Developing a Python Tool to Validate IP Addresses, Determine Class, and Calculate Subnet Ranges

COMPUTER NETWORKS(Team C11)

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1. Project Overview

Aim

To create a Python-based tool that can:

1. Validate IPv4 and IPv6 addresses
2. Identify the IP class (A–E)
3. Calculate subnet ranges and broadcast addresses

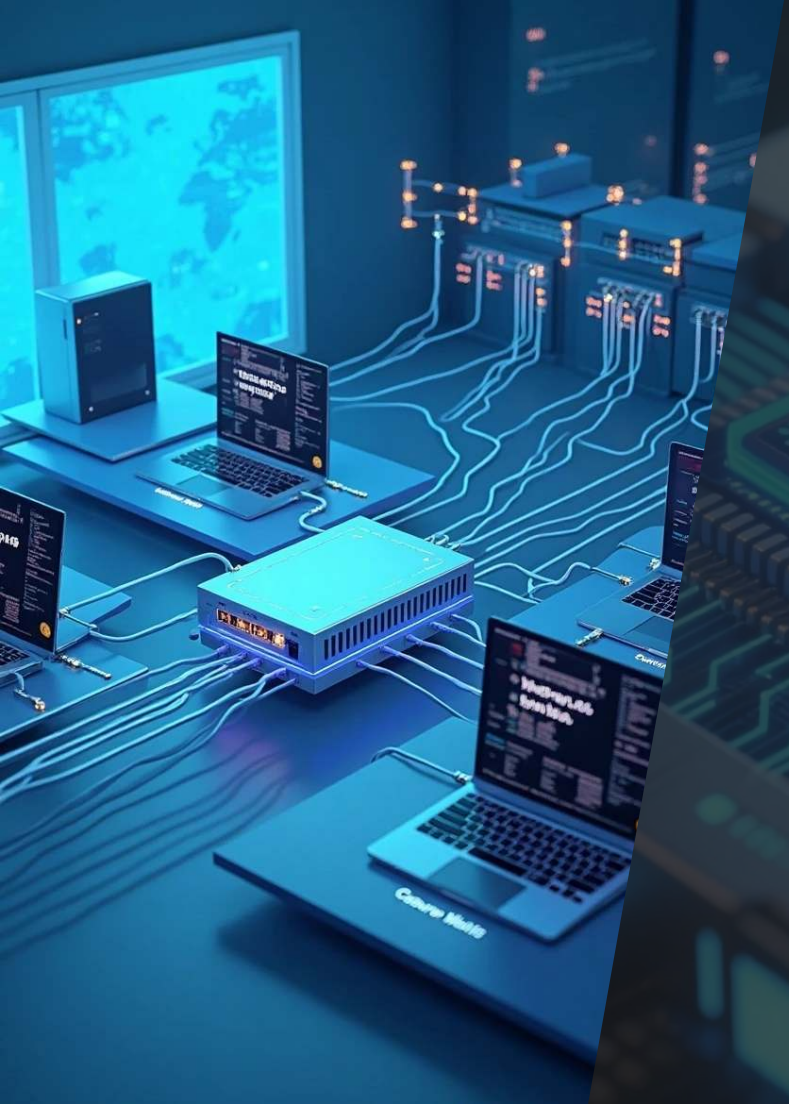
Motivation

Simplify manual network configuration tasks.

2. Objectives

Project Objectives

- Develop an automated IP validation tool
- Understand differences between IPv4 and IPv6
- Implement subnetting logic programmatically
- Provide user-friendly CLI or GUI output



3. Concepts Used

Core Networking & Python Concepts

1

Networking Concepts:

- IP address structure
- Subnet masks and network classes
- CIDR notation

2

Python Concepts:

- String handling and regex for validation
- ipaddress module (for subnet and class detection)
- Functions and exception handling

4. Understanding IP Addresses

What is an IP Address?

IPv4: 32-bit, written as 192.168.1.1

IPv6: 128-bit, written as 2001:0db8:85a3::7334

Uniquely identifies a device in a network.

Feature	IPv4	IPv6
Length	32-bit	128-bit
Format	Decimal (4 octets)	Hexadecimal (8 groups)
Example	192.168.0.1	2001:db8::1

5. IP Address Classes & Subnet Masks

IP Classes and Subnet Masks

Class	Range	Default Subnet Mask	Usage
A	1.0.0.0 – 126.255.255.255	255.0.0.0	Large networks
B	128.0.0.0 – 191.255.255.255	255.255.0.0	Medium networks
C	192.0.0.0 – 223.255.255.255	255.255.255.0	Small networks
D	224.0.0.0 – 239.255.255.255	N/A	Multicasting
E	240.0.0.0 – 255.255.255.255	N/A	Experimental

