

# DHCP Relay-Agent 007

The secrets of an humble network service

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# Agenda

- DHCP Relay-Agent operation
- DHCP Proxies
- "snooping" DHCP-Agent
- DHCP Option 54 - Server-Identifier
- Open Source DHCP-Relay-Agents
- References

# DHCP Relay-Agent operation

# DHCP Relay-Agent operation

- Because a client machine without IP address can only communicate on the local link, the base DHCPv4 protocol is "link-local" only
- DHCPv4 relay-agents can be used to forward DHCPv4 requests to centralised DHCPv4 server
  - DHCP relay-agents are often found in network equipment (e.g. router)
  - Dedicated "software based" relay-agents are available

# DHCP Clients, Relays and Server

## DHCP Operation



DHCP Client



DHCP Relay



DHCP Server

# DHCP Clients, Relays and Server

## DHCP Operation



0.0.0.0

DHCP Client



10.0.0.1

192.0.2.20

DHCP Relay

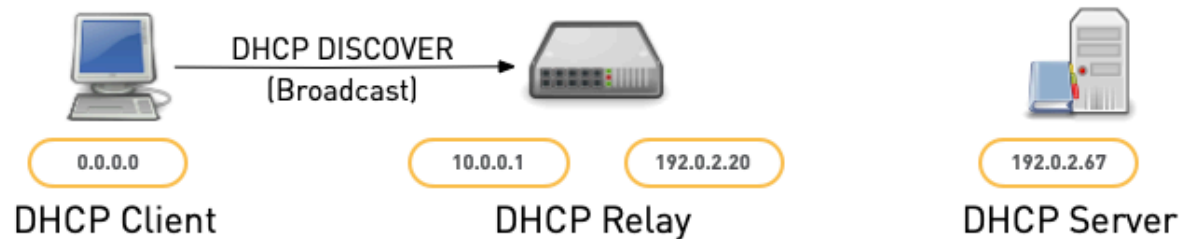


192.0.2.67

DHCP Server

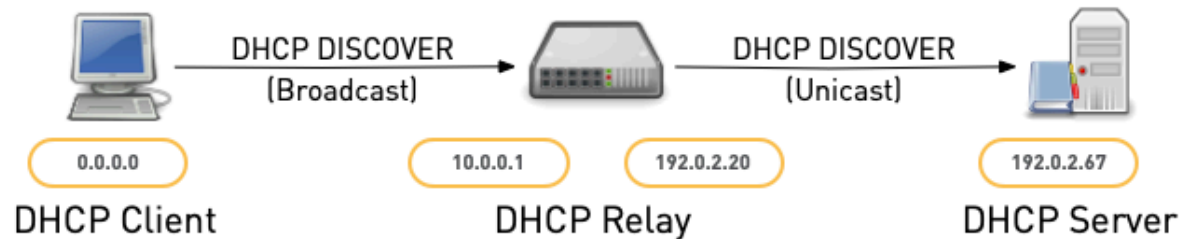
# DHCP Clients, Relays and Server

## DHCP Operation (Init-State)



# DHCP Clients, Relays and Server

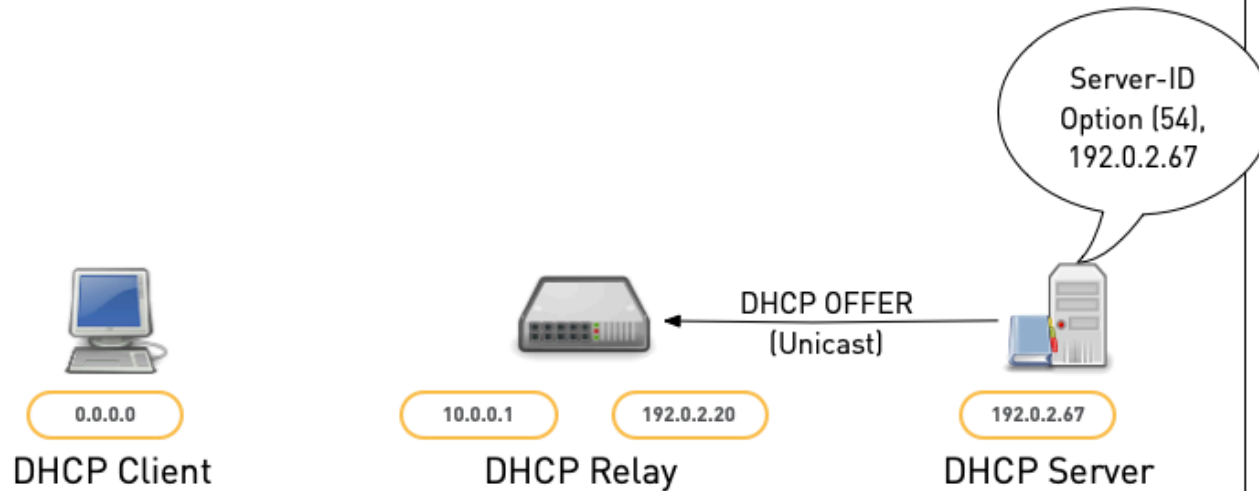
## DHCP Operation (Init-State)





