

I don't have root access, so I needed a place to install Mosh and its dependencies. I created a directory `~/local` where all compiled software would be installed:

```
erfan@erfan-virtual-machine:~$ mkdir -p ~/local
```

Then, I added these lines to `~/.bashrc`:

```
erfan@erfan-virtual-machine:~$ export PATH="$HOME/local/bin:$PATH"
erfan@erfan-virtual-machine:~$ export LD_LIBRARY_PATH="$HOME/local/lib:$LD_LIBRARY_PATH"
erfan@erfan-virtual-machine:~$ export PKG_CONFIG_PATH="$HOME/local/lib/pkgconfig:$PKG_CONFIG_PATH"
erfan@erfan-virtual-machine:~$ export CPPFLAGS="-I$HOME/local/include"
erfan@erfan-virtual-machine:~$ export LDFLAGS="-L$HOME/local/lib"
erfan@erfan-virtual-machine:~$
```

After that I reloaded `.bashrc` so that it would be possible to run binaries (like `protoc`, `openssl`) directly, help the system find locally installed libraries, help `configure` scripts detect dependencies, and tell the compiler where to find headers and libraries:

```
erfan@erfan-virtual-machine:~$ source ~/.bashrc
```

Then, I installed protobuf (a Google library for serializing structured data which is required by Mosh):

```
erfan@erfan-virtual-machine:~$ wget https://github.com/protocolbuffers/protobuf/releases/download/v21.12/protobuf-all-21.12.tar.gz
--2025-04-13 16:11:11-- https://github.com/protocolbuffers/protobuf/releases/download/v21.12/protobuf-all-21.12.tar.gz
Resolving github.com (github.com)... 20.27.177.113
Connecting to github.com (github.com)[20.27.177.113]:443... connected.
ERROR: cannot verify github.com's certificate, issued by 'CN= Sectigo ECC Domain Validation Secure Server CA,O=Sectigo Limited,L=Salford,ST=Greater Manchester,C=GB':
Unable to locally verify the issuer's authority.
To connect to github.com insecurely, use '--no-check-certificate'.
erfan@erfan-virtual-machine:~$ tar -xzf protobuf-all-21.12.tar.gz
erfan@erfan-virtual-machine:~$ cd protobuf-21.12
erfan@erfan-virtual-machine:~/protobuf-21.12$ ./configure --prefix=$HOME/local
checking whether to enable maintainer-specific portions of Makefiles... yes
checking build system type... x86_64-pc-linux-gnu
checking host system type... x86_64-pc-linux-gnu
checking target system type... x86_64-pc-linux-gnu
checking for a BSD-compatible install... /usr/bin/install -c
checking whether build environment is sane... yes
```

```
erfan@erfan-virtual-machine:~/protobuf-21.12$ make && make install
make all-recursive
make[1]: Entering directory '/home/erfan/protobuf-21.12'
Making all in .
make[2]: Entering directory '/home/erfan/protobuf-21.12'
make[2]: Leaving directory '/home/erfan/protobuf-21.12'
Making all in src
make[2]: Entering directory '/home/erfan/protobuf-21.12/src'
make[2]: Nothing to be done for 'all'.
make[2]: Leaving directory '/home/erfan/protobuf-21.12/src'
make[1]: Leaving directory '/home/erfan/protobuf-21.12'
Making install in .
make[1]: Entering directory '/home/erfan/protobuf-21.12'
make[2]: Entering directory '/home/erfan/protobuf-21.12'
make[2]: Nothing to be done for 'install-exec-am'.
/usr/bin/mkdir -p '/home/erfan/local/lib/pkgconfig'
/usr/bin/install -c -m 644 protobuf.pc protobuf-lite.pc '/home/erfan/local/lib/pkgconfig'
make[2]: Leaving directory '/home/erfan/protobuf-21.12'
make[1]: Leaving directory '/home/erfan/protobuf-21.12'
```

```
erfan@erfan-virtual-machine:~/protobuf-21.12$ protoc --version
libprotoc 3.21.12
```

