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Transición a IPv6
(En Inglés)

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IMDEA Networks / UC3M
Madrid, 11 may 2009

IPv4

- Total: 3706.65 million addresses
- Free in IANA pool: 30 /8s (503 M)
- Free in RIR pools: 371 M
- Total free: 874 M /32s
- Used last year: 197 M
- 874 / 197 = 4.4 years

IPv6

- Global unicast: 42 million million million million million million
- (Let's say 536 million /32s)
- 138635 /32s in use
- 81015 given out last year
- 5368709l2 / 81015 = 6626

May 2009: 191 /8s, 86.4%

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111
112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127
128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143
144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175
176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191
192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207
208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223
224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239
240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255

Legend

★ Not usable

★ Given out to end-user

★ "Various registries"

★ RIPE NCC (Europe and more)

★ ARIN (North America)

★ APNIC (Asia, Australia and Pacific)

★ LACNIC (Latin America + Caribbean)

★ AfriNIC (Africa)

So we need IPv6!

- Still a few years of IPv4 addresses left, but just a **few**
- IPv6 has been around since late 1990s
- (Yes, that's more than 10 years!)
- So how far along is IPv6?

IPv6 capability

- OSes: Vista, Mac OS X and many Linuxes and BSDs have it enabled by default (XP...)
  - (just need IPv6 router on the local net)
- Routers: Cisco, Juniper, many others: available at full speed in newest boxes
  - slower than IPv4 or not available in older ones

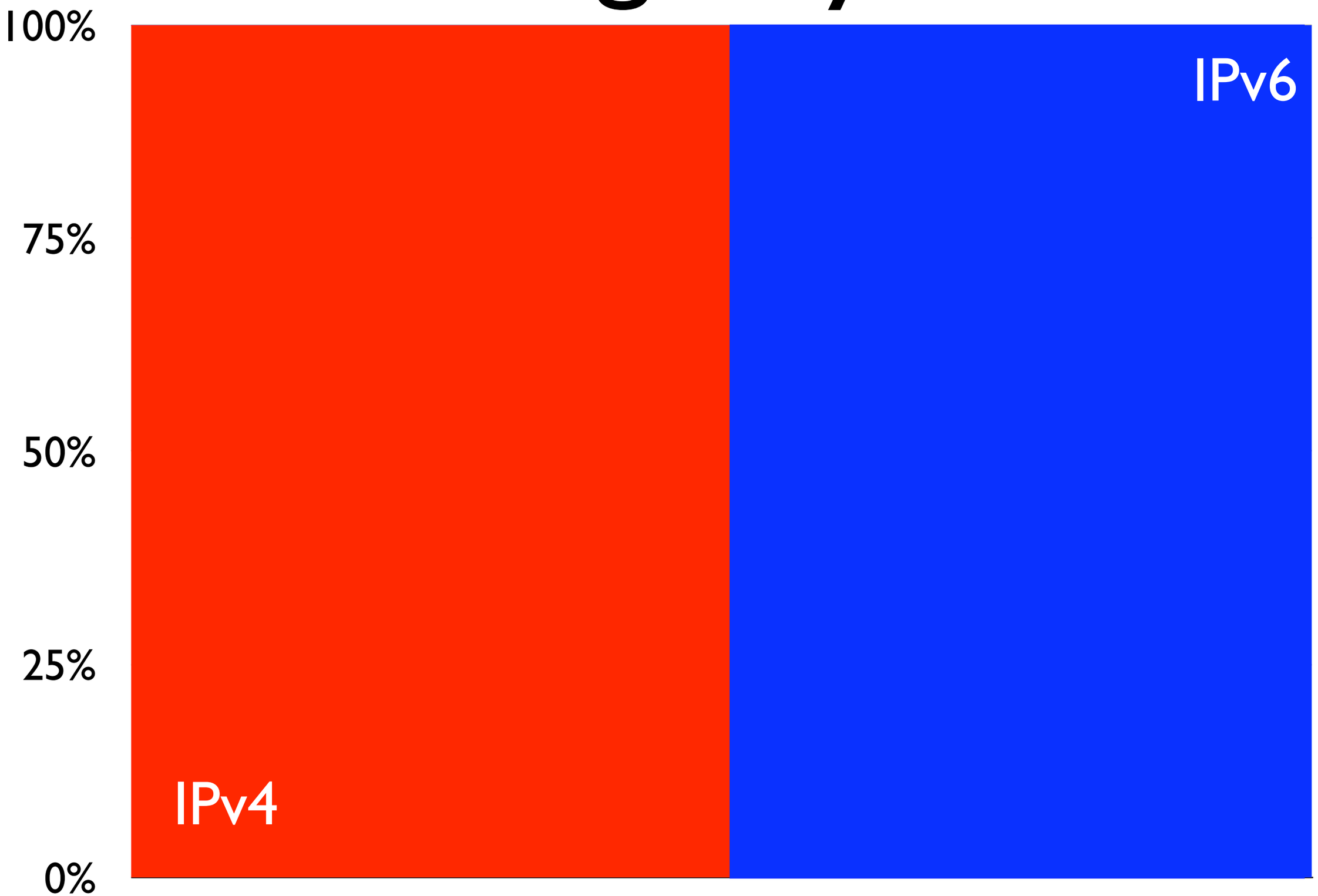
IPv6 capability (2)

