

# DHCP Server Configuration (ArchLinux)

## A very brief introduction

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(under construction :))

# Agenda

- Introduction
- Theory
- Hands-on
- Refs

# Introduction

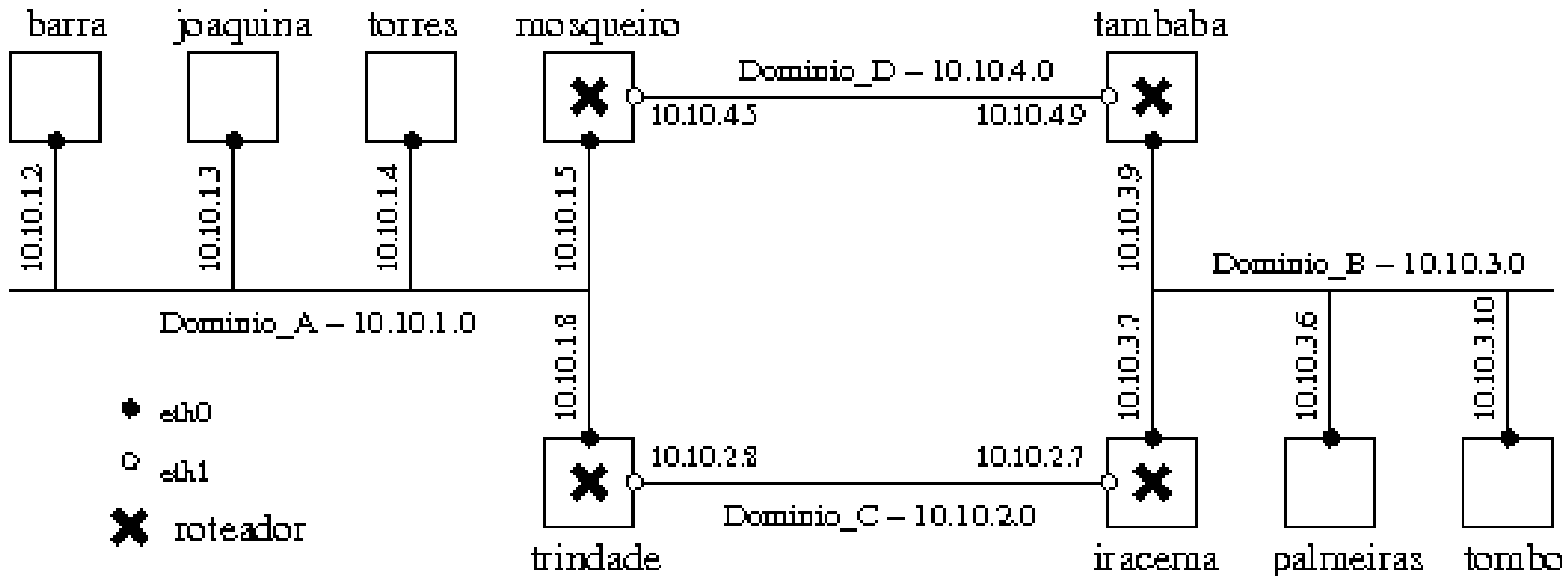
- Network computers must be properly configured to use network resources. It must know at least:
  - It's own IP address / netmask
  - DNS server's IPs
  - Network gateway
- Each network offers a number of features, so a client computer can also ask for:
  - NTP server address, syslog host, proxy servers, WINS servers, X servers, NIS servers, etc..

# Introduction

- DHCP is used to automatically configure all those parameters
  - DHCP – Dynamic Host Configuration **Protocol**
  - RFC 2132
  - 2 versions of DHCP: DHCPv4 and DHCPv6
  - Reference implementation: [isc.org](http://isc.org)

# Introduction

- Network operation - example:
  - MAC address, IP address, NETMASK, ARP, ROUTING, GATEWAY, UNICAST, BROADCAST. Ex.: Packet from “barra” to “torres” and “iracema”