Next, I installed ncurses (A library for text-based user interfaces which is used by Mosh for terminal control):

```
erfan@erfan-virtual-machine:~$ tar -xzf ncurses-6.4.tar.gz
erfan@erfan-virtual-machine:~$ cd ncurses-6.4
erfan@erfan-virtual-machine:~/ncurses-6.4$ ./configure --prefix=$HOME/local --with-shared --without-debug
checking for ggrep... no
checking for grep... grep
checking for egrep... grep -E
Configuring NCURSES 6.4 ABI 6 (Sun Apr 13 16:15:19 +0330 2025)
checking for package version... 6.4
checking for package patch date... 20221231
checking build system type... x86_64-pc-linux-gnu
checking host system type... x86_64-pc-linux-gnu
checking target system type... x86_64-pc-linux-gnu
Configuring for linux-gnu
```

```

erfan@erfan-virtual-machine:~/ncurses-6.4$ make && make install
( cd man && make DESTDIR="" RPATH_LIST="/home/erfan/local/lib" all )
make[1]: Entering directory '/home/erfan/ncurses-6.4/man'
/bin/sh ./MKterminfo.sh ./terminfo.head ../../include/Caps ../../include/Caps-ncurses ./terminfo.tail >terminfo.5
make[1]: Leaving directory '/home/erfan/ncurses-6.4/man'
( cd include && make DESTDIR="" RPATH_LIST="/home/erfan/local/lib" all )
make[1]: Entering directory '/home/erfan/ncurses-6.4/include'
cat curses.head >curses.h
AWK=mawk /bin/sh ./MKkey_defs.sh ./Caps ./Caps-ncurses >>curses.h
/bin/sh -c 'if test "0" = "1" ; then cat ./curses.events >>curses.h ; fi'
/bin/sh -c 'if test "ctype" = "cchar_t" ; then cat ./curses.wide >>curses.h ; fi'
cat ./curses.tail >>curses.h
mawk -f MKterm.h.awk ./Caps ./Caps-ncurses > term.h
/bin/sh ./edit_cfg.sh ../include/ncurses_cfg.h term.h
** edit: HAVE_TGETATTR 1

erfan@erfan-virtual-machine:~/ncurses-6.4$ ls ~/local/lib/libncurses.so*
/home/erfan/local/lib/libncurses.so /home/erfan/local/lib/libncurses.so.6 /home/erfan/local/lib/libncurses.so.6.4
erfan@erfan-virtual-machine:~/ncurses-6.4$

```

And for the last dependency, I installed openssl (provides cryptographic functions which Mosh uses for secure connections):

```

erfan@erfan-virtual-machine:~$ wget https://www.openssl.org/source/openssl-1.1.1w.tar.gz
--2025-04-13 16:22:21-- https://www.openssl.org/source/openssl-1.1.1w.tar.gz
Resolving www.openssl.org (www.openssl.org)... 34.49.79.89, 2600:1901:0:d50b::
Connecting to www.openssl.org (www.openssl.org)|34.49.79.89|:443... connected.
ERROR: cannot verify www.openssl.org's certificate, issued by 'CN=WR3,O=Google Trust Services,C=US':
  Unable to locally verify the issuer's authority.
To connect to www.openssl.org insecurely, use '--no-check-certificate'.
erfan@erfan-virtual-machine:~$ tar -xzf openssl-1.1.1w.tar.gz
erfan@erfan-virtual-machine:~$ cd openssl-1.1.1w
erfan@erfan-virtual-machine:~/openssl-1.1.1w$ ./config --prefix=$HOME/local --openssldir=$HOME/local/ssl
Operating system: x86_64-whatever-linux2
Configuring OpenSSL version 1.1.1w (0x1010117fL) for linux-x86_64
Using os-specific seed configuration
Creating configdata.pm
Creating Makefile

*****
***
***   OpenSSL has been successfully configured   ***
***
***   If you encounter a problem while building, please open an ***
***   issue on GitHub <https://github.com/openssl/openssl/issues> ***
***   and include the output from the following command: ***
***
***       perl configdata.pm --dump ***
***
***   (If you are new to OpenSSL, you might want to consult the ***
***   'Troubleshooting' section in the INSTALL file first) ***
***
*****
erfan@erfan-virtual-machine:~/openssl-1.1.1w$

