

Exercise 1 – Installation and Configuration a CUPS Server

CUPS Server installation

Exercise 1.1: Tasks to be perform on AlmaLinux:

1. Verify if the **CUPS** package is installed.

```
root@server07 ~ $ dnf list cups
AlmaLinux 9 - AppStream
AlmaLinux 9 - AppStream
AlmaLinux 9 - BaseOS
AlmaLinux 9 - BaseOS
AlmaLinux 9 - Extras
AlmaLinux 9 - Extras
Extra Packages for Enterprise Linux 9 - x86_64
Extra Packages for Enterprise Linux 9 - x86_64
Installed Packages
cups.x86_64 ✓
```

2. Verify if the **CUPS** service is started and enabled, if not start it.

```
root@server07 ~ $ systemctl status cups
● cups.service - CUPS Scheduler
   Loaded: loaded (/usr/lib/systemd/system/cups.service; enabled; preset: enabled)
   Drop-In: /usr/lib/systemd/system/cups.service.d
            └─server.conf
   Active: active (running) since Sun 2025-03-30 14:41:44 EDT; 1 week 0 days ago
   TriggeredBy: ● cups.path
                ● cups.socket
```

3. Authorise in the **firewall** the port used to access the CUPS Service Admin web page.

```
root@server07 ~ $ firewall-cmd --permanent --add-port=631/tcp --zone=nm-shared
success
root@server07 ~ $ firewall-cmd --permanent --add-port=631/tcp --zone=external
success
root@server07 ~ $ firewall-cmd --reload
success
root@server07 ~ $
```

4. Check that the port is added and authorised in the firewall.

```
root@server07 ~ $ firewall-cmd --list-ports --zone=nm-shared
631/tcp
root@server07 ~ $ firewall-cmd --list-ports --zone=external
631/tcp
root@server07 ~ $
```

5. List all **tcp** and **udp** ports that are listening on the server.

```
root@server07 ~ $ netstat -tunap | grep cups
tcp        0      0 127.0.0.1:631          0.0.0.0:*              LISTEN      983/cupsd
tcp6       0      0 :::631                :::*                   LISTEN      983/cupsd
root@server07 ~ $
```

6. What is the **tcp** port number used by the cups service?

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```
root@server07 ~ $ netstat -tunap | grep 631
tcp        0      0 127.0.0.1:631          0.0.0.0:*              LISTEN      983/cupsd
tcp6       0      0 :::1:631               :::*                    LISTEN      983/cupsd
root@server07 ~ $
```

7. What is the name of the CUPS service main configuration file?

```
root@server07 ~ $ rpm -qc cups
/etc/cups/classes.conf
/etc/cups/client.conf
/etc/cups/cups-files.conf
/etc/cups/cupsd.conf ✓
/etc/cups/lpoptions
/etc/cups/printers.conf
/etc/cups/snmp.conf
/etc/cups/subscriptions.conf
/etc/dbus-1/system.d/cups.conf
/etc/pam.d/cups
root@server07 ~ $
```

CUPS Server Configuration

Exercise 1.2: Tasks to be perform on AlmaLinux:

1. Modify the **CUPS** service **main configuration file**, to allow the use of the CUPS server Web Admin interface, from any machine on the network.

```
# Restrict access to the server...
<Location />
  Allow all
  Order allow,deny
</Location>

# Restrict access to the admin pages...
<Location /admin>
  Allow all
  Order allow,deny
</Location>

# Restrict access to configuration files...
<Location /admin/conf>
  Allow all
  AuthType Default
  Require user @SYSTEM
  Order allow,deny
</Location>

