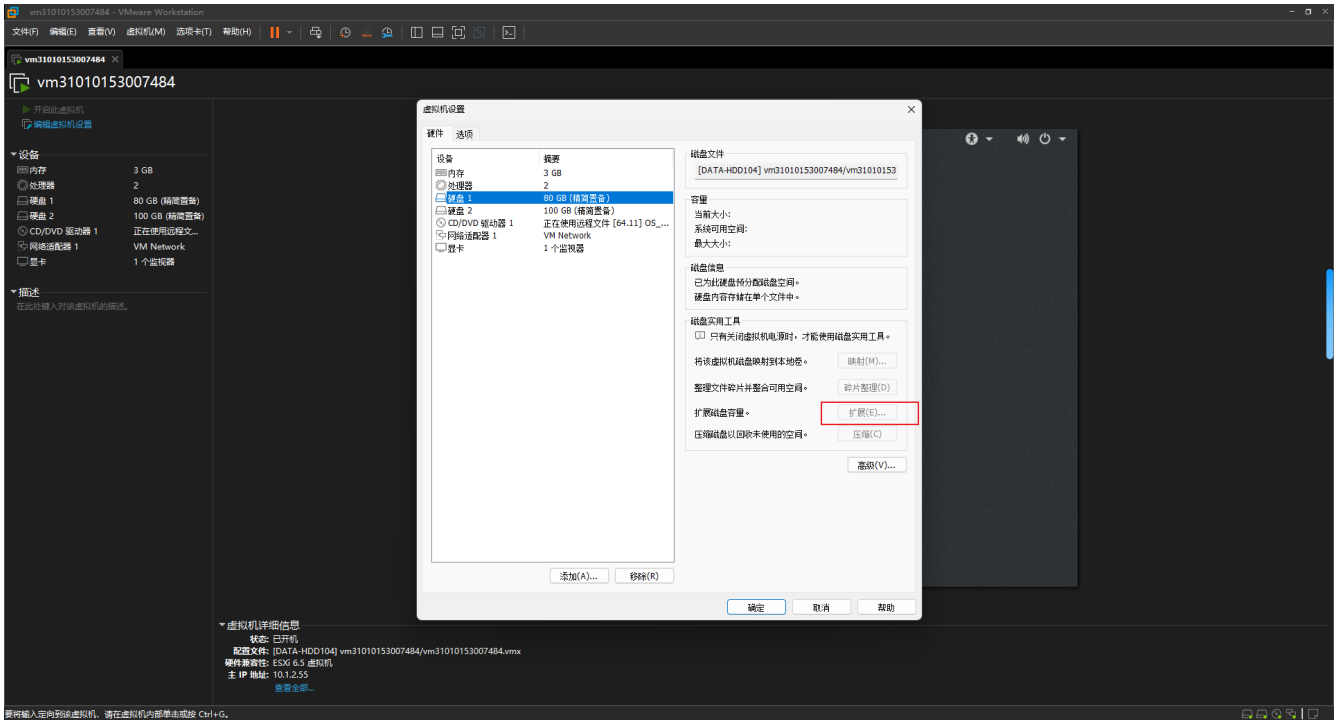
linux非LVM管理的虚机扩展根目录（suse)

1、磁盘扩大

VMware 管理平台 VSphere Client 登陆，将需要扩容的虚拟机进行**关机**操作，然后编辑设置，将磁盘大小进行调整（**需要删除所有快照**）



2. 扩分区

2.1. 查看当前分区信息

以下指令可以查看到根分区是 sda2，sda2 分区总容量只有 13G 大小

```
dttsuse:~ # df -h
Filesystem      Size  Used Avail Use% Mounted on
devtmpfs        874M     0  874M   0% /dev
tmpfs           887M     0  887M   0% /dev/shm
tmpfs           887M   18M  870M   2% /run
tmpfs           887M     0  887M   0% /sys/fs/cgroup
/dev/sda2        13G  6.0G  4.7G  57% /
/dev/sda2        13G  6.0G  4.7G  57% /boot/grub2/x86_64-efi
/dev/sda2        13G  6.0G  4.7G  57% /usr/local
/dev/sda2        13G  6.0G  4.7G  57% /tmp
/dev/sda2        13G  6.0G  4.7G  57% /srv
/dev/sda2        13G  6.0G  4.7G  57% /boot/grub2/i386-pc
/dev/sda2        13G  6.0G  4.7G  57% /opt
/dev/sda2        13G  6.0G  4.7G  57% /var
/dev/sda2        13G  6.0G  4.7G  57% /root
/dev/sda2        13G  6.0G  4.7G  57% /.snapshots
/dev/sda3       5.4G   48M  5.4G   1% /home
tmpfs           178M   16K  178M   1% /run/user/471
tmpfs           178M     0  178M   0% /run/user/0
dttsuse:~ #
```

