25D Linux Foundation Course

10 – Managing Network Services on Linux

Overview

❑ **Maintaining System Time**

❑ **Managing SQL Data**

Setting the Hardware Clock with hwclock

❑ **Important to keep the system time accurate especially if:**

- – **providing network services**

- – **participating in database or directory service**

- – **may be required to have accurate time stamping (RMF)**

  - • **may disrupt integrity of data if accurate timing is not maintained (database modification out of sync)**

Setting the Hardware Clock with hwclock

❑ **Hardware clock**

– **CMOS chip**

– **Runs all the time, even when the system is off**

❑ **System time**

– **Clock runs via software inside the Linux kernel itself**

– **Measured as the number of seconds since 00:00:00 January 1, 1970, UTC**

❑ **Both of these times may not be the same**

– **Role of the hardware clock is basic, keep time when powered off**

– **System time is synced to hardware time on startup**

Setting the Hardware Clock with hwclock

❑ **Options for hwclock Utility Options:**

hwclock Option	Description
--r or --show	Reads the current time from the hardware clock and displays it on the screen.
--set --date=*date_string*	Sets the hardware clock to the time specified by the --date option. For example, **hwclock --set --date="9/16/11 08:00:00"** will set the date to September 16, 2001, and the time to 8:00 A.M. The argument is in local time, even if you keep your hardware clock in Universal Time Coordinated.
--s or --hctosys	Sets the system time to the current time of the hardware clock.
--w or --systohc	Sets the hardware clock to the current system time.
--utc or --localtime	Specifies that the hardware clock time is configured to use either UTC or local time.

❑ **The hwclock Utility is limited only to the local computer system**

❑ **On a network you may need to have the system synchronized with a time server**

Synchronizing Time with netdate

❑ **You can use the netdate command to synchronize time on the local system with the time on a time server over the network**

❑ **Syntax:**

- **netdate time_server, where time_server is the IP address or DNS name of another Linux system on the network that is running the time service**

- **configured to listen on UDP port 37 by default for time requests**

❑ **After syncing the system time with netdate, you may want to synchronize the system time with your hardware clock using the hwclock --systohc command**

❑ **The netdate utility only syncs time once**

- **Because of this the netdate utility may need to be run regularly or as a scheduled job using cron**

- **netdate is not the best option for synchronizing time on a regular schedule, use the Network Time Protocol (NTP) instead**

Synchronizing Time with NTP

- ❑ **One other big disadvantage to using netdate as a chron job is the utility adjusts the time abruptly**

  - – **This can be time adjustments forward or backward**

  - – **Possibly causing issues with file timestamps and other Linux services**

- ❑ **NTP adjusts the time gradually in small increments until time is synchronized (stepping and slewing)**

- ❑ **You can use the ntpd daemon on Linux to synchronize time with another NTP time provider**

- ❑ **A system running ntpd can function as both a time consumer and a time provider at the same time**

- ❑ **The NTP protocol operates over port 123**

 - – **The consumer sends a request to the provider, the provider responds back with the time**

NTP Concepts

❑ **Stratum – hierarchy of NTP servers**

- **Stratum 0: Atomic clocks, GPS clocks**

- **Stratum 1: Get time from Stratum 0**

- **Stratum 2: Get time from Stratum 1**

- **Stratum 3: Get time from Stratum 2**

- **Stratum n (4 to 256) Get time from Stratum above**

❑ **Stepping and slewing**

- **Stepping: differences between provider and consumer are large and adjustments are made quickly on the consumer**