# Theory

# DHCP operation

Client

Server

10.10.10.4/24

## OVERVIEW:

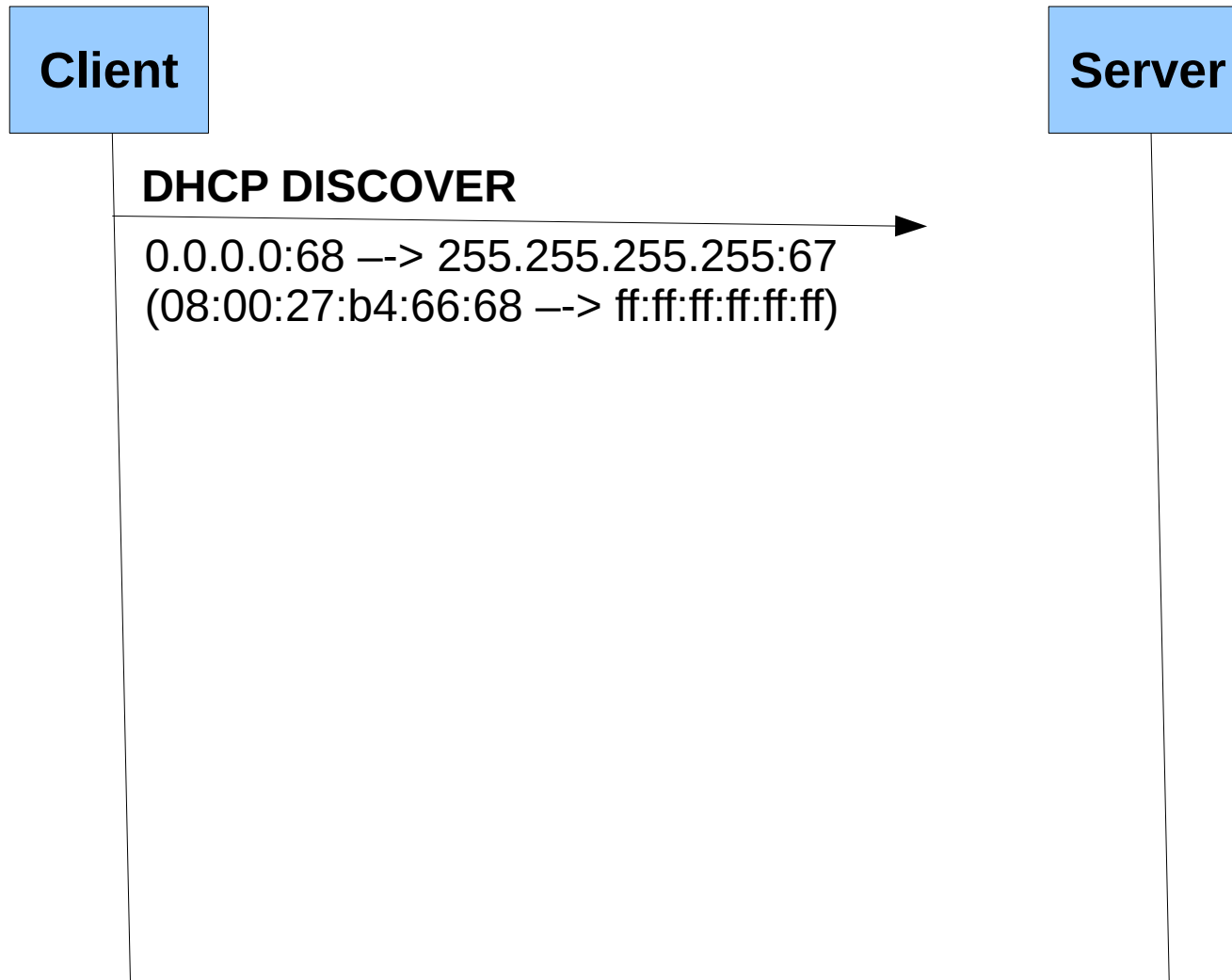
**DHCP DISCOVER** →

**DHCP OFFER** ←

**DHCP REQUEST** →

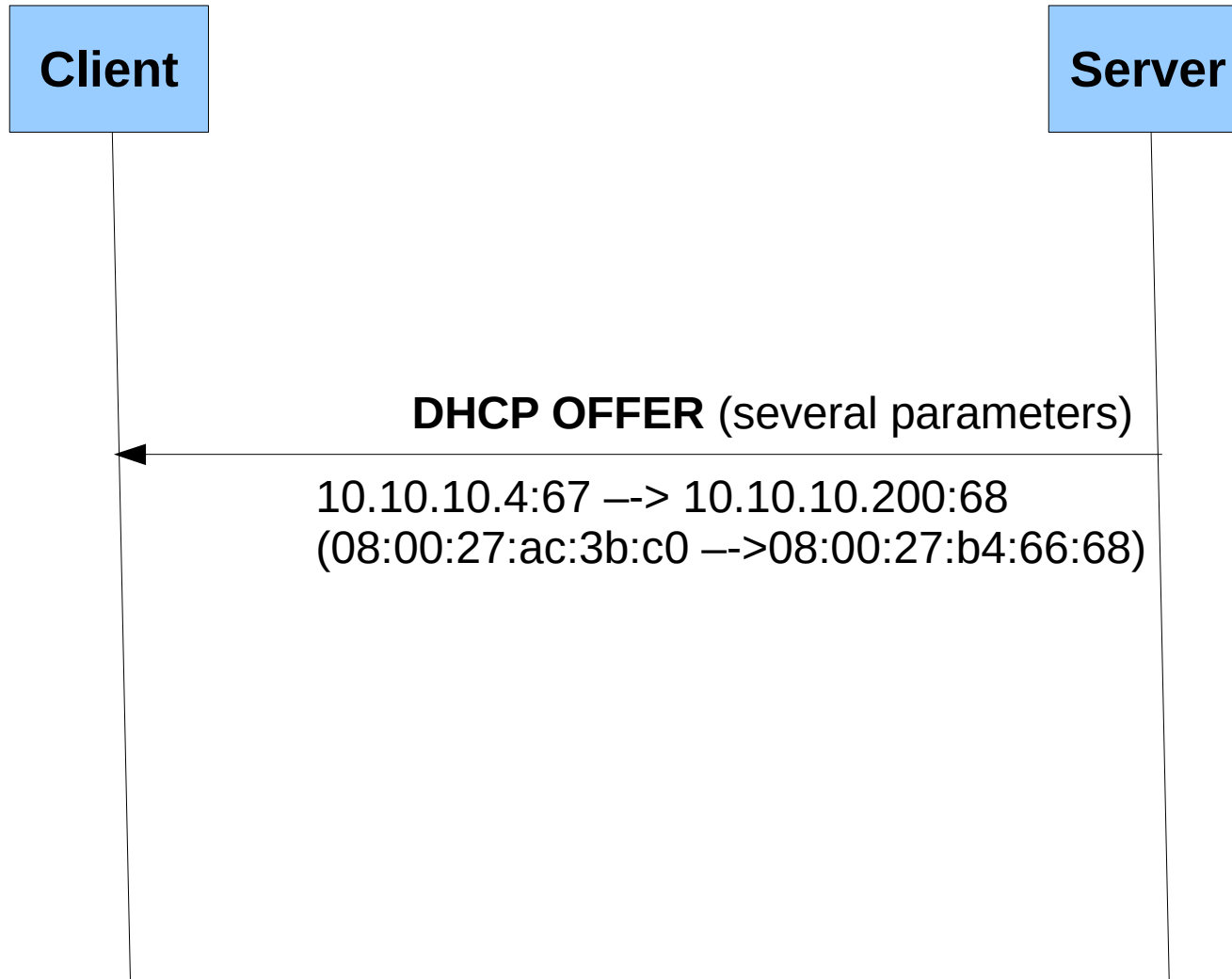
**DHCP ACK** ←

# DHCP operation

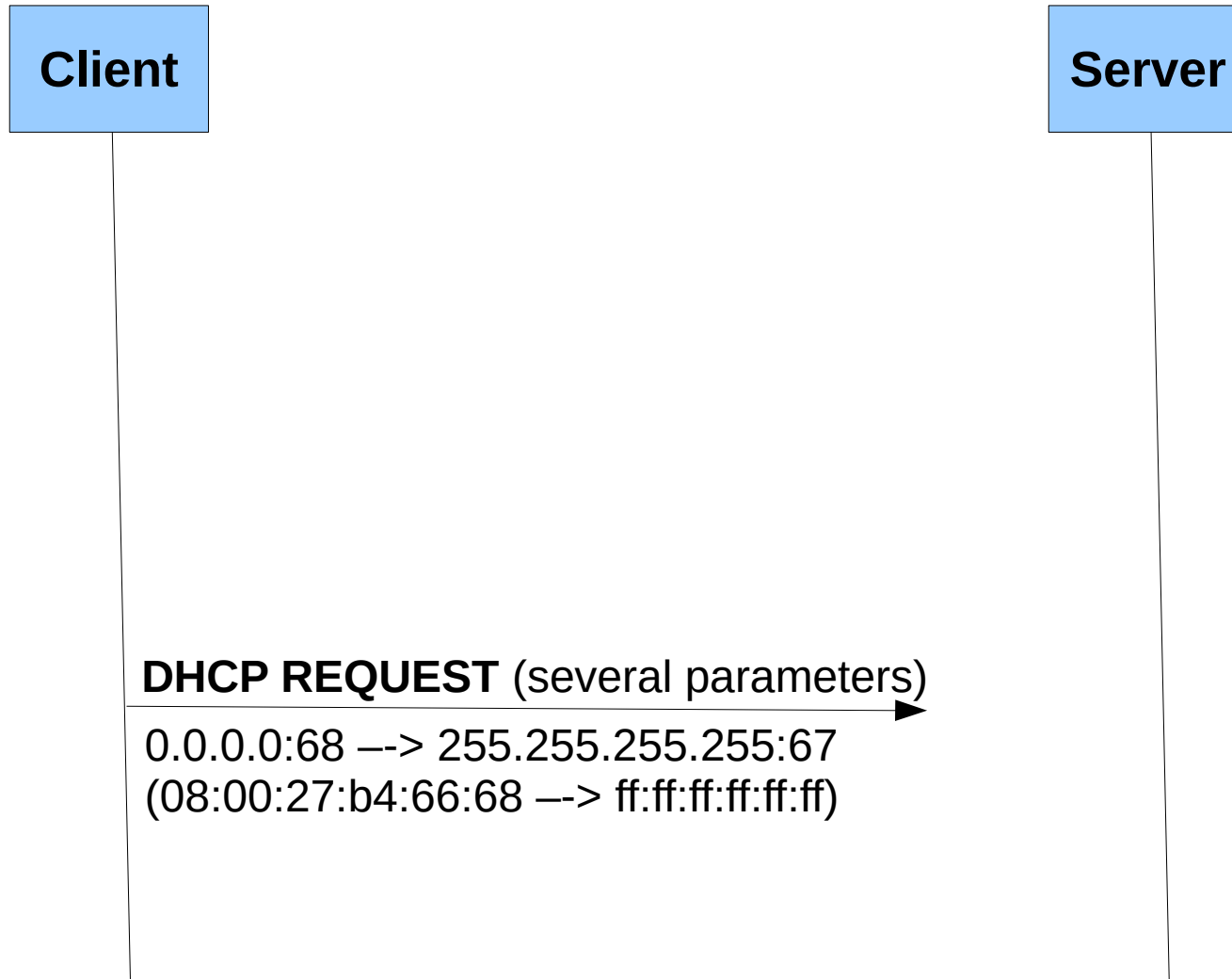




# DHCP operation



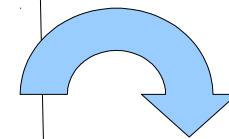
# DHCP operation



# DHCP operation

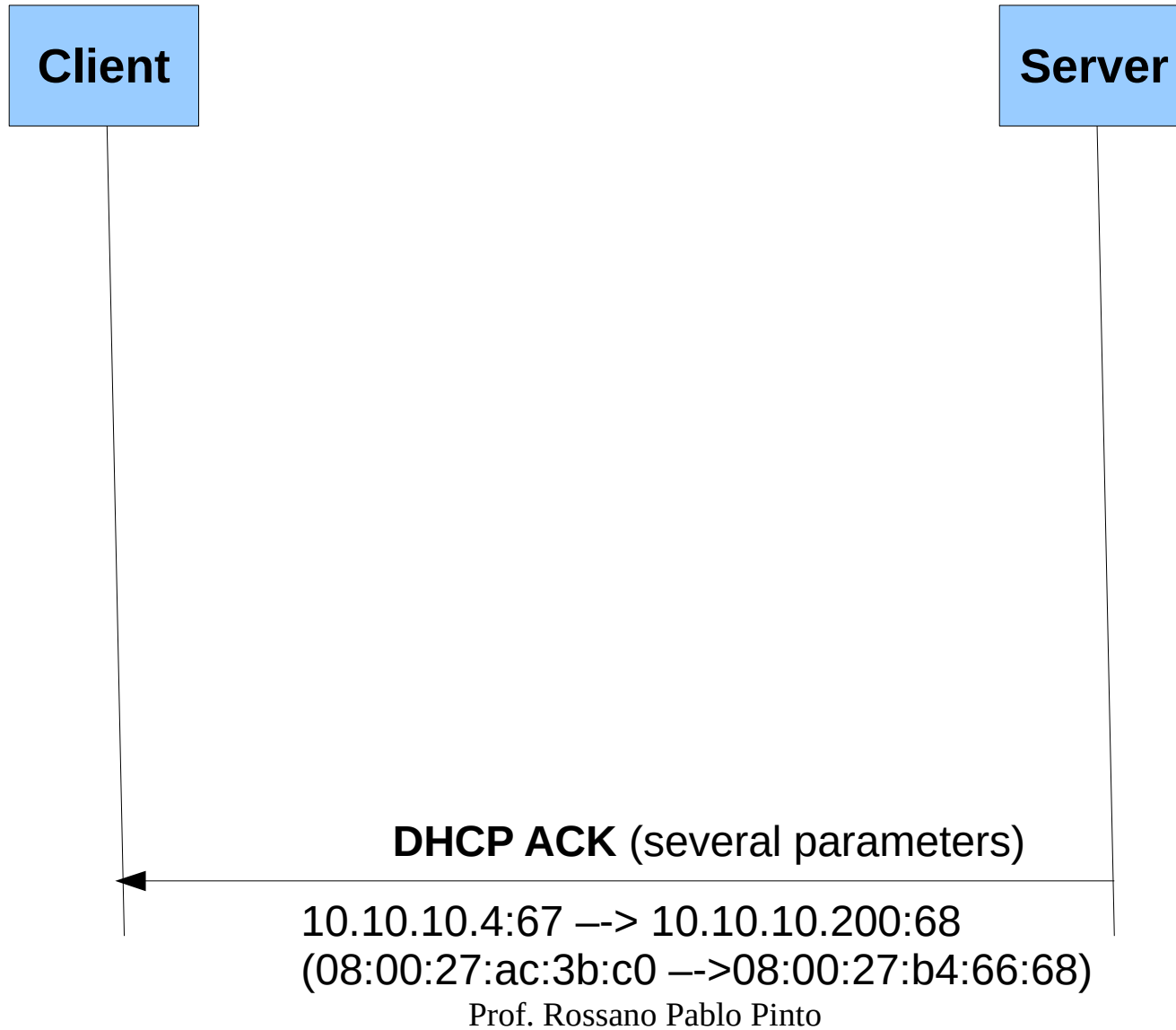
Client

Server



`/var/state/dhcp/dhcpd.leases`

# DHCP operation



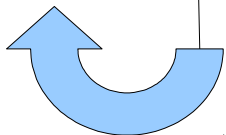
# DHCP operation

Client

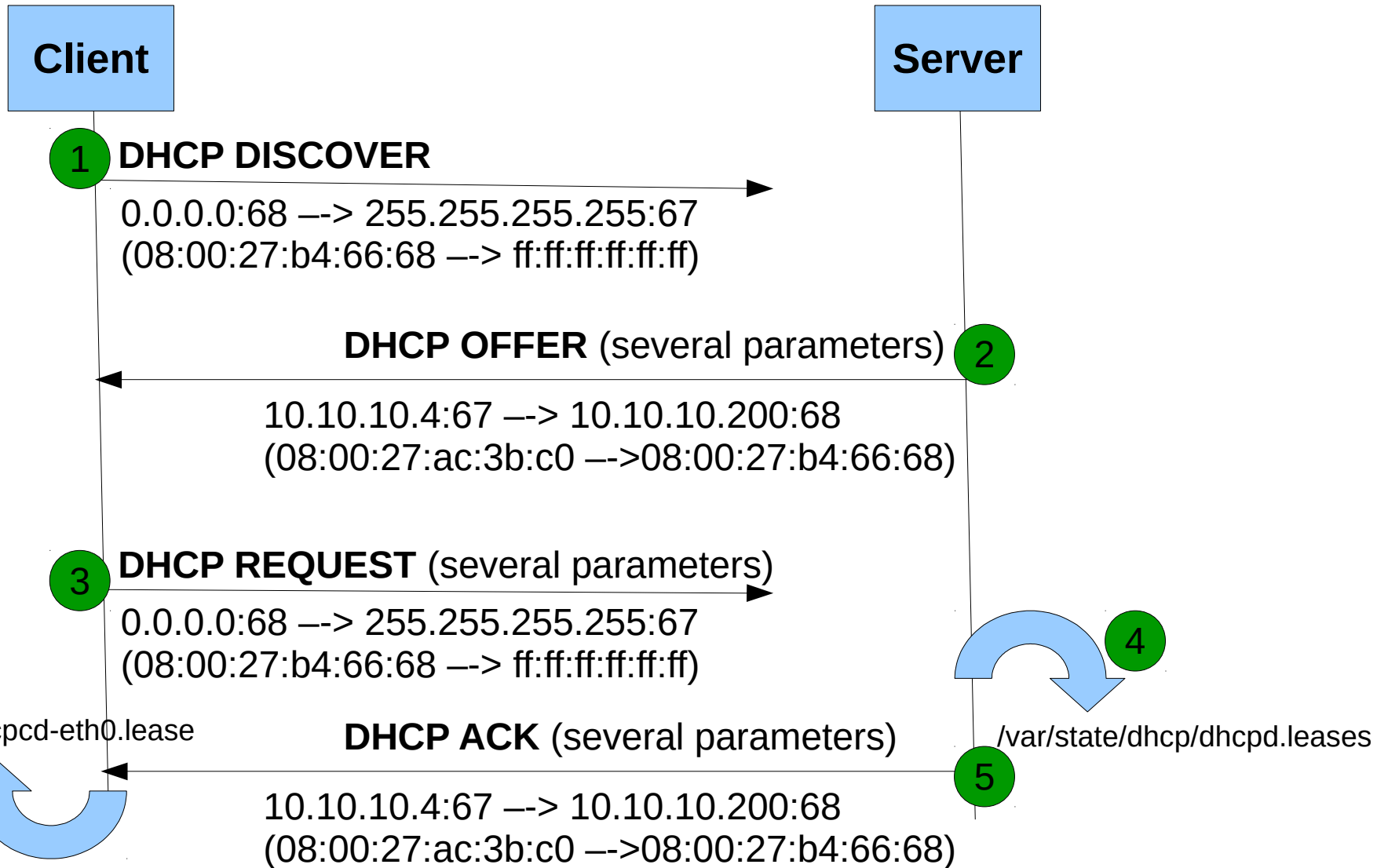
Server



`/var/lib/dhcpd/dhcpd-eth0.lease`



