

IPv6 and Configuration

Old protocol for building future networks

Dmitry Moiseev



Cambium Networks™

Agenda

- IPv4
- What is IPv6
- IPv6 Features
- IPv6 configuration examples

IPv4

- Internet Protocol standard de facto
- IPv4 has address space of 2^{32} addresses
- Main problem is depletion of address space
- It is old and was first deployed by a small subset of universities and government structures
- Many features are lacking or considered optional:
 - Multicast
 - IPSec
- Additional tricks to save address space are required:
 - Classless Inter Domain Routing(CIDR)
 - Network Address Translation(NAT)

IPv4 address

An IPv4 address (dotted-decimal notation)

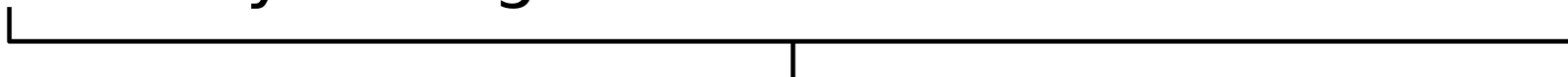
172 . 16 . 254 . 1



10101100 . 00010000 . 11111110 . 00000001



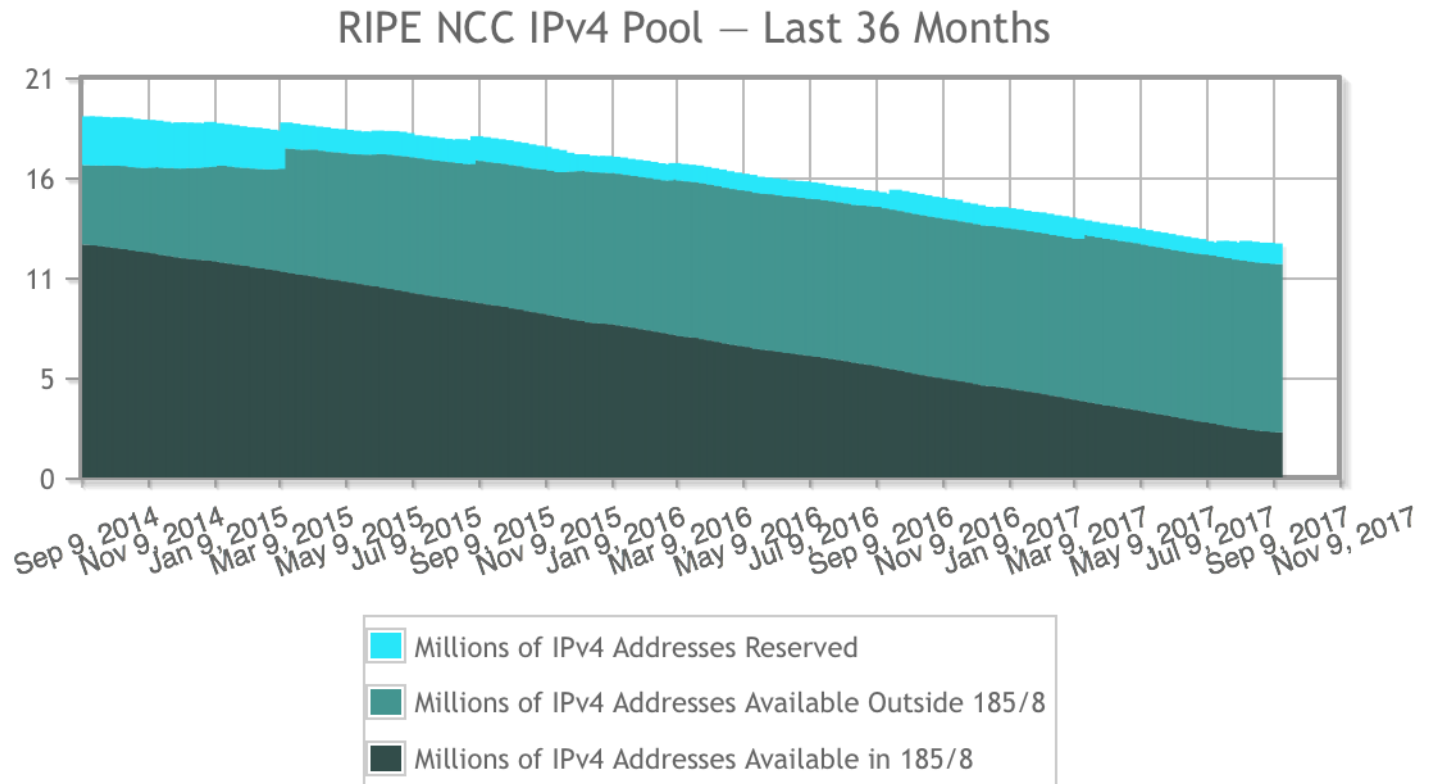
One byte = Eight bits



Thirty-two bits (4 x 8), or 4 bytes

IPv4 status

- Only 185.0.0.0/8 (the last /8) is available for allocation
- IANA's Recovered IPv4 Pool and addresses returned by resource holders
- Reserved for IXP



