Enabling Internet-Scale DNS-Based measurements

Bachelor Thesis Final Talk

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Motivation

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- Evolving to fulfill changing requirements

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  - IPv6

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Evolution of the Internet?

⇒ Use the Domain Name System to draw conclusions!

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Using the DNS: Not a new idea...

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```
cat domainlist.txt | ./tdns -ns 8.8.8.8 -t A
```

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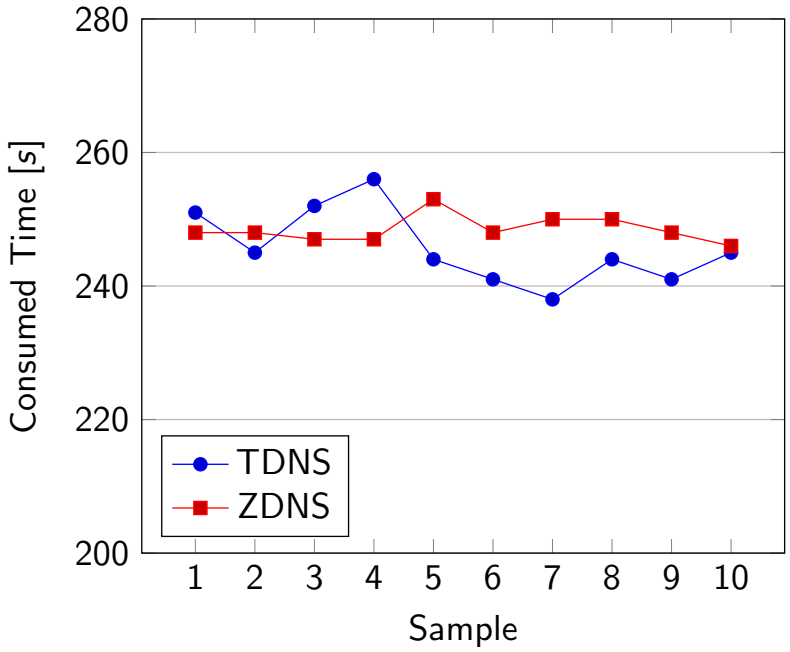

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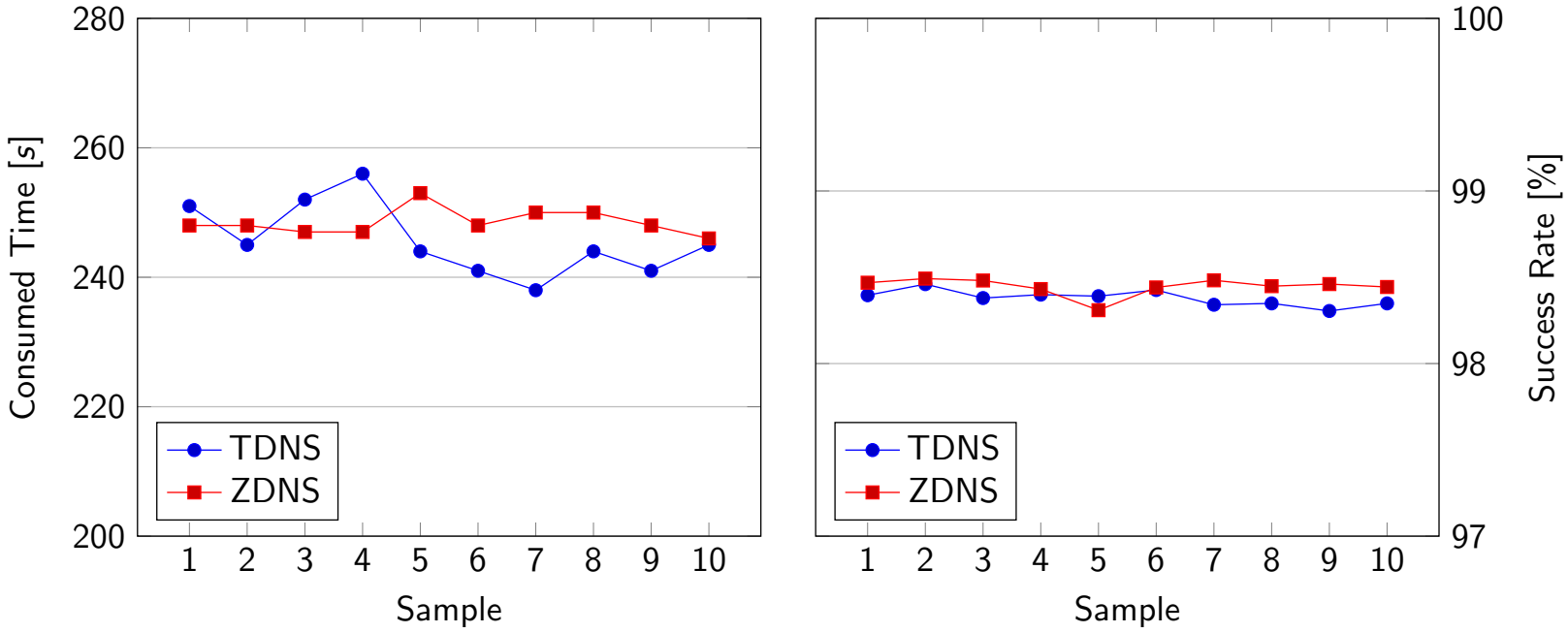

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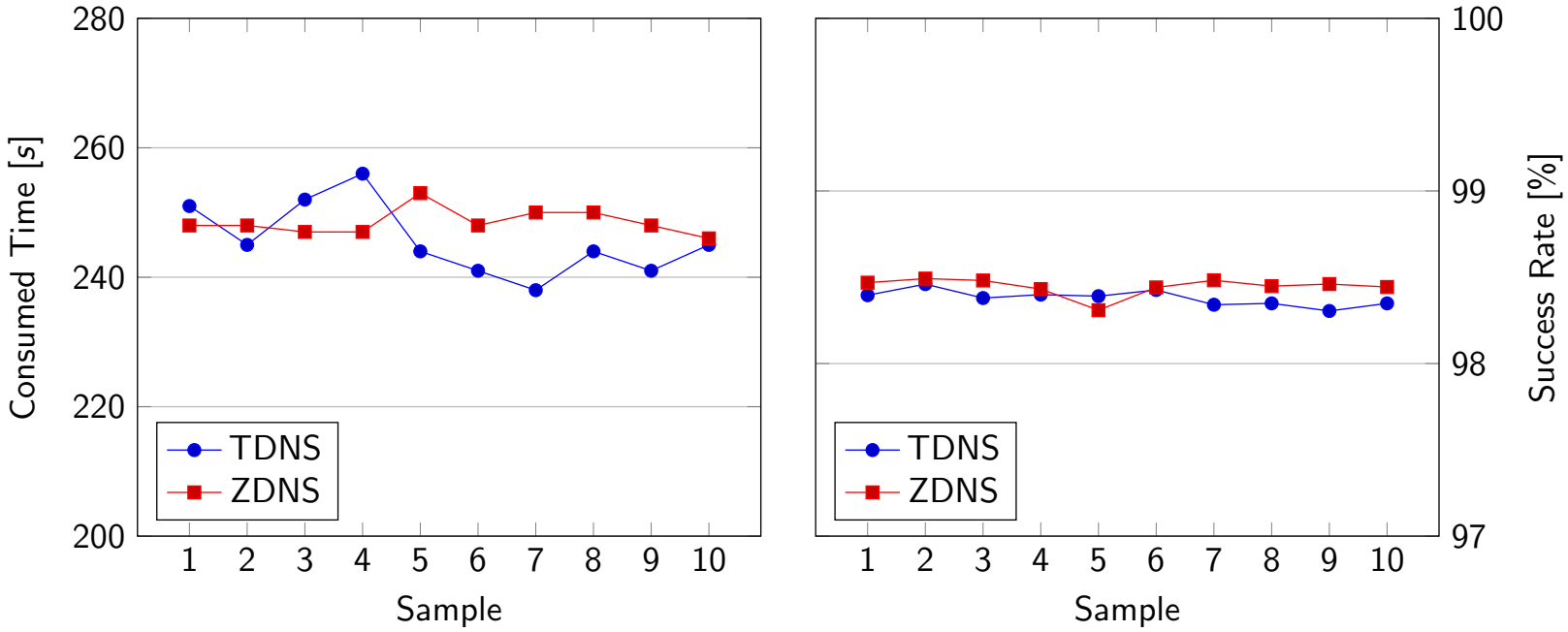

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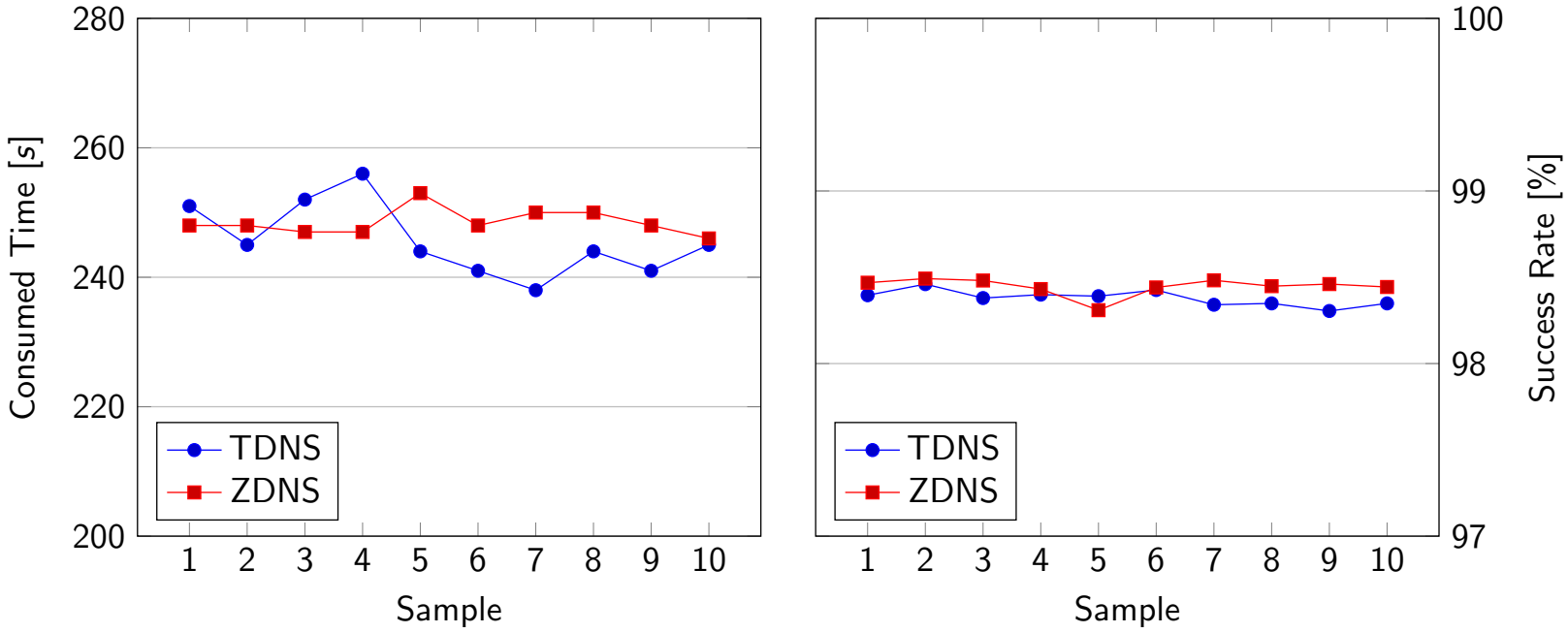

