

实验一 Linux 集群基础

任务 1 使用 ssh 远程登录服务器

```
xueyuan@XueY ~$ ssh 2021214316@10.103.9.11
Welcome to Ubuntu 16.04.6 LTS (GNU/Linux 4.4.0-210-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:    https://landscape.canonical.com
 * Support:       https://ubuntu.com/advantage

70 个可升级软件包。
2 个安全更新。

New release '18.04.6 LTS' available.
Run 'do-release-upgrade' to upgrade to it.

*** 需要重启系统 ***
Last login: Tue Sep 28 19:32:45 2021 from 10.97.135.16
2021214316@thumm01:~$ pwd
```

任务 2 配置免密登录

生成公钥和私钥

```
xueyuan@XueY ~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/Users/xueyuan/.ssh/id_rsa):
/Users/xueyuan/.ssh/id_rsa already exists.
Overwrite (y/n)? y
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /Users/xueyuan/.ssh/id_rsa.
Your public key has been saved in /Users/xueyuan/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:eXFLYzVYQn+B2S3LxDjB2I+ZUwRJtfjIE4oRruTbzyw xueyuan@XueY.local
The key's randomart image is:
+---[RSA 3072]-----+
|      .  **@X.. |
|      .  .. BB=+o |
|      . o . BXoo. |
|    o . + B=*+. |
|    o S o =.. |
|      o . . |
|      . . |
|      E+ |
|      .+ |
+---[SHA256]-----+
```

将公钥内容复制到服务器

```
xueyuan@XueY ~$ ssh-copy-id -i ~/.ssh/id_rsa.pub 2021214316@10.103.9.11
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/Users/xueyuan/.ssh/id_rsa.pub"
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
2021214316@10.103.9.11's password:

Number of key(s) added:      1

Now try logging into the machine, with:  "ssh '2021214316@10.103.9.11'"
and check to make sure that only the key(s) you wanted were added.
```

任务 3 pwd、mkdir、cd 命令

```
2021214316@thumm01:~$ pwd
/home/dsjxtjc/2021214316
2021214316@thumm01:~$ mkdir dir_name
2021214316@thumm01:~$ ls
dir_name
2021214316@thumm01:~$ cd dir_name
2021214316@thumm01:~/dir_name$ pwd
/home/dsjxtjc/2021214316/dir_name
2021214316@thumm01:~/dir_name$ cd ..
2021214316@thumm01:~$ pwd
/home/dsjxtjc/2021214316
```

任务 4 cp、vim、ls、mv、rm 命令

```
2021214316@thumm01:~$ vim file.txt
2021214316@thumm01:~$ ls
dir_name  file.txt
2021214316@thumm01:~$ cat file.txt
helloworld
2021214316@thumm01:~$ cp file.txt new_file.txt
2021214316@thumm01:~$ ls
dir_name  file.txt  new_file.txt
2021214316@thumm01:~$ mv new_file.txt new_file_renamed.txt
2021214316@thumm01:~$ ls
dir_name  file.txt  new_file_renamed.txt
2021214316@thumm01:~$ rm file.txt
2021214316@thumm01:~$ ls
dir_name  new_file_renamed.txt
2021214316@thumm01:~$ ls -l
total 8
drwxr-xr-x 2 2021214316 dsjxtjc 4096 9月 28 19:43 dir_name
-rw-r--r-- 1 2021214316 dsjxtjc  11 9月 28 19:51 new_file_renamed.txt
```

任务 5 cat、head、scp、awk、grep 命令

head、tail 命令

```
2021214316@thumm01:~$ cp /home/dsjxtjc/wc_dataset.txt ./
2021214316@thumm01:~$ ls
dir_name  new_file_renamed.txt  wc_dataset.txt
2021214316@thumm01:~$ head wc_dataset.txt
chapter
i
down
the
rabbit
hole
alice
was
beginning
to
2021214316@thumm01:~$ head -n 5 wc_dataset.txt
chapter
i
down
the
rabbit
2021214316@thumm01:~$ head -n 10 wc_dataset.txt | tail -n 5
hole
alice
was
beginning
to
```

