

An IPv6 Story

And why it is taking so long

RAGNAR ANFINSEN

Chief Architect CPE, also responsible for IP Address Management

Been with Altibox since 2003, almost since the beginning

One of the co-founders of the IPv6 Forum Norge

Main driving force for IPv6 in Altibox

A worker in a high-visibility yellow-green safety suit and a grey cap is crouched in a deep, narrow trench. They are handling a bundle of bright orange fiber optic cables that stretch from the foreground into the distance. The trench walls are made of dark, moist earth. In the background, another worker is visible further down the trench. The scene is brightly lit, suggesting daylight.

450.000!

In 2016, Altibox signed its customer number 450,000, and became the biggest fiber optic network provider in Norway



The partnership – a model for success!

National presence through strong local brands.

A person's hand is visible on the right side of the frame, using a mouse on a desk. In the background, there is a large Apple iMac monitor and a smaller vertical monitor. The iMac screen displays a website with Norwegian text, including 'Kundeservice' and 'Opprett Altibox bruker'. The vertical monitor is a Wacom tablet. The scene is dimly lit, with a desk lamp visible on the right. The overall image has a soft, blurred quality with a red overlay on the right side.

Currently Altibox engages 170 FTE

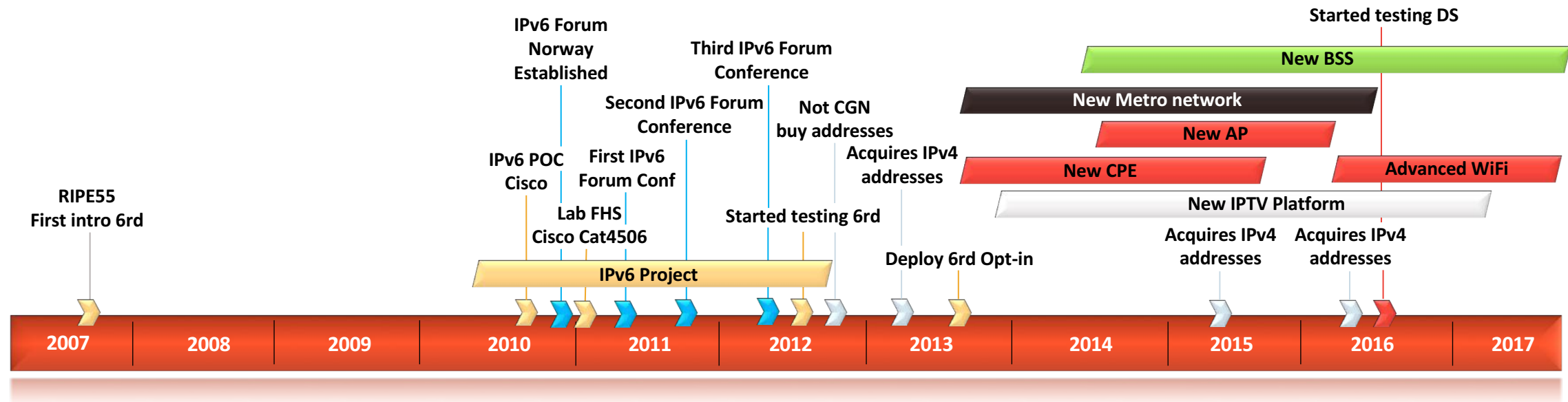
IPV6 HISTORY

It all started in 1991 when Steve Deering, Bob Hinden and Erik Nordmark...

JUST KIDDING...

