Rolling the KSK

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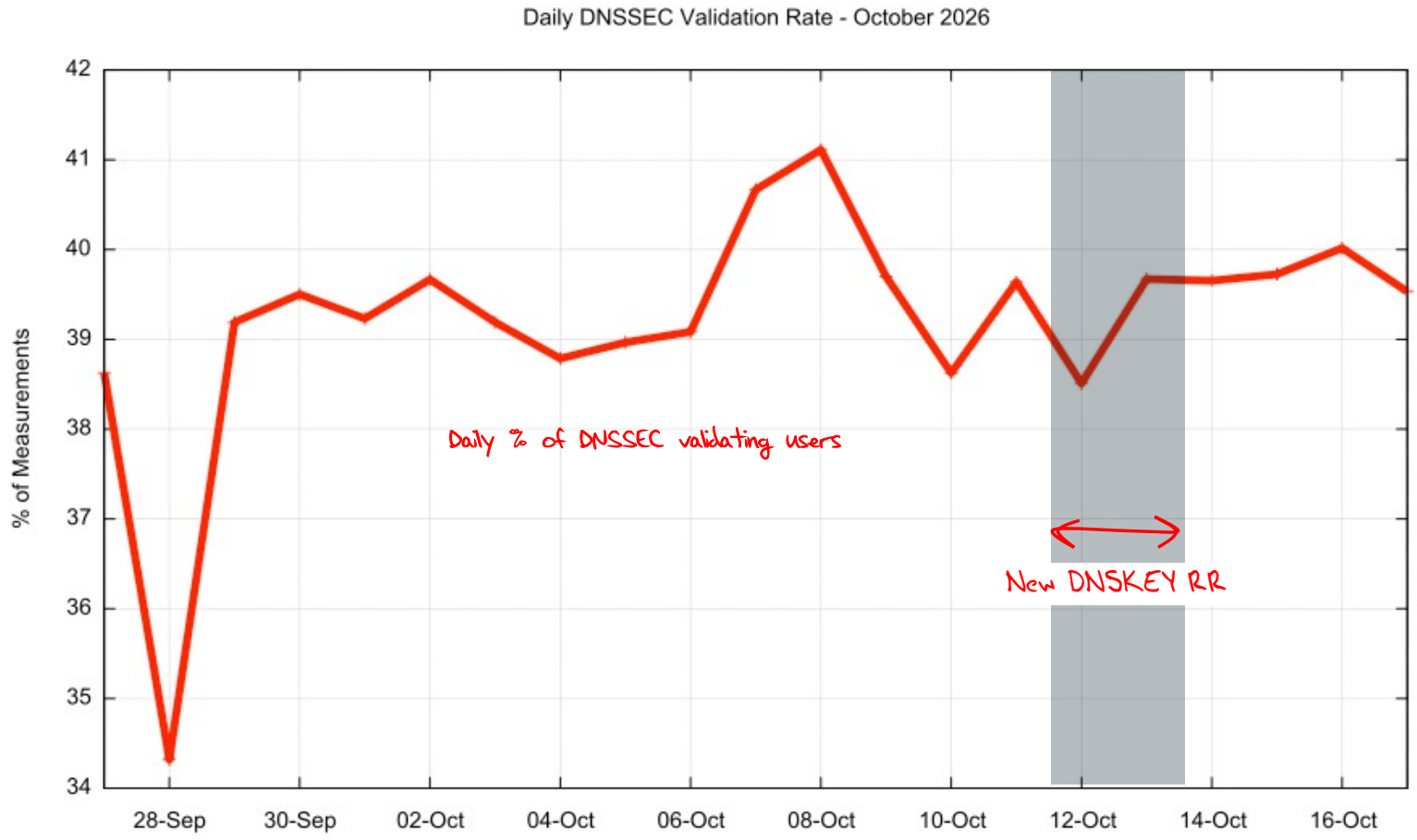
We rolled the KSK on the 11th October.. and it appeared to just work!

The KSK roll had no noticeable impact on overall DNSSEC validation rates for users.