- **Slewing: differences between provider and consumer are less than 128 milliseconds, NTP adjusts the time on the consumer gradually**
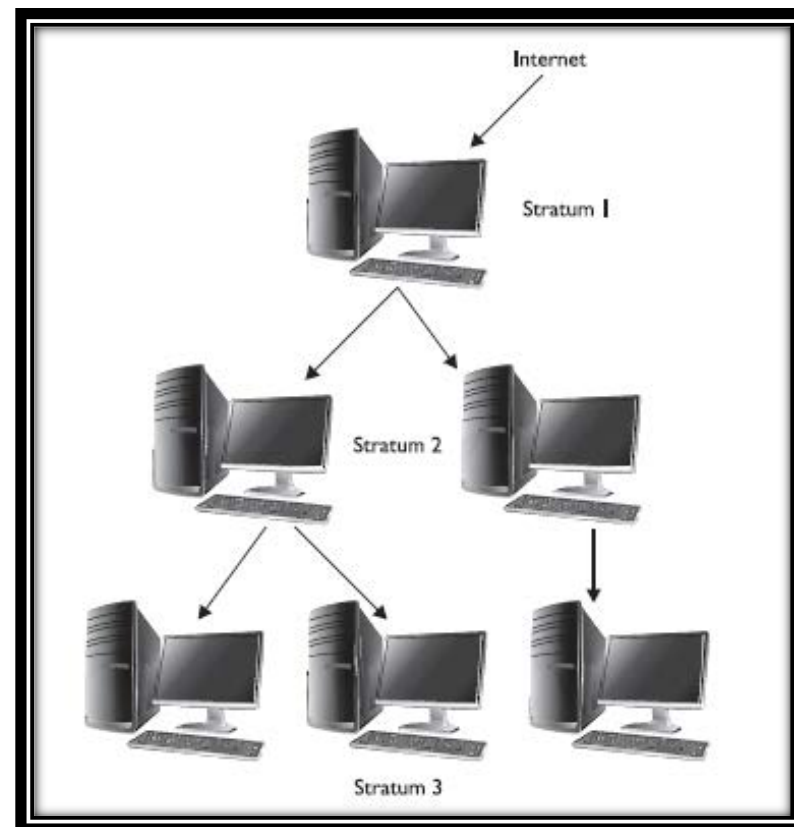
NTP Concepts

❑ **Insane time**

– **difference is more than 17 minutes off, ntpd considers this to be "insane" and will not adjust it**

❑ **Drift**

– **NTP measures and corrects for incidental clock frequency errors (called drift)**

– **NTP writes the current frequency value to the ntp.drift file in the /var/lib/ntp/drift/ directory**

❑ **Jitter**

– **Jitter is the estimated time difference between the consumer and the provider since the last time poll**
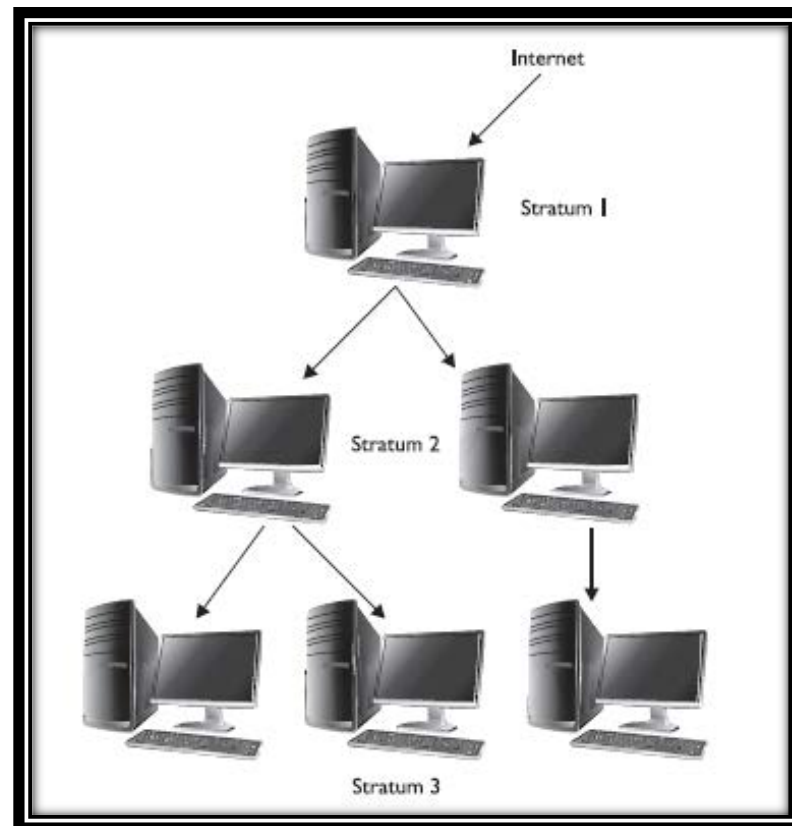
Configuring NTP

