

NETWORKING BASICS

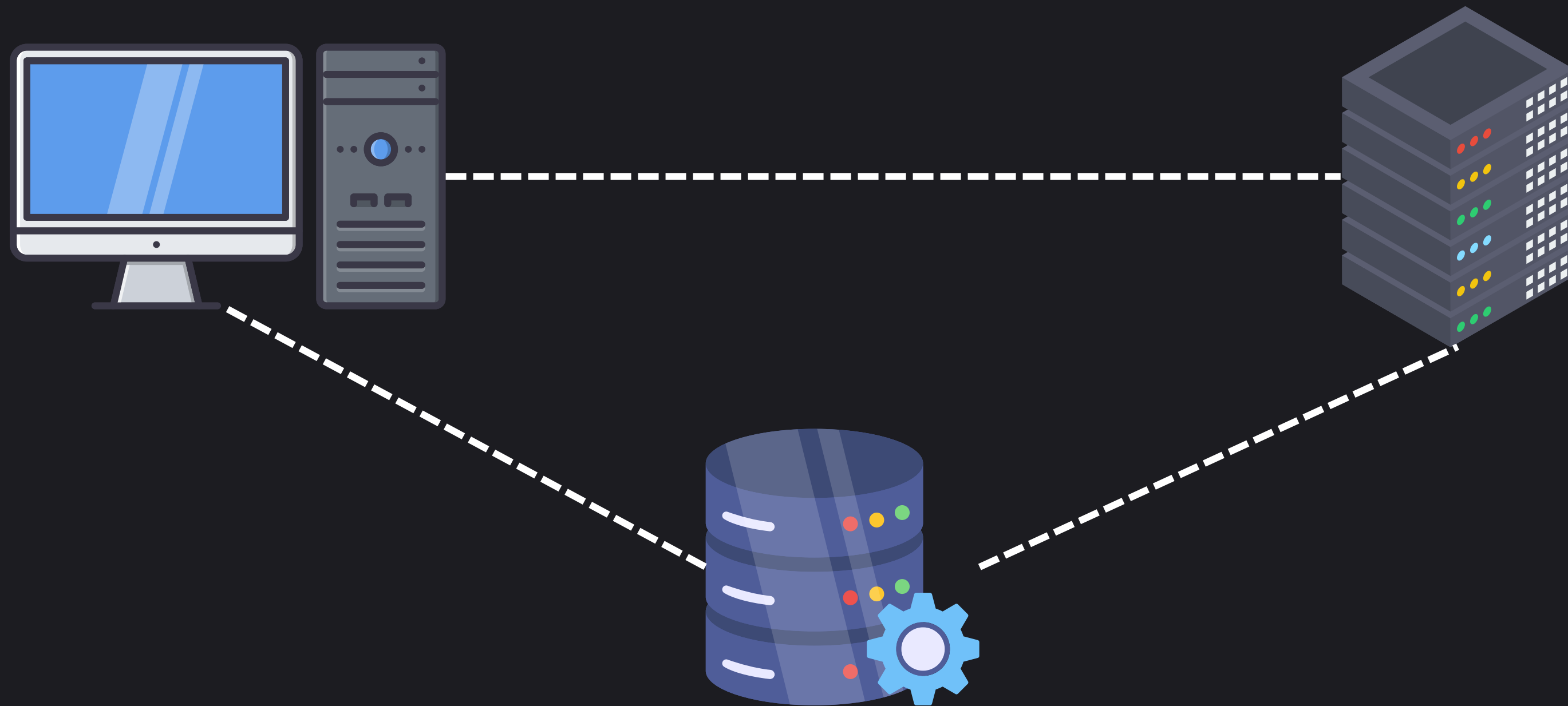
ESSENTIAL NETWORKING BASICS

| Layer | Details |
|----------------------|--|
| Application Layer | HTTP FTP, SMTP DNS Ports (80, 21, 25) |
| | Application Data |
| Transport Layer | TCP (Reliable, Sequence Numbers, Acknowledgments) UDP (Faster, Unreliable) |
| Internet Layer | IP (IPv4/IPv6) IP Addresses (Public/Private, Static/Dynamic) Routing, IP Header ICMP |
| Link (Network) Layer | Ethernet MAC Address Switches |
| Physical Hardware | Computers Routers Firewalls LANs |