# DHCP operation



# DHCP operation - DISCOVER

13:29:17.258489 IP (tos 0x0, ttl 64, id 36183, offset 0, flags [none], proto **UDP** (17), length 375)

**0.0.0.0.68 > 255.255.255.255.67:** [udp sum ok] BOOTP/DHCP, **Request from 08:00:27:b4:66:68**, length 347, xid 0x3fd5b22b, Flags [none] (0x0000)

Client-Ethernet-Address 08:00:27:b4:66:68

Vendor-rfc1048 Extensions

Magic Cookie 0x63825363

**DHCP-Message Option 53, length 1: Discover**

Client-ID Option 61, length 19: hardware-type 255, 65:74:68:30:00:01:00:01:1a:cc:50:04:08:00:27:b4:66:68

SLP-NA Option 80, length 0""

MSZ Option 57, length 2: 1500

Vendor-Class Option 60, length 48: "dhcpcd-6.0.5:Linux-3.10.17-smp:i686:GenuineIntel"

Hostname Option 12, length 8: "cliente2"

**Parameter-Request Option 55, length 14:**

**Subnet-Mask, Classless-Static-Route, Static-Route, Default-Gateway, Domain-Name-Server, Hostname, Domain-Name, BR NTP, Lease-Time, Server-ID, RN**

RB, Option 119

END Option 255, length 0

# DHCP operation - OFFER

13:29:18.260398 IP (tos 0x10, ttl 128, id 0, offset 0, flags [none], proto **UDP** (17), length 328)

**10.10.10.4.67** > **10.10.10.200.68**: [udp sum ok] BOOTP/DHCP, **Reply**, length 300, xid 0x3fd5b22b, Flags [none] (0x0000)

**Your-IP 10.10.10.200**

**Client-Ethernet-Address 08:00:27:b4:66:68**

Vendor-rfc1048 Extensions

