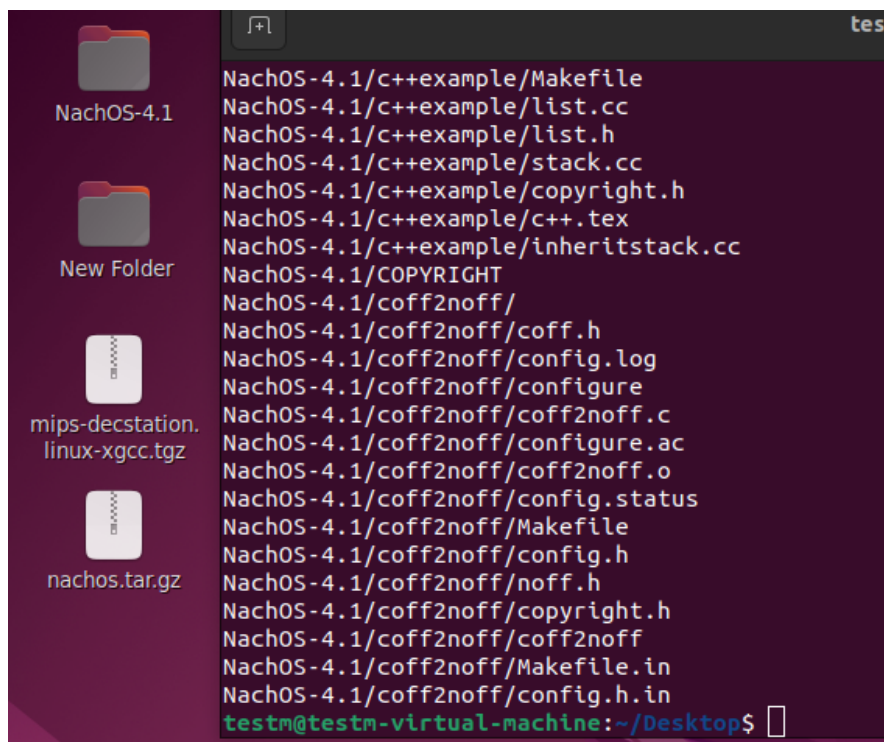
6.解压 nachos 源码

当然你要先把这个压缩文件拖到桌面，如果不能拖的话，需要进行 VMtools 的安装。

[VMware——VMware Tools 的介绍及安装方法_William.csj 的博客-CSDN 博客](#)

[安装 VMware Tools](#)

tar xvfz nachos.tar.gz



解压完成，产生了一个叫 NachOS-4.1 的文件夹

进入目录

cd NachOS-4.1/code/build.linux/

```
NachOS-4.1/coff2noff/coff2noff
NachOS-4.1/coff2noff/Makefile.in
NachOS-4.1/coff2noff/config.h.in
testm@testm-virtual-machine:~/Desktop$ cd NachOS-4.1/code/build.linux/
testm@testm-virtual-machine:~/Desktop/NachOS-4.1/code/build.linux$
```

进行编译

make depend

```
testm@testm-virtual-machine:~/Desktop/NachOS-4.1/code/build.linux$ make depend
g++ -I../network -I../filesystems -I../userprog -I../threads -I../machine -I../lib -DFILESYS_
x86 -DLINUX -DCHANGED -M ../lib/bitmap.cc ../lib/debug.cc ../lib/hash.cc ../lib/libtest.c
c ../machine/interrupt.cc ../machine/stats.cc ../machine/timer.cc ../machine/console.cc .
mipssim.cc ../machine/translate.cc ../machine/network.cc ../machine/disk.cc ../threads/al
hreads/main.cc ../threads/scheduler.cc ../threads/synch.cc ../threads/synchlist.cc ../thr
pace.cc ../userprog/exception.cc ../userprog/synchconsole.cc ../filesystems/directory.cc ../f
esys.cc ../filesystems/pbitmap.cc ../filesystems/openfile.cc ../filesystems/synchdisk.cc ../network/
ed - Makefile.dep < eddep
rm eddep makedep
testm@testm-virtual-machine:~/Desktop/NachOS-4.1/code/build.linux$
```

Make

这个地方会狂报错，各种缺文件

我选择执行了一下前面的命令

sudo apt-get install build-essential

sudo apt-get install lib32ncurses5 lib32z1

sudo apt-get install zlib1g:i386 libstdc++6:i386

sudo apt-get install libc6:i386 libncurses5:i386

sudo apt-get install libgcc1:i386 libstdc++5:i386

sudo aptitude install gcc-multilib g++-multilib

然后还是不行，之后我重启了一下客户机，居然成功了

```
testm@testm-virtual-machine:~/Desktop/NachOS-4.1/code/build.linux$ make
g++ -ftemplate-depth-100 -Wno-deprecated -g -Wall -fpermissive -I../network -I.
../filesystems -I../userprog -I../threads -I../machine -I../lib -DFILESYS_STUB -DRDAT
A -DSIM_FIX -DTUT -Dx86 -DLINUX -DCHANGED -m32 -c ../lib/sysdep.cc
g++ -ftemplate-depth-100 -Wno-deprecated -g -Wall -fpermissive -I../network -I.
../filesystems -I../userprog -I../threads -I../machine -I../lib -DFILESYS_STUB -DRDAT
A -DSIM_FIX -DTUT -Dx86 -DLINUX -DCHANGED -m32 -c ../machine/interrupt.cc
../machine/interrupt.cc:29:45: warning: deprecated conversion from string consta
nt to 'char*' [-Wwrite-strings]
../machine/interrupt.cc:29:45: warning: deprecated conversion from string consta
```