NETWORKING BASICS



NETWORKING BASICS



IP ADDRESS



IP ADDRESS

192.168.1.1



172.16.254.1



IP ADDRESS

192.168.1.1



172.16.254.1



IPv4 - 32-bit

IP ADDRESS

192.168.1.1



172.16.254.1



IPv4 - 32-bit -> 4B

IP ADDRESS

192.168.1.1



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IPv4 - 32-bit -> 4B

IPv6 - 128-bit

IP ADDRESS

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IPv4 - 32-bit -> 4B

IPv6 - 128-bit -> 340T

192.168.1.1



172.16.254.1



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172.16.254.1



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172.16.254.1



192.168.1.1



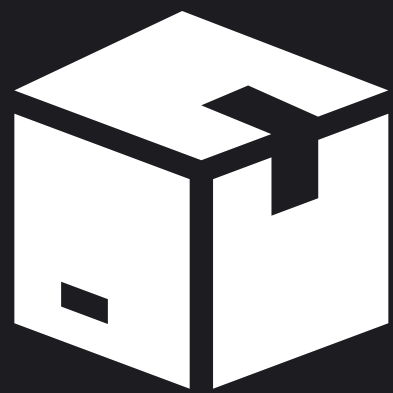
172.16.254.1



192.168.1.1



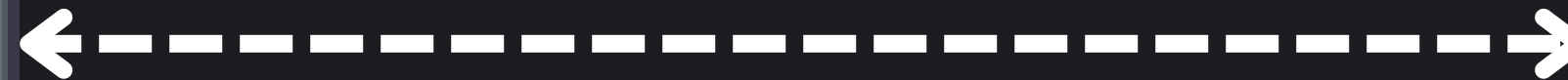
172.16.254.1



192.168.1.1



172.16.254.1



IP HEADER

Version: 4

IHL: 5 (indicating a 20-byte header)

Total Length: 100 bytes (Header + Data)

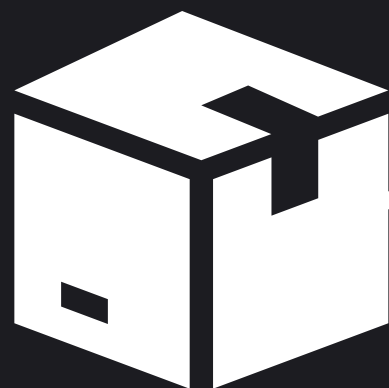
Time to Live: 64

Protocol: 6 (TCP)

Header Checksum: 0x8A2E

Source IP Address: 192.168.1.1

Destination IP Address: 172.16.254.1



192.168.1.1

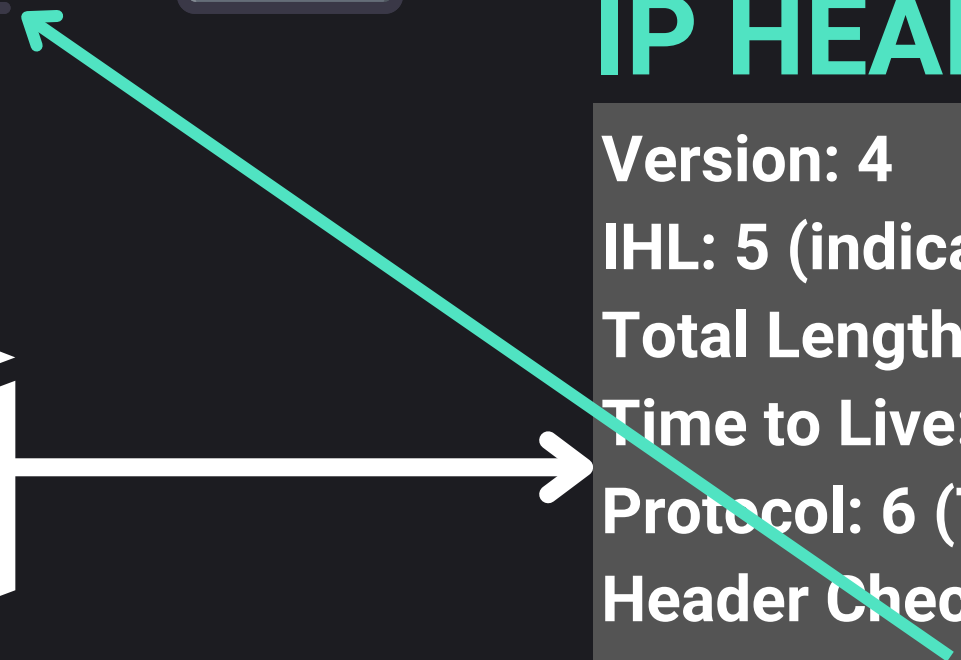


172.16.254.1



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INTERNET PROTOCOL (IP)

