



Are We There Yet?

IPv6 as Related to GDP per Capita

Alain Durand, October 26th 2016

Questions for this Study:

I. Where are we across the globe with IPv6 adoption?

- a. Is IPv6 deployed uniformly?
- b. Is there a rich country/poor country divide?

II. What can IPv6 adoption numbers tell us about IPv6 as a replacement for IPv4?

- a. How to best measure IPv6 adoption? Penetration or usage?
How do they differ?
- b. Are we there yet? (As in, can we retire IPv4?)

Methodology

I. Find data about IPv6 adoption per country

- Penetration data
- Bandwidth data

II. Compare countries

- Use GDP per capita to characterize countries
 - Gross Domestic Product divided by population size
 - Metric widely use by economists to compare countries
- Look at outliers

III. Assessment of the data

- Are the various data set telling the same story?
- Are we there yet?

**Find data about
IPv6 adoption per country**

Data Sources

I. APNIC/Geoff Huston IPv6 penetration study

- Uses Google ads
- Provide a proxy* for measuring penetration, i.e. the potential of using IPv6 per country

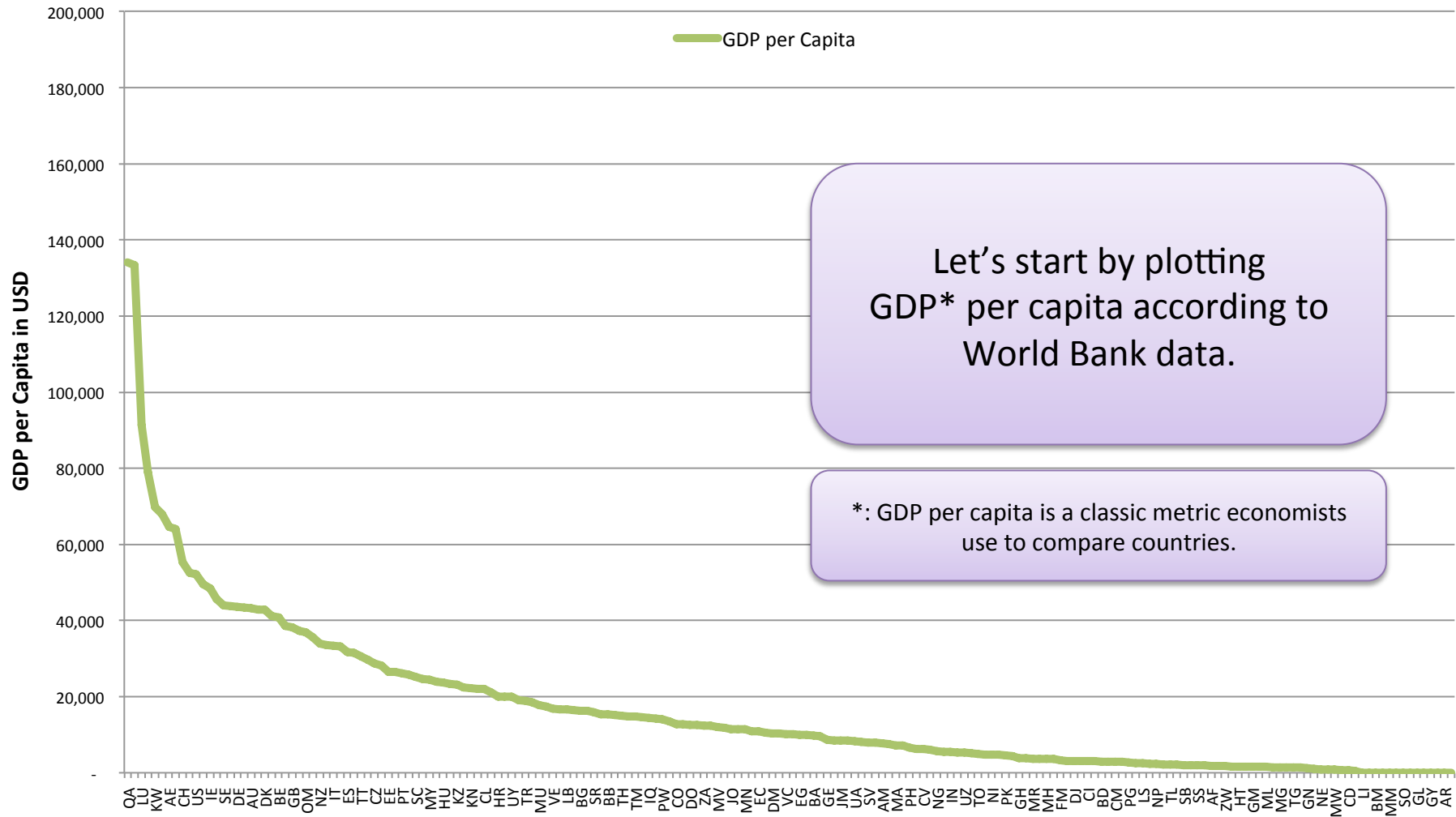
II. AKAMAI State of the Internet study

- Measure hits over IPv6 on Akamai caches
- Provide a proxy* for measuring bandwidth, i.e. the usage of IPv6 per country

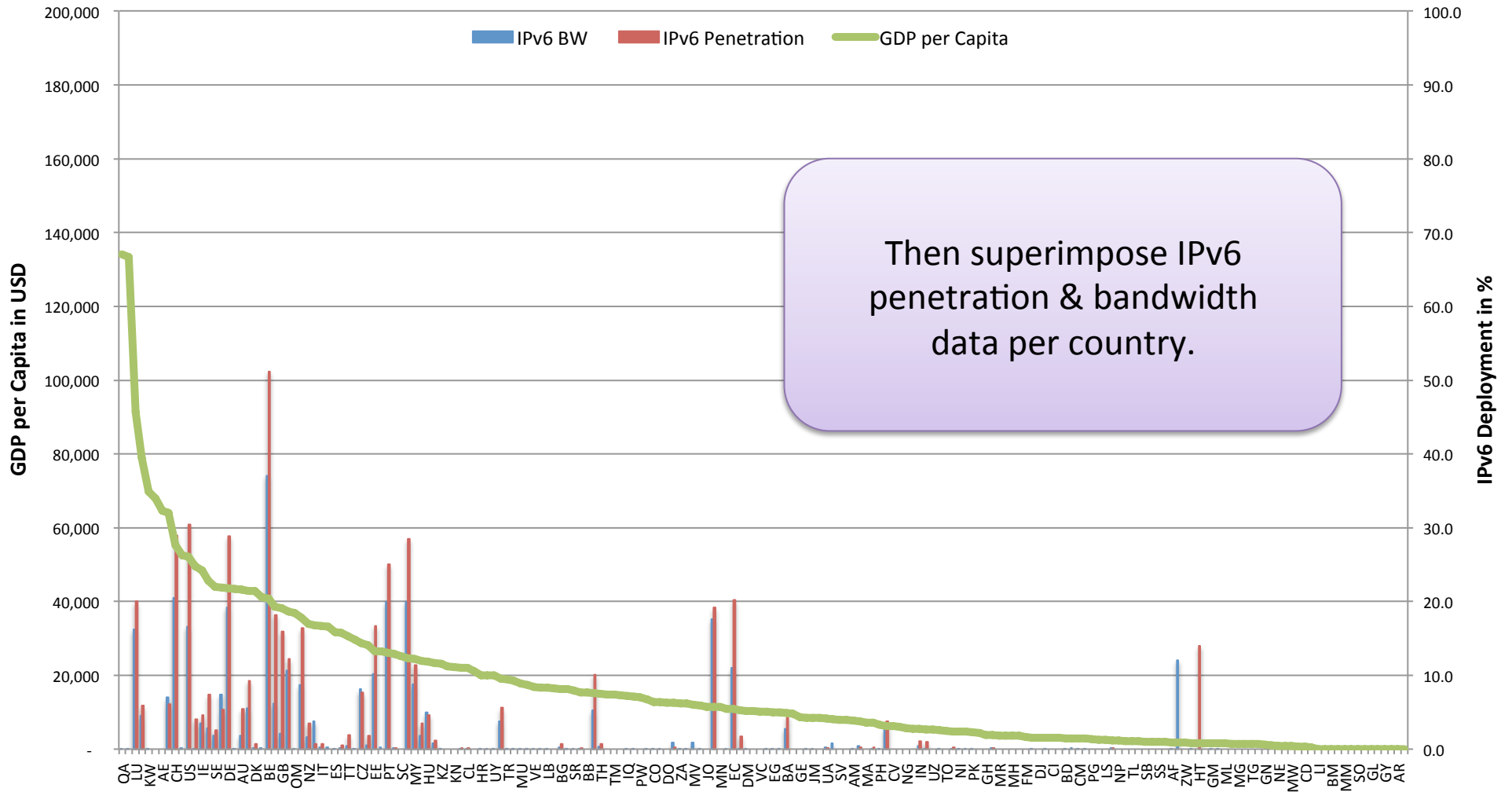
* Proxy: a figure that can be used to represent the value of something in a calculation

