

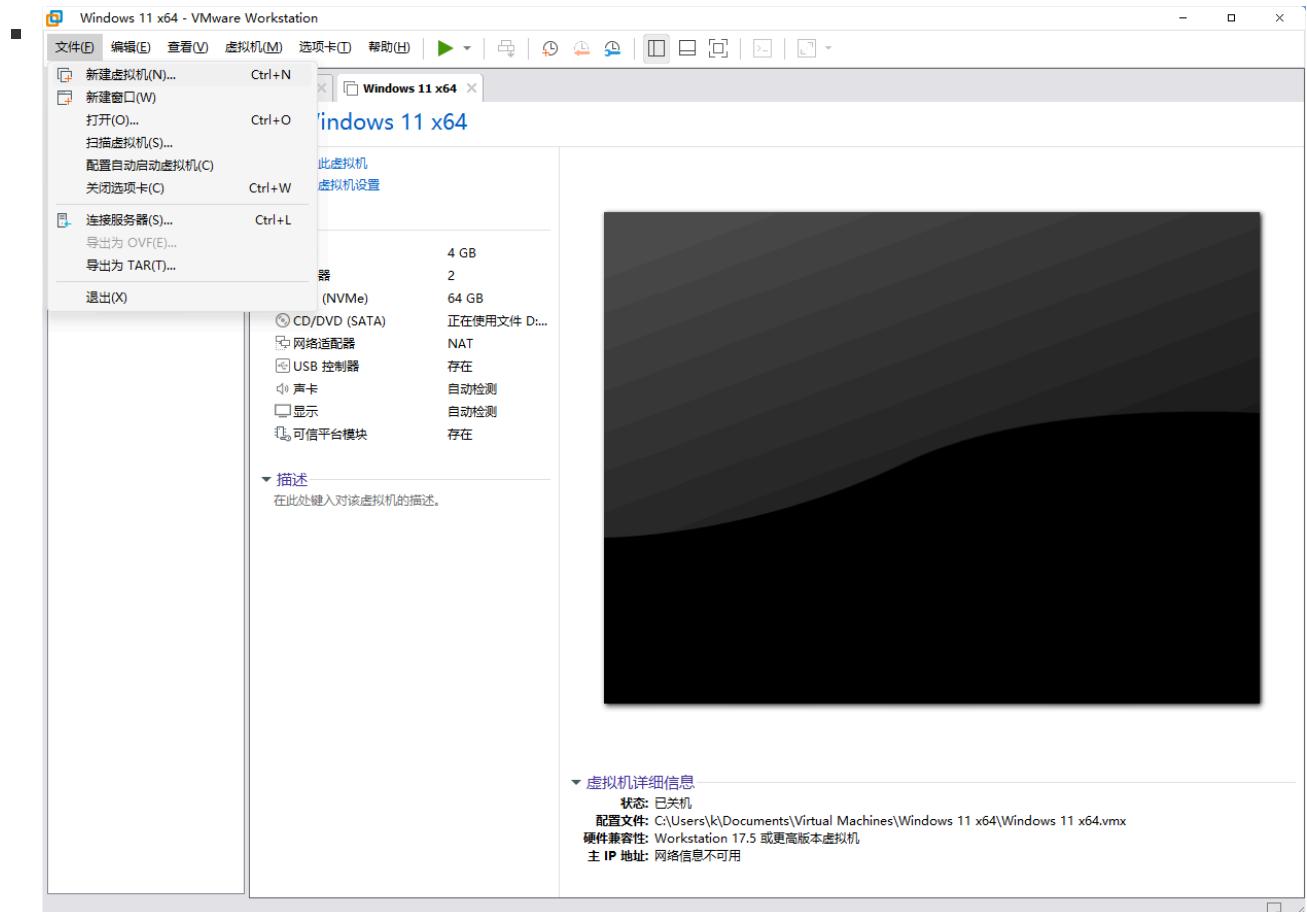
OpenEuler 实验报告

实验步骤

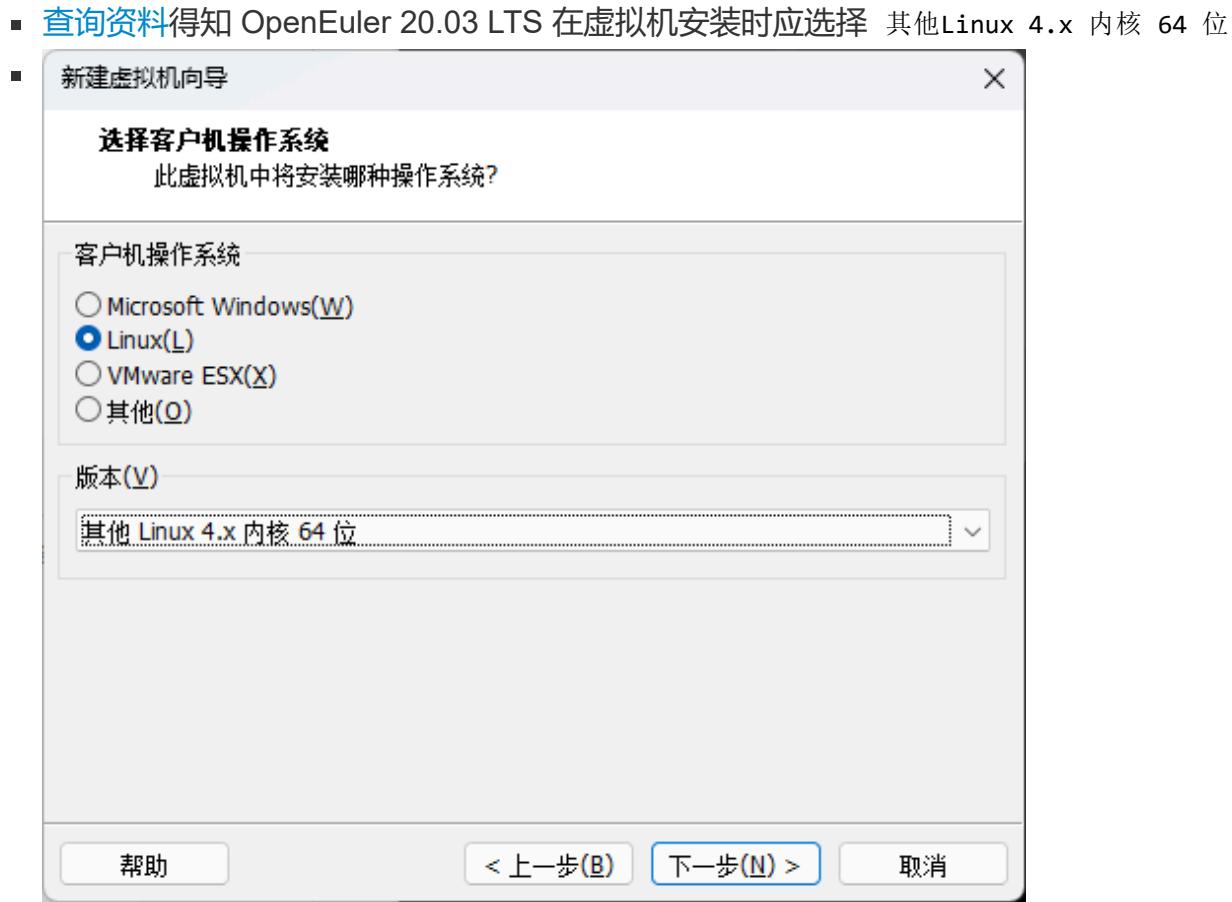
- 用虚拟机 VMware 完成 OpenEuler 操作系统的安装

- 安装

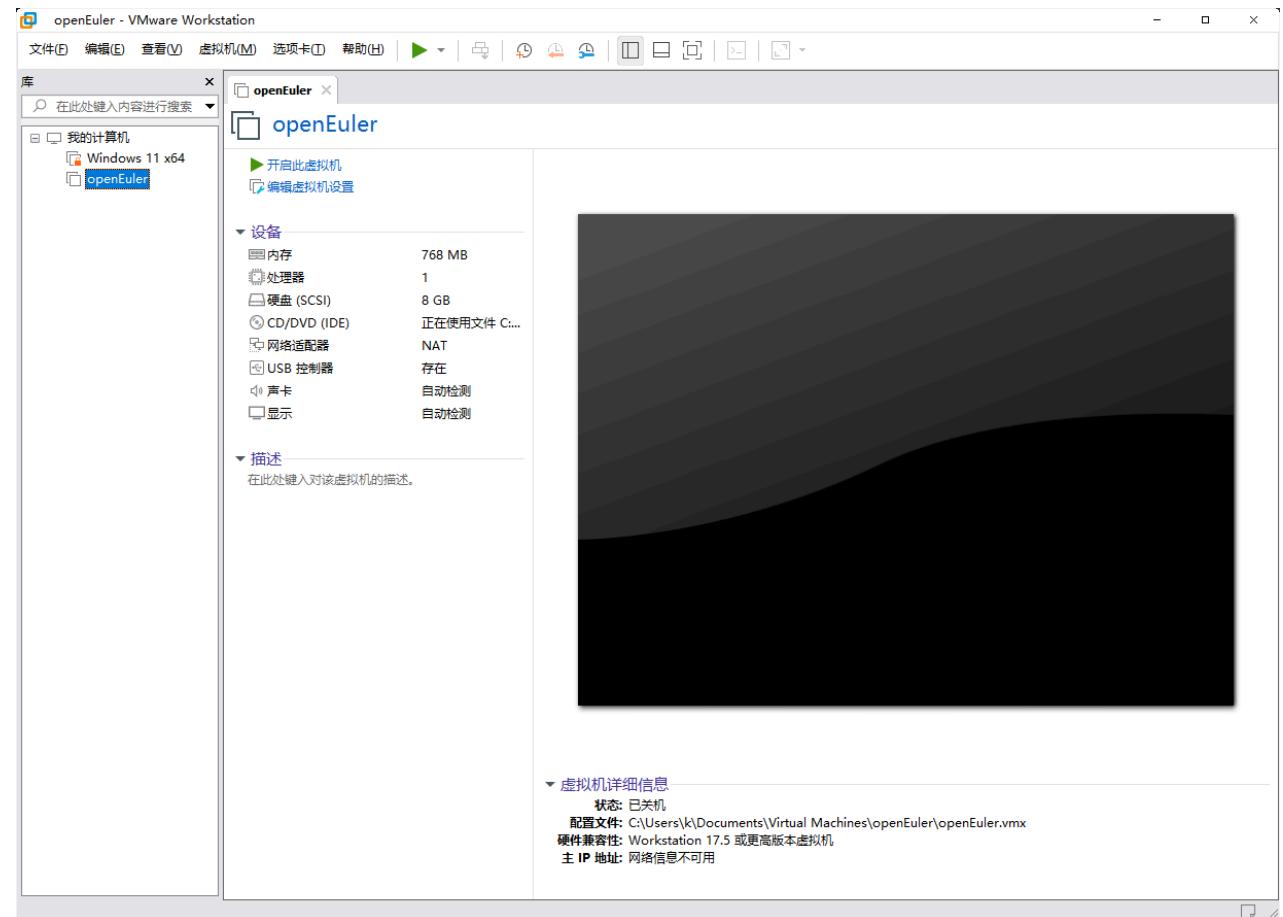
- 在 VMware 中新建虚拟机