192.168.1.1

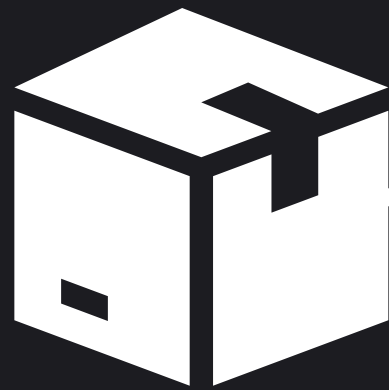


172.16.254.1



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INTERNET PROTOCOL (IP)

set of rules that defines how data is sent and received

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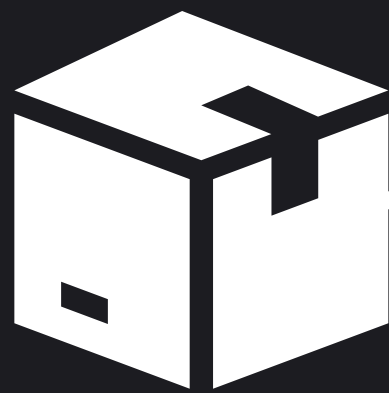


172.16.254.1



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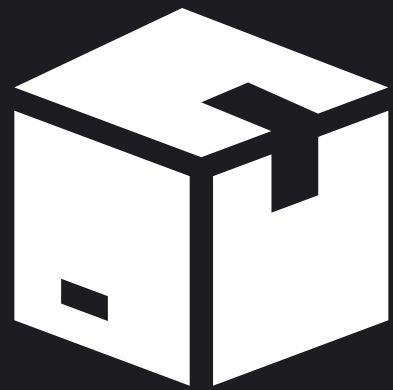


APPLICATION LAYER

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APPLICATION LAYER

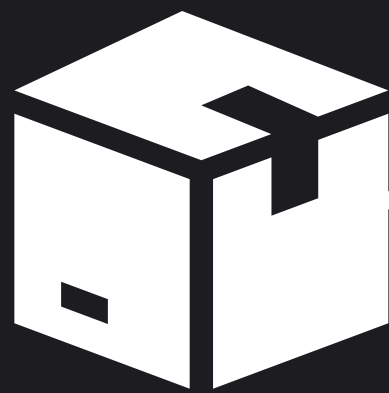
192.168.1.1



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APPLICATION LAYER (HTTP DATA)



```
HTTP Method: GET
URI: /example-page.html
Host: www.example.com
User-Agent: Mozilla/5.0 (Windows ...)
Accept-Language: en-US,en;q=0.9
```

TRANSPORT LAYER

• **Transport layer** is responsible for moving data from one process to another process on the same host or from one host to another host.

• It is responsible for **multiplexing** and **demultiplexing** of data.

• It is responsible for **error detection** and **error correction**.

• It is responsible for **flow control** and **congestion control**.

• It is responsible for **data segmentation** and **data reassembly**.

• It is responsible for **data encryption** and **data decryption**.

• It is responsible for **data compression** and **data decompression**.

• It is responsible for **data scheduling** and **data prioritization**.

• It is responsible for **data buffering** and **data queuing**.

TRANSPORT LAYER



```
graph TD; A[TRANSPORT LAYER] --> B[TCP]; A --> C[UDP];
```

TCP

(Transmission Control Protocol)

UDP

(User Datagram Protocol)

TCP

(TRANSMISSION CONTROL PROTOCOL)

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TCP

(TRANSMISSION CONTROL PROTOCOL)

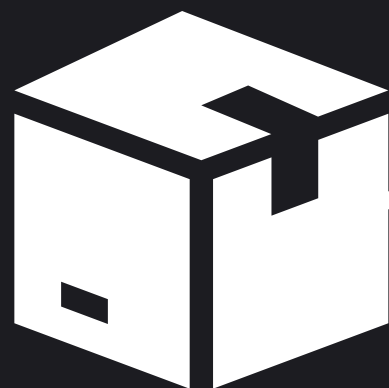
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TCP HEADER

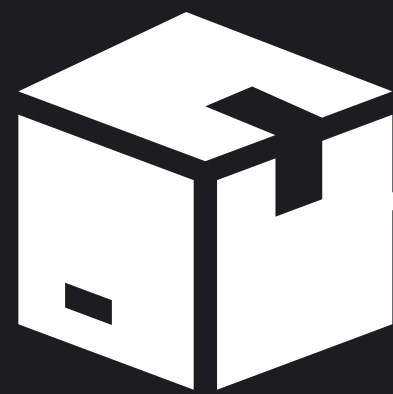


Source Port: 53728
Destination Port: 80
Sequence Number: 123456789
Acknowledgment Number: 987654321
Flags: 0x18 (ACK, PSH)
Checksum: 0x1A2B