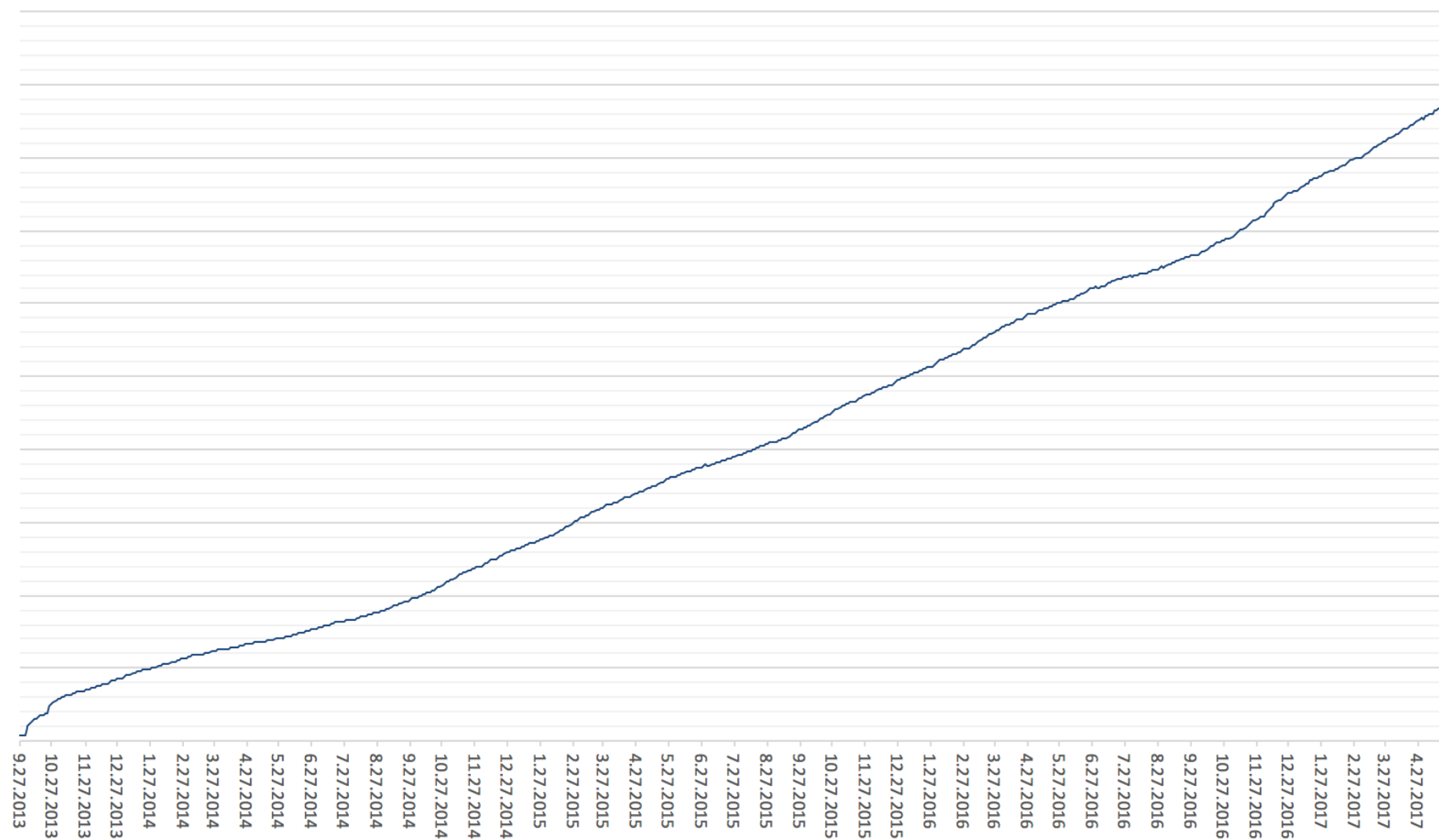
ALTIBOX STORY

Timeline



6rd Deployment

Customer Opt-In



We had to rebuild our network to increase partner revenue and reduce network complexity. Great benefit for Dual Stack IPv6/IPv4 implementation.

Altibox continues to pursue the full Dual Stack implementation of IPv6 and IPv4.

BUSINESS CASE

CGN vs IPv6

IPv6 does not remove the need for IPv4 as long as most of the important service providers only offers IPv4.

Acquisition of IPv4 vs. translation mechanisms (CGN/4rd/lw4o6)

As long as it is cheaper to buy IPv4 address space than to use translation mechanisms, acquisition is always preferred.

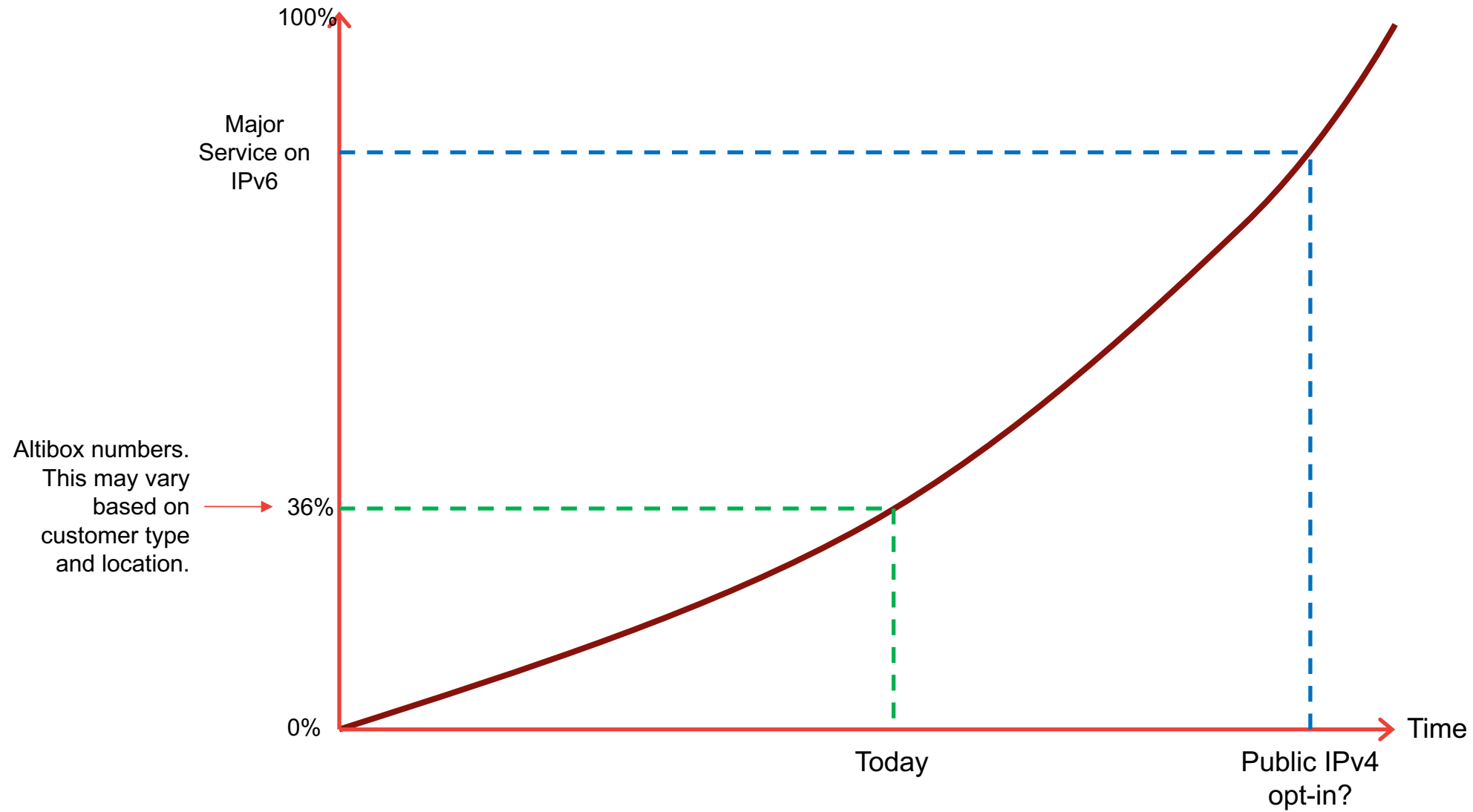
This is directly connected to IPv4 traffic volume.