**Where are we across the globe
with IPv6 adoption?**

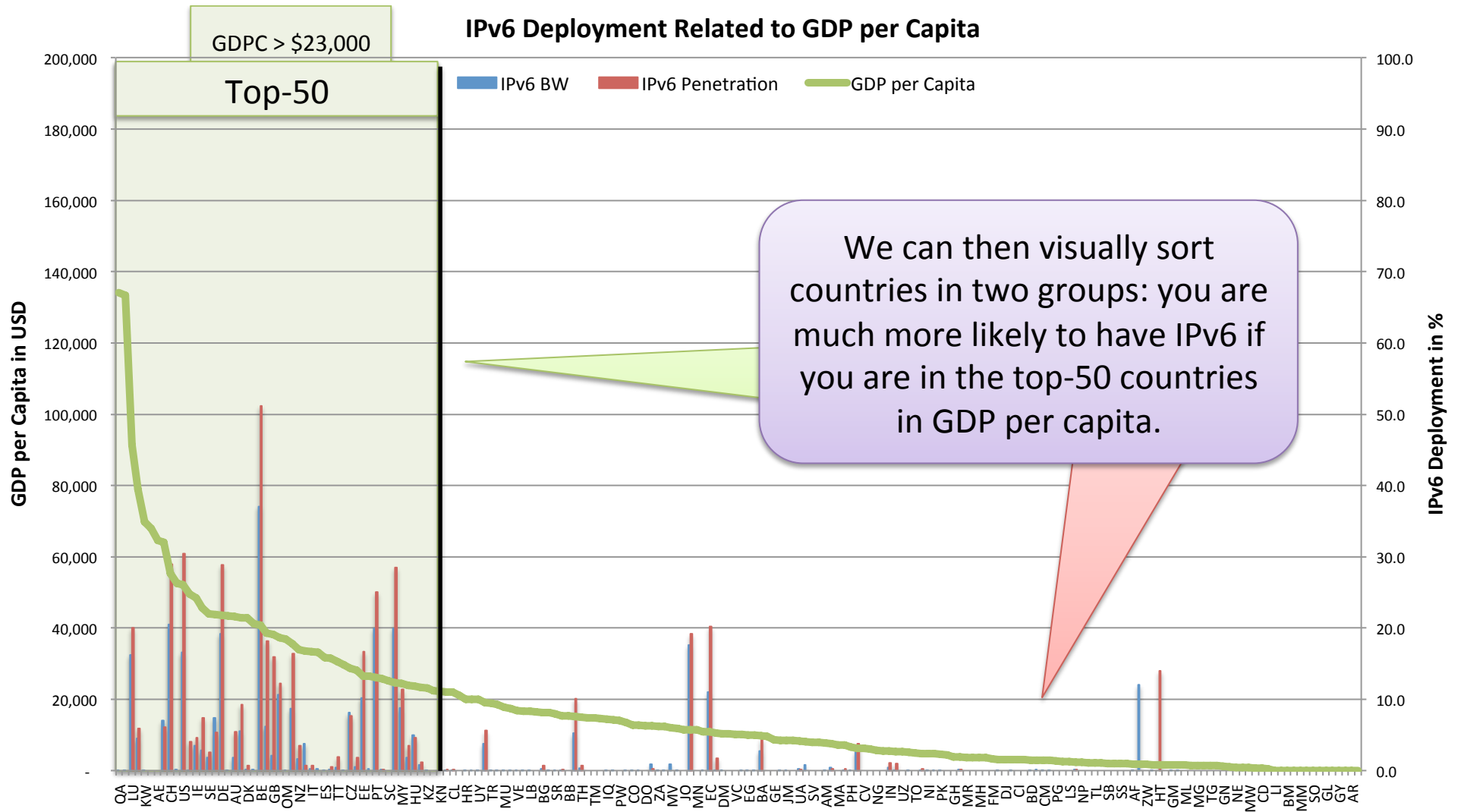
IPv6 Deployment Related to GDP per Capita



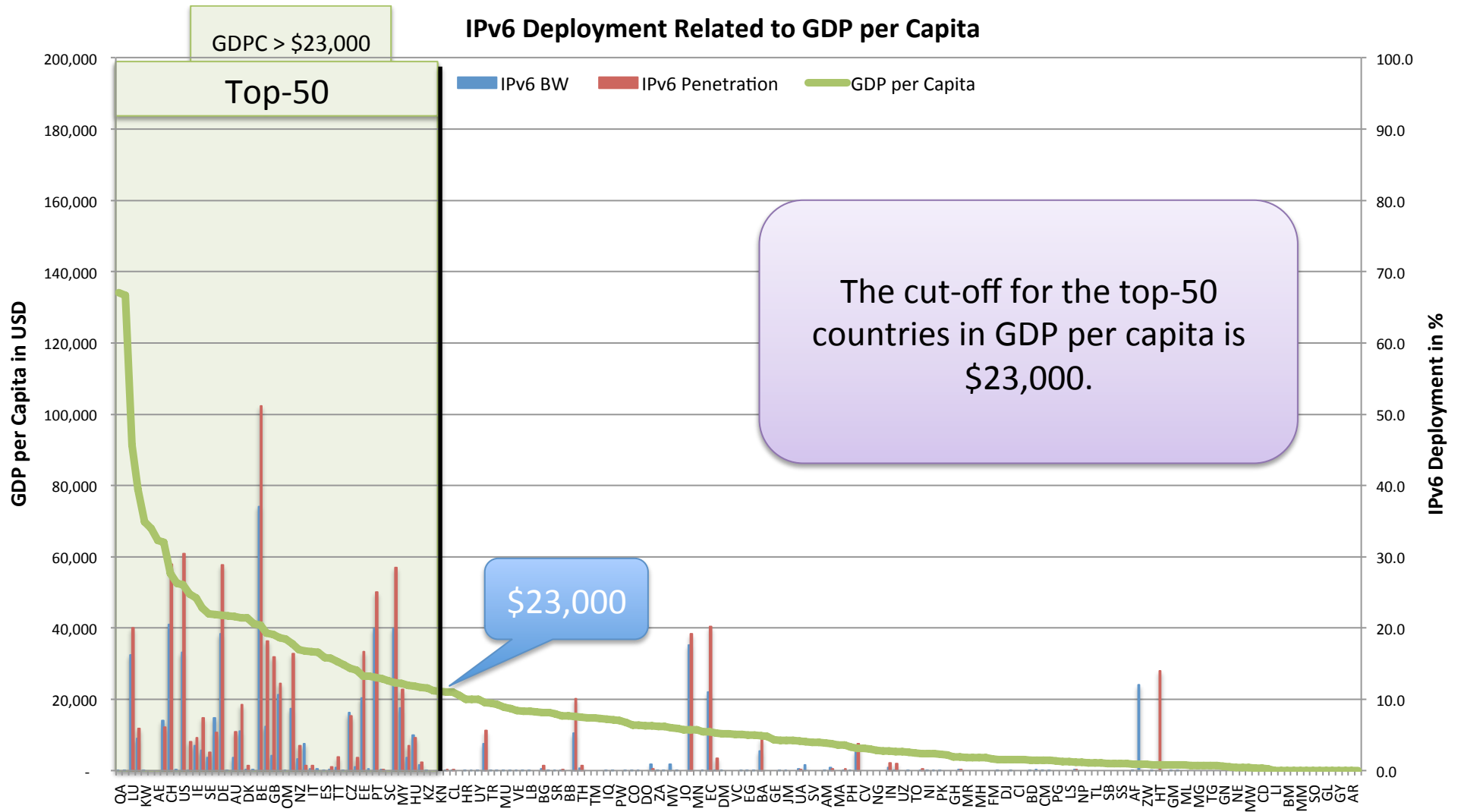
IPv6 Deployment Related to GDP per Capita



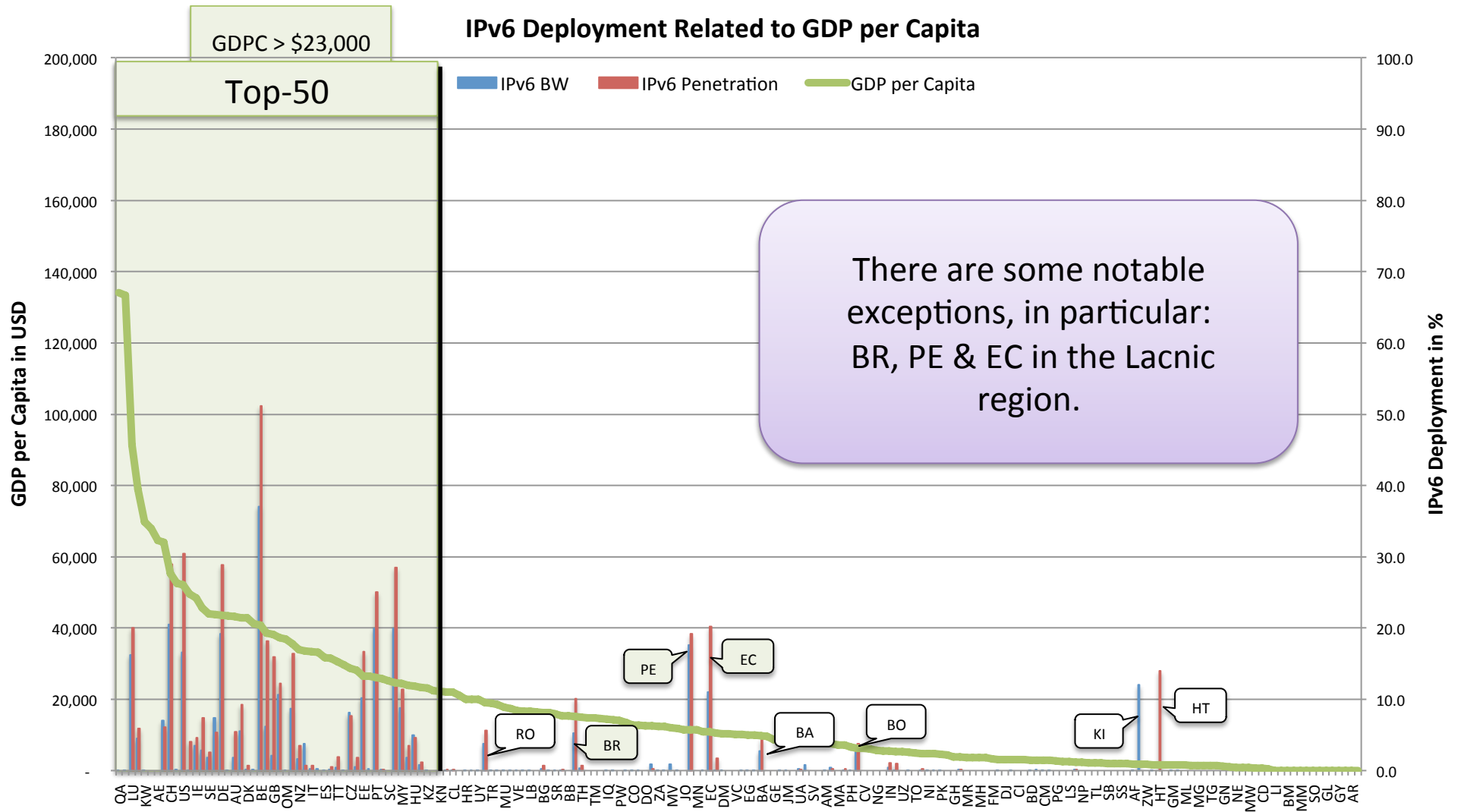
IPv6 Deployment Related to GDP per Capita



