



原谅我的不善言辞，只懂得一味的陪伴。

《名侦探柯南》

Linux 扩容 / 根分区(LVM+非LVM)



梁哥

如果你得到从未拥有过的东西，那么你必须去做从未做过的事情！

52 人赞同了该文章

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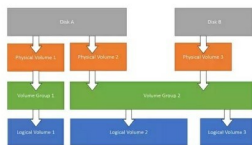
一、背景，概述

- MBR (Master Boot Record) (主引导记录) 和GPT (GUID Partition Table) (GUID意为全局唯一标识符) 是在磁盘上存储分区信息的两种不同方式

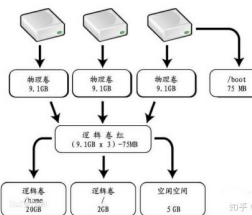
对于传统的MBR分区方式，有很多的限制：

- 1：最多4个主分区 (3个主分区+1个扩展分区(扩展分区里面可以放多个逻辑分区))，无法创建大于2TB的分区，使用fdisk分区工具，而GPT分区方式不受这样的限制。
- 2：GPT分区方式将不会有这种限制，使用的工具是parted；

- 逻辑卷管理(LVM)，是 Logical Volume Manager (逻辑卷管理) 的缩写，lvm是卷的一种管理方式，并不是分区工具 (也可不采用这种LVM管理方式) 。



逻辑卷管理(LVM)
LVM管理图1



LVM管理图2

上图所示：如果直接扩展/home逻辑卷目录，会提示逻辑卷组没有空间。

LVM的扩容思维流程：创建一个物理分区-->将这个物理分区转换为物理卷-->把这个物理卷添加到要扩展的卷组中-->然后才能用extend命令扩展此卷组中的逻辑卷。。还是有些乱，根据上图理解。

问：如何查看本地机器是否使用LVM管理？

`pvsdisplay #查看物理卷`

`vgdisplay #查看卷组`

`lvdisplay #查看逻辑卷`

答：执行上面命令，如果没有采用LVM管理的话，是查看不到上面卷组，物理卷，逻辑卷的 (有可执行fdisk -l查看)。逻辑卷即是挂载在目录上的卷。

```
root@ubuntu:~#  
root@ubuntu:~#  
root@ubuntu:~# fdisk -l  
Disk /dev/loop0: 91 MiB, 95406128 bytes, 186344 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/sda: 100 GiB, 107374182400 bytes, 209715200 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  
Disklabel type: gpt  
Disk identifier: CECFC25D-7E63-4DF3-86B8-5B09D839BBD1  
  
Device      Start       End     Sectors  Size Type  
/dev/sda1    2048        4095      2048    1M BIOS boot  
/dev/sda2   4096 209713151 209709056 100G linux filesystem  
root@ubuntu:~#
```

图LVM

下面分别介绍LVM 和 非LVM 扩展根分区：

二、CentOS7，LVM根分区扩容步骤：

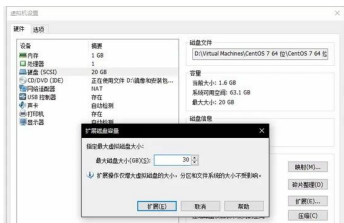
1.查看现有分区大小

`df -TH`

```
[root@localhost ~]# df -Th  
Filesystem      Type      Size  Used Avail Use% Mounted on  
devmapper/centos-root.xfs  xfs       17G  1.2G  15G   8% /  
devtmpfs        devtmpfs  476M    0  476M   0% /dev  
tmpfs           tmpfs     488M    0  488M   0% /dev/shm  
tmpfs           tmpfs     488M  7.8M  480M   2% /run  
tmpfs           tmpfs     488M    0  488M   0% /sys/fs/cgroup  
devfsd1         xfs      201.8M  32.0M  169.8M  16% /root  
tmpfs           tmpfs     98M    0   98M   0% /run/gdm2  
[root@localhost ~]#
```

LVM分区，磁盘总大小为20G,根分区总容量为17G

2.关机增加大小为30G(测试环境使用的Vmware Workstation)