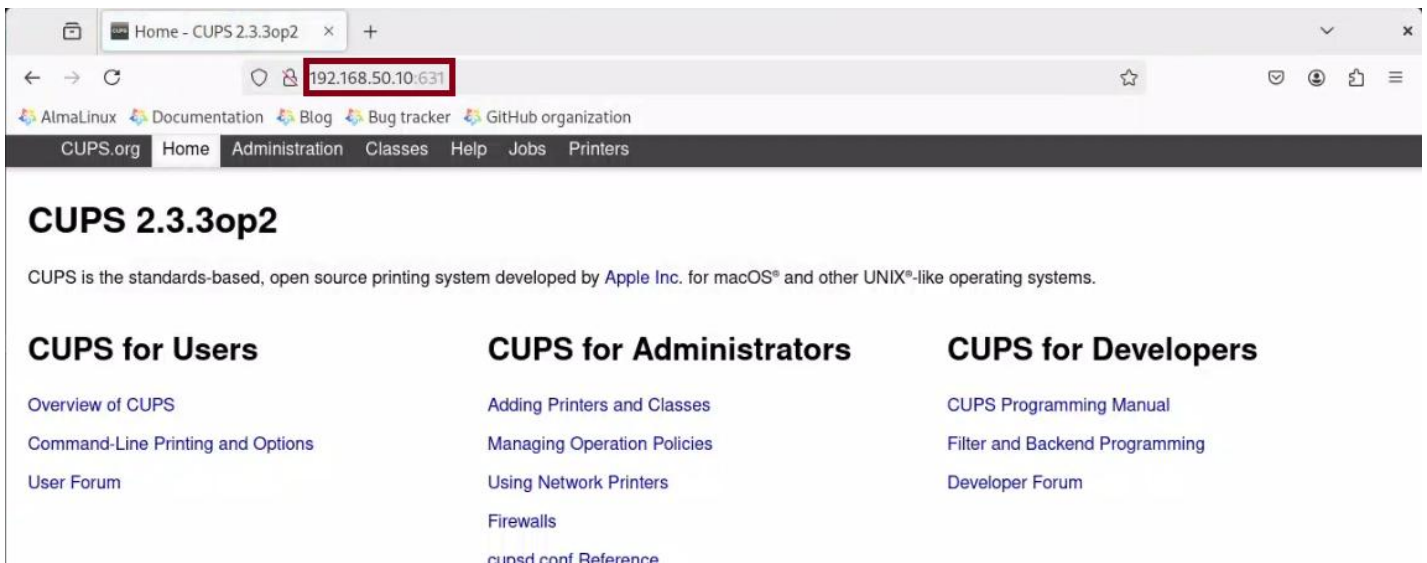
# Restrict access to log files...
<Location /admin/log>
  Allow all
  AuthType Default
  Require user @SYSTEM
  Order allow,deny

# Only listen for connections from the local machine.
Listen 631
Listen /run/cups/cups.sock
```

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2. Restart the **CUPS** service to apply your configuration.

```
root@server07 /etc/cups $ vim cupsd.conf
root@server07 /etc/cups $ systemctl restart cups
root@server07 /etc/cups $
```



Installing and Sharing a Network Printer

Exercise 1.3: Tasks to be perform on AlmaLinux:

1. Using the cups web interface, **install** and **share** the following network printer:

- Model: Brother DCP-8045D
- IP Adress: 192.168.50.100
- Name: Brother-8045D
- Description: Printer for management.
- Location: Mezzanine.

Add Printer

Name:
(May contain any printable characters except "/", "#", and space)

Description:
(Human-readable description such as "HP LaserJet with Duplexer")

Location:
(Human-readable location such as "Lab 1")

Connection:

Sharing: ☒ Share This Printer

Add Printer

Name: Brother-8045D
Description: Printer for management
Location: Mezzanine
Connection: ipp://192.168.50.100
Sharing: Share This Printer

Make: Brother

Model:
Brother DCP-8025D Foomatic/Postscript (en)
Brother DCP-8040 BR-Script3 (en)
Brother DCP-8040 Foomatic/Postscript (en)
Brother DCP-8045D - CUPS+Gutenprint v5.3.4 (en)
Brother DCP-8045D - CUPS+Gutenprint v5.3.4 Simplified (en)
Brother DCP-8045D BR-Script3 (en)
Brother DCP-8045D Foomatic/hi1250 (en)
Brother DCP-8045D Foomatic/hi1250 (en)
Brother DCP-8045D Foomatic/hi5gray (en)

Or Provide a PPD File: No file selected.

Add Printer

Add Printer Brother-8045D

Printer Brother-8045D has been added successfully.

Note: Printer drivers and raw queues are deprecated and will stop working in a future version of CUPS.

[Set Printer Options](#)

Brother-8045D

Brother-8045D (Idle, Accepting Jobs, Shared)

Maintenance Administration

Description: Printer for management

Location: Mezzanine

Driver: Brother DCP-8045D - CUPS+Gutenprint v5.3.4 (grayscale, 2-sided printing)

Connection: ipp://192.168.50.100

Defaults: job-sheets=none, none media=na_letter_8.5x11in sides=one-sided