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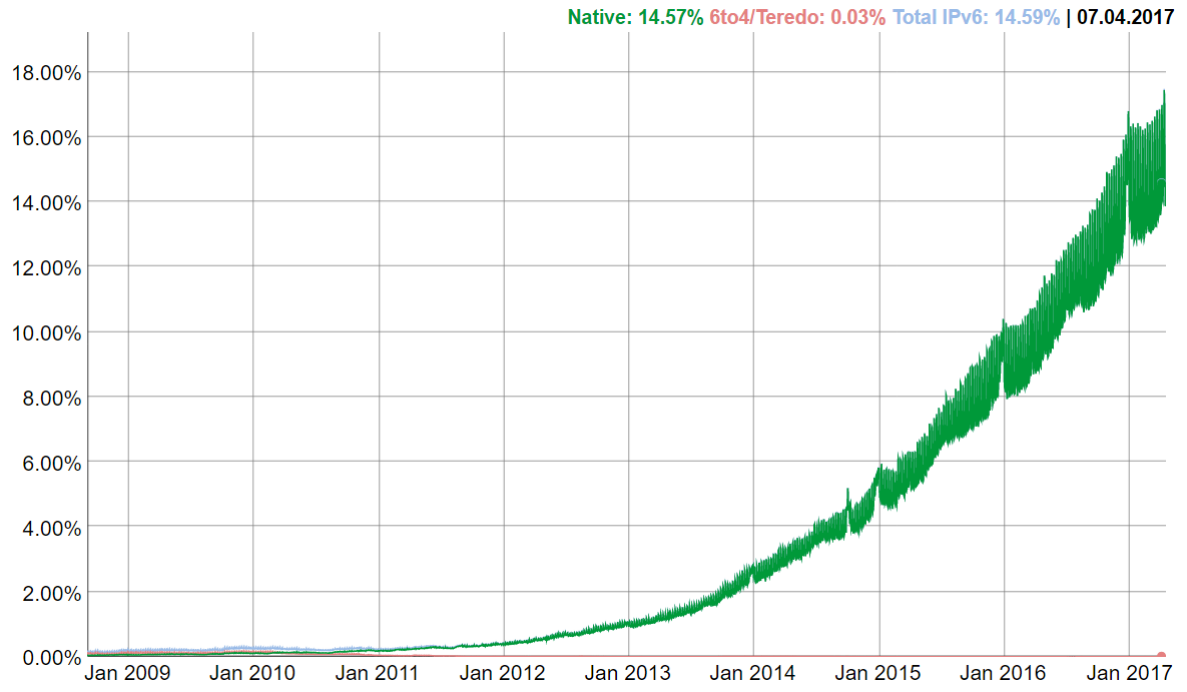

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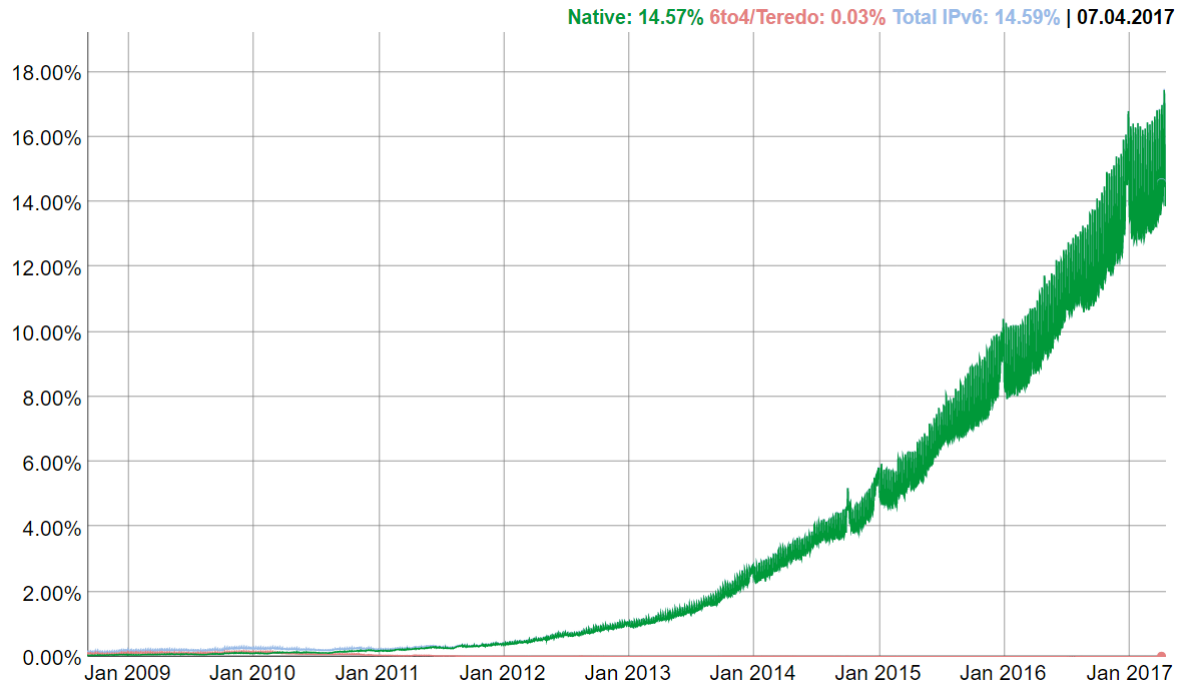

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What about the Infrastructure?