6. Python Tool Design & Workflow

Tool Design

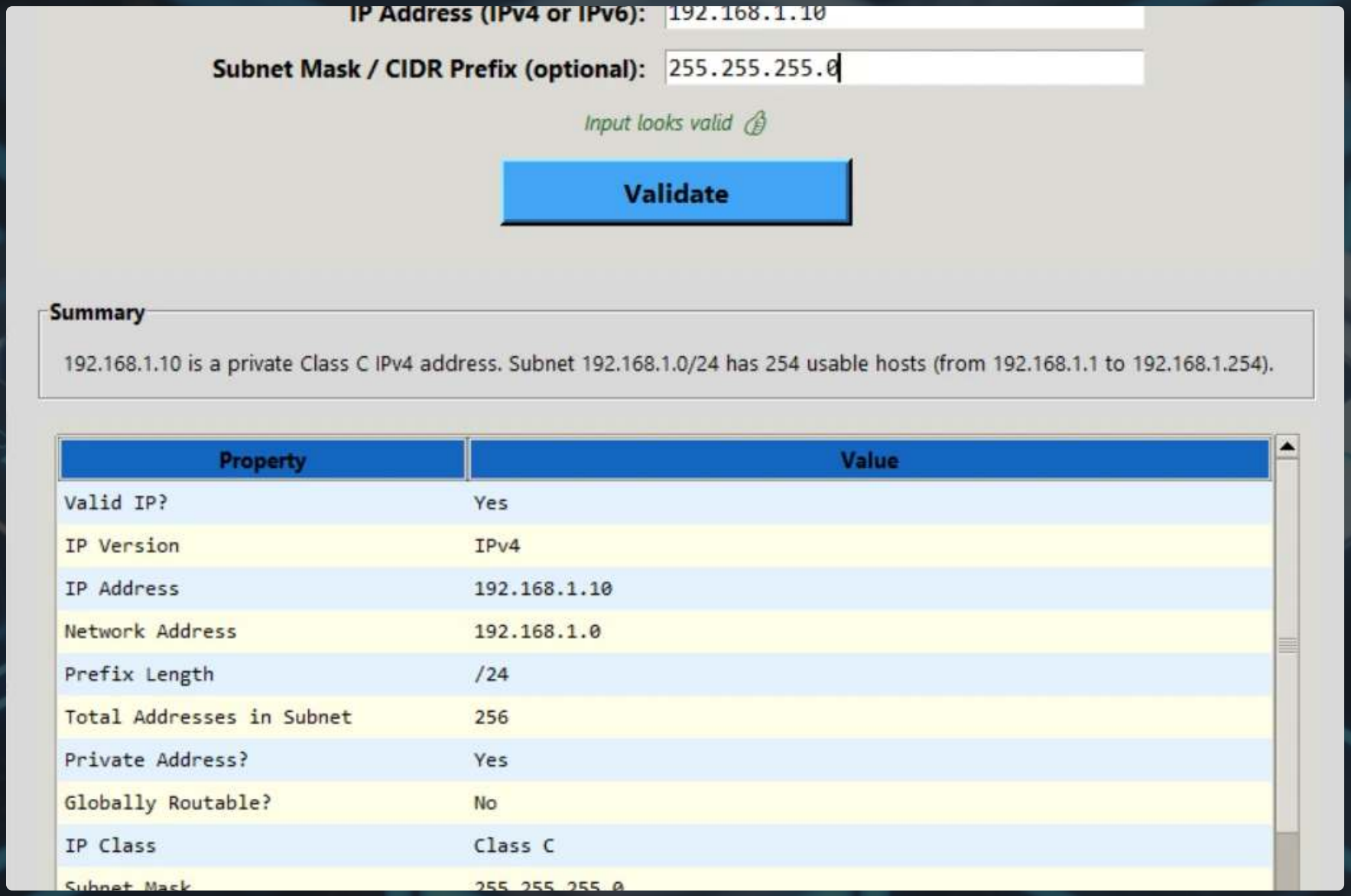
- Input: IP address (IPv4/IPv6)
- Validation: Regex or ipaddress.ip_address()
- Determine Class (if IPv4)
- Calculate Subnet and Broadcast (using ip_network())
- Output results

Tool Design

Sample Code Snippet:

```
import ipaddress  ip = input("Enter IP: ") try:     addr =
ipaddress.ip_address(ip)     print("Valid IP:", addr)     if addr.version == 4:
print("Class:", "A" if addr.is_private else "Public") except ValueError:
print("Invalid IP")
```

7.OUTPUT


IP Address (IPv4 or IPv6): 192.168.1.10
Subnet Mask / CIDR Prefix (optional): 255.255.255.0
Input looks valid
Validate
Summary
192.168.1.10 is a private Class C IPv4 address. Subnet 192.168.1.0/24 has 254 usable hosts (from 192.168.1.1 to 192.168.1.254).
Property
Value
Valid IP?
Yes
IP Version
IPv4
IP Address
192.168.1.10
Network Address
192.168.1.0
Prefix Length
/24
Total Addresses in Subnet
256
Private Address?
Yes
Globally Routable?
No
IP Class
Class C
Subnet Mask
255.255.255.0

IP Address (IPv4 or IPv6): 192.168.1.10

Subnet Mask / CIDR Prefix (optional): 255.255.255.0

Input looks valid

Validate

Summary

192.168.1.10 is a private Class C IPv4 address. Subnet 192.168.1.0/24 has 254 usable hosts (from 192.168.1.1 to 192.168.1.254).