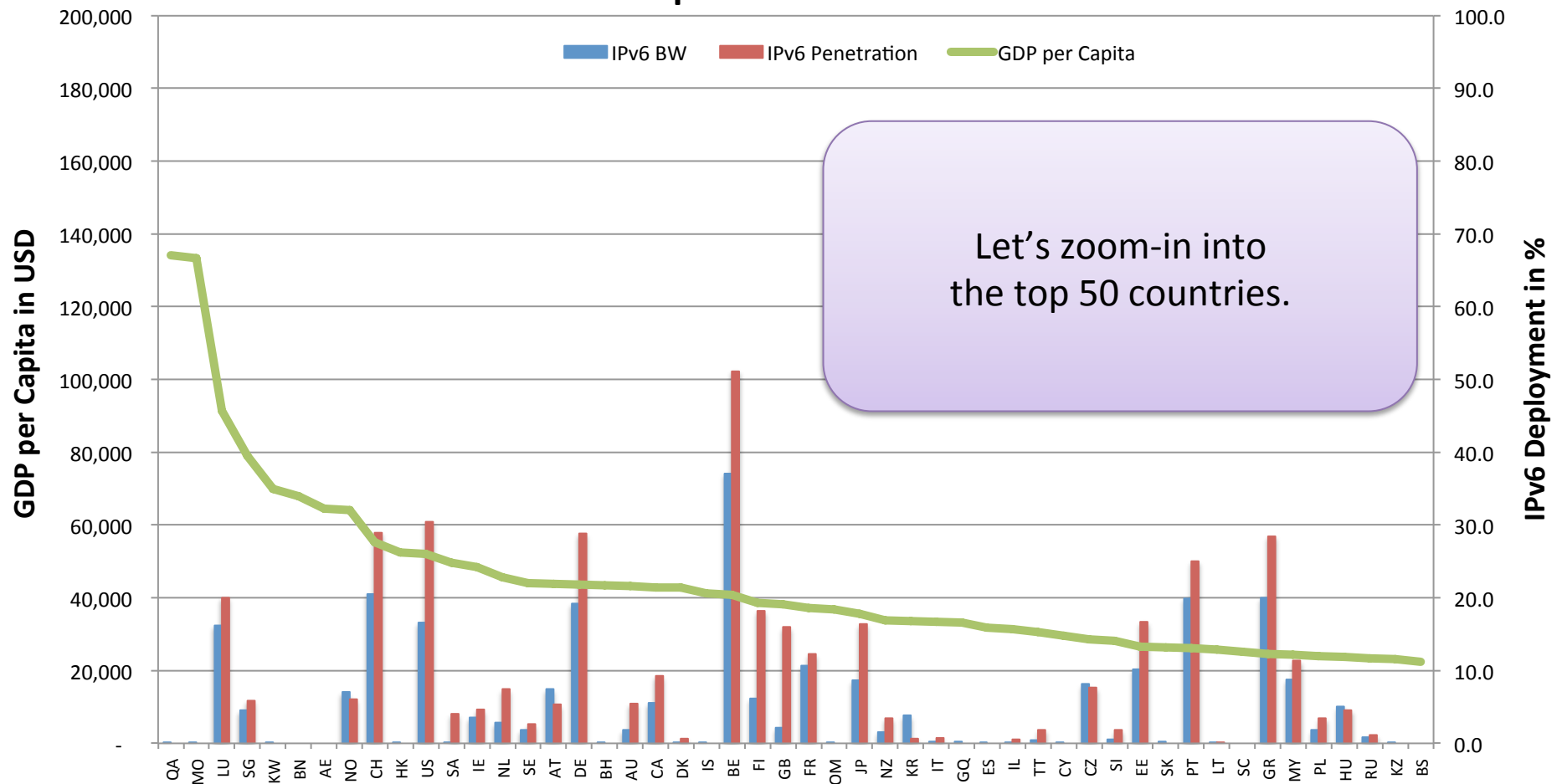
IPv6 Deployment Related to GDP per Capita



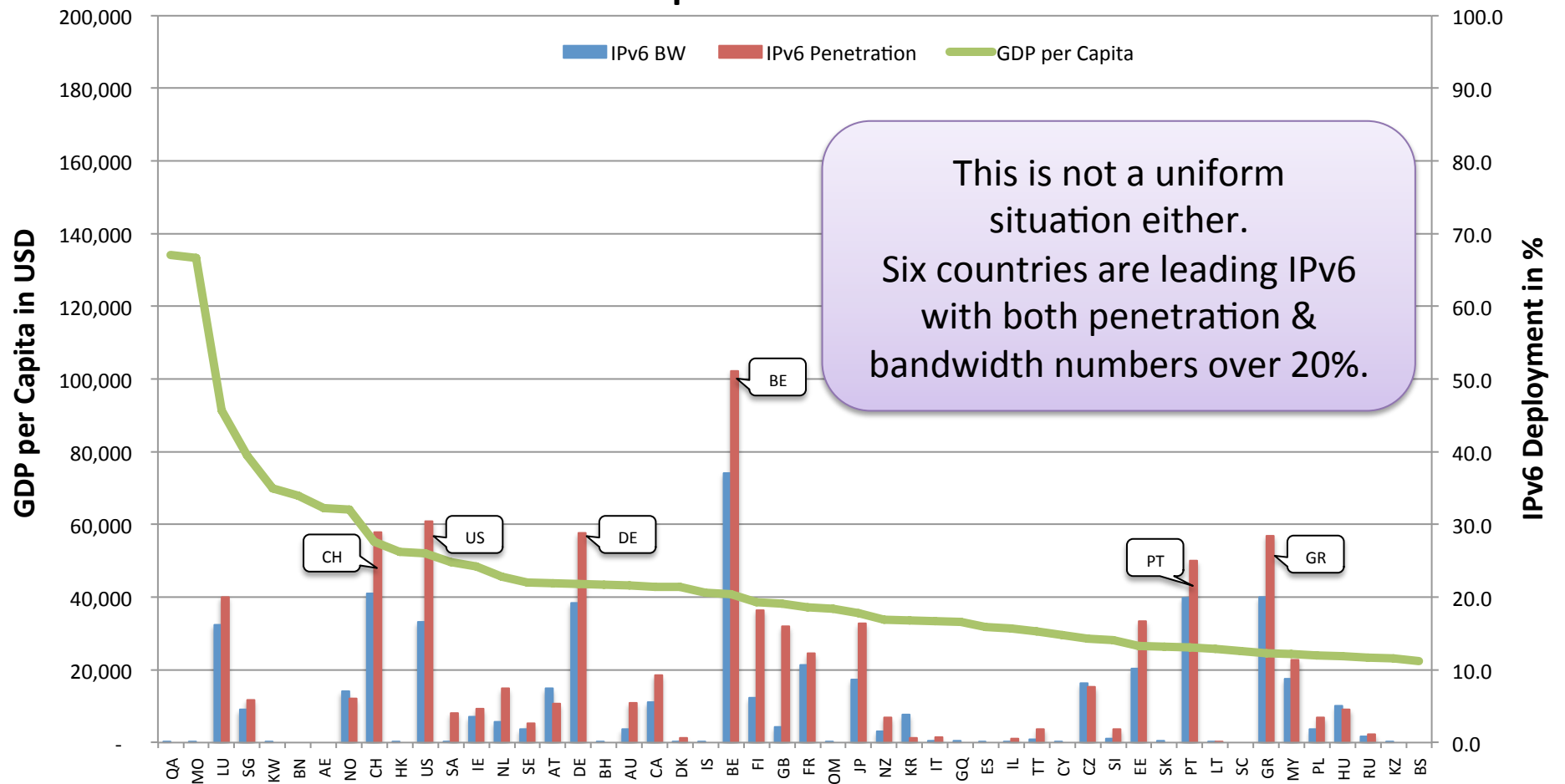
IPv6 Deployment Related to GDP per Capita



