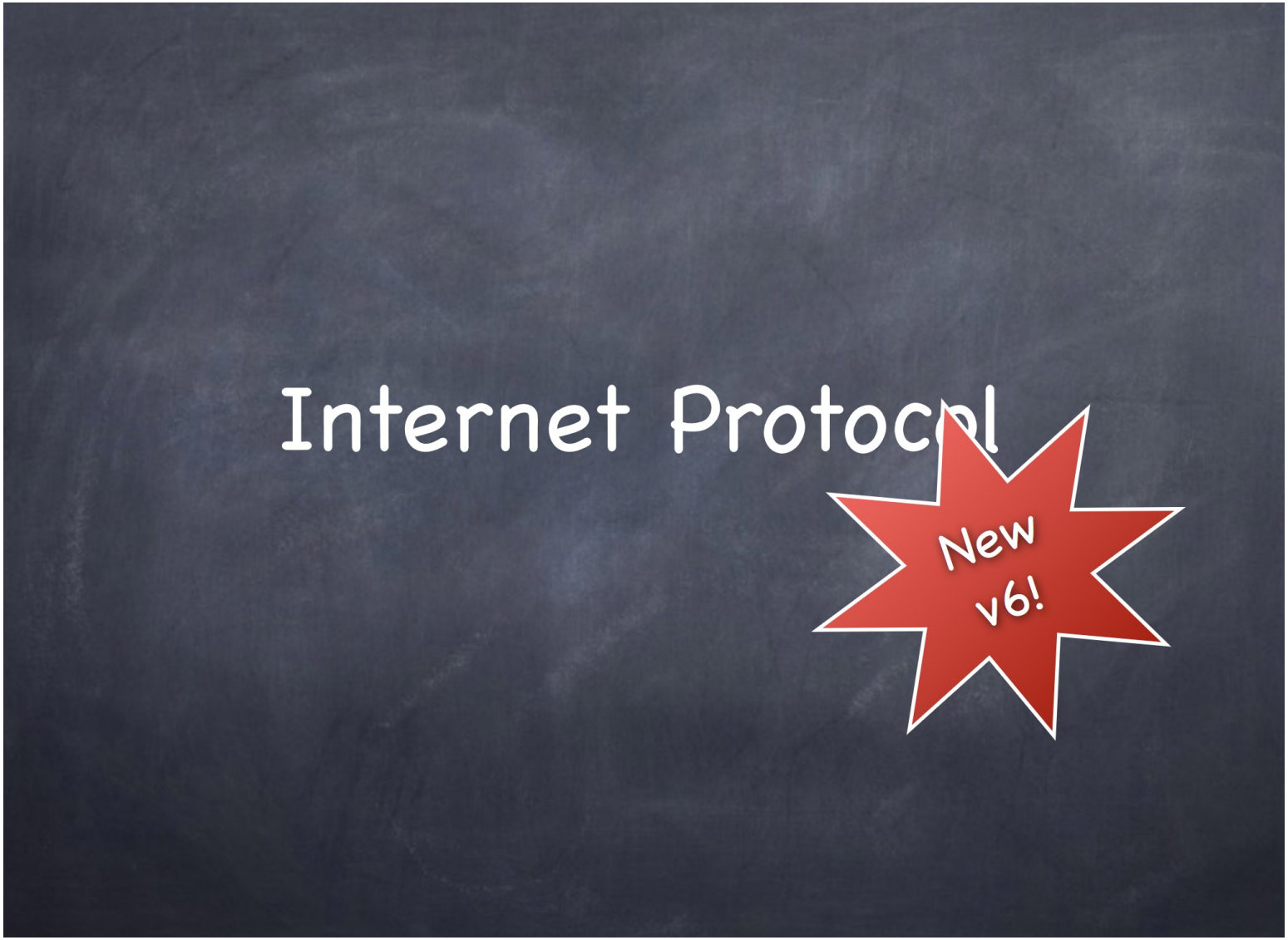
IT 609
Network and System Administration

IPv6

Tuesday October 14, 2021

IPv6



IPv6

Much larger address space

- 128 bits --> 2^{128} addresses ≈ 3.4×10^{38}
- About 5×10^{28} addresses for each person alive!

Simplified processing by routers

No fragmentation

Multicast support is built in

IPsec security - optional

Stateless address autoconfiguration

IPv6 Addressing

Eight groups of 4 hexadecimal values

`2001:0db8:85a3:0000:0000:8a2e:0370:7334`

Can be compressed by eliminating leading zeros and groups of zeros

`2001:db8:85a3::8a2e:370:7334`

Still contain a network part and a device part

- The device or link-local part is always 64 bits

The device part can be based on the 48-bit MAC address converted to 64 bits

UNH's IPv6 Addresses

`2606:4100/32`

What's the mean?

`2606:4100:0000:0000:0000:0000:0000:0000`

`to`

`2606:4100:ffff:ffff:ffff:ffff:ffff:ffff`

How many?

128 bits - 32 bits for network = 96 bits

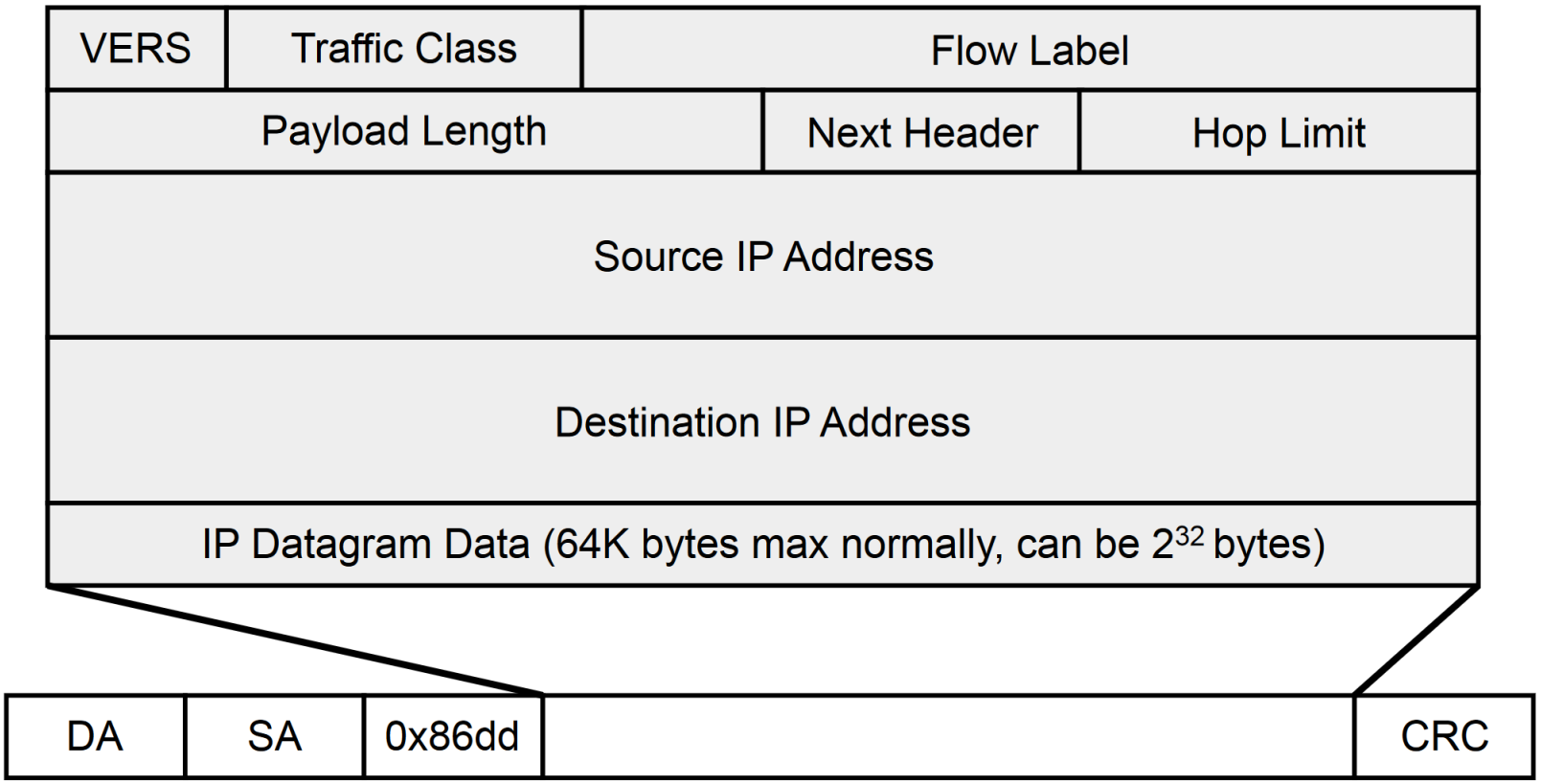
2^96 = 79 octillion (more or less)

Equivalent to 64 IPv4 Internets!

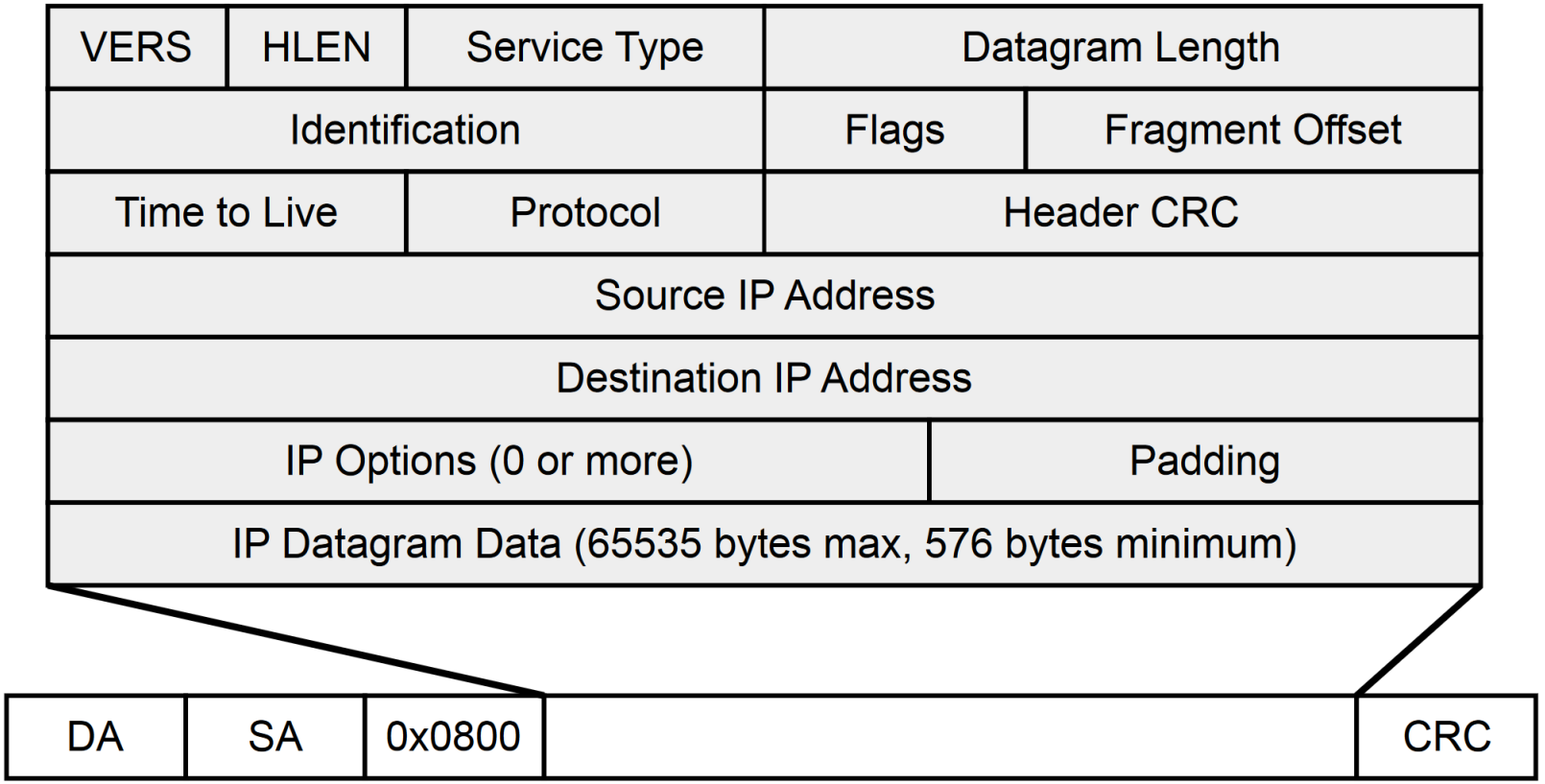
Keep in mind that 64 bits are reserved for the link-local part of the address so UNH really has 128 bits - 32 bits fixed - 64 bits for local device address = 32 bits available for networks

That's still 1 IPv4 Internet worth of UNH subnets!

IPv6 Packets



IPv4 Packets



IPv6 History & Adoption

RFC 1883 published in 1996

Major OS's support IPv6 starting with Mac OS X in 2003 and going through Windows Vista in 2007

February 2008 - IPv6 added to 6 root name servers

Last IPv4 /8 blocks allocated in February 2011

June 8, 2011 - World IPv6 Day

- Major providers turned on IPv6 support for 24 hours
- Amazingly, nothing bad happened!

June 6, 2012 - World IPv6 Launch

Overall, adoption is still limited:

- http://www.mrp.net/IPv6_Survey.html

IPv6 and IPv4

Dual stack

- Side-by-side existence in the NIC, network, etc
- IPv6 is preferred if both can work

Tunneling

- Encapsulate IPv6 in IPv4 packets
- 6to4 is a frequently used one
- Relay routers convert between
- 2002::/16 IPv6 addresses make to IPv4 addresses

NAT64

- Network address translation plus protocol translation