❑ **Ensure that the ntpd daemon is present and installed**

```
openSUSE:~ # rpm -q ntp
ntp-4.2.6p5-15.2.1.i586
```

❑ **Edit the /etc/ntp.conf file to configure the ntpd daemon**

```
# server  127.127.1.0              # local clock (LCL)
# fudge   127.127.1.0 stratum 10 # LCL is unsynchronized
```

❑ **The above directives (once uncommented) tell the ntpd daemon to get time from the local clock in the event it can't reach any of the configured NTP time providers**

❑ **Add entries to the file for network time providers you want your system to sync time with:**

```
server 10.10.0.2                # local NTP server
server 127.127.1.0              # local clock (LCL)
fudge  127.127.1.0 stratum 10   # LCL is unsynchronized

##
## Add external Servers using
## # rcntp addserver <yourserver>
##
server 0.pool.ntp.org
server 1.pool.ntp.org
server 2.pool.ntp.org
server 3.pool.ntp.org
```

❑ **Time providers can be:**

  – **An NTP time provider on your network**

  – **A public NTP time provider on the Internet (http://support.ntp.org/bin/view/Servers/WebHome)**

Configuring NTP

❑ **Use the rcntp ntptimeset command to perform initial synchronization:**

```
openSUSE:/etc # rcntp ntptimeset
28 Dec 11:25:34 sntp[6589]: Started sntp
28 Dec 11:25:34 sntp[6589]: kod_init_kod_db(): Cannot open KoD db file /var/db/n
tp-kod
2016-12-28 11:25:34.906249 (+0700) -0.003737 +/- 0.095840 secs
2016-12-28 11:25:34.985041 (+0700) -0.002425 +/- 0.040237 secs
2016-12-28 11:25:35.066808 (+0700) -0.000353 +/- 0.054977 secs
2016-12-28 11:25:35.155761 (+0700) +0.007150 +/- 0.000488 secs
Time synchronized with  0.pool.ntp.org
```

❑ **After the initial synchronization is performed, the ntpd daemon should be started:**

❑ **Configuring ntpd with systemd**

– **systemctl status ntp**

– **systemctl start ntp**

– **systemctl stop ntp**

```
openSUSE:~ # rcntp start
redirecting to systemctl start ntp
openSUSE:~ # systemctl status ntp
ntp.service - LSB: Network time protocol daemon (ntpd)
   Loaded: loaded (/etc/init.d/ntp)
  Drop-In: /run/systemd/generator/ntp.service.d
           └─50-insserv.conf-$time.conf
   Active: active (running) since Wed 2016-12-28 11:29:28 MST; 1min 35s ago
  Process: 6662 ExecStop=/etc/init.d/ntp stop (code=exited, status=0/SUCCESS)
  Process: 6682 ExecStart=/etc/init.d/ntp start (code=exited, status=0/SUCCESS)
   CGroup: /system.slice/ntp.service
           └─6700 /usr/sbin/ntpd -p /var/run/ntp/ntpd.pid -g -u ntp:ntp -i /v...

Dec 28 11:29:28 openSUSE systemd[1]: Started LSB: Network time protocol dae...).
Dec 28 11:29:28 openSUSE ntpd[6700]: ntp_io: estimated max descriptors: 102...16
Dec 28 11:29:28 openSUSE ntpd[6700]: Listen and drop on 0 v4wildcard 0.0.0....23
Dec 28 11:29:28 openSUSE ntpd[6700]: Listen and drop on 1 v6wildcard :: UDP 123
Dec 28 11:29:28 openSUSE ntpd[6700]: Listen normally on 2 lo 127.0.0.1 UDP 123
Dec 28 11:29:28 openSUSE ntpd[6700]: Listen normally on 3 enp0s3 10.120.1.9...23
Dec 28 11:29:28 openSUSE ntpd[6700]: Listen normally on 4 lo ::1 UDP 123
Dec 28 11:29:28 openSUSE ntpd[6700]: Listen normally on 5 enp0s3 fe80::a00:...23
Dec 28 11:29:28 openSUSE ntpd[6700]: peers refreshed
Dec 28 11:29:28 openSUSE ntpd[6700]: Listening on routing socket on fd #22 ...es
Hint: Some lines were ellipsized, use -l to show in full.
```