Magic Cookie 0x63825363

**DHCP-Message Option 53, length 1: Offer**

Server-ID Option 54, length 4: 10.10.10.4

Lease-Time Option 51, length 4: 21600

**Subnet-Mask Option 1, length 4: 255.255.255.0**

**Default-Gateway Option 3, length 4: 10.10.10.4**

**Domain-Name-Server Option 6, length 12: 10.10.10.4,200.246.46.134,8.8.8.8**

**Domain-Name Option 15, length 15: "admsom.fatec.br"**

END Option 255, length 0

PAD Option 0, length 0



# DHCP operation - REQUEST

13:29:18.262681 IP (tos 0x0, ttl 64, id 10938, offset 0, flags [none], proto **UDP** (17), length 385)

**0.0.0.0.68 > 255.255.255.255.67:** [udp sum ok] BOOTP/DHCP, **Request from 08:00:27:b4:66:68**, length 357, xid 0x3fd5b22b, secs 1, Flags [none] (0x0000)

Client-Ethernet-Address 08:00:27:b4:66:68

Vendor-rfc1048 Extensions

Magic Cookie 0x63825363

**DHCP-Message Option 53, length 1: Request**

Client-ID Option 61, length 19: hardware-type 255, 65:74:68:30:00:01:00:01:1a:cc:50:04:08:00:27:b4:66:68

Requested-IP Option 50, length 4: 10.10.10.200

Server-ID Option 54, length 4: 10.10.10.4

MSZ Option 57, length 2: 1500

Vendor-Class Option 60, length 48: "dhcpcd-6.0.5:Linux-3.10.17-smp:i686:GenuineIntel"

Hostname Option 12, length 8: "cliente2"