TCP



TCP HEADER



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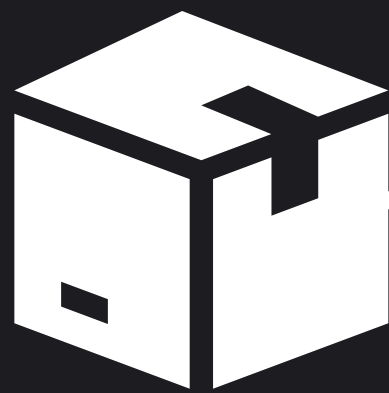
TCP



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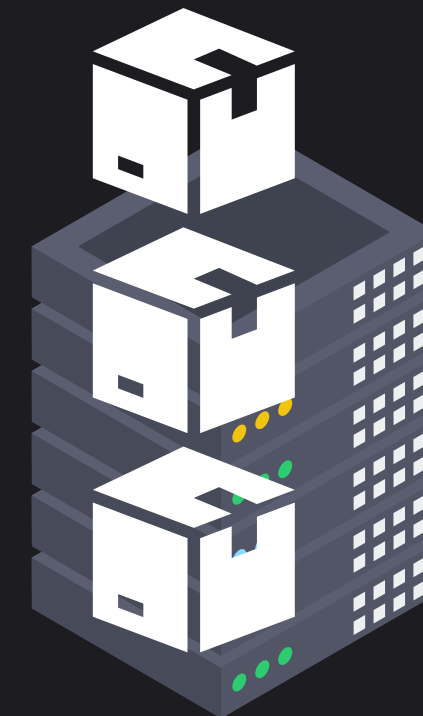
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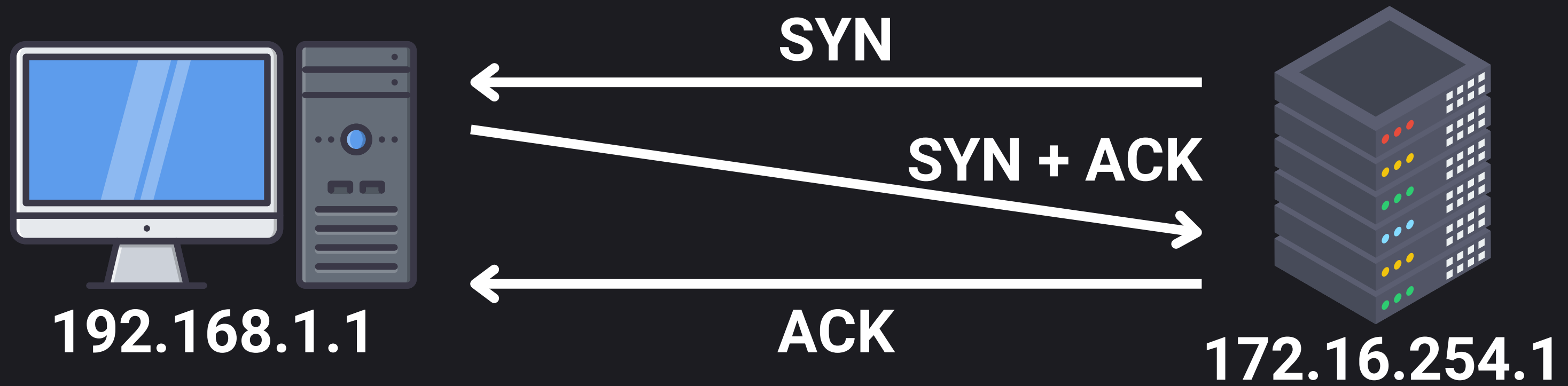
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TCP



3-way handshake

UDP

(USER DATAGRAM PROTOCOL)