DNSSEC validation rates remained approximately steady(*) through this period



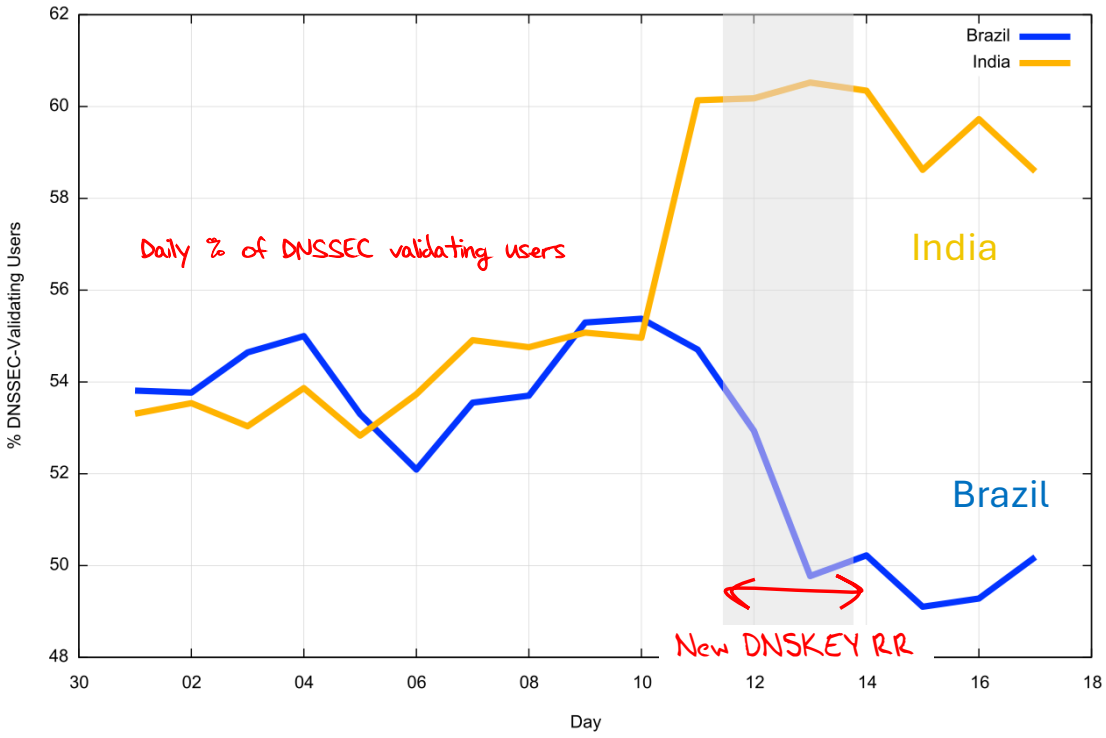
* Within the normal bounds of day-to-day variation

Or did it?

Once the KSK rolled, the old KSK was progressively withdrawn as local cached DNSKEY records were updated over the ensuing 48 hours.

By 1400 UTC on the 13th October DNSSEC validation relied on the new KSK being loaded into the local trust key collection.