Property	Value
Prefix Length	/24
Total Addresses in Subnet	256
Private Address?	Yes
Globally Routable?	No
IP Class	Class C
Subnet Mask	255.255.255.0
Wildcard Mask	0.0.0.255
Broadcast Address	192.168.1.255
First Usable Host	192.168.1.1

8.Difference Between IPv4 and IPv6

IPV4

Address length is 32-bit

Format is Decimal

Example :192.168.1.1

Total Address is ~4.3 Billion

Type is Dotted-decimal

Security :Optimal IPSec

Broadcast is Supported

NAT Required : Yes

Auto Config :DHCP/manual

IPV6

Address length is 128-Bit

Format is Hexadecimal

Example :2001:db8:85a3:8a2e:370:73334

Total Address is ~340 Undecillion

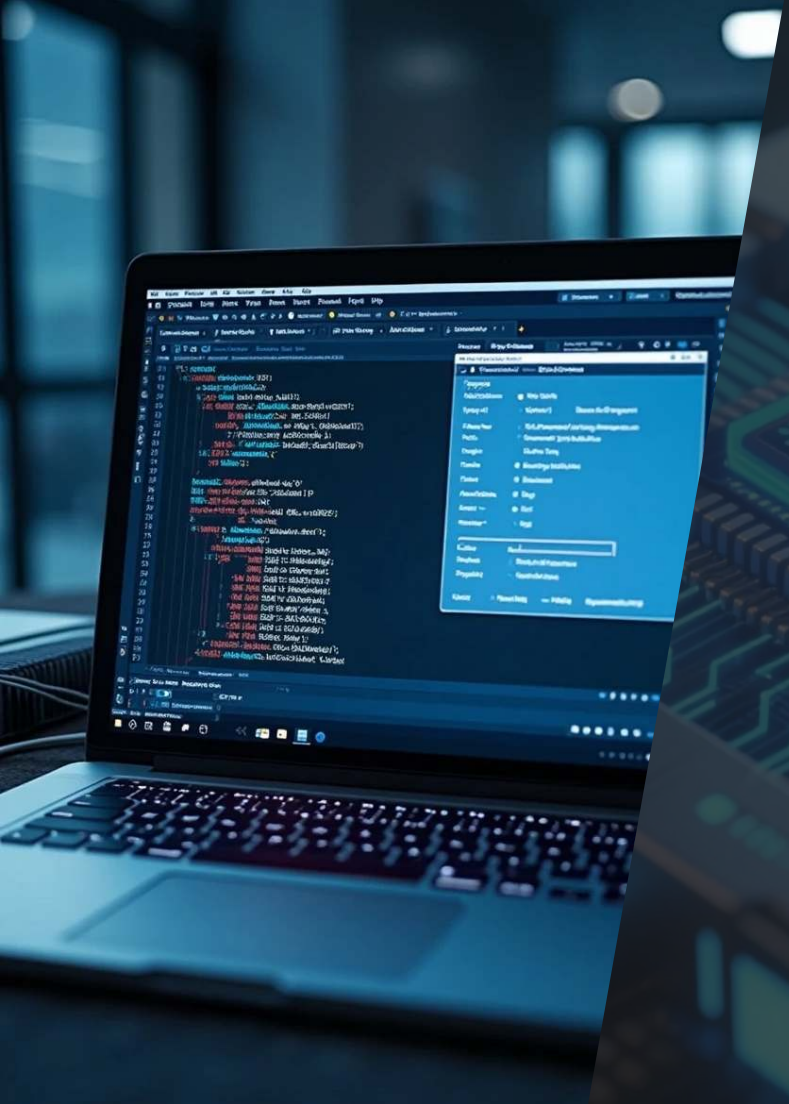
Type is Colon-Seperated

Security : IPSec Mandatory

Broadcast is Not Supported

NAT Required : No

Auto Config : SLAAC



9. Conclusion & Future Scope

Conclusion

- The tool simplifies IP validation and subnetting.
- Demonstrates real-world Python networking application.

Future Enhancements

- GUI-based interface
- Integration with database or network scanning tools


THANK YOU