- Software: 50/50, a lot of IPv6-capable software, also a lot of IPv4-only software
- Home routers... a problem!
- Firewalls, load balancers: getting there, but still a lot of IPv4-only stuff
  - or not all IPv4 features in IPv6

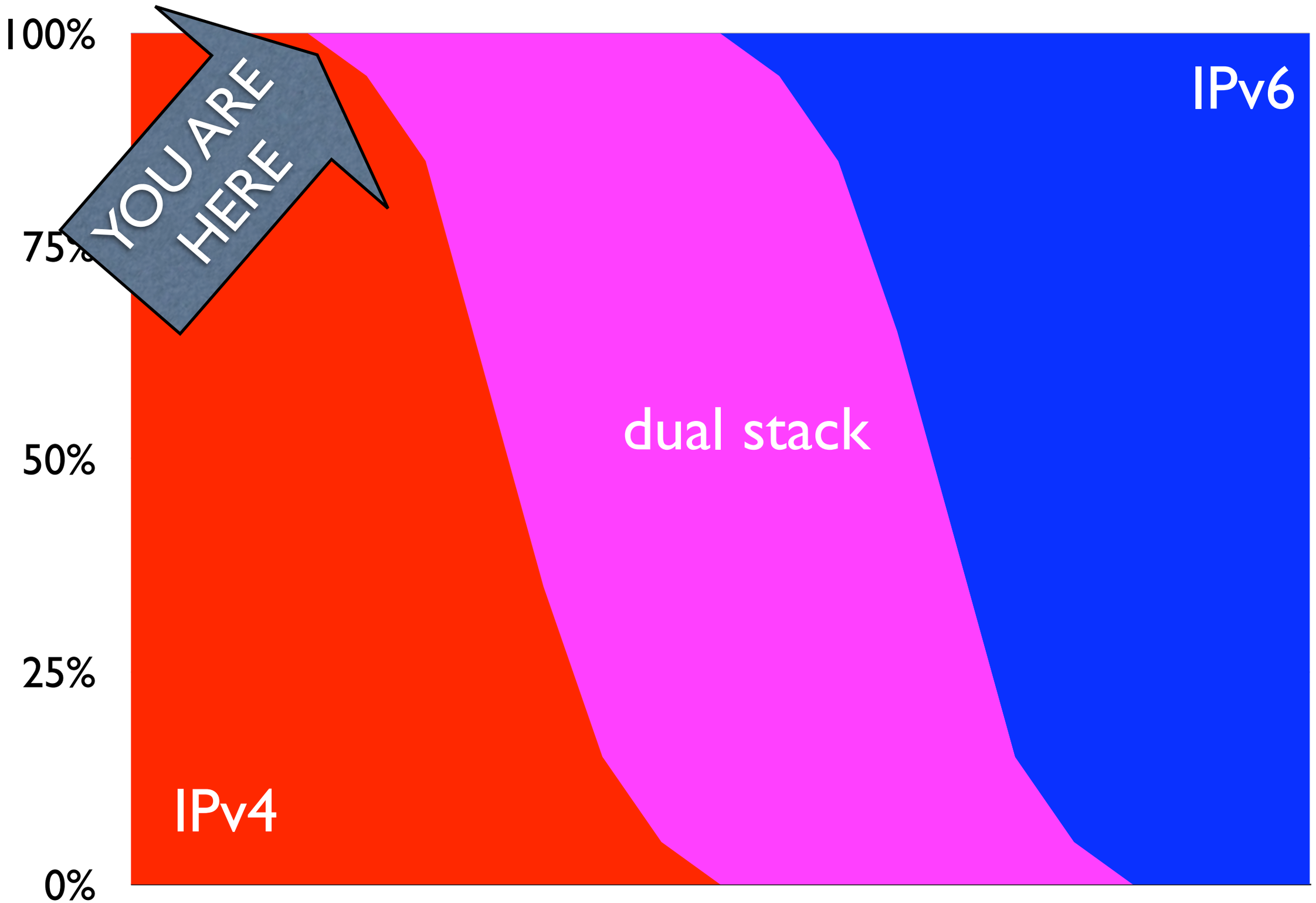
Actual deployment

- Arbor Networks test with many ISPs: 0.0026% IPv6 traffic
- Lars Eggert, top 500 websites: 0.4% (US) to 1.4% (DE) have AAAA records
- Google, search users: 0.25% have working IPv6, 0.09% broken IPv6
- 4.5% of ASes advertise an IPv6 prefix
- AMS-IX: ± 1 Gbps = 0.2% IPv6 traffic

"Flag Day"



Dual Stack



Where is the IPv6???