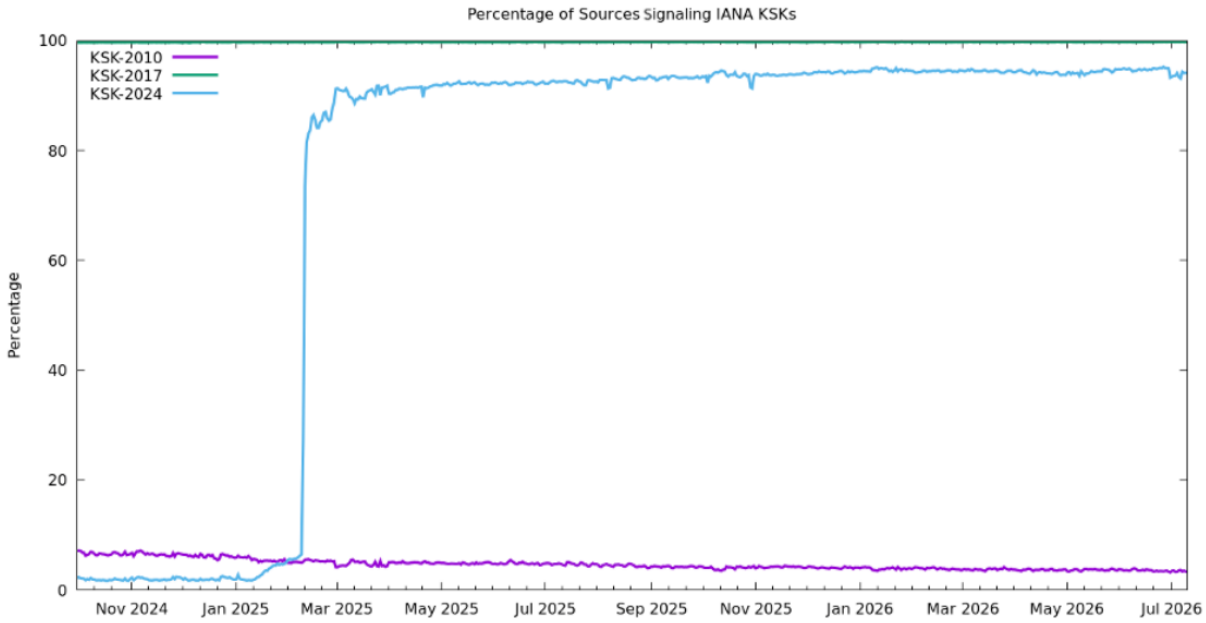
In some cases, the effort to update the DNS trust configurations improved the overall DNSSEC validation level for a country, while in other cases networks were caught out. This was reflected in national DNSSEC validation measurements.



One tool predicted a smooth transition

The result from RFC 8145 Key Tag Signalling indicated that in July 2026 all reporting resolvers reported trust in KSK 2017 (outgoing KSK), and some 95% of reports also indicated trust in KSK 2024 (incoming KSK)

It was looking pretty good!

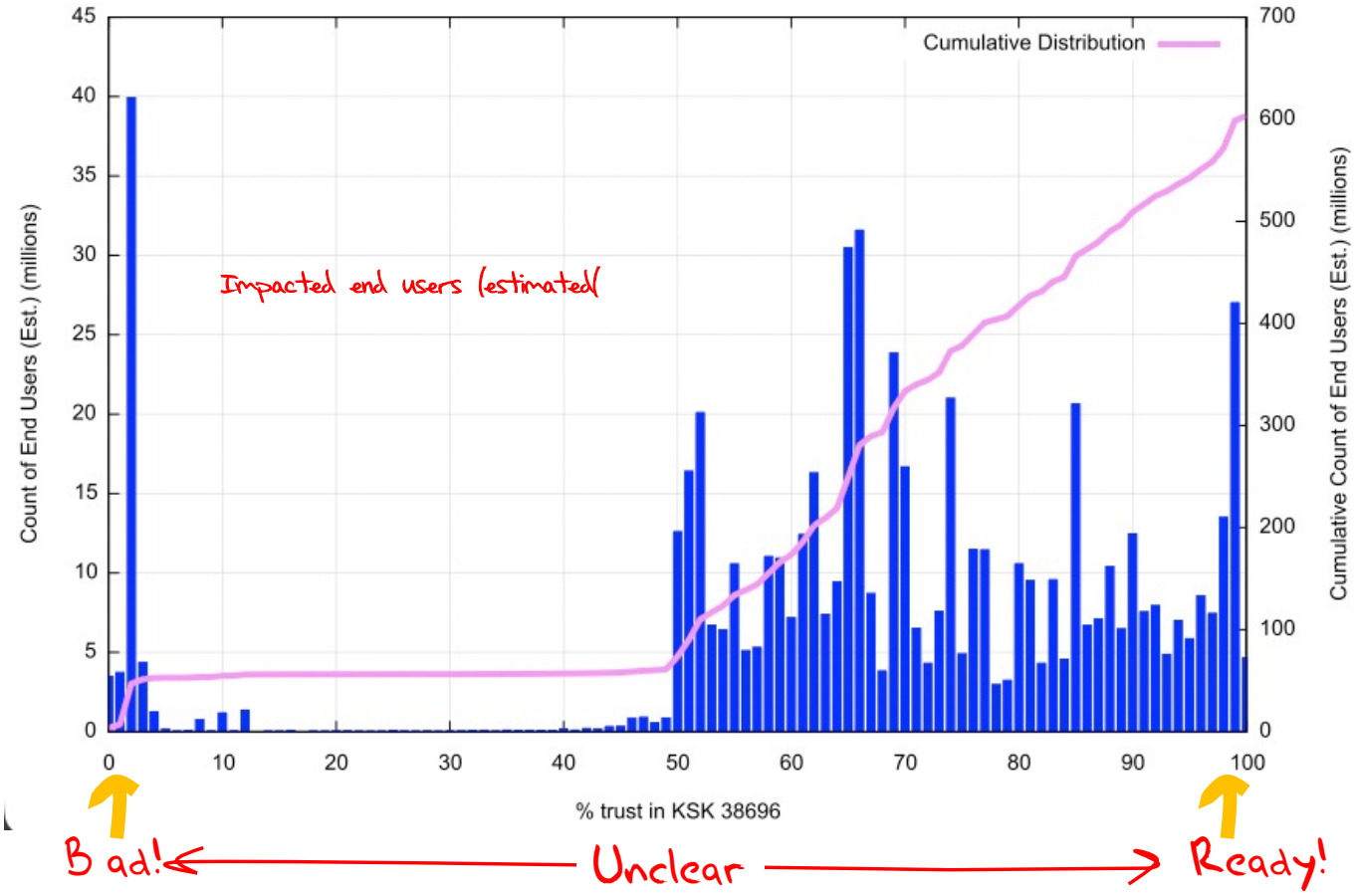


https://blog.verisign.com/security/2024-2026-root-zone-ksk-rollover-updates-observations/

Another tool was giving a different signal

This is a snapshot of the RFC8509 KSK Sentinel reporting tool, looking at preparedness with a user impact metric just 3 days before the roll

By the 8th October (3 days before the KSK roll) some 10% of end users (60M end users) who are served by KSK Sentinel-reporting resolvers appeared to be at some risk of encountering DNS failure upon KSK Roll.



