

DNS Magnitude

A novel way of measuring domain popularity

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DNS Magnitude

magnitude /'mægnɪtu:d/ the great size or importance of something; the degree to which something is large or important.

(Oxford English Dictionary)

- ⊙ Term and methodology invented by Alexander Mayrhofer (NIC.AT)
 - First presented at ICANN58 (March 2017)
- ⊙ A simple popularity measure for domains
- ⊙ Human friendly, practical and based on DNS traffic measurements
- ⊙ Mimicked after seismic magnitude scales (earthquake “size”)
 - The scale is logarithmic
- ⊙ Count the number of hosts that query for a domain
 - Not the number of queries for a domain

The 3 principles of DNS magnitude

- ⦿ Count unique hosts per domain instead of queries per domain
- ⦿ Use a logarithmic scale
- ⦿ Normalize the result

Use a logarithmic scale, and normalize to 0-10 range

- ⊙ A set of domains (such as top-level domains) is typically extremely diverse. On a linear scale, a handful of very busy domains will dwarf the long tail, so we'll use a logarithmic scale
 - $\text{Log}(\# \text{ hosts for ".uk"}) = \text{Log}(380596) = 12.849$
- ⊙ Account for differences in daily volume by scaling to total host population observed.
 - $\text{Log}(\# \text{ all hosts}) = \text{Log}(1358477) = 14.122$
 - $12.849 / 14.122 = 0.9099$
- ⊙ Normalize to a range between 0 and 10:
 - $0.9099 * 10 = 9.099$
- ⊙ In summary: $\text{Mag}(d) = \frac{\ln(Hd)}{\ln(Hall)} * 10$

DNS Magnitude at ICANN

- ⦿ The 2013 interisle report:
 - “The sources of queries for proposed TLD strings also follow a power-law distribution. For most of the most-queried proposed TLD strings, a relatively small number of distinct sources (as identified by IP address prefixes) account for a relatively large fraction of all queries.”

- ⦿ OCTO-007 (2017, published 2020)
Study of the Prevalence of DNS Queries for CORP, HOME, and MAIL
<https://www.icann.org/octo-007-en.pdf>
 - Counted number of prefixes (/24 on IPv4 and /48 on IPv6)

- ⦿ Counting hosts (i.e. sources of queries, or IP address prefixes) were used in the context of Name Collisions research.

- ⦿ **A high magnitude value indicates that a top-level domain is queried for by a large number of networks and presents a high collision risk.**

DNS Magnitude at ICANN

- ⦿ In 2019, worked with nic.at to apply DNS-Magnitude to IMRS traffic
 - <https://www.icann.org/dns-magnitude-05aug20-en.pdf>
 - This formed the basis of ICANN's DNS Magnitude research:
- ⦿ <https://observatory.research.icann.org/magnitude>
 - Daily (top 2000) ranking of top-level domains based on their DNS Magnitude ranking
 - Observed from IMRS traffic
 - Aggregated by /24 (IPv4) and /48 (IPv6)
 - Calculated per UTC day
 - Six days delay
 - to allow the measurements to catch up after maintenance
 - to allow changes in IMRS deployment to be reflected
 - to avoid "gaming" the system