扩展分区到30G

3.查看扩容后磁盘大小

```
df -TH  
lsblk
```

```
root@localhost ~# df -TH  
Filesystem      Type      Size  Used Avail Use% Mounted on  
/dev/mapper/centos-root.xfs  xfs        17G  1.3G  15G   8% /  
devtmpfs        devtmpfs   476M    0  476M   0% /dev  
tmpfs           tmpfs      488M    0  488M   0% /dev/shm  
tmpfs           tmpfs      488M    0  488M   0% /run  
/dev/sda1       xfs        101.8G  132M  85.8M  1% /boot  
tmpfs           tmpfs      59M     0   59M   0% /run/user/0  
  
root@localhost ~# lsblk  
NAME        MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT  
sda          8:0    0   30G  0 disk  
├─sda1       8:1    0    1G  0 part /boot  
├─sda2       8:2    0   19G  0 part  
├─┌centos-root 253:0   0   17G  0 lvm /  
│ └─centos-root 253:0   0   17G  0 lvm [SWAP]  
└─sda3       8:3    0   10G  0 part  
sr0         11:0    0    1G  0 rom  
root@localhost ~#
```

磁盘大小为30G,根分区为17G

4.创建分区

```
fdisk /dev/sda
```

```
root@localhost ~# fdisk /dev/sda  
Welcome to fdisk (util-linux 2.23.2).  
Changes will remain in memory only, until you decide to write them.  
Be careful before using the write command.  
  
Command (m for help): n  
Partition type:  
p primary (2 primary, 0 extended, 2 free)  
e extended  
Select (default p): p  
Partition number (1-4, default 1):  
First sector (41943040-62914559, default 41943040):  
Using default value 41943040  
Last sector, +sectors or +size(K,M,G) (41943040-62914559, default 62914559):  
Using default value 62914559  
Partition 3 of type Linux and of size 18 GiB is set  
  
Command (m for help): p  
Disk /dev/sda: 32.2 GB, 32212254720 bytes, 62914560 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 label type: dos  
Disk identifier: 0x00082b86  
  
Device boot      Start          End              Blocks      Id  System  
/dev/sda1 *      2048          2099199         1948736     83  Linux  
/dev/sda2        2099200      41943039        19921920     8e  Linux LVM  
/dev/sda3        41943040      62914559        16487360     83  Linux  
  
Command (m for help): w  
The partition table has been altered!  
Calling ioctl() to re-read partition table.  
WARNING: Re-reading the partition table failed with error 16: Device or resource busy.  
The kernel still uses the old table. The new table will be used at the next reboot or after you run partprobe(8) or kpartx(8)  
Syncing disks.  
root@localhost ~#
```

将sda剩余空间全部给sda3

5.刷新分区并创建逻辑卷

```
partprobe /dev/sda  
pvcreate /dev/sda3
```

```
root@localhost ~# partprobe /dev/sda  
root@localhost ~#  
root@localhost ~#  
root@localhost ~# lsblk  
NAME        MAJ:MIN RM  SIZE RO TYPE MOUNTPOINT  
sda          8:0    0   30G  0 disk  
├─sda1       8:1    0    1G  0 part /boot  
├─sda2       8:2    0   19G  0 part  
├─┌centos-root 253:0   0   17G  0 lvm /  
│ └─centos-root 253:0   0   17G  0 lvm [SWAP]  
└─sda3       8:3    0   10G  0 part  
sr0         11:0    0    1G  0 rom  
root@localhost ~# pvcreate /dev/sda3  
Physical volume "/dev/sda3" successfully created.  
root@localhost ~#
```

6.查看卷组名称, 以及卷组使用情况

```
vgdisplay
```

```
root@localhost ~# vgdisplay  
--- Volume group ---  
VG Name                centos  
System ID                
Format                 lvm2  
Metadata Areas         1  
Metadata Sequence Num  3  
VG Access               readwrite  
VG Status               resizable  
MAX LV                 0  
Cur LV                2  
Open LV                2  
Max PV                 0  
Cur PV                1  
Act PV                 1  
VG Size                <19.00 GiB  
PE Size                4.00 MiB  
Total PE               4863  
Alloc PE / Size        4863 / <19.00 GiB  
Free PE / Size         0 / 0  
VG UUID                4000qC-GU5-eW5V-c140-dp0-KKhx-C2M09v  
root@localhost ~#
```