重定向符'>'的使用

```
2021214316@thumm01:~$ head -n 5 wc_dataset.txt > wc_1-5.txt
2021214316@thumm01:~$ ls
dir_name  new_file_renamed.txt  wc_1-5.txt  wc_dataset.txt
2021214316@thumm01:~$ head -n 10 wc_dataset.txt | tail -n 5 > wc_6-10.txt
2021214316@thumm01:~$ ls
dir_name  new_file_renamed.txt  wc_1-5.txt  wc_6-10.txt  wc_dataset.txt
```

cat 命令

```
2021214316@thumm01:~$ cat wc_1-5.txt
chapter
i
down
the
rabbit
2021214316@thumm01:~$ cat wc_6-10
cat: wc_6-10: No such file or directory
2021214316@thumm01:~$ cat wc_6-10.txt
hole
alice
was
beginning
to
```

```
2021214316@thumm01:~$ cat wc_1-5.txt wc_6-10.txt > wc_1-10.txt
2021214316@thumm01:~$ ls
dir_name  new_file_renamed.txt  wc_1-10.txt  wc_1-5.txt  wc_6-10.txt  wc_dataset.txt
2021214316@thumm01:~$ cat wc_1-10.txt
chapter
i
down
the
rabbit
hole
alice
was
beginning
to
2021214316@thumm01:~$ head -n 10 wc_dataset.txt
chapter
i
down
the
rabbit
hole
alice
was
beginning
to
```

scp 命令

配置 thumm01 和 thumm02 的免密登录

```

2021214316@thumm01:~$ ssh-copy-id -i ~/.ssh/id_rsa.pub thumm02

/usr/bin/ssh-copy-id: ERROR: failed to open ID file '/home/dsjxtjc/2021214316/.ssh/id_rsa.pub': No such file
2021214316@thumm01:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/dsjxtjc/2021214316/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/dsjxtjc/2021214316/.ssh/id_rsa.
Your public key has been saved in /home/dsjxtjc/2021214316/.ssh/id_rsa.pub.
The key fingerprint is:
SHA256:sdZhwgyNdhm0JtjYedkVmYUhbkggbb5Mi4oiMPUD3gs 2021214316@thumm01
The key's randomart image is:
+----[RSA 2048]-----+
|      ..o=+o. +B. |
|      *=+*  o+  |
|      o+=.@ *   |
|      o  o+ B .  |
|      o + + oS .  |
|      o E = +.   |
|      .o o o     |
|      + . .      |
|      o          |
+-----[SHA256]-----+
2021214316@thumm01:~$ ssh-copy-id -i ~/.ssh/id_rsa.pub thumm02
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/dsjxtjc/2021214316/.ssh/id_rsa.pub"
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
2021214316@thumm02's password:

Number of key(s) added: 1

Now try logging into the machine, with:  "ssh 'thumm02'"
and check to make sure that only the key(s) you wanted were added.

```

scp 命令执行

```

2021214316@thumm01:~$ scp wc_1-10.txt thumm02:~/
wc_1-10.txt                                     100% 54    0.1KB/s   00:00

2021214316@thumm02:~$ ls
wc_1-10.txt