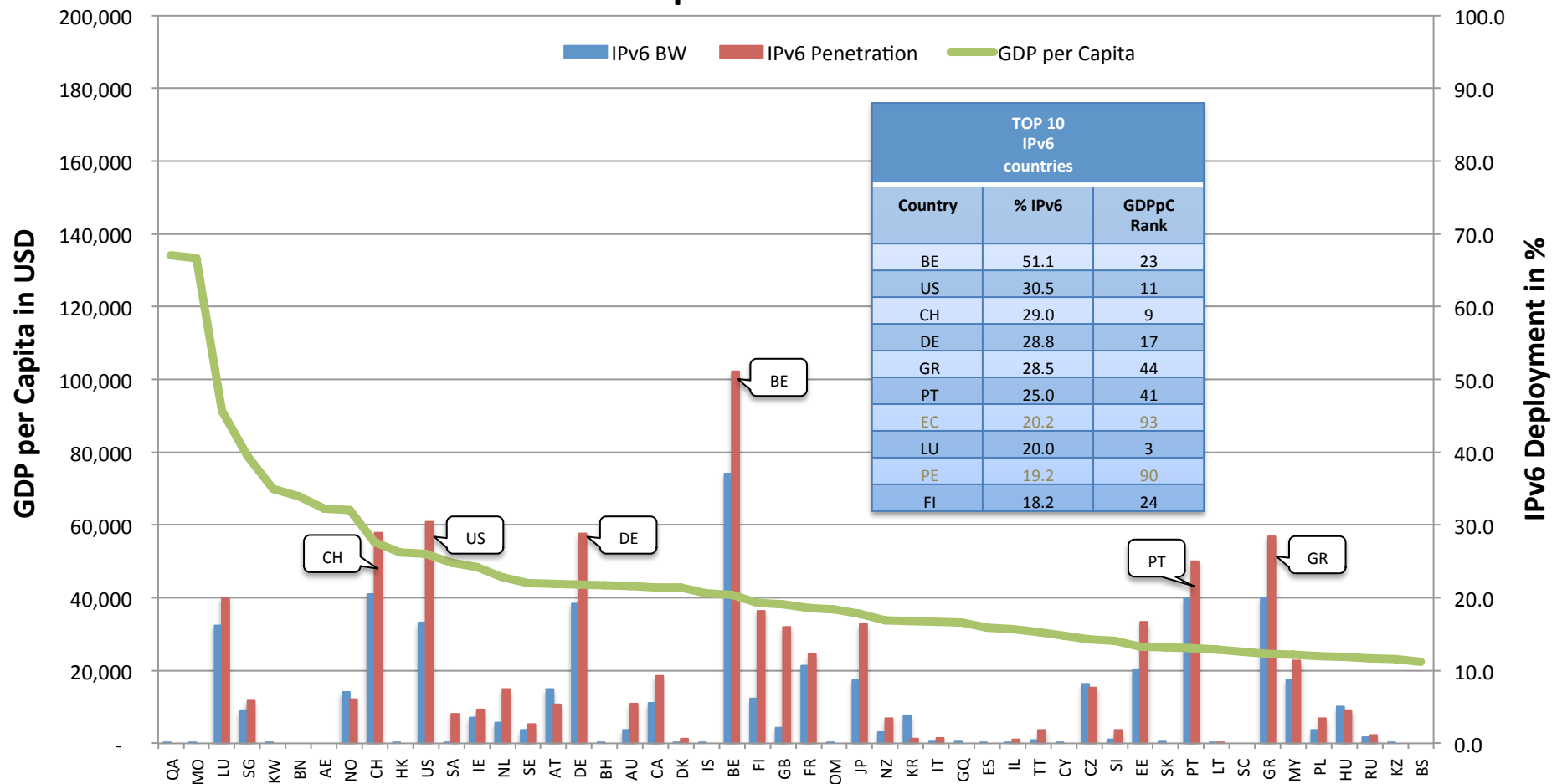
IPv6 Deployment Related to GDP per Capita Top-50 Countries



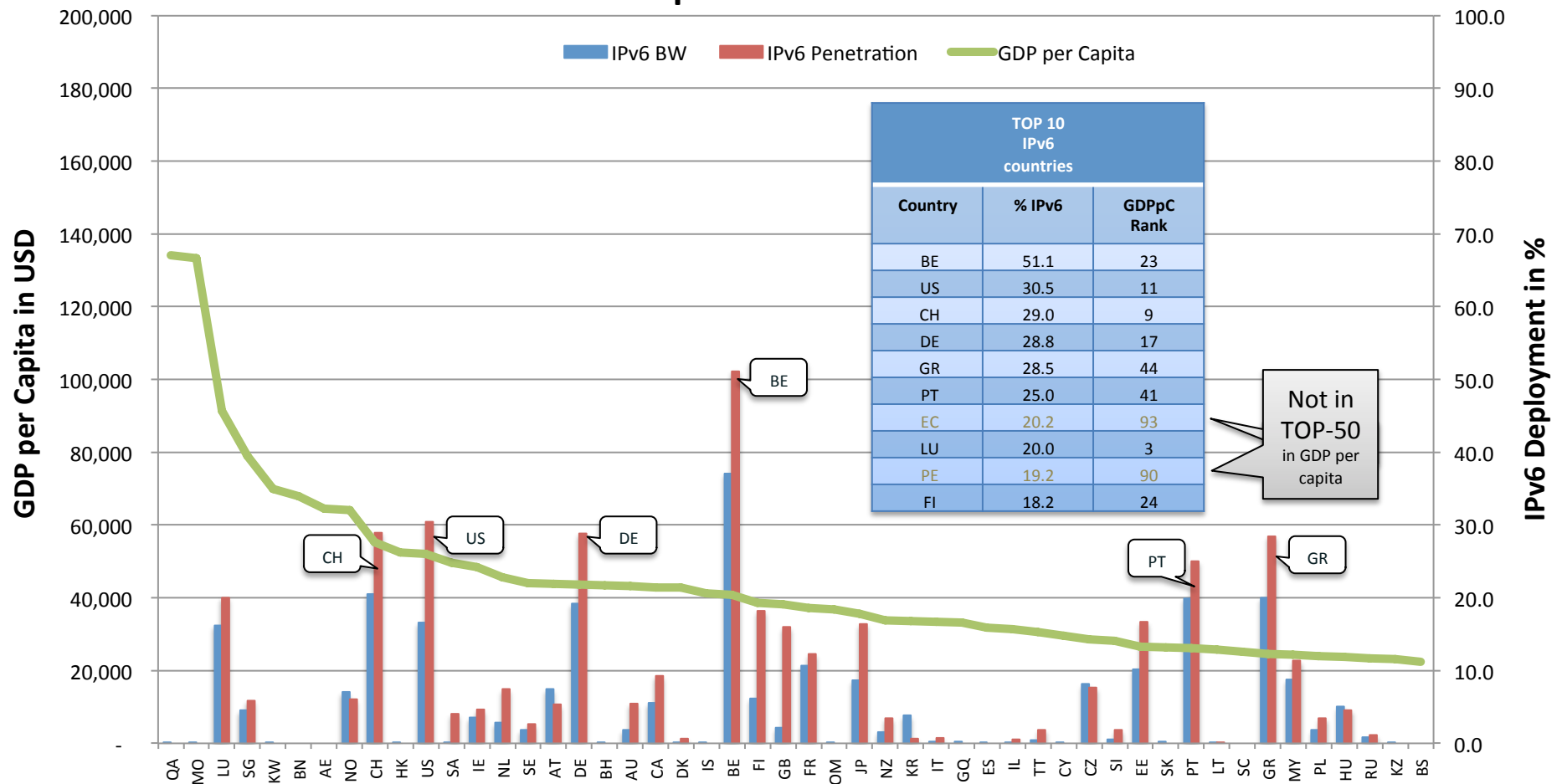
IPv6 Deployment Related to GDP per Capita Top-50 Countries



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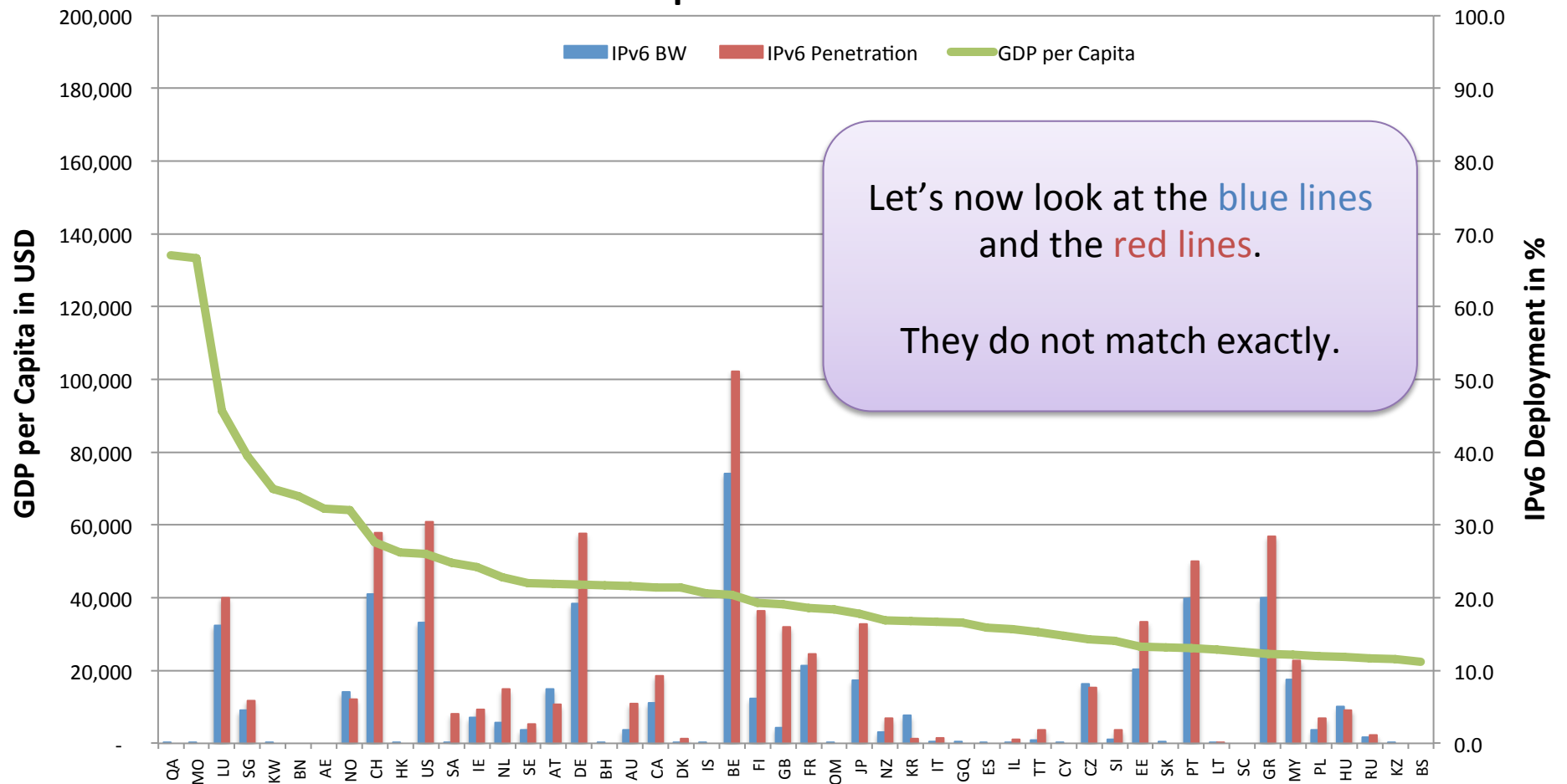