**Parameter-Request Option 55, length 14:**

**Subnet-Mask, Classless-Static-Route, Static-Route, Default-Gateway, Domain-Name-Server, Hostname, Domain-Name, BR NTP, Lease-Time, Server-ID, RN**

RB, Option 119

END Option 255, length 0

# DHCP operation - ACK

13:29:18.267254 IP (tos 0x10, ttl 128, id 0, offset 0, flags [none], proto **UDP** (17), length 328)

**10.10.10.4.67** > **10.10.10.200.68**: [udp sum ok] BOOTP/DHCP, Reply, length 300, xid 0x3fd5b22b, secs 1, Flags [none] (0x0000)

Your-IP 10.10.10.201

Client-Ethernet-Address 08:00:27:2c:88:ed

Vendor-rfc1048 Extensions

Magic Cookie 0x63825363

**DHCP-Message Option 53, length 1: ACK**

Server-ID Option 54, length 4: 10.10.10.4

Lease-Time Option 51, length 4: 21600

**Subnet-Mask Option 1, length 4: 255.255.255.0**

**Default-Gateway Option 3, length 4: 10.10.10.4**

**Domain-Name-Server Option 6, length 12: 10.10.10.4,200.246.46.134,8.8.8.8**

**Domain-Name Option 15, length 15: "admsom.fatec.br"**

END Option 255, length 0

PAD Option 0, length 0

# DHCP Operation – Lease concepts

- Each client is granted exclusive and non-exclusive resources during a LEASE TIME
  - i.e.: Client **IP address** is an exclusive resource
  - i.e.: **Default gateway** is a non-exclusive resource
  - Offer message from server (given in seconds):

...

DHCP-Message Option 53, length 1: Offer

Server-ID Option 54, length 4: 10.10.10.4

**Lease-Time** Option 51, length 4: **21600** ...

# DHCP Operation – Lease concepts

- Lease updating
  - RENEW LEASE: generally occurs every half the allocated lease time
- Read man dhcpcd.conf (DYNAMIC ADDRESS ALLOCATION)
  - **DHCPDISCOVER**
  - **DHCPREQUEST**
  - **DHCPACK**
  - **DHCPNACK**

# Hands-on !

# DHCP Configuration

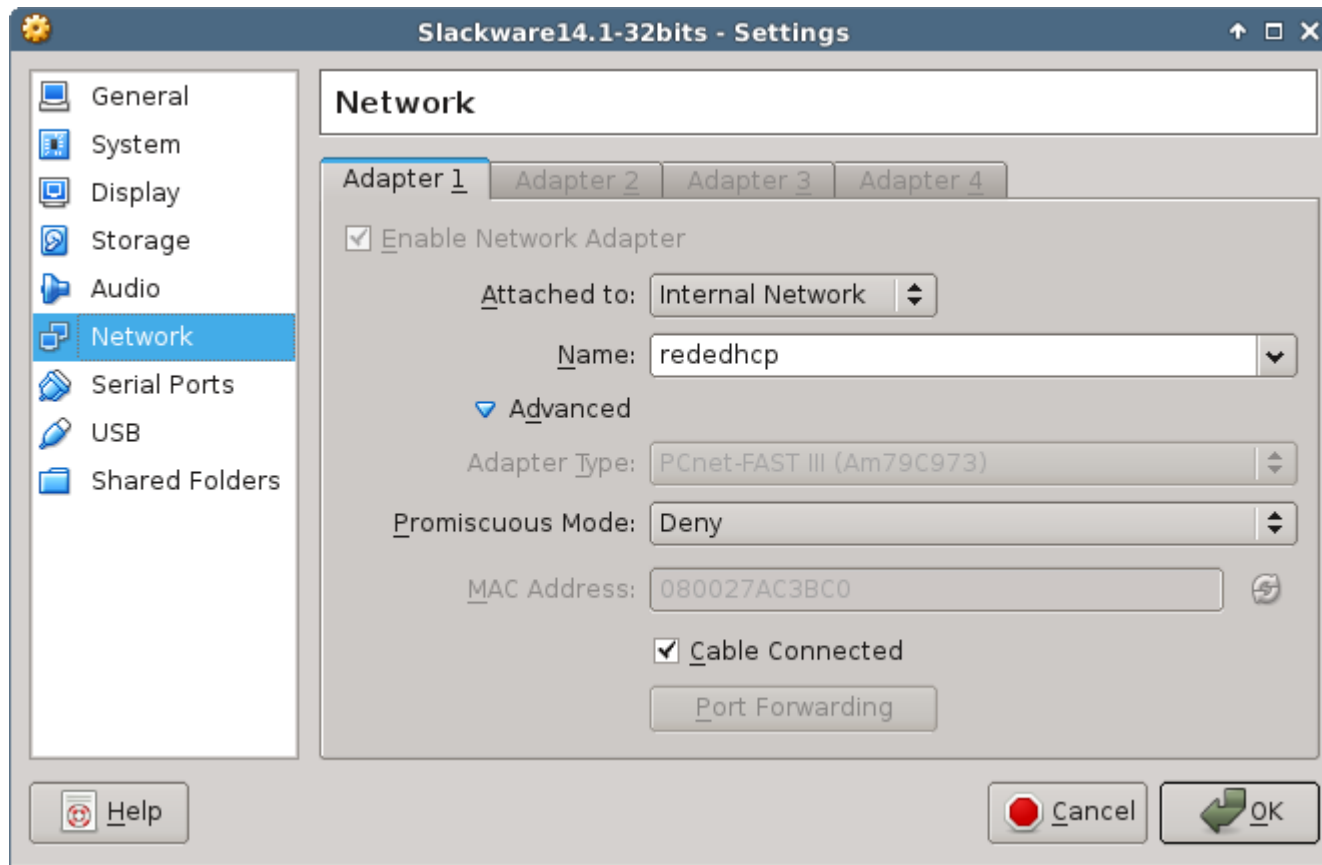
- `pacman -S dhcp`
- **Systemd service units:**
  - `/etc/systemd/system/dhcpd4.service`
    - Serves all interfaces
  - `/etc/systemd/system/dhcpd4@.service`
    - Observe the “@”. This is a template unit. It will become `dhcpd@eth0.service` if it binds to `eth0` (it will listen on only one interface)