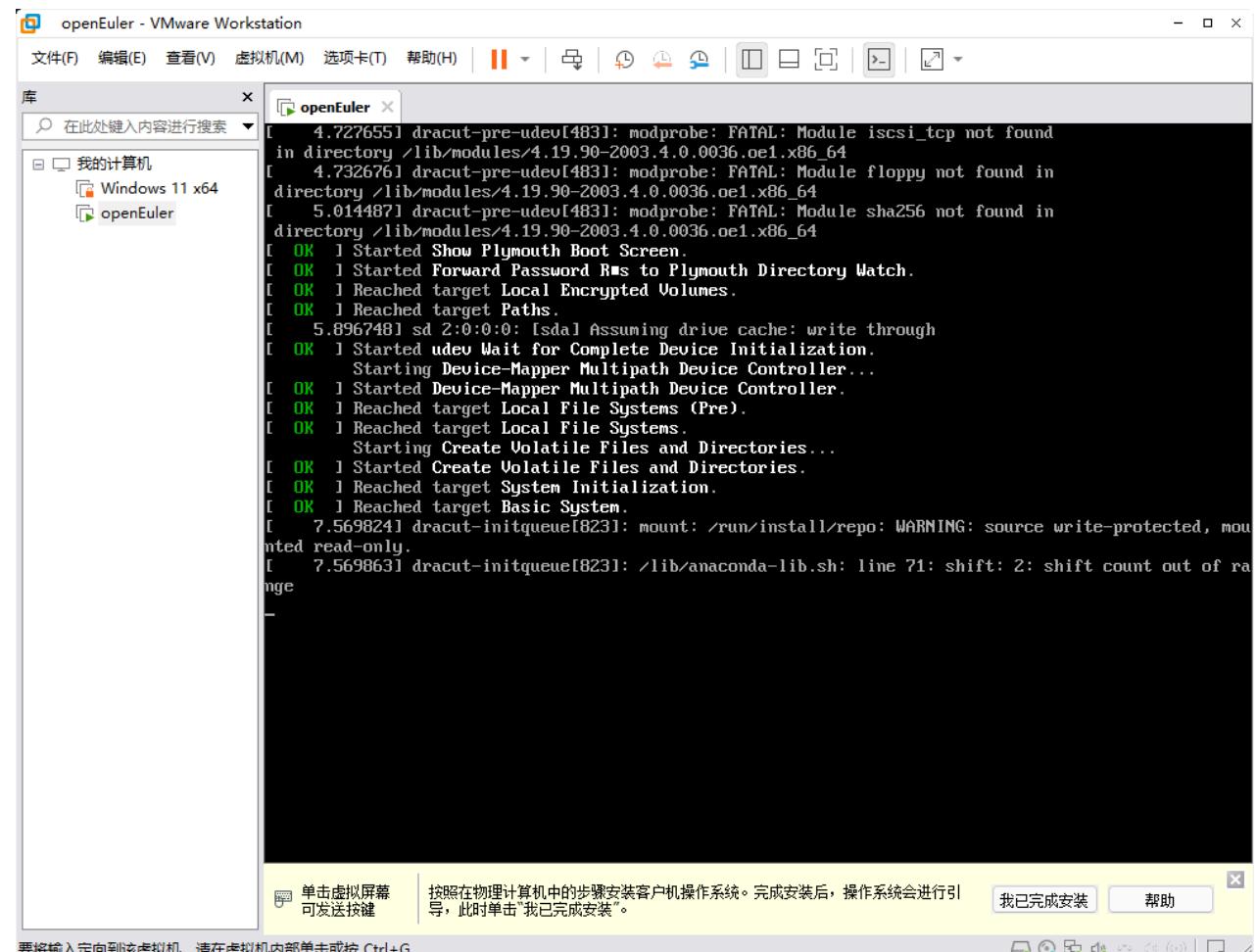
- 选择下载的 iso 文件



- 其他 VMware 参数选择默认参数 成功添加虚拟机



■ 启动虚拟机 等待系统安装



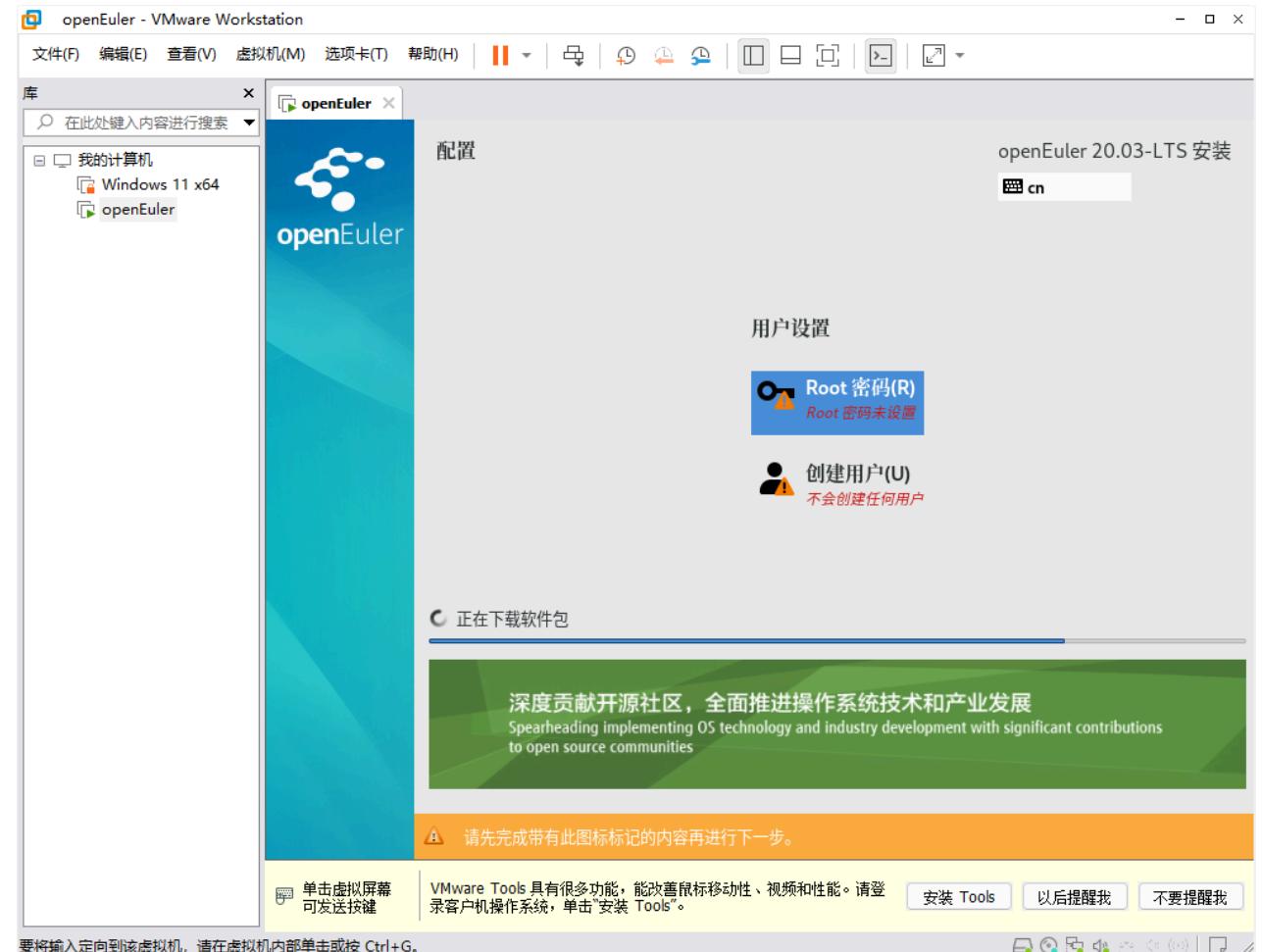
要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。

