

Host and Network Addressing

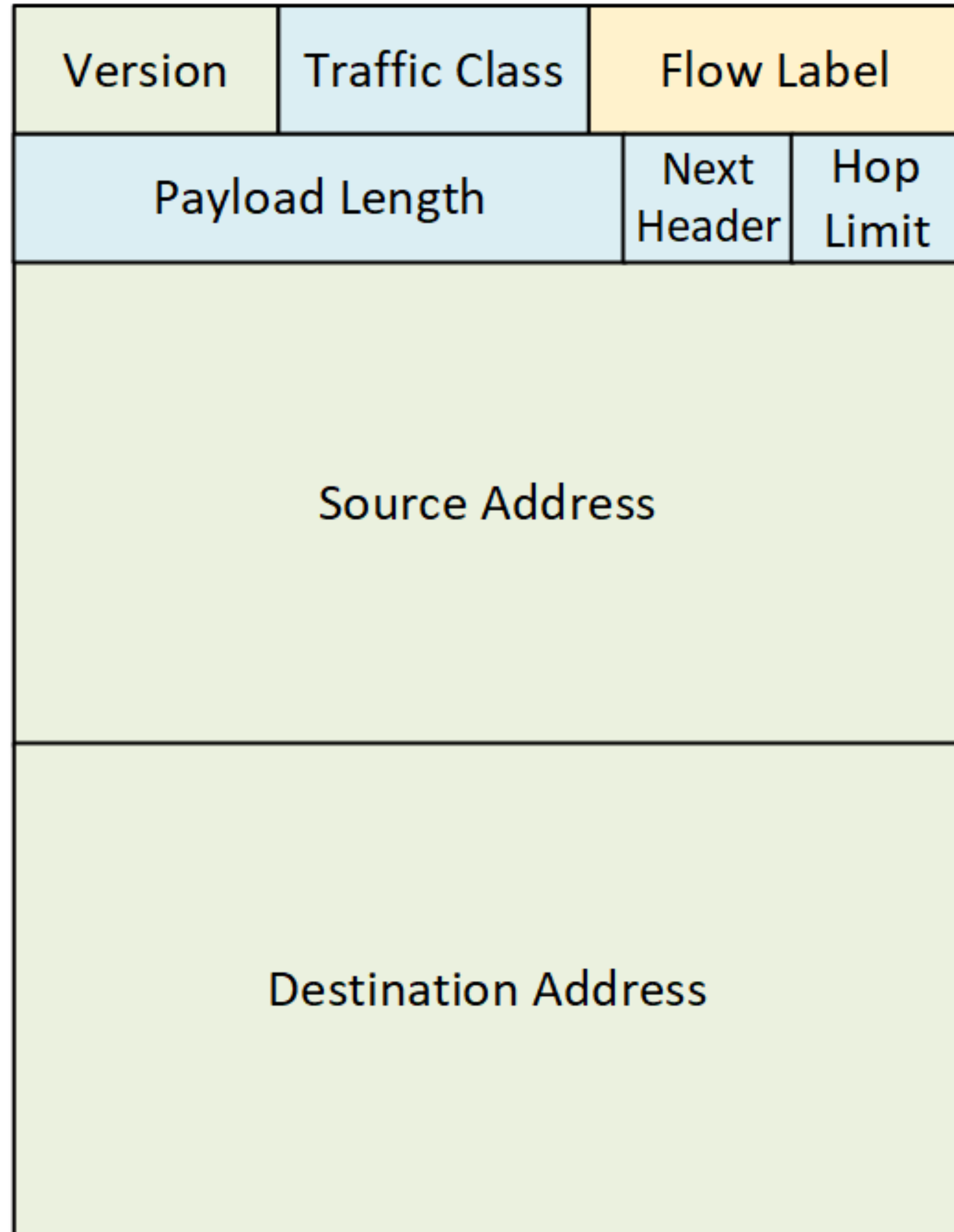
CS249i: The Modern Internet



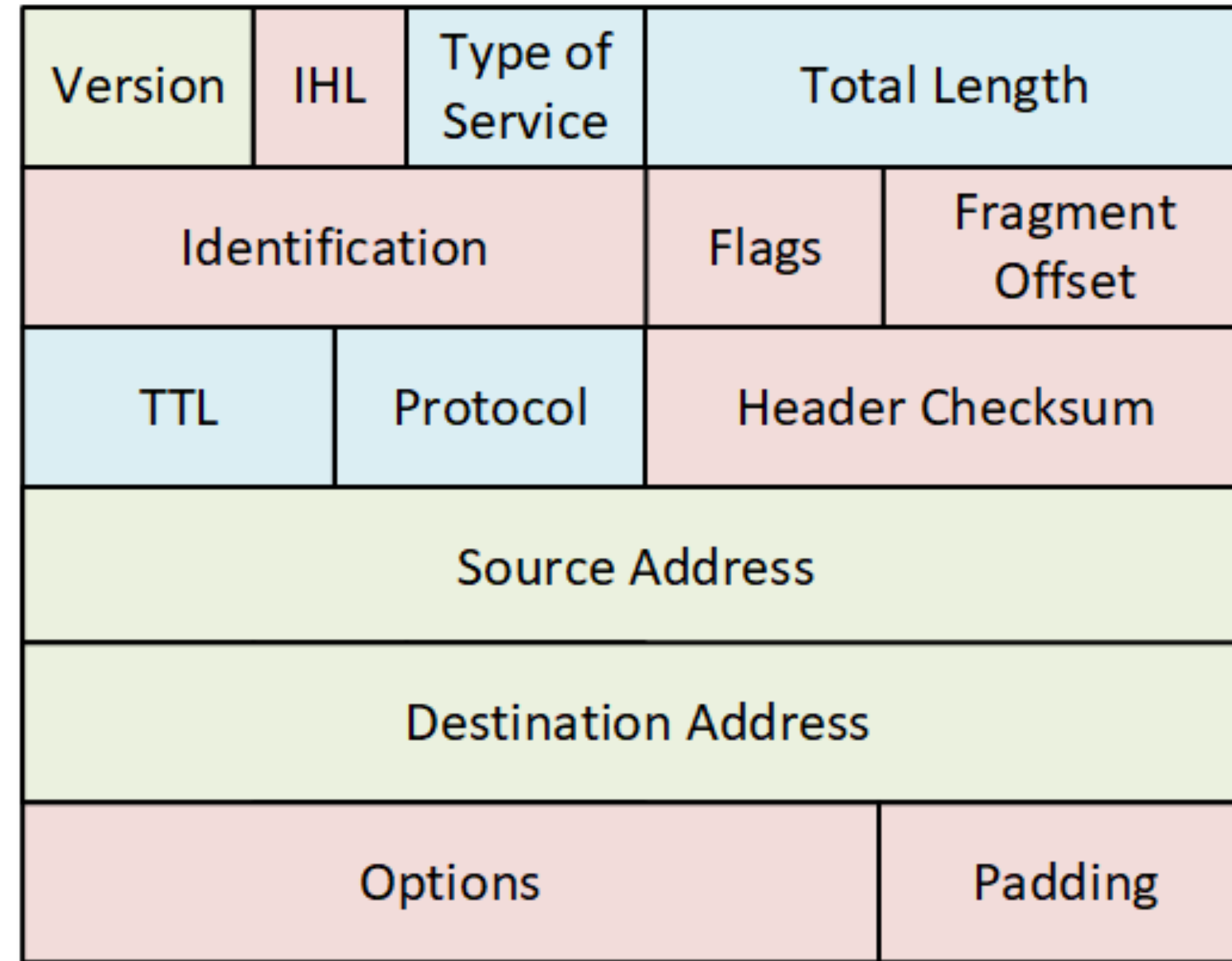
IPv4 → IPv6

	IPv4	IPv6
Address Size	32-bit	128-bit
Header Size	20 bytes	40 bytes
Header Fields	12 fields	8 fields
Checksum	IP + TCP, Sometimes UDP	TCP + UDP
Flow Labeling	—	Flow ID
Fragmentation	Host + Router	Host Only
Host Addressing	DHCP, ARP, IRDP	SLAC, ICMP, DHCPv6
Broadcast	Yes!	No!