Configuring NTP

❑ **Once the NTP daemon has been started, you can use two commands to keep track of how the ntpd daemon is working:**

- **ntptrace**
  - **Traces how the time consumer is receiving time from the provider**
  - **May get a timeout with this utility as ntp has been used in DDoS attacks**
    - **Firewall rules/policy blocking the traffic by organization or ISP**
    - **If by ISP they may have internal NTP servers you can use**
- **ntpq –p**
  - **Queries status of the ntpd daemon**

Configuring NTP

❑ **Output columns**

- **remote: specifies the hostname or IP address of the time provider**

- **refid: specifies the type of the reference source**

- **st: specifies the stratum of the time provider**

- **when: specifies the number of seconds since the last time poll**

- **poll: specifies the number of seconds between two time polls.**

- **reach: displays whether or not the time server was reached in the last poll. Each successful poll increments this field by 1**

- **delay: specifies the time (in milliseconds) that it took for the time provider to respond to the request**

- **offset: specifies the time difference between the local system clock and the time provider (in milliseconds)**

- **jitter: specifies the size of time discrepancies (in milliseconds)**

```
openSUSE:~ # ntpq -p
     remote           refid        st t when poll reach   delay   offset  jitter
==============================================================================
*LOCAL(0)        .LOCL.           10 l    8   64  177    0.000    0.000   0.000
 ha82.smatwebdes 200.98.196.212    2 u    1   64  177   36.117   -3.500   3.233
 195.21.137.209  193.62.22.74      2 u   65   64   77   34.061    0.806   3.633
 a1.pcloud.com   200.98.196.212    2 u   60   64   77   67.725    1.067   3.984
 four10.gac.edu  128.138.141.172   2 u   57   64   77   42.289   -5.624   5.863
```

Configuring NTP

❑ **The commands we covered in the prior slides will keep the time synchronized so long as the system does not restart**

❑ **To have the ntpd daemon and thus the ntp service to start automatically on a reboot we need can use the chkconfig utility and alter the services run levels**

❑ **To do this enter the following:**

– **chkconfig –s ntp 35**

• **This will have the ntp service start on startup with run levels 3 (multiuser with networking) and 5 (multiuser with networking and GUI)**