Altibox's mission is to provide the absolutely best Internet access, and as long as major services are only available on IPv4, we will do native IPv4.

Altibox has already acquired two /15 nets and a /16 net.

Constantly evaluation transition CGN/4rd/lw4o6, but when will it happen?

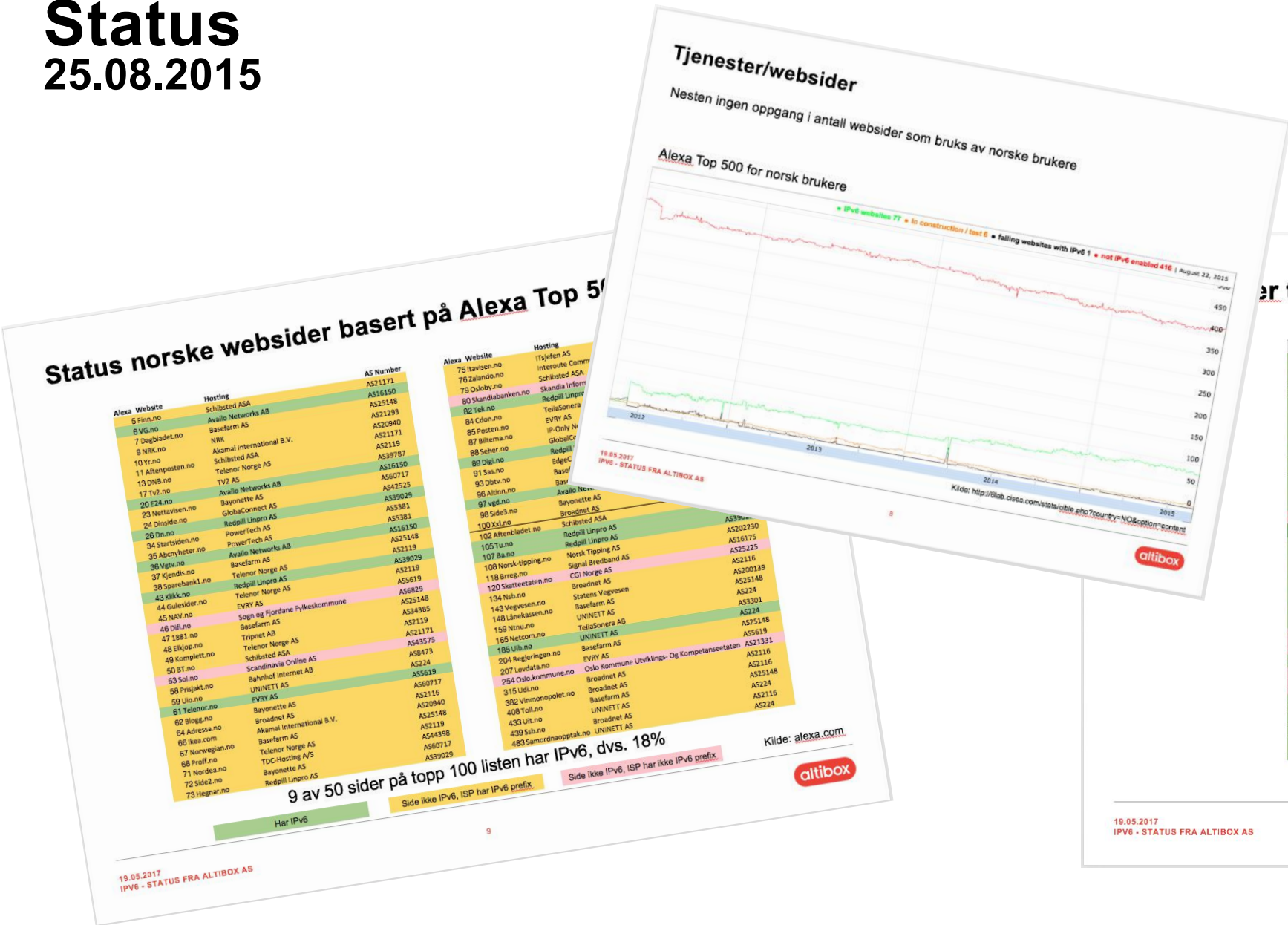
IPv6 vs IPv4



CONTENT DATA

Status

25.08.2015



er til norske websider

ISP	Non IPv6 pages	IPv6 Pages	Pages
Basefarm AS	9	0	9
Broadnet AS	6	0	6
Schibsted ASA	5	0	5
Telenor Norge AS	5	0	5
UNINETT AS	4	1	5
Bayonette AS	4	0	4
EVRY AS	3	1	4
Akamai International B.V.	2	0	2
PowerTech AS	2	0	2
TeliaSonera AB	2	0	2
Redpill Linpro AS	1	6	7