VG Name=centos

7.将物理卷扩展到卷组

```
vgextend centos /dev/sda3
```

```
root@localhost ~# vgextend centos /dev/sda3  
Volume group "centos" successfully extended  
root@localhost ~#
```

使用sda3扩展VG centos

8.查看当前逻辑卷的空间状态

```
lvdisplay
```

```
root@localhost ~# lvdisplay  
--- Logical volume ---  
LV Path                /dev/centos/root  
LV Name                root  
VG Name                centos  
LV UUID                F4B272-y02M-A1mN-Q3u7-N6pK-az72-1lw6M  
LV Write Access         read/write  
LV Creation host, time localhost 2018-06-13 09:14:37 +0800  
LV Status               available  
# open                 1  
LV Size                 <17.00 GiB  
Current LE             4521  
Segments               1  
Allocation              inherit  
Read ahead sectors     auto  
Currently not set to    
Block device           253:0  
  
--- Logical volume ---  
LV Path                /dev/centos/swap  
LV Name                swap  
VG Name                centos  
LV UUID                650140-R4K-W7d4-mHFr-suP2-rYqg-EB75sk  
LV Write Access         read/write  
LV Creation host, time localhost 2018-06-13 09:14:38 +0800  
LV Status               available  
# open                 2  
LV Size                 2.00 GiB  
Current LE             512  
Segments               1  
Allocation              inherit  
Read ahead sectors     auto  
Currently not set to    
Block device           253:1  
root@localhost ~#
```

需要扩展LV /dev/centos/root

9.将卷组中的空闲空间扩展到根分区逻辑卷

```
lvextend -l +100%FREE /dev/centos/root
```

```
root@localhost ~# lvextend -l +100%FREE /dev/centos/root  
Size of logical volume centos/root changed from <17.00 GiB (4521 extents) to 26.99 GiB (6933 extents).  
Logical volume centos/root successfully resized.  
root@localhost ~#
```

10.刷新根分区

```
xfs_growfs /dev/centos/root
```

```
root@localhost ~# xfs_growfs /dev/centos/root  
meta-data=/dev/mapper/centos-root isize=512    agcount=4, agsize=113856 blks  
         =                       sectsz=512   attr=0, projid32bit=1  
         =                       crc=1        finobt=0 spinodes=0  
         =                       bmap=0      extents-per-block=1  
         =                       inodes=65536  ino-chk=0  
root@localhost ~#
```

```
reading = version 2
log = internal
realtime = none
data blocks changed from 4455424 to 7075840
[root@localhost centos]#
```

11.查看磁盘使用情况，扩展之前和之后是不一样的

```
[root@localhost centos]# df -Th
Filesystem      Type      Size  Used Avail Use% Mounted on
/dev/mapper/centos-root xfs        27G  1.3G  26G   5% /
devtmpfs        devtmpfs  477M    0  477M   0% /dev
tmpfs           tmpfs     488M    0  488M   0% /dev/shm
tmpfs           tmpfs     488M    0  488M   0% /run
tmpfs           tmpfs     488M    0  488M   0% /sys/fs/cgroup
/dev/sda1       xfs     1014M  130M   884M  13% /boot
tmpfs           tmpfs     90M     0   90M   0% /run/user/0
```

根分区已变成27G

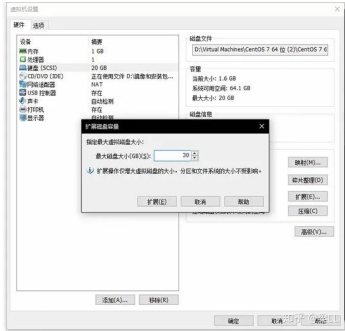
三、CentOS7，非LVM根分区扩容步骤：

1.查看现有的分区大小

```
[root@localhost ~]#
[root@localhost ~]# df -Th
Filesystem      Type      Size  Used Avail Use% Mounted on
/dev/sda3       xfs        17G  1.5G   15G   9% /
devtmpfs        devtmpfs  477M    0  477M   0% /dev
tmpfs           tmpfs     488M    0  488M   0% /dev/shm
tmpfs           tmpfs     488M    0  488M   0% /run
tmpfs           tmpfs     488M    0  488M   0% /sys/fs/cgroup
/dev/sda1       xfs     1014M  130M   884M  13% /boot
tmpfs           tmpfs     90M     0   90M   0% /run/user/0
```