如果尝试重启没有成功，可以考虑换一个版本的 ubuntu，重新进行一边上述步骤，本次是在 22 版本的 Ubuntu 下成功，到这一步我重新执行了一遍以下指令，然后就可以编译了

```
sudo apt-get install gcc-4.8-multilib g++-4.8-multilib
```

[Index of /ubuntu-releases/22.04.3/ \(ustc.edu.cn\)](https://ubuntu-releases/22.04.3/)

```
testm@testm-virtual-machine:~/Desktop/NachOS-4.1/code/build.linux$ ./nachos -u
Partial usage: nachos [-z -d debugFlags]
Partial usage: nachos [-x programName]
Partial usage: nachos [-K] [-C] [-N]

tests summary: ok:0
Partial usage: nachos [-rs randomSeed]
Partial usage: nachos [-s]
Partial usage: nachos [-ci consoleIn] [-co consoleOut]
Partial usage: nachos [-n #] [-m #]
Machine halting!

Ticks: total 10, idle 0, system 10, user 0
Disk I/O: reads 0, writes 0
Console I/O: reads 0, writes 0
Paging: faults 0
Network I/O: packets received 0, sent 0
```

这个地方我做了两次，都是缺文件，然后乱操作一通，莫名其妙就可以编译了，我也不清楚原因，大家多尝试一下吧。

总之我们已经成功安装了

7.建立交叉编译环境

将 mips-decstation.linux-xgcc.tgz 压缩文件拷贝到根目录

```
sudo mv mips-decstation.linux-xgcc.tgz /.
```

```
testm@testm-virtual-machine:~/Desktop$ sudo mv mips-decstation.linux-xgcc.tgz /.
[sudo] password for testm:
```

进入根目录

解压

```
cd /
```

```
sudo tar xvzf mips-decstation.linux-xgcc.tgz
```

```
testm@testm-virtual-machine:~/Desktop$ cd /
testm@testm-virtual-machine:/$ tar xvzf mips-decstation.linux-xgcc.tgz
```

解压完成

下面编译可执行文件格式转换器

进入到 NachOS 文件夹下面的 coff2noff 文件中

```
testm@testm-virtual-machine:~/Desktop$ cd NachOS-4.1
testm@testm-virtual-machine:~/Desktop/NachOS-4.1$ cd coff2noff
testm@testm-virtual-machine:~/Desktop/NachOS-4.1/coff2noff$
```

运行文件

./configure

```
testm@testm-virtual-machine:~/Desktop/NachOS-4.1/coff2noff$ ./configure
checking for gcc... gcc
checking for C compiler default output... a.out
checking whether the C compiler works... yes
checking whether we are cross compiling... no
checking for executable suffix...
checking for object suffix... o
checking whether we are using the GNU C compiler... yes
checking whether gcc accepts -g... yes
checking for strip... strip
checking for ld... ld
checking how to run the C preprocessor... gcc -E
checking for fcntl.h... yes
checking for limits.h... yes
checking for unistd.h... yes
checking for ANSI C header files... yes
checking for stdlib.h... yes
checking for working malloc... yes
configure: creating ./config.status
config.status: creating Makefile
config.status: creating config.h
config.status: config.h is unchanged
testm@testm-virtual-machine:~/Desktop/NachOS-4.1/coff2noff$
```

然后打开生成的 Makefile 文件

修改为

```
CC=gcc
CFLAGS= -g -m32 -O2 -DRDATA -DHAVE_CONFIG_H -I@top_dir@
LD=gcc -m32
```

注意有两行要添加 -m32

修改之后

终端输入

make clean

make

之后进入到 Nachos 目录下 code 子目录下的 test 目录

```
testm@testm-virtual-machine:~/Desktop/NachOS-4.1/coff2noff$ cd ../code/test
testm@testm-virtual-machine:~/Desktop/NachOS-4.1/code/test$
```

检查 Makefile.dep 下的交叉编译器路径是否正确

编译 test 目录下的用户程序 make

```
numsections 3
Loading 3 sections:
    ".text", filepos 0xd0, mempos 0x0, size 0x210
    ".data", filepos 0x2e0, mempos 0x280, size 0x0
    ".bss", filepos 0x0, mempos 0x280, size 0x0
/usr/local/nachos/bin/decstation-ultrix-gcc -G 0 -O3 -ggdb -c -I../userprog -I../lib -c sort.c -o sort.o
/usr/local/nachos/bin/decstation-ultrix-ld -T script -N start.o sort.o -o sort.coff
/usr/local/nachos/bin/decstation-ultrix-strip sort.coff
../../coff2noff/coff2noff sort.coff sort.noff
numsections 3
Loading 3 sections:
    ".text", filepos 0xd0, mempos 0x0, size 0x270
    ".data", filepos 0x340, mempos 0x280, size 0x0
    ".bss", filepos 0x0, mempos 0x280, size 0x1000
rm halt.coff sort.coff matmult.o add.coff halt.o sort.o shell.o add.o matmult.coff shell.coff
```

测试用户态程序是否能在 nachos 上运行

```
testm@testm-virtual-machine:~/Desktop/NachOS-4.1/code/test$ ../build.linux/nachos -x add.noff

tests summary: ok:0
Machine halting!

Ticks: total 28, idle 0, system 10, user 18
Disk I/O: reads 0, writes 0
Console I/O: reads 0, writes 0
Paging: faults 0
Network I/O: packets received 0, sent 0
testm@testm-virtual-machine:~/Desktop/NachOS-4.1/code/test$
```

如果可以看到系统运行界面，则说明程序运行成功