单击虚拟屏幕
可发送按键
按照在物理计算机中的步骤安装客户机操作系统。完成安装后，操作系统会进行引导，此时单击“我已完成安装”。

我已完成安装

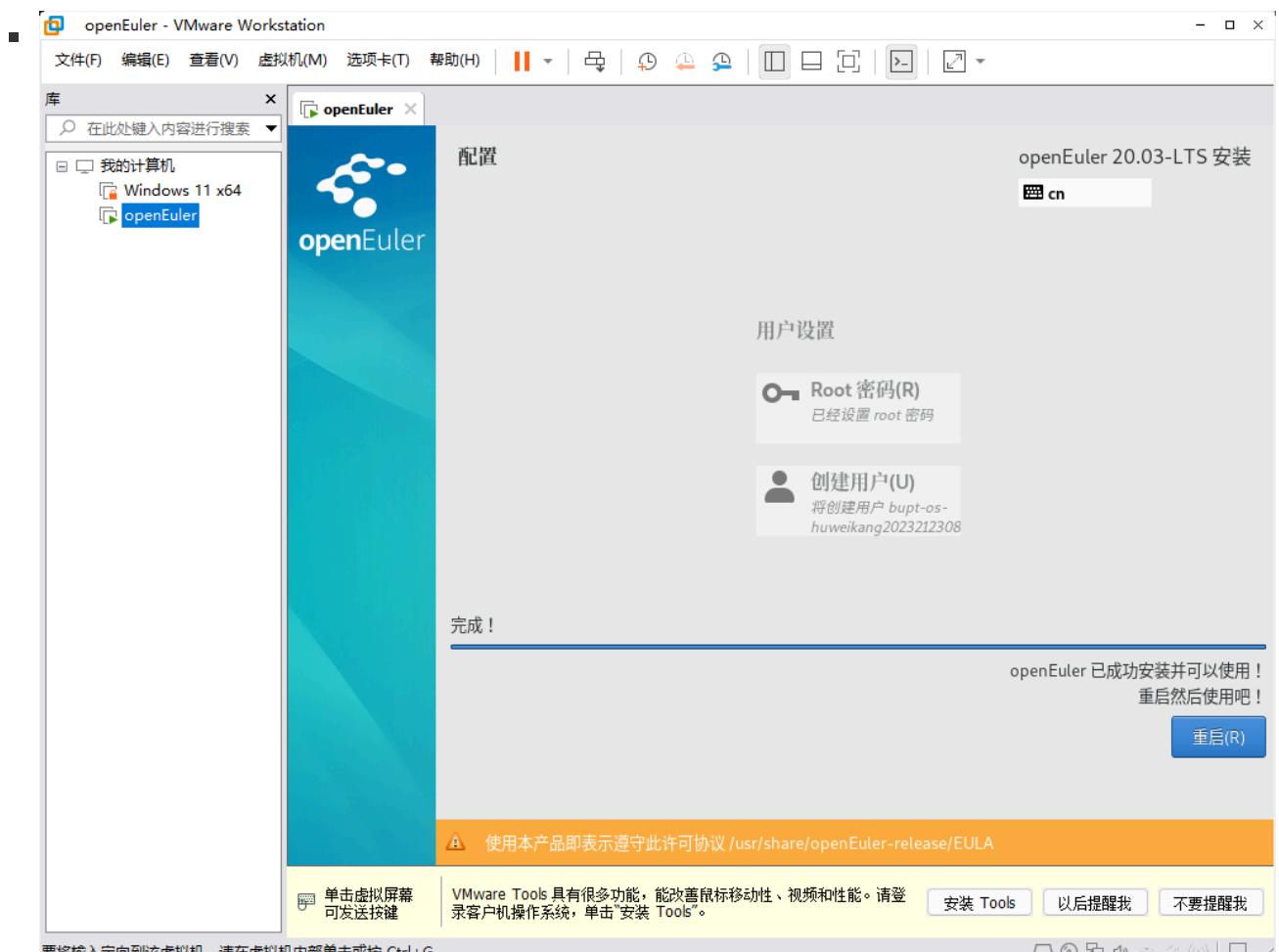
帮助

■ 设置 Root 密码 创建用户

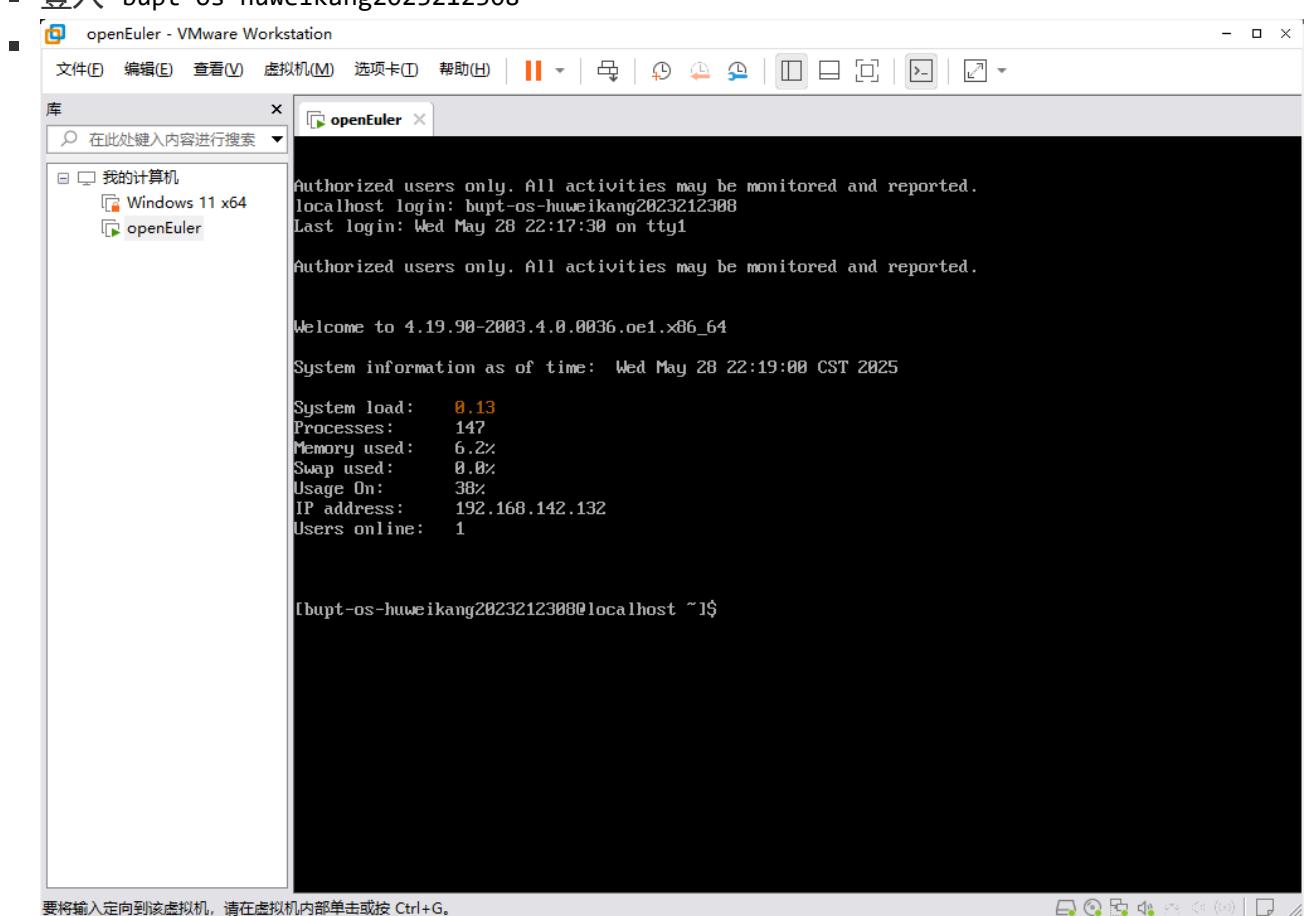




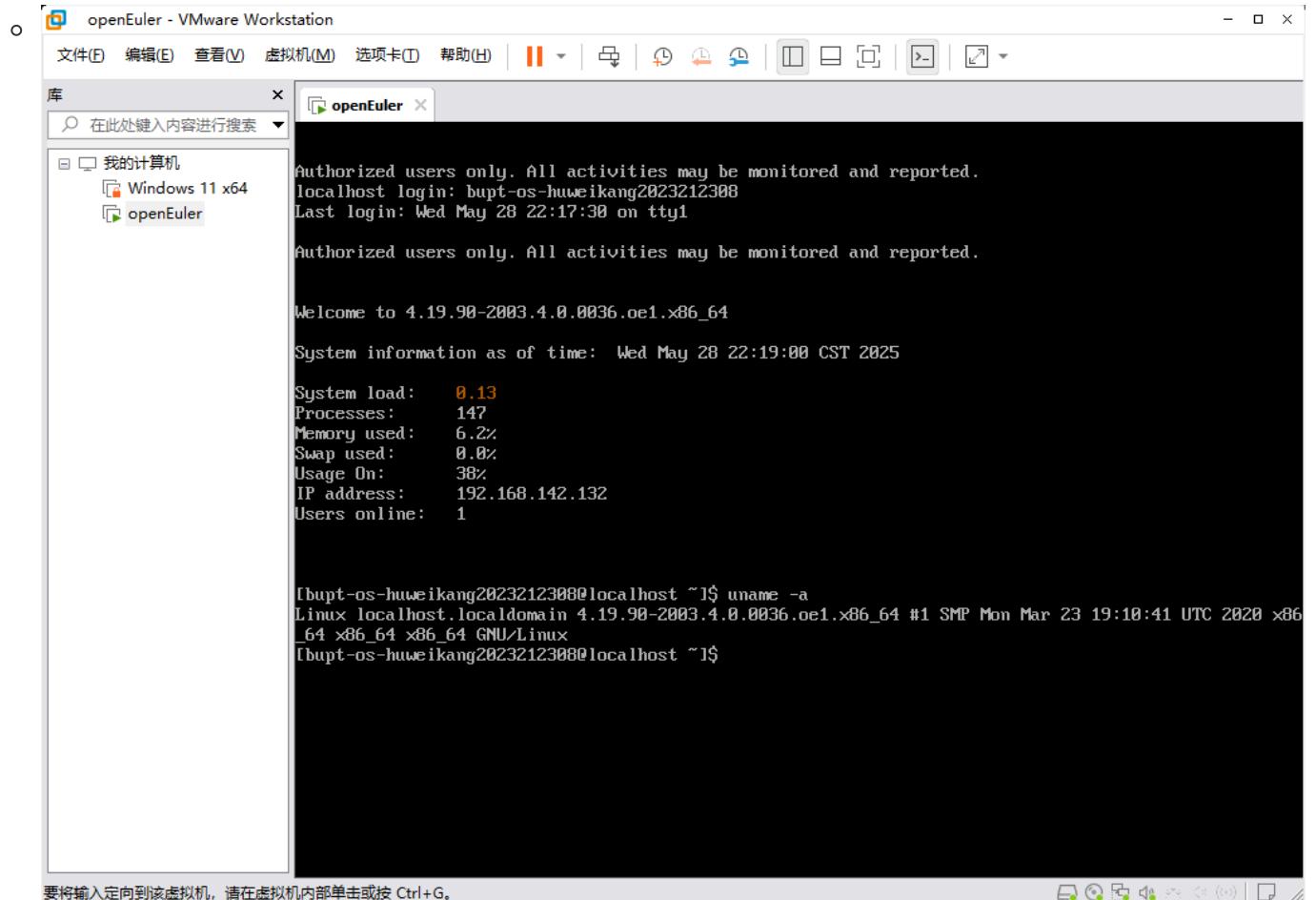
- 安装完毕 重启虚拟机



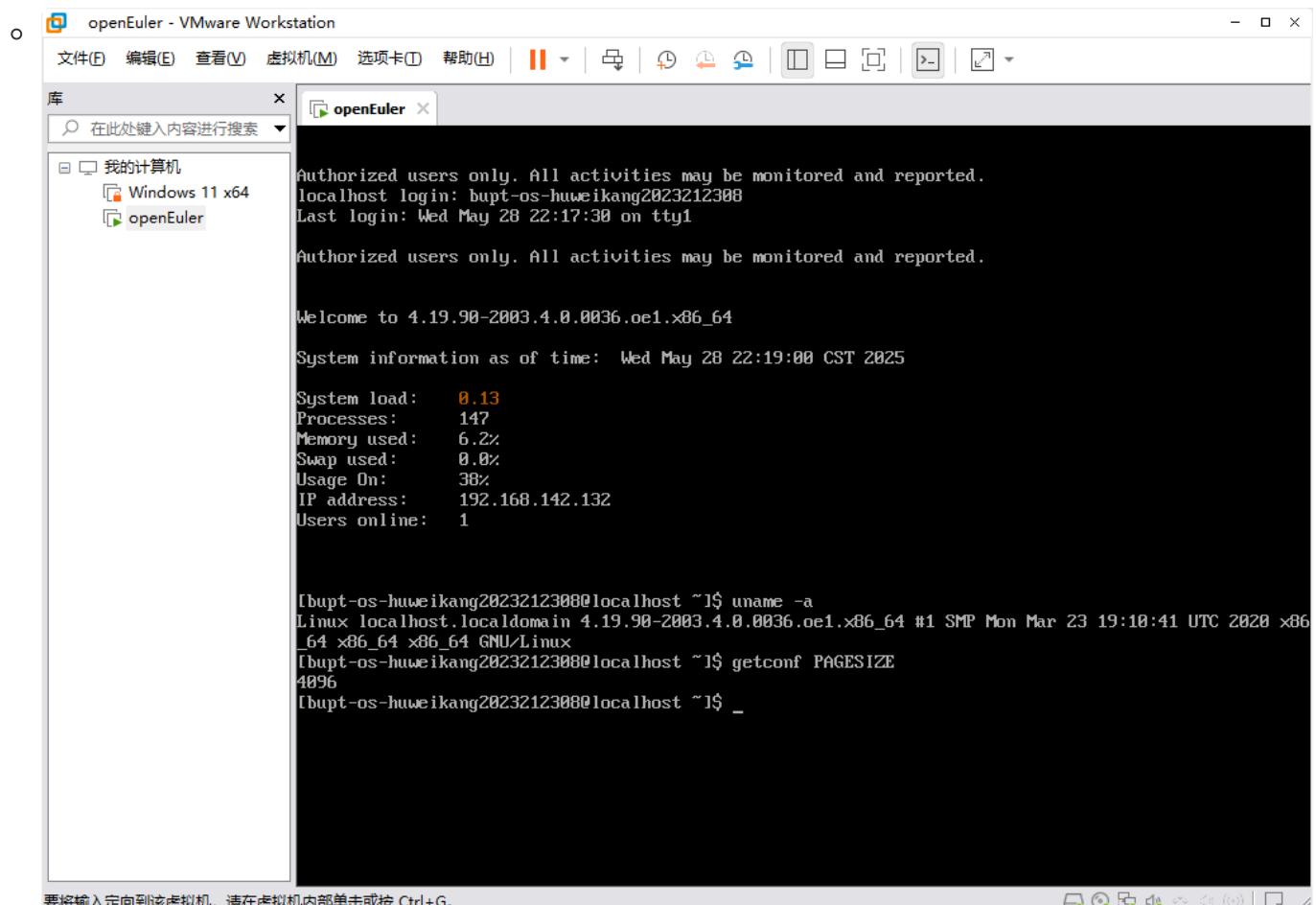
■ 登入 bupt-os-huweikang2023212308



- o uname -a 指令



- o getconf PAGESIZE 指令



要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。



- 采用重新编译源代码的方式将内核更新至最新版

- 登出 bupt-os-huweikang2023212308 登入 root
 - 指令
 - logout
- 下载 openEuler 20.03 update 4.19.90-2403.4.0 对应 Source code
- 将文件传入虚拟机中
 - 指令
 - scp .\kernel-4.19.90-2403.4.0.tar.gz root@192.168.142.132:/root/
- IP 地址在登陆 OpenEuler 时可以得到

```
Windows PowerShell
版权所有 (C) Microsoft Corporation。保留所有权利。

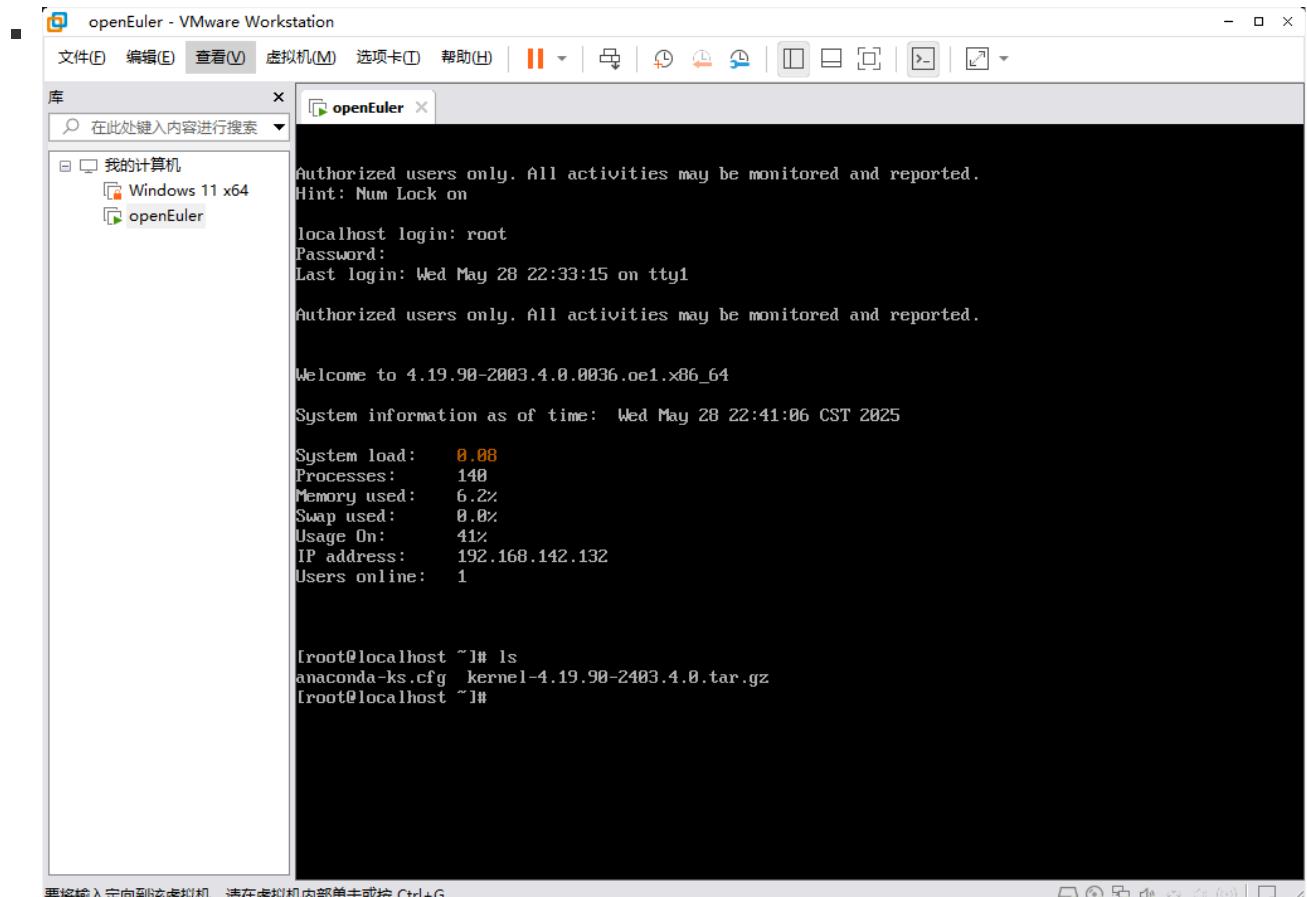
安装最新的 PowerShell, 了解新功能和改进! https://aka.ms/PSWindows

加载个人及系统配置文件用了 1924 毫秒。
PS C:\Users\k\Downloads> scp .\kernel-4.19.90-2403.4.0.tar.gz root@192.168.142.132:/root/
The authenticity of host '192.168.142.132 (192.168.142.132)' can't be established.
ED25519 key fingerprint is SHA256:RG1Y2tfN7eeWP5DDN4GZdPNic7Nnt83+t2BnrhVpU.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])?
Warning: Permanently added '192.168.142.132' (ED25519) to the list of known hosts.

Authorized users only. All activities may be monitored and reported.
root@192.168.142.132's password:
kernel-4.19.90-2403.4.0.tar.gz                                         100%  157MB 147.1MB/s   00:01
PS C:\Users\k\Downloads> |
```

■ 指令

- 1s
 - 可以发现成功传入



○ 解压文件

- ## ■ 指令

- `tar -xvf kernel-4.19.90-2403.4.0.tar.gz`

```
openEuler
kernel-4.19.90-2403.4.0/virt/kvm/arm/mmio.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/mmio.h
kernel-4.19.90-2403.4.0/virt/kvm/arm/perf.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/pmu.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/psci.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/pvscched.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/trace.h