# DHCP Configuration

- Lab with VirtualBox
  - Server: devices → network settings → Adapter 1 → Attached to: **Internal Network**, Name: **rededhcp**
  - Client: devices → network settings → Adapter 1 → Attached to: **Internal Network**, Name: **rededhcp**

# DHCP Configuration

- Lab with VirtualBox





# DHCP Configuration

- Server - /etc/dhcpd.conf example:

```
ddns-update-style interim; #ad-hoc is DEPRECATED – ALWAYS USE interim!!!

ignore client-updates; # CHOOSE ONLY 1: ignore client-updates OR allow client-updates;

## GLOBAL PARAMETERS - COMMON TO ALL SUBNETS

## .i.e.: organization's domain name, name server addresses, etc..

option domain-name "admsom.localdomain";

option domain-name-servers 10.10.10.4, 200.246.46.134, 8.8.8.8;

subnet 10.10.10.0 netmask 255.255.255.0 {

    option routers          10.10.10.4;

    option subnet-mask     255.255.255.0;

    range dynamic-bootp    10.10.10.200 10.10.10.210;

    default-lease-time     21600; # IN SECONDS. 21600 = 6 hrs
                            # DEFAULT = 43200 seconds

    max-lease-time         43200; # IN SECONDS. 43200 = 12 hrs
                            # DEFAULT = 86400 seconds (24 hrs)

}....
```

# DHCP Configuration

- Server - /etc/dhcpd.conf example:

...

```
host chefe {  
    hardware ethernet          00:E0:4C:E7:5D:7E;  
    fixed-address              10.10.10.199;  
    option host-name           "chefe";  
    option dhcp-client-identifier "chefe";  
    option routers             10.10.10.4;  
    option subnet-mask         255.255.255.0;  
}
```

# DHCP Configuration

From man dhcpd.conf:

- default-lease-time time;

Time should be the length in **seconds** that will be assigned to a lease if the client requesting the lease does not ask for a specific expiration time. This is used for both DHCPv4 and DHCPv6 leases (it is also known as the "valid lifetime" in DHCPv6). The **default is 43200 seconds**.

- max-lease-time time;

Time should be the **maximum** length in **seconds** that will be assigned to a lease. If not defined, the **default maximum** lease time is **86400...**

# DHCP Configuration

- Server (login as root):
  - `systemctl start dhcpd4`
  - `systemctl enable dhcpd4`
  - `systemctl status dhcpd4`
  - `journalctl -xe`

# DHCP Configuration

- Testing
  - Server (login as root):
    - `tail -f /var/lib/dhcp/dhcpd.leases`
  - Client (login as root):
    - `systemctl restart systemd-networkd`
    - `dhcpcd -U eth0`

# Refs

- man pages:
  - man 5 dhcpd.conf
  - man 8 dhcpcd
  - man 8 dhcpd
  - man 5 dhcpd.leases
  - RFC2132