IPv6 Deployment Related to GDP per Capita Top-50 Countries

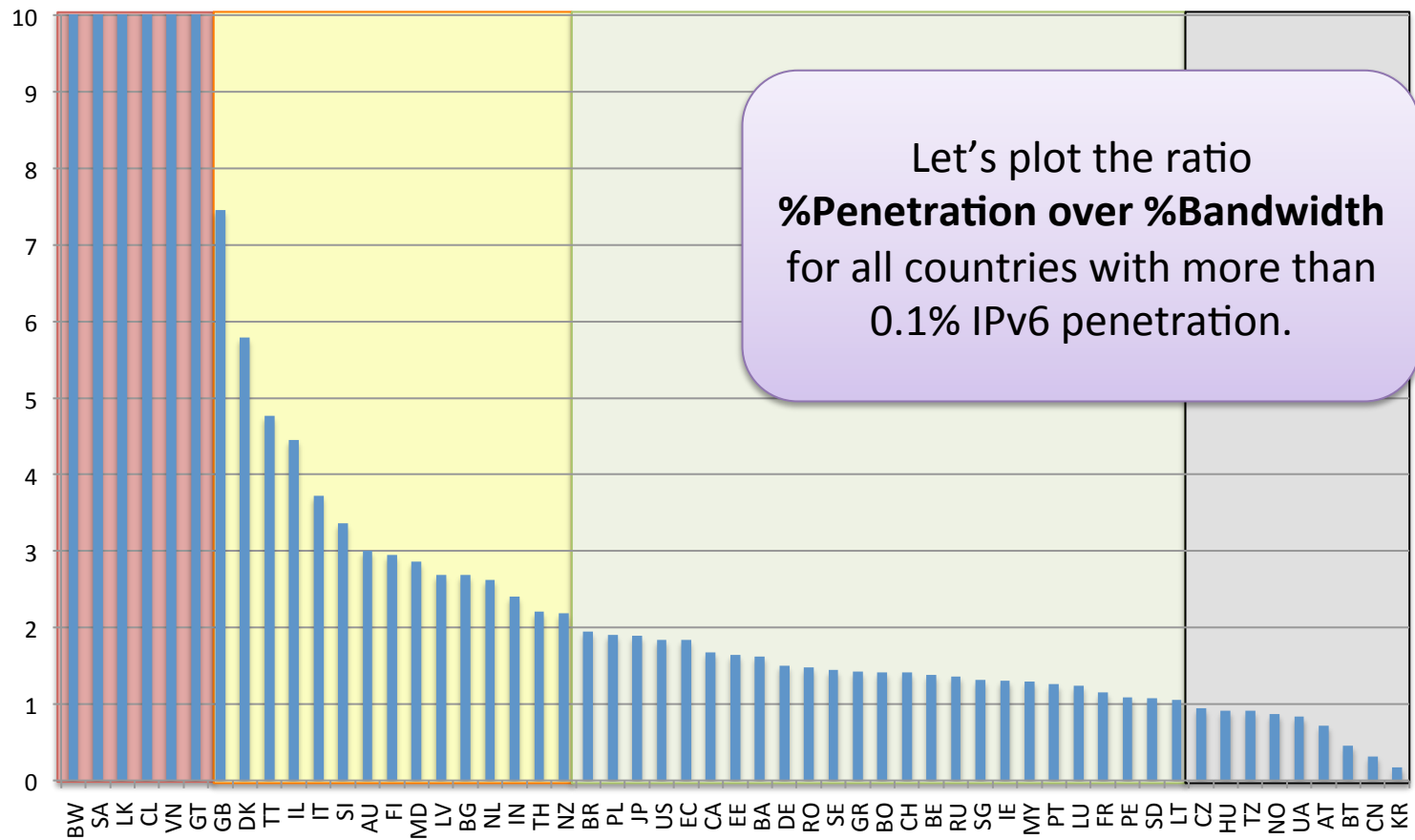


Assessment of the data

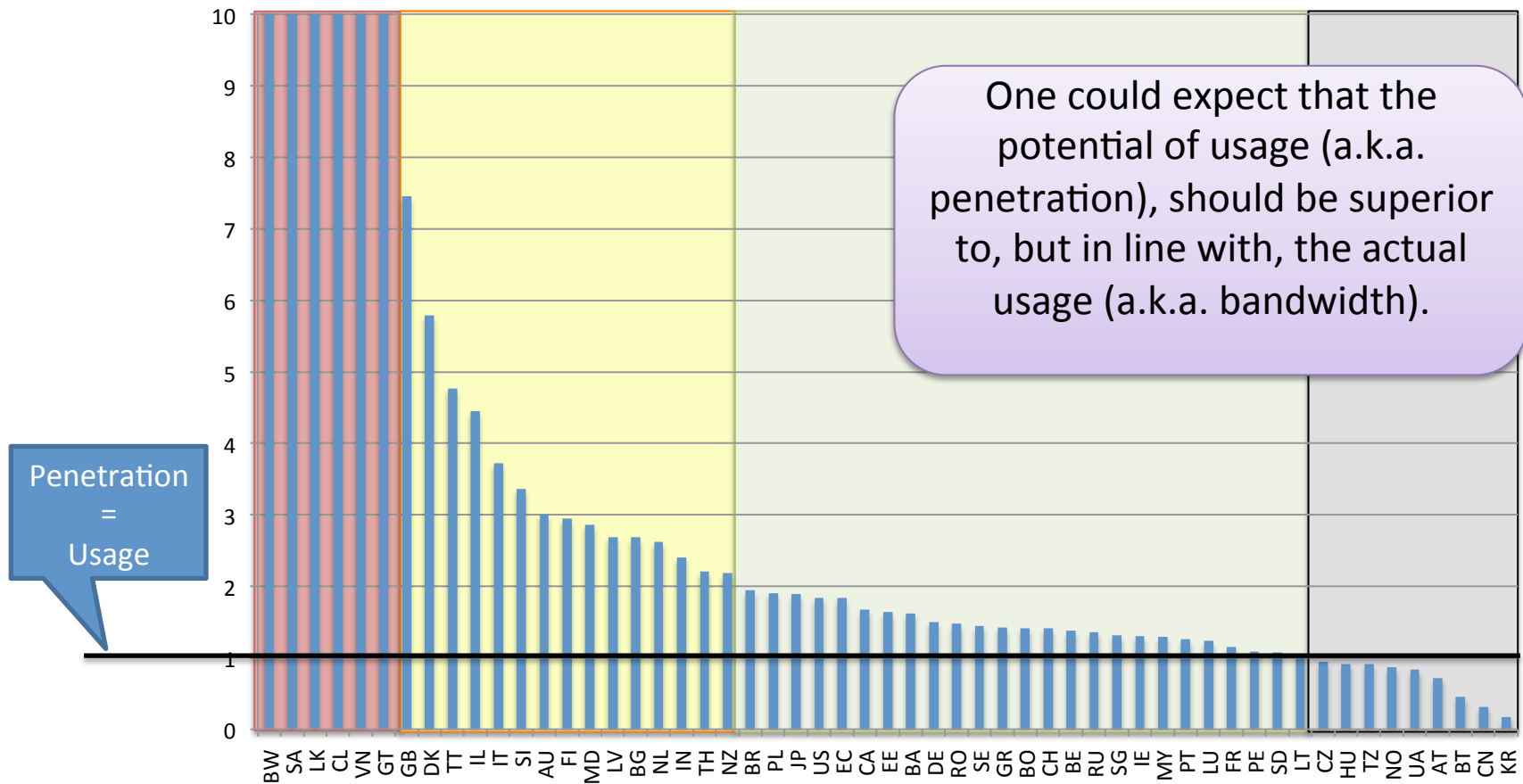
IPv6 Deployment Related to GDP per Capita Top-50 Countries