```

Awk 命令

```

root@kali:~# cat /etc/passwd
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:bin:/usr/sbin/nologin
sys:x:3:sys:/dev:/usr/sbin/nologin
cron:x:4:cron:/var/spool/cron/crontabs:/bin/bash
mail:x:5:5:mail:/var/mail:/bin/bash
nobody:x:65534:65534:/usr/sbin/nologin
games:x:67:games:/usr/games:/usr/sbin/nologin
man:x:68:man:/var/cache/man:/usr/sbin/nologin
lxc:x:69:man:/var/lib/lxc/:/usr/sbin/nologin
www-data:x:77:www-data:/var/www:/usr/sbin/nologin
mailnull:x:81:mail:/var/mail:/usr/sbin/nologin
news:x:82:news:/var/news:/usr/sbin/nologin
uucp:x:83:uucp:/usr/lib/uucp:/usr/sbin/nologin
halt:x:9:halt:/usr/lib/halt:/usr/sbin/nologin
ntp:x:330:ntp:/var/run/ntp:/usr/sbin/nologin
kthash:x:145:kthash:/usr/lib:/usr/sbin/nologin
x11:x:38:x11:/usr/lib/X11:/usr/sbin/nologin
irc:x:39:irc:/usr/lib/irc:/usr/sbin/nologin
gnats:x:41:Gnats Bug-Reporting System (admin):/usr/lib/gnats:/usr/sbin/nologin
_apt:x:100:100:/var/lib/ftp:/usr/sbin/nologin
systemd-networkd:x:101:101:/run/systemd/network:/run/systemd/netif:/bin/false
systemd-timesyncd:x:102:102:/run/systemd/timesync:/run/systemd/timesync:/bin/false
systemd-bus-proxy:x:103:103:/usr/bin/Bus.Proxy:/run/systemd/bin/false
systemd-journald:x:104:104:/var/log:/usr/sbin/nologin
systemd-logind:x:105:105:/usr/bin/Logind:/usr/sbin/nologin
systemd-udevd:x:106:106:/dev:/usr/sbin/nologin
systemd-sysctl:x:107:107:/usr/lib/sysctl.d:/bin/bash
systemd-sysd:x:108:108:/usr/lib/sysd.d:/bin/bash
systemd-udevd:x:109:109:/usr/lib/udev:/bin/false
systemd-journald:x:110:110:/var/log:/usr/sbin/nologin
systemd-logind:x:111:111:/usr/lib/Logind:/bin/false
systemd-udevd:x:112:112:/dev:/usr/sbin/nologin
systemd-sysctl:x:113:113:/usr/lib/sysctl.d:/bin/false
systemd-sysd:x:114:114:/usr/lib/sysd.d:/bin/false
systemd-udevd:x:115:115:/dev:/usr/sbin/nologin
systemd-journald:x:116:116:/var/log:/usr/sbin/nologin
systemd-logind:x:117:117:/usr/lib/Logind:/bin/false
systemd-udevd:x:118:118:/dev:/usr/sbin/nologin
systemd-sysctl:x:119:119:/usr/lib/sysctl.d:/bin/bash
systemd-sysd:x:120:120:/usr/lib/sysd.d:/bin/bash
systemd-udevd:x:121:121:/dev:/usr/sbin/nologin
systemd-journald:x:122:122:/var/log:/usr/sbin/nologin
systemd-logind:x:123:123:/usr/lib/Logind:/bin/bash
systemd-udevd:x:124:124:/dev:/usr/sbin/nologin
systemd-sysctl:x:125:125:/usr/lib/sysctl.d:/bin/bash
systemd-sysd:x:126:126:/usr/lib/sysd.d:/bin/bash
systemd-udevd:x:127:127:/dev:/usr/sbin/nologin
systemd-journald:x:128:128:/var/log:/usr/sbin/nologin
systemd-logind:x:129:129:/usr/lib/Logind:/bin/bash
systemd-udevd:x:130:130:/dev:/usr/sbin/nologin
systemd-journald:x:131:131:/var/log:/usr/sbin/nologin
systemd-logind:x:132:132:/usr/lib/Logind:/bin/bash
systemd-udevd:x:133:133:/dev:/usr/sbin/nologin
systemd-sysctl:x:134:134:/usr/lib/sysctl.d:/bin/bash
systemd-sysd:x:135:135:/usr/lib/sysd.d:/bin/bash
systemd-udevd:x:136:136:/dev:/usr/sbin/nologin
systemd-journald:x:137:137:/var/log:/usr/sbin/nologin
systemd-logind:x:138:138:/usr/lib/Logind:/bin/bash
systemd-udevd:x:139:139:/dev:/usr/sbin/nologin