可以看到当前磁盘容量已经增加到 80Gb 了，但是分区仍是之前的大小，所以接下来我们需要按照步骤，将分区大小进行调整

```
dttsuse:~ # fdisk -l
GPT PMBR size mismatch (41943039 != 167772159) will be corrected by write.
The backup GPT table is not on the end of the device. This problem will be corrected by write.
Disk /dev/sda: 80 GiB, 85899345920 bytes, 167772160 sectors
Disk model: Virtual disk
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: gpt
Disk identifier: 33193FED-8BA0-4AEA-9479-31FCC6DE4E45

Device        Start      End  Sectors  Size Type
/dev/sda1      2048    18431    16384    8M BIOS boot
/dev/sda2     18432 26433535 26415104 12.6G Linux filesystem
/dev/sda3  26433536 37748735 11315200  5.4G Linux filesystem
/dev/sda4  37748736 41943006  4194271    2G Linux swap
dttsuse:~ #
```

2.2. 增加根分区大小

💡 注意：标准分区的扩容方式其实是将原有分区删除掉，然后再重建时增加容量，但是千万要记住以下步骤，通过 fdisk 操作时，不要将根分区删除后就执行 w 保存，这样会导致所有数据写盘丢失

Bash

```
dttsuse:~ # fdisk /dev/sda

Welcome to fdisk (util-linux 2.33.1).
Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

GPT PMBR size mismatch (41943039 != 167772159) will be corrected by write.
The backup GPT table is not on the end of the device. This problem will be corrected by write.

Command (m for help): p //这里输入p，列出分区列表，记住下面的所有的分区

Disk /dev/sda: 80 GiB, 85899345920 bytes, 167772160 sectors
Disk model: Virtual disk
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: gpt
Disk identifier: 33193FED-8BA0-4AEA-9479-31FCC6DE4E45

Device         Start      End  Sectors  Size Type
/dev/sda1       2048    18431    16384    8M BIOS boot
/dev/sda2      18432 26433535 26415104 12.6G Linux filesystem
/dev/sda3   26433536 37748735 11315200  5.4G Linux filesystem
/dev/sda4   37748736 41943006  4194271    2G Linux swap

Command (m for help): d //这里输入d，删除一个分区，因为之前的分区是/dev/sda2，所以它之后的分区都要重建
Partition number (1-4, default 4): 4

Partition 4 has been deleted.

Command (m for help): d
Partition number (1-3, default 3): 3

Partition 3 has been deleted.

Command (m for help): d
Partition number (1,2, default 2): 2

Partition 2 has been deleted.
```

```
40
41 Command (m for help): n //删除完，输入n新建一个分区
42 Partition number (2-128, default 2):
43 First sector (18432-167772126, default 18432):
44 Last sector, +/-sectors or +/-size{K,M,G,T,P} (18432-167772126, defaul
   t 167772126): +70G //扩展分区
45
46 Created a new partition 2 of type 'Linux filesystem' and of size 70 Gi
   B.
47 Partition #2 contains a btrfs signature.
48
49 Do you want to remove the signature? [Y]es/[N]o: n
50
51 Command (m for help): n
52 Partition number (3-128, default 3): 3
53 First sector (146819072-167772126, default 146819072):
54 Last sector, +/-sectors or +/-size{K,M,G,T,P} (146819072-167772126, def
   ault 167772126): +6G
55
56 Created a new partition 3 of type 'Linux filesystem' and of size 6 GiB.
57
58 Command (m for help): n
59 Partition number (4-128, default 4): 4
60 First sector (159401984-167772126, default 159401984):
61 Last sector, +/-sectors or +/-size{K,M,G,T,P} (159401984-167772126, def
   ault 167772126):
62
63 Created a new partition 4 of type 'Linux filesystem' and of size 4 GiB.
64
65 Command (m for help): p
66 Disk /dev/sda: 80 GiB, 85899345920 bytes, 167772160 sectors
67 Disk model: Virtual disk
68 Units: sectors of 1 * 512 = 512 bytes
69 Sector size (logical/physical): 512 bytes / 512 bytes
70 I/O size (minimum/optimal): 512 bytes / 512 bytes
71 Disklabel type: gpt
72 Disk identifier: 33193FED-8BA0-4AEA-9479-31FCC6DE4E45
73
74 Device          Start       End   Sectors Size Type
75 /dev/sda1       2048     18431     16384   8M BIOS boot
76 /dev/sda2      18432 146819071 146800640  70G Linux filesystem
77 /dev/sda3  146819072 159401983  12582912   6G Linux filesystem
78 /dev/sda4  159401984 167772126   8370143   4G Linux filesystem
79
80 Command (m for help): w //最后写入保存
81 The partition table has been altered.
```