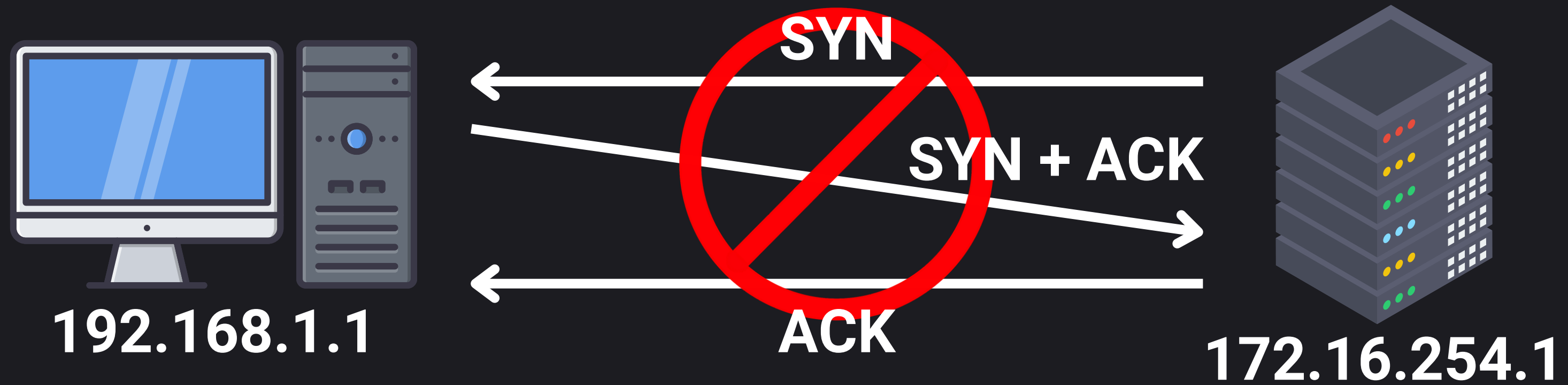
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UDP

(USER DATAGRAM PROTOCOL)



UDP

(USER DATAGRAM PROTOCOL)



192.168.1.1



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UDP

(USER DATAGRAM PROTOCOL)



192.168.1.1



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UDP

(USER DATAGRAM PROTOCOL)



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● LIVE



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192.168.1.1



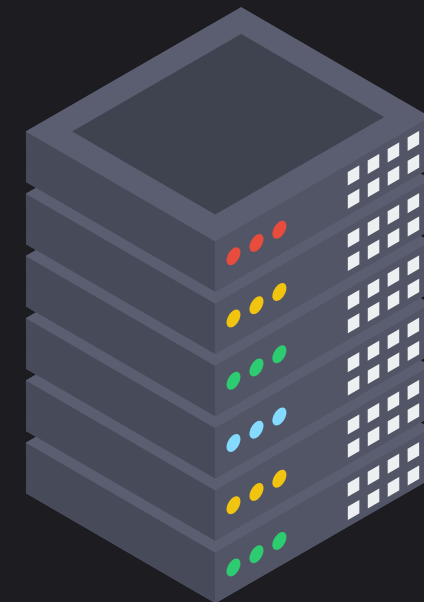
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DNS

(DOMAIN NAME SYSTEM)