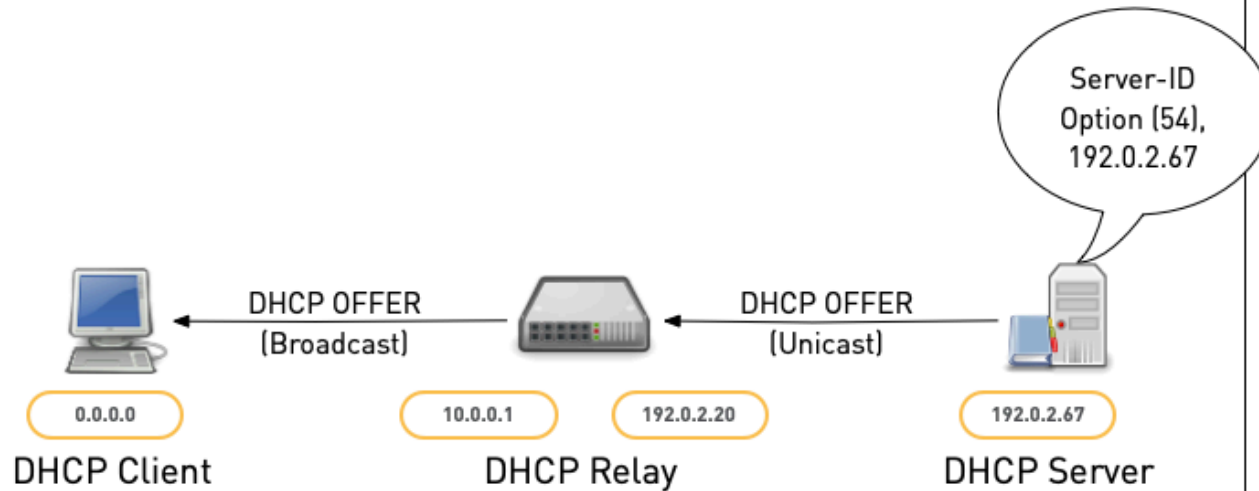
# DHCP Clients, Relays and Server

## DHCP Operation (Init-State)



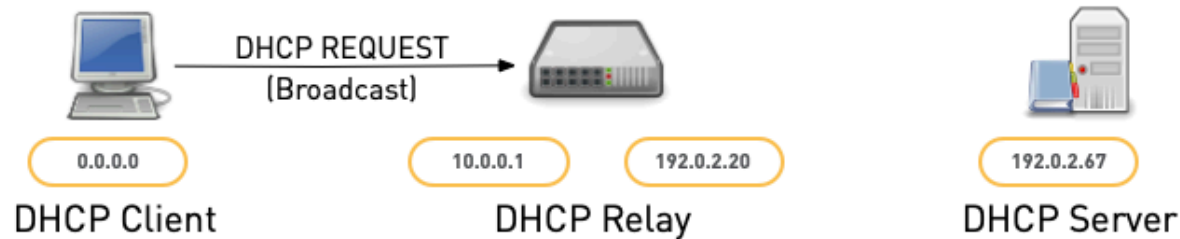
# DHCP Clients, Relays and Server

## DHCP Operation (Init-State)



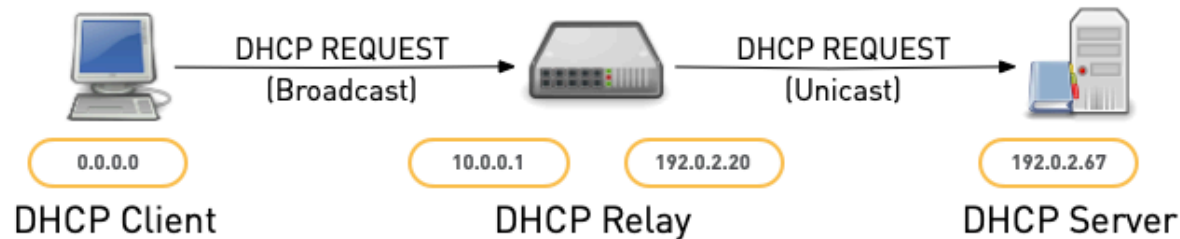
# DHCP Clients, Relays and Server

## DHCP Operation (Selecting-State)



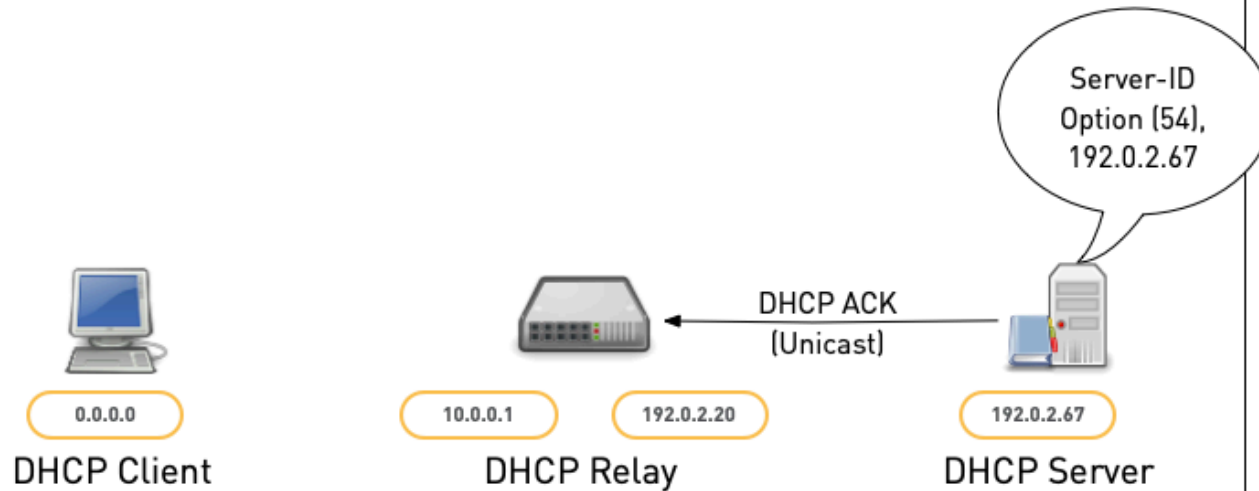
# DHCP Clients, Relays and Server

## DHCP Operation (Selecting-State)



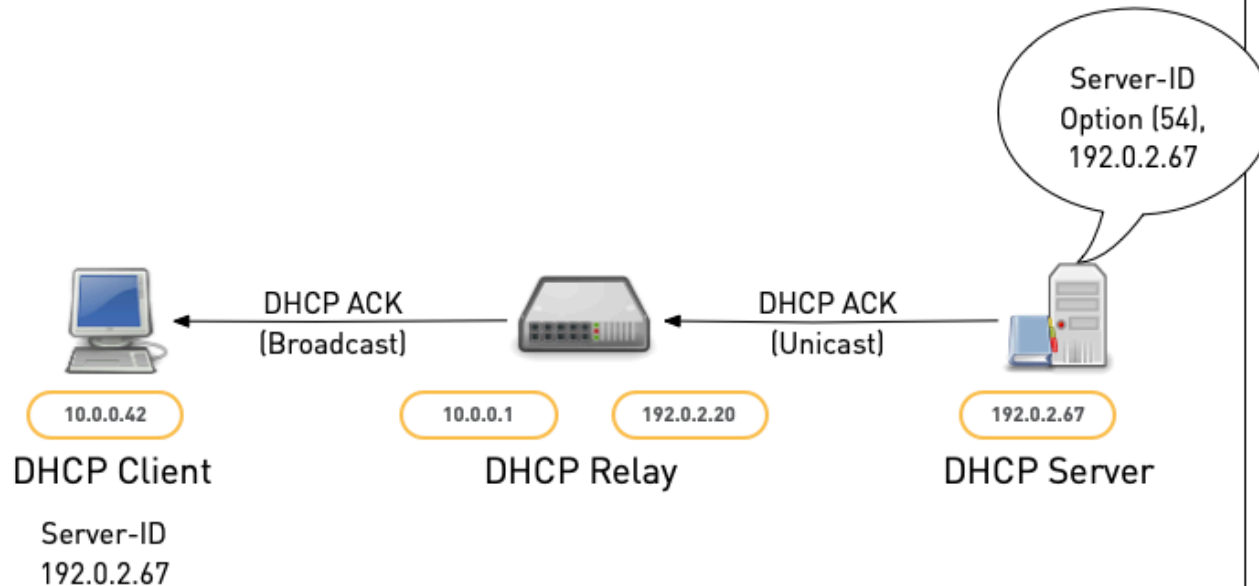
# DHCP Clients, Relays and Server

## DHCP Operation (Selecting-State)



# DHCP Clients, Relays and Server

## DHCP Operation (Selecting-State)



# DHCP Renew

# RFC 2131

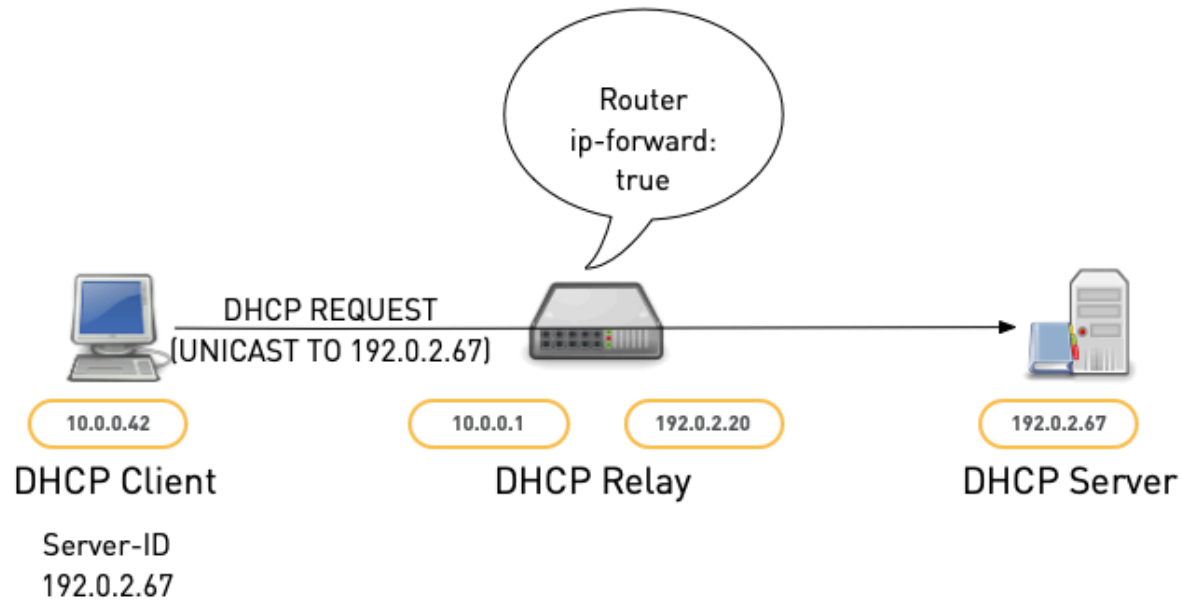
DHCPREQUEST generated during RENEWING state:

[...] This message will be unicast, so no relay agents will be involved in its transmission. [...]