IPv6

formalized by IETF in 1998



Cambium Networks™

IPv6 Features

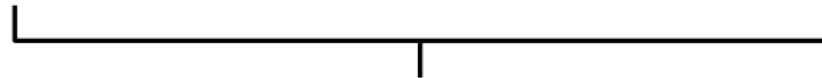
- Larger Address Space
- Simplified Header
- End-to-end connectivity
- Auto-configuration
- IPSec
- No broadcast and multicast built-in
- Anycast support
- Mobility
- Enhanced QoS
- Smooth Transition
- Extensibility

Larger address space with 128-bit address

An IPv6 address

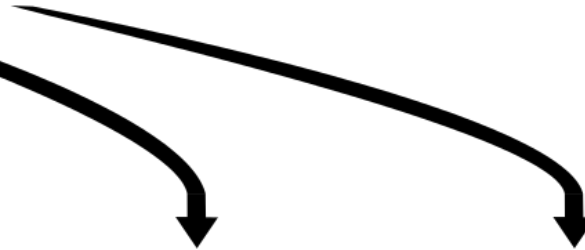
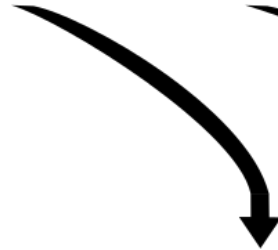
(in hexadecimal)

2001:0DB8:AC10:FE01:0000:0000:0000:0000



2001:0DB8:AC10:FE01::

Zeroes can be omitted



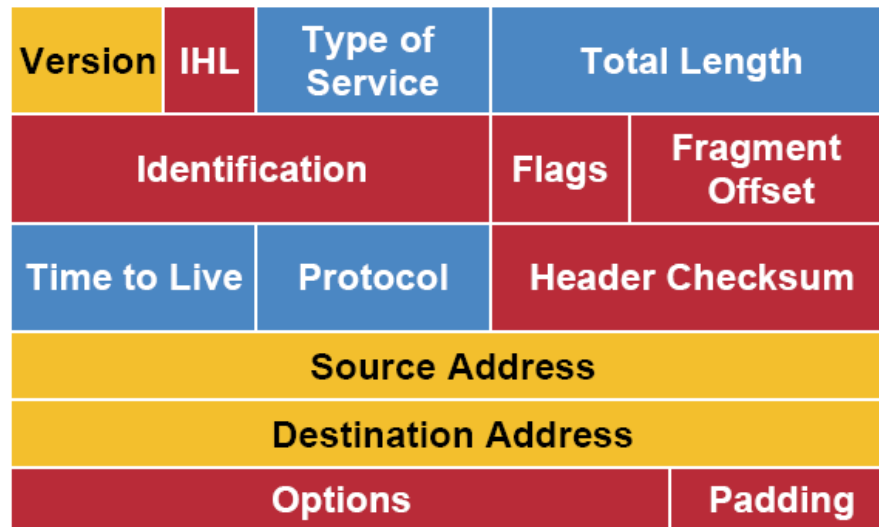
0010000000000001:0000110110111000:1010110000010000:1111111000000001:

0000000000000000:0000000000000000:0000000000000000:0000000000000000

So we could assign an IPV6 address to every atom on the surface of earth

Simplified Header

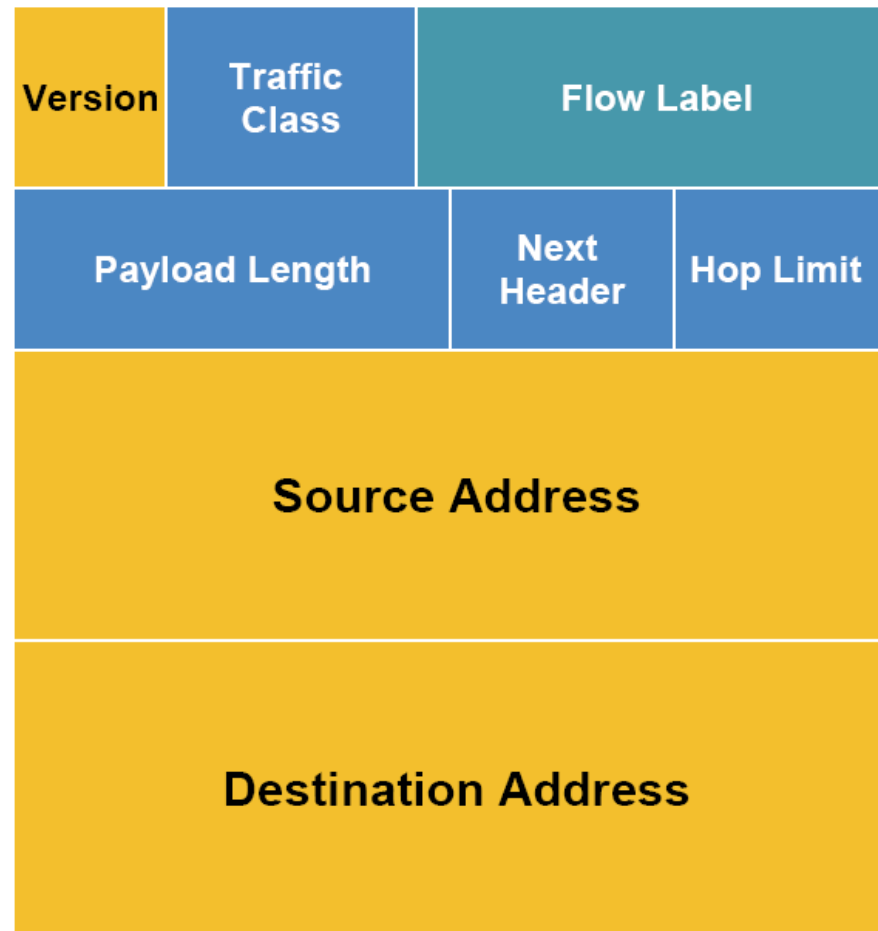
IPv4 Header



Legend

- Field's Name Kept from IPv4 to IPv6
- Fields Not Kept in IPv6
- Name and Position Changed in IPv6
- New Field in IPv6

IPv6 Header



Other Features

- No need for NAT and NAT traversal algorithms for end-to-end connectivity
- Auto configuration:
 - Stateless using Neighbor Discovery Protocol
 - Statefull using DHCPv6
- Simplified header makes routing faster
- IPSec as a part of standard

IPv6 addressing

- No Broadcast
- Unicast
 - Global
 - Link-local(starts with FE80)
 - Unique Local
 - Loopback
- Multicast
- Anycast(similar to unicast, but address can be assigned to multiple systems)