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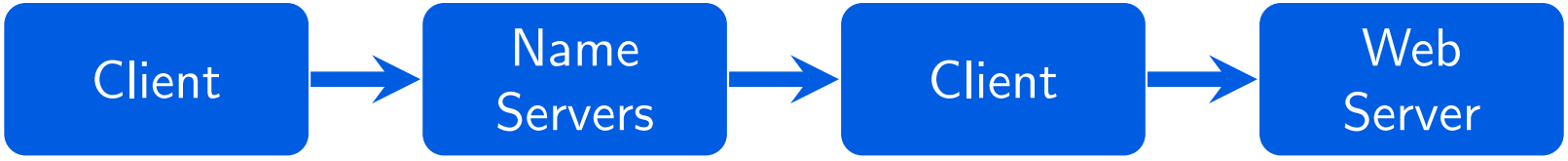

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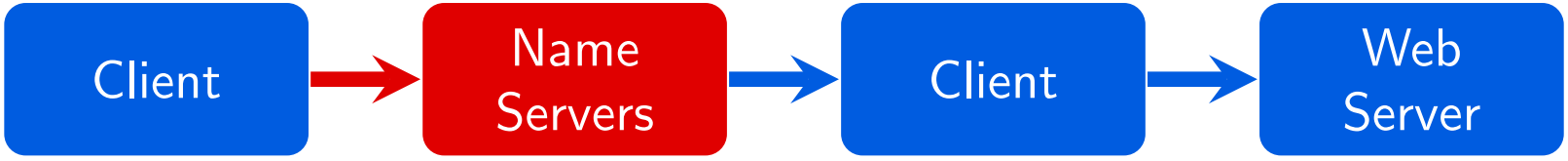

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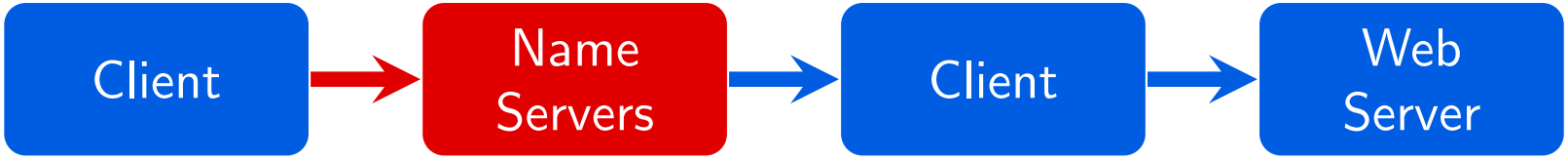

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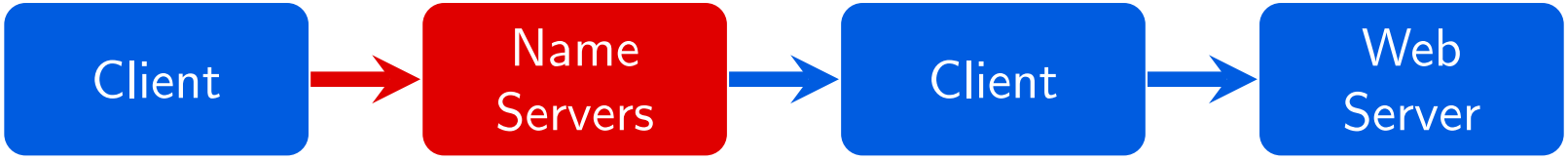
  $\Rightarrow$ Investigate multiple aspects

IPv6-Capability Study

Problem

- Domain: More than just a `AAAA`-record
- Mail Exchangers, Name Servers, Subdomains, . . .