IPv6 Header

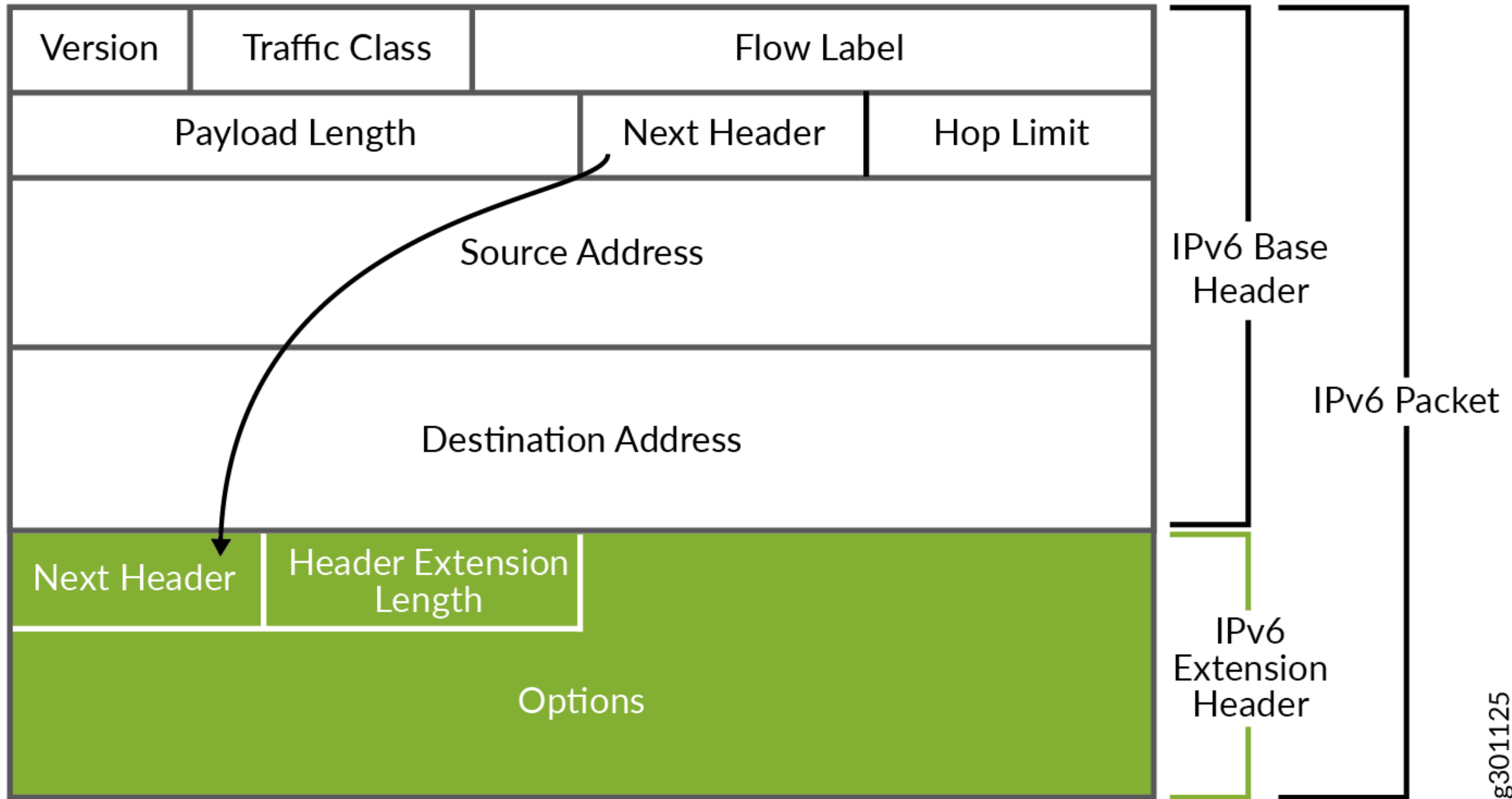


IPv4 Header



Legend

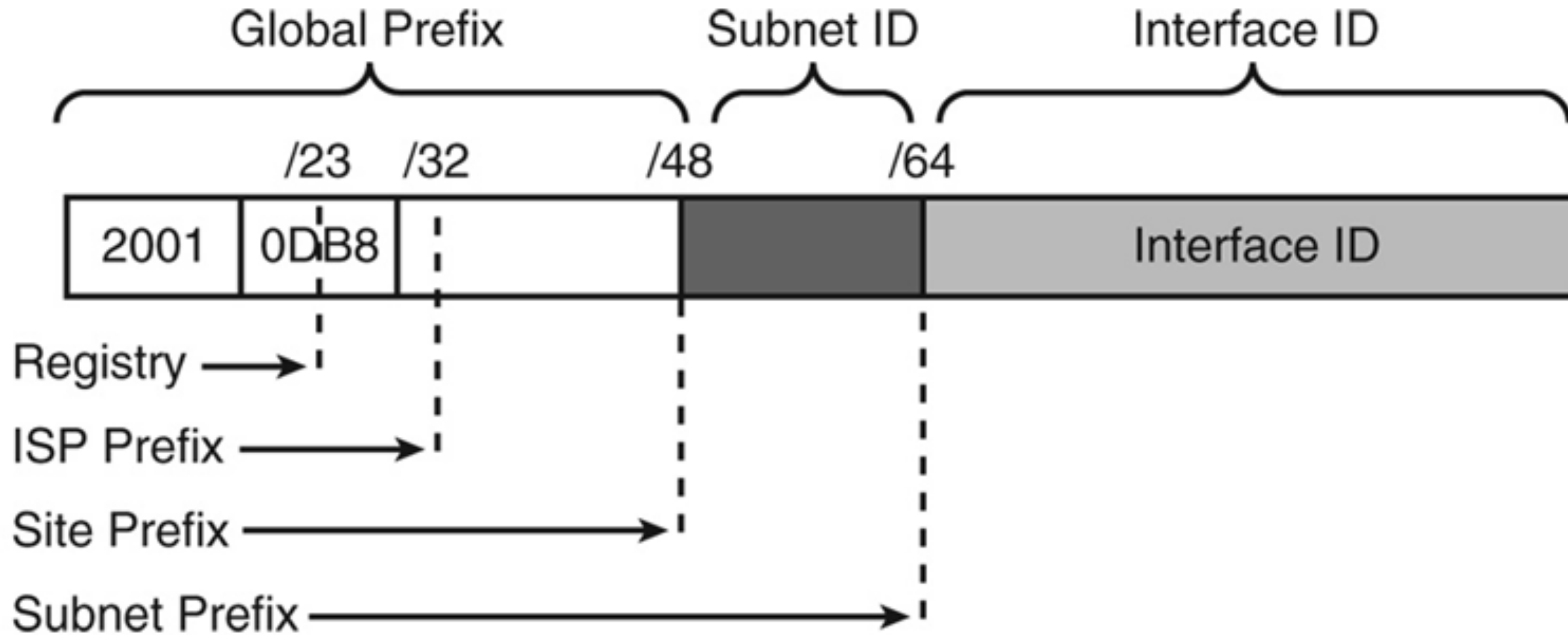
-  Fields **kept** in IPv6
-  Fields **kept** in IPv6, but name and position changed
-  Fields **not kept** in IPv6
-  Fields that are **new** in IPv6



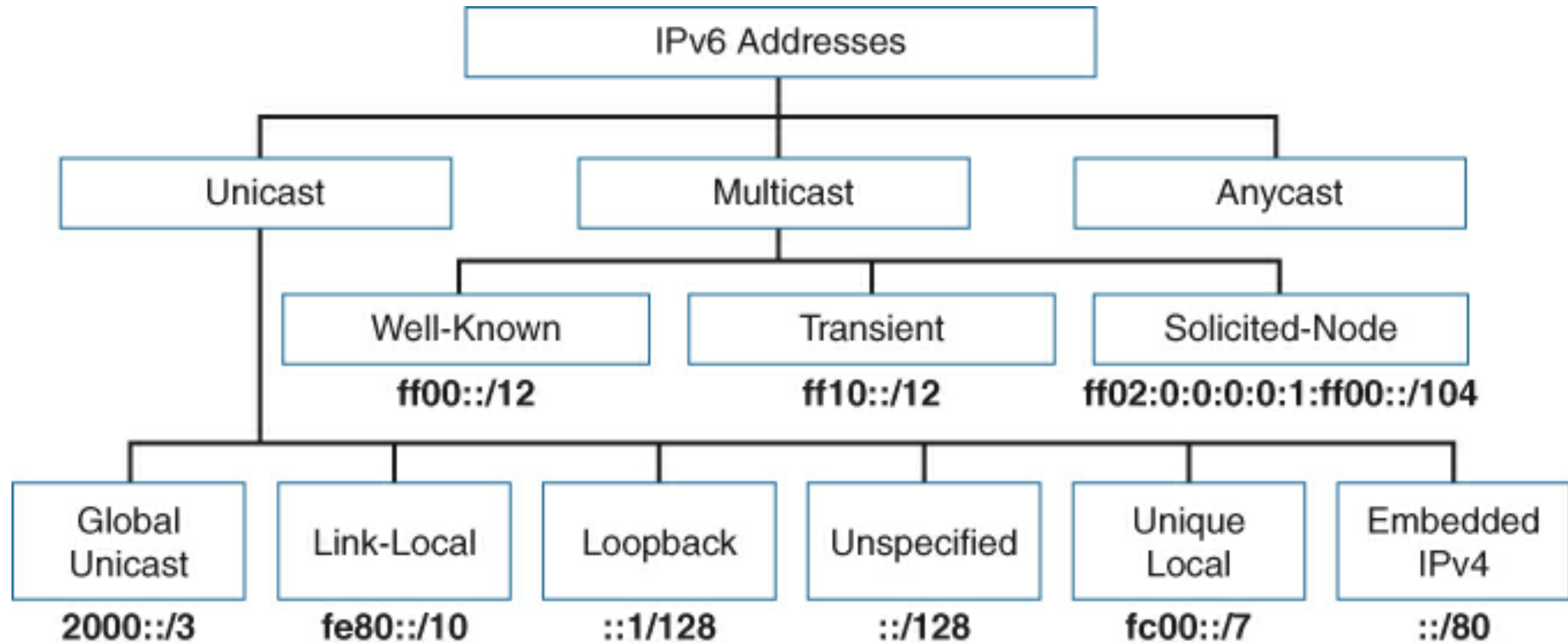


IPv6 Addresses

128 Bit Addresses



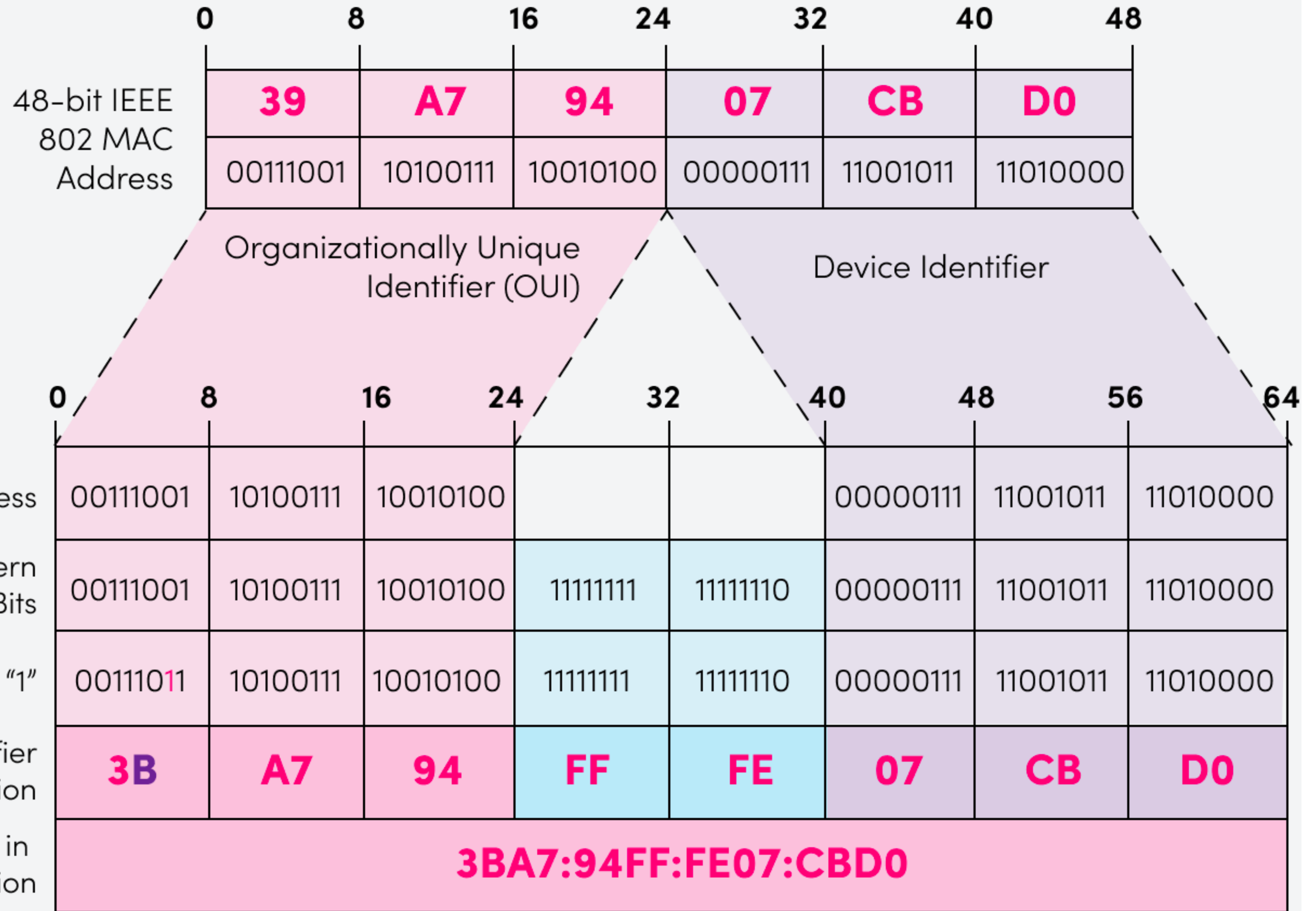
128 Bit Addresses





Interfaces have Multiple IPs

```
48: vlan50@bridge: <BROADCAST,MULTICAST,UP,LOWER_UP  
link/ether a8:1e:84:ce:64:5f brd ff:ff:ff:ff:ff:ff  
inet 171.67.70.1/23 scope global vlan50  
    valid_lft forever preferred_lft forever  
inet6 2607:f6d0:ec50:100::1/56 scope global  
    valid_lft forever preferred_lft forever  
inet6 fe80::aa1e:84ff:face:645f/64 scope link  
    valid_lft forever preferred_lft forever
```


EUI-64



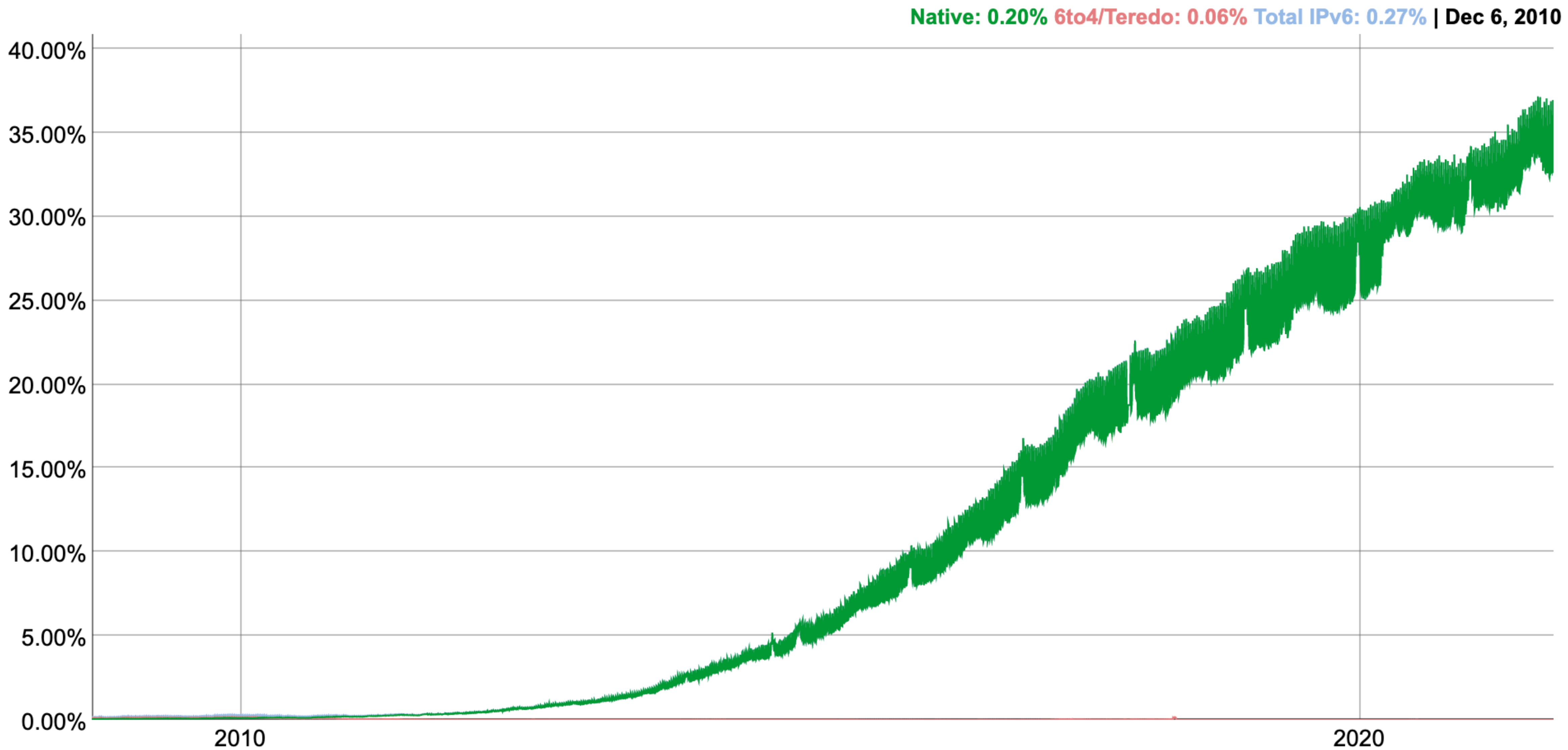
Standardized Multicast Addresses

Address(es) 	Description 
FF02:0:0:0:0:0:0:1	All Nodes Address
FF02:0:0:0:0:0:0:2	All Routers Address
FF02:0:0:0:0:0:0:3	Unassigned
FF02:0:0:0:0:0:0:4	DVMRP Routers
FF02:0:0:0:0:0:0:5	OSPF/IGMP
FF02:0:0:0:0:0:0:6	OSPF/IGMP Designated Routers
FF02:0:0:0:0:0:0:7	ST Routers
FF02:0:0:0:0:0:0:8	ST Hosts
FF02:0:0:0:0:0:0:9	RIP Routers
FF02:0:0:0:0:0:0:A	EIGRP Routers
FF02:0:0:0:0:0:0:B	Mobile-Agents
FF02:0:0:0:0:0:0:C	SSDP
FF02:0:0:0:0:0:0:D	All PIM Routers
FF02:0:0:0:0:0:0:E	RSVP-ENCAPSULATION
FF02:0:0:0:0:0:0:F	UPnP
FF02:0:0:0:0:0:0:10	All-BBF-Access-Nodes
FF02:0:0:0:0:0:0:11	All-Homenet-Nodes
FF02:0:0:0:0:0:0:12	VRRP
FF02:0:0:0:0:0:0:13	ALL_GRASP_NEIGHBORS
FF02:0:0:0:0:0:0:16	All MLDv2-capable routers
FF02:0:0:0:0:0:0:1A	all-RPL-nodes
FF02:0:0:0:0:0:0:6A	All-Snoopers
FF02:0:0:0:0:0:0:6B	PTP-pdelay



IPv6 Usage

Google Observed Users

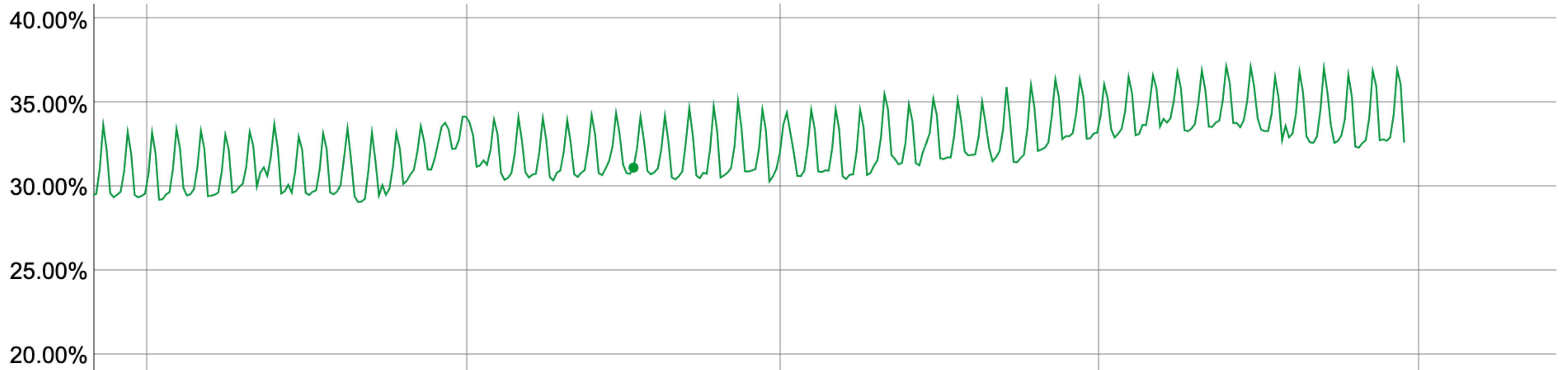


Higher Weekend Usage

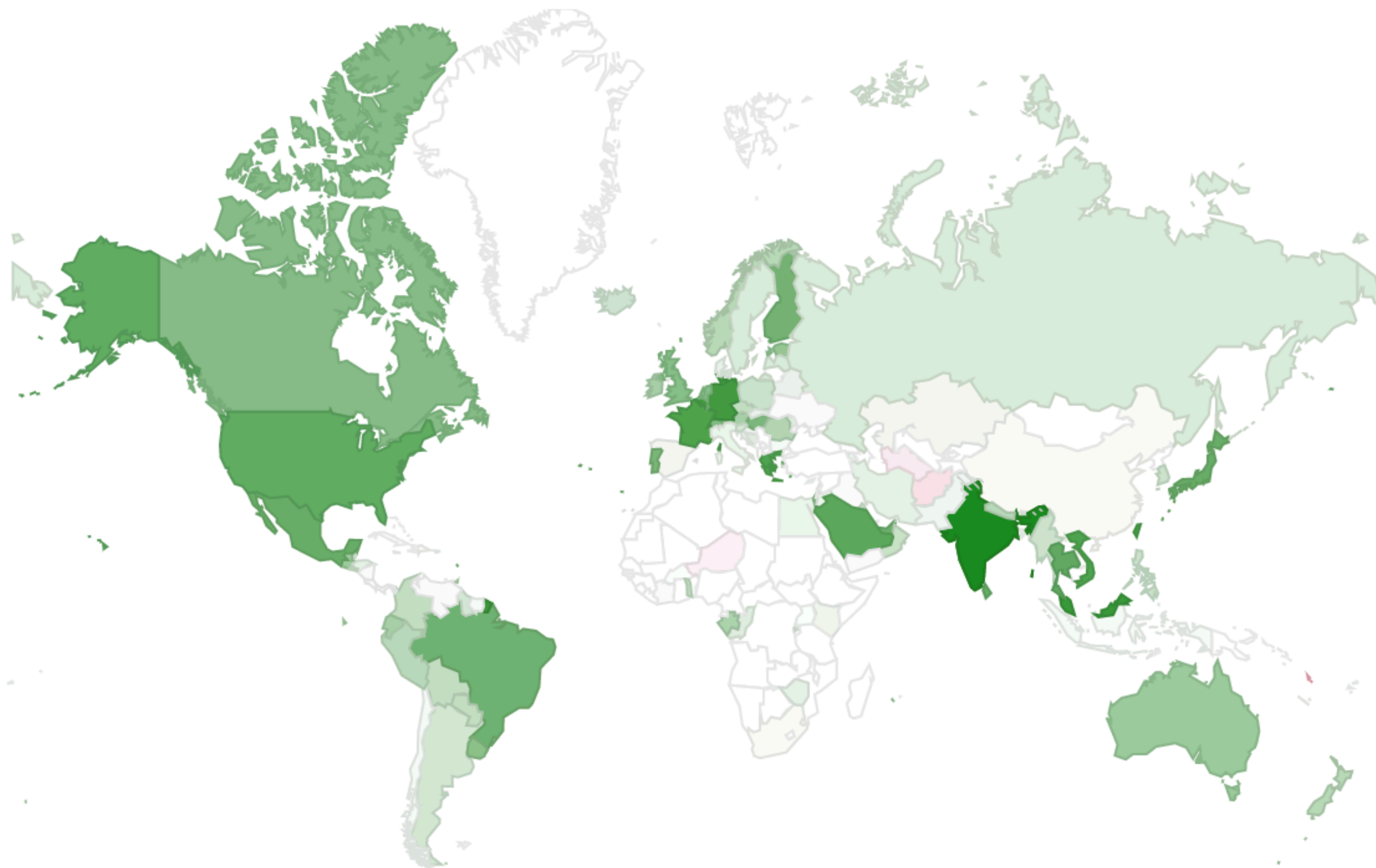
IPv6 Adoption

We are continuously measuring the availability of IPv6 connectivity among Google users. The graph shows the percentage of users that access Google over IPv6.

Native: 31.12% **6to4/Teredo: 0.00%** **Total IPv6: 31.12%** | Feb 18, 2021



Geographic Biases



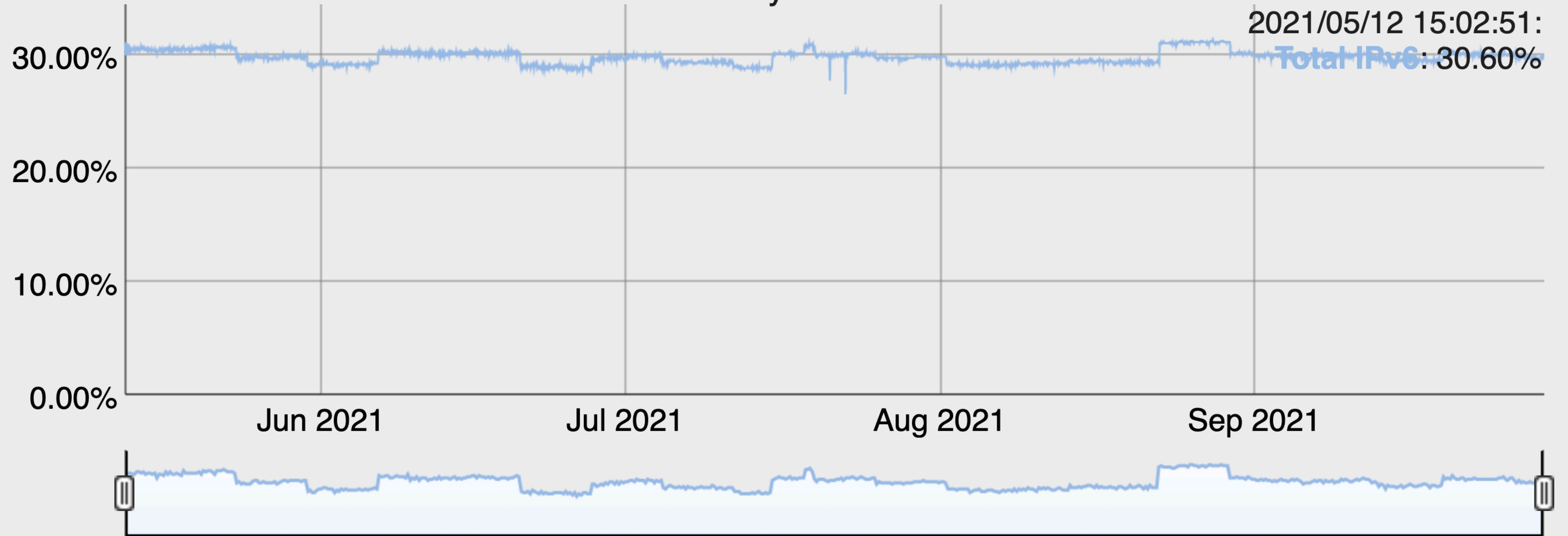
Alexa Top 1K Support

Alexa Rank	Website	AAAA Record	AAAA Record for www. Site	Site returns IPv6 source address	www. Site returns IPv6 source address
1	Google.com	✓	✓	✓	✓
2	YouTube.com	✓	✓	✓	✓
3	Facebook.com	✓	✓	✓	✓
4	Baidu.com	x	x	-	-
5	Wikipedia.org	✓	✓	✓*	✓*
6	Qq.com	x	✓	-	✓*
7	Tmall.com	x	x	-	-
8	Taobao.com	x	x	-	-
9	Yahoo.com	✓	✓	✓	✓
10	Amazon.com	x	x	-	-
11	Twitter.com	x	x	-	-
12	Sohu.com	x	x	-	-
13	Instagram.com	✓	✓	✓	✓
14	Reddit.com	x	x	-	-
15	Jd.com	x	x	-	-

Lots of Traffic != Lots of Deployment

Percentage of Alexa Top 1000 websites currently reachable over IPv6

Measurements every hour from AS35425



AMS-IX Traffic Breakdown