- Reasons why IPv6 is deployed so slowly:
  - being the first = find all the bugs!
  - waiting means: more expertise available, (probably) lower cost
  - customers aren't asking for IPv6
  - can't charge extra for IPv6

Where is IPv4 going?

- Nowhere.
  - still no good IPv6 DSL/cable modems, home routers
  - still IPv4-only OSes (Windows before XP, iPhone, non-computer devices)
  - still IPv4-only software

The future

- First and foremost:
  - IPv4 needs to keep working!
    - even if we have to break it to keep it!!
    - and is going to cost money!!!
- Then, *maybe*:
  - IPv6 to do what IPv4 can't do

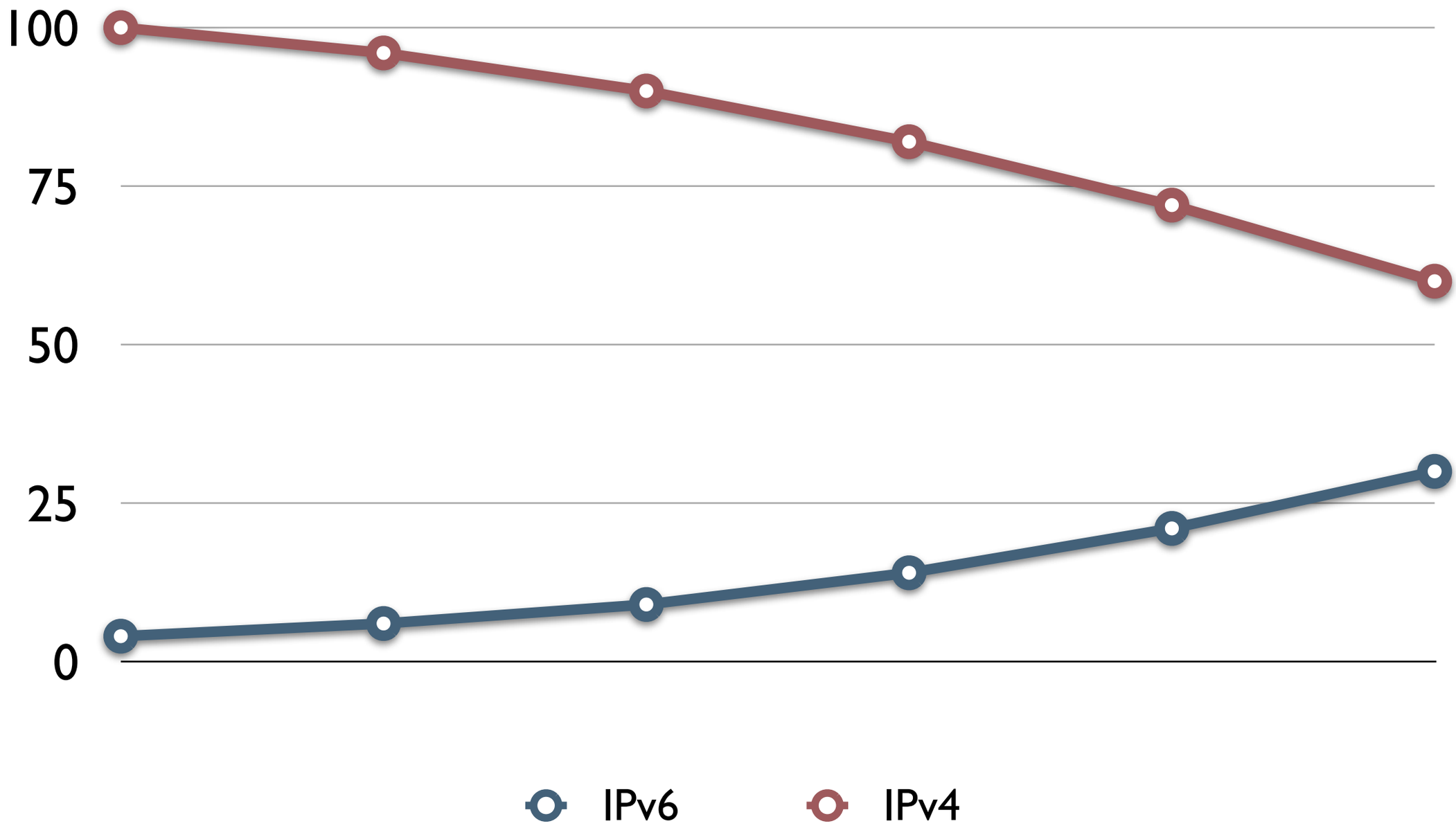
Sharing the pain

- In a few years: not enough addresses to give one to each user
- So: share one address with multiple users
  - with network address translation (NAT)

Problems with NAT

- Doesn't support incoming connections
  - fix with: UPnP (port forwarding), ICE
- If you have to share an address with your neighbors, who gets ports 80 and 5060?
- All NATs break *some* stuff, some NATs break a *lot* of stuff
  - so more NATs: less chance of your peer-to-peer protocol working