3 days to go - 50 At-Risk Networks

AS	CC	KSK-2024	Tests	Validating	RFC8509	KSK-2024	NOT KSK-2024	Name
262202	CR	49.40%	9,441	9,343	2,201	469	481	Telefonica de Costa Rica, Costa Rica
328169	SZ	48.90%	4,694	4,687	1,199	276	288	Swazi Mobile, Swaziland
328341	ZA	48.90%	2,551	2,522	1,352	284	297	Capricom Networks , South Africa
17470	LK	48.70%	15,011	11,749	2,952	717	756	Hutchison Telecoms, Sri Lanka
9335	TH	48.40%	4,905	4,877	1,355	299	319	National Teleco, Thailand
45925	BD	48.20%	7,886	7,811	2,046	465	499	Teletalk, Bangladesh
29544	MR	47.90%	41,149	40,758	8,032	1,842	2,003	Mauritanian Telecommunication, Mauritania
30990	DJ	47.40%	9,472	9,393	2,701	641	711	Dibjouti Telecom, Djibouti
329129	LY	46.80%	7,879	7,843	1,790	384	436	Libya Tech, Lybia
136336	IN	46.00%	8,113	6,972	1,818	353	414	Thamizhaga, India
9658	PH	45.60%	6,920	6,293	2,062	555	661	Eastern Telecoms, Philippines
135300	MM	45.40%	5,813	4,600	1,150	228	274	Myanmar Broadband, Myanmar
205368	AM	38.60%	4,227	4,209	2,349	536	852	Fnet, Armenia
24812	UA	32.00%	10,791	3,437	1,322	205	436	HomeNet, Ukraine
39065	UA	26.10%	1,701	1,666	1,238	193	546	Southern Telecommunication s, Ukraine
15108	US	16.40%	17,966	17,209	15,036	2,014	10,282	Allo Comms, United States
132199	PH	13.10%	73,176	71,705	35,310	2,915	19,310	Globe Telecom, Philippines
33915	NL	12.70%	170,615	19,642	13,292	1,328	9,105	Vodafone Libertel, Netherlands
5056	US	10.70%	7,519	6,933	4,883	427	3,556	Aureon Network Services, United States
12969	IS	10.00%	4,567	4,520	3,954	331	2,979	Vodafone, Iceland
327931	DZ	9.00%	160,973	17,701	9,705	357	3,627	Optimum Telecom, Algeria
58895	PK	8.20%	13,757	5,584	3,034	128	1,432	Ebone, Pakistan
16019	CZ	8.20%	45,089	43,692	32,266	1,885	21,166	Vodafone-CZ, Czechia
38195	AU	6.20%	24,038	19,612	16,004	787	11,931	Superloop, Australia
53435	US	5.20%	2,320	2,089	1,050	36	661	Jackson Energy, United States
203214	IQ	4.50%	165,409	153,024	115,657	3,636	76,631	HulumTele , Iraq
205889	IQ	4.50%	4,836	1,750	1,102	30	636	Giga Nineveh, Iraq
5690	CA	4.40%	1,983	1,936	1,659	61	1,323	Vianet, Canada
56207	PH	4.20%	12,110	11,720	6,860	149	3,399	ComClark, Philippines
4775	PH	4.00%	272,137	268,811	174,084	4,439	105,397	Globe Telecoms, Philippines
15547	CH	4.00%	3,011	2,967	2,508	78	1,865	Netplus, Switzerland
47794	SA	3.90%	6,665	6,462	4,693	114	2,814	Etihad GO, Saudi Arabia
17639	PH	3.70%	259,256	255,140	165,934	3,830	98,347	Converge, Philippines
31898	US	3.10%	2,104	2,073	1,619	39	1,230	Oracle Corp, United States
203409	IQ	2.80%	6,745	4,192	2,676	44	1,542	Nawafeth Al-hadhara, Iraq
55836	IN	2.50%	6,075,237	5,084,127	3,114,217	35,837	1,400,178	Reliance Jio, India
9534	MY	1.60%	163,667	161,851	116,154	1,223	73,955	MAXIS Binariang Berhad, Malaysia
6661	LU	1.50%	10,391	10,197	9,132	113	7,493	LU - POST, Luxembourg
37119	AO	1.40%	63,226	62,103	41,113	308	21,624	Unitel, Angola
24432	BD	1.20%	127,742	126,100	79,233	437	35,570	TM International, Bangladesh
199739	IQ	1.20%	217,762	217,286	163,587	1,293	110,580	Earthlink Telecommunications, Iraq
14988	BW	1.00%	8,730	8,616	7,533	65	6,533	Botswana Telecommunications, Botswana
48695	SA	0.90%	1,742	1,741	1,395	10	1,144	Etihad GO, Saudi Arabia
212661	OM	0.90%	12,634	12,574	9,765	62	7,163	Vodafone-Oman, Oman
37054	MG	0.70%	19,313	19,117	13,628	62	8,476	Telecom Malagasy, Madagascar
43766	SA	0.70%	158,163	157,292	131,327	744	108,836	Mobile Telecommunication, Saudi Arabia
29244	BG	0.70%	33,217	33,072	23,809	102	14,943	Telenor BG-AS, Bulgaria
56665	LU	0.60%	3,790	3,727	3,273	15	2,625	Proximus, Luxembourg
57293	AZ	0.50%	19,186	19,133	14,531	48	10,412	Telekom MMC, Azerbaijan
327697	RE	0.40%	1,883	1,876	1,450	4	1,045	TELCO OI , Reunion