```
root@server07 /etc/cups $ systemctl restart cups
```

Exercise 1.4: Tasks to be perform on Ubuntu and Windows 11:

1. On the **Ubuntu** and **Windows 11** clients, install the shared network printer from the AlmaLinux server.

Ubuntu:

Home - CUPS 2.4.1

localhost:631

OpenPrinting CUPS Home Administration Classes Help Jobs Printers

OpenPrinting CUPS 2.4.1

The standards-based, open source printing system developed by OpenPrinting for Linux® and other Unix®-like operating systems. CUPS uses IPP Everywhere™ to support printing to local and network printers.

| | | |
|--|--|---|
| CUPS for Users <ul style="list-style-type: none">Overview of CUPSCommand-Line Printing and Options | CUPS for Administrators <ul style="list-style-type: none">Adding Printers and ClassesManaging Operation PoliciesUsing Network PrintersFirewallscupsd.conf Reference | CUPS for Developers <ul style="list-style-type: none">CUPS Programming ManualFilter and Backend Programming |
|--|--|---|

Add Printer

- Local Printers:**
- ☐ HP Printer (HPLIP)
 - ☐ CUPS-BRF (Virtual Braille BRF Printer)
 - ☐ HP Fax (HPLIP)

Discovered Network Printers: ☒ Printer for management @ server07 (Brother Brother DCP-8045D)

- Other Network Printers:**
- ☐ Internet Printing Protocol (ipp)
 - ☐ Backend Error Handler
 - ☐ LPD/LPR Host or Printer
 - ☐ Internet Printing Protocol (https)
 - ☐ AppSocket/HP JetDirect
 - ☐ Internet Printing Protocol (http)
 - ☐ Internet Printing Protocol (ipps)
 - ☐ Windows Printer via SAMBA

[Continue](#)

Add Printer

Name:
(May contain any printable characters except "/", "#", and space)

Description:
(Human-readable description such as "HP LaserJet with Duplexer")

Location:
(Human-readable location such as "Lab 1")

Connection:

Sharing: ☐ Share This Printer

Add Printer

Name: Brother_Brother_DCP-8045D
Description: Printer for Management
Location: Mezzanine
Connection: dnssd://Printer%20for%20management%20%40%20server07._ipp._tcp.local/cups?uuid=877d75ae-5a11-3a4a-5ae8-9bfcfbc8b20e
Sharing: Do Not Share This Printer
Make: Brother

Model:
 Brother DCP-1200 Foomatic/hl1250 (recommended) (en)
 Brother DCP-1200 Foomatic/ljet2p (en)
 Brother DCP-1510 series, using brlaser v6 (en)
 Brother DCP-1600 series, using brlaser v6 (en)
 Brother DCP-7010 Foomatic/hl1250 (recommended) (en)
 Brother DCP-7010 Foomatic/lj4dith (en)
 Brother DCP-7010 Foomatic/ljet4 (en)
 Brother DCP-7010 Foomatic/ljet4d (en)
 Brother DCP-7020 Foomatic/hl1250 (recommended) (en)

Or Provide a PPD File: No file chosen

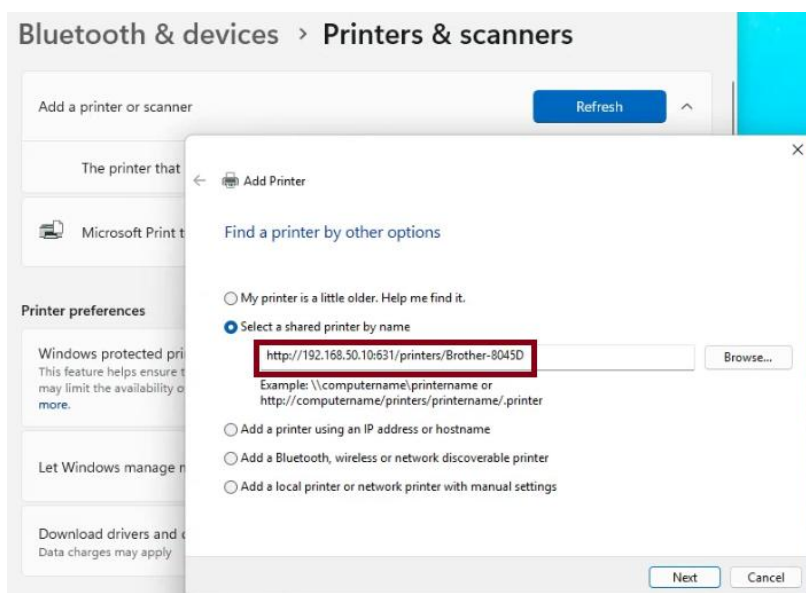
Printers

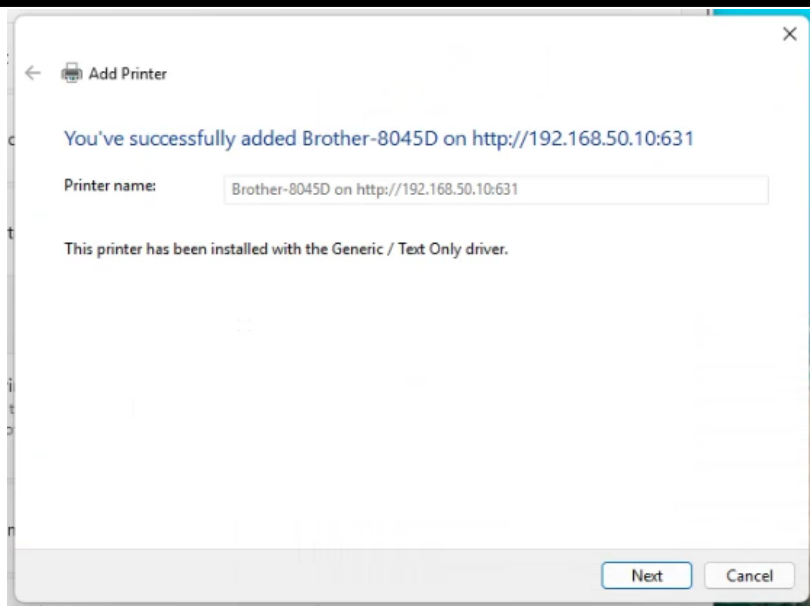
Search in Printers:

Showing 2 of 2 printers.

| Queue Name | Description | Location | Make and Model | Status |
|---------------------------------|---------------------------------|-----------|--|--------|
| Brother_Brother_DCP-8045D | Printer for Management | Mezzanine | Local Raw Printer | Idle |
| Printer_for_management_server07 | Printer_for_management_server07 | | Brother DCP-8045D - CUPS+Gutenprint v5.3.4, driverless, cups-filters 1.28.15 | Idle |

Windows:





Exercise 2 – Installing and Configuring a NTP Server

NTP Server Installation

Exercise 2.1: Tasks to be perform on AlmaLinux:

1. Verify that the **chrony** application is installed correctly.