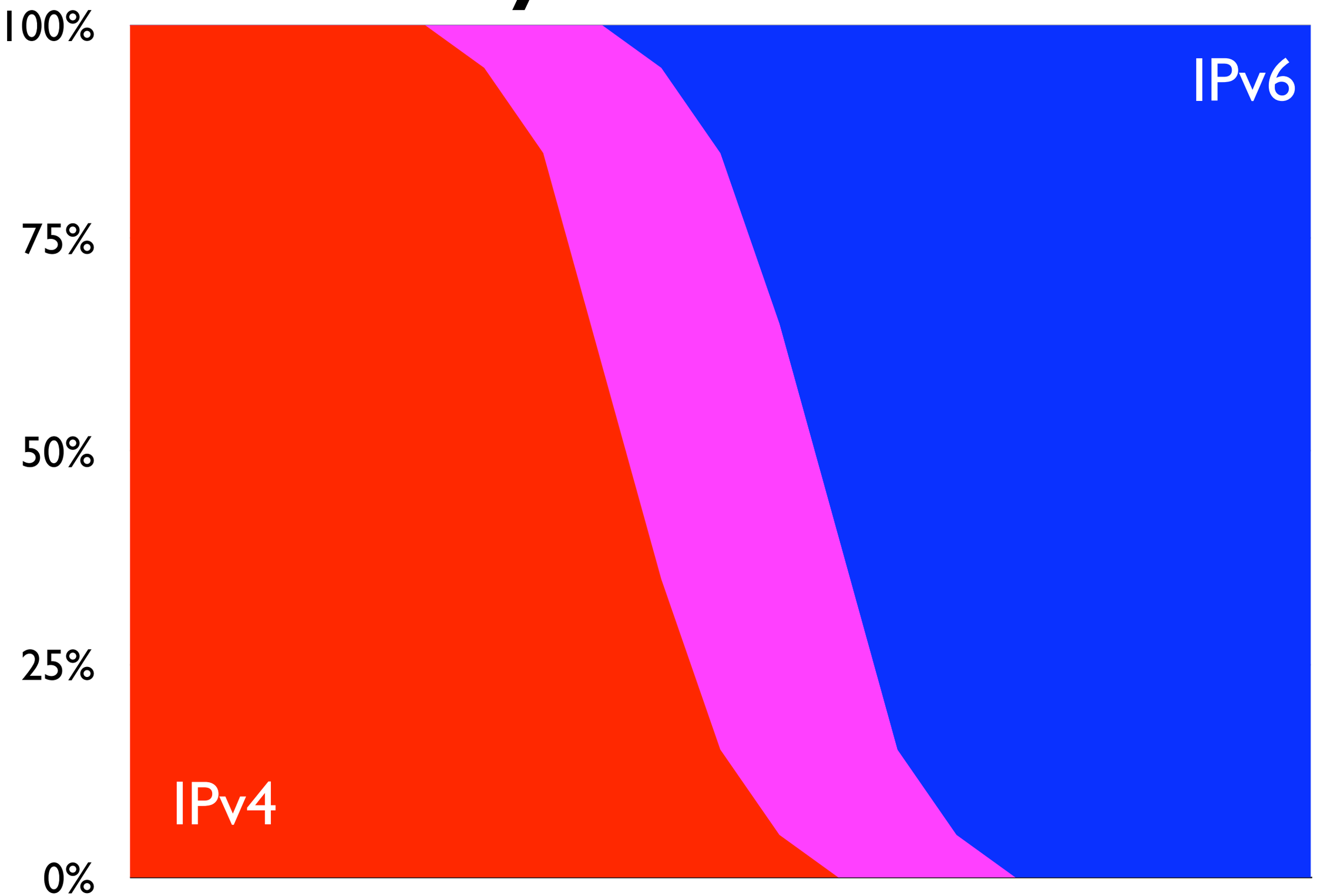
Usefulness



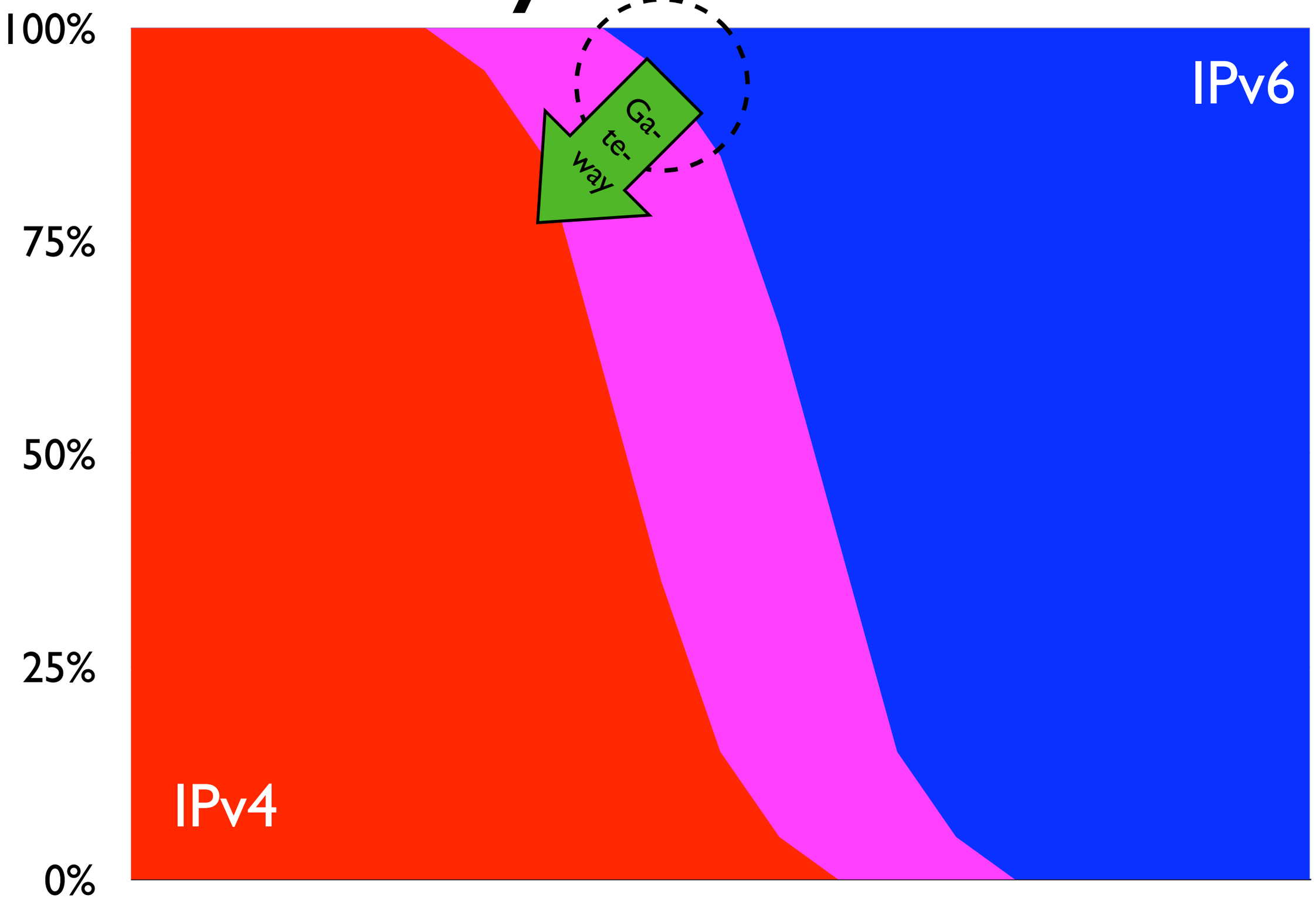
What if we want IPv6?

- (Probably not everyone wants it...)
- ((Probably some people connected to non-IPv6 service providers want it))
- (((If you try hard you can always tunnel)))