IPv6 Penetration vs Usage: %Penetration / %Bandwidth



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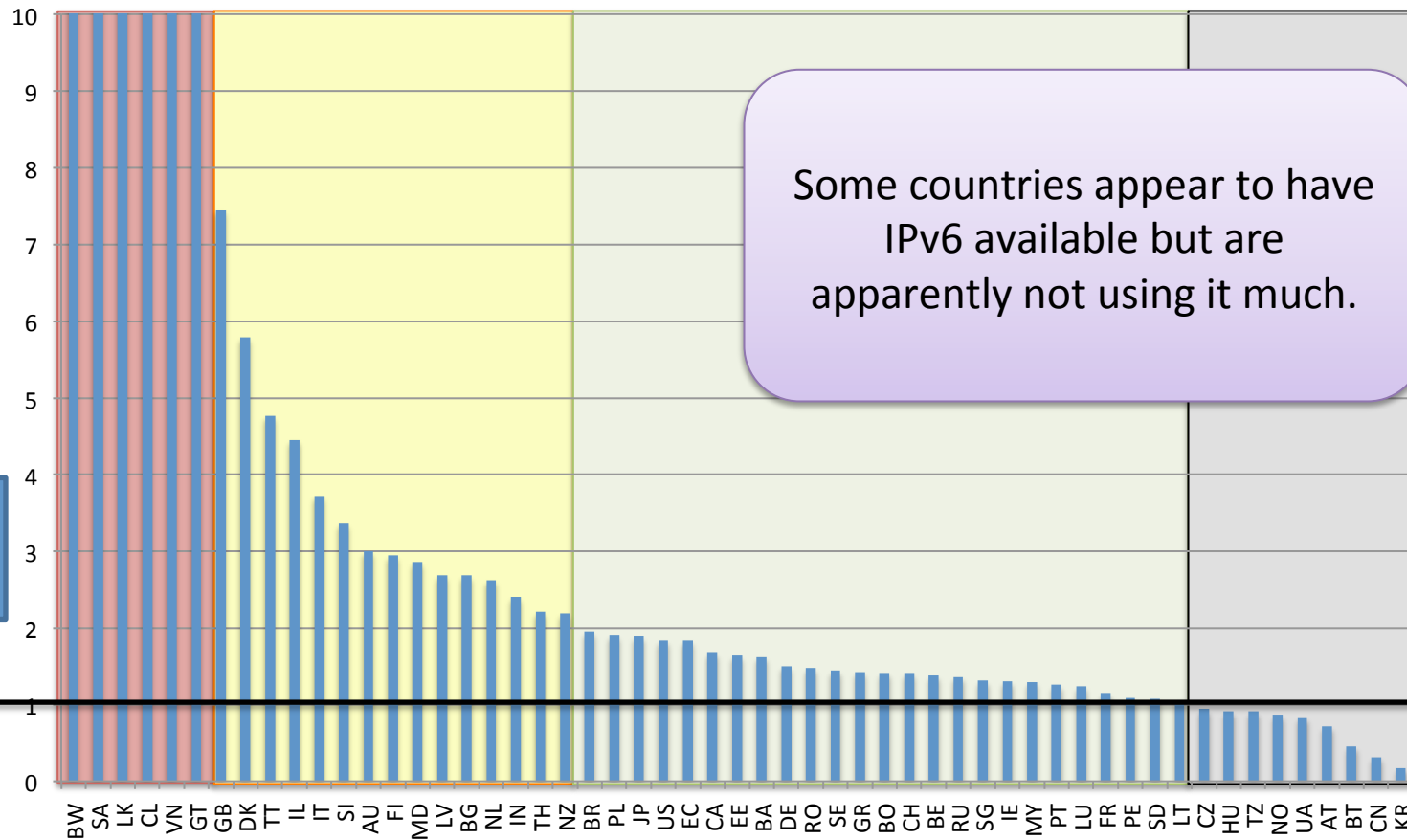


Off the chart:
IPv6 is available but not
used: x15 to x900

IPv6 Penetration vs Usage: %Penetration / %Bandwidth

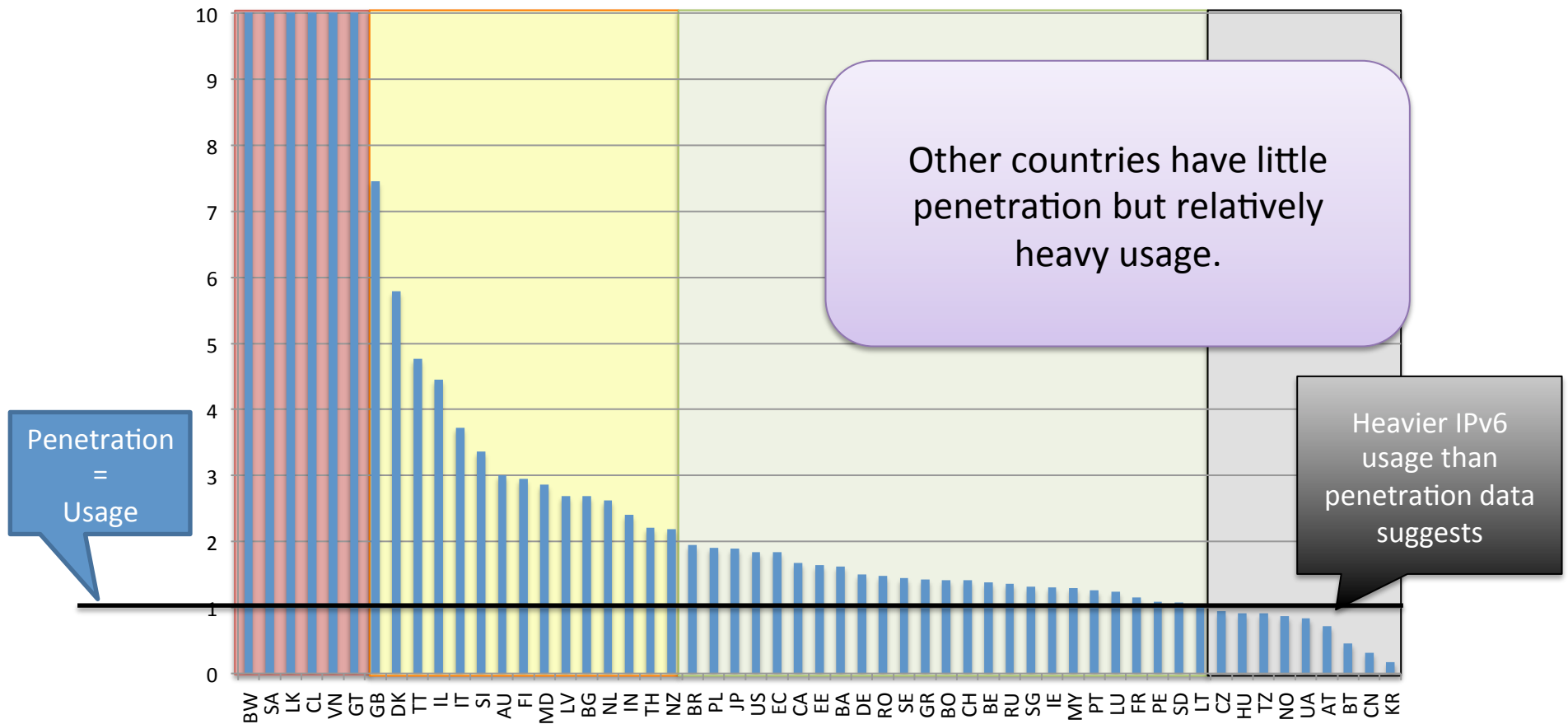
Some countries appear to have
IPv6 available but are
apparently not using it much.

Penetration
=
Usage

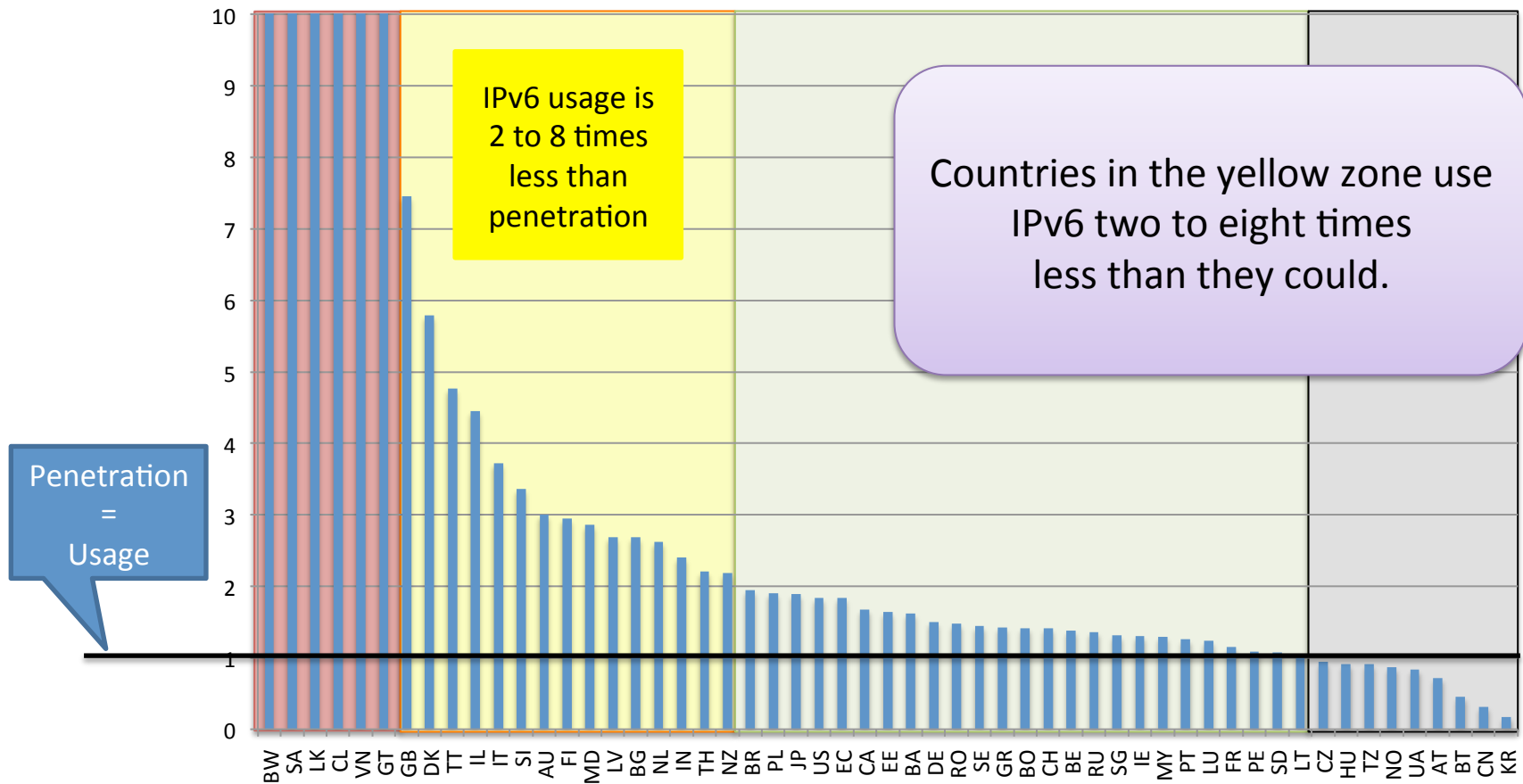


IPv6 Penetration vs Usage:

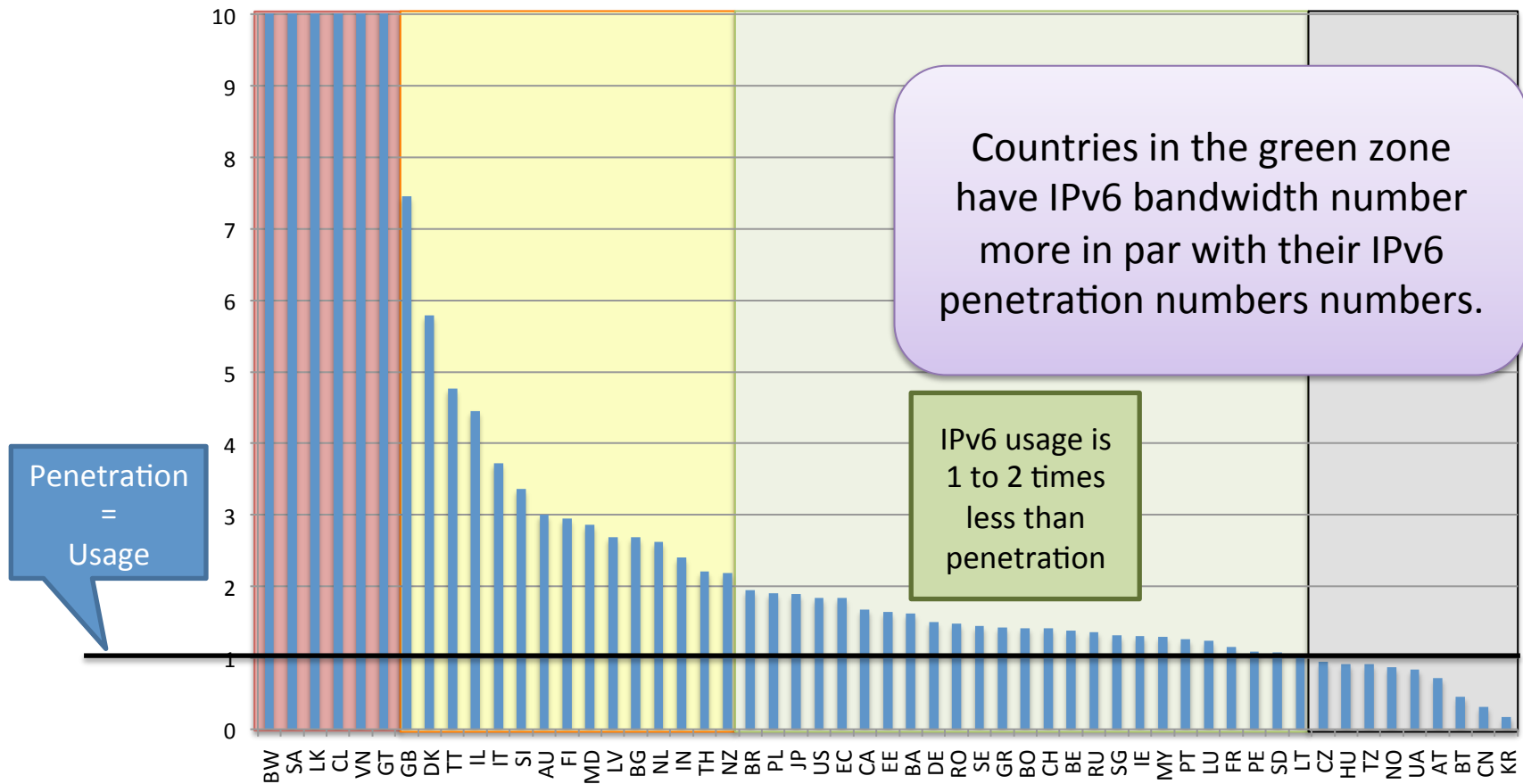
%Penetration / %Bandwidth



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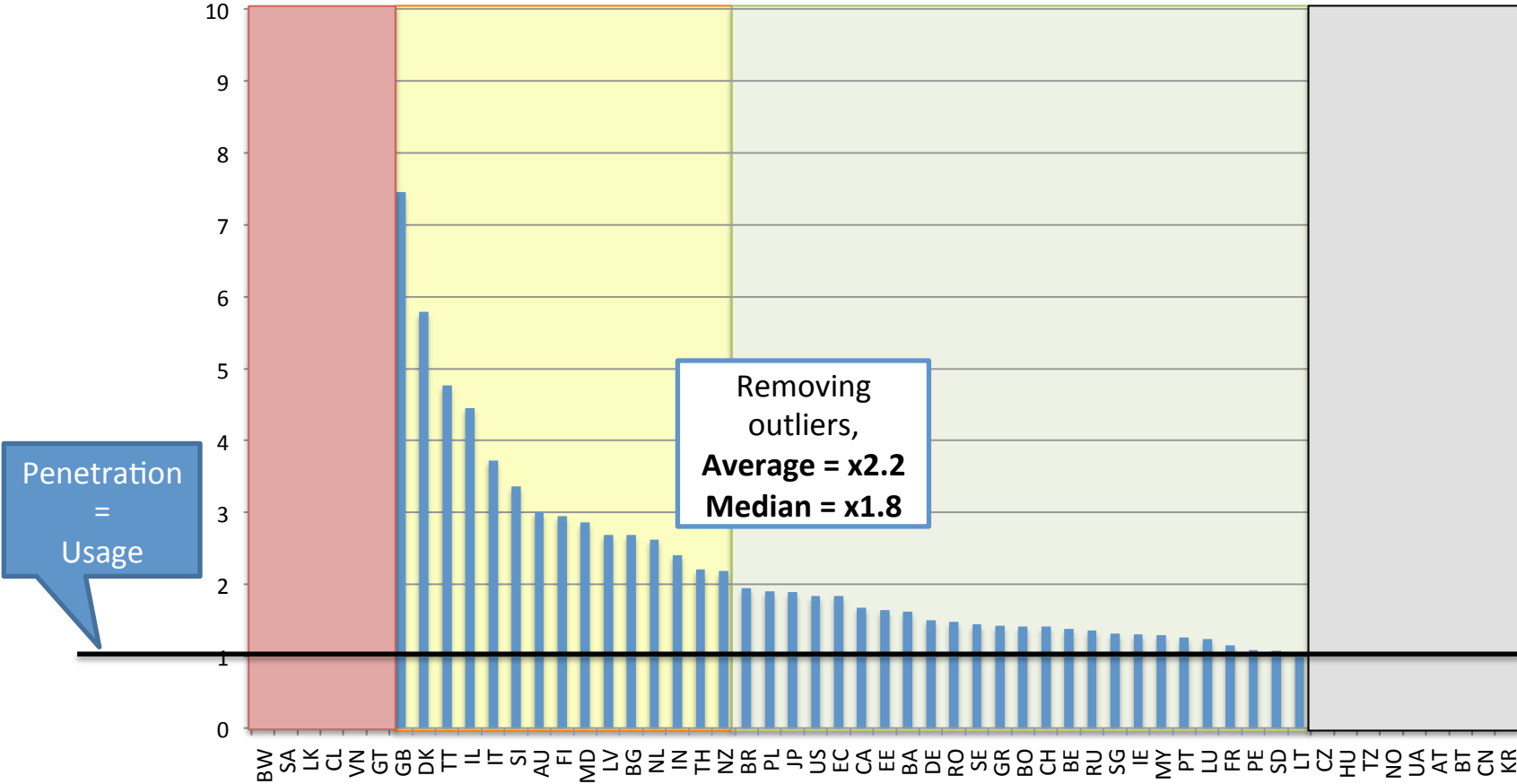