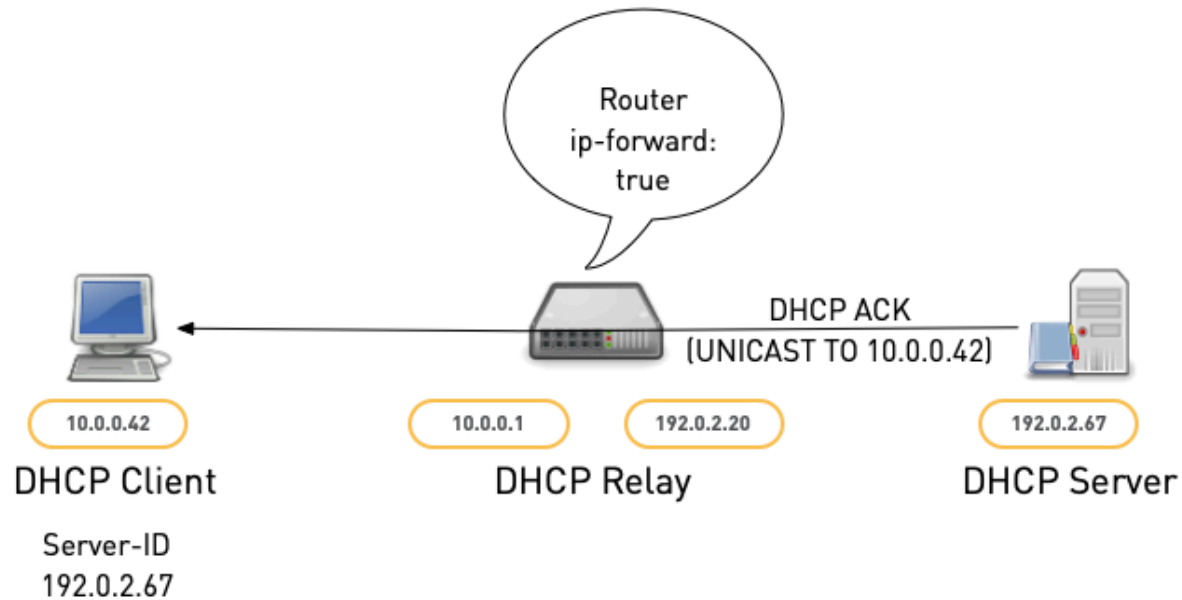
# DHCP Renew

## DHCP Operation (Renew-State)



# DHCP Renew

## DHCP Operation (Renew-State)

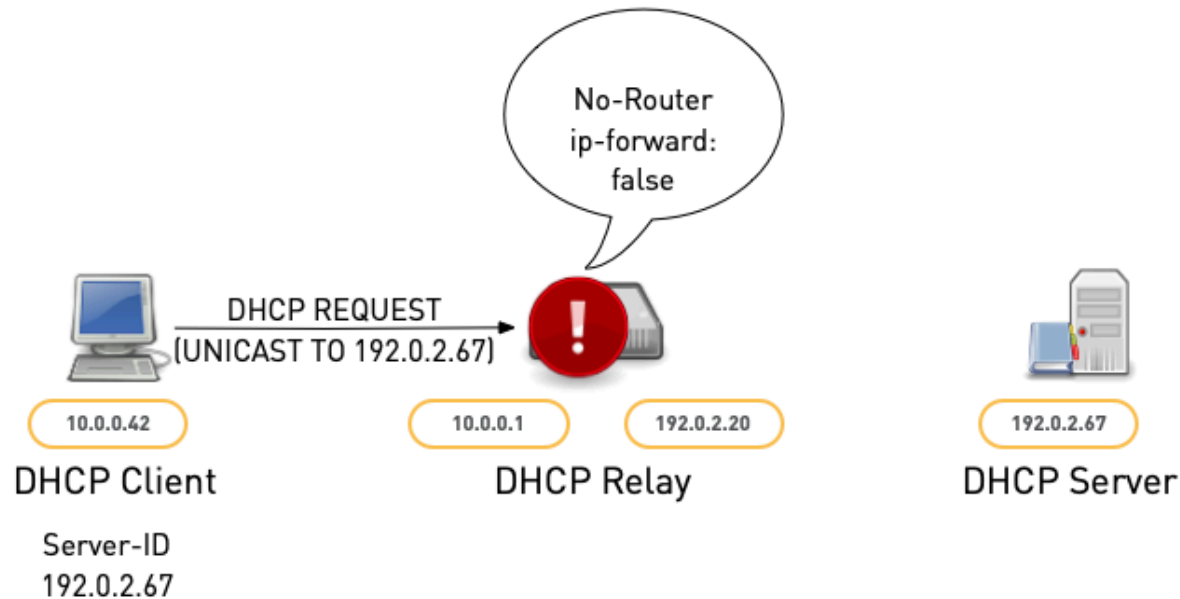


# DHCP Renew challenges

- There might be no direct communication between the DHCP client and the DHCP server
  - no ip forwarding
  - firewall
  - client in private IP address space, DHCP server in public address space

# DHCP Renew issue

## DHCP Operation (Renew-State)



# DHCP Rebinding

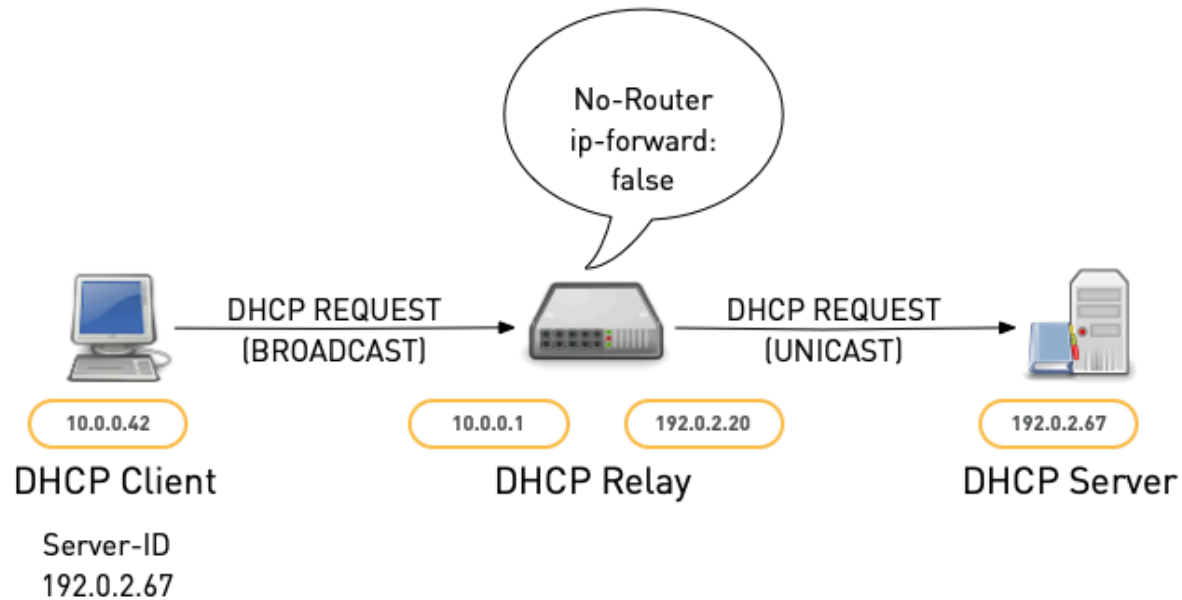
# RFC 2131

DHCPREQUEST generated during REBINDING state: [...] This message MUST be broadcast to the 0xffffffff IP broadcast address. The DHCP server SHOULD check 'ciaddr' for correctness before replying to the DHCPREQUEST.

The DHCPREQUEST from a REBINDING client is intended to accommodate sites that have multiple DHCP servers and a mechanism for maintaining consistency among leases managed by multiple servers. A DHCP server MAY extend a client's lease only if it has local administrative authority to do so.

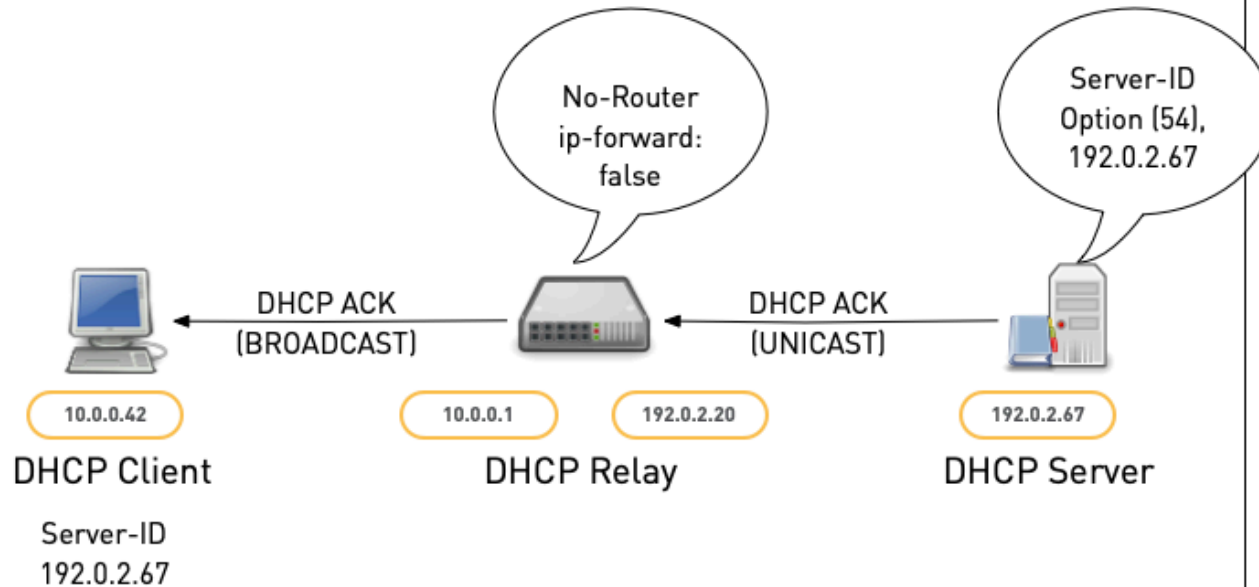
# DHCP Rebinding

## DHCP Operation (Rebinding-State)



# DHCP Rebinding

## DHCP Operation (Rebinding-State)





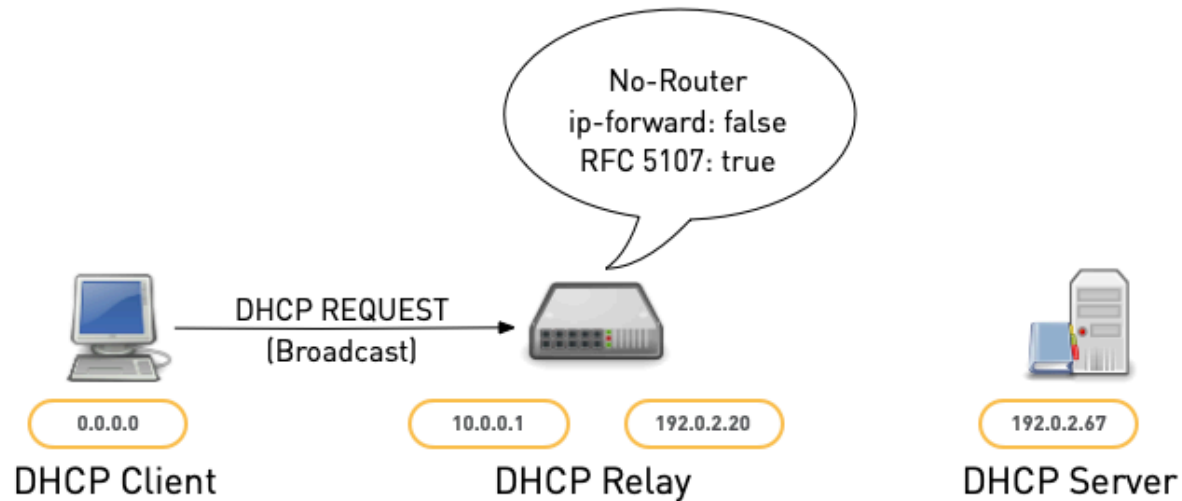
# Solution 1 - RFC 5107

# RFC 5107 - DHCP Server Identifier Override Suboption

This memo defines a new suboption of the DHCP relay information option that allows the DHCP relay to specify a new value for the Server Identifier option, which is inserted by the DHCP Server. This allows the DHCP relay to act as the actual DHCP server such that RENEW DHCPREQUESTs will come to the relay instead of going to the server directly. This gives the relay the opportunity to include the Relay Agent option with appropriate suboptions even on DHCP RENEW messages.

