

# DAY 13 - Subnetting

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## Subnetting

### Topics:

1. **CIDR** (Classless Inter-Domain Routing)
  2. **Subnetting**
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### IPv4 Classes

Class	First Octet	First Octet Range	Prefix
<b>A</b>	<b>0xxxxxxx</b>	0 - 127	/8
<b>B</b>	<b>10xxxxxx</b>	128 - 191	/16
<b>C</b>	<b>110xxxxx</b>	192 - 223	/24
<b>D</b>	<b>1110xxxx</b>	224 - 239	-
<b>E</b>	<b>1111xxxx</b>	240 - 255	-

**Remember:** Only **Class A**, **B**, **C** IP addresses can be assigned as a device's address.

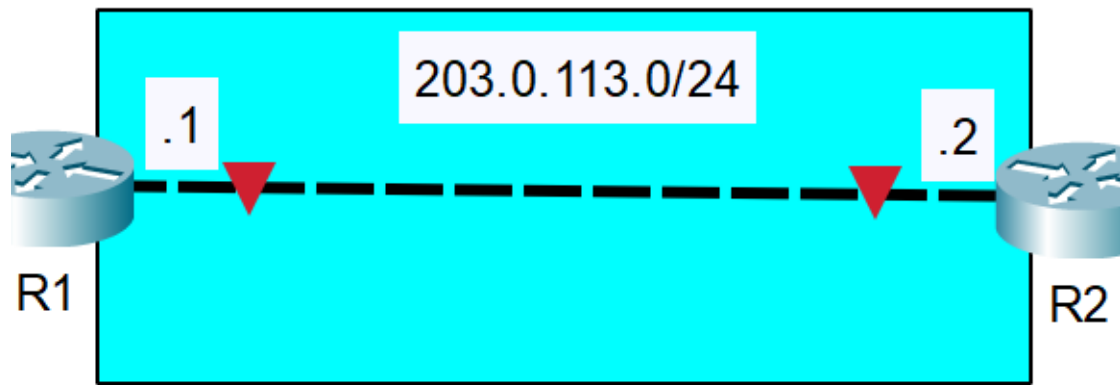
### Who Assigned IP Classes?

The **IANA** (**I**nternet **A**ssigned **N**umbers **A**uthority) assigns IPv4 addresses/networks to companies based on their size.

For example, a very large company might receive a **Class A** or **Class B** network, while a small company might receive a **Class C** network.

However, this led to *many wasted* IP addresses.

## IP Wasting



- **203.0.113.0/24** Class C Network:
  - **203.0.113.0** = Network ID
  - **203.0.113.255** = Broadcast IP
  - **203.0.113.1** = R1
  - **203.0.113.2** = R2
  - 252 out of 256 IP wasted!

To fix IP wasting, **IETF** (**I**nternet **E**ngineering **T**ask **F**orce) introduced **CIDR** in 1993 to replace the "classful" addressing system.

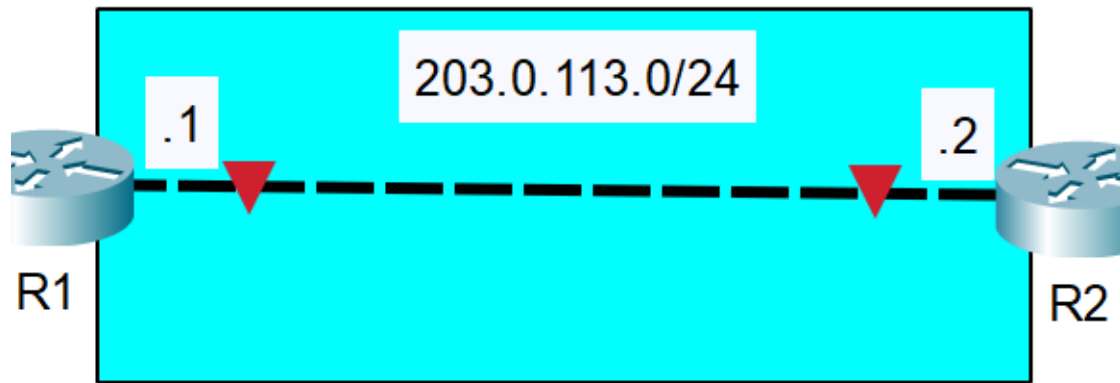
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## CIDR