Ranked by Magnitude score

Magnitude ▼	Top-Level Domain ▲▼	status ▲▼	Daily Rank ▲▼	Weekly Rank ▲▼	Monthly Rank ▲▼	Quarterly Rank ▲▼	Coverage ▲▼	Unique Sources ▲▼	Query Volume ▲▼	Avg Query/Source ▲▼
9.667	com	delegated	1	1	1	1	62%	848,184	1,162,177,228	1,370
9.602	net	delegated	2	2	2	2	57%	773,920	595,018,169	768
9.321	org	delegated	3	3	3	3	38%	520,688	98,464,786	189
9.160	info	delegated	4	4	4	4	30%	414,360	33,419,937	80
9.099	uk	delegated	5	5	5	5	28%	380,596	31,876,078	83
9.086	arpa	delegated	6	6	6	6	27%	373,235	99,484,064	266
8.886	biz	delegated	7	7	7	7	20%	281,487	14,840,876	52
8.838	local	special-use	8	8	8	8	19%	263,184	665,943,575	2,530
8.835	de	delegated	9	9	9	9	19%	262,116	15,650,575	59
8.798	io	delegated	10	10	10	10	18%	248,620	26,211,825	105
8.754	eu	delegated	11	11	11	11	17%	233,701	12,430,627	53
8.634	jp	delegated	▲ 12	▼ 13	▲ 12	13	14%	197,361	19,824,476	100
8.622	co	delegated	▲ 13	▲ 15	16	16	14%	193,926	6,954,260	35
8.617	cn	delegated	▼ 14	▲ 12	▼ 13	12	14%	192,636	129,131,637	670
8.609	me	delegated	▲ 15	▼ 16	15	15	14%	190,319	11,819,653	62
8.593	us	delegated	▲ 16	17	17	17	13%	186,167	11,738,242	63
8.591	br	delegated	▼ 17	14	14	14	13%	185,761	28,392,916	152
8.569	cz	delegated	18	▲ 18	▲ 21	23	13%	180,028	6,803,175	37
8.550	ru	delegated	19	▼ 19	18	18	12%	175,154	25,940,692	148
8.520	pl	delegated	▲ 20	▼ 21	▼ 20	19	12%	168,025	8,697,961	51
8.518	google	delegated	▲ 21	23	▼ 23	22	12%	167,383	3,471,284	20
8.514	it	delegated	▼ 22	▼ 20	▲ 19	20	12%	166,541	6,816,362	40
8.488	kr	delegated	▼ 23	22	▲ 22	24	11%	160,602	47,962,407	298
8.459	fr	delegated	▲ 24	25	▲ 25	26	11%	154,054	8,431,761	54
8.440	edu	delegated	▼ 25	24	▲ 24	25	11%	149,957	11,383,435	75

Ranked by Query Volume

Magnitude ▲▼	Top-Level Domain ▲▼	status ▲▼	Daily Rank ▲▼	Weekly Rank ▲▼	Monthly Rank ▲▼	Quarterly Rank ▲▼	Coverage ▲▼	Unique Sources ▲▼	Query Volume ▼	Avg Query/Source ▲▼
9.667	com	delegated	1	1	1	1	62%	848,184	1,162,177,228	1,370
8.838	local	special-use	8	8	8	8	19%	263,184	665,943,575	2,530
9.602	net	delegated	2	2	2	2	57%	773,920	595,018,169	768
7.813	home		▼ 99	▲ 95	▼ 96	95	4%	61,866	332,884,771	5,380
7.971	internal		▼ 64	62	▲ 62	64	5%	77,305	192,590,156	2,491
8.617	cn	delegated	▼ 14	▲ 12	▼ 13	12	14%	192,636	129,131,637	670
6.336	dhcp		▼ 581	▲ 575	▼ 594	575	0%	7,691	109,204,021	14,198
9.086	arpa	delegated	6	6	6	6	27%	373,235	99,484,064	266
9.321	org	delegated	3	3	3	3	38%	520,688	98,464,786	189
7.885	lan		▼ 80	▲ 78	▼ 83	82	5%	68,500	82,082,701	1,198
6.205	bbrouter		663	▲ 663	▼ 680	677	0%	6,389	81,504,538	12,757
7.320	corp		▲ 209	▲ 218	▼ 221	214	2%	30,847	64,361,720	2,086
8.488	kr	delegated	▼ 23	22	▲ 22	24	11%	160,602	47,962,407	298
7.125	localhost	special-use	▼ 288	▲ 274	▼ 284	269	1%	23,417	37,919,166	1,619
8.220	localdomain		▼ 41	38	▼ 38	37	8%	110,004	37,193,782	338
7.410	invalid	special-use	▼ 178	▲ 167	▼ 168	166	2%	35,003	35,294,395	1,008
9.160	info	delegated	4	4	4	4	30%	414,360	33,419,937	80
9.099	uk	delegated	5	5	5	5	28%	380,596	31,876,078	83
6.925	intra		▲ 343	▲ 347	▼ 349	345	1%	17,660	31,014,655	1,756
8.591	br	delegated	▼ 17	14	14	14	13%	185,761	28,392,916	152
8.798	io	delegated	10	10	10	10	18%	248,620	26,211,825	105
8.550	ru	delegated	19	▼ 19	18	18	12%	175,154	25,940,692	148
6.927	dlink		▼ 340	▲ 339	▼ 343	339	1%	17,697	21,919,536	1,238
7.474	mil	delegated	▼ 152	146	▼ 146	125	2%	38,351	20,278,650	528
8.143	tw	delegated	▼ 49	47	47	47	7%	98,582	20,075,422	203
8.634	jp	delegated	▲ 12	▼ 13	▲ 12	13	14%	197,361	19,824,476	100
6.153	openstacklocal		▼ 700	▼ 658	▼ 654	642	0%	5,940	19,178,166	3,228