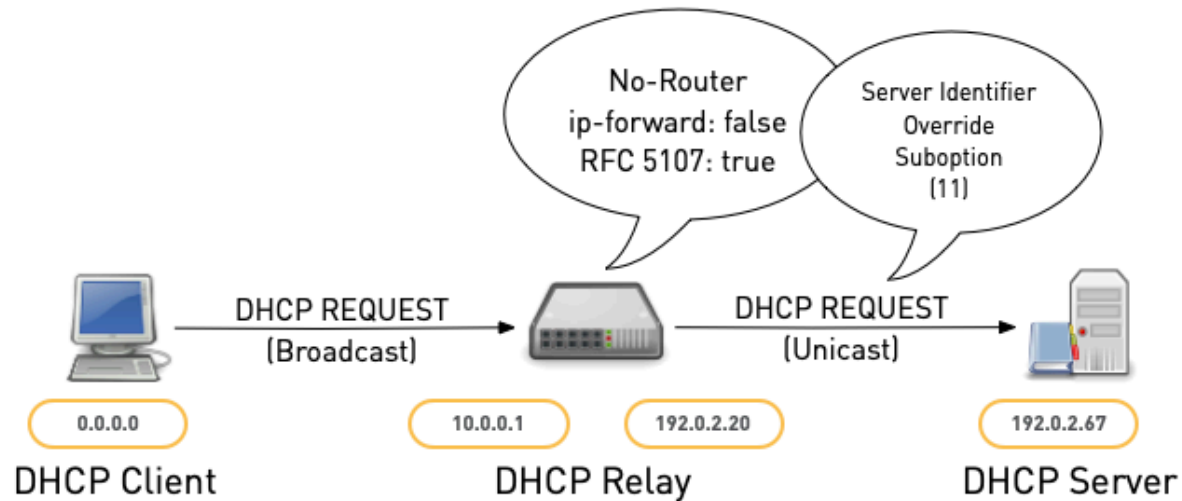
# DHCP RFC 5107

## DHCP Operation (Selecting-State / RFC 5107)



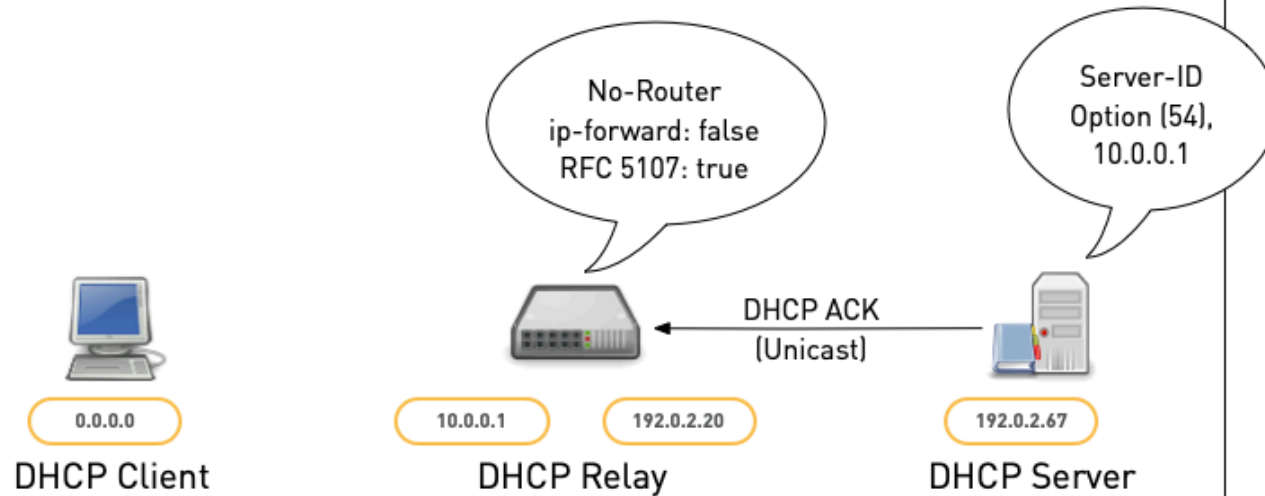
# DHCP RFC 5107

## DHCP Operation (Selecting-State / RFC 5107)



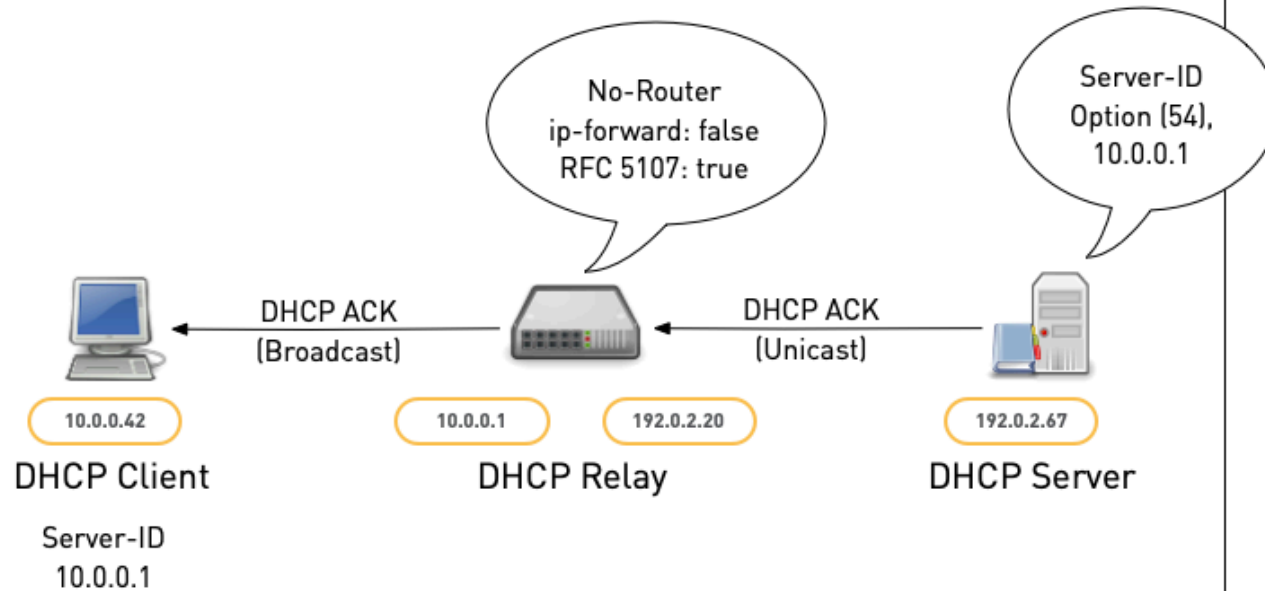
# DHCP RFC 5107

## DHCP Operation (Selecting-State / RFC 5107)



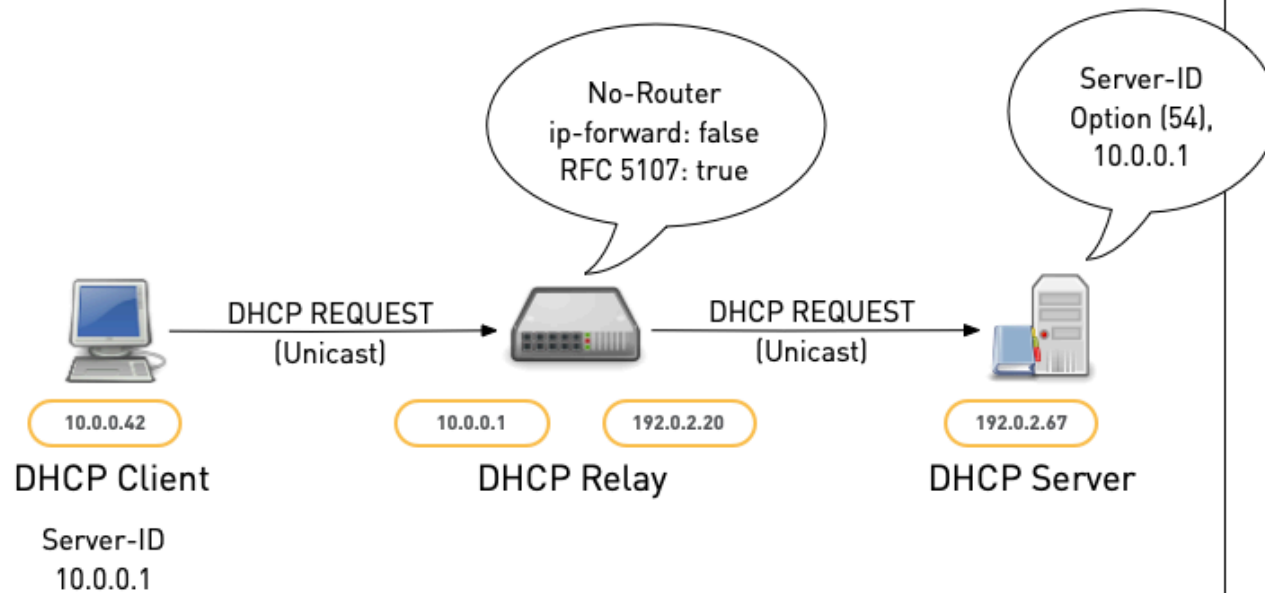
# DHCP RFC 5107

## DHCP Operation (Selecting-State / RFC 5107)



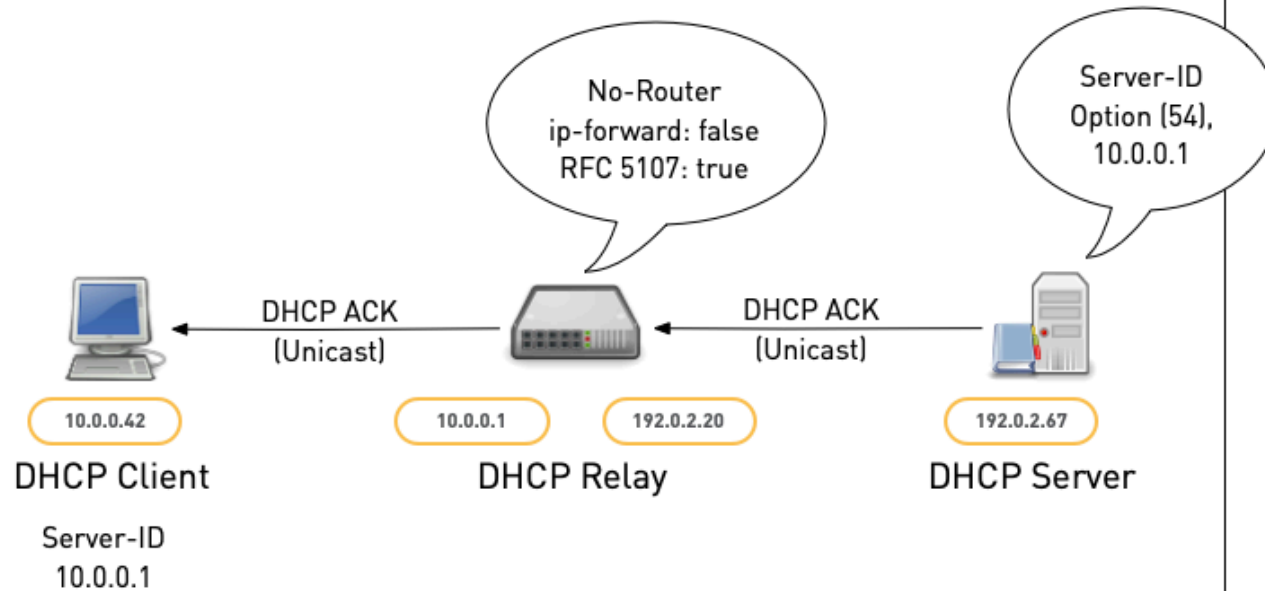
# DHCP RFC 5107

## DHCP Operation (Renewing-State / RFC 5107)



# DHCP RFC 5107

## DHCP Operation (Renewing-State / RFC 5107)





# "DHCP Proxy"

- Some hardware network devices include a "DHCP Proxy"