❑ **Verify by entering**

– **chkconfig –l ntp (should see 3 and 5 set to on)**

Configuring NTP

❑ **The chkconfig –s ntp 35 command from the last slide will create aliases within the /etc/init.d/rc3.d and rc5.d directories which are run at startup:**

```
openSUSE:~ # chkconfig -s ntp 35
openSUSE:~ # chkconfig -l ntp

Note: This output shows SysV services only and does not include native
systemd services. SysV configuration data might be overridden by native
systemd configuration.

ntp                            0:off  1:off  2:off  3:on  4:off  5:on  6:off
```

```
openSUSE:~ # ls -l /etc/init.d/rc5.d
total 0
lrwxrwxrwx 1 root root 12 Nov  6  2013 K50alsasound -> ../alsasound
lrwxrwxrwx 1 root root 15 Nov  6  2013 K50avahi-daemon -> ../avahi-daemon
lrwxrwxrwx 1 root root  7 Nov  6  2013 K50cron -> ../cron
lrwxrwxrwx 1 root root  7 Nov  6  2013 K50cups -> ../cups
lrwxrwxrwx 1 root root  7 Nov  6  2013 K50dbus -> ../dbus
lrwxrwxrwx 1 root root 10 Nov  6  2013 K50network -> ../network
lrwxrwxrwx 1 root root  6 Dec 29 07:12 K50ntp -> ../ntp
lrwxrwxrwx 1 root root  8 Nov  6  2013 K50pcscd -> ../pcscd
lrwxrwxrwx 1 root root 10 Nov  6  2013 K50postfix -> ../postfix
lrwxrwxrwx 1 root root 10 Feb  4  2015 K50vboxadd -> ../vboxadd
lrwxrwxrwx 1 root root  6 Nov  6  2013 K50xdm -> ../xdm
lrwxrwxrwx 1 root root 12 Nov  6  2013 S50alsasound -> ../alsasound
lrwxrwxrwx 1 root root 15 Nov  6  2013 S50avahi-daemon -> ../avahi-daemon
lrwxrwxrwx 1 root root  7 Nov  6  2013 S50cron -> ../cron
lrwxrwxrwx 1 root root  7 Nov  6  2013 S50cups -> ../cups
lrwxrwxrwx 1 root root  7 Nov  6  2013 S50dbus -> ../dbus
lrwxrwxrwx 1 root root 10 Nov  6  2013 S50network -> ../network
lrwxrwxrwx 1 root root  6 Dec 29 07:12 S50ntp -> ../ntp
lrwxrwxrwx 1 root root  8 Nov  6  2013 S50pcscd -> ../pcscd
lrwxrwxrwx 1 root root 10 Nov  6  2013 S50postfix -> ../postfix
lrwxrwxrwx 1 root root 10 Feb  4  2015 S50vboxadd -> ../vboxadd
lrwxrwxrwx 1 root root  6 Nov  6  2013 S50xdm -> ../xdm
```

Exercise 10-1: Configuring NTP

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Please open your Practical Exercise book to Exercise 10-1.

Time to Complete: 5 Minutes

Managing SQL Data How Databases Work

❑ Database services run on a client/server model

❑ Client and server pieces are installed on the database server; client software is installed on client systems

❑ Two database services are commonly implemented:

– MySQL

– PostgreSQL

❑ SQL is the language utilized by these services as a means of accessing and manipulating databases

❑ SQL defines statements that can be used to retrieve and update data in a database, such as SELECT, UPDATE, DELETE, INSERT, and WHERE

❑ Relational databases are organized using fields, records, and tables

Installing MySQL

❑ **MySQL may or may not be installed by default on your distribution**

❑ **Install the following packages for MySQL if not present on system**

- **mysql-community-server**

- **mysql-community-server-client**

- **mysql-community-server-tools**

❑ **Upon installing MySQL, you'll quickly find that it has its own set of user accounts defined in its grant tables**

Installing MySQL

❑ **Five grant tables are implemented within MySQL:**

– **user: specifies whether a user can connect to server**

– **db: defines the db a user can access**

– **host: specifies hosts allowed to access a db**

– **tables_priv: defines access privileges for a given table**

– **columns_priv: access privileges for specific columns**

❑ **These tables must be initialized before you can use MySQL;**

– **run mysql_install_db (ensure that you are in the /usr/bin directory)**

Installing MySQL

❑ **Running the mysql_install_db will create two accounts by default**

– **root (has no password assigned, get to that later)**

– **anonymous-user (probably going to remove)**

❑ **With the grant tables created we can now start the database service**

– **If using init use the mysql init script in the init script directory followed by the insserv or chkconfig utilities**