```
root@server07 ~$ dnf list chrony
Last metadata expiration check: 15:19:01 ago on Mon 07 Apr 2025 06:09:28 PM.
Installed Packages
chrony.x86_64                                4.5-3.el9
root@server07 ~$
```

2. Verify that the **chronyd** service is started and enabled, if not start it.

```
root@server07 ~$ systemctl status chronyd
● chronyd.service - NTP client/server
   Loaded: loaded (/usr/lib/systemd/system/chronyd.service; enabled; preset: enabled)
   Active: active (running) since Sun 2025-03-30 14:41:44 EDT; 1 week 1 day ago
     Docs: man:chronyd(8)
           man:chrony.conf(5)
```

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3. What is the name of the main configuration file of the **chronyd** service?

```
root@server07 ~ $ rpm -qc chrony
/etc/chrony.conf
/etc/chrony.keys
/etc/logrotate.d/chrony
/etc/sysconfig/chronyd
root@server07 ~ $
```

4. Run a command to list the source of the NTP time.

```
root@server07 ~ $ chronyc sources
MS Name/IP address          Stratum Poll Reach LastRx Last sample
=====
^* ntp2.torix.ca             1      6   377    36   +591us[ +593us] +/- 5648us
^+ time.cloudflare.com       3      6   377    37   -1259us[-1257us] +/- 16ms
^+ 64.ip-54-39-23.net        2      6   377    38    -181us[ -180us] +/- 8573us
^- 23.133.168.244           4      7   377    39   +2400us[+2402us] +/- 37ms
root@server07 ~ $
```

5. View the **exact time** of your server.