  - Cisco, Juniper, ...
  - Similar to RFC 5107, but documentation often does not mention RFC 5107

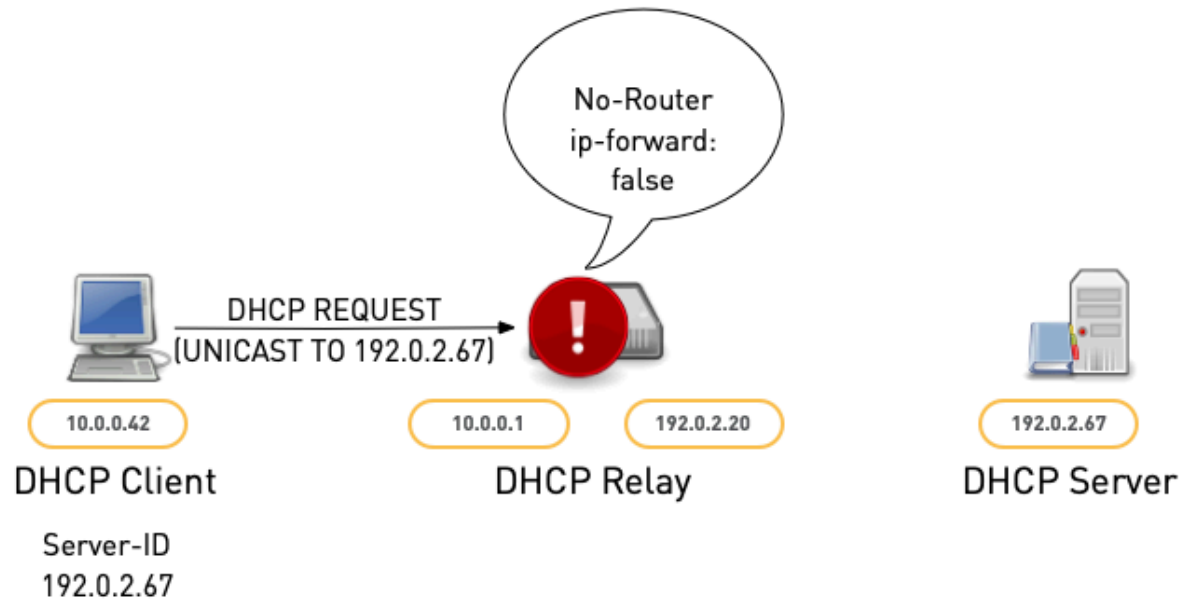
# Solution 2 - "Snooping DHCP Agent"

# "Snooping DHCP Agent"

- Some DHCP-Relays snoop on DHCP traffic passing "through" (not broadcast and not addressed for the relay agent)
- Relay-Agent creates own DHCP-Request as if the client had send a broadcast DHCP-request

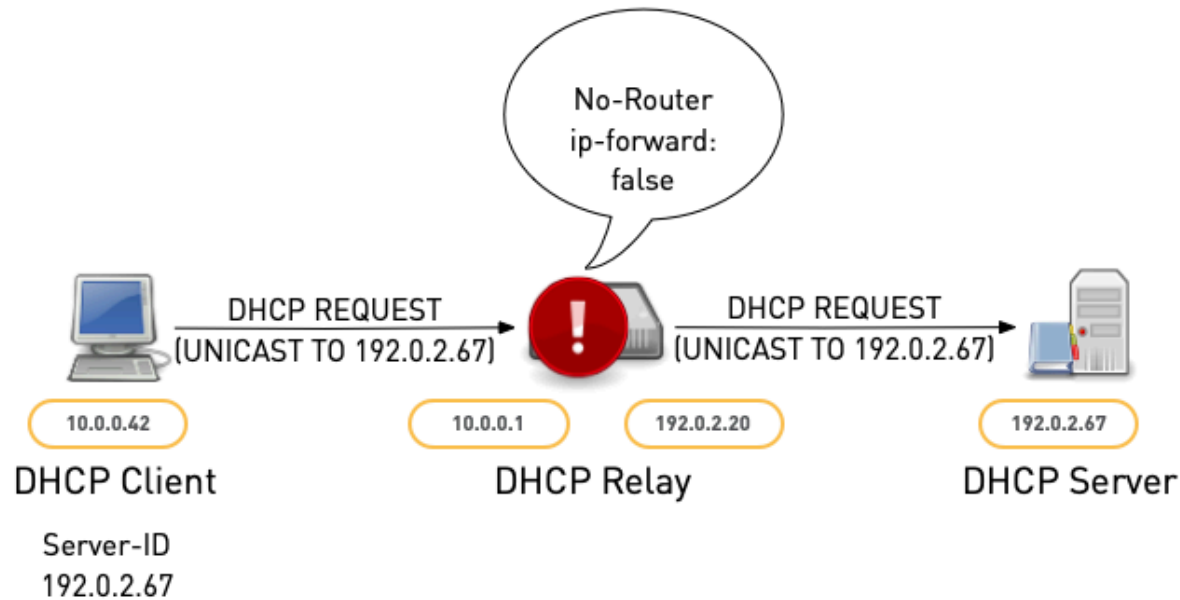
# "Snoopic DHCP Agent"

DHCP Operation (Renew-State / Snooping-Relay-Agent)



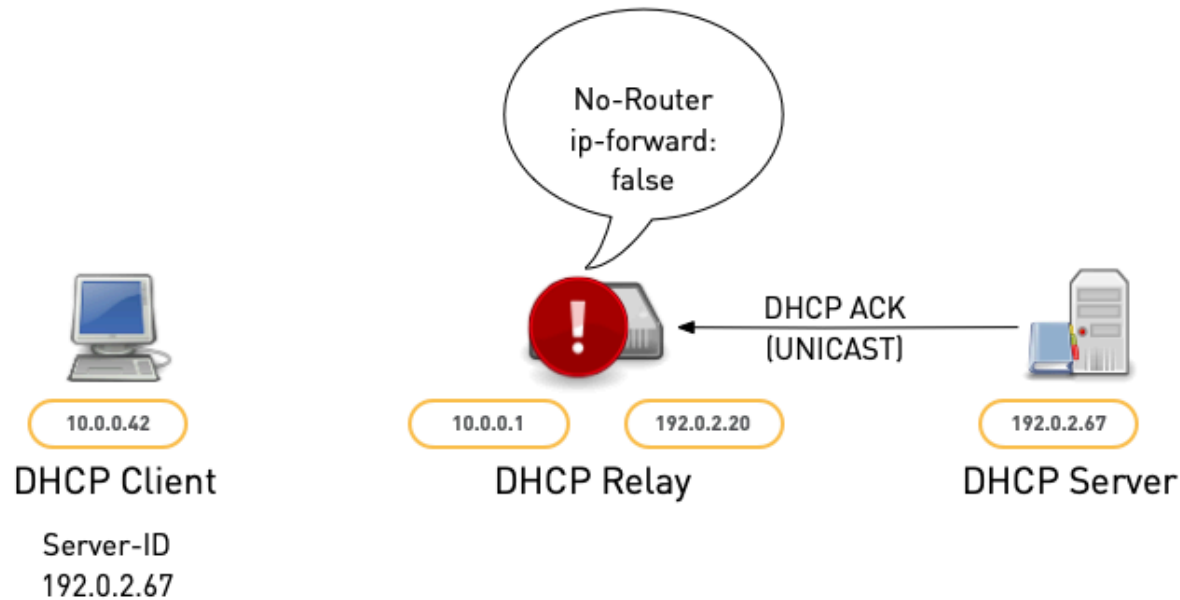
# "Snoopic DHCP Agent"

DHCP Operation (Renew-State / Snooping-Relay-Agent)