Bahnhof Internet AB	1	0	1
CGI Norge AS	1	0	1
EdgeCast Networks, Inc.	1	0	1
GlobalConnect AS	1	0	1
GlobalConnect A/S	1	0	1
Interoute Communications Limited	1	0	1
IP-Only Networks AB	1	0	1
ITsjefen AS	1	0	1
Norsk Tipping AS	1	0	1
NRK	1	0	1
Oslo Kommune Utviklings- Og Kompetanseetaten	1	0	1
Scandinavia Online AS	1	0	1
Signal Bredband AS	1	0	1
Skandia Informationsteknologi AB	1	0	1
Sogn og Fjordane Fylkeskommune	1	0	1
Statens Vegvesen	1	0	1
TDC-Hosting A/S	1	0	1
Trippel AS	1	0	1
TV2 AS	1	0	1
Avallo Networks AB	0	4	4

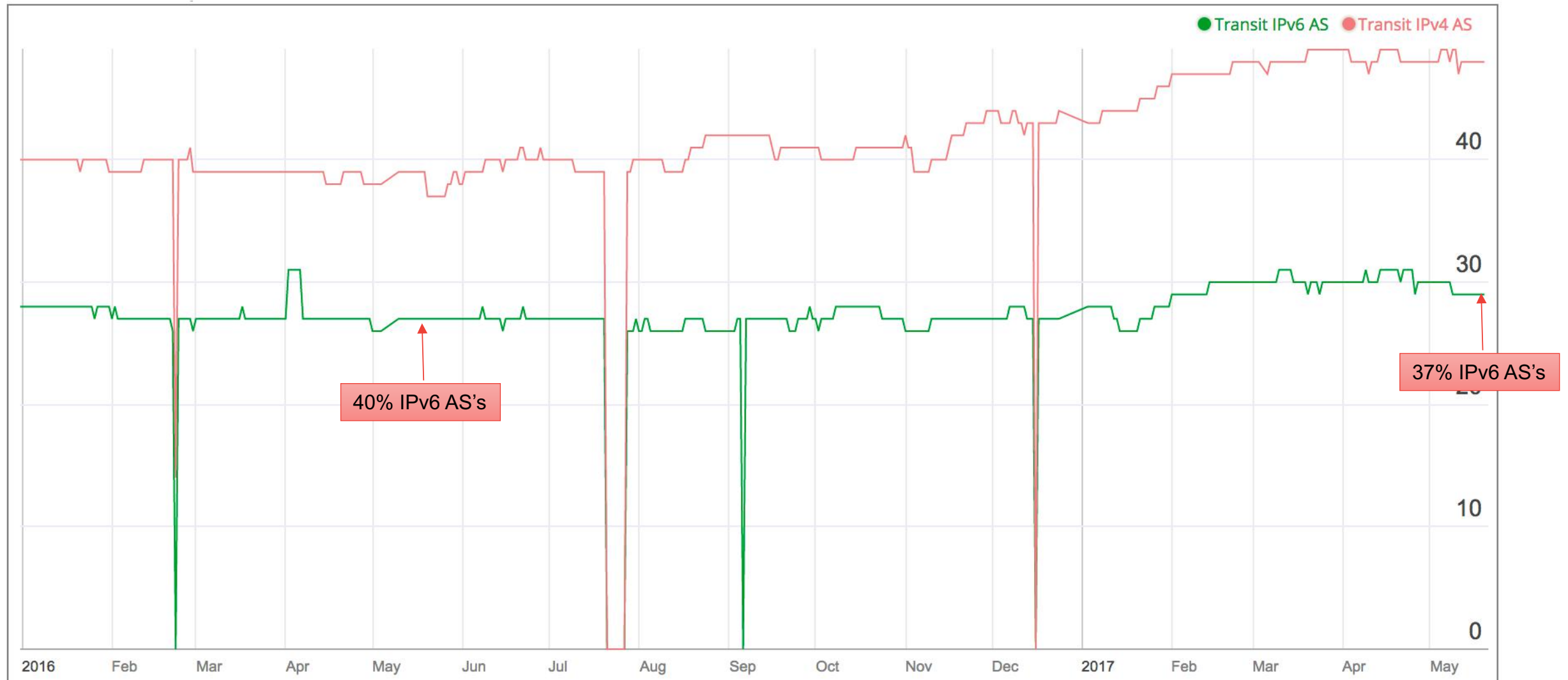
Kilde: [alexacom](http://blab.cisco.com/stats/obie.php?country=NO&option=content)