- With **CIDR**, the requirements of
  - Class A = **/8**
  - Class B = **/16**
  - Class C = **/24**
  - were *removed*.
- This allowed larger networks to be split into smaller networks.
- These smaller networks are called **Subnetworks** or **Subnets**.

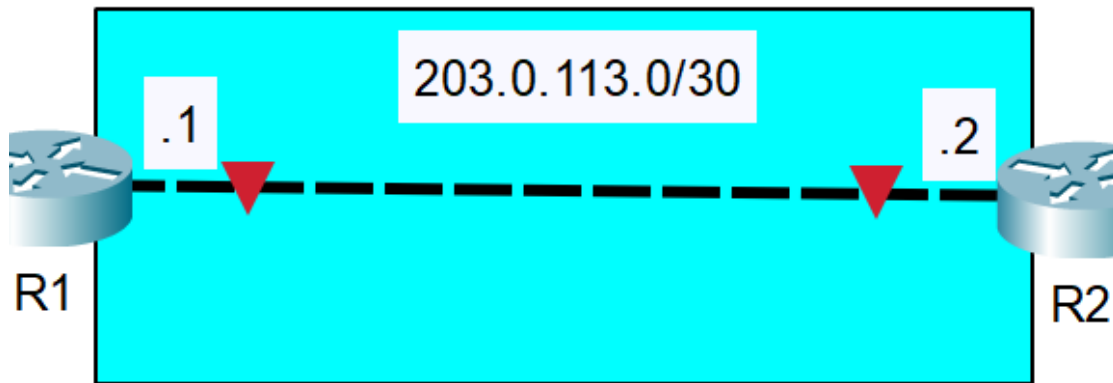
## CIDR Example:

From the previous example:



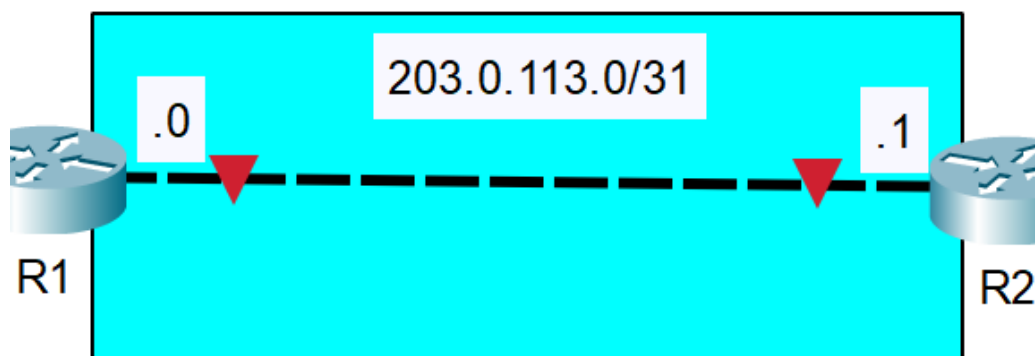
- Originally (/24):
  - Address: 11001011.00000000.01110001 . 00000000
  - Mask: 11111111.11111111.11111111 . 00000000
  - Gives 256 - 2 Hosts
    - \* 252 IP Wasted
- Changing/Borrowing 1 bit (/25):
  - Address: 11111111.11111111.11111111 .0 0000000
  - Mask: 11111111.11111111.11111111 .1 0000000 (128)
  - Gives 128 - 2 Hosts = 126 Hosts
    - \* 124 IP Wasted (Used 2 for R1 & R2 IP addresses)
- Changing/Borrowing 2 bits (/26):
  - Address: 11111111.11111111.11111111 .00 000000
  - Mask: 11111111.11111111.11111111 .11 000000 (192)
  - Gives 64 - 2 Hosts
    - \* 60 IP Wasted
- Changing/Borrowing 3 bits (/27):
  - Address: 11111111.11111111.11111111 .000 00000
  - Mask: 11111111.11111111.11111111 .111 00000 (224)
  - Gives 32 - 2 Hosts
    - \* 28 IP Wasted
- Changing/Borrowing 4 bits (/28):
  - Address: 11111111.11111111.11111111 .0000 0000
  - Mask: 11111111.11111111.11111111 .1111 0000 (240)
  - Gives 16 - 2 Hosts
    - \* 12 IP Wasted
- Changing/Borrowing 5 bits (/29):
  - Address: 11111111.11111111.11111111 .00000 000
  - Mask: 11111111.11111111.11111111 .11111 000 (248)