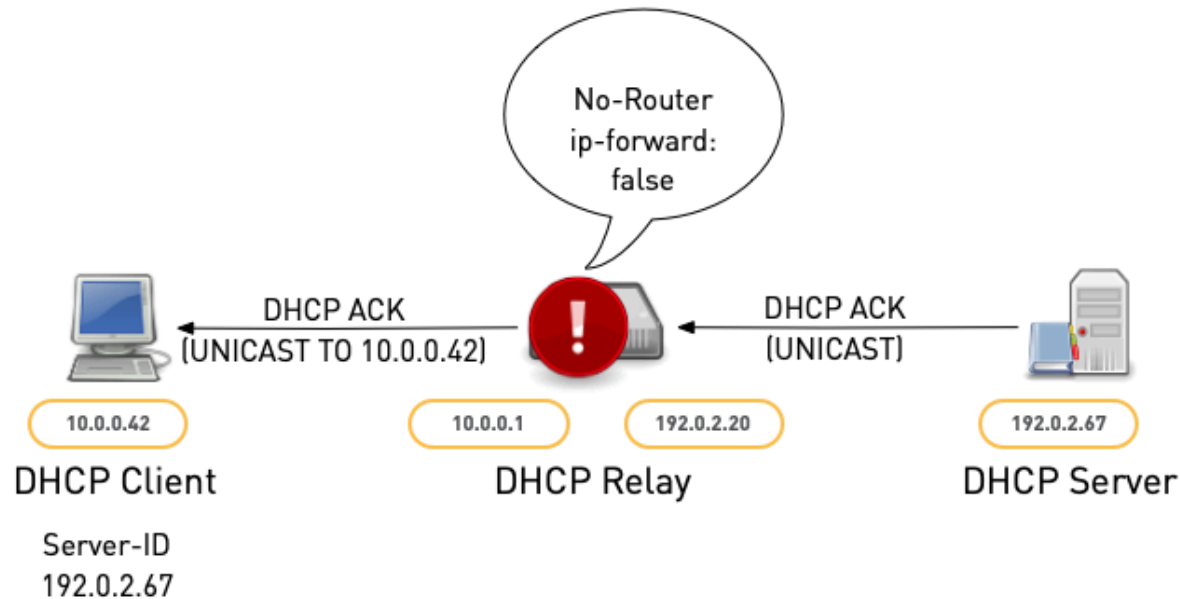
# "Snoopic DHCP Agent"

DHCP Operation (Renew-State / Snooping-Relay-Agent)



# "Snoopic DHCP Agent"

## DHCP Operation (Renew-State / Snooping-Relay-Agent)



# Solution 3 - Explicit Server- Identifier Option

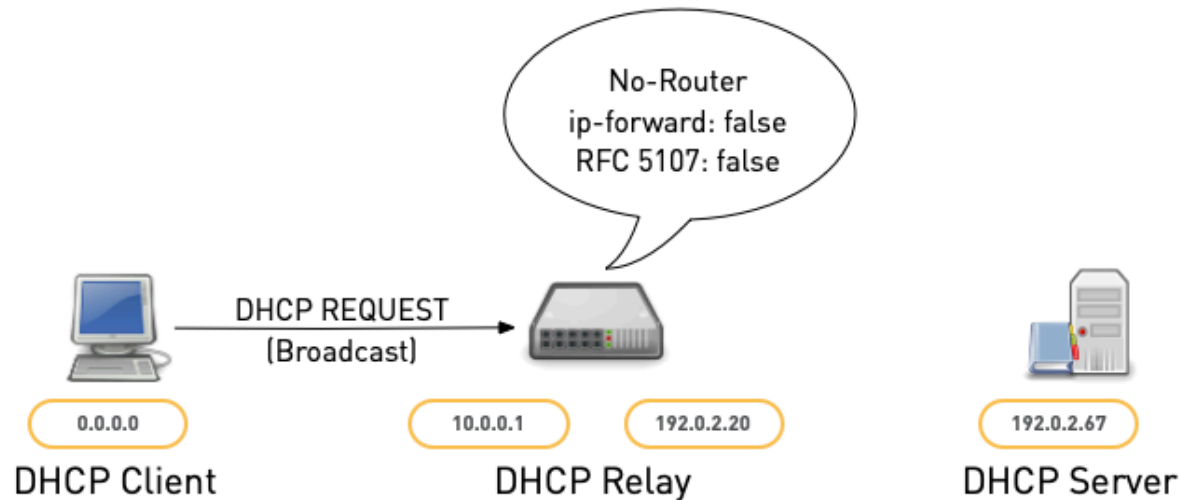


# Explicit Server-Identifier Option

- The 'Server-Identifier' Option (Code 54) is usually set by the DHCP-server with the IPv4 address of the DHCP server
- The value is used by the client to send the unicast renew DHCP-request
- This option is a regular DHCP option
  - it can be set manually for a subnet or a reservation to any IPv4 address
  - including the IPv4 address of the subnets relay agent!

# Explicit Server-Identifier

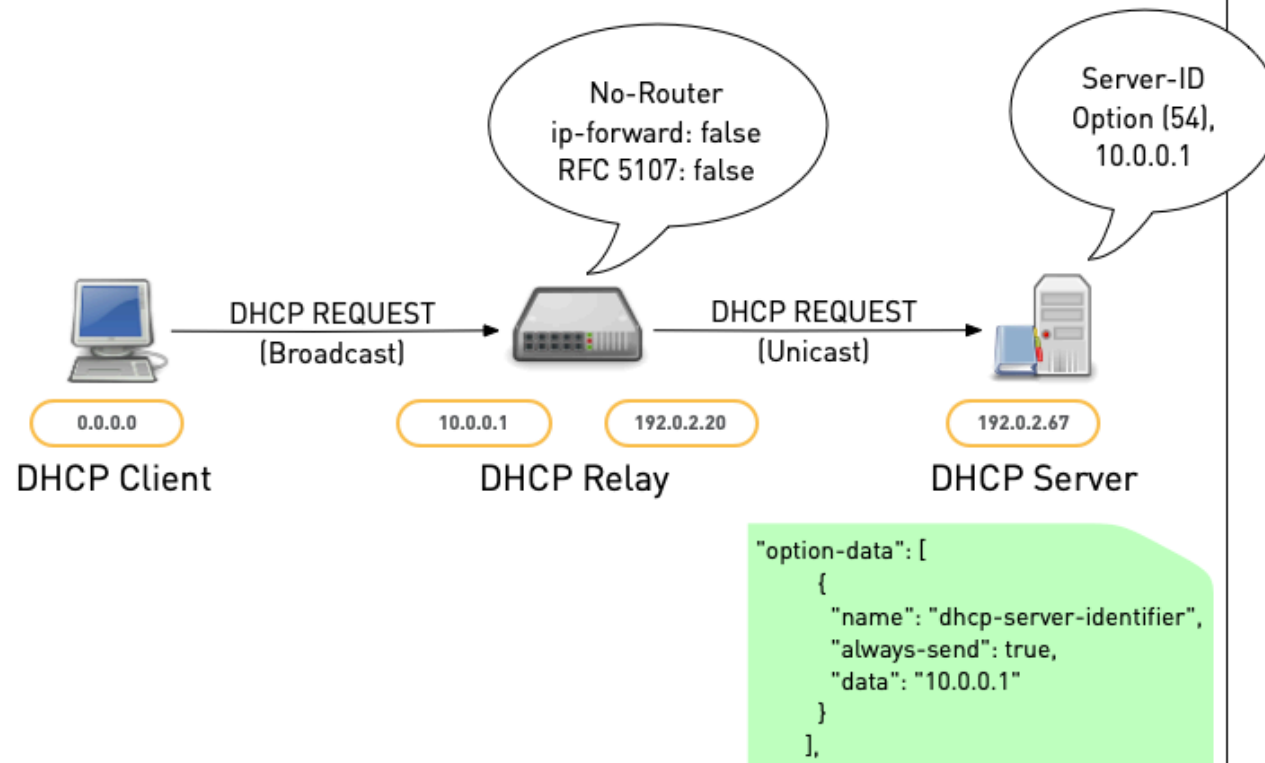
## DHCP Operation (Selecting-State / Explicit Server-ID Option)



```
"option-data": [  
  {  
    "name": "dhcp-server-identifier",  
    "always-send": true,  
    "data": "10.0.0.1"  
  },  
]
```