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/trace.h
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic-debug.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic-init.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic-irqfd.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic-its.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic-kvm-device.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic-mmio-v2.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic-mmio-v3.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic-mmio.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic-mmio.h
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic-v2.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic-v3.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic-v4.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic.c
kernel-4.19.90-2403.4.0/virt/kvm/arm/vgic/vgic.h
kernel-4.19.90-2403.4.0/virt/kvm/async_pf.c
kernel-4.19.90-2403.4.0/virt/kvm/async_pf.h
kernel-4.19.90-2403.4.0/virt/kvm/coalesced_mmio.c
kernel-4.19.90-2403.4.0/virt/kvm/coalesced_mmio.h
kernel-4.19.90-2403.4.0/virt/kvm/eventfd.c
kernel-4.19.90-2403.4.0/virt/kvm/irqchip.c
kernel-4.19.90-2403.4.0/virt/kvm/kvm_main.c
kernel-4.19.90-2403.4.0/virt/kvm/vfio.c
kernel-4.19.90-2403.4.0/virt/kvm/vfio.h
kernel-4.19.90-2403.4.0/virt/lib/
kernel-4.19.90-2403.4.0/virt/lib/Kconfig
kernel-4.19.90-2403.4.0/virt/lib/Makefile
kernel-4.19.90-2403.4.0/virt/lib/irqbypass.c
[root@localhost ~]#
```

○ 编译源代码

■ 指令

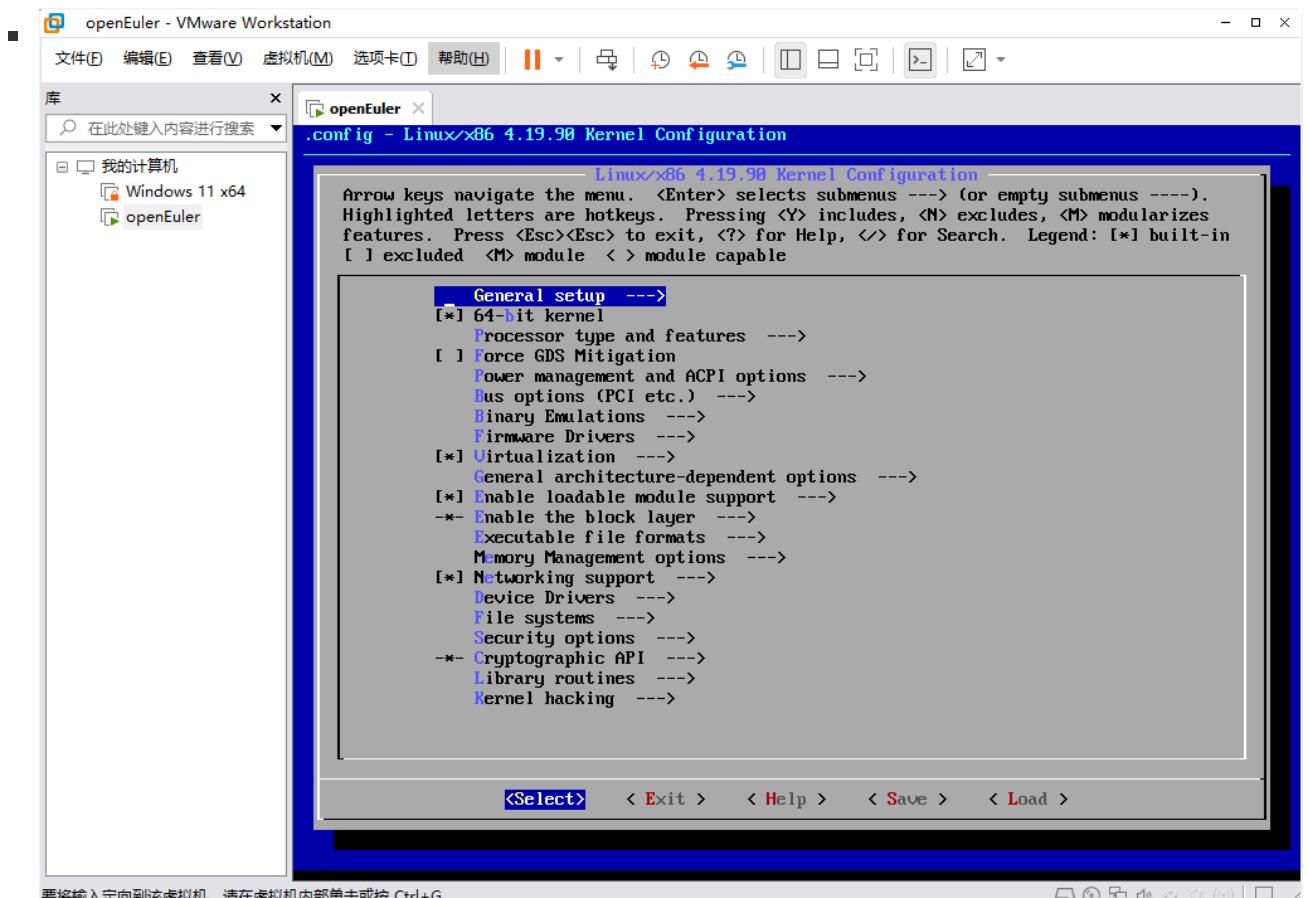
- `cd kernel-4.19.90-2403.4.0`

■ 安装依赖

- `yum install ncurses-devel`
- `yum install flex`
- `yum install bc`
- `yum install openssl-devel`
- `yum install elfutils-libelf-devel`

