

Names and Addresses: IPv6

Goal of Internet Protocol Addresses

- Stitch many different networks together
- Need network-independent, unique address
 - ▶ Well, these days it can be only mostly unique -- see NATs, anycast, etc.
- But there are only 2^{32} IPv4 addresses
 - ▶ Generally, utilization is ~35%
 - ▶ Need an address to communicate...

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Internet Protocol, Version 6

- Work started in 1994
- Basic protocol published in 1998 (RFC 2460)
- Lull, then increased interest in 2003-2006
- Hard push within the IETF today for adoption

Address Structure

- IPv6 has 128 bits of address
 - ▶ 2^{128} (3.4×10^{38}) addresses: 21 addresses/in² of the world's surface!
- Separated into subnet and interface portions (RFC 4291)

| | |
|-------------------|----------------------|
| subnet prefix (n) | interface ID (128-n) |
|-------------------|----------------------|

- Write address in hexadecimal as 8 blocks of 16 bits, separated by :
 - ▶ market.scs.stanford.edu: 2001:470:806d:1::9 prefixlen 64 2001:470:806d:1:0:0:0:9
 - ▶ Can omit a single run of zeros with :: 5, 6, 7 = 0
 - ▶ Use brackets in URLs: http://[2001:470:806d:1::9]:80
 - ▶ Can write low 32 bits like IPv4: 64:ff9b::171.66.3.9 76 bits

IPv6 Address Assignment

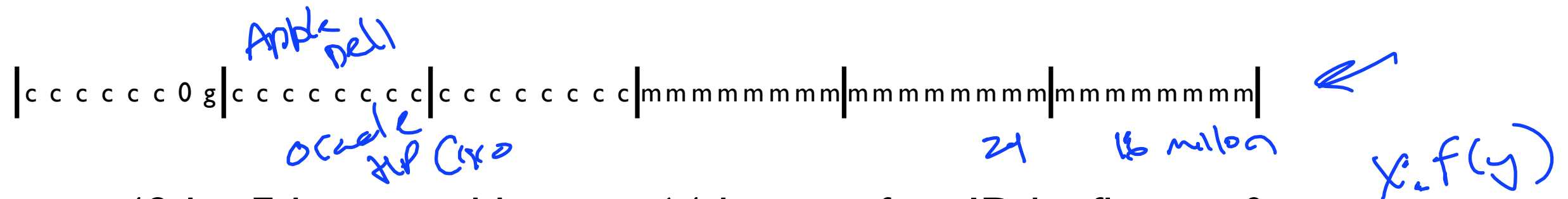
- Gone through several iterations, improved with experience
- RFC 3177: /48 in general case, /64 sometimes, /128 very rarely
- RFC 6177: at least /64, don't use /128
 - ▶ Up to RIRs to decide on allocation size (kind of like IPv4 today)

64,
60,
56,

123

Example Approach (RFC 4291)

- Can auto-generate IPv6 address from subnet /64 and Ethernet address
- Ethernet devices have a 48-bit unique identifier (layer 2 address) ←
 - Specified at manufacturing, today you can typically change it if you want
 - Manufacturer code (c) and assigned value (m), g is 0 for unicast MAC address



- Convert 48-bit Ethernet address to 64-bit interface ID by flipping 0, sticking 0xfffe in middle:

