NASA 2017 Final Project
SA#2 NFS Server Static Load Balance

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1 Introduction

Currently, we have only one NFS server supplying all the workstation. Now suppose we have N NFS server, providing M users to access their home directory, we have to support following functions:

1. If a new grade of students joins, we have to use scripts to create their corresponding home directory on NFS.
2. If new NFS servers joins, we have to adjust the home directories to balance the load.
3. If there are old NFS servers discarded, we have to move the home directories to other NFS servers.

In this project, all VMs are under CentOS 7

2 Workstation Environment Simulation

2.1 Structure

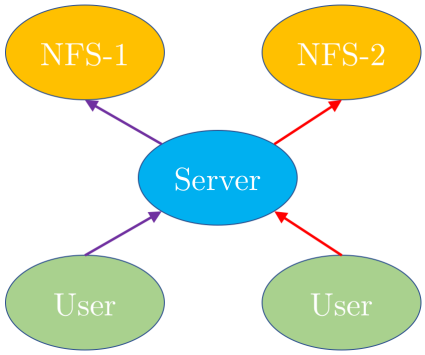


Figure 1: Structure of the workstation

2.2 NFS Setup

In NFS server, we must write the IP of the server in `/etc/exports` to share directories to the workstation server. It is important that the IP address of NFS server and workstation server must be constant. In `/etc/systemd/network/25-wired.network`, we add

```
[Match]
Name=enp0s8

[Network]
Address=192.168.100.3/24
```

So that the IP addresses of NFS server and workstation server will be constant, which is the value given manually. And the mount points are divided by grades of users. i.e. b03, b04, b05, etc. For example, in NFS-1:

2.3 Server Setup

First, to decrease system loading, we use **autofs** to mount the NFS directories. Only when the directories are used will the directories be mounted. If a directory is not used for a given time, it will be unmounted.

3 Creating One Single User

There are several steps we must follow to create a user:

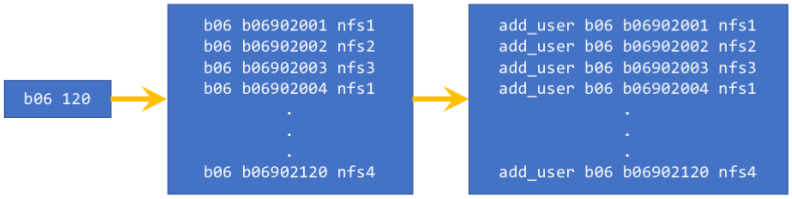
1. Give a user name and password
2. Set the home directory
3. Link the home directory to NFS
4. Change the owner of the home directory of the user.

```
#!/usr/bin/bash
if [ $# -lt 3 ]; then
   echo "Usage: add_user.sh <grade> <username> <NFSname>"
   exit 1
fi
grade=$1
username=$2
nfs=$3
useradd $username -d /home/$grade/$username
echo -e "$username\n$username\n" | passwd $username >& /dev/null
mv /home/$grade/$username /autofs/$nfs/$grade/$username
ln -s /autofs/$nfs/$grade/$username /home/$grade/$username
chown -R $username /autofs/$nfs/$grade/$username
```

After this, we create a new user whose home directory is a symbolic link to the directory lies in NFS server.

4 Creating A Group of Users

Suppose now we want to create accounts for freshmen, e.g. b06902{001-120}. First, for convinence, we need some scripts to support follow data transform.



And the main problem here is how to distribute users among NFS servers. To both consider randomness and even distribution, we first shuffle the list, then evenly distribute the list to each server. To be more clearly, part of codes to do this job is shown below.

```
shuffle(userlist.begin(), userlist.end());
cout << numNFS << endl;
for (i=1;i<numNFS;++i) {
   k = i*userlist.size()/numNFS;
   sort(userlist.begin()+j, userlist.begin()+k);
   cout << k-j;
   for (;j<k;++j)
      printf(" %s%03d", prefix, userlist[j]);
   cout << endl;
}
```

5 Creating New NFS Server

Steps are as following:

1. Setup NFS server for the workstation server to connect to and mount.
2. Generate a new distribution list and find the users that are to be moved.
3. Move the directories of these users to the new server.
4. Update the symbolic link of the home directories of these users.

5.1 Setup NFS Server

For administrator's convinence, we can `ssh` to the NFS server from workstation server and setup directories to share in `/etc/exports`. Then setup the autofs at the workstation side (`/etc/auto.master`, `/etc/auto.nfs*`)

5.2 Find The Users To Be Moved

We write a C++ program to do this job. The input is the previous distribution list, and output would be a new distribution list and the modification we should make. We evenly take some users from each server, and move them to the new server.

5.3 Move The Directories

6 Deleting Old NFS Server

Quite similar to adding new NFS server, but now we need not to setup a new server. Steps are as following:

1. Decide the new distribution
2. Move the directories to the new distributed NFS server
3. Update the symbolic link of the home directories of these users.

6.1 Decide The New Distribution

Similar to adding new NFS server, we use a C++ program to distribute the users on the to-be-deleted server to other servers, and figure out the users that are influenced.

7 Difficulties