Ranked by magnitude, undelegated only

Magnitude ▼	Top-Level Domain ▲▼	status ▲▼	Daily Rank ▲▼	Weekly Rank ▲▼	Monthly Rank ▲▼	Quarterly Rank ▲▼	Coverage ▲▼	Unique Sources ▲▼	Query Volume ▲▼	Avg Query/Source ▲▼
8.838	local	special-use	8	8	8	8	19%	263,184	665,943,575	2,530
8.220	localdomain		▼ 41	38	▼ 38	37	8%	110,004	37,193,782	338
7.971	internal		▼ 64	62	▲ 62	64	5%	77,305	192,590,156	2,491
7.885	lan		▼ 80	▲ 78	▼ 83	82	5%	68,500	82,082,701	1,198
7.813	home		▼ 99	▲ 95	▼ 96	95	4%	61,866	332,884,771	5,380
7.478	onion	special-use	▲ 149	▲ 176	177	177	2%	38,571	1,245,827	32
7.434	wpad		▼ 165	▲ 158	▼ 159	156	2%	36,256	1,906,581	52
7.410	invalid	special-use	▼ 178	▲ 167	▼ 168	166	2%	35,003	35,294,395	1,008
7.336	router		▲ 201	▼ 207	▼ 198	191	2%	31,560	4,274,666	135
7.320	corp		▲ 209	▲ 218	▼ 221	214	2%	30,847	64,361,720	2,086
7.251	tcs		▲ 238	▲ 266	▼ 271	263	2%	27,976	396,368	14
7.224	https		245	▲ 245	▼ 247	237	1%	26,944	2,277,927	84
7.202	server		▼ 253	▼ 243	▼ 240	231	1%	26,104	1,564,670	59
7.193	blank		▼ 256	▲ 249	▼ 253	252	1%	25,791	1,254,189	48
7.178	loc		▲ 261	▲ 267	▲ 270	274	1%	25,251	18,909,688	748
7.146	tld		▲ 274	▲ 295	▼ 296	290	1%	24,118	3,941,380	163
7.125	localhost	special-use	▼ 288	▲ 274	▼ 284	269	1%	23,417	37,919,166	1,619
7.114	null		▼ 293	▼ 271	▼ 260	251	1%	23,045	2,489,428	108
7.078	test	special-use	▲ 305	▲ 309	▼ 314	304	1%	21,926	8,644,903	394
7.073	workgroup		▲ 307	▲ 312	▼ 317	316	1%	21,751	6,312,684	290
7.030	undefined		323	▲ 323	▼ 330	329	1%	20,482	872,700	42
6.983	unifi		▼ 330	320	▼ 320	314	1%	19,173	1,497,707	78
6.936	bind		▼ 335	▲ 330	▼ 331	327	1%	17,930	6,045,299	337
6.927	dlink		▼ 340	▲ 339	▼ 343	339	1%	17,697	21,919,536	1,238
6.925	intra		▲ 343	▲ 347	▼ 349	345	1%	17,660	31,014,655	1,756

