IPv6 and Configuration

Old protocol for building future networks

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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

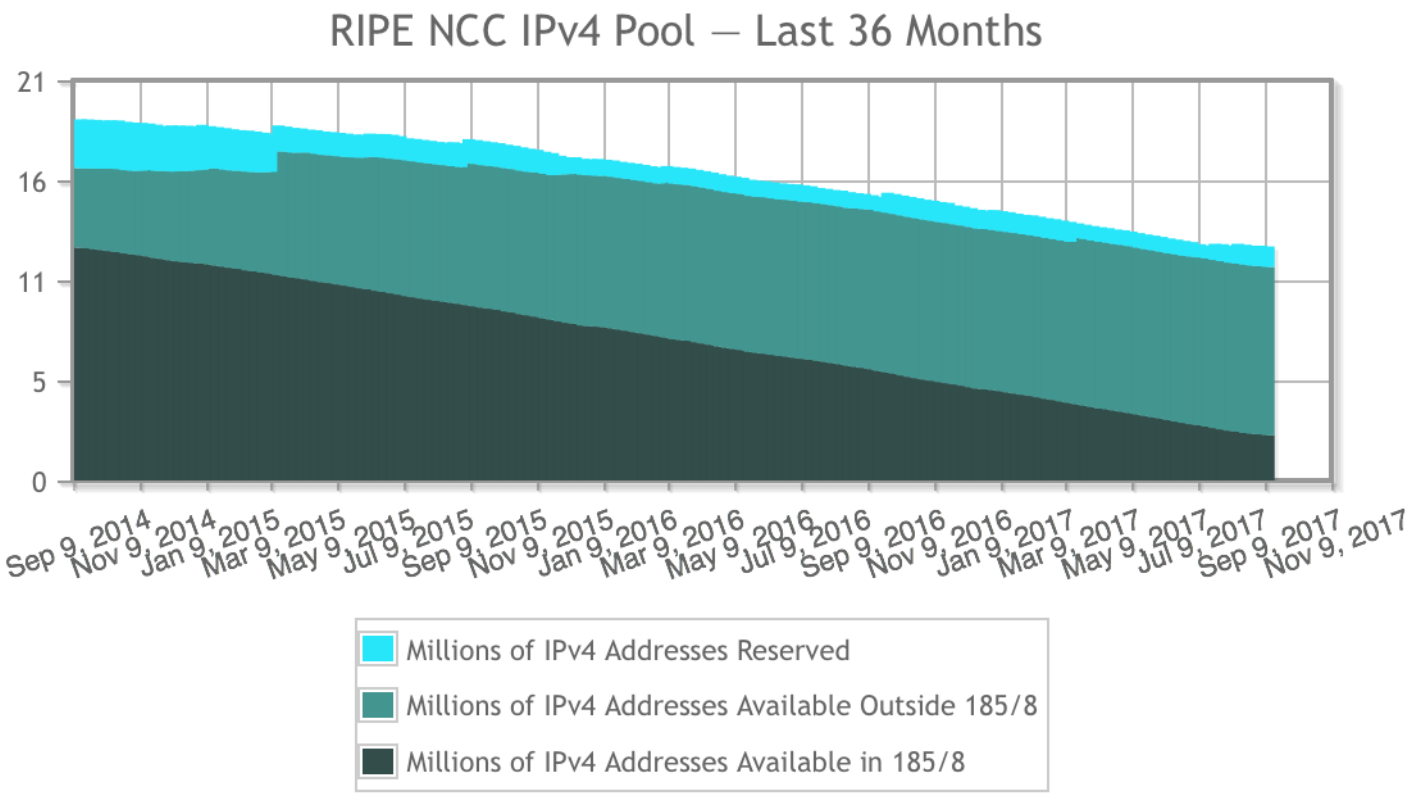
10101100 . 00010000 . 11111110 . 00000001

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

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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

Version	IHL	Type of Service	Total Length	
Identification			Flags	Fragment Offset
Time to Live		Protocol	Header Checksum	
Source Address				
Destination Address				
Options				Padding

IPv6 Header

Version	Traffic Class	Flow Label		
Payload Length			Next Header	Hop Limit
Source Address				
Destination Address				

Legend

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

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

Made with excuses from ipv6excuses.com

Suggest a new excuse: Tweet to @ipv6excuses

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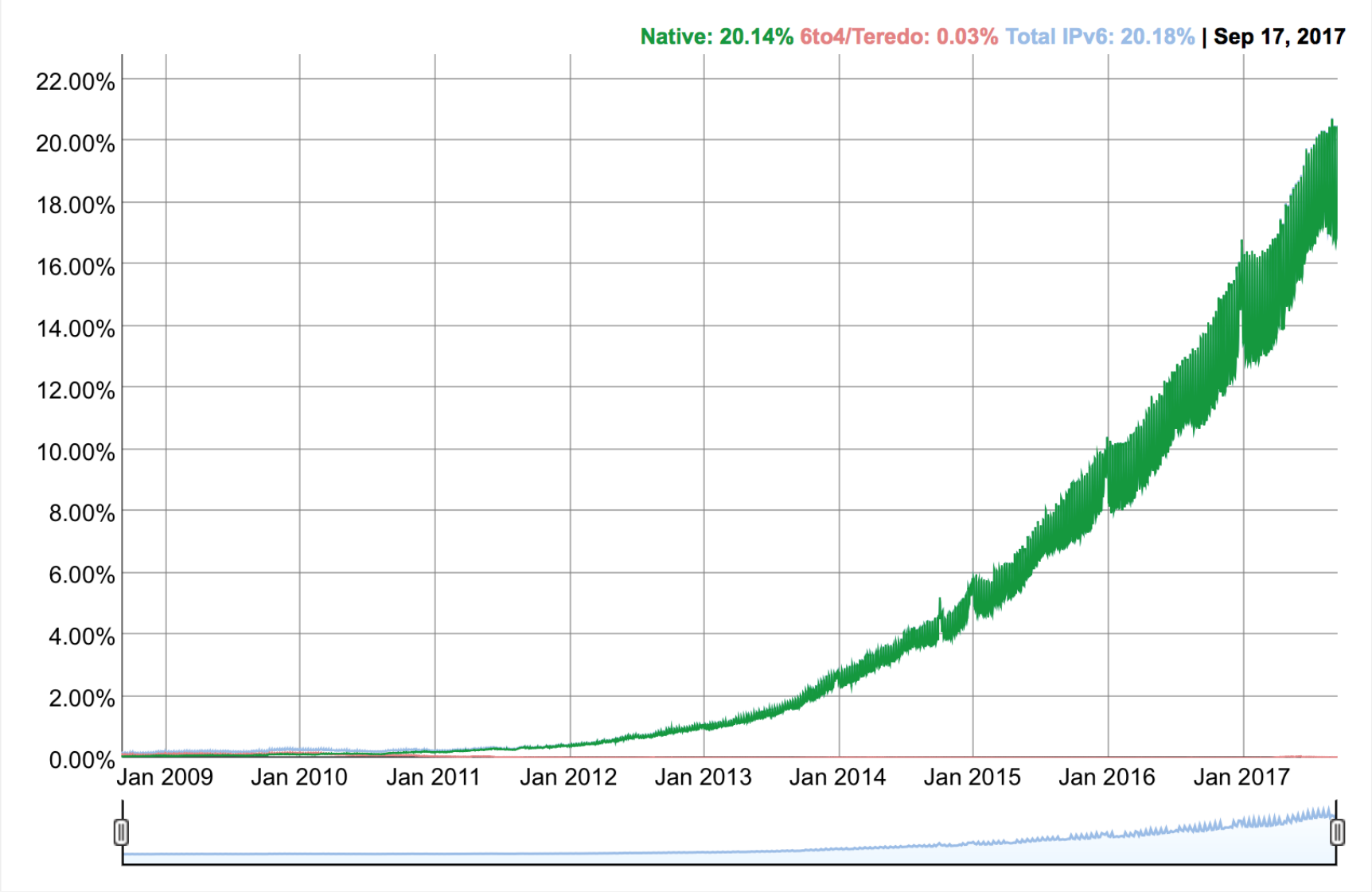
IPv6 adoption



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

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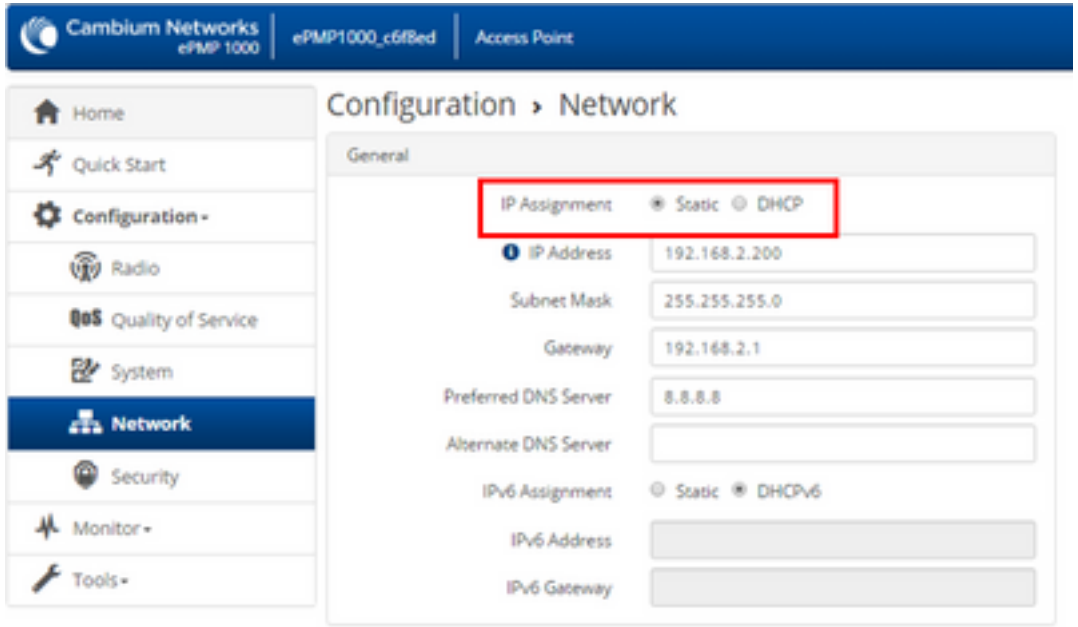
- Transparency
- IPv6 management:
  - ePMP
  - cnPilot R-series
- IPv6 QoS and Filtering:
  - PMP450

ePMP IPv6 settings

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

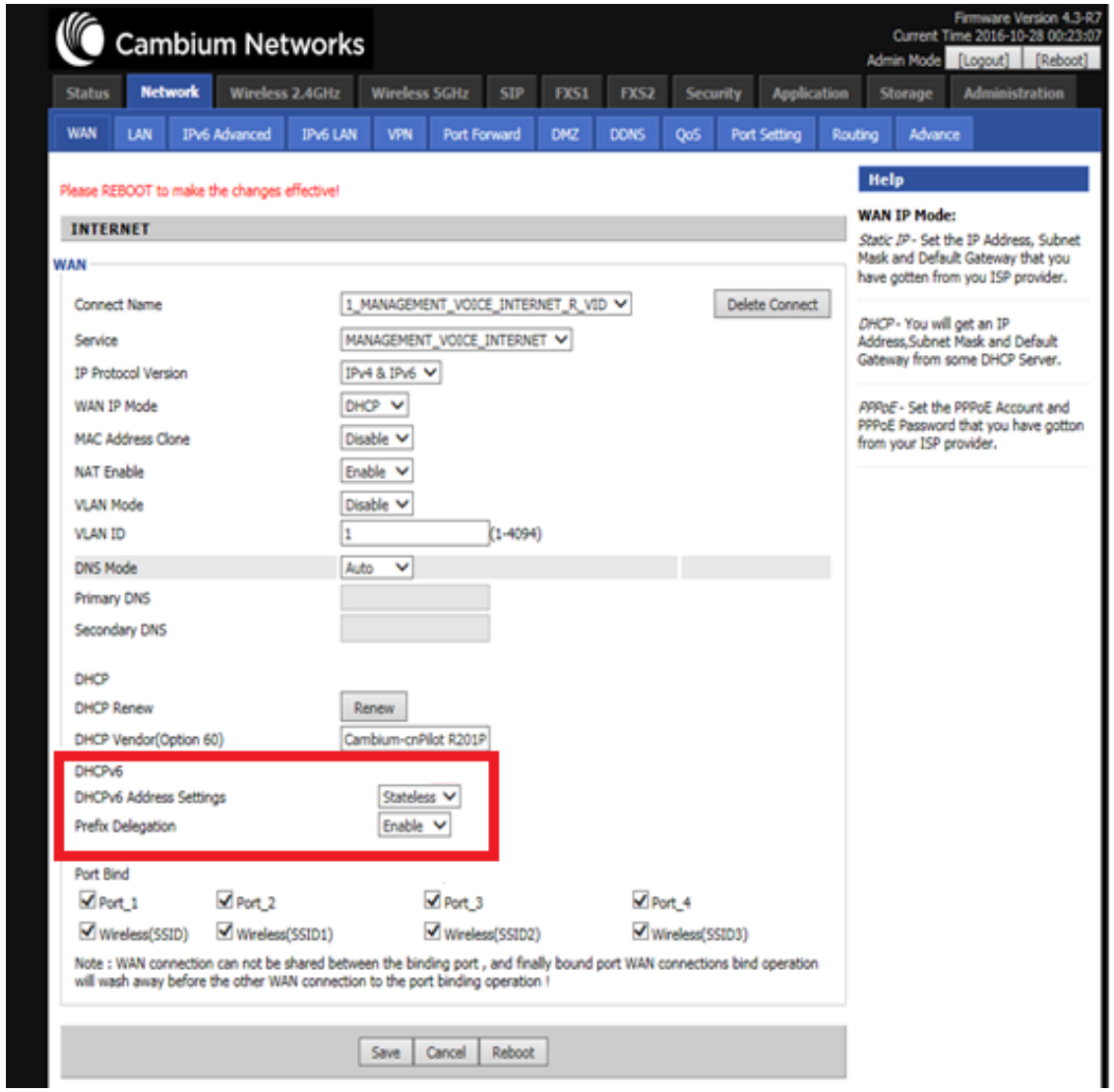
  There are two applicable settings for the **IPv6 Assignment** parameter:

  - **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.