Messy transition



Messy transition



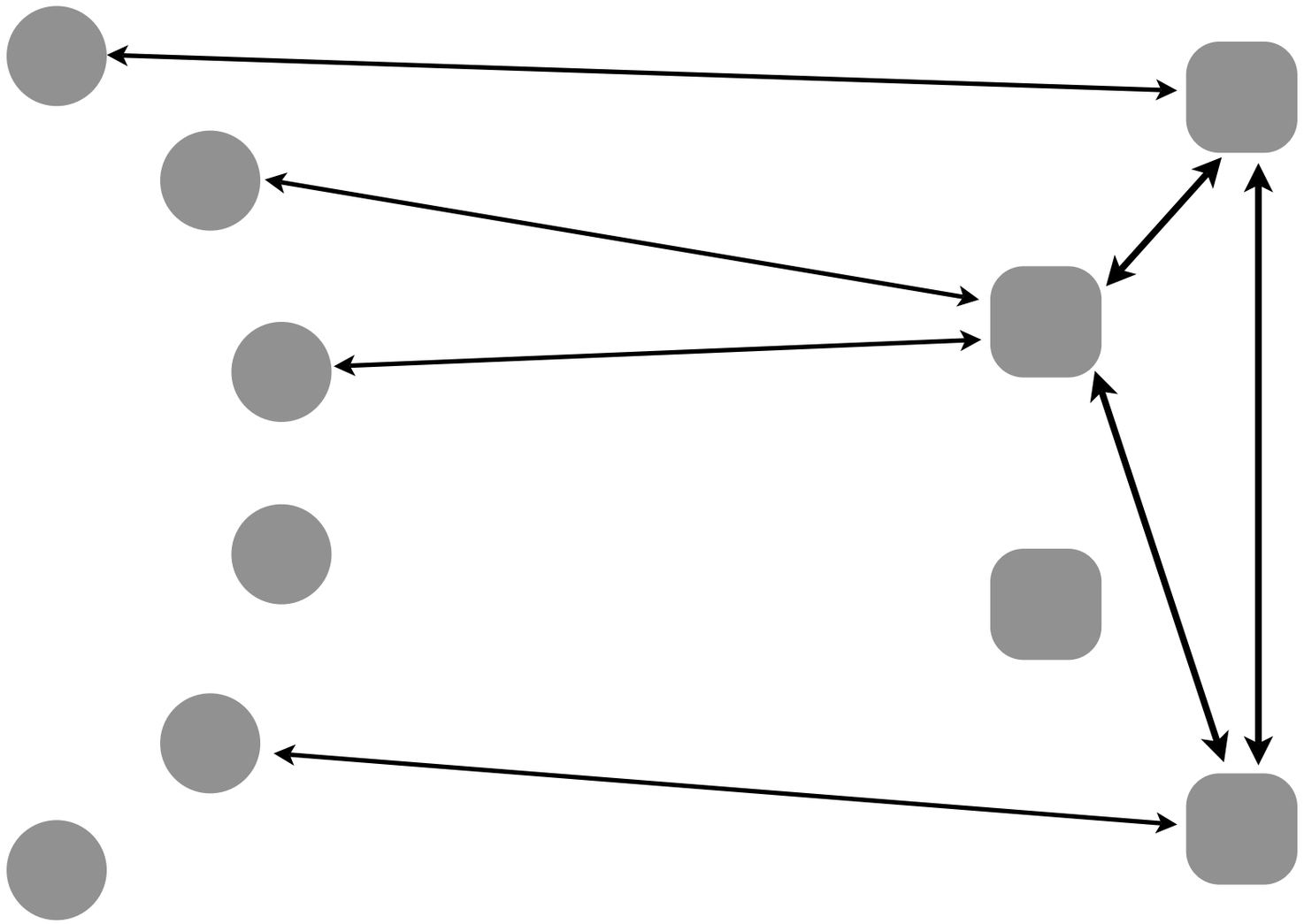
ISPs vs content

- ISPs:
  - need new addresses every year
  - can leave existing customers on IPv4 