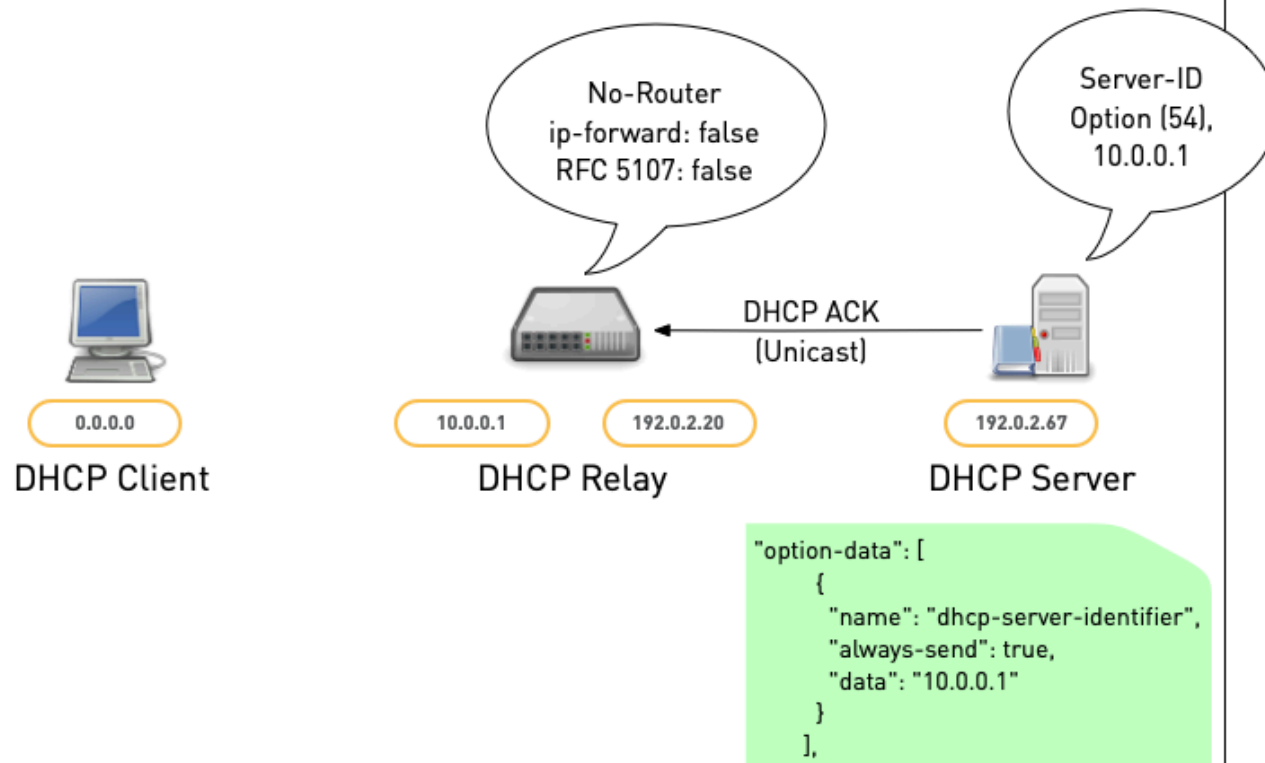
# Explicit Server-Identifier

## DHCP Operation (Selecting-State / Explicit Server-ID Option)



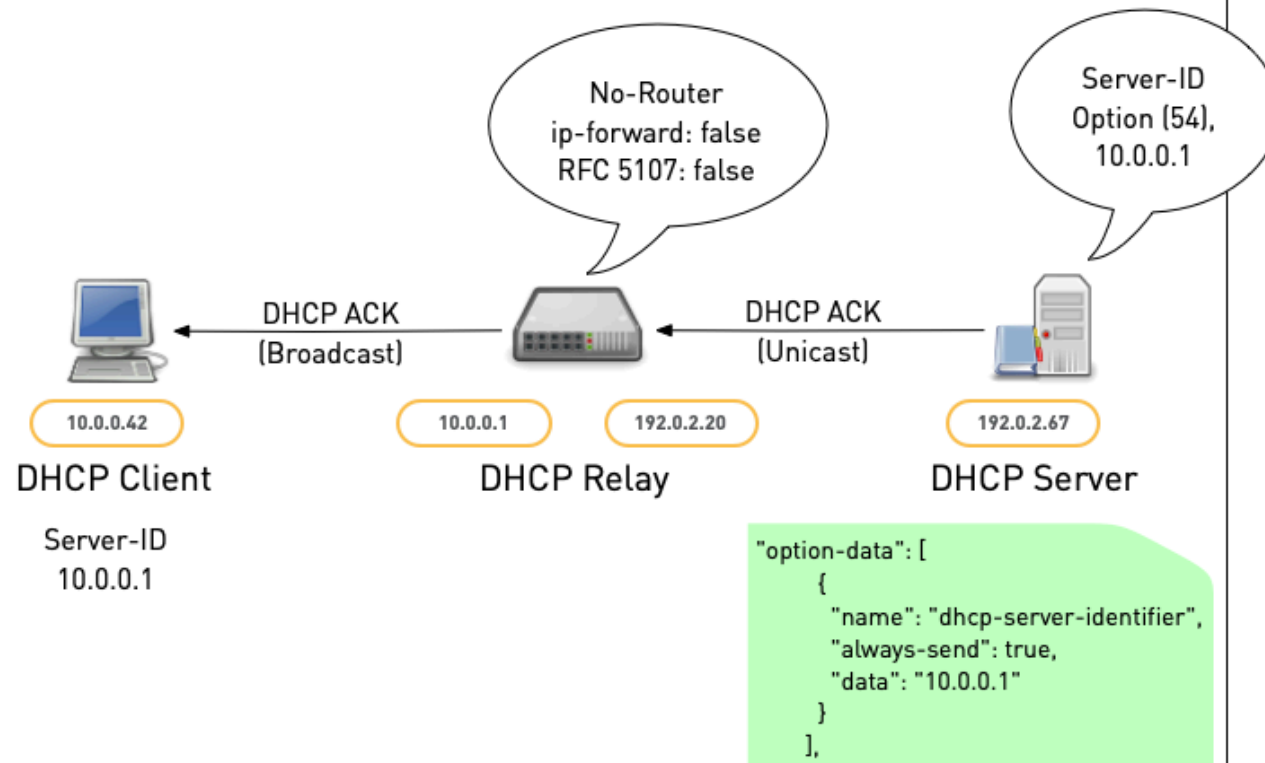
# Explicit Server-Identifier

## DHCP Operation (Selecting-State / Explicit Server-ID Option)



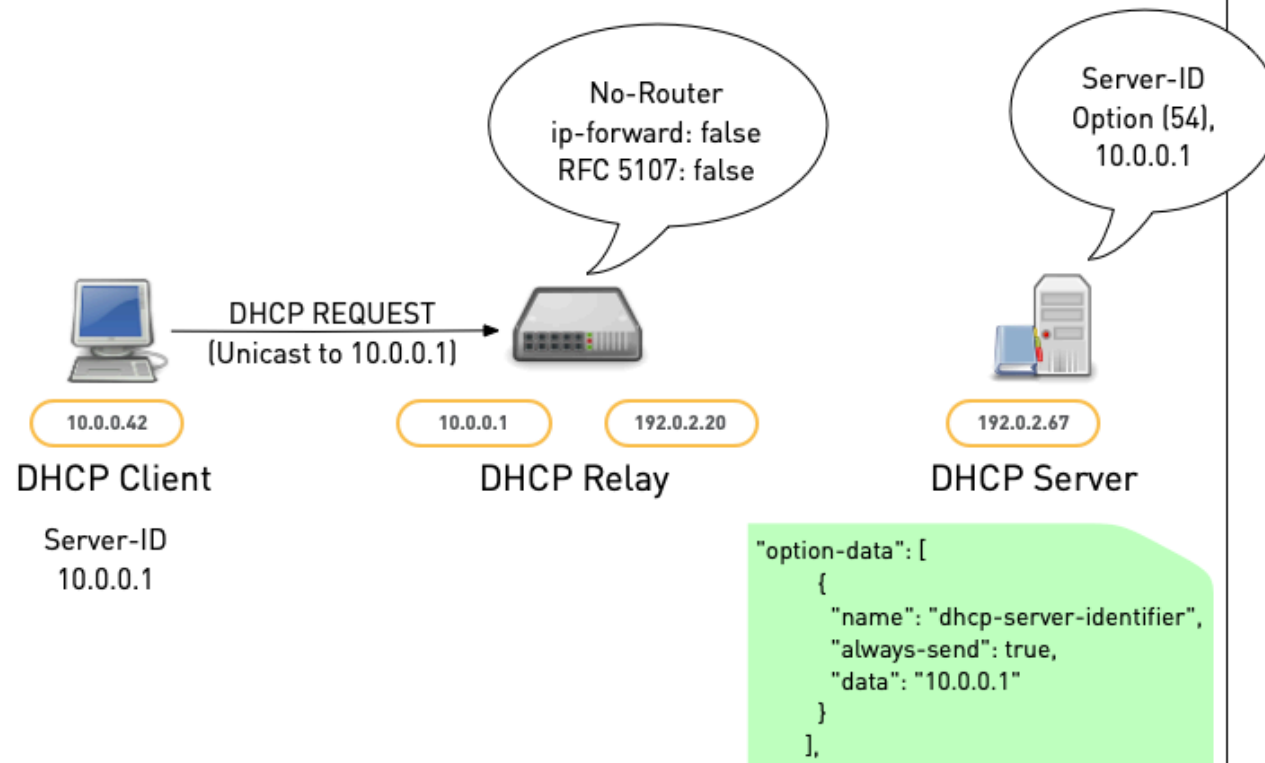
# Explicit Server-Identifier

## DHCP Operation (Selecting-State / Explicit Server-ID Option)



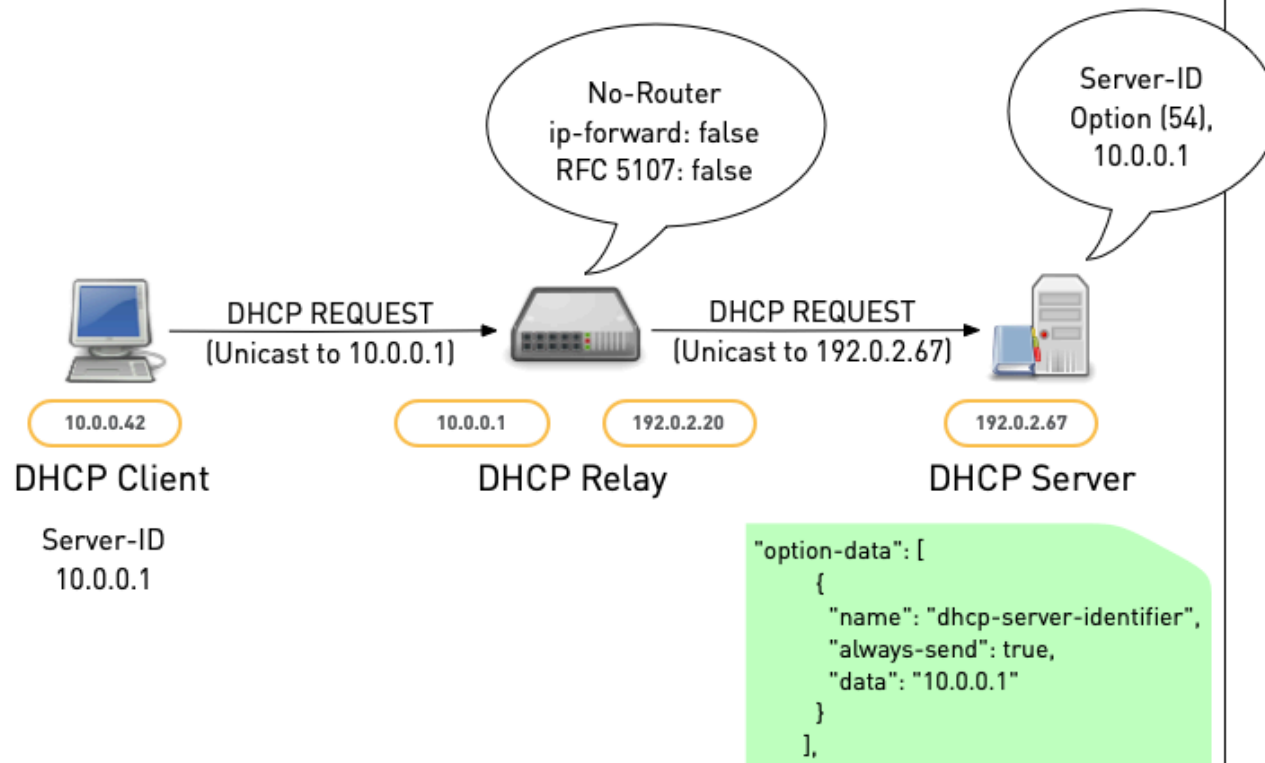
# Explicit Server-Identifier

## DHCP Operation (Renewing-State / Explicit Server-ID Option)



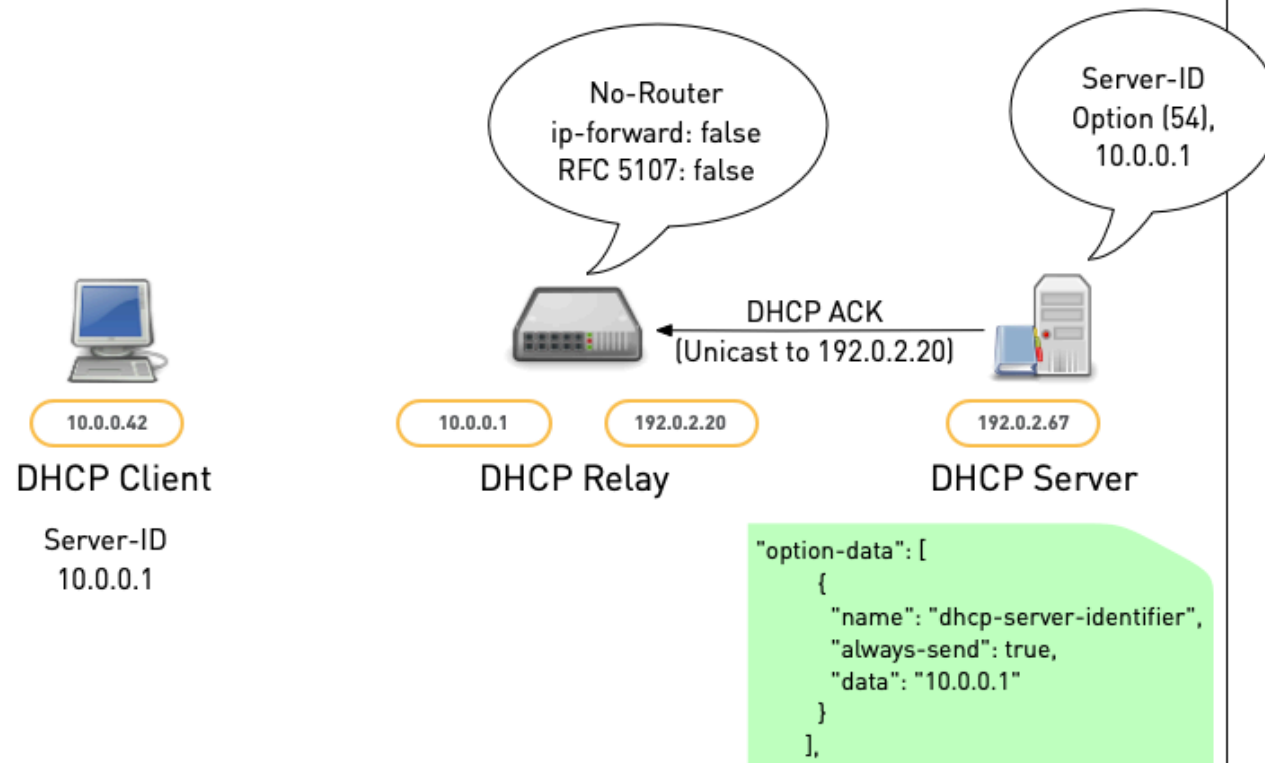
# Explicit Server-Identifier

## DHCP Operation (Renewing-State / Explicit Server-ID Option)



# Explicit Server-Identifier

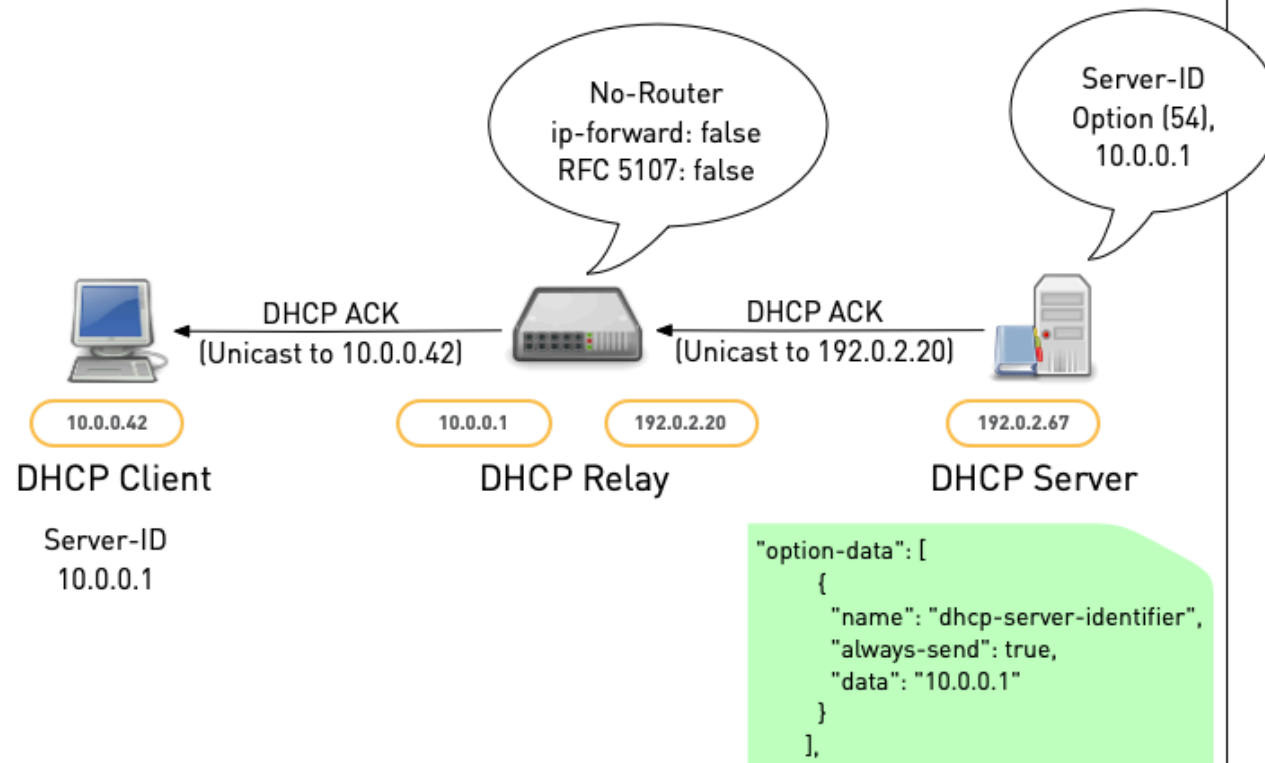
## DHCP Operation (Renewing-State / Explicit Server-ID Option)





# Explicit Server-Identifier

## DHCP Operation (Renewing-State / Explicit Server-ID Option)



# Open Source DHCP-Relay- Agent Software

# ISC dhcp-relay

- DHCP snooping: YES
- DHCP Server Identifier Override Suboption: NO
- Note: End of life
- URL: <https://www.isc.org/dhcp/>

# DHCP-Helper

- DHCP snooping: NO