Afterwards - Change in Validating Populations by country

Decrease in validating users, post KSK-Roll

CC	Users	Validating Users		Difference	Name
		Pre-Roll	Post-Roll		
BR	162,001,400	80,503,978	72,723,712	-7,780,266	Brazil
RU	48,347,835	20,747,762	17,668,816	-3,078,946	Russian Federation
CN	800,174,861	6,712,165	4,955,581	-1,756,584	China
US	258,027,837	99,719,340	98,812,775	-906,565	United States
BG	4,300,933	1,763,608	1,002,739	-760,869	Bulgaria
BD	35,938,032	30,926,189	30,315,215	-610,974	Bangladesh
JP	107,256,266	16,394,309	15,785,216	-609,093	Japan
UG	15,672,479	9,164,418	8,834,481	-329,937	Uganda
PK	42,572,160	37,659,911	37,347,439	-312,472	Pakistan
EG	63,180,212	47,591,181	47,290,182	-300,999	Egypt

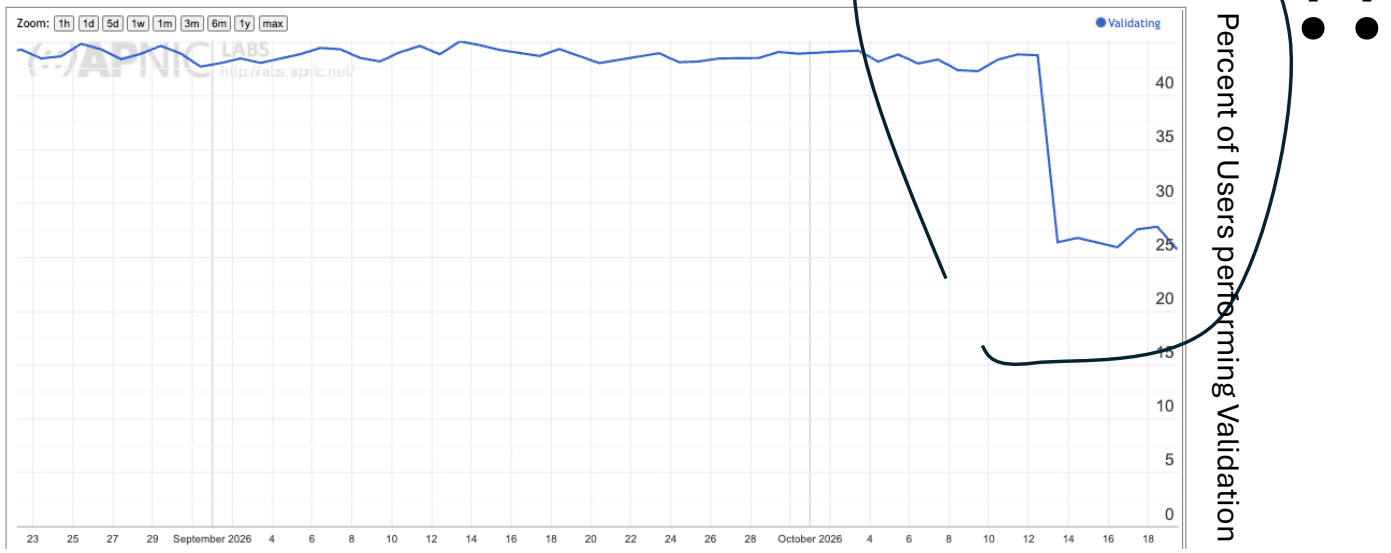
Afterwards - Change in Validating Populations by country

Increase in validating users, post KSK-Roll

CC	Users	Validating Users		Difference	Name
		Pre-Roll	Post-Roll		
IN	655,274,727	321,679,249	367,102,609	45,423,360	India
VN	57,005,838	23,332,777	32,490,227	9,157,450	Vietnam
DZ	27,956,896	7,425,886	10,692,147	3,266,261	Algeria
MA	26,532,749	23,750,578	26,111,432	2,360,854	Morocco
KZ	16,658,542	6,466,559	7,417,541	950,982	Kazakhstan
SK	4,601,745	1,102,337	1,767,006	664,669	Slovakia
IR	66,196,332	15,989,998	16,548,704	558,706	Iran
TH	48,229,404	28,867,282	29,149,702	282,420	Thailand
LK	8,510,654	1,607,257	1,870,630	263,373	Sri Lanka
LT	2,180,224	629,544	838,531	208,987	Lithuania