```
root@server07 ~ $ timedatectl
Local time: Tue 2025-04-08 09:35:06 EDT
Universal time: Tue 2025-04-08 13:35:06 UTC
RTC time: Tue 2025-04-08 13:35:06
Time zone: America/Toronto (EDT, -0400)
System clock synchronized: yes
NTP service: active
RTC in local TZ: no
root@server07 ~ $
```

6. Stop the **chronyd** service and verify that the NTP service is inactive.

```
root@server07 ~ $ systemctl stop chronyd
root@server07 ~ $ timedatectl
Local time: Tue 2025-04-08 09:36:27 EDT
Universal time: Tue 2025-04-08 13:36:27 UTC
RTC time: Tue 2025-04-08 13:36:26
Time zone: America/Toronto (EDT, -0400)
System clock synchronized: yes
NTP service: inactive
RTC in local TZ: no
root@server07 ~ $
```

7. Set up your server time **manually**.

```
root@server07 ~ $ timedatectl set-time 07:39:02
root@server07 ~ $ timedatectl
Local time: Tue 2025-04-08 07:39:07 EDT
Universal time: Tue 2025-04-08 11:39:07 UTC
RTC time: Tue 2025-04-08 11:39:08
Time zone: America/Toronto (EDT, -0400)
System clock synchronized: no
NTP service: inactive
RTC in local TZ: no
root@server07 ~ $
```

NTP Server Configuration

Exercise 2.2: Tasks to be perform on AlmaLinux:

1. Modify the **chronyd** service configuration file, to allow your internal subnet **192.168.50.0/24** to use this server as an NTP server.

```
# Allow NTP client access from local network.
allow 192.168.50.0/24

# Serve time even if not synchronized to a time source.
local stratum 2
```

```
root@server07 ~ $ vim /etc/chrony.conf
root@server07 ~ $
```

2. Restart the **chronyd** service to apply your configuration.

```
root@server07 ~ $ systemctl restart chronyd
root@server07 ~ $ systemctl status chronyd
● chronyd.service - NTP client/server
   Loaded: loaded (/usr/lib/systemd/system/chronyd.service; enabled; preset: enabled)
   Active: active (running) since Tue 2025-04-08 07:45:12 EDT; 2h 0min ago
     Docs: man:chronyd(8)
           man:chrony.conf(5)
```

3. Configure the **firewall** to authorise the usage of the **NTP** service.
4. Verify that the **NTP** service is added and authorised in the firewall.

```
root@server07 ~ $ firewall-cmd --permanent --add-service=ntp --zone=nm-shared
success
root@server07 ~ $ firewall-cmd --reload
success
root@server07 ~ $ firewall-cmd --list-services --zone=nm-shared
dhcp dns mountd nfs ntp rpc-bind samba ssh
root@server07 ~ $
```

5. List the **chronyd** service **udp** port that is listening on the server.

```
root@server07 ~ $ netstat -tunap | grep chronyd
udp        0      0 0.0.0.0:123          0.0.0.0:*            16640/chronyd
udp        0      0 127.0.0.1:323       0.0.0.0:*            16640/chronyd
udp6       0      0 :::1:323           :::*                  16640/chronyd
root@server07 ~ $
```

6. What is the **udp port number** used by the **chronyd** service?

```
root@server07 ~ $ netstat -tunap | grep 123
udp        0      0 0.0.0.0:123       0.0.0.0:*            16640/chronyd
```

Client Configuration

Exercise 2.3: Tasks to be perform on Ubuntu:

1. Go to the **Ubuntu** client and install the **chrony** package.

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```
gkeymole@client07:~$ sudo apt update
[sudo] password for gkeymole:
Hit:1 https://dl.google.com/linux/chrome/deb stable InRelease
Hit:2 http://security.ubuntu.com/ubuntu jammy-security InRelease
Hit:3 http://ca.archive.ubuntu.com/ubuntu jammy InRelease
Hit:4 http://ca.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:5 http://ca.archive.ubuntu.com/ubuntu jammy-backports InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
14 packages can be upgraded. Run 'apt list --upgradable' to see them.
gkeymole@client07:~$ sudo apt install chrony
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
Suggested packages:
  dnswutils
The following packages will be REMOVED:
  systemd-timesyncd
The following NEW packages will be installed:
  chrony
0 upgraded, 1 newly installed, 1 to remove and 13 not upgraded.
Need to get 290 kB of archives.
After this operation, 360 kB of additional disk space will be used.
```