```

```

erfan@erfan-virtual-machine:~/openssl-1.1.1w$ make && make install
/usr/bin/perl "-I." -Mconfigdata "util/dofile.pl" \
  "-oMakefile" include/crypto/bn_conf.h.in > include/crypto/bn_conf.h
/usr/bin/perl "-I." -Mconfigdata "util/dofile.pl" \
  "-oMakefile" include/crypto/dso_conf.h.in > include/crypto/dso_conf.h
/usr/bin/perl "-I." -Mconfigdata "util/dofile.pl" \
  "-oMakefile" include/openssl/opensslconf.h.in > include/openssl/opensslconf.h
make depend && make _all
make[1]: Entering directory '/home/erfan/openssl-1.1.1w'
make[1]: Leaving directory '/home/erfan/openssl-1.1.1w'
make[1]: Entering directory '/home/erfan/openssl-1.1.1w'
/usr/bin/perl util/mkbuildinf.pl "gcc -fPIC -pthread -m64 -Wa,--noexecstack -Wall -O3 -DOPENSSL_USE_NODELETE -DL_ENDIAN -DOPENSSL_PIC -DOPENSSL_CPUID_OBJ -DOPENSSL_IA32_SSE2 -DOPENSSL_BN_ASM_MONT -DOPENSSL_BN_ASM_MONT5 -DOPENSSL_BN_ASM_GF2m -DSHA1_ASM -DSHA256_ASM -DSHA512_ASM -DKECCAK1600_ASM -DRC4_ASM -DMD5_ASM -DAESNI_ASM -DVPAES_ASM -DGHASH_ASM -DECP_NISTZ256_ASM -DX25519_ASM -DPOLY1305_ASM -DNDEBUG -I/home/erfan/local/include" "linux-x86_64" > crypto/buildinf.h
gcc -I. -Iinclude -Icrypto -fPIC -pthread -m64 -Wa,--noexecstack -Wall -O3 -DOPENSSL_USE_NODELETE -DL_ENDIAN -DOPENSSL_PIC -DOPENSSL_CPUID_OBJ -DOPENSSL_IA32_SSE2 -DOPENSSL_BN_ASM_MONT -DOPENSSL_BN_ASM_MONT5 -DOPENSSL_BN_ASM_GF2m -DSHA1_ASM -DSHA256_ASM -DSHA512_ASM -DKECCAK1600_ASM -DRC4_ASM -DMD5_ASM -DAESNI_ASM -DVPAES_ASM -DGHASH_ASM -DECP_NISTZ256_ASM -DX25519_ASM -DPOLY1305_ASM -DOPENSSLDIR=""/home/erfan/local/ssl" -DENGINEIDIR=""/home/erfan/local/lib/engines-1.1" -DNDEBUG -I/home/erfan/local/include -DMD -MF crypto/cversion.d.tmp -MT crypto/cversion.o -C -o crypto/cversion.o crypto/cversion.c
ar r libcrypto.a crypto/cversion.o
ranlib libcrypto.a || echo Never mind.
gcc -fPIC -pthread -m64 -Wa,--noexecstack -Wall -O3 -L. -Wl,-znodelete -shared -Wl,-Bsymbolic -L/home/erfan/local/lib -Wl,-soname=libcrypto.so.1.1 \
  -o libcrypto.so.1.1 -Wl,--version-script=libcrypto.map crypto/aes/aes_cbc.o crypto/aes/aes_cfb.o crypto/aes/aes_core.o crypto/aes/aes_ecb.o crypto/aes/aes_ige.o crypto/aes/aes_misc.o crypto/aes/aes_ofb.o
crypto/aes/aes_wrap.o crypto/aes/aesni-mb-x86_64.o crypto/aes/aesni-sha1-x86_64.o crypto/aes/aesni-sha256-x86_64.o crypto/aes/aesni-x86_64.o crypto/aes/vpaes-x86_64.o crypto/aria/aria.o crypto/asn1/a_bitstr.o c
crypto/asn1/a_d2i_fp.o crypto/asn1/a_digest.o crypto/asn1/a_dup.o crypto/asn1/a_gentm.o crypto/asn1/a_i2d_fp.o crypto/asn1/a_int.o crypto/asn1/a_mbstr.o crypto/asn1/a_object.o crypto/asn1/a_octet.o crypto/asn1/a
print.o crypto/asn1/a_sign.o crypto/asn1/a_strex.o crypto/asn1/a_strnid.o crypto/asn1/a_time.o crypto/asn1/a_type.o crypto/asn1/a_utctm.o crypto/asn1/a_utf8.o crypto/asn1/a_verify.o crypto/asn1/aeth.lib.o crypt
o/asn1/asn1_err.o crypto/asn1/asn1_gen.o crypto/asn1/asn1_item_list.o crypto/asn1/asn1_lib.o crypto/asn1/asn1_par.o crypto/asn1/asn_mime.o crypto/asn1/asn_moid.o crypto/asn1/asn_mtbl.o crypto/asn1/asn_pack.o cr
ypto/asn1/bio_asn1.o crypto/asn1/bio_ndef.o crypto/asn1/d2i_pr.o crypto/asn1/d2i_pub.o crypto/asn1/evp_asn1.o crypto/asn1/f_int.o crypto/asn1/f_string.o crypto/asn1/i2d_pr.o crypto/asn1/i2d_pub.o crypto/asn1/n_pke
y.o crypto/asn1/nsseq.o crypto/asn1/p5_pbe.o crypto/asn1/p5_pbev2.o crypto/asn1/p5_scmpt.o crypto/asn1/p8_key.o crypto/asn1/t_bitst.o crypto/asn1/t_pkey.o crypto/asn1/t_spki.o crypto/asn1/tasn_dec.o crypto/asn