A Bulgarian example

Bulgaria DNSSEC
Validation rates



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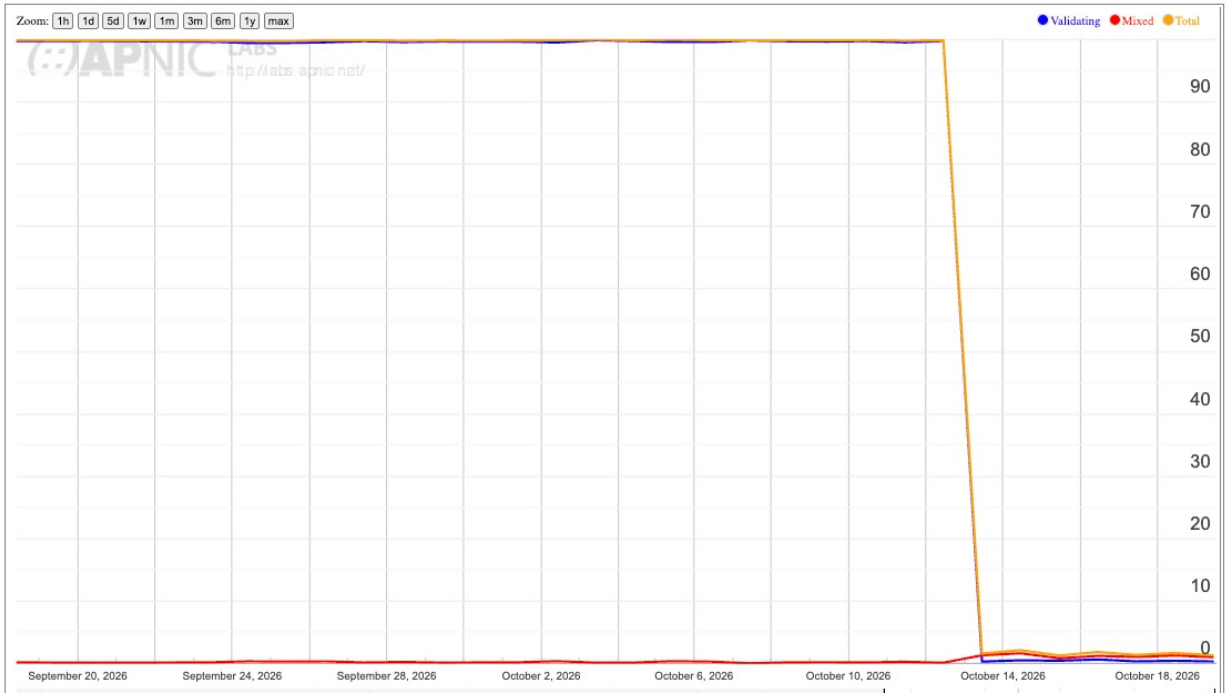
Customer Populations (Est.) per Network for Bulgaria (BG)

Date: 21/10/2026

Rank	ASN	AS Name	CC	Users (est.)	% of country	% of Internet	Samples
1	AS8866	VIVACOM-AS - Vivacom Bulgaria EAD	BG	1,512,122	31.21	0.036	1,457,594
2	AS29244	TelenorBG-AS - CETIN Bulgaria EAD	BG	746,825	15.41	0.018	720,521
3	AS12716	A1BG_MB - A1 Bulgaria EAD	BG	678,411	14	0.016	655,106
4	AS29580	A1BG_RSG - A1 Bulgaria EAD	BG	383,639	7.92	0.009	369,828
5	AS13124	A1BG_RSD - A1 Bulgaria EAD	BG	127,583	2.63	0.003	123,551

TelenorBG!