■ 指令

- `make menuconfig`



- 通过方向键选择 Save 并回车 保存默认配置
- 指令
 - make -j8
 - 8 线程加快编译速度

- 重新编译后，安装内核，执行 `uname -a` 指令

◦ 指令

- make modules_install -j8

```
INSTALL sound/soc/intel/boards/snd_soc_kbl_rtl5663_max90927.ko
INSTALL sound/soc/intel/boards/snd_soc_kbl_rtl5663_max5514_max90927.ko
INSTALL sound/soc/intel/boards/snd_soc_kl_nau88125_ssm4567.ko
INSTALL sound/soc/intel/boards/snd_soc_kl_rtl286.ko
INSTALL sound/soc/intel/boards/snd_soc_sst_bxt_da7219_max90357a.ko
INSTALL sound/soc/intel/boards/snd_soc_sst_bxt_rt298.ko
INSTALL sound/soc/intel/boards/snd_soc_sst_bjt_cht_da7213.ko
INSTALL sound/soc/intel/boards/snd_soc_sst_bjt_cht_es8316.ko
INSTALL sound/soc/intel/boards/snd_soc_sst_bjt_cht_nocodec.ko
INSTALL sound/soc/intel/boards/snd_soc_sst_btcr_rt5649.ko
INSTALL sound/soc/intel/boards/snd_soc_sst_btcr_rt5651.ko
INSTALL sound/soc/intel/boards/snd_soc_sst_cht_bsw_max009871.ti.ko
INSTALL sound/soc/intel/boards/snd_soc_sst_cht_bsw_nau824.ko
INSTALL sound/soc/intel/boards/snd_soc_sst_cht_bsw_rt5645.ko
INSTALL sound/soc/intel/boards/snd_soc_sst_cht_bsw_rt5672.ko
INSTALL sound/soc/intel/common/snd_soc_acpi-intel-match.ko
INSTALL sound/soc/intel/common/snd_soc_sst-aci1.ko
INSTALL sound/soc/intel/common/snd_soc_sst-dsp.ko
INSTALL sound/soc/intel/common/snd_soc_sst-firmware.ko
INSTALL sound/soc/intel/common/snd_soc_sst-ipk.ko
INSTALL sound/soc/intel/haswell/snd_soc_sst-haswell-pcm.ko
INSTALL sound/soc/intel/sklake/snd_soc_skl-ipk.ko
INSTALL sound/soc/intel/sklake/snd_soc_skl-ssp-clk.ko
INSTALL sound/soc/intel/sklake/snd_soc_skl-acpi.ko
INSTALL sound/soc/snd/snd_soc-acpi.ko
INSTALL sound/soc/snd/snd_soc-core.ko
INSTALL sound/soundcore.ko
INSTALL sound/synth/cmix/snd_enaux-synth.ko
INSTALL sound/synth/snd-util-mem.ko
INSTALL sound/usb/gf ire/snd-usb-gf ire.ko
INSTALL sound/usb/bcd2000/snd-bcd2000.ko
INSTALL sound/usb/caiaq/snd-usb-caiaq.ko
INSTALL sound/usb/hiface/snd-usb-hiface.ko
INSTALL sound/usb/line6/snd-usb-line6.ko
INSTALL sound/usb/line6/snd-usb-pod6.ko
INSTALL sound/usb/line6/snd-usb-toneport.ko
INSTALL sound/usb/line6/snd-usb-variax.ko
INSTALL sound/usb/misc/snd-ua101.ko
INSTALL sound/usb/snd-usb-audio.ko
INSTALL sound/usb/snd-usbmididi-lib.ko
INSTALL sound/usb/usbx2y/snd-usb-usbx21.ko
INSTALL sound/usb/usbx2y/snd-usb-usbx2y.ko
INSTALL sound/dfx/snd-hdmi-1pe-aud10.ko
INSTALL sound/xen/snd_xen_front.ko
INSTALL virt/lib/irqbypass.ko
DEPMOD 4.19.90
```

- 指令

- make install -j8

```
INSTALL sound/soc/intel/boards/snd-soc-skl_rt286.ko
INSTALL sound/soc/intel/boards/snd-soc-sst-bxt-da7219_max90357a.ko
INSTALL sound/soc/intel/boards/snd-soc-sst-bxt-rt298.ko
INSTALL sound/soc/intel/boards/snd-soc-sst-hyt-cht-d47213.ko
INSTALL sound/soc/intel/boards/snd-soc-sst-hyt-cht-es9316.ko
INSTALL sound/soc/intel/boards/snd-soc-sst-hyt-cht-nocodec.ko
INSTALL sound/soc/intel/boards/snd-soc-sst-hytc-r-rt5649.ko
INSTALL sound/soc/intel/boards/snd-soc-sst-hytc-r-rt5651.ko
INSTALL sound/soc/intel/boards/snd-soc-sst-cht-bsw-max90898_t1.ko
INSTALL sound/soc/intel/boards/snd-soc-sst-cht-bsw-naut824.ko
INSTALL sound/soc/intel/boards/snd-soc-sst-cht-bsw-rt5645.ko
INSTALL sound/soc/intel/boards/snd-soc-sst-cht-bsw-rt5672.ko
INSTALL sound/soc/intel/common/snd-soc-acpi-intel-match.ko
INSTALL sound/soc/intel/common/snd-soc-sst-acpi.ko
INSTALL sound/soc/intel/common/snd-soc-sst-dsp.ko
INSTALL sound/soc/intel/common/snd-soc-sst-firmware.ko
INSTALL sound/soc/intel/common/snd-soc-sst-ipc.ko
INSTALL sound/soc/intel/haswell/snd-soc-sst-haswell-pcm.ko
INSTALL sound/soc/intel/skylake/snd-soc-skl-ipc.ko
INSTALL sound/soc/intel/skylake/snd-soc-skl-ssp-clk.ko
INSTALL sound/soc/snd-soc-acpi.ko
INSTALL sound/soc/snd-soc-core.ko
INSTALL sound/soundcore.ko
INSTALL sound/synth/cmix/snd-cmix-synth.ko
INSTALL sound/synth/snd-util-mem.ko
INSTALL sound/usb/bf_iore/snd-usb-bf_iore.ko
INSTALL sound/usb/bcd2800/snd-bcd2800.ko
INSTALL sound/usb/caiq/snd-usb-caiq.ko
INSTALL sound/usb/hiface/snd-usb-hiface.ko
INSTALL sound/usb/lmef/snd-usb-lmef.ko
INSTALL sound/usb/lmef/snd-usb-pod.ko
INSTALL sound/usb/lmef/snd-usb-podhd.ko
INSTALL sound/usb/lmef/snd-usb-toneport.ko
INSTALL sound/usb/misc/snd-ua101.ko
INSTALL sound/usb/snd-usbmidi-1b.ko
INSTALL sound/usb/usx2y/snd-usb-usx2l.ko
INSTALL sound/usb/usx2y/snd-usb-usx2y.ko
INSTALL sound/x86/snd-hdm1-ipe-audio.ko
INSTALL sound/xen/snd_xen_front.ko
INSTALL vtrr/lib/trpbpass.ko
DEPMOD 4.19.98
[root@bupt-os-openEuler kernel-4.19.98-2403.4.8]# make install -j8
sh ./arch/x86/boot/install.sh 4.19.98 arch/x86/boot/bzImage \
System.map "/boot"
[root@bupt-os-openEuler kernel-4.19.98-2403.4.8]#
```

- 重启虚拟机

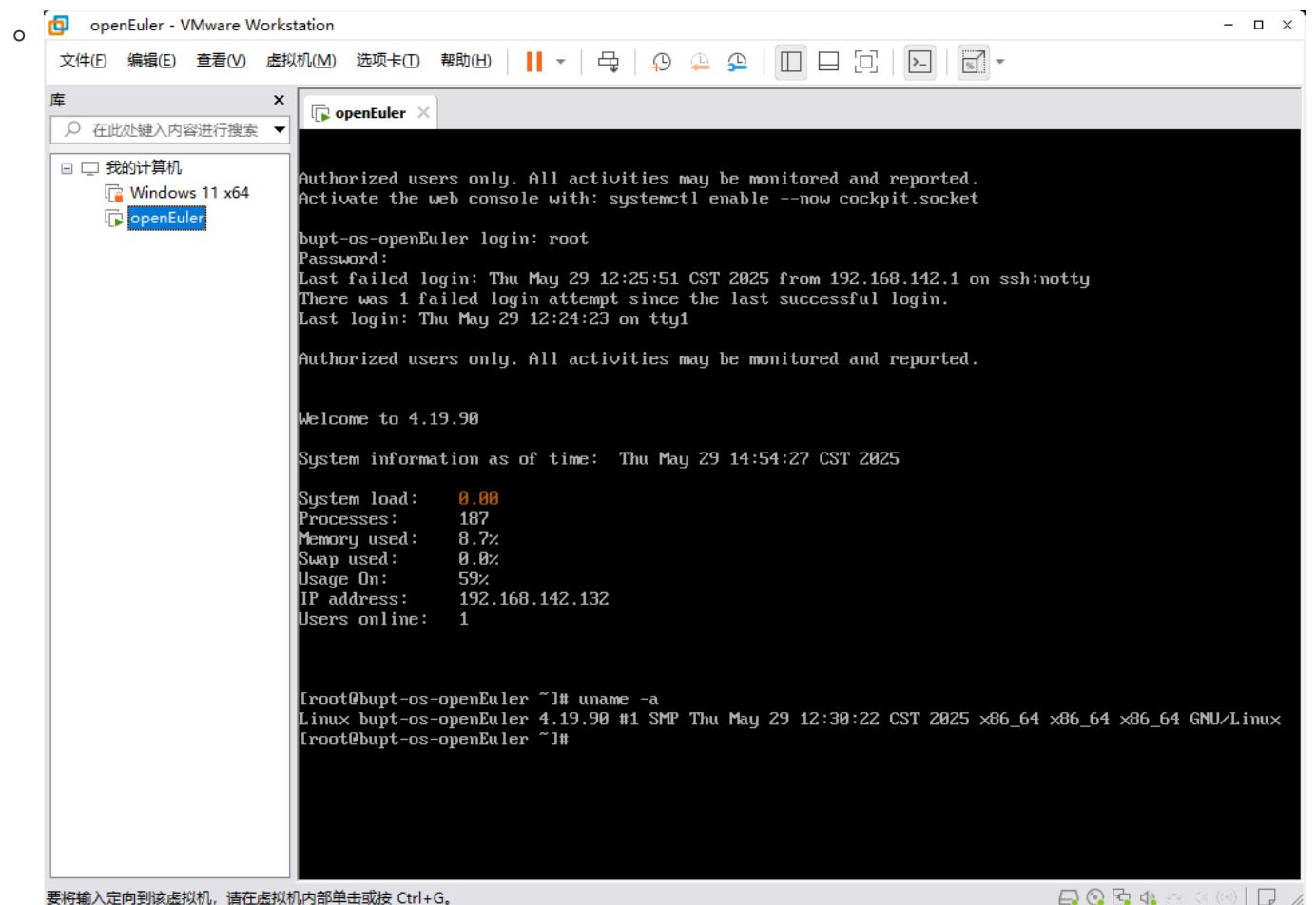
- 引导页面出现新的内核

```
openEuler (4.19.90) 20.03 (LTS)
openEuler (4.19.90-2003.4.0.0036.oe1.x86_64) 20.03 (LTS)
openEuler (0-rescue-ed1f0c276cf24573b95ffa771e39e2c8) 20.03 (LTS)

Use the ↑ and ↓ keys to change the selection.
Press 'e' to edit the selected item, or 'c' for a command prompt.
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。

- 执行 uname -a



- 基础操作系统实验

- 。将代码传入虚拟机中

■ 指令

- scp -r .\MemoryManagement\ root@192.168.142.132:/root/
 - scp -r .\ProcessManagement\ root@192.168.142.132:/root/

```
Windows PowerShell x + v - □ ×

root@192.168.142.132's password:
C:\Windows\System32\OpenSSH\scp.exe: local "./345\206\205\345\255\230\347\256\241\347\220\206/" is not a regular file
C:\Windows\System32\OpenSSH\scp.exe: failed to upload file ./345\206\205\345\255\230\347\256\241\347\220\206/ to /root/
PS C:\Users\k\Desktop> scp .\MemoryManagement\ root@192.168.142.132:/root/