- DHCP Server Identifier Override Suboption: NO
- URL: <https://launchpad.net/ubuntu/+source/dhcp-helper>

# dhcp-relay

- DHCP snooping: YES
- DHCP Server Identifier Override Suboption: ??
- Note: supports resolving the DHCP server via DNS for each request
- Note: opinionated Golang implementation
- URL: <https://github.com/Mirantis/dhcp-relay>

# dhcp-fwd (DHCP-Forwarder)

- DHCP snooping: NO
- DHCP Server Identifier Override Suboption: NO
- Note: quite powerful
- Note: last release 2014
- URL: <https://www.nongnu.org/dhcp-fwd/>

# dnsmasq

- DHCP snooping: NO
- DHCP Server Identifier Override Suboption: (dhcp-proxy ??)
- URL: <https://dnsmasq.org/doc.html>

# References



# Internet Standards

- RFC 2131 <https://www.rfc-editor.org/rfc/rfc2131>
- RFC 5107 <https://www.rfc-editor.org/rfc/rfc5107>
- RFC 8357 <https://www.rfc-editor.org/rfc/rfc8357>

# Commercial Implementations

- Cisco DHCP Proxy
- Juniper DHCP Relay Proxy

# Misc

- ISC Requirements for a DHCP Relay
- DHCP L2 RELAY Application
- dhcp-relay (replacement for ISC dhcrelay in OpenBSD)
- Westermo DHCP Relay Agent with Option 82 support
- SONiC DHCP relay