systemd-journald:x:140:140:/var/log:/usr/sbin/nologin
systemd-logind:x:141:141:/usr/lib/Logind:/bin/bash
systemd-udevd:x:142:142:/dev:/usr/sbin/nologin
systemd-sysctl:x:143:143:/usr/lib/sysctl.d:/bin/bash
systemd-sysd:x:144:144:/usr/lib/sysd.d:/bin/bash
systemd-udevd:x:145:145:/dev:/usr/sbin/nologin
systemd-journald:x:146:146:/var/log:/usr/sbin/nologin
systemd-logind:x:147:147:/usr/lib/Logind:/bin/bash
systemd-udevd:x:148:148:/dev:/usr/sbin/nologin
systemd-sysctl:x:149:149:/usr/lib/sysctl.d:/bin/bash
systemd-sysd:x:150:150:/usr/lib/sysd.d:/bin/bash
systemd-udevd:x:151:151:/dev:/usr/sbin/nologin
systemd-journald:x:152:152:/var/log:/usr/sbin/nologin
systemd-logind:x:153:153:/usr/lib/Logind:/bin/bash
systemd-udevd:x:154:154:/dev:/usr/sbin/nologin
systemd-journald:x:155:155:/var/log:/usr/sbin/nologin
systemd-logind:x:156:156:/usr/lib/Logind:/bin/bash
systemd-udevd:x:157:157:/dev:/usr/sbin/nologin
systemd-journald:x:158:158:/var/log:/usr/sbin/nologin
systemd-logind:x:159:159:/usr/lib/Logind:/bin/bash
systemd-udevd:x:160:160:/dev:/usr/sbin/nologin
systemd-journald:x:161:161:/var/log:/usr/sbin/nologin
systemd-logind:x:162:162:/usr/lib/Logind:/bin/bash
systemd-udevd:x:163:163:/dev:/usr/sbin/nologin
systemd-journald:x:164:164:/var/log:/usr/sbin/nologin
systemd-logind:x:165:165:/usr/lib/Logind:/bin/bash
systemd-udevd:x:166:166:/dev:/usr/sbin/nologin
systemd-journald:x:167:167:/var/log:/usr/sbin/nologin
systemd-logind:x:168:168:/usr/lib/Logind:/bin/bash
systemd-udevd:x:169:169:/dev:/usr/sbin/nologin
systemd-journald:x:170:170:/var/log:/usr/sbin/nologin
systemd-logind:x:171:171:/usr/lib/Logind:/bin/bash
systemd-udevd:x:172:172:/dev:/usr/sbin/nologin
systemd-journald:x:173:173:/var/log:/usr/sbin/nologin
systemd-logind:x:174:174:/usr/lib/Logind:/bin/bash
systemd-udevd:x:175:175:/dev:/usr/sbin/nologin
systemd-journald:x:176:176:/var/log:/usr/sbin/nologin
systemd-logind:x:177:177:/usr/lib/Logind:/bin/bash
systemd-udevd:x:178:178:/dev:/usr/sbin/nologin
systemd-journald:x:179:179:/var/log:/usr/sbin/nologin
systemd-logind:x:180:180:/usr/lib/Logind:/bin/bash
systemd-udevd:x:181:181:/dev:/usr/sbin/nologin
systemd-journald:x:182:182:/var/log:/usr/sbin/nologin
systemd-logind:x:183:183:/usr/lib/Logind:/bin/bash
systemd-udevd:x:184:184:/dev:/usr/sbin/nologin
systemd-journald:x:185:185:/var/log:/usr/sbin/nologin
systemd-logind:x:186:186:/usr/lib/Logind:/bin/bash
systemd-udevd:x:187:187:/dev:/usr/sbin/nologin
systemd-journald:x:188:188:/var/log:/usr/sbin/nologin
systemd-logind:x:189:189:/usr/lib/Logind:/bin/bash
systemd-udevd:x:190:190:/dev:/usr/sbin/nologin
systemd-journald:x:191:191:/var/log:/usr/sbin/nologin
systemd-logind:x:192:192:/usr/lib/Logind:/bin/bash
systemd-udevd:x:193:193:/dev:/usr/sbin/nologin
systemd-journald:x:194:194:/var/log:/usr/sbin/nologin
systemd-logind:x:195:195:/usr/lib/Logind:/bin/bash
systemd-udevd:x:196:196:/dev:/usr/sbin/nologin
systemd-journald:x:197:197:/var/log:/usr/sbin/nologin
systemd-logind:x:198:198:/usr/lib/Logind:/bin/bash
systemd-udevd:x:199:199:/dev:/usr/sbin/nologin