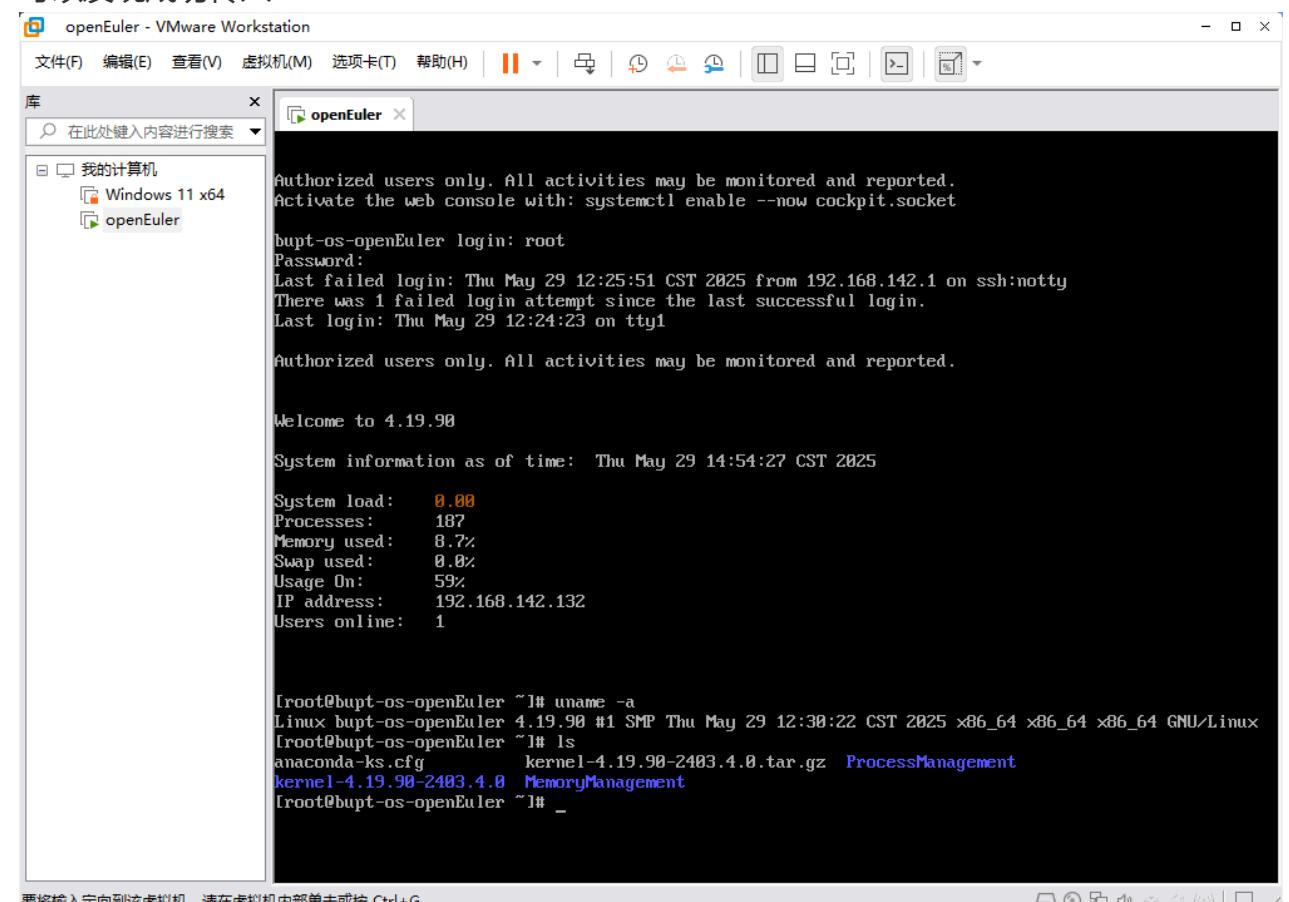
Authorized users only. All activities may be monitored and reported.
root@192.168.142.132's password:
C:\Windows\System32\OpenSSH\scp.exe: local "./MemoryManagement/" is not a regular file
C:\Windows\System32\OpenSSH\scp.exe: failed to upload file ./MemoryManagement/ to /root/
PS C:\Users\k\Desktop> scp -r .\MemoryManagement\ root@192.168.142.132:/root/

Authorized users only. All activities may be monitored and reported.
root@192.168.142.132's password:
kmalloc.c                                         100%   834    407.2KB/s  00:00
Makefile                                           100%   229      0.2KB/s  00:00
Makefile                                           100%   229      0.2KB/s  00:00
vmalloc.c                                         100%  1043    1.0MB/s  00:00
PS C:\Users\k\Desktop> scp -r .\ProcessManagement\ root@192.168.142.132:/root/

Authorized users only. All activities may be monitored and reported.
root@192.168.142.132's password:
kthread.c                                         100%   613    598.7KB/s  00:00
Makefile                                           100%   228      0.2KB/s  00:00
cpu_loadavg.c                                     100%   841    821.2KB/s  00:00
Makefile                                           100%   232    226.6KB/s  00:00
Makefile                                           100%   233      0.2KB/s  00:00
process_info.c                                    100%   491    479.5KB/s  00:00
while_long                                         100%   69KB   33.9MB/s  00:00
while_long.c                                       100%   117    114.3KB/s  00:00
PS C:\Users\k\Desktop> |
```

■ 指令

- ls
 - 可以发现成功传入



。 内存管理实验

- 使用 kmalloc 分配 1KB, 8KB的内存，并打印指针地址
 - 指令
 - cd /root/MemoryManagement/task1
 - make

```
[root@bupt-os-openEuler ~]# cd /root/MemoryManagement/task1
[root@bupt-os-openEuler task1]# make
make -C /usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64 M=/root/MemoryManagement/task1 modules
make[1]: Entering directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
  CC [M] /root/MemoryManagement/task1/kmalloc.o
  Building modules, stage 2.
  MODPOST 1 modules
  CC      /root/MemoryManagement/task1/kmalloc.mod.o
  LD [M]  /root/MemoryManagement/task1/kmalloc.ko
make[1]: Leaving directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
[root@bupt-os-openEuler task1]#
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。



■ 指令

- insmod kmalloc.ko
- dmesg | tail -n 3
- rmmod kmalloc
- dmesg | tail -n 4

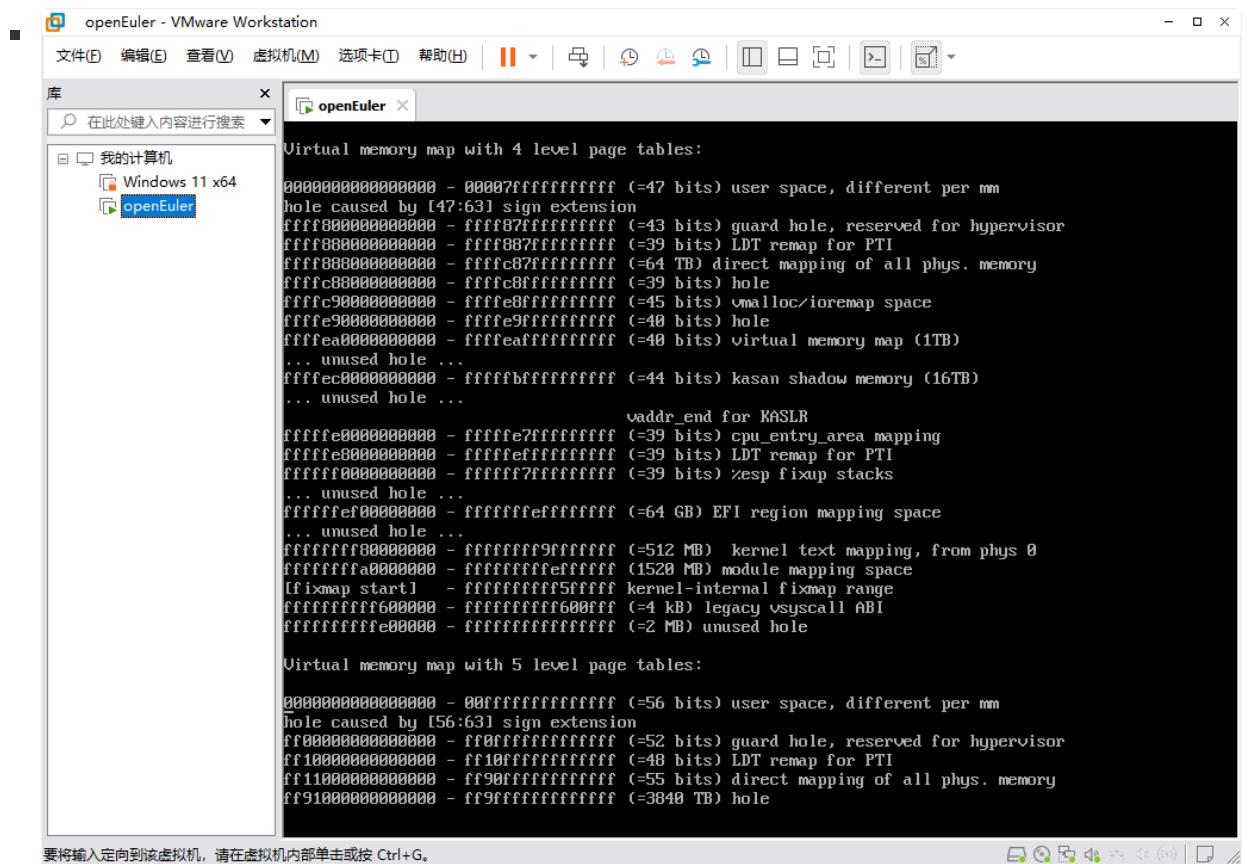
```
[root@bupt-os-openEuler ~]# cd /root/MemoryManagement/task1
[root@bupt-os-openEuler task1]# make
make -C /usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64 M=/root/MemoryManagement/task1 modules
make[1]: Entering directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
  CC [M] /root/MemoryManagement/task1/kmalloc.o
  Building modules, stage 2.
  MODPOST 1 modules
  CC      /root/MemoryManagement/task1/kmalloc.mod.o
  LD [M]  /root/MemoryManagement/task1/kmalloc.ko
make[1]: Leaving directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
[root@bupt-os-openEuler task1]# insmod kmalloc.ko
[ 2601.527745] kmallocmem1 addr = ffff94adcc131400
[ 2601.527758] kmallocmem2 addr = ffff94adc9c5a000
[root@bupt-os-openEuler task1]# dmesg | tail -n 3
[ 2601.527744] Start kmalloc!
[ 2601.527745] kmallocmem1 addr = ffff94adcc131400
[ 2601.527758] kmallocmem2 addr = ffff94adc9c5a000
[root@bupt-os-openEuler task1]# rmmod kmalloc
[root@bupt-os-openEuler task1]# dmesg | tail -n 4
[ 2601.527744] Start kmalloc!
[ 2601.527745] kmallocmem1 addr = ffff94adcc131400
[ 2601.527758] kmallocmem2 addr = ffff94adc9c5a000
[ 2634.938441] Exit kmalloc!
[root@bupt-os-openEuler task1]#
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。



■ 指令

- `vi /root/kernel-4.19.90-2403.4.0/Documentation/x86/x86_64/mm.txt`



- 可知 kmalloc 分配的内存地址位于内核空间
 - 使用 vmalloc 分别分配8KB、1MB、64MB的内存，打印指针地址
 - 指令
 - cd /root/MemoryManagement/task2

```
[root@bupt-os-openEuler Documentation]# cd /root/MemoryManagement/task2
[root@bupt-os-openEuler task2]# make
make -C /usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64 M=/root/MemoryManagement/task2 modules
make[1]: Entering directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
  CC [M]  /root/MemoryManagement/task2/vmalloc.o
  Building modules, stage 2.
  MODPOST 1 modules
  CC      /root/MemoryManagement/task2/vmalloc.mod.o
  LD [M]  /root/MemoryManagement/task2/vmalloc.ko
make[1]: Leaving directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
[root@bupt-os-openEuler task2]#
```

要返回到您的计算机，请按 Ctrl+Alt。



■ 指令

- insmod vmalloc.ko
- dmesg | tail -n 4
- rmmod vmalloc
- dmesg | tail -n 5

