

# 23ITT204 - COMPUTER NETWORK

## UNIT 3 - NETWORK LAYER

### IPV4

# Empathize

## IPv4: The Backbone of the Internet

Since its introduction in 1983 by DARPA, the Internet Protocol version has served as the foundation of global digital communication. This revolutionary protocol established the fundamental framework for how billions of devices identify themselves and exchange data across networks worldwide.

### 32-Bit Architecture

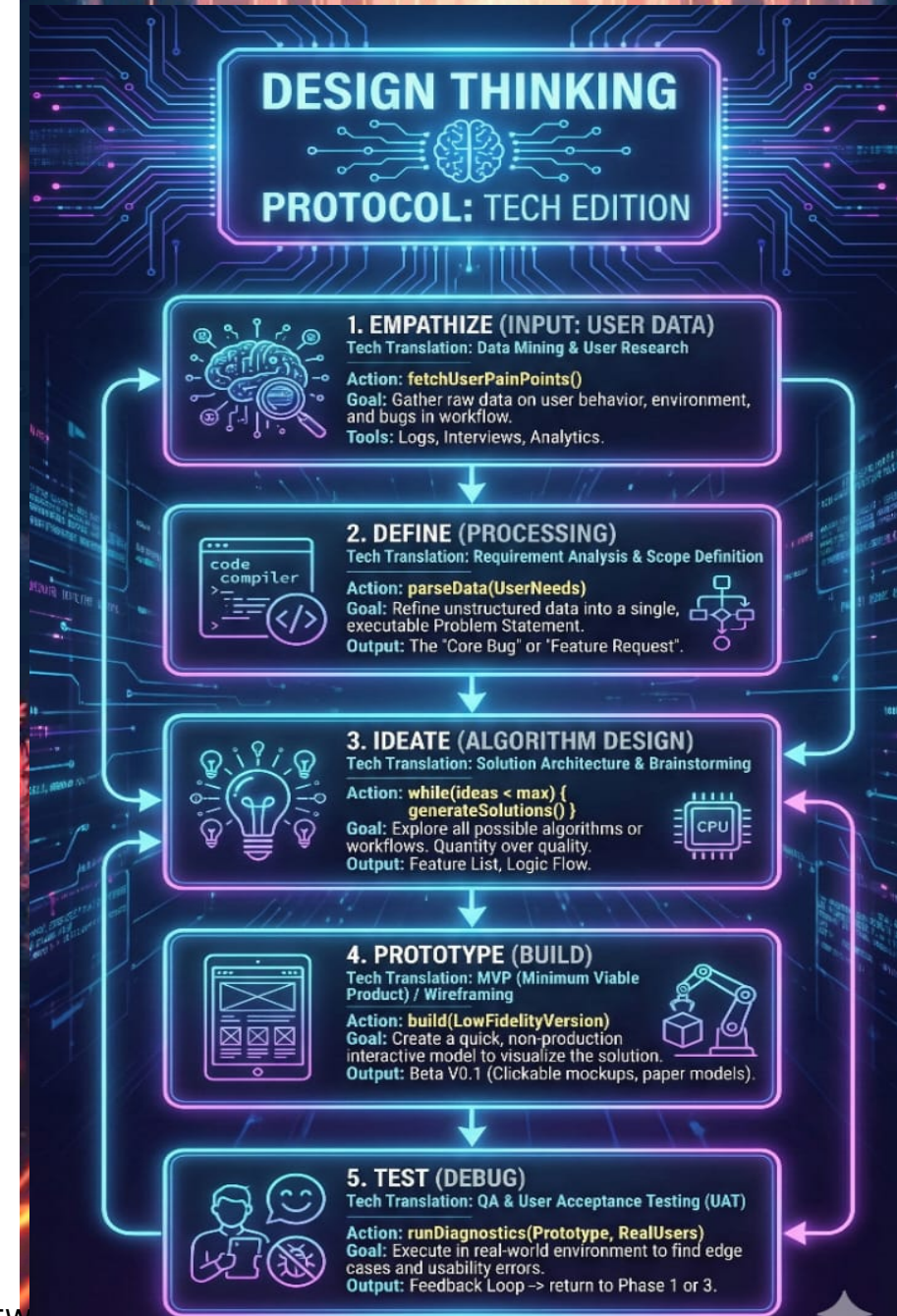
IPv4's elegant design uses 32-bit addresses, creating approximately 4.3 billion unique identifiers for connected devices.

### Universal Standard

Despite being over four decades old, IPv4 continues to route the vast majority of today's internet traffic globally.

### Routing Foundation

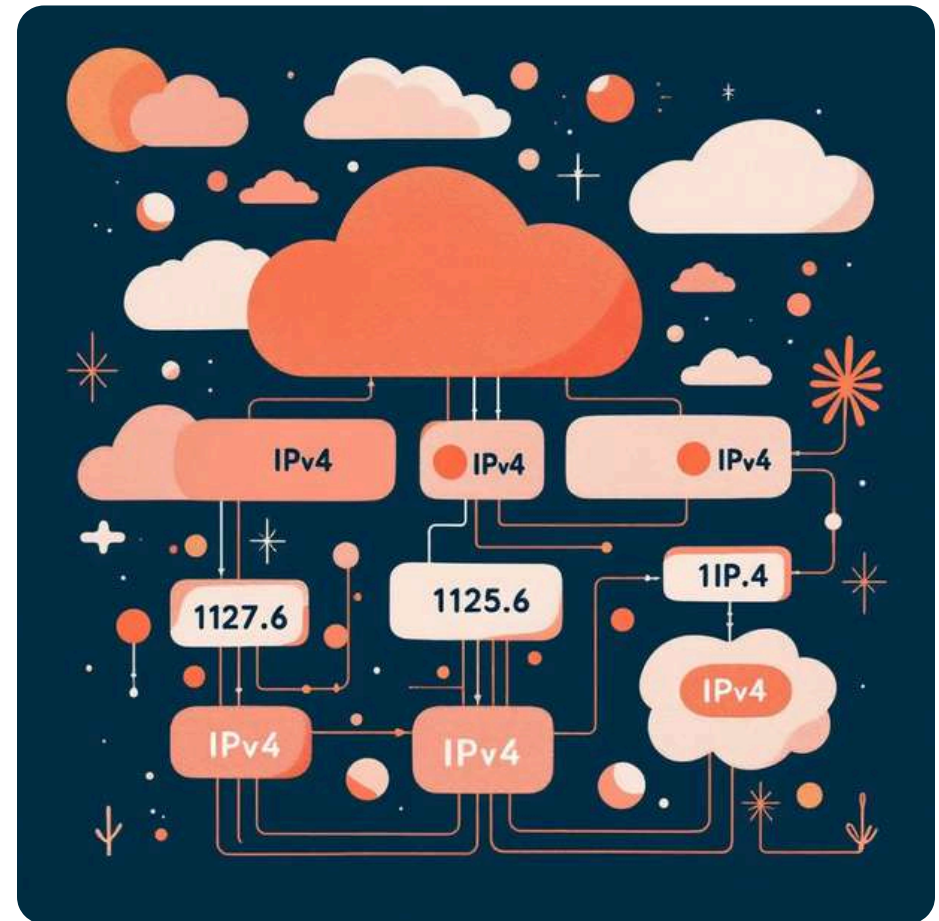
The protocol enables seamless data routing across complex networks, connecting devices from smartphones to servers.



# Understanding IPv4 Addressing

IPv4 addresses are 32-bit numbers elegantly displayed in dotted decimal notation, making them human-readable. Each address consists of four octets (8-bit segments) that range from 0 to 255, separated by periods, like the familiar 192.168.0.1.

The architecture divides addresses into two critical components: the network prefix, which identifies the broader network, and the host identifier, which pinpoints individual devices within that network. This dual structure enables efficient routing and precise device identification across the internet.



1

## Class A Networks

Large networks with 8-bit network prefix and 24-bit host identifier, supporting millions of devices per network.

2

## Class B Networks

Medium-sized networks using 16-bit network prefix and 16-bit host identifier, balancing network size and device capacity.

3

## Class C Networks

Smaller networks with 24-bit network prefix and 8-bit host identifier, ideal for organizations with fewer devices.

# The IPv4 Address Exhaustion Crisis

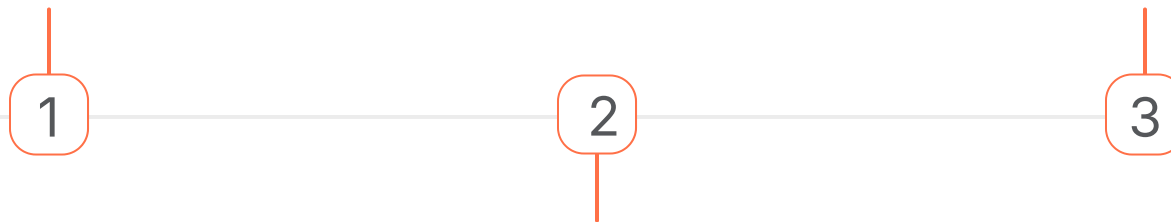
The internet's explosive growth has created an unprecedented challenge: IPv4's approximate 4.3 billion addresses simply cannot accommodate the tens of billions of smartphones, computers, IoT devices, and servers now demanding connectivity worldwide.

## 2011: IANA Depletion

The Internet Assigned Numbers Authority exhausted its free IPv4 address pool, marking a critical milestone.

## Today: NAT Solutions

Network Address Translation enables multiple devices to share single public IPs, extending IPv4's lifespan.



## 2011-2020: Regional Exhaustion

Regional Internet registries across continents depleted their allocations, intensifying the address scarcity.

## The Numbers Crisis

With global internet users exceeding 5 billion and IoT devices multiplying exponentially, the 4.3 billion address limit has become a critical bottleneck for continued internet expansion.

## Temporary Solutions

NAT technology allows private networks to share public addresses, but this workaround adds complexity and can't solve the fundamental shortage driving IPv6 adoption.

# The Future Beyond IPv4: Transition to IPv6

# 128

## Bit Address Space

IPv6's revolutionary architecture exponentially expands addressing capacity beyond IPv4's limitations.

# 340T

## Unique Addresses

That's 340 undecillion ( $3.4 \times 10^{30}$ ) addresses enough for every device imaginable for centuries.

IPv6 represents more than just additional addresses. The protocol introduces enhanced routing efficiency, built-in security features through IPsec, and simplified network configuration through auto-configuration capabilities. These improvements address fundamental limitations that have challenged IPv4 networks for years.



### Dual-Stack Operation

Networks run IPv4 and IPv6 simultaneously during the transition period.



### Coexistence Required

Legacy infrastructure ensures IPv4 remains essential for years ahead.



### Foundational Knowledge

IPv4 expertise remains critical for network professionals today and tomorrow.

**Key Takeaway:** While IPv6 adoption accelerates globally, IPv4 fundamentals remain indispensable knowledge for anyone working in networking, cybersecurity, or IT infrastructure. The transition is evolutionary, not revolutionary.