and give new customers IPv6
- Content providers:
  - need very few addresses
  - either have an AAAA record or not

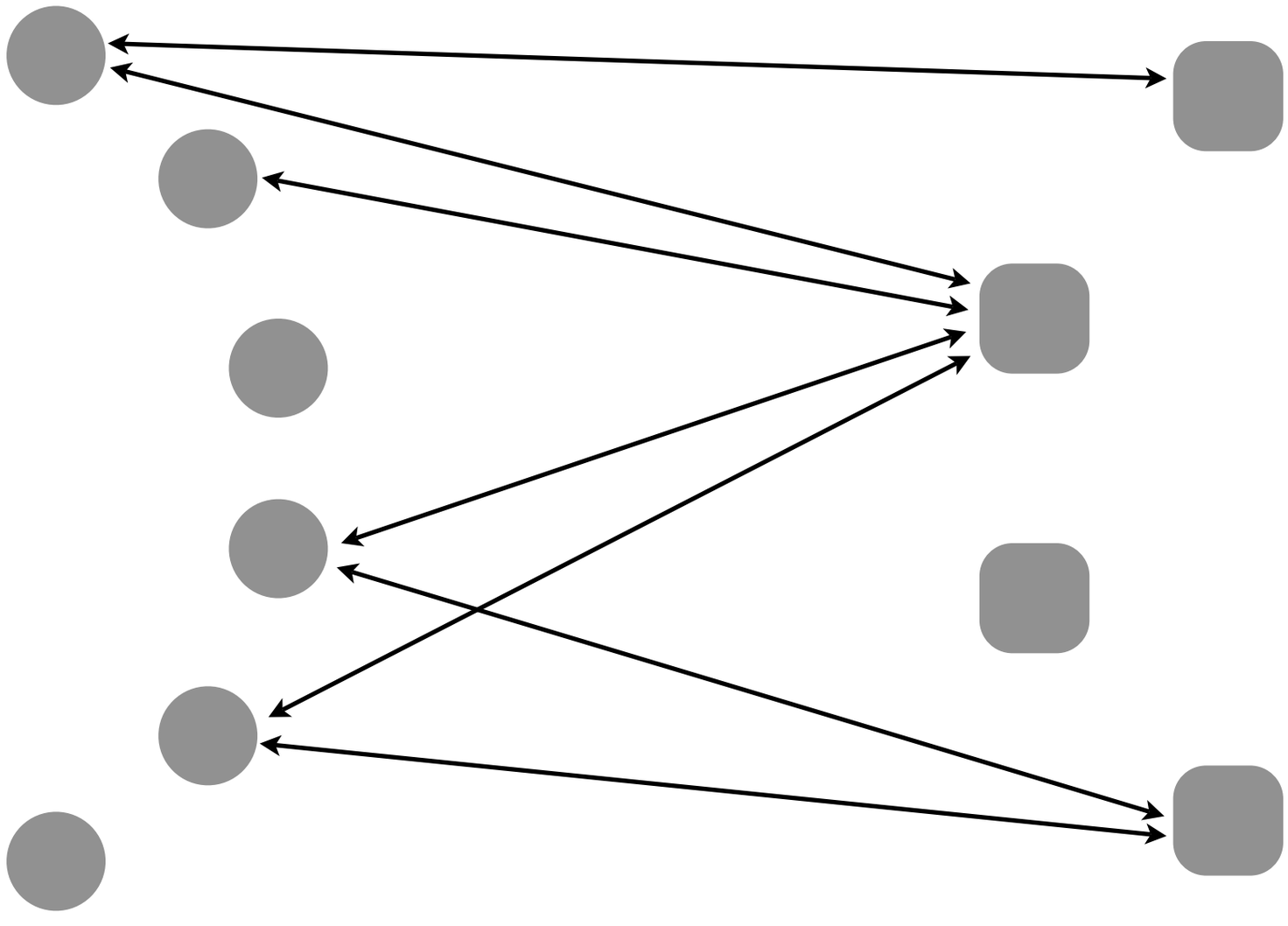
ISPs vs content (2)