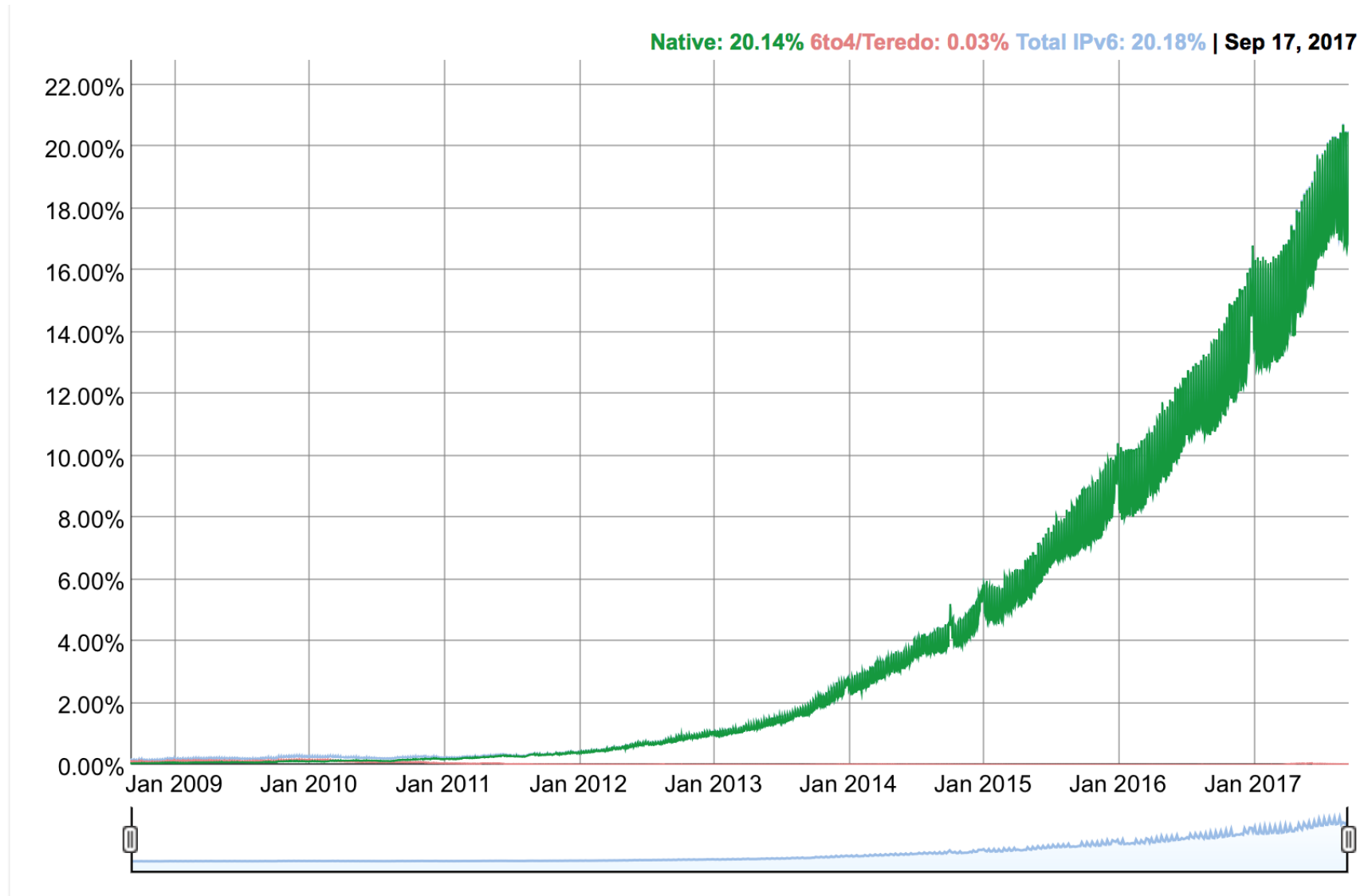
Issues with IPv6

- IPv6 is not backwards compatible
- Migration paths:
 - implementing dual stack
 - Tunneling
 - Advanced NAT

💧 IPv6 Excuse Bingo

We would have to rewrite our entire application to support it	Android doesn't support DHCPv6	My transit provider doesn't support IPv6	AWS doesn't support it
NAT444 is fine	There's no ROI on deploying IPv6	We'll deploy IPv6 next financial year	Our Lawful Intercept doesn't support IPv6 yet
Can't we just buy more IPv4 addresses?	We don't have a lab to test it	It's not mature enough	It'll make it easier for the government to track me
Github doesn't support IPv6	It's too complicated	IPv6 isn't an Internet Standard yet	Azure doesn't support it

IPv6 adoption



Future of IPv6

- Most of IPv4 resource is US and Europe
- Many IPv6 deployments are in Asia
- Many countries drives IPv6 on the government level

Cambium Networks IPv6

- Transparency
- IPv6 management:
 - ePMP
 - cnPilot R-series
- IPv6 QoS and Filtering:
 - PMP450

ePMP IPv6 settings

- For ePMP devices, the configuration parameter **IPv6 Assignment** specifies how the IPv6 address is obtained.

There are two applicable settings for the **IPv6 Assignment** parameter:

- Static:** Device management IP addressing is configured manually in fields **IPv6 Address** and **IPv6 Gateway**.
- DHCPv6:** Device management IP addressing (IP address and gateway) is assigned via a network DHCP server, and parameters IPv6 Address and IPv6 Gateway are unused. If the DHCPv6 server is not available previous static IPv6 address will be used as a fallback IPv6 address. If no previous static IPv6 address is available, no IPv6 address will be assigned. DHCPv6 will occur over the wireless interface by default.

The screenshot displays the Cambium Networks ePMP 1000 configuration interface. The top navigation bar shows the device name 'ePMP1000_c6fBed' and the role 'Access Point'. The left sidebar contains a menu with options: Home, Quick Start, Configuration, Radio, QoS Quality of Service, System, Network (selected), Security, Monitor, and Tools. The main content area is titled 'Configuration > Network' and shows the 'General' tab. A red box highlights the 'IP Assignment' section, which includes radio buttons for 'Static' (selected) and 'DHCP'. Below this, the 'IP Address' field is populated with '192.168.2.200'. Other fields include 'Subnet Mask' (255.255.255.0), 'Gateway' (192.168.2.1), 'Preferred DNS Server' (8.8.8.8), and 'Alternate DNS Server'. The 'IPv6 Assignment' section at the bottom shows radio buttons for 'Static' and 'DHCPv6' (selected), with empty fields for 'IPv6 Address' and 'IPv6 Gateway'.