– **If using systemd, use the systemctl utility to start and enable mysql**

❑ **To verify the mysql service is running enter mysqladmin version**

Installing MySQL

❑ **Example of mysqladmin version:**

```
openSUSE:/usr/bin # mysqladmin version
mysqladmin  Ver 9.0 Distrib 5.5.33-MariaDB, for Linux on i686
Copyright (c) 2000, 2013, Oracle, Monty Program Ab and others.

Server version          5.5.33-MariaDB
Protocol version        10
Connection              Localhost via UNIX socket
UNIX socket             /var/run/mysql/mysql.sock
Uptime:                 26 sec

Threads: 1  Questions: 1  Slow queries: 0  Opens: 0  Flush tables: 2  Open table
s: 26  Queries per second avg: 0.038
```

Installing MySQL

❑ **With the service started you can enter mysqlshow to show the current db on the server**

```
openSUSE:/usr/bin # mysqlshow
+--------------------+
|      Databases     |
+--------------------+
| information_schema |
| mysql              |
| performance_schema |
| test               |
+--------------------+
```

```
openSUSE:/usr/bin # mysqlshow -p
Enter password:
+--------------------+
|      Databases     |
+--------------------+
| information_schema |
| customers          |
| mysql              |
| performance_schema |
| test               |
+--------------------+
```

❑ **Remember that by using the msql_install_db a root user was created with no password**

– **The mysqladmin utility can be used to set a password**

• **Enter mysqladmin –u root password 'new_password'**

• **You can add a password to the anonymous default account you created as well, or remove the account**

Managing Data in the SQL Server

❑ **Once the password is changed the database can be accessed to manage**

❑ **From the command line you can access and manipulate the database with the mysql utility:**

```
openSUSE:/usr/bin # mysql -h localhost -u root -p
Enter password:
Welcome to the MariaDB monitor.  Commands end with ; or \g.
Your MariaDB connection id is 12
Server version: 5.5.33-MariaDB openSUSE package

Copyright (c) 2000, 2013, Oracle, Monty Program Ab and others.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.
```

❑ **The –h option is host_name meaning connect via the given host (localhost in this example)**

❑ **The –u is the username you wish to use when connecting (root in this example)**

❑ **The –p is password. If left blank like in this example you will be prompted for one**

Managing Data in the SQL Server

❑ **Now that you are logged in to the root user you can create a database:**

```
MariaDB [(none)]> CREATE DATABASE customers;
Query OK, 1 row affected (0.00 sec)

MariaDB [(none)]> USE customers;
Database changed
MariaDB [customers]> SHOW TABLES;
Empty set (0.00 sec)

MariaDB [customers]> CREATE TABLE active (first VARCHAR(15),last VARCHAR(15),pho
ne CHAR(12), lastcontact DATE);
Query OK, 0 rows affected (0.02 sec)
```

❑ **In this example a database was created named customers**

❑ **The database was accessed to manipulate**

❑ **The database tables were viewed (there are none)**

❑ **Tables in the database were created (first and last name, phone number and last contact date)**

Exercise 10-2: Managing SQL Data

Please open your Practical Exercise book to Exercise 10-2.

Time to Complete: 5 Minutes

Summary

❑ **Maintaining System Time**

❑ **Managing SQL Data**

Questions?

Question 1

Which command can be used to set the hardware clock on Linux system to the system time?

A. hwclock –s

B. hwclock –w

C. hwclock –set

D. hwclock –r

Check on Learning

Question 2

You want to use the netdate command to synchronize your local system time with a time server whose DNS name is time.mydom.com. Which command will do this?

A.   netdate time.mydom.com

B.   netdate –utc time.mydom.com

C.   netdate –u time.mydom.com

D.   netdate --sync time.mydom.com

Check on Learning

Question 3

Which NTP concept refers to situations where the time on the consumer and the time on the provider are more than 17 minutes apart?

A. Insane time

B. Slewing

C. Drift

D. Jitter

Check on Learning

Question 4

Which command can be used to view all the databases defined on a MySQL server from the command line?

A. **mysqlshow**

B. **mysqladmin**

C. **mysql_install_db**

D. **mysqldatabase**

Check on Learning

Question 5

Which command can be used to install MySQL from the /usr/bin directory from the command line?

A. mysqlshow

B. mysqladmin

C. mysql_install_db

D. mysqldatabase