- Likely result once v4 addresses are scarce:
  - more and more (home) users on IPv6
    - most content still on IPv4
- This is a good thing!
  - (well, everyone on IPv6 would be better)

Email Model



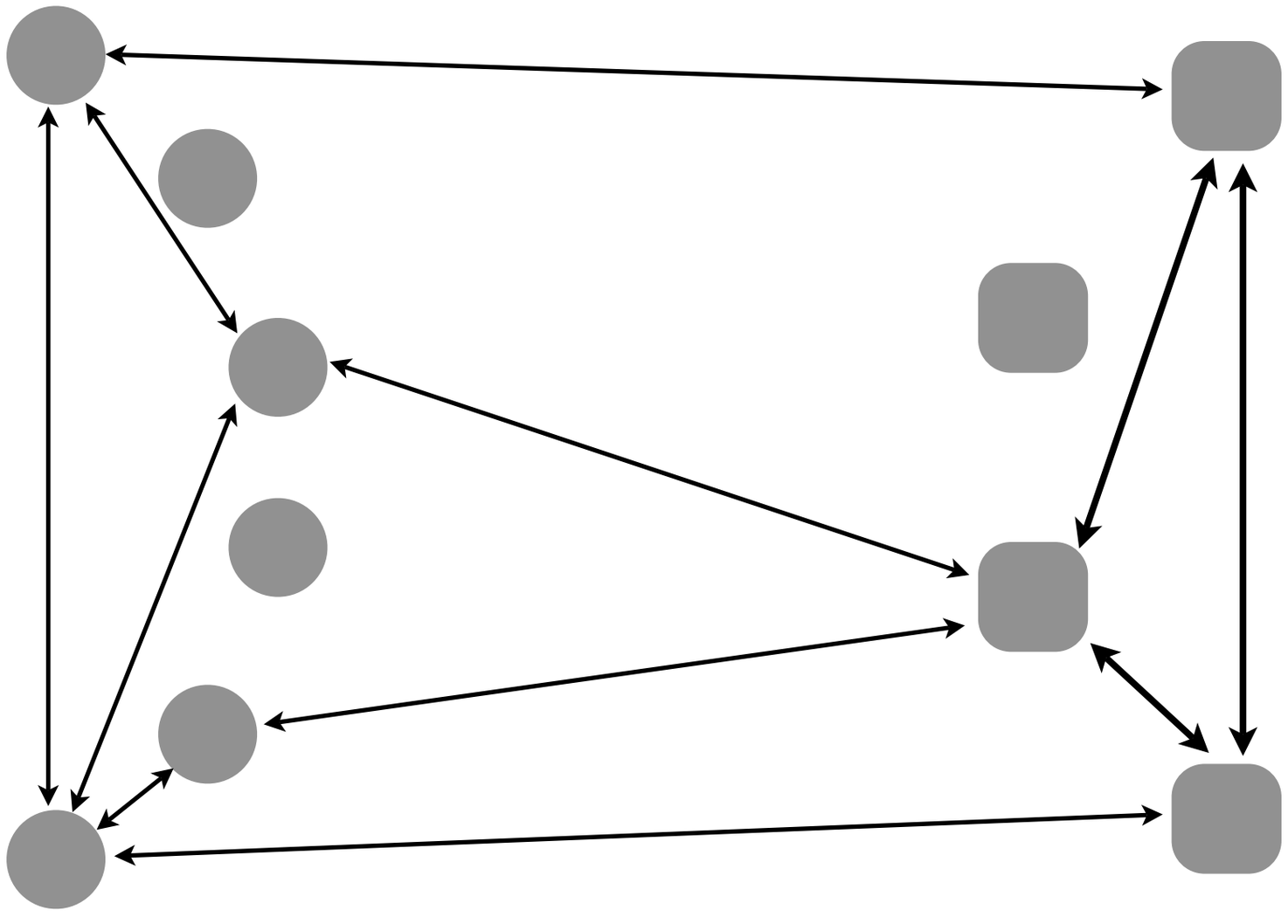
WWW Model



Client/Server Apps

- Email
  - clients talk to one server
  - servers communicate between them
- World Wide Web
  - clients talk to all servers
  - servers don't communicate with servers