IPv6 Penetration vs Usage: %Penetration / %Bandwidth

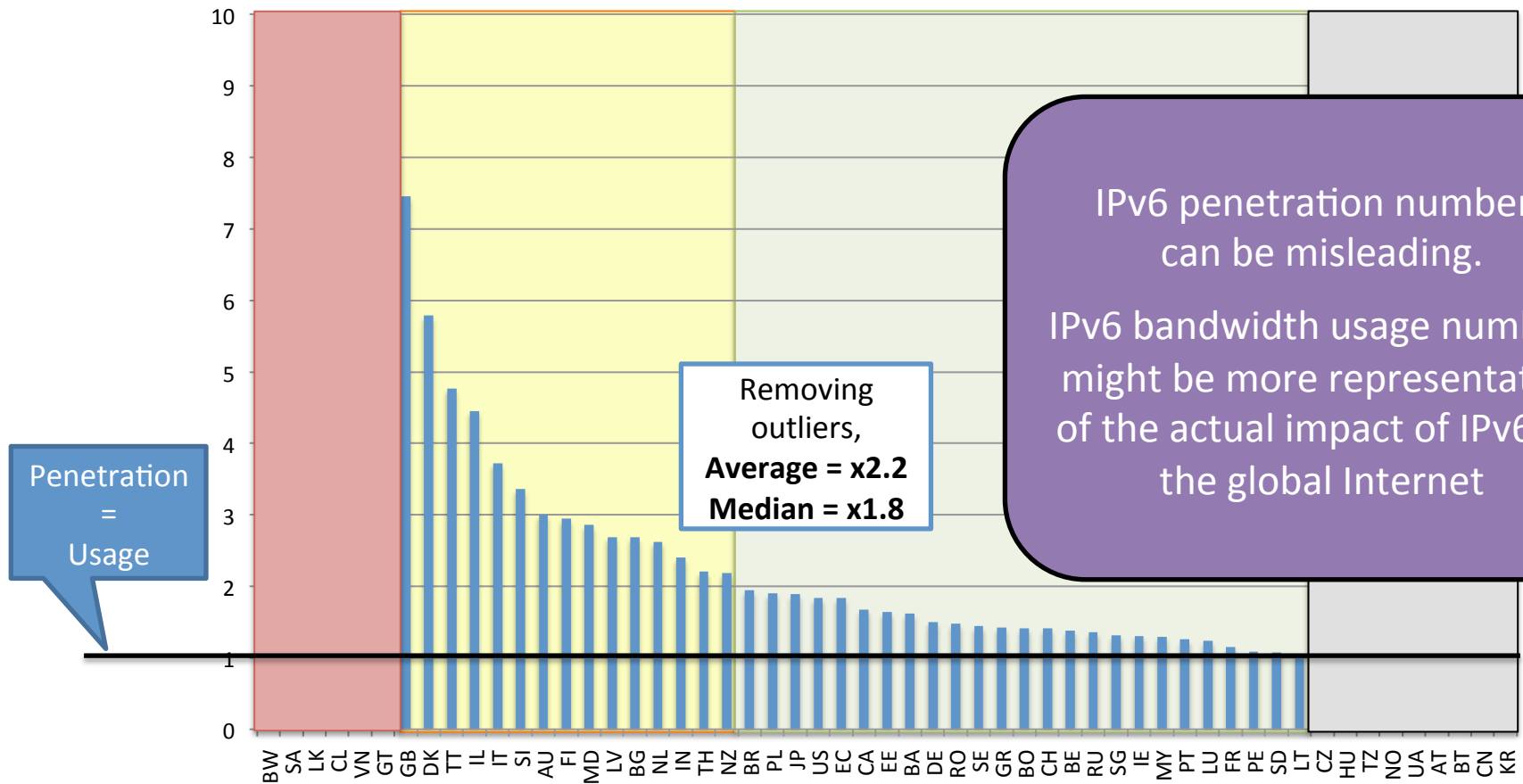


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Are We There Yet?

A.k.a. Is IPv6 a viable replacement for IPv4?

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I. No

II. There are positive signs

- Six countries have both penetration and bandwidth numbers over 20%.

III. IPv4 will still be very relevant for a long while

- The large number of countries with low GDP per capita that have very little or no IPv6 should temper enthusiasm.

Raw Data

Raw Data: Top-50 Countries (GDP per Capita)

Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration
QA	134,182	0.0	0.0	US	52,118	16.6	30.5	DK	42,765	0.1	0.7	IT	33,336	0.2	0.7	PT	26,175	19.9	25.0
MO	133,341	0.0	0.0	SA	49,619	0.0	4.1	IS	41,262	0.1	0.0	GQ	33,142	0.2	0.0	LT	25,786	0.1	0.1
LU	91,368	16.2	20.0	IE	48,400	3.5	4.6	BE	40,802	37.1	51.1	ES	31,753	0.1	0.0	SC	25,207	0.0	0.0
SG	78,958	4.5	5.9	NL	45,662	2.8	7.4	FI	38,550	6.2	18.2	IL	31,483	0.1	0.6	GR	24,570	20.0	28.5
KW	69,878	0.0	0.0	SE	44,004	1.8	2.6	GB	38,149	2.1	16.0	TT	30,497	0.4	1.9	MY	24,460	8.8	11.4
BN	67,912	0.0	0.0	AT	43,849	7.4	5.3	FR	37,208	10.7	12.3	CY	29,673	0.0	0.0	PL	23,966	1.8	3.5
AE	64,563	0.0	0.0	DE	43,559	19.2	28.8	OM	36,855	0.0	0.0	CZ	28,675	8.1	7.7	HU	23,731	5.0	4.6
NO	63,999	7.0	6.1	BH	43,408	0.0	0.0	JP	35,635	8.7	16.4	SI	28,156	0.5	1.8	RU	23,293	0.8	1.1
CH	55,275	20.5	29.0	AU	43,256	1.8	5.5	NZ	33,846	1.6	3.5	EE	26,594	10.2	16.7	KZ	23,114	0.0	0.0
HK	52,552	0.1	0.0	CA	42,774	5.5	9.3	KR	33,629	3.8	0.7	SK	26,470	0.2	0.0	BS	22,411	0.0	0.0

Raw Data: 51-100 Countries (GDP per Capita)

Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration
KN	22,171	0.0	0.0	MU	17,731	0.0	0.0	BB	15,320	0.0	0.0	CO	12,743	0.0	0.0	MN	11,396	0.0	0.0
LV	22,038	0.0	0.1	BY	17,349	0.0	0.0	BR	15,162	5.2	10.1	RS	12,717	0.1	0.0	TN	10,910	0.0	0.0
CL	21,980	0.0	0.1	VE	16,751	0.0	0.0	TH	15,012	0.3	0.7	DO	12,653	0.0	0.0	EC	10,849	11.0	20.2
AG	21,062	0.0	0.0	AZ	16,715	0.0	0.0	LY	14,880	0.0	0.0	CN	12,599	0.9	0.3	LK	10,599	0.1	1.7
HR	20,033	0.1	0.0	LB	16,659	0.0	0.0	TM	14,762	0.0	0.0	ZA	12,449	0.0	0.0	DM	10,377	0.0	0.0
PA	19,934	0.0	0.0	IR	16,507	0.0	0.0	ME	14,534	0.0	0.0	MK	12,287	0.1	0.0	LC	10,240	0.0	0.0
UY	19,924	0.0	0.0	BG	16,363	0.2	0.7	IQ	14,365	0.0	0.0	MV	11,954	0.9	0.0	VC	10,234	0.0	0.0
RO	19,104	3.8	5.6	MX	16,284	0.0	0.0	CR	14,232	0.0	0.0	GD	11,854	0.0	0.0	AL	10,136	0.0	0.0
TR	18,869	0.0	0.0	SR	15,873	0.0	0.0	PW	14,078	0.0	0.0	JO	11,496	0.0	0.0	EG	10,049	0.0	0.0
GA	18,537	0.0	0.0	BW	15,359	0.0	0.2	DZ	13,541	0.0	0.0	PE	11,438	17.6	19.2	ID	10,033	0.0	0.0

Raw Data: 101-150 Countries (GDP per Capita)

Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration
BA	9,699	2.8	4.5	AM	7,699	0.0	0.0	IN	5,439	0.5	1.1	GH	3,894	0.0	0.0	CI	3,108	0.0	0.0
NA	9,498	0.0	0.0	BT	7,456	0.5	0.2	VN	5,370	0.0	1.0	SD	3,882	0.1	0.1	ST	3,030	0.0	0.0
GE	8,742	0.0	0.0	MA	7,146	0.0	0.0	UZ	5,317	0.0	0.0	MR	3,732	0.0	0.0	BD	2,979	0.0	0.0
PY	8,502	0.0	0.0	GT	7,112	0.0	0.2	LA	5,076	0.0	0.0	ZM	3,725	0.0	0.0	VU	2,891	0.1	0.0
JM	8,470	0.0	0.0	PH	6,649	0.0	0.0	TO	4,972	0.0	0.0	MH	3,628	0.0	0.0	CM	2,836	0.0	0.0
FJ	8,388	0.0	0.0	BO	6,325	2.7	3.8	MD	4,754	0.1	0.2	TV	3,592	0.0	0.0	KE	2,818	0.0	0.0
UA	8,267	0.2	0.2	CV	6,220	0.0	0.0	NI	4,692	0.0	0.0	FM	3,177	0.0	0.0	PG	2,723	0.0	0.0
BZ	8,030	0.8	0.0	CG	5,988	0.0	0.0	HN	4,683	0.0	0.0	KG	3,169	0.0	0.0	TJ	2,567	0.0	0.0
SV	7,967	0.0	0.0	NG	5,639	0.0	0.0	PK	4,590	0.0	0.0	DJ	3,120	0.0	0.0	LS	2,517	0.0	0.0
SZ	7,911	0.0	0.0	WS	5,523	0.0	0.0	PS	4,302	0.0	0.0	KH	3,113	0.0	0.0	TZ	2,421	0.1	0.1

Raw Data: 151-194 Countries (GDP per Capita)

Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration	Alpha2	GDP per Capita	% IPv6 BW	% IPv6 Penetration
NP	2,265	0.0	0.0	ZW	1,709	0.0	0.0	TG	1,363	0.0	0.0	LI	-	0.1	0.0	GY	-	0.0	0.0
SN	2,226	0.0	0.0	UG	1,689	0.0	0.0	GW	1,322	0.0	0.0	MT	-	0.0	0.0	YE	-	0.0	0.0
TL	2,125	0.0	0.0	HT	1,652	0.0	14.0	GN	1,165	0.0	0.0	BM	-	0.0	0.0	AR	-	0.0	0.0
TD	2,082	0.0	0.0	RW	1,584	0.0	0.0	MZ	1,077	0.0	0.0	AD	-	0.0	0.0	FO	-	0.0	0.0
SB	2,032	0.0	0.0	GM	1,556	0.0	0.0	NE	895	0.0	0.0	MM	-	0.0	0.0				
BJ	1,937	0.0	0.0	BF	1,545	0.0	0.0	LR	804	0.0	0.0	CU	-	0.0	0.0				
SS	1,926	0.0	0.0	ML	1,526	0.0	0.0	MW	784	0.0	0.0	SO	-	0.0	0.0				
SL	1,876	0.0	0.0	ET	1,431	0.0	0.0	BI	734	0.0	0.0	AO	-	0.0	0.0				
AF	1,844	0.0	0.0	MG	1,373	0.0	0.0	CD	712	0.0	0.0	GL	-	0.0	0.0				
KI	1,726	12.0	0.0	KM	1,364	0.0	0.0	CF	567	0.0	0.0	PR	-	0.0	0.0				