DNSSEC Per-Country Deployment for AS29244: TelenorBG-AS - CETIN Bulgaria EAD, Bulgaria (BG)



Average Interval (days) 1

Hide country ASN List
Hide Partial Validation
Show Country Totals
Redraw

Download JSON Time Series Data for AS29244 in Code BG

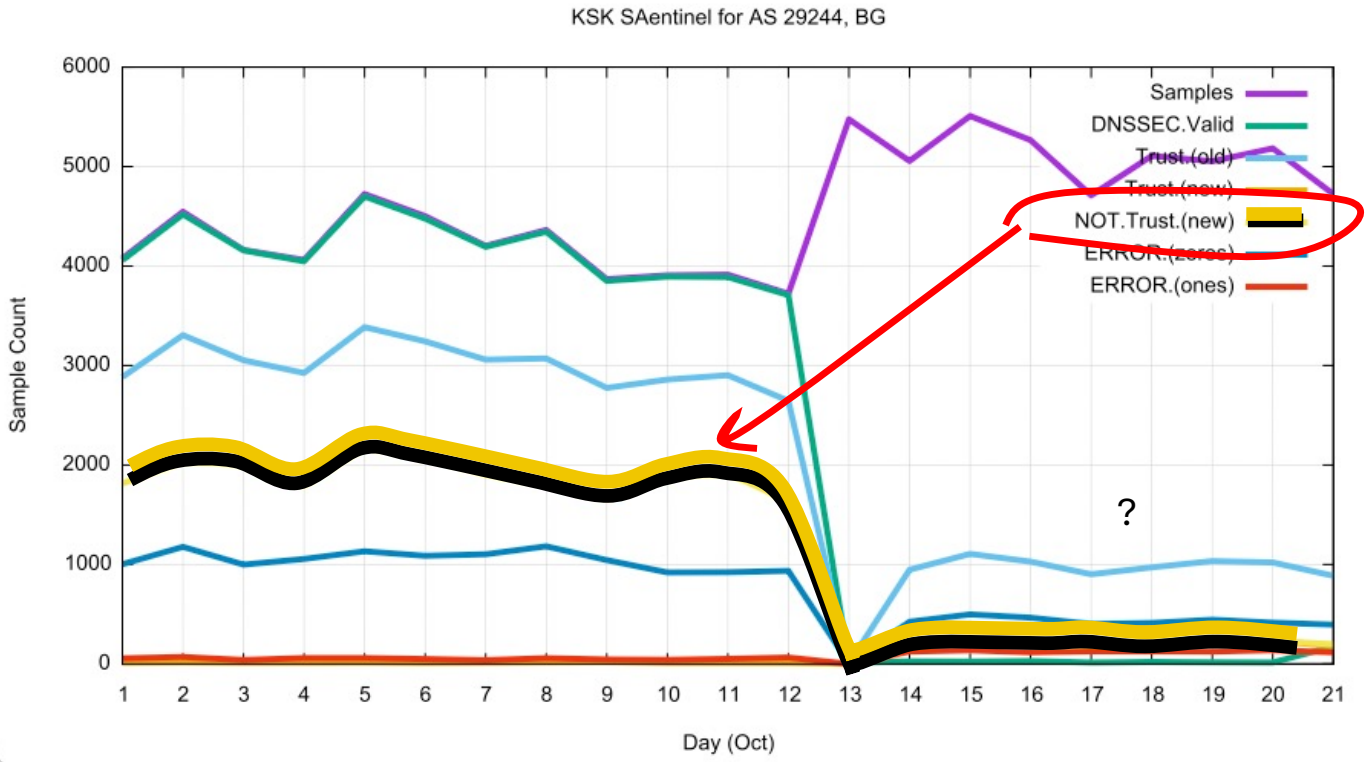
From Hero to Zero in one KSK Roll!

Did the KSK Sentinel data predict this? Yes!

Yes and No

Prior to the KSK roll we observed a clear count of samples in this network (44%) reporting that they did NOT trust the incoming KSK, while 72% of all samples reported trust in the outgoing KSK

Post KSK roll, the KSK Sentinel signal lost coherency. It appears that when this ISP's resolver system failed to validate DNS responses it did not apply the KSK Sentinel test correctly.



Observations

The KSK roll worked – mostly

- Key Tag signalling is not overly useful – maybe we should deprecate it
- Key Sentinel Signalling was pretty good – it was useful as a predictive diagnostic to identify potential problems
- After the roll this signal fell into incoherence for those networks that failed to track the KSK roll – maybe we should revise RFC8509 to remove this behaviour from the spec

See you next time!

- In three years?