P2P Model



Peers

Servers

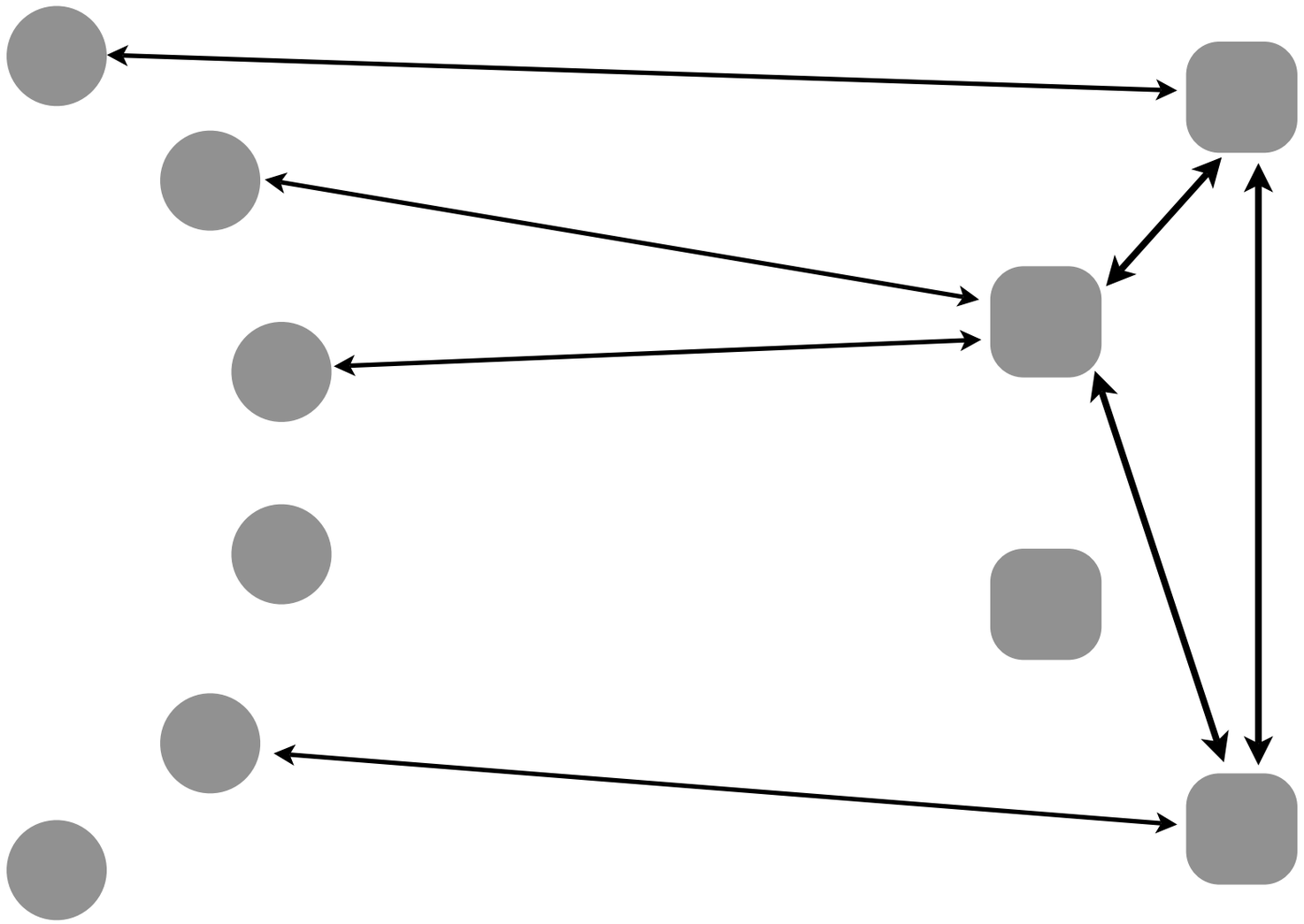
Peer to Peer Apps

- P2P type BitTorrent (file distribution):
  - no server-to-server and only subset clients needs to be reachable
- P2P type VoIP (one-to-one/one-to-few):
  - potentially all servers with all servers, all clients with all clients

Translating IPv4 - IPv6

- From IPv6 clients to IPv4 servers:
  - relatively easy!
- From IPv4 clients to IPv6 servers:
  - very hard
- With translation, everything looks like email model

Translation Model



NAT-PT

- Network Address Translation - Protocol Translation
- Translate IPv6 to IPv4 and then NAT
  - translator has /96 prefix
  - A records translated to AAAA records
  - /96 + 32 IPv4 = 128 bits (so each IPv4 address maps to an IPv6 address in the translator)

IETF

- NAT-PT "deprecated" in the IETF
- Now work on "NAT64", improved NAT-PT
  - support for ICE, DNSSEC, IPsec
- What can the IETF do to help you?
- What can you do to help the IETF?

Questions?

Thanks for listening!

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