systemd-journald:x:200:200:/var/log:/usr/sbin/nologin
systemd-logind:x:201:201:/usr/lib/Logind:/bin/bash
systemd-udevd:x:202:202:/dev:/usr/sbin/nologin
systemd-journald:x:203:203:/var/log:/usr/sbin/nologin
systemd-logind:x:204:204:/usr/lib/Logind:/bin/bash
systemd-udevd:x:205:205:/dev:/usr/sbin/nologin
systemd-journald:x:206:206:/var/log:/usr/sbin/nologin
systemd-logind:x:207:207:/usr/lib/Logind:/bin/bash
systemd-udevd:x:208:208:/dev:/usr/sbin/nologin
systemd-journald:x:209:209:/var/log:/usr/sbin/nologin
systemd-logind:x:210:210:/usr/lib/Logind:/bin/bash
systemd-udevd:x:211:211:/dev:/usr/sbin/nologin
systemd-journald:x:212:212:/var/log:/usr/sbin/nologin
systemd-logind:x:213:213:/usr/lib/Logind:/bin/bash
systemd-udevd:x:214:214:/dev:/usr/sbin/nologin
systemd-journald:x:215:215:/var/log:/usr/sbin/nologin
systemd-logind:x:216:216:/usr/lib/Logind:/bin/bash
systemd-udevd:x:217:217:/dev:/usr/sbin/nologin
systemd-journald:x:218:218:/var/log:/usr/sbin/nologin
systemd-logind:x:219:219:/usr/lib/Logind:/bin/bash
systemd-udevd:x:220:220:/dev:/usr/sbin/nologin
systemd-journald:x:221:221:/var/log:/usr/sbin/nologin
systemd-logind:x:222:222:/usr/lib/Logind:/bin/bash
systemd-udevd:x:223:223:/dev:/usr/sbin/nologin
systemd-journald:x:224:224:/var/log:/usr/sbin/nologin
systemd-logind:x:225:225:/usr/lib/Logind:/bin/bash
systemd-udevd:x:226:226:/dev:/usr/sbin/nologin
systemd-journald:x:227:227:/var/log:/usr/sbin/nologin
systemd-logind:x:228:228:/usr/lib/Logind:/bin/bash
systemd-udevd:x:229:229:/dev:/usr/sbin/nologin
systemd-journald:x:230:230:/var/log:/usr/sbin/nologin
systemd-logind:x:231:231:/usr/lib/Logind:/bin/bash
systemd-udevd:x:232:232:/dev:/usr/sbin/nologin
systemd-journald:x:233:233:/var/log:/usr/sbin/nologin
systemd-logind:x:234:234:/usr/lib/Logind:/bin/bash
systemd-udevd:x:235:235:/dev:/usr/sbin/nologin
systemd-journald:x:236:236:/var/log:/usr/sbin/nologin
systemd-logind:x:237:237:/usr/lib/Logind:/bin/bash
systemd-udevd:x:238:238:/dev:/usr/sbin/nologin
systemd-journald:x:239:239:/var/log:/usr/sbin/nologin
systemd-logind:x:240:240:/usr/lib/Logind:/bin/bash
systemd-udevd:x:241:241:/dev:/usr/sbin/nologin
systemd-journald:x:242:242:/var/log:/usr/sbin/nologin
systemd-logind:x:243:243:/usr/lib/Logind:/bin/bash
systemd-udevd:x:244:244:/dev:/usr/sbin/nologin
systemd-journald:x:245:245:/var/log:/usr/sbin/nologin
systemd-logind:x:246:246:/usr/lib/Logind:/bin/bash
systemd-udevd:x:247:247:/dev:/usr/sbin/nologin
systemd-journald:x:248:248:/var/log:/usr/sbin/nologin
systemd-logind:x:249:249:/usr/lib/Logind:/bin/bash
systemd-udevd:x:250:250:/dev:/usr/sbin/nologin
systemd-journald:x:251:251:/var/log:/usr/sbin/nologin
systemd-logind:x:252:252:/usr/lib/Logind:/bin/bash
systemd-udevd:x:253:253:/dev:/usr/sbin/nologin
systemd-journald:x:254:254:/var/log:/usr/sbin/nologin
systemd-logind:x:255:255:/usr/lib/Logind:/bin/bash
systemd-udevd:x:256:256:/dev:/usr/sbin/nologin
systemd-journald:x:257
```

```
2021214316@thumm02:~$ awk -F: '$1~"^2020"{print $1}' /etc/passwd | wc -l
2
```

Grep 命令

```
2021214316@thumm01:~$ grep "^dis" wc_dataset.txt |head
disappointment
distance
disagree
distance
distance
distance
distant
dish
dishes
disgust
```

```
2021214316@thumm01:~$ grep "^t" wc_1-10.txt
the
to
2021214316@thumm01:~$ grep -v "^t" wc_1-10.txt
chapter
i
down
rabbit
hole
alice
was
beginning
```

任务 6 阻塞和非阻塞时间对比

```
2021214316@thumm01:~$ vim shell_block.sh
2021214316@thumm01:~$ vim shell_unblock.sh
2021214316@thumm01:~$ time bash ./shell_block.sh

real    0m4.120s
user    0m4.088s
sys     0m0.024s
2021214316@thumm01:~$ time bash ./shell_unblock.sh

real    0m0.983s
user    0m4.512s
sys     0m0.028s
2021214316@thumm01:~$
```

任务 7 多节点任务处理

集群主机之间免密登录配置

```
由 Xnip 截图
2021214316@thumm01:~/ssh-keys$ bash ./auto_autho.sh
The authenticity of host 'thumm01 (192.168.0.101)' can't be established.
ECDSA key fingerprint is SHA256:rgu0++2Y5npZ0Mm/pW1GSE+ja1rjUJT0rR/iPCnnI4.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'thumm01,192.168.0.101' (ECDSA) to the list of known hosts.
2021214316@thumm01's password:
2021214316@thumm01's password:
authorized_keys                                100% 2401      2.3KB/s   00:00
id_rsa                                          100% 1675      1.6KB/s   00:00
id_rsa.pub                                    100% 400       0.4KB/s   00:00
2021214316@thumm02's password:
2021214316@thumm02's password:
authorized_keys                                100% 2401      2.3KB/s   00:00
id_rsa                                          100% 1675      1.6KB/s   00:00
id_rsa.pub                                    100% 400       0.4KB/s   00:00
The authenticity of host 'thumm03 (192.168.0.103)' can't be established.
ECDSA key fingerprint is SHA256:TbMcJfwC7cnUzDHk9440xMPyt30RzxxE1fBeEFegFo.
Are you sure you want to continue connecting (yes/no)? 2021214316yes
Please type 'yes' or 'no': yes
Warning: Permanently added 'thumm03,192.168.0.103' (ECDSA) to the list of known hosts.
2021214316@thumm03's password:
2021214316@thumm03's password:
Permission denied, please try again.
2021214316@thumm03's password:
authorized_keys                                100% 2401      2.3KB/s   00:00
id_rsa                                          100% 1679      1.6KB/s   00:00
id_rsa.pub                                    100% 400       0.4KB/s   00:00
The authenticity of host 'thumm04 (192.168.0.104)' can't be established.
ECDSA key fingerprint is SHA256:HHEICd0xoc3cJUNVPKNWxkviF0m42H1bRV1jrfoI2NA.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'thumm04,192.168.0.104' (ECDSA) to the list of known hosts.
2021214316@thumm04's password:
2021214316@thumm04's password:
authorized_keys                                100% 2401      2.3KB/s   00:00
id_rsa                                          100% 1679      1.6KB/s   00:00
id_rsa.pub                                    100% 400       0.4KB/s   00:00
The authenticity of host 'thumm05 (192.168.0.105)' can't be established.
ECDSA key fingerprint is SHA256:aAkP0kqgYyoEk0LcyqSYWwT7Qu9+5q15PzahrzPevTA.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'thumm05,192.168.0.105' (ECDSA) to the list of known hosts.
2021214316@thumm05's password:
2021214316@thumm05's password:
authorized_keys                                100% 2401      2.3KB/s   00:00
id_rsa                                          100% 1679      1.6KB/s   00:00
id_rsa.pub                                    100% 400       0.4KB/s   00:00
The authenticity of host 'thumm06 (192.168.0.106)' can't be established.
ECDSA key fingerprint is SHA256:oZ0kUf51aloEV9hYXaW2+f99ggDFfKQNKCKq7j60Yxo.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added 'thumm06,192.168.0.106' (ECDSA) to the list of known hosts.
2021214316@thumm06's password:
2021214316@thumm06's password:
authorized_keys                                100% 2401      2.3KB/s   00:00
id_rsa                                          100% 1675      1.6KB/s   00:00
id_rsa.pub                                    100% 400       0.4KB/s   00:00
2021214316@thumm01:~/ssh-keys$
```


集群批管理

```
2021214316@thumm01:~/ssh-keys$ pssh date
[1] 20:45:48 [SUCCESS] thumm01
[2] 20:45:49 [SUCCESS] thumm04
[3] 20:45:49 [SUCCESS] thumm06
[4] 20:45:49 [SUCCESS] thumm02
[5] 20:45:49 [SUCCESS] thumm05
[6] 20:45:49 [SUCCESS] thumm03
```