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- Domain itself, Mail Exchangers, Name Servers, `www`-subdomain

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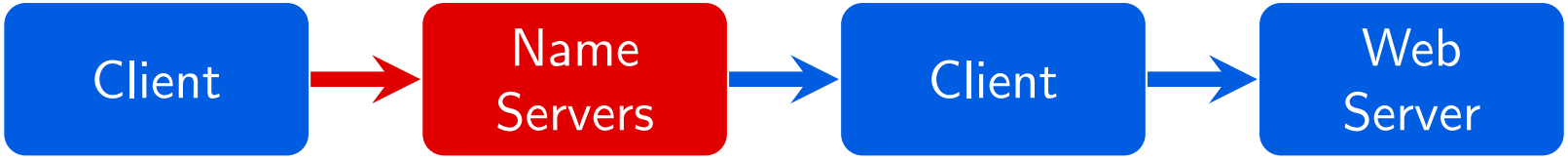

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Approach

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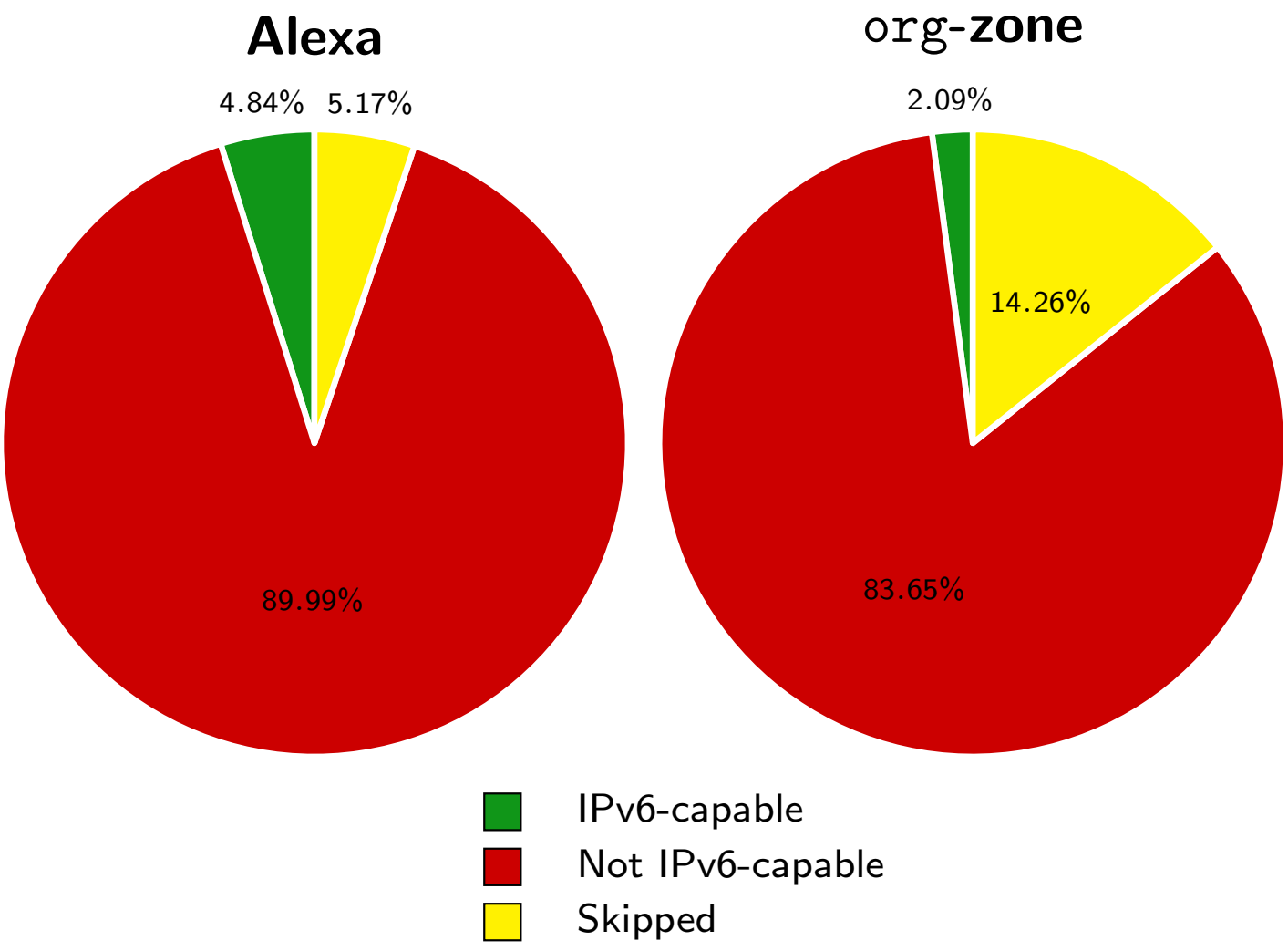
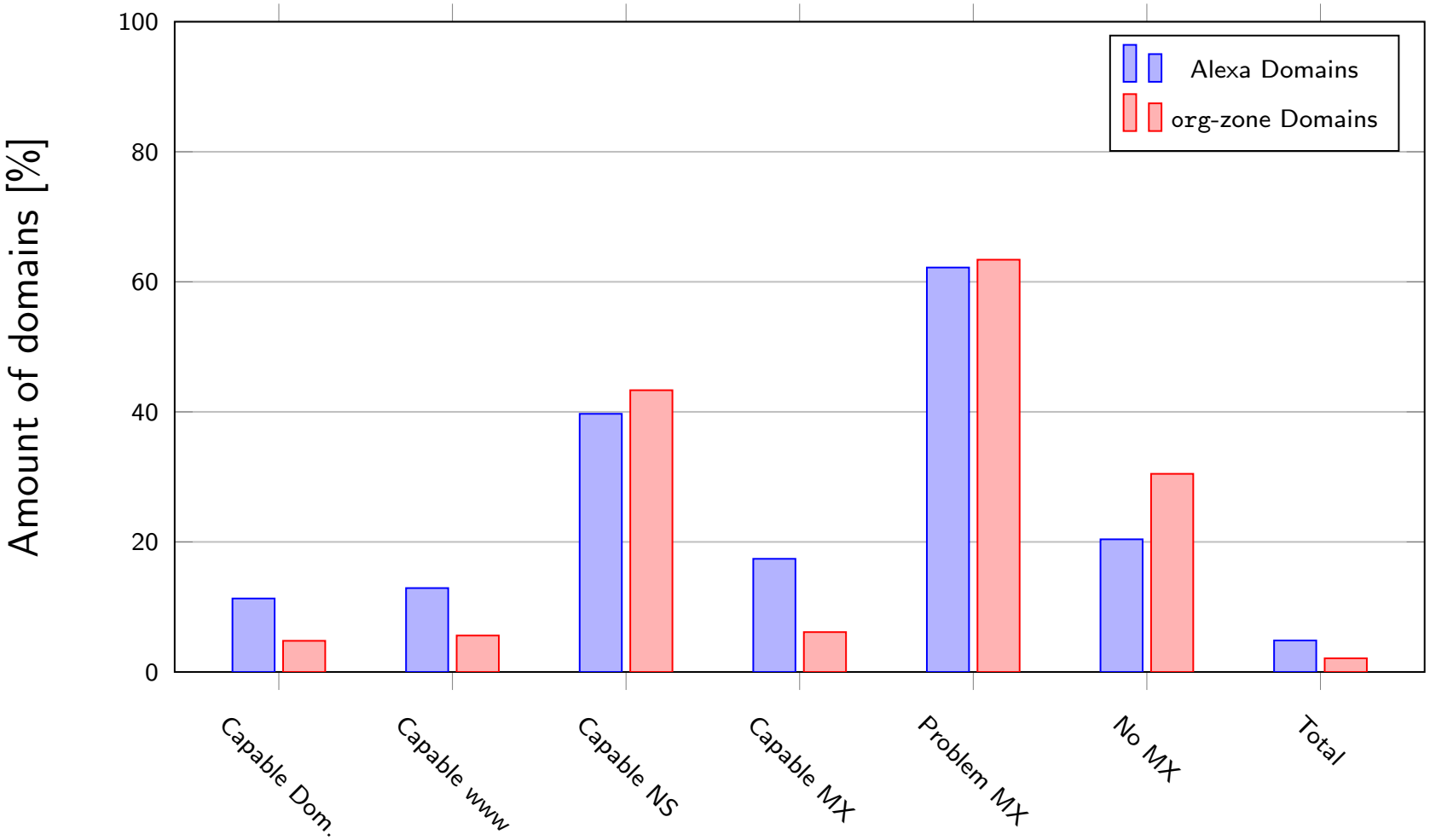
- Alexa Top 1M & complete `org`-zone

IPv6-Capability Study



IPv6-Capability Study



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