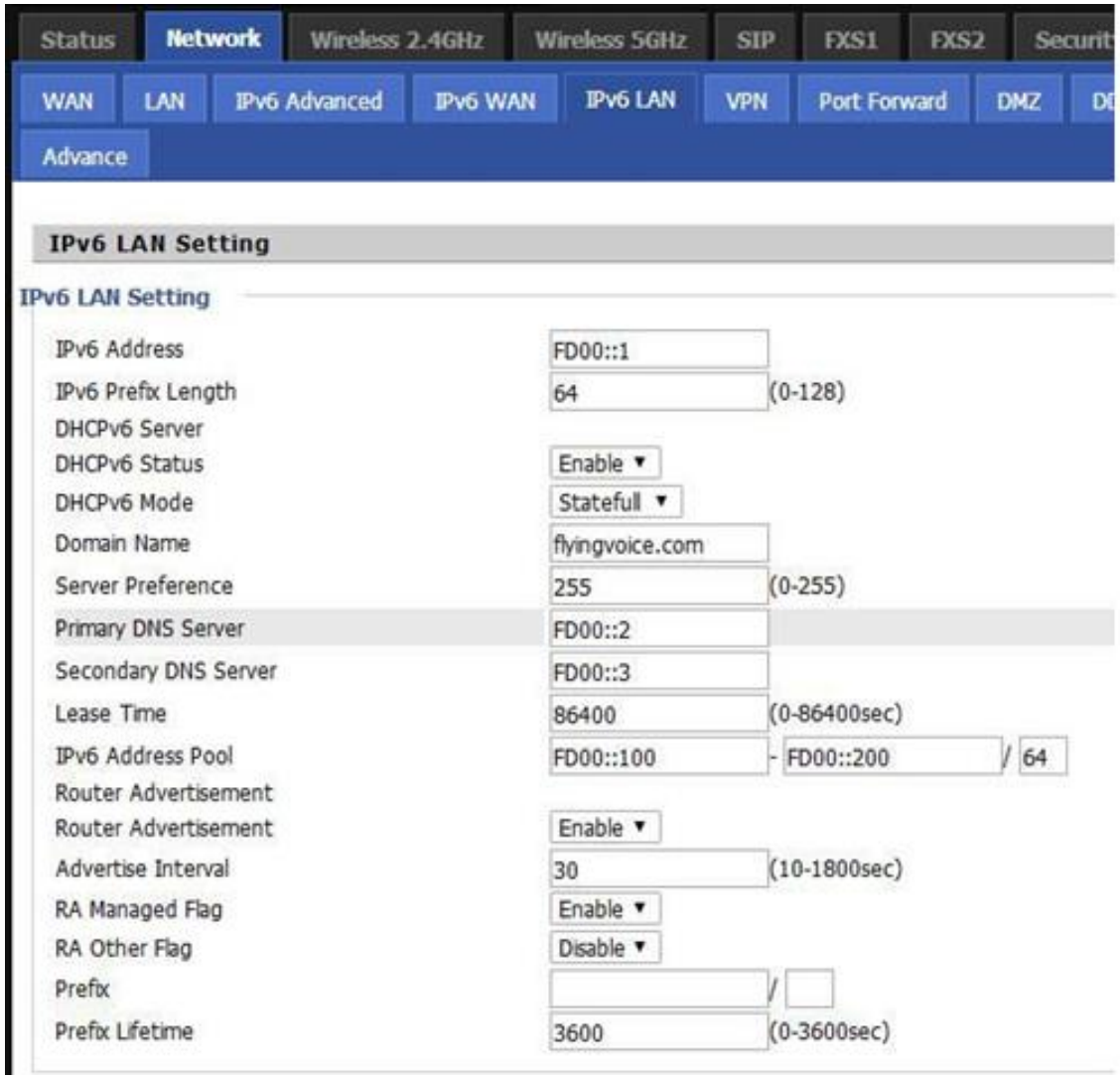
cnPilot R-series

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



cnPilot R-series

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



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?

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Questions?

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