19.05.2017
IPv6 - STATUS FRA ALTIBOX AS

10



Historical expansion of IPv6 and IPv4 transit AS



Source: <http://6lab.cisco.com/>

Status Norwegian webpages based on Alexa Top 500

2015	2017			
Alexa	Alexa	Website	Hosting	AS Number
6		6VG.no	Availo Networks AB	AS16150
5↓		8Finn.no	Schibsted ASA	AS21171
9		9NRK.no	NRK	AS21293
7↓		12Dagbladet.no	Cloudflare	AS13335
		14itslearning.com	Cloudflare	AS13335
		16Feide.no	UNINETT AS	AS224
17		17Tv2.no	TV2 AS	AS39787
10↓		21Yr.no	Akamai International B.V.	AS20940
13↓		22DNB.no	Akamai International B.V.	AS16625
11↓		24Aftenposten.no	Schibsted ASA	AS21171
49↑		30Komplett.no	Akamai International B.V.	AS20940
23↓		31Nettavisen.no	Bayonette AS	AS60717
36		36Vgtv.no	Availo Networks AB	AS16150
46↑		37Difi.no	Sogn og Fjordane Fylkeskommune	AS6829
38↓		40Sparebank1.no	Telenor Norge AS	AS2119
20↓		42E24.no	Availo Networks AB	AS16150
24↓		43Dinside.no	Cloudflare	AS13335
		44P3.no	NRK	AS21293
		46vgliive.no	Availo Networks AB	AS16150
45↓		49NAV.no	Broadnet AS	AS2116
159↑		50Ntnu.no	UNINETT AS	AS224
62↑		52Blogg.no	Bayonette AS	AS60717
		57Viaplay.no	Amazon Inc	AS16509
26↓		58Dn.no	Redpill Linpro AS	AS39029
82↑		62Tek.no	Redpill Linpro AS	AS39029
		63Snl.no	Blix Solutions AS	AS50304
64↓		66Adressa.no	Broadnet AS	AS2116
96↑		67Altinn.no	Basefarm AS	AS25148
59↓		68Uio.no	UNINETT AS	AS224
75↑		69Itavisen.no	Cloudflare	AS13335
58↓		71Prisjakt.no	Bahnhof Internet AB	AS8473
44↓		74Gulesider.no	Telenor Norge AS	AS2119
50↓		79BT.no	Schibsted ASA	AS21171
47↓		811881.no	Basefarm AS	AS25148
48↓		83Elkjop.no	Tripnet AB	AS34385
76↓		84Zalando.no	Akamai International B.V.	AS16625
185↑		89Uib.no	UNINETT AS	AS224
35↓		91Abcnhyheter.no	PowerTech AS	AS5381
120↑		93Skatteetaten.no	CGI Norge AS	AS25225
67↓		96Norwegian.no	Basefarm AS	AS25148
34↓		97Startsiden.no	PowerTech AS	AS5381

2015	2017			
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97↓		105vgd.no	Availo Networks AB	AS16150
61↓		109Telenor.no	EVRY AS	AS5619
68↓		111Proff.no	Telenor Norge AS	AS2119
66↓		119Ikea.com	Akamai International B.V.	AS20940
73↓		121Hegnar.no	Redpill Linpro AS	AS39029
143↑		122Vegvesen.no	Statens Vegvesen	AS200139
71↓		124Nordea.no	GlobalConnect A/S	AS42525
98↓		126Side3.no	Bayonette AS	AS60717
43↓		127Klikk.no	Cloudflare	AS13335
108↓		134Norsk-tipping.no	Norsk Tipping AS	AS202230
85↓		137Posten.no	EVRY AS	AS5619
102↓		138Aftenbladet.no	Schibsted ASA	AS21171
80↓		139Skandiabanken.no	Basefarm AS	AS25148
87↓		140Biltema.no	IP-Only Networks AB	AS12552
53↓		147Sol.no	Cloudflare	AS13335
84↓		151Cdon.no	TeliaSonera AB	AS3301
134↓		159Nsb.no	TDC A/S	AS3292
100↓		160Xxl.no	Amazon Inc	AS16509
207↑		170Lovdata.no	EVRY AS	AS5619
91↓		174Sas.no	EdgeCast Networks, Inc.	AS15133
88↓		179Seher.no	Cloudflare	AS13335
107↓		184Ba.no	Redpill Linpro AS	AS39029
118↓		189Brreg.no	Signal Bredband AS	AS16175
105↓		194Tu.no	Redpill Linpro AS	AS39029
72↓		217Side2.no	Bayonette AS	AS60717
89↓		232Digi.no	Redpill Linpro AS	AS39029
148↓		250Lanekassen.no	Basefarm AS	AS25148
204↓		313Regjeringen.no	Defense.Net, Inc	AS55002
433↑		314Uit.no	UNINETT AS	AS224
382↑		320Vinmonopolet.no	Broadnet AS	AS2116
254↓		336Oslo.kommune.no	Oslo Kommune Utviklings- Og Kompetanseetaten	AS21331
483↑		356Samordnaopptak.no	UNINETT AS	AS224
439↑		374Ssb.no	Broadnet AS	AS2116
315↓		388Udi.no	Broadnet AS	AS2116
408↓		909Toll.no	Basefarm AS	AS25148
79↓		2532Osloby.no	Schibsted ASA	AS21171
165↓		4087Netcom.no	Telia Norge AS	AS12929
37↓		12747Kjendis.no	Cloudflare	AS13335
93↓		Dbtv.no	Cloudflare	AS13335