在多主机上并行执行任务

```
2021214316@thumm01:~/ssh-keys$ bash ./multi_host
[1] 20:50:16 [SUCCESS] thumm01
[2] 20:50:16 [SUCCESS] thumm06
[3] 20:50:16 [SUCCESS] thumm03
[4] 20:50:16 [SUCCESS] thumm04
[5] 20:50:16 [SUCCESS] thumm05
[6] 20:50:16 [SUCCESS] thumm02
part00 100% 2210KB 2.2MB/s 00:00
part01 100% 2210KB 2.2MB/s 00:00
part03 100% 2212KB 2.2MB/s 00:00
part05 100% 2215KB 2.2MB/s 00:00
part04 100% 2214KB 2.2MB/s 00:00
part02 100% 2210KB 2.2MB/s 00:00
[1] 20:50:17 [SUCCESS] thumm03
[2] 20:50:17 [SUCCESS] thumm01
[3] 20:50:17 [SUCCESS] thumm05
[4] 20:50:17 [SUCCESS] thumm04
[5] 20:50:17 [SUCCESS] thumm06
[6] 20:50:17 [SUCCESS] thumm02
[1] 20:50:18 [SUCCESS] thumm06
[2] 20:50:18 [SUCCESS] thumm04
[3] 20:50:18 [SUCCESS] thumm01
[4] 20:50:18 [SUCCESS] thumm03
[5] 20:50:18 [SUCCESS] thumm05
[6] 20:50:18 [SUCCESS] thumm02
```

任务 8 尝试提出一种可以加快多节点处理速度的方法并验证

我们考虑将长文本分割为 6 份和 12 份来加快多节点处理速度。具体地，对 WMT16 数据集进行 7000 次的重复扩充，得到 2G+ 的大数据集。

```
-rw-r--r-- 1 2021214316 dsjxtjc 2363977000 9月 28 21:53 BigDataset.txt
```

接着以类似任务 7 的方法将其平均分割为 6 份小数据集

```
-rw-r--r-- 1 2021214316 dsjxtjc 393998964 9月 29 15:29 part600
-rw-r--r-- 1 2021214316 dsjxtjc 393998764 9月 29 15:29 part601
-rw-r--r-- 1 2021214316 dsjxtjc 393990867 9月 29 15:29 part602
-rw-r--r-- 1 2021214316 dsjxtjc 393999016 9月 29 15:29 part603
-rw-r--r-- 1 2021214316 dsjxtjc 393999071 9月 29 15:29 part604
-rw-r--r-- 1 2021214316 dsjxtjc 393990318 9月 29 15:29 part605
```

将 6 份小数据集分别发送至 thumm01~thumm05, 运行 `pssh "grep '^t' ~/multi-nodes/part > ~/multi-nodes/result"` 命令，记录时间

```
2021214316@thumm01:~/Task8$ time bash 6parts
[1] 15:57:38 [SUCCESS] thumm01
[2] 15:57:38 [SUCCESS] thumm03
[3] 15:57:38 [SUCCESS] thumm05
[4] 15:57:38 [SUCCESS] thumm04
[5] 15:57:38 [SUCCESS] thumm02
[6] 15:57:38 [SUCCESS] thumm06
[1] 15:57:39 [SUCCESS] thumm03
[2] 15:57:39 [SUCCESS] thumm05
[3] 15:57:39 [SUCCESS] thumm04
[4] 15:57:39 [SUCCESS] thumm02
[5] 15:57:39 [SUCCESS] thumm06
[6] 15:57:39 [SUCCESS] thumm01

real    0m2.037s
user    0m0.348s
sys     0m0.076s
```

相似地，将大数据集平均分为 12 份，每两份发送至一个节点，运行相同命令，记录时间。

```
2021214316@thumm01:~/Task8$ time bash 12parts
[1] 15:57:58 [SUCCESS] thumm01
[2] 15:57:58 [SUCCESS] thumm03
[3] 15:57:58 [SUCCESS] thumm04
[4] 15:57:58 [SUCCESS] thumm05
[5] 15:57:58 [SUCCESS] thumm06
[6] 15:57:58 [SUCCESS] thumm02
[1] 15:58:00 [SUCCESS] thumm03
[2] 15:58:00 [SUCCESS] thumm01
[3] 15:58:00 [SUCCESS] thumm05
[4] 15:58:00 [SUCCESS] thumm04
[5] 15:58:00 [SUCCESS] thumm06
[6] 15:58:00 [SUCCESS] thumm02

real    0m1.991s
user    0m0.272s
sys     0m0.088s
```

发现 real time 较之前有了小部分提升。