```

```

erfan@erfan-virtual-machine:~/openssl-1.1.1w$ ~/local/bin/openssl version
OpenSSL 1.1.1w 11 Sep 2023
erfan@erfan-virtual-machine:~/openssl-1.1.1w$

```

At last, I installed and compiled Mosh:

```

erfan@erfan-virtual-machine:~$ tar -xzf mosh-1.4.0.tar.gz
erfan@erfan-virtual-machine:~$ cd mosh-1.4.0
erfan@erfan-virtual-machine:~/mosh-1.4.0$ ./configure --prefix=$HOME/local
checking for a BSD-compatible install... /usr/bin/install -c
checking whether build environment is sane... yes
checking for a race-free mkdir -p... /usr/bin/mkdir -p
checking for gawk... no
checking for mawk... mawk
checking whether make sets $(MAKE)... yes
checking whether make supports nested variables... yes
checking whether make supports nested variables... (cached) yes
checking whether to build with code coverage support... no
checking for cc... cc
checking whether the C compiler works... yes
checking for C compiler default output file name... a.out
checking for suffix of executables...

```

```

erfan@erfan-virtual-machine:~/mosh-1.4.0$ make && make install
make all-recursive
make[1]: Entering directory '/home/erfan/mosh-1.4.0'
Making all in scripts
make[2]: Entering directory '/home/erfan/mosh-1.4.0/scripts'
perl -Mdiagnostics -c ./mosh.pl
./mosh.pl syntax OK
make[2]: Leaving directory '/home/erfan/mosh-1.4.0/scripts'
Making all in src
make[2]: Entering directory '/home/erfan/mosh-1.4.0/src'
Making all in include
make[3]: Entering directory '/home/erfan/mosh-1.4.0/src/include'
make all-am

```

I added to *PATH* permanently:

```
erfan@erfan-virtual-machine:~/mosh-1.4.0$ echo 'export PATH="$HOME/local/bin:$PATH"' >> ~/.bashrc
erfan@erfan-virtual-machine:~/mosh-1.4.0$ echo 'export LD_LIBRARY_PATH="$HOME/local/lib:$LD_LIBRARY_PATH"' >> ~/.bashrc
erfan@erfan-virtual-machine:~/mosh-1.4.0$ source ~/.bashrc
erfan@erfan-virtual-machine:~/mosh-1.4.0$
```

Here is testing of Mosh:

```
erfan@erfan-virtual-machine:~/mosh-1.4.0$ mosh-server

MOSH CONNECT 60001 vy5LEfs3A3Dyy8KkYSfyWA

mosh-server (mosh 1.4.0) [build mosh 1.4.0]
Copyright 2012 Keith Winstein <mosh-devel@mit.edu>
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>.
This is free software: you are free to change and redistribute it.
There is NO WARRANTY, to the extent permitted by law.

[mosh-server detached, pid = 125091]
erfan@erfan-virtual-machine:~/mosh-1.4.0$ mosh normal_user@192.168.38.130
normal_user@192.168.38.130's password:

Welcome to Ubuntu 20.04.6 LTS (GNU/Linux 5.15.0-136-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

 * Introducing Expanded Security Maintenance for Applications.
   Receive updates to over 25,000 software packages with your
   Ubuntu Pro subscription. Free for personal use.

   https://ubuntu.com/pro

Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

The list of available updates is more than a week old.
To check for new updates run: sudo apt update
New release '22.04.5 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

Your Hardware Enablement Stack (HWE) is supported until April 2025.

normal_user@erfan-virtual-machine:~$
```