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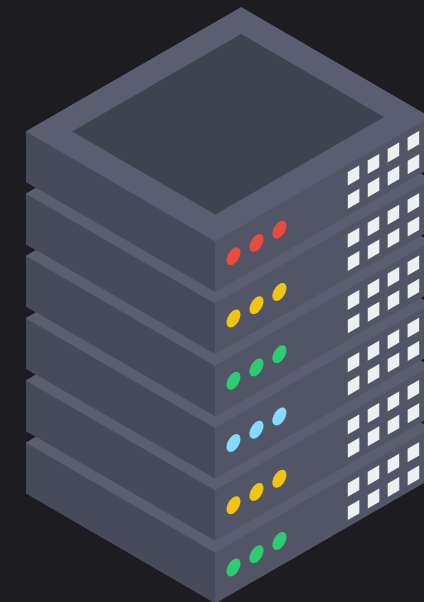
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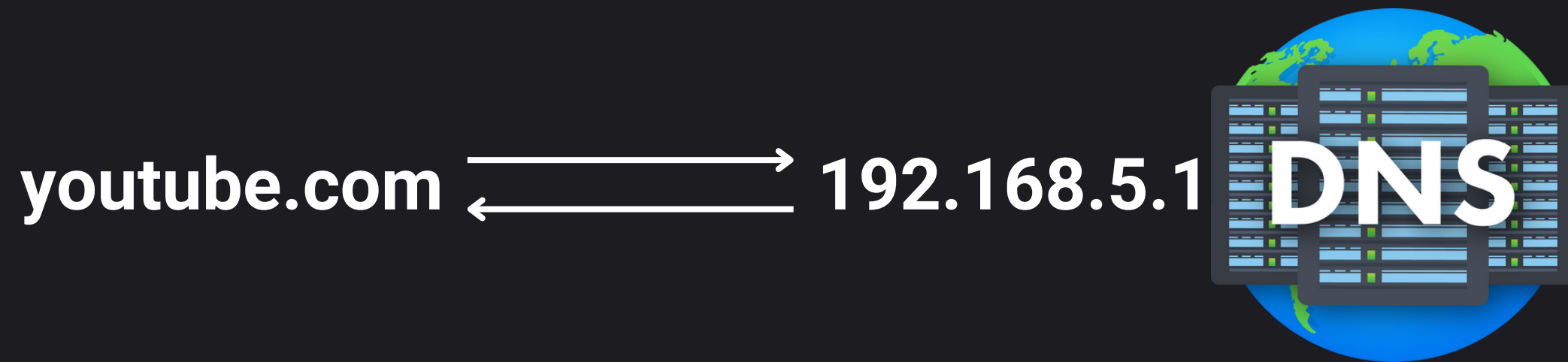
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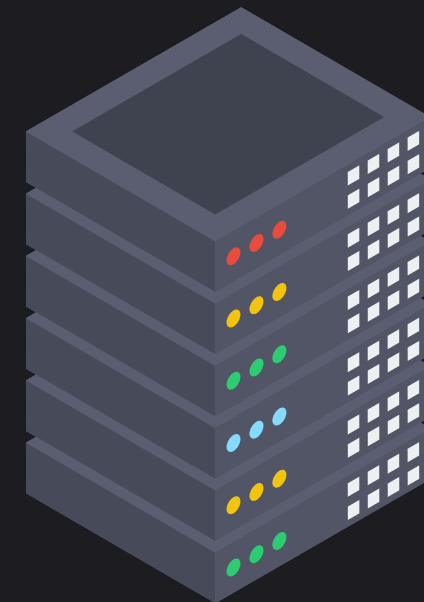
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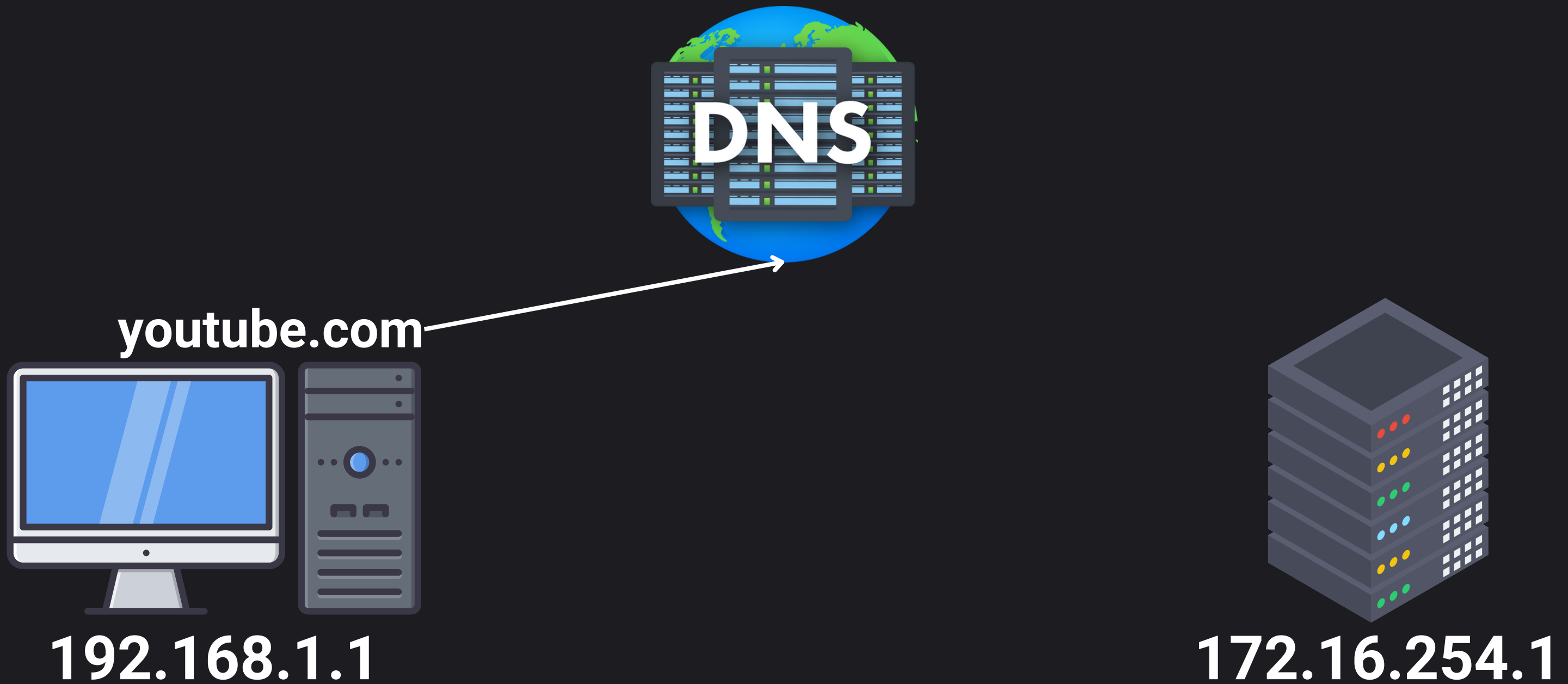
192.168.1.1