Ranked by query volume, undelegated only

Magnitude ▲▼	Top-Level Domain ▲▼	status ▲▼	Daily Rank ▲▼	Weekly Rank ▲▼	Monthly Rank ▲▼	Quarterly Rank ▲▼	Coverage ▲▼	Unique Sources ▲▼	Query Volume ▼	Avg Query/Source ▲▼
8.838	local	special-use	8	8	8	8	19%	263,184	665,943,575	2,530
7.813	home		▼ 99	▲ 95	▼ 96	95	4%	61,866	332,884,771	5,380
7.971	internal		▼ 64	62	▲ 62	64	5%	77,305	192,590,156	2,491
6.336	dhcp		▼ 581	▲ 575	▼ 594	575	0%	7,691	109,204,021	14,198
7.885	lan		▼ 80	▲ 78	▼ 83	82	5%	68,500	82,082,701	1,198
6.205	bbrouter		663	▲ 663	▼ 680	677	0%	6,389	81,504,538	12,757
7.320	corp		▲ 209	▲ 218	▼ 221	214	2%	30,847	64,361,720	2,086
7.125	localhost	special-use	▼ 288	▲ 274	▼ 284	269	1%	23,417	37,919,166	1,619
8.220	localdomain		▼ 41	38	▼ 38	37	8%	110,004	37,193,782	338
7.410	invalid	special-use	▼ 178	▲ 167	▼ 168	166	2%	35,003	35,294,395	1,008
6.925	intra		▲ 343	▲ 347	▼ 349	345	1%	17,660	31,014,655	1,756
6.927	dlink		▼ 340	▲ 339	▼ 343	339	1%	17,697	21,919,536	1,238
6.153	openstacklocal		▼ 700	▼ 658	▼ 654	642	0%	5,940	19,178,166	3,228
7.178	loc	loc	▲ 261	▲ 267	▲ 270	274	1%	25,251	18,909,688	748
6.920	getcacheddhcpresultsforcurrentconfig		▼ 346	▲ 340	▲ 346	347	1%	17,534	16,907,884	964
6.295	wifi		▲ 602	▲ 605	▼ 619	609	0%	7,257	16,311,833	2,247
5.701	ctc		▼ 1099	▲ 1087	▼ 1091	1075	0%	3,136	15,493,261	4,940
6.766	dlinkrouter		▼ 388	▲ 386	▼ 390	376	1%	14,107	12,603,437	893
5.231	sercomm		▲ 1723	▼ 1801	–	–	0%	1,615	12,257,400	7,589
6.529	gateway		▼ 475	▲ 468	▼ 469	445	0%	10,100	11,203,516	1,109
5.135	cmcc		▼ 1895	▲ 1860	▼ 1916	1845	0%	1,410	10,996,991	7,799
6.636	pvt		▲ 434	▼ 436	▼ 435	431	0%	11,740	10,772,112	917
5.585	modem		▲ 1211	▼ 1212	▼ 1197	1169	0%	2,662	10,708,824	4,022
5.857	lan1		▲ 957	▼ 998	▼ 994	950	0%	3,906	9,252,962	2,368
5.330	rac2v1a		▲ 1553	▼ 1591	▼ 1579	1535	0%	1,856	8,994,922	4,846

Interesting newly observed domains

Most popular newly observed tlds, today

Magnitude ▲▼	Top-Level Domain ▲▼	status ▲▼	Daily Rank ▲▼	Weekly Rank ▼	Monthly Rank ▲▼	Quarterly Rank ▲▼	Coverage ▲▼	Unique Sources ▲▼	Query Volume ▲▼	Avg Query/Source ▲▼
6.302	xow		▼ 598	-	-	-	0%	7,330	28,297	3
6.122	xit		▼ 720	-	-	-	0%	5,678	47,681	8
5.858	brcriacao		▼ 955	-	-	-	0%	3,913	36,340	9
5.553	eventpoints		▼ 1247	-	-	-	0%	2,543	12,591	4