非LVM分区，目前磁盘大小为20G，根分区总容量为17G

2.关机增加磁盘大小为30G



3.查看磁盘扩容后状态

```
lsblk
dh -TH

[root@localhost ~]# lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda 8:0 0 30G 0 disk
├─sda1 8:1 0 10 0 part /boot
├─sda2 8:2 0 2G 0 part [SWAP]
├─sda3 8:3 0 17G 0 part /
└─sr0 11:0 1 4.2G 0 rom

[root@localhost ~]# df -h
Filesystem      Size  Used Avail Use% Mounted on
/dev/sda3       17G  1.5G   15G   9% /
devtmpfs        477M    0  477M   0% /dev
tmpfs           488M    0  488M   0% /dev/shm
tmpfs           488M    0  488M   0% /run
tmpfs           488M    0  488M   0% /sys/fs/cgroup
/dev/sda1       1014M  130M   884M  13% /boot
tmpfs           90M     0   90M   0% /run/user/0
```

现在磁盘总大小为30G,根分区为17G

4.进行分区扩展磁盘，记住根分区起始位置和结束位置

```
[root@localhost ~]# fdisk /dev/sda
Welcome to fdisk (util-linux 2.23.2).

Changes will remain in memory only, until you decide to write them.
Be careful before using the write command.

Command (for help): p
Disk /dev/sda: 32.2 GB, 32212254720 bytes, 62914560 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 label type: dos
Disk identifier: 0x000c460f

Device Boot      Start         End      Blocks   Id  System
/dev/sda1 *        2048     2099199     1048576    83  Linux
/dev/sda2          2099200     6291303     2097152    82  Linux swap / Solaris
/dev/sda3          6291304     41943039     17824768    83  Linux

Command (for help):
```

5.删除根分区，切记不要保存

```
Command (for help): d
Partition number (1-3, default 3): 3
Partition 3 is deleted

Command (for help): p
Disk /dev/sda: 32.2 GB, 32212254720 bytes, 62914560 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 label type: dos
Disk identifier: 0x000c460f

Device Boot      Start         End      Blocks   Id  System
/dev/sda1 *        2048     2099199     1048576    83  Linux
/dev/sda2          2099200     6291303     2097152    82  Linux swap / Solaris

Command (for help):
```

6.创建分区，箭头位置为分区起始位置

```
Command (for help): n
Partition type:
  p primary (1 primary, 0 extended, 2 free)
  e extended
Partition number (1-2, default 1): 3
Partition start (sector), default 0: 6291304
First sector (6291304-4294965), default 6291304: 6291304
Last sector, sector or +sizeG or +sizeM or +sizeK or +sizeB (4294965),
using default value 4294965:
Partition 3 is a type Linux and of size 27 GB is set

Command (for help): p
Disk /dev/sda: 32.2 GB, 32212254720 bytes, 62914560 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 label type: dos
Disk identifier: 0x000c460f

Device Boot      Start         End      Blocks   Id  System
/dev/sda1 *        2048     2099199     1048576    83  Linux
/dev/sda2          2099200     6291303     2097152    82  Linux swap / Solaris
/dev/sda3          6291304     4294965      3036660    83  Linux

Command (for help):
```

7.保存退出并刷新分区

```
partprobe /dev/sda

Command (for help): w
The partition table has been altered!

Calling ioctl() to re-read partition table.

WARNING: Re-reading the partition table failed with error 16: Device or resource busy.
The kernel still uses the old table. The new table will be used at
the next reboot or after you run partprobe(s) or kpartx(s)
Syncing disks.
[root@localhost ~]# partprobe /dev/sda
[root@localhost ~]#
```

8.查看分区状态

```
[root@localhost ~]# lsblk
NAME MAJ:MIN RM SIZE RO TYPE MOUNTPOINT
sda 8:0 0 30G 0 disk
├─sda1 8:1 0 10 0 part /boot
├─sda2 8:2 0 2G 0 part [SWAP]
├─sda3 8:3 0 27G 0 part /
└─sr0 11:0 1 4.2G 0 rom

[root@localhost ~]# df -Th
Filesystem      Type      Size  Used Avail Use% Mounted on
/dev/sda3       xfs        27G  1.5G  25G   5% /
devtmpfs        devtmpfs  500M    0  500M   0% /dev
tmpfs           tmpfs     511M    0  511M   0% /dev/shm
tmpfs           tmpfs     511M    0  511M   0% /run
tmpfs           tmpfs     511M    0  511M   0% /sys/fs/cgroup
/dev/sda1       xfs     1.01G  130M   920M  13% /boot
tmpfs           tmpfs     103M    0  103M   0% /run/user/0
```

这里不知道为啥变成19G了。

9.刷新根分区并查看状态

| xfs_growfs /dev/sda3 (这里先看自己的文件系统是xfs, 还是ext4...)

使用 resize2fs或xfs_growfs 对挂载目录在线扩容：

- resize2fs 针对文件系统ext2 ext3 ext4 (我在本地用ubuntu18是ext4, 我用的是resize2fs /dev/sda3)
- xfs_growfs 针对文件系统xfs

```
[root@localhost ~]# xfs_growfs /dev/sda3
meta-data=/dev/sda3             isize=512    agcount=4, agsize=114048 blks
       =                       sectsz=512   attr=2, projid32bit=1
       =                       crc=1        fault=agjourn=0
data     =                       bsize=4096   blocks=4456102, inagct=25
       =                       slotted=0    bmap=0      noaligned blks
naming   =version 2             bsize=4096   blocklog=26, version=2
log      =internal             sectsz=512   unit=0 blks, log-cnt=1
realtime none                    extsz=4096   blocks=0, rtextents=0
data blocks changed from 445610 to 7677632
[root@localhost ~]# df -Th
Filesystem Type Size Used Avail Mounted on
/dev/sda3 xfs 77G 1.3G 26G 5% /
devtmpfs devtmpfs 477M 0 477M 0% /dev
tmpfs tmpfs 480M 0 480M 0% /dev/shm
tmpfs tmpfs 480M 7.7M 480M 2% /run
tmpfs tmpfs 480M 0 480M 0% /sys/fs/cgroup
/dev/sda1 xfs 10.8G 1.39G 8.56G 13% /boot
tmpfs tmpfs 480M 0 480M 0% /run/user/0
```

知乎 @梁LL

根分区大小已变为27G

最后感谢后面连接的作者，在启基础修改了下，包括错别字。

【转】：jianshu.com/p/273daea17 ...



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Linux 运维

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LVM——让Linux磁盘空间的弹性管理

什么是LVM? LVM(Logical Volume Manager)逻辑卷管理是在Linux2.4内核以上实现的磁盘管理技术。它是Linux环境下对磁盘分区进行管理的一种机制。现在不仅仅是Linux系统上可以使用LVM这...

杰米尼

Linux—LVM

一、什么是LVM(LVM(Logical Volume Manager)，即逻辑卷管理。是Linux环境下对磁盘分区进行管理的一种机制。LVM是建立在磁盘和分区之上的一个逻辑层。来提高磁盘分区管理的灵活性。通过...

空x

LVM

Logical Volume Manager

Linux存储管理：LVM

一只小白鸟

职场晋升记

(专为职场新人准备的入门指南)

Linux系统LVM逻辑卷工作原理，必看~

Wayne 发表于Linux...

10 条评论

切换为时间顺序

写下你的评论...

- Hakureim
xfs_growfs 成功刷新，谢谢！
赞

04-10
- kek
用新盒(/dev/sdb1)怎么给非LVM的根目录(/dev/sda2)扩容啊？
赞

02-08
- 梁菊 (作者) 回复 kek
我好象写的另外一个文章，可以去我写的文章下找找，具体哪一篇不记得了。
赞

02-08
- 宫晓
我的redhat6.5 resize2fs需要重启才能执行
赞

2021-10-16
- 梁菊 (作者) 回复 宫晓
中途步骤有报错不？
赞

2021-12-03
- 宫晓 回复 梁菊 (作者)
好像没有
赞

2021-12-11
- 知乎用户
感谢up主
赞

2021-09-14
- 狗牙
完美
赞

2021-07-31
- 知乎用户
赞 清晰
赞

2021-06-05
- 运维开发工程师
删除分区重新创建有风险，推荐使用growpart来扩容
赞

2021-05-21