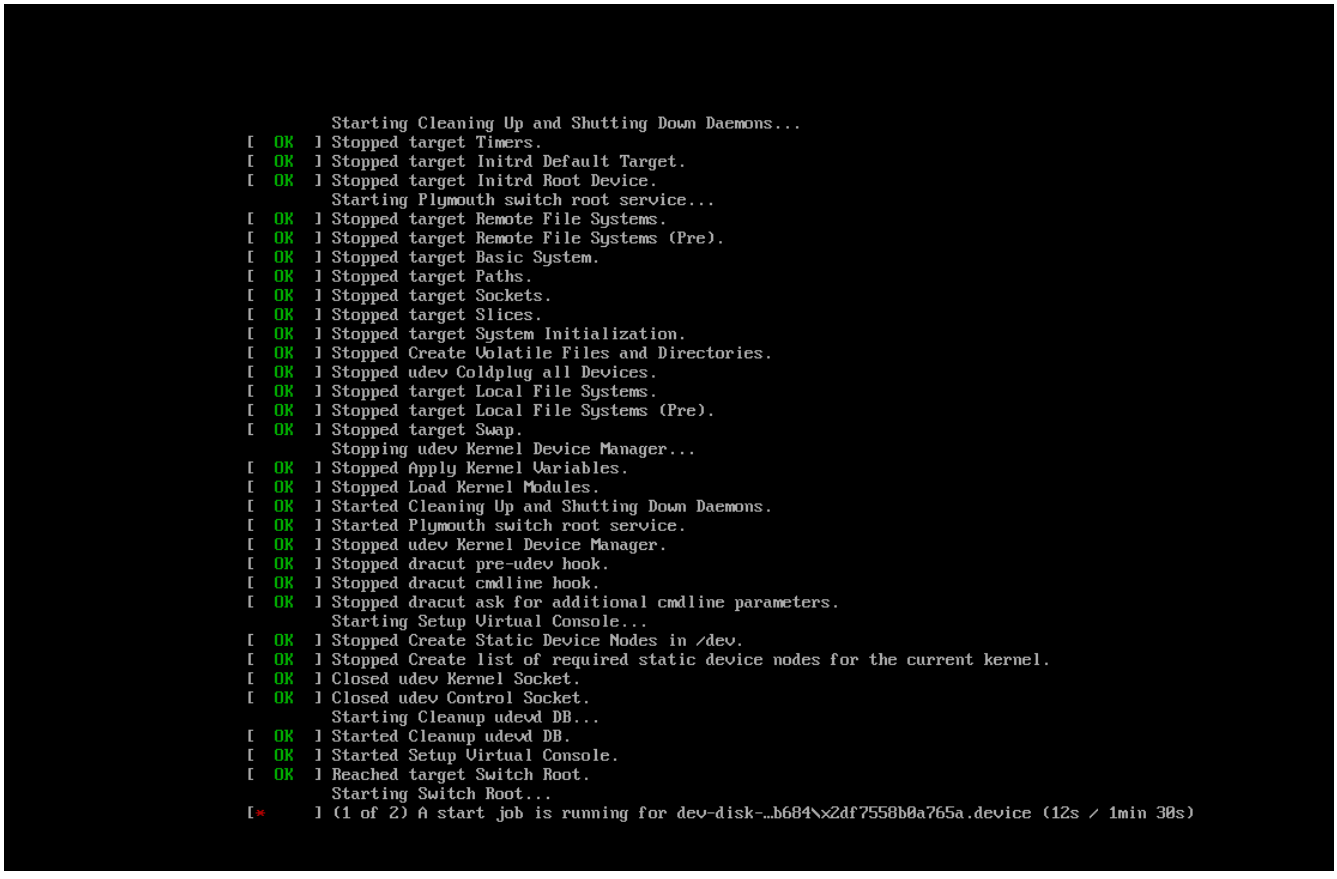
```
Failed to remove partition 3 from system: Device or resource busy
Failed to remove partition 4 from system: Device or resource busy
Failed to update system information about partition 2: Device or resource busy
Failed to add partition 3 to system: Device or resource busy
Failed to add partition 4 to system: Device or resource busy

The kernel still uses the old partitions. The new table will be used at the next reboot.
Syncing disks.

dttsuse:~ # reboot
```