Most popular newly observed tlds, this week

Magnitude ▲▼	Top-Level Domain ▲▼	status ▲▼	Daily Rank ▲▼	Weekly Rank ▲▼	Monthly Rank ▼	Quarterly Rank ▲▼	Coverage ▲▼	Unique Sources ▲▼	Query Volume ▲▼	Avg Query/Source ▲▼
6.282	null-null		▼ 613	▼ 609	-	-	0%	7,118	76,316	10
6.218	coart-club		▼ 659	▼ 637	-	-	0%	6,509	55,017	8
6.212	rore		▲ 660	▼ 710	-	-	0%	6,454	161,533	25
5.715	drft		▼ 1083	▼ 985	-	-	0%	3,200	18,962	5

Highest Average queries per host

Magnitude ▲▼	Top-Level Domain ▲▼	status ▲▼	Daily Rank ▲▼	Weekly Rank ▲▼	Monthly Rank ▲▼	Quarterly Rank ▲▼	Coverage ▲▼	Unique Sources ▲▼	Query Volume ▲▼	Avg Query/Source ▼
6.336	dhcp		▼ 581	▲ 575	▼ 594	575	0%	7,691	109,204,021	14,198
6.205	bbrouter		663	▲ 663	▼ 680	677	0%	6,389	81,504,538	12,757
5.135	cmcc		▼ 1895	▲ 1860	▼ 1916	1845	0%	1,410	10,996,991	7,799
5.231	sercomm		▲ 1723	▼ 1801	–	–	0%	1,615	12,257,400	7,589
7.813	home		▼ 99	▲ 95	▼ 96	95	4%	61,866	332,884,771	5,380
5.701	ctc		▼ 1099	▲ 1087	▼ 1091	1075	0%	3,136	15,493,261	4,940
5.330	rac2v1a		▲ 1553	▼ 1591	▼ 1579	1535	0%	1,856	8,994,922	4,846
5.585	modem		▲ 1211	▼ 1212	▼ 1197	1169	0%	2,662	10,708,824	4,022
6.153	openstacklocal		▼ 700	▼ 658	▼ 654	642	0%	5,940	19,178,166	3,228
8.838	local	special-use	8	8	8	8	19%	263,184	665,943,575	2,530
7.971	internal		▼ 64	62	▲ 62	64	5%	77,305	192,590,156	2,491
5.857	lan1		▲ 957	▼ 998	▼ 994	950	0%	3,906	9,252,962	2,368
6.295	wifi		▲ 602	▲ 605	▼ 619	609	0%	7,257	16,311,833	2,247
7.320	corp		▲ 209	▲ 218	▼ 221	214	2%	30,847	64,361,720	2,086
5.993	novalocal		▼ 825	▼ 805	▼ 764	761	0%	4,733	8,325,018	1,758
6.925	intra		▲ 343	▲ 347	▼ 349	345	1%	17,660	31,014,655	1,756
7.125	localhost	special-use	▼ 288	▲ 274	▼ 284	269	1%	23,417	37,919,166	1,619
5.140	ralinkap		▼ 1880	▲ 1793	▼ 1800	1758	0%	1,420	2,295,497	1,616
5.210	sopra		▲ 1760	▼ 1867	▼ 1857	1852	0%	1,568	2,510,927	1,601
5.636	socgen		▲ 1157	▲ 1218	▼ 1219	1213	0%	2,859	4,305,430	1,505
5.133	mygateway		▼ 1899	–	–	–	0%	1,406	2,084,752	1,482
5.953	mars		▲ 858	▲ 886	▼ 895	861	0%	4,475	6,634,043	1,482
5.331	airdream		▲ 1549	▲ 1578	▼ 1626	1613	0%	1,859	2,599,101	1,398
9.667	com	delegated	1	1	1	1	62%	848,184	1,162,177,228	1,370
5.628	lvmh		▲ 1162	▼ 1180	▼ 1177	1167	0%	2,829	3,571,618	1,262

References

- ⦿ [2013 Interisle report](#)
- ⦿ OCTO-007 (2017, published 2020): Study of the Prevalence of DNS Queries for CORP, HOME, and MAIL
<https://www.icann.org/octo-007-en.pdf>
- ⦿ [NIC.AT DNS Magnitude Study](#)
- ⦿ <https://observatory.research.icann.org/magnitude>

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