cnPilot R-series

- DHCPv6 address setting:
 - Stateless/Statefull
 - Prefix Delegation

Cambium Networks

Firmware Version 4.3-R7
Current Time 2016-10-28 00:23:07
Admin Mode [Logout] [Reboot]

Status Network Wireless 2.4GHz Wireless 5GHz SIP FXS1 FXS2 Security Application Storage Administration

WAN LAN IPv6 Advanced IPv6 LAN VPN Port Forward DMZ DNS QoS Port Setting Routing Advance

Please REBOOT to make the changes effective!

INTERNET

WAN

Connect Name: 1_MANAGEMENT_VOICE_INTERNET_R_VID [Delete Connect]

Service: MANAGEMENT_VOICE_INTERNET

IP Protocol Version: IPv4 & IPv6

WAN IP Mode: DHCP

MAC Address Clone: Disable

NAT Enable: Enable

VLAN Mode: Disable

VLAN ID: 1 (1-4094)

DNS Mode: Auto

Primary DNS:

Secondary DNS:

DHCP

DHCP Renew: Renew

DHCP Vendor(Option 60): Cambium-cnPilot R201P

DHCPv6

DHCPv6 Address Settings: Stateless

Prefix Delegation: Enable

Port Bind

☒ Port_1 ☒ Port_2 ☒ Port_3 ☒ Port_4

☒ Wireless(SSID) ☒ Wireless(SSID1) ☒ Wireless(SSID2) ☒ Wireless(SSID3)

Note : WAN connection can not be shared between the binding port, and finally bound port WAN connections bind operation will wash away before the other WAN connection to the port binding operation !

Save Cancel Reboot

Help

WAN IP Mode:
Static IP - Set the IP Address, Subnet Mask and Default Gateway that you have gotten from your ISP provider.

DHCP - You will get an IP Address, Subnet Mask and Default Gateway from some DHCP Server.

PPPoE - Set the PPPoE Account and PPPoE Password that you have gotten from your ISP provider.

cnPilot R-series

- DHCPv6 address pool
 - Addresses
 - DNS
 - Router advertisement
 - Prefix

The screenshot displays the 'IPv6 LAN Setting' page in the cnPilot R-series web interface. The interface has a top navigation bar with tabs for Status, Network, Wireless 2.4GHz, Wireless 5GHz, SIP, FXS1, FXS2, and Security. Below this is a sub-navigation bar with tabs for WAN, LAN, IPv6 Advanced, IPv6 WAN, IPv6 LAN, VPN, Port Forward, DMZ, and DDNS. The 'IPv6 LAN' tab is selected. The main content area is titled 'IPv6 LAN Setting' and contains the following configuration fields:

Field	Value	Range/Options
IPv6 Address	FD00::1	
IPv6 Prefix Length	64	(0-128)
DHCPv6 Server		
DHCPv6 Status	Enable	▼
DHCPv6 Mode	Statefull	▼
Domain Name	flyingvoice.com	
Server Preference	255	(0-255)
Primary DNS Server	FD00::2	
Secondary DNS Server	FD00::3	
Lease Time	86400	(0-86400sec)
IPv6 Address Pool	FD00::100 - FD00::200 / 64	
Router Advertisement	Enable	▼
Router Advertisement		
Advertise Interval	30	(10-1800sec)
RA Managed Flag	Enable	▼
RA Other Flag	Disable	▼
Prefix		/
Prefix Lifetime	3600	(0-3600sec)

PMP450 IPv6 filtering

Packet Filter Configuration

Packet Filter Types :

- ☒ PPPoE
- ☐ All IPv4
 - ☐ SMB (Network Neighborhood)
 - ☐ SNMP
 - ☐ Bootp Client
 - ☐ Bootp Server
 - ☐ IPv4 Multicast
 - ☐ User Defined Port 1 (See Below)
 - ☐ User Defined Port 2 (See Below)
 - ☐ User Defined Port 3 (See Below)
 - ☐ All other IPv4
- ☐ All IPv6
 - ☐ SMB (Network Neighborhood)
 - ☐ SNMP
 - ☐ Bootp Client
 - ☐ Bootp Server
 - ☐ IPv6 Multicast
 - ☐ All other IPv6
- ☐ ARP
- ☐ All others

Filter Direction :

- ☒ Upstream
- ☒ Downstream

FAQ

- What happen with IPv5?
- Can we just buy more addresses?

Questions?