2. Verify that the **chronyd** service is started and enabled.

```
gkeymole@client07:~$ systemctl status chronyd
● chrony.service - chrony, an NTP client/server
   Loaded: loaded (/lib/systemd/system/chrony.service; enabled; vendor preset: enabled)
   Active: active (running) since Tue 2025-04-08 09:54:40 EDT; 2min 20s ago
     Docs: man:chronyd(8)
           man:chronyc(1)
           man:chrony.conf(5)
```

3. View the **exact time** of your server.

```
gkeymole@client07:~$ timedatectl
Local time: Tue 2025-04-08 09:58:45 EDT
Universal time: Tue 2025-04-08 13:58:45 UTC
RTC time: Tue 2025-04-08 13:58:45
Time zone: America/Toronto (EDT, -0400)
System clock synchronized: yes
NTP service: active
RTC in local TZ: no
gkeymole@client07:~$
```

4. Run a command to list the **source** of the **NTP** time.

```
gkeymole@client07:~$ chronyc sources
MS Name/IP address         Stratum Poll Reach LastRx Last sample
=====
^- prod-ntp-4.ntp4.ps5.cano> 2 6 377 0 -444us[ -444us] +/- 39ms
^- prod-ntp-3.ntp4.ps5.cano> 2 6 377 0 +5256us[+5256us] +/- 43ms
^- prod-ntp-5.ntp4.ps5.cano> 2 6 377 3 +5458us[+5473us] +/- 43ms
^- alphyn.canonical.com     2 6 377 1 -22us[ -22us] +/- 30ms
^* ntp.netlinkify.com        2 6 377 2 -3154ns[ +12us] +/- 2321us
^- time.cloudflare.com      3 6 377 4 -1838us[-1822us] +/- 17ms
^- 23.133.168.247           4 6 377 2 +2358us[+2358us] +/- 38ms
^- time.cloudflare.com      3 6 377 3 -1714us[-1699us] +/- 17ms
gkeymole@client07:~$
```

- Configure **chronyd** to use the **AlmaLinux** server as the NTP server.

```
confdir /etc/chrony/conf.d

# This will use (up to):
# - 4 sources from ntp.ubuntu.com which some are ipv6 enabled
# - 2 sources from 2.ubuntu.pool.ntp.org which is ipv6 enabled as well
# - 1 source from [01].ubuntu.pool.ntp.org each (ipv4 only atm)
# This means by default, up to 6 dual-stack and up to 2 additional IPv4-only
# sources will be used.
# At the same time it retains some protection against one of the entries being
# down (compare to just using one of the lines). See (LP: #1754358) for the
# discussion.
#
# About using servers from the NTP Pool Project in general see (LP: #104525).
# Approved by Ubuntu Technical Board on 2011-02-08.
# See http://www.pool.ntp.org/join.html for more information.
#pool ntp.ubuntu.com iburst maxsources 4
#pool 0.ubuntu.pool.ntp.org iburst maxsources 1
#pool 1.ubuntu.pool.ntp.org iburst maxsources 1
#pool 2.ubuntu.pool.ntp.org iburst maxsources 2
server 192.168.50.10 iburst
```

```
gkeymole@client07:~$ sudo vim /etc/chrony/chrony.conf
gkeymole@client07:~$
```

Note. **iburst** tells chronyd to **send 4–8 rapid requests** instead of 1 when the service **starts** (or restarts). This makes the **initial sync faster**, especially useful when booting or starting the service after downtime. If you want to reduce traffic it would be best to remove **iburst**.

- Restart the **chronyd** service to apply your configuration.
- Wait a few minutes, then check if the **source** of the **NTP** time is the AlmaLinux server.

```
gkeymole@client07:~$ sudo systemctl restart chronyd
gkeymole@client07:~$ chronyc sources
MS Name/IP address         Stratum Poll Reach LastRx Last sample
=====
^*_gateway                  3      6    17    11   -369ns[ -11us] +/- 7603us
gkeymole@client07:~$
```

- Go back to the **AlmaLinux** server, and check if the server has NTP clients.

```
root@server07 ~ $ chronyc clients
Hostname                    NTP      Drop Int IntL Last      Cmd      Drop Int  Last
=====
192.168.50.20                5         0   4   -    22         0         0   -    -
root@server07 ~ $
```