- Gives 8 - 2 Hosts
  - \* 4 IP Wasted
- **Changing/Borrowing 6 bits (/30):**
  - Address: 11111111.11111111.11111111 .000000 00
  - Mask: 11111111.11111111.11111111 .111111 00 (252)
  - Gives 4 - 2 Hosts = 2 Usable addresses.
    - \* 0 IP Wasted (Both are used for R1 and R2)



#### CIDR: /31 Mask

- Address: 11111111.11111111.11111111 .00000000 0
- Mask: 11111111.11111111.11111111 .11111111 0 (254)
- Gives 2 - 2 Hosts = 0 Usable addresses *but*.
  - Why use this?
  - **For *Point-to-Point* Connection**
    - \* Normally we'd need 2 for network address and broadcast address.
    - \* But for **Point-to-Point** communication, there isn't a need for network address or broadcast address.
    - \* e.g. 2 routers connection



#### CIDR /32 Mask

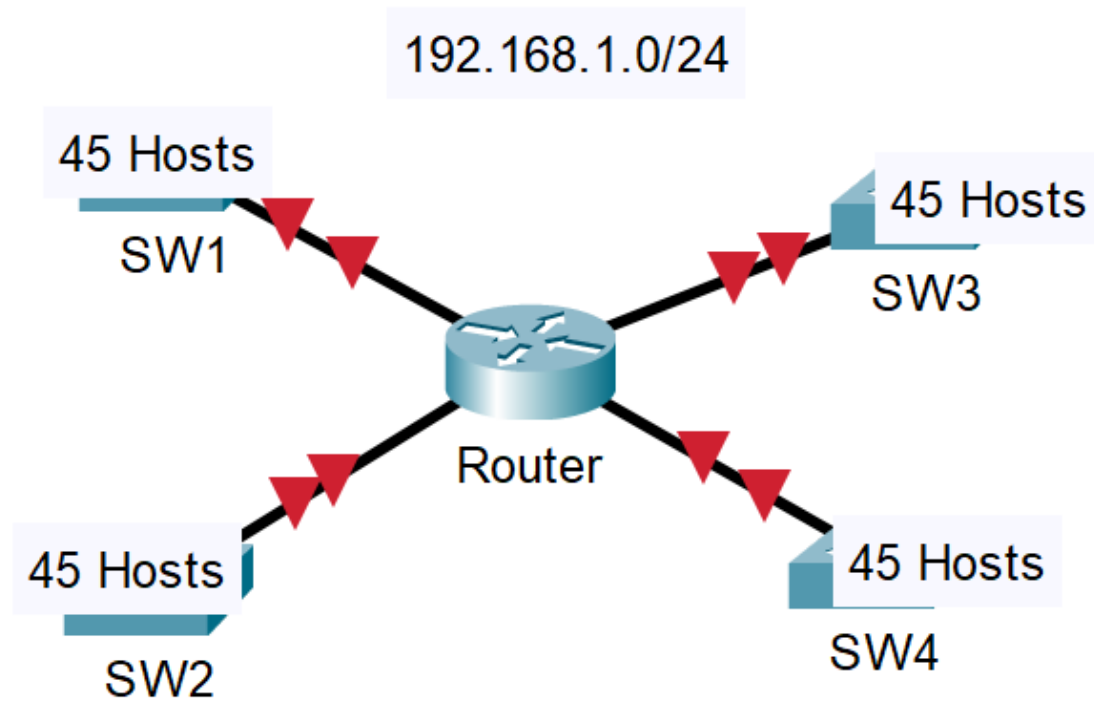
- Address: 11111111.11111111.11111111 .00000000