13 of 40 Alexa Top 100 sites has IPv6, that is 13%

Have IPv6

Page not IPv6, ISP has IPv6 prefix

Page not IPv6, ISP not IPv6 prefix

Source: <http://www.alexa.com>

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Observations:

- Fewer Norwegian webpages on Alexa Top100 list. 57⁽²⁰¹⁵⁾ vs 41⁽²⁰¹⁷⁾.
- But more sites with IPv6. 9⁽²⁰¹⁵⁾ vs 13⁽²⁰¹⁷⁾. Non lost.
- Dagbladet and Yr.no on IPv6 due to Cloudflare and Akamai. 👍
- 5 new websites, 4 with IPv6.
- 6 UNINETT sites, only 2 with IPv6.
- 5 Akamai sites, only 1 with IPv6.
- Biggest IPv6 site provider is Cloudflare with 9 sites, but 1 site without IPv6.

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Have IPv6

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Source: <http://www.alexa.com>

Status ISP's to Norwegian webpages

ISP	Non IPv6 pages	IPv6 Pages	Pages
Basefarm AS	6	0	6
Broadnet AS	5	0	5
Schibsted ASA	5	0	5
Bayonette AS	4	0	4
Akamai International B.V.	4	1	5
UNINETT AS	4	2	6
Telenor Norge AS	3	0	3
Amazon Inc	2	0	2
NRK	2	0	2
PowerTech AS	2	0	2
EVERY AS	2	1	3
Bahnhof Internet AB	1	0	1
CGI Norge AS	1	0	1
Defense.Net, Inc	1	0	1
EdgeCast Networks, Inc.	1	0	1
GlobalConnect A/S	1	0	1
IP-Only Networks AB	1	0	1
Norsk Tipping AS	1	0	1
Oslo Kommune Utviklings- Og Kompetanseetaten	1	0	1
Signal Bredband AS	1	0	1
Sogn og Fjordane Fylkeskommune	1	0	1
Statens Vegvesen	1	0	1
TDC A/S	1	0	1
Telia Norge AS	1	0	1
TeliaSonera AB	1	0	1
Tripnet AB	1	0	1
TV2 AS	1	0	1
Cloudflare	1	8	9
Blix Solutions AS	0	1	1
Availo Networks AB	0	5	5
Redpill Linpro AS	0	6	6

Observations:

- Few of the big site providers do IPv6.
- Cloudflare and Redpill/Availo serving most of the sites.
- Very little else have happened since 2015.

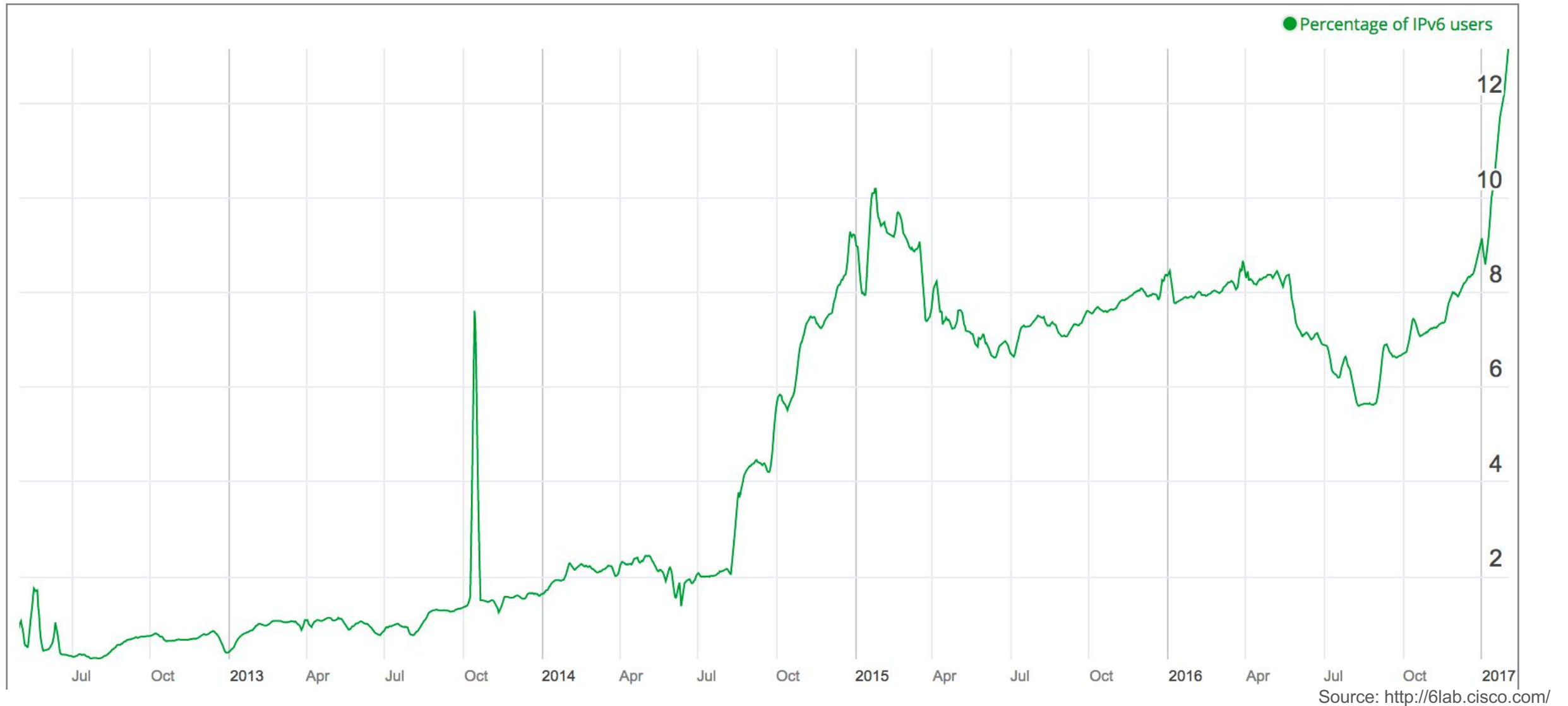
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Status ISP's to Norwegian webpages