2.3. 修改 /etc/fstab

分区重建后，重启机器由于无法找到原来的磁盘文件，无法正常启动。需要进入紧急救援模式，修改 /etc/fstab 文件



可以看到挂载目录的空间没有扩大，但对应的分区空间已成功扩大

```
■ ■  root ■ ■ ■ ■ ■
(■ ■  Control-D ■ ■ ■ )■
dttsuse:~ # df -hT
■ ■ ■ ■        ■ ■       ■ ■   ■ ■   ■ ■  ■ ■ % ■ ■ ■
devtmpfs       devtmpfs  874M     0  874M    0% /dev
tmpfs          tmpfs     887M     0  887M    0% /dev/shm
tmpfs          tmpfs     887M   17M  870M    2% /run
tmpfs          tmpfs     887M     0  887M    0% /sys/fs/cgroup
/dev/sda2      btrfs      13G  5.9G  4.7G   56% /
/dev/sda2      btrfs      13G  5.9G  4.7G   56% /tmp
/dev/sda2      btrfs      13G  5.9G  4.7G   56% /.snapshots
/dev/sda2      btrfs      13G  5.9G  4.7G   56% /boot/grub2/x86_64-efi
/dev/sda2      btrfs      13G  5.9G  4.7G   56% /opt
/dev/sda2      btrfs      13G  5.9G  4.7G   56% /usr/local
/dev/sda2      btrfs      13G  5.9G  4.7G   56% /root
/dev/sda2      btrfs      13G  5.9G  4.7G   56% /boot/grub2/i386-pc
/dev/sda2      btrfs      13G  5.9G  4.7G   56% /var
/dev/sda2      btrfs      13G  5.9G  4.7G   56% /srv
dttsuse:~ # lsblk
NAME   MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT
sda      8:0    0   80G  0 disk
├─sda1   8:1    0    8M  0 part
├─sda2   8:2    0   70G  0 part /
├─sda3   8:3    0    6G  0 part
└─sda4   8:4    0    4G  0 part
sr0     11:0    1  9.9G  0 rom
dttsuse:~ # _
```

2.3.1 恢复 /dev/sda3 分区

重新格式化 /dev/sda3 分区（**在进行扩展之前，要查看 /etc/fstab 记录下原本的文件系统**）

```
dttsuse:~ # mkfs -t xfs /dev/sda3
meta-data=/dev/sda3              isize=512    agcount=4, agsize=393216 blks
         =                       sectsz=512   attr=2, projid32bit=1
         =                       crc=1        finobt=1, sparse=0, rmapbt=0
         =                       reflink=0
data     =                       bsize=4096   blocks=1572864, imaxpct=25
         =                       sunit=0      swidth=0 blks
naming   =version 2              bsize=4096   ascii-ci=0, ftype=1
log      =internal log           bsize=4096   blocks=2560, version=2
         =                       sectsz=512   sunit=0 blks, lazy-count=1
realtime =none                   extsz=4096   blocks=0, rtextents=0
```

2.3.2 恢复 /dev/sda4 分区

重建分区之前，发现 /dev/sda4 分区是 swap 分区，所以要恢复成 swap 分区

```
dttsuse:~ # mkswap /dev/sda4
■ ■ ■ ■ ■ ■ ■ ■ ■ ■  1■ ■ ■  = 4 GiB (4285505536  ■ ■ ■ )
■ ■ ■ ■ UUID=f72197f5-6f97-49d0-8689-b00062fc7d72
dttsuse:~ # swapon /dev/sda4
dttsuse:~ # swapon -s
■ ■ ■                            ■ ■            ■ ■     ■ ■     ■ ■
/dev/sda4                                partition       4185064 0       -2
dttsuse:~ #
```

Bash

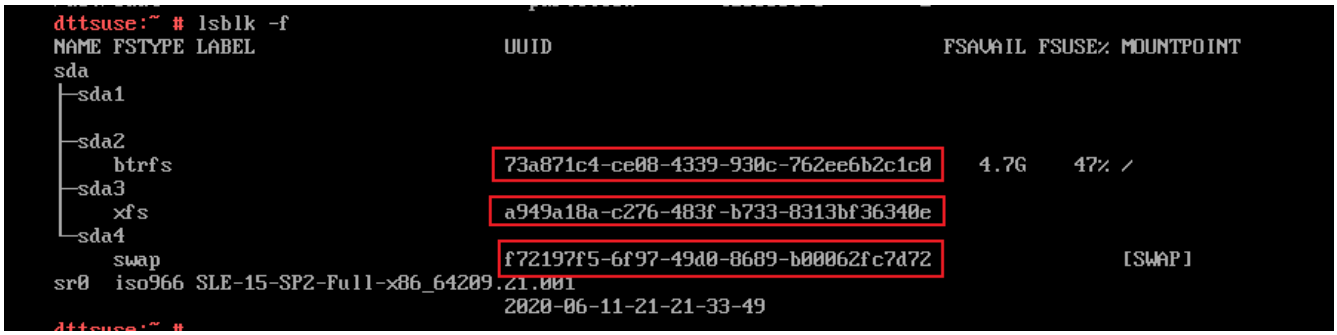
```
执行以下命令，将新建的分区创建为swap。
# mkswap /dev/vdb1

执行以下命令，激活swap分区。
# swapon /dev/vdb1

执行以下命令，查询已启动的swap。
# swapon -s
```

2.3.3 查看分区的 uuid，修改 /etc/fstab 文件

记录分区重建后的 uuid



修改 /etc/fstab 文件

```
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /                       btrfs  defaults
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /boot/grub2/x86_64-efi   btrfs  subvol=/@/boot/grub2/x86_6
4-efi  0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /boot/grub2/i386-pc      btrfs  subvol=/@/boot/grub2/i386-
pc  0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /.snapshots             btrfs  subvol=/@/.snapshots
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /var                    btrfs  subvol=/@/var
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /usr/local              btrfs  subvol=/@/usr/local
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /tmp                    btrfs  subvol=/@/tmp
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /srv                    btrfs  subvol=/@/srv
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /root                   btrfs  subvol=/@/root
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /opt                    btrfs  subvol=/@/opt
    0  0
UUID=65610288-1d11-49aa-b982-c112135d8b13  /home                   xfs    defaults
    0  0
UUID=56bf7b87-cd7c-4123-b684-f7558b0a765a  swap                    swap   defaults
    0  0
~
~
~
~
~
~
~
~
~
~
~
~
"/etc/fstab" 12L, 1311C                                          10,29         ▮ ▮
```

```
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /                       btrfs  defaults
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /boot/grub2/x86_64-efi   btrfs  subvol=/@/boot/grub2/x86_6
4-efi  0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /boot/grub2/i386-pc      btrfs  subvol=/@/boot/grub2/i386-
pc  0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /.snapshots             btrfs  subvol=/@/.snapshots
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /var                    btrfs  subvol=/@/var
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /usr/local              btrfs  subvol=/@/usr/local
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /tmp                    btrfs  subvol=/@/tmp
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /srv                    btrfs  subvol=/@/srv
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /root                   btrfs  subvol=/@/root
    0  0
UUID=73a871c4-ce08-4339-930c-762ee6b2c1c0  /opt                    btrfs  subvol=/@/opt
    0  0
UUID=a949a18a-c276-483f-b733-8313bf36340e  /home                   xfs    defaults
    0  0
UUID=f72197f5-6f97-49d0-8689-b00062fc7d72_ swap                    swap   defaults
    0  0
~
~
~
~
~
~
~
~
~
~
~
~
-- ▮ ▮  --                                                        12,42         ▮ ▮
```

保存之后重启操作系统

2.4. 刷新文件系统

重启系统后，要刷新文件系统，不然扩展不会生效

这里需要根据不同的文件系统类型来执行不同的刷新指令，查看 sda2 的文件系统是 btrfs，所以这里我们使用 **btrfs filesystem resize max /** 来刷新

Bash

```
1 resize2fs命令          针对的是ext2、ext3、ext4文件系统
2 xfs_growfs命令         针对的是xfs文件系统
```

```
dttsuse:~ # df -hT
Filesystem     Type      Size  Used Avail Use% Mounted on
devtmpfs       devtmpfs  874M     0  874M   0% /dev
tmpfs          tmpfs     887M     0  887M   0% /dev/shm
tmpfs          tmpfs     887M   18M  870M   2% /run
tmpfs          tmpfs     887M     0  887M   0% /sys/fs/cgroup
/dev/sda2      btrfs      13G  5.9G  4.7G  56% /
/dev/sda2      btrfs      13G  5.9G  4.7G  56% /.snapshots
/dev/sda2      btrfs      13G  5.9G  4.7G  56% /srv
/dev/sda2      btrfs      13G  5.9G  4.7G  56% /boot/grub2/x86_64-efi
/dev/sda2      btrfs      13G  5.9G  4.7G  56% /tmp
/dev/sda2      btrfs      13G  5.9G  4.7G  56% /var
/dev/sda2      btrfs      13G  5.9G  4.7G  56% /opt
/dev/sda2      btrfs      13G  5.9G  4.7G  56% /boot/grub2/i386-pc
/dev/sda2      btrfs      13G  5.9G  4.7G  56% /root
/dev/sda2      btrfs      13G  5.9G  4.7G  56% /usr/local
/dev/sda3      xfs       6.0G   39M  6.0G   1% /home
tmpfs          tmpfs     178M   16K  178M   1% /run/user/471
tmpfs          tmpfs     178M     0  178M   0% /run/user/0
dttsuse:~ # btrfs filesystem resize max /
Resize '/' of 'max'
dttsuse:~ # df -hT
Filesystem     Type      Size  Used Avail Use% Mounted on
devtmpfs       devtmpfs  874M     0  874M   0% /dev
tmpfs          tmpfs     887M     0  887M   0% /dev/shm
tmpfs          tmpfs     887M   18M  870M   2% /run
tmpfs          tmpfs     887M     0  887M   0% /sys/fs/cgroup
/dev/sda2      btrfs      70G  5.9G   63G   9% /
/dev/sda2      btrfs      70G  5.9G   63G   9% /.snapshots
/dev/sda2      btrfs      70G  5.9G   63G   9% /srv
/dev/sda2      btrfs      70G  5.9G   63G   9% /boot/grub2/x86_64-efi
/dev/sda2      btrfs      70G  5.9G   63G   9% /tmp
/dev/sda2      btrfs      70G  5.9G   63G   9% /var
/dev/sda2      btrfs      70G  5.9G   63G   9% /opt
/dev/sda2      btrfs      70G  5.9G   63G   9% /boot/grub2/i386-pc
/dev/sda2      btrfs      70G  5.9G   63G   9% /root
/dev/sda2      btrfs      70G  5.9G   63G   9% /usr/local
/dev/sda3      xfs       6.0G   39M  6.0G   1% /home
tmpfs          tmpfs     178M   16K  178M   1% /run/user/471
tmpfs          tmpfs     178M     0  178M   0% /run/user/0
dttsuse:~ #
```

在扩展存储池后，建议运行 `btrfs balance start -d -m /` 来重新平衡数据和元数据，以确保它们分布均匀在新磁盘上。

```
dttsuse:~ # btrfs balance start -d -m /
Done, had to relocate 10 out of 10 chunks
```

至此，已经将根分区扩容成功，后续就可以正常使用了