- Mask: 11111111.11111111.11111111 .11111111 (255)
- Gives  $1 - 2 = -1$  Usable Hosts???
- Why use this?
- For **Static Route** and some other uses.

## CIDR Notation Conversion

Dotted Decimal	CIDR Notation
255.255.255.128	/25
255.255.255.192	/26
255.255.255.224	/27
255.255.255.240	/28
255.255.255.248	/29
255.255.255.252	/30
255.255.255.254	/31
255.255.255.255	/32

## Subnetting Problems:



Divide the 192.168.1.0/24 network into four subnets.

### My Attempt:

- Original (/24):

- Addresses: 11000000.10101000.00000001.00000000
- Mask: 11111111.11111111.11111111.00000000
- Hosts:  $256 - 2 = 254$

- Borrow 2 (/26):

- Addresses: 11000000.10101000.00000001 .00 000000
- Mask: 11111111.11111111.11111111. 11 000000
- Hosts:  $64 - 2 = 62$  Hosts

- \* Note the **bold IP block**

- \* **SW1:**

- 00 part:
- 192.168.1.0/26
- Network Address: 192.168.1.0
- Broadcast Address: 192.168.1.63
- Last Host: 192.168.1.62
- First Host: 192.168.1.1
- Usable: **62 IP**

- \* **SW2:**

- 01 part:

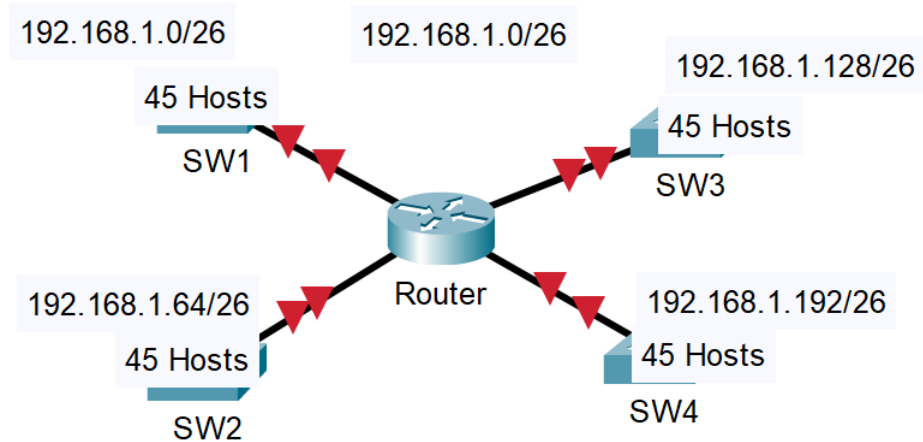
- 192.168.1.64/26
- Network Address: 192.168.1.64
- Broadcast Address: 192.168.1.127
- Last Host: 192.168.1.126
- First Host: 192.168.1.65
- Usable: **62 IP**

\* **SW3:**

- 10 part:
- 192.168.1.128/26
- Network Address: 192.168.1.128
- Broadcast Address: 192.168.1.191
- Last Host: 192.168.1.190
- First Host: 192.168.1.129
- Usable: **62 IP**

\* **SW4:**

- 11 part:
- 192.168.1.192/26
- Network Address: 192.168.1.192
- Broadcast Address: 192.168.1.255
- Last Host: 192.168.1.254
- First Host: 192.168.1.193
- Usable: **62 IP**



His Attempt:

