As of 2016-02-26, there will be no more posts for this blog. s/blog/pbo/

df: Size = Used + Avail + Reserved

Saturday, December 15, 2012

df · disk management · ext2 · ext3 · ext4 · Extended File System · file system

A few days ago, I ran `df -h` for no reasons as I usually did, the output as follows:

```
$ df -h
Filesystem      Size  Used Avail Use% Mounted on
rootfs           72G   49G   20G  72% /
[...]
```

To my amaze or not to, the part of my brain which manages mathematics finally told me that 72G != 49G + 20G. I have been using Linux full-time for more than five years and probably have run `df` for a thousand times if not less. Finding the inconsistency is not really what confused me but why it took me so long to see the numbers.

I found the answer after consulted Google using columns of `df`, ie. `"df size used avail"`. Yes, that's how I found the answer at my first try. I am still a master of Google.

The discrepancy comes from **Reserved Blocks**. From what I read, Extended File System (ext) since *ext2*, has such feature and the default reserved blocks are 5% of total blocks, marked by `mke2fs`.

```
-m reserved-blocks-percentage
  Specify the percentage of the filesystem blocks reserved for the
  super-user.  This avoids fragmentation, and allows root-owned daei
  such as syslogd(8), to continue to function correctly after non-p
  processes are prevented from writing to the filesystem.  The defai
  percentage is 5%.
```

To see how many blocks are reserved, you can use `tune2fs`:

```
$ sudo tune2fs -l /dev/sda3 | grep -i block
Block count:              19037025
Reserved block count:     951851
Free blocks:              6019654
[...]
Block size:               4096
[...]
```

In my case, it's 19,037,025 * 0.05 = 951,851.25. Round to 951,851 blocks as you see in the output above. To do the math correctly, use 1K-blocks for calculations:

```
$ df | head -2
Filesystem     1K-blocks     Used Available Use% Mounted on
rootfs          74953252 50727968  20417880  72% /
```

The reserved size is 951,851 * 4 (Block size, 4096 = 4*1K-blocks) + 507,279,68 + 204,178,880 = 74,953,252. Mystery solved!

5% (3.6G) is really a lot, even for my tiny harddrive. Imagine a 1TB harddrive, that's 50G, almost as big as my harddrive. There are two ways to set the reserved amount of blocks using `tune2fs`, one by percentage, another by number of blocks.

YJL

For percentage using `-m`, the following code set to 1%, you can assign a float number.

```
$ sudo tune2fs -m 1 /dev/sda3
tune2fs 1.42 (29-Nov-2011)
Setting reserved blocks percentage to 1% (190370 blocks)
```

Or, the specific amount of block using `-r`, the following code set to around 500MB in 4K block size.

```
$ sudo tune2fs -r 129008 /dev/sda3
tune2fs 1.42 (29-Nov-2011)
Setting reserved blocks count to 129008
```

When creating an ext2/ext3/ext4 filesystem using `mke2fs`/`mkfs.ext2`/`mkfs.ext3`/`mkfs.ext4`, you can only use `-m` to specify a reversed percentage.

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