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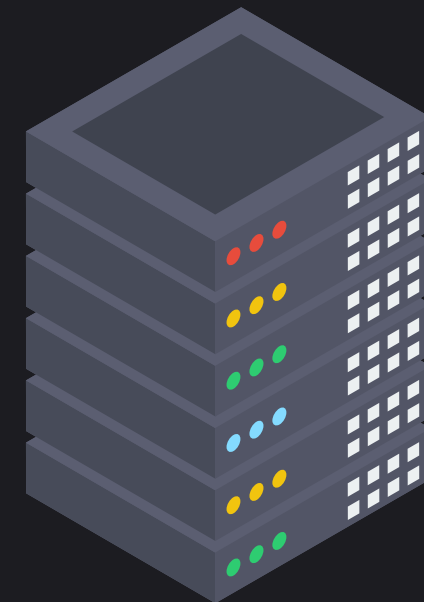


DNS -> ICANN

(INTERNET CORPORATION FOR ASSIGNED NAMES AND NUMBERS)



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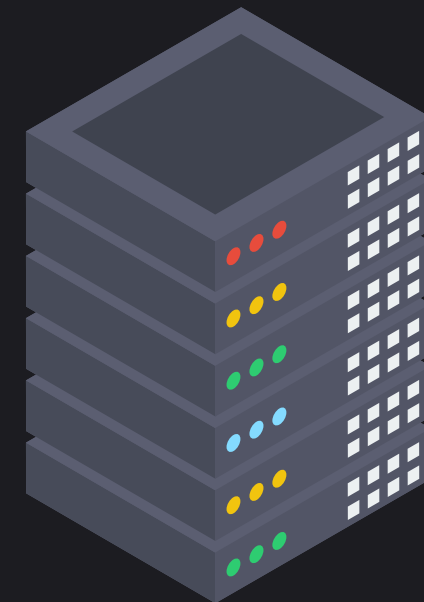


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A Record: Maps a domain name to an IPv4 address



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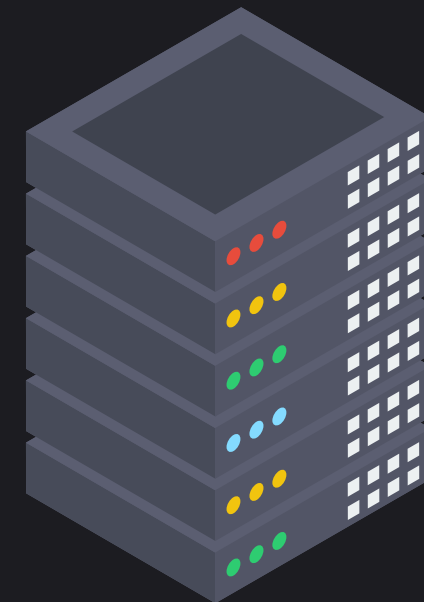
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AAAA Record: Maps a domain name to an IPv6 address

A Record: Maps a domain name to an IPv4 address



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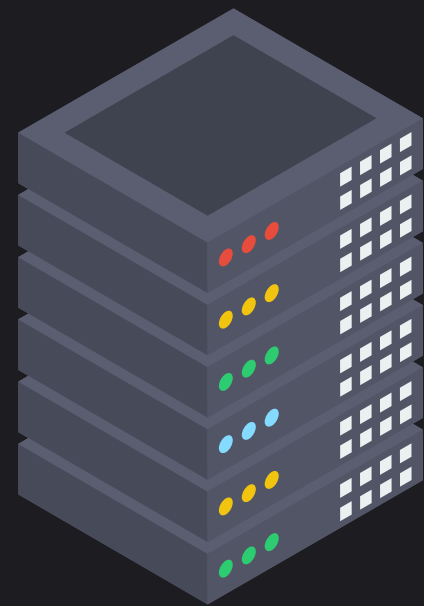


172.16.254.1

NETWORKING INFRASTRUCTURE



NETWORKING INFRASTRUCTURE



Public IP address 172.16.254.1

Private IP address  172.16.254.1

NETWORKING INFRASTRUCTURE



Static IP address

172.16.254.1



Dynamic IP address

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192.168.1.1

NETWORKING INFRASTRUCTURE

Local Area Network (LAN)