```
[root@bupt-os-openEuler Documentation]# cd /root/MemoryManagement/task2
[root@bupt-os-openEuler task2]# make
make -C /usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64 M=/root/MemoryManagement/task2 modules
make[1]: Entering directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
  CC [M]  /root/MemoryManagement/task2/vmalloc.o
  Building modules, stage 2.
  MODPOST 1 modules
  CC      /root/MemoryManagement/task2/vmalloc.mod.o
  LD [M]  /root/MemoryManagement/task2/vmalloc.ko
make[1]: Leaving directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
[root@bupt-os-openEuler task2]# insmod vmalloc.ko
[root@bupt-os-openEuler task2]# dmesg | tail -n 4
[22312.144783] Start vmalloc!
[22312.144786] vmallocmem1 addr = fffffb65780677000
[22312.144800] vmallocmem2 addr = fffffb65782149000
[22312.145474] vmallocmem3 addr = fffffb65782f8f000
[root@bupt-os-openEuler task2]# rmmod vmalloc
[root@bupt-os-openEuler task2]# dmesg | tail -n 5
[22312.144783] Start vmalloc!
[22312.144786] vmallocmem1 addr = fffffb65780677000
[22312.144800] vmallocmem2 addr = fffffb65782149000
[22312.145474] vmallocmem3 addr = fffffb65782f8f000
[22438.299068] Exit vmalloc!
[root@bupt-os-openEuler task2]#
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。



- 可知 vmalloc 分配的内存地址位于内核空间
- 进程管理实验

- 创建并运行内核线程

- 指令

- `cd /root/ProcessManagement/task1`

- `make`

```
[root@bupt-os-openEuler x86_64]# cd /root/ProcessManagement/task1
[root@bupt-os-openEuler task1]# make
make -C /usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64 M=/root/ProcessManagement/task1 modules
make[1]: Entering directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
CC [M] /root/ProcessManagement/task1/kthread.o
Building modules, stage 2.
MODPOST 1 modules
CC /root/ProcessManagement/task1/kthread.mod.o
LD [M] /root/ProcessManagement/task1/kthread.ko
make[1]: Leaving directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
[root@bupt-os-openEuler task1]# _
```

- 指令

- `insmod kthread.ko`

- `dmesg | tail -n 5`

- `rmmod kthread`

- `dmesg | tail -n 5`

```
[root@bupt-os-openEuler x86_64]# cd /root/ProcessManagement/task1
[root@bupt-os-openEuler task1]# make
make -C /usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64 M=/root/ProcessManagement/task1 modules
make[1]: Entering directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
  CC [M] /root/ProcessManagement/task1/kthread.o
  Building modules, stage 2.
  MODPOST 1 modules
  CC      /root/ProcessManagement/task1/kthread.mod.o
  LD [M] /root/ProcessManagement/task1/kthread.ko
make[1]: Leaving directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
[root@bupt-os-openEuler task1]# insmod kthread.ko
[root@bupt-os-openEuler task1]# dmesg | tail -n 5
[22855.873738] Create kernel thread!
[22855.873936] New kthread is running.
[22857.914442] New kthread is running.
[22859.962219] New kthread is running.
[22862.018589] New kthread is running.
[root@bupt-os-openEuler task1]# rmmod kthread
[root@bupt-os-openEuler task1]# dmesg | tail -n 5
[22868.153568] New kthread is running.
[22870.201457] New kthread is running.
[22872.249255] New kthread is running.
[22874.297159] New kthread is running.
[22874.535728] Kill new kthread.
[root@bupt-os-openEuler task1]# _
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。

■ 打印输出当前系统 CPU 负载情况

■ 指令

- `cd /root/ProcessManagement/task2`
- `make`

```
[root@bupt-os-openEuler task1]# cd /root/ProcessManagement/task2
[root@bupt-os-openEuler task2]# make
make -C /usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64 M=/root/ProcessManagement/task2 modules
make[1]: Entering directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
  CC [M] /root/ProcessManagement/task2/cpu_loadavg.o
  Building modules, stage 2.
  MODPOST 1 modules
  CC      /root/ProcessManagement/task2/cpu_loadavg.mod.o
  LD [M] /root/ProcessManagement/task2/cpu_loadavg.ko
make[1]: Leaving directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
[root@bupt-os-openEuler task2]#
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。

■ 指令

- insmod cpu_loadavg.ko
 - dmesg | tail -n 2
 - rmmod cpu_loadavg
 - dmesg | tail -n 3

```
[root@bupt-os-openEuler task1]# cd /root/ProcessManagement/task2
[root@bupt-os-openEuler task2]# make
make -C /usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64 M=/root/ProcessManagement/task2 modules
make[1]: Entering directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
  CC [M]  /root/ProcessManagement/task2/cpu_loadavg.o
Building modules, stage 2.
MODPOST 1 modules
  CC      /root/ProcessManagement/task2/cpu_loadavg.mod.o
  LD [M]  /root/ProcessManagement/task2/cpu_loadavg.ko
make[1]: Leaving directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
[root@bupt-os-openEuler task2]# insmod cpu_loadavg.ko
[root@bupt-os-openEuler task2]# dmesg | tail -n 2
[22972.897474] Start cpu_loadavg!
[22972.897481] The cpu loadavg in one minute is: 0.09
[root@bupt-os-openEuler task2]# rmmod cpu_loadavg
[root@bupt-os-openEuler task2]# dmesg | tail -n 3
[22972.897474] Start cpu_loadavg!
[22972.897481] The cpu loadavg in one minute is: 0.09
[22993.073760] Exit cpu_loadavg!
[root@bupt-os-openEuler task2]#
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 **Ctrl+G**。

A set of small, semi-transparent navigation icons located at the bottom of the slide.

- 打印输出当前处于运行状态的进程的 PID 和名字

- ## ■ 指令

- `cd /root/ProcessManagement/task3`
 - `make`

```
[root@bupt-os-openEuler task2]# cd /root/ProcessManagement/task3
[root@bupt-os-openEuler task3]# make
make -C /usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64 M=/root/ProcessManagement/task3 modules
make[1]: Entering directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
CC [M] /root/ProcessManagement/task3/process_info.o
Building modules, stage 2.
MODPOST 1 modules
CC /root/ProcessManagement/task3/process_info.mod.o
LD [M] /root/ProcessManagement/task3/process_info.ko
make[1]: Leaving directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
[root@bupt-os-openEuler task3]#
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。



■ 指令

- insmod process_info.ko
- dmesg | tail -n 3
- rmmod process_info

```
[root@bupt-os-openEuler task2]# cd /root/ProcessManagement/task3
[root@bupt-os-openEuler task3]# make
make -C /usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64 M=/root/ProcessManagement/task3 modules
make[1]: Entering directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
CC [M] /root/ProcessManagement/task3/process_info.o
Building modules, stage 2.
MODPOST 1 modules
CC /root/ProcessManagement/task3/process_info.mod.o
LD [M] /root/ProcessManagement/task3/process_info.ko
make[1]: Leaving directory '/usr/src/kernels/4.19.90-2003.4.0.0036.oe1.x86_64'
[root@bupt-os-openEuler task3]# insmod process_info.ko
[root@bupt-os-openEuler task3]# dmesg | tail -n 3
[23136.961388] Start process_info!
[23136.961400] 1)name:kworker/7:0 2)pid:3875 3)state:0
[23136.961402] 1)name:insmod 2)pid:9609 3)state:0
[root@bupt-os-openEuler task3]# rmmod process_info
[root@bupt-os-openEuler task3]#
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。



■ 使用 cgroup 实现限制 CPU 核数

- 指令

- `mkdir /cgroup`
- `mount -t tmpfs tmpfs /cgroup`
- `cd /cgroup`
- `mkdir cpuset`
- `mount -t cgroup -o cpuset cpuset /cgroup/cpuset`
- `cd cpuset`
- `mkdir mycpuset`
- `cd mycpuset`
- `cat cpuset.mems`
- `echo 0 > cpuset.mems`
- `cat cpuset.cpus`
- `echo 0-2 > cpuset.cpus`
- `cat cpuset.mems`
- `cat cpuset.cpus`

```
[root@bupt-os-openEuler ~]# mkdir /cgroup
[root@bupt-os-openEuler ~]# mount -t tmpfs tmpfs /cgroup
[root@bupt-os-openEuler ~]# cd /cgroup/
[root@bupt-os-openEuler cgroup]# mkdir cpuset
[root@bupt-os-openEuler cgroup]# mount -t cgroup -o cpuset cpuset /cgroup/cpuset/
[root@bupt-os-openEuler cgroup]# cd cpuset/
[root@bupt-os-openEuler cpuset]# mkdir mycpuset
[root@bupt-os-openEuler cpuset]# cd mycpuset/
[root@bupt-os-openEuler mycpuset]# cat cpuset.mems

[root@bupt-os-openEuler mycpuset]# echo 0 > cpuset.mem
cpuset.mem_exclusive          cpuset.memory_pressure      cpuset.mems
cpuset.mem_hardwall           cpuset.memory_spread_page
cpuset.memory_migrate         cpuset.memory_spread_slab
[root@bupt-os-openEuler mycpuset]# echo 0 > cpuset.mems
[root@bupt-os-openEuler mycpuset]# cat cpuset.cpus
0
[root@bupt-os-openEuler mycpuset]# cat cpuset.cpus
0-2
[root@bupt-os-openEuler mycpuset]#
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 **Ctrl+G**。



- 指令

- `cd /root/ProcessManagement/task4`
- `gcc while_long.c -o while_long`
- `yum install libcgrou`

```

root@bupt-os-openEuler ~# cd /root/ProcessManagement/task4
root@bupt-os-openEuler task4# gcc while_long.c -o while_long
[root@bupt-os-openEuler task4]# yum install libcgroup
Last metadata expiration check: 2:42:48 ago on Thu 29 May 2025 06:52:28 PM CST.
Dependencies resolved.
=====
Package           Architecture      Version       Repository      Size
=====
Installing:
libcgroup         x86_64          0.41-23.oe1   openEuler-everything 92 k
Transaction Summary
=====
Install 1 Package

Total download size: 92 k
Installed size: 329 k
Is this ok [y/N]: y

```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。



■ 指令

■ top

```

top - 21:38:07 up 6:57, 1 user, load average: 0.42, 0.12, 0.03
Tasks: 177 total, 2 running, 175 sleeping, 0 stopped, 0 zombie
%Cpu(s): 12.5 us, 0.0 sy, 0.0 ni, 84.2 id, 3.2 wa, 0.0 hi, 0.0 si, 0.0 st
MiB Mem : 3406.3 total, 2348.0 free, 324.4 used, 734.0 buff/cache
MiB Swap: 4048.0 total, 4048.0 free, 0.0 used. 2662.9 avail Mem

PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
10296 root 20 0 2148 756 692 R 99.7 0.0 0:00.75 while_long
9934 root 20 0 0 0 0 I 0.3 0.0 0:00.39 kworker/2:0-events
 1 root 20 0 107368 14932 9832 S 0.0 0.4 0:02.49 systemd
 2 root 20 0 0 0 0 S 0.0 0.0 0:00.01 kthreadd
 3 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 rcu_gp
 4 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 rcu_par_gp
 6 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/0:0H-kblockd
 8 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 mm_percpu_wq
 9 root 20 0 0 0 0 S 0.0 0.0 0:00.00 ksoftirqd/0
10 root 20 0 0 0 0 I 0.0 0.0 0:02.07 rcu_sched
11 root 20 0 0 0 0 I 0.0 0.0 0:00.00 rcu_bh
12 root rt 0 0 0 0 S 0.0 0.0 0:00.07 migration/0
13 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/0
14 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/1
15 root rt 0 0 0 0 S 0.0 0.0 0:00.08 migration/1
16 root 20 0 0 0 0 S 0.0 0.0 0:00.00 ksoftirqd/1
18 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/1:0H-kblockd
19 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/2
20 root rt 0 0 0 0 S 0.0 0.0 0:00.41 migration/2
21 root 20 0 0 0 0 S 0.0 0.0 0:00.00 ksoftirqd/2
23 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/2:0H-kblockd
24 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/3
25 root rt 0 0 0 0 S 0.0 0.0 0:00.04 migration/3
26 root 20 0 0 0 0 S 0.0 0.0 0:00.00 ksoftirqd/3
28 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/3:0H-kblockd
29 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/4
30 root rt 0 0 0 0 S 0.0 0.0 0:00.36 migration/4
31 root 20 0 0 0 0 S 0.0 0.0 0:00.00 ksoftirqd/4
33 root 0 -20 0 0 0 I 0.0 0.0 0:00.00 kworker/4:0H
34 root 20 0 0 0 0 S 0.0 0.0 0:00.00 cpuhp/5