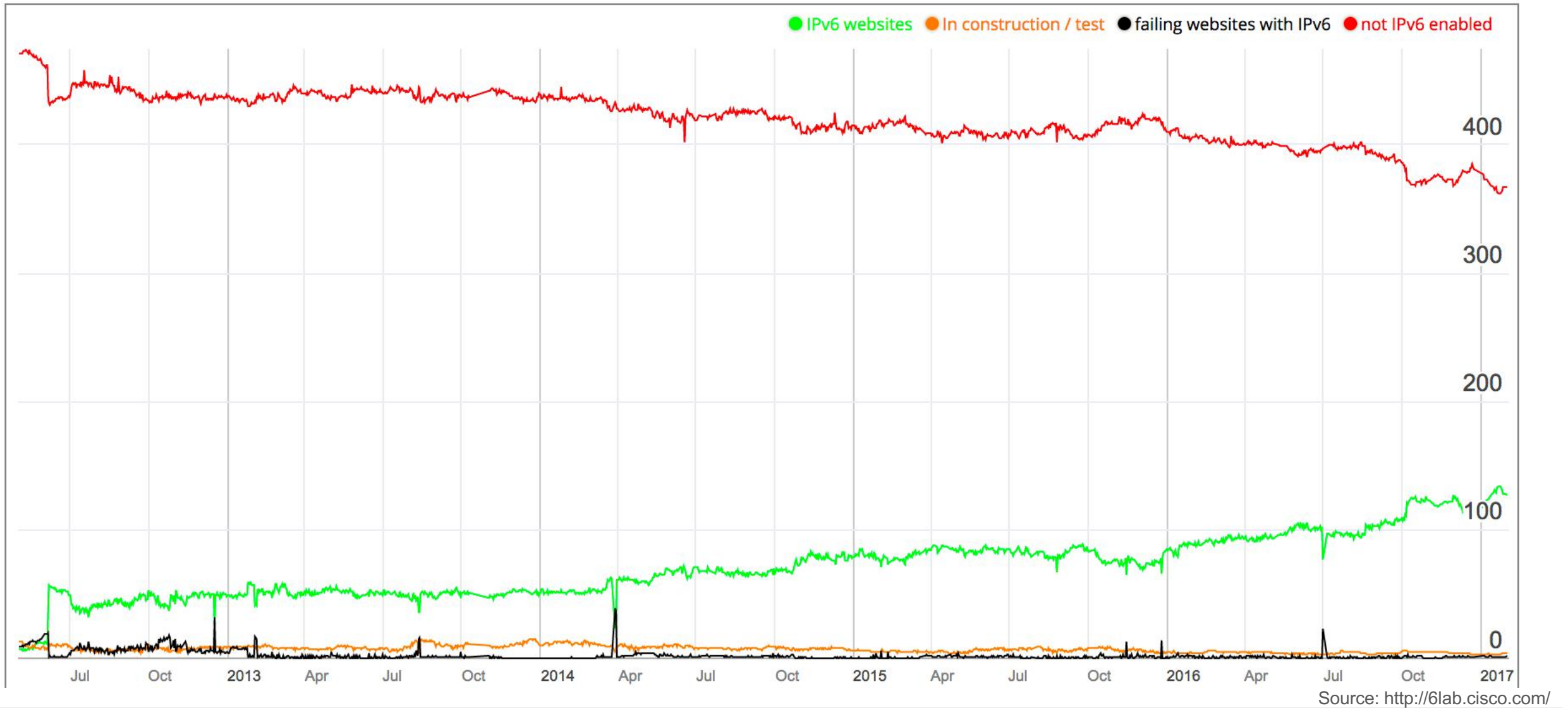
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EVRY AS	2	1	3
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TeliaSonera AB	2	0	2
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Bahnhof Internet AB	1	0	1
CGI Norge AS	1	0	1
EdgeCast Networks, Inc.	1	0	1
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Oslo Kommune Utviklings- Og Kompetanseetaten	1	0	1
Scandinavia Online AS	1	0	1
Signal Bredband AS	1	0	1
Skandia Informationsteknologi AB	1	0	1
Sogn og Fjordane Fylkeskommune	1	0	1
Statens Vegvesen	1	0	1
TDC-Hosting A/S	1	0	1
Tripnet AB	1	0	1
TV2 AS	1	0	1
Availo Networks AB	0	4	4