NETWORKING INFRASTRUCTURE

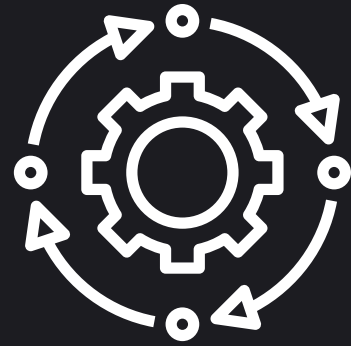
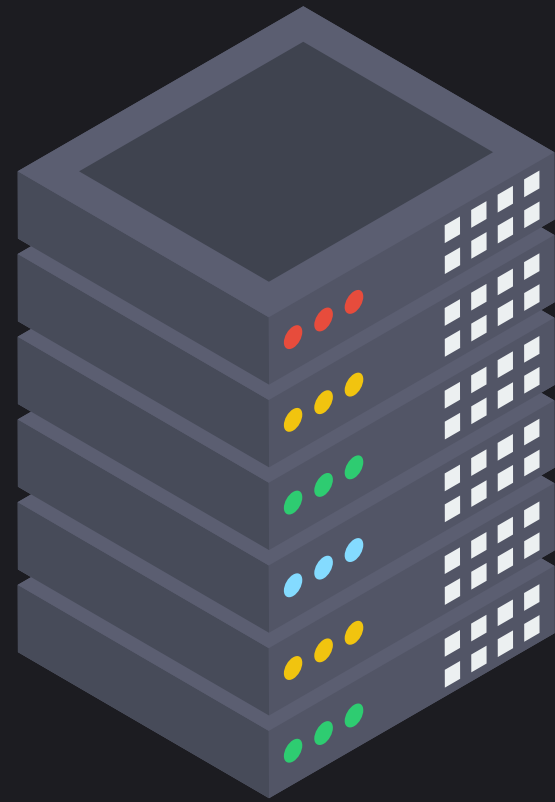
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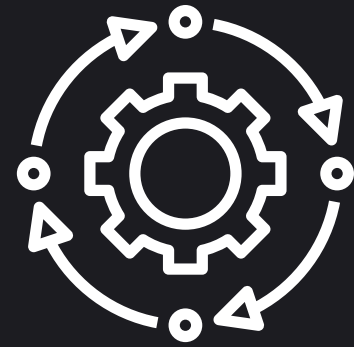
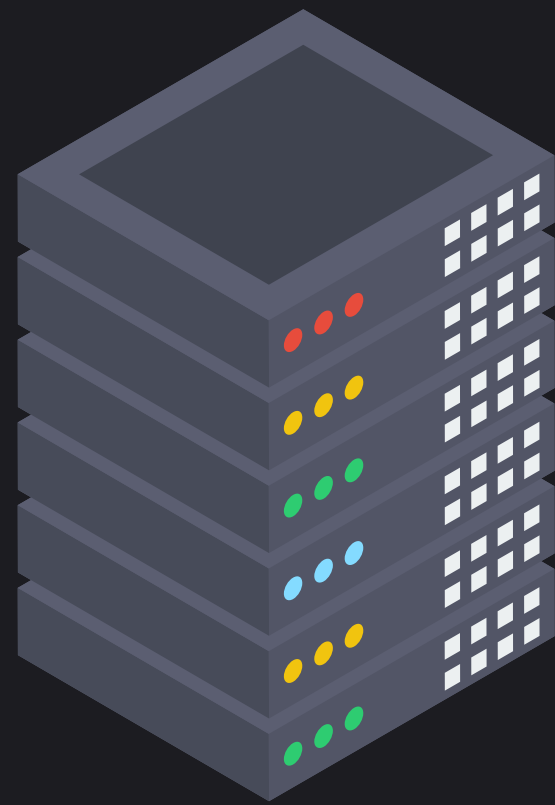
Firewall

monitoring and controlling
incoming and outgoing network
traffic based on security policies

NETWORKING INFRASTRUCTURE



NETWORKING INFRASTRUCTURE



PORTS

HTTP - 80

HTTPS - 443

SSH - 22

MYSQL - 3306

SIMPLIFIED LAYER DIAGRAM

| | |
|--------------------------|--|
| Application Layer | <ul style="list-style-type: none">• HTTP, FTP, SMTP• DNS• Ports (80, 21, 25)• Application Data |
| Transport Layer | <ul style="list-style-type: none">• TCP (Reliable, 3-way Handshake) (Sequence Numbers, Acknowledgments)• UDP (Faster, Unreliable) |
| Internet Layer | <ul style="list-style-type: none">• IP (IPv4/IPv6)• IP Address (Public/Private, Static/Dynamic)• (Routing, IP Header) |
| Link (Network) | Ethernet MAC Address Switches |
| Physical Hardware | Computers, Routers, Firewalls, LANs |