```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。



■ 指令

- taskset -p 10296
- taskset -pc 10296

The screenshot shows a VMware Workstation interface with an open terminal window titled 'openEuler'. The terminal displays the following information:

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+ COMMAND
10296	root	20	0	2148	756	692	R	99.3	0.0	0:54.71 while_long
9934	root	20	0	0	0	0	I	0.3	0.0	0:00.48 kworker/2:0-events_power_ef+
1	root	20	0	107368	14932	9032	S	0.0	0.4	0:02.49 systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.01 kthreadd
3	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 rcu_gp
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 rcu_par_gp
6	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 kworker/0:0H-kblockd
8	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 mm_percpu_wq
9	root	20	0	0	0	0	S	0.0	0.0	0:00.00 ksoftirqd/0
10	root	20	0	0	0	0	I	0.0	0.0	0:02.07 rcu_sched
11	root	20	0	0	0	0	I	0.0	0.0	0:00.00 rcu_bh
12	root	rt	0	0	0	0	S	0.0	0.0	0:00.07 migration/0
13	root	20	0	0	0	0	S	0.0	0.0	0:00.00 cpuhp/0
14	root	20	0	0	0	0	S	0.0	0.0	0:00.00 cpuhp/1
15	root	rt	0	0	0	0	S	0.0	0.0	0:00.06 migration/1
16	root	20	0	0	0	0	S	0.0	0.0	0:00.00 ksoftirqd/1
18	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 kworker/1:0H-kblockd
19	root	20	0	0	0	0	S	0.0	0.0	0:00.00 cpuhp/2
20	root	rt	0	0	0	0	S	0.0	0.0	0:00.41 migration/2
21	root	20	0	0	0	0	S	0.0	0.0	0:00.00 ksoftirqd/2
23	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 kworker/2:0H-kblockd
24	root	20	0	0	0	0	S	0.0	0.0	0:00.00 cpuhp/3
25	root	rt	0	0	0	0	S	0.0	0.0	0:00.04 migration/3
26	root	20	0	0	0	0	S	0.0	0.0	0:00.00 ksoftirqd/3
28	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 kworker/3:0H-kblockd
29	root	20	0	0	0	0	S	0.0	0.0	0:00.00 cpuhp/4
30	root	rt	0	0	0	0	S	0.0	0.0	0:00.36 migration/4
31	root	20	0	0	0	0	S	0.0	0.0	0:00.00 ksoftirqd/4
33	root	0	-20	0	0	0	I	0.0	0.0	0:00.00 kworker/4:0H
34	root	20	0	0	0	0	S	0.0	0.0	0:00.00 cpuhp/5

```
[root@ubut-os-openEuler task4]# taskset -p 10296
pid 10296's current affinity mask: ?
[root@ubut-os-openEuler task4]# taskset -pc 10296
pid 10296's current affinity list: 0-2
[root@ubut-os-openEuler task4] -
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。

- 测试限制 cpu 核数成功
- 使用 cgroup 实现不允许访问U盘

▪ 指令

- **fdisk -l**

The screenshot shows the VMware Workstation interface with a running openEuler virtual machine. The left sidebar displays '我的计算机' (My Computer) with entries for 'Windows 11 x64' and 'openEuler'. The main window shows detailed disk information for the openEuler VM:

- Disk /dev/sda:** 48 GiB, 42949672960 bytes, 83886000 sectors.
 - Disk model: VMware Virtual S
 - Units: sectors of 1 * 512 = 512 bytes
 - Sector size (logical/physical): 512 bytes / 512 bytes
 - I/O size (minimum/optimal): 512 bytes / 512 bytes
 - Disklabel type: dos
 - Disk identifier: 0x944d8597
- Device Boot Start End Sectors Size Id Type**

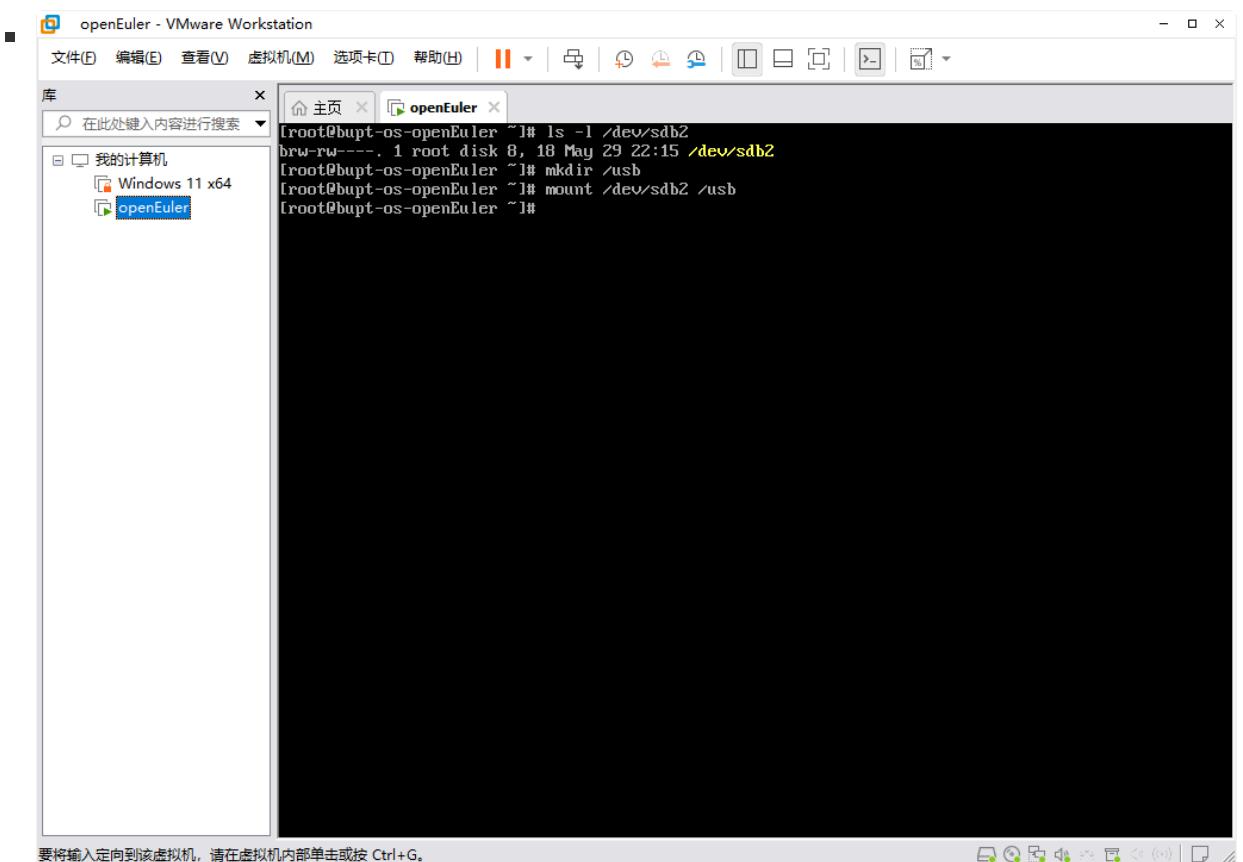
/dev/sda1	*	2048	2099199	2097152	1G	83	Linux
/dev/sda2		2099200	83886079	81786080	39G	8e	Linux LVM
- Disk /dev/mapper/openeuler-root:** 35.4 GiB, 37627101184 bytes, 73490432 sectors.
 - Units: sectors of 1 * 512 = 512 bytes
 - Sector size (logical/physical): 512 bytes / 512 bytes
 - I/O size (minimum/optimal): 512 bytes / 512 bytes
- Disk /dev/mapper/openeuler-swap:** 3.98 GiB, 4244635648 bytes, 8290304 sectors.
 - Units: sectors of 1 * 512 = 512 bytes
 - Sector size (logical/physical): 512 bytes / 512 bytes
 - I/O size (minimum/optimal): 512 bytes / 512 bytes
- Disk /dev/sdb:** 57.31 GiB, 61530439680 bytes, 120176640 sectors.
 - Disk model: Dual Drive
 - Units: sectors of 1 * 512 = 512 bytes
 - Sector size (logical/physical): 512 bytes / 512 bytes
 - I/O size (minimum/optimal): 512 bytes / 512 bytes
 - Disklabel type: dos
 - Disk identifier: 0x3930463e
- Device Boot Start End Sectors Size Id Type**

/dev/sdb1	*	1654784	119255839	117600256	56.1G	7	HPFS/NTFS/exFAT
/dev/sdb2		119255840	120172542	917583	448M	1b	Hidden W95 FAT32

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。

▪ 指令

- `ls -l /dev/sdb2`
- `mkdir /usb`
- `mount /dev/sdb2 /usb`



```
[root@bupt-os-openEuler ~]# ls -l /dev/sdb2
brw-rw----. 1 root disk 8, 18 May 29 22:15 /dev/sdb2
[root@bupt-os-openEuler ~]# mkdir /usb
[root@bupt-os-openEuler ~]# mount /dev/sdb2 /usb
[root@bupt-os-openEuler ~]#
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。



■ 指令

- `cd /cgroup/`
- `mkdir devices`
- `mount -t cgroup -o devices devices /cgroup/devices`
- `cd /cgroup/devices`
- `mkdir mydevices`
- `cd mydevices`
- `echo 'a 8:18 rwm' > /cgroup/devices/mydevices/devices.deny`

```
[root@bupt-os-openEuler ~]# cd /cgroup/
[root@bupt-os-openEuler cgroup]# mkdir devices
[root@bupt-os-openEuler cgroup]# mount -t cgroup -o devices devices /cgroup/devices/
[root@bupt-os-openEuler cgroup]# cd /cgroup/devices/
[root@bupt-os-openEuler devices]# mkdir mydevices
[root@bupt-os-openEuler devices]# cd mydevices
[root@bupt-os-openEuler mydevices]# echo 'a 8:18 rwm' > /cgroup/devices/mydevices/devices.deny
[root@bupt-os-openEuler mydevices]#
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。



■ 指令

■ `cgexec -g devices:mydevices dd if=/dev/sdb2 of=/root/temfile bs=1 count=12800`

```
[root@bupt-os-openEuler ~]# cd /cgroup/
[root@bupt-os-openEuler cgroup]# mkdir devices
[root@bupt-os-openEuler cgroup]# mount -t cgroup -o devices devices /cgroup/devices/
[root@bupt-os-openEuler cgroup]# cd /cgroup/devices/
[root@bupt-os-openEuler devices]# mkdir mydevices
[root@bupt-os-openEuler devices]# cd mydevices
[root@bupt-os-openEuler mydevices]# echo 'a 8:18 rwm' > /cgroup/devices/mydevices/devices.deny
[root@bupt-os-openEuler mydevices]# cgexec -g devices:mydevices dd if=/dev/sdb2 of=/root/temfile bs=1 count=12800
dd: failed to open '/dev/sdb2': Operation not permitted
[root@bupt-os-openEuler mydevices]# _
```

要将输入定向到该虚拟机，请在虚拟机内部单击或按 Ctrl+G。



- 可见终端显示 Operation not permitted
- 说明不允许访问u盘设置成功