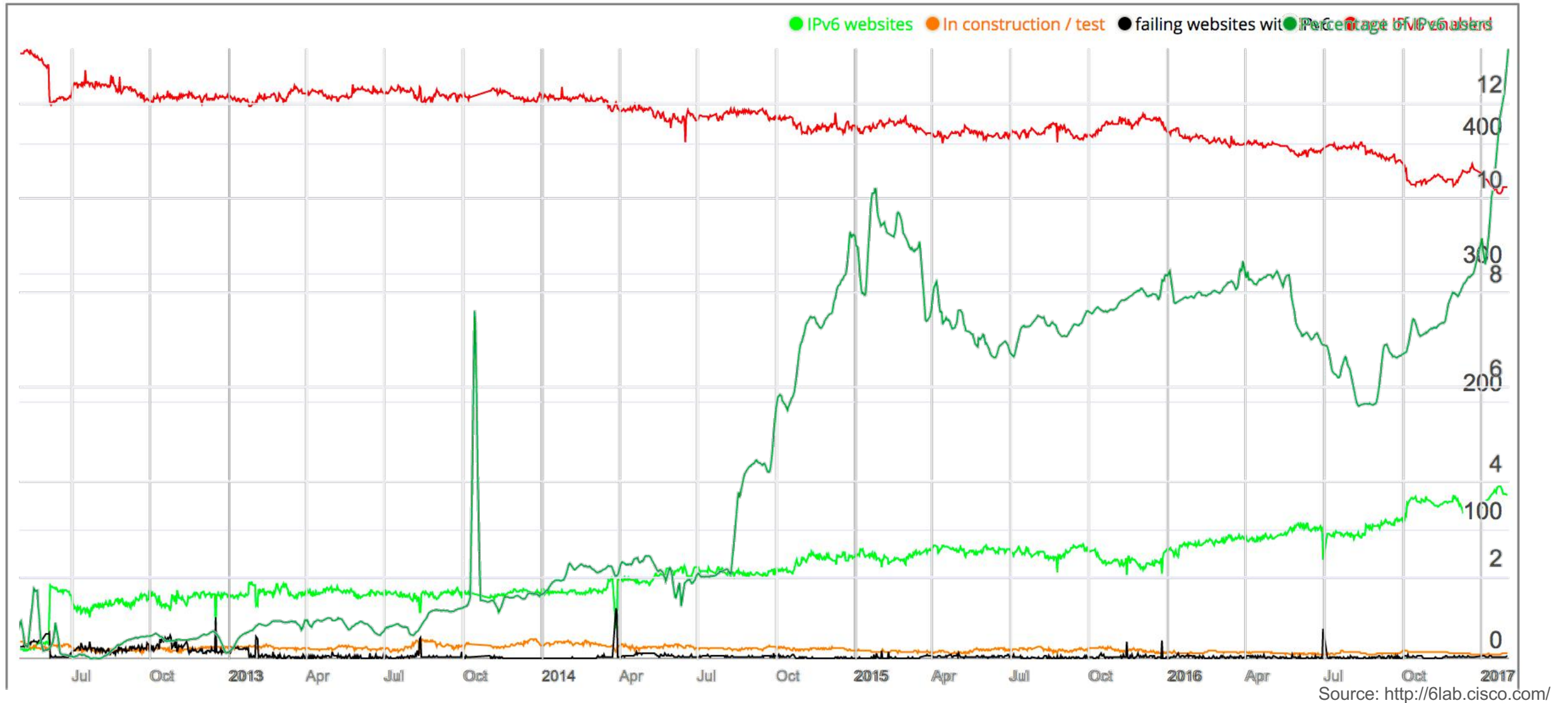
Users in Norway



Content in Norway



Content vs. Users in Norway



SO DOES IT MAKE SENSE

As of today, Altibox does not see any rush in doing Dual Stack IPv6/IPv4, as the business case does not force us to do transition mechanisms.

However, we are working hard to implement IPv6, as we need to prepare for internal depletion of IPv4.

So, what can we do to increase the IPv6 penetration in Norway?

Questions?

The altibox logo is a circular emblem composed of numerous small white dots arranged in a ring. The word "altibox" is written in a white, lowercase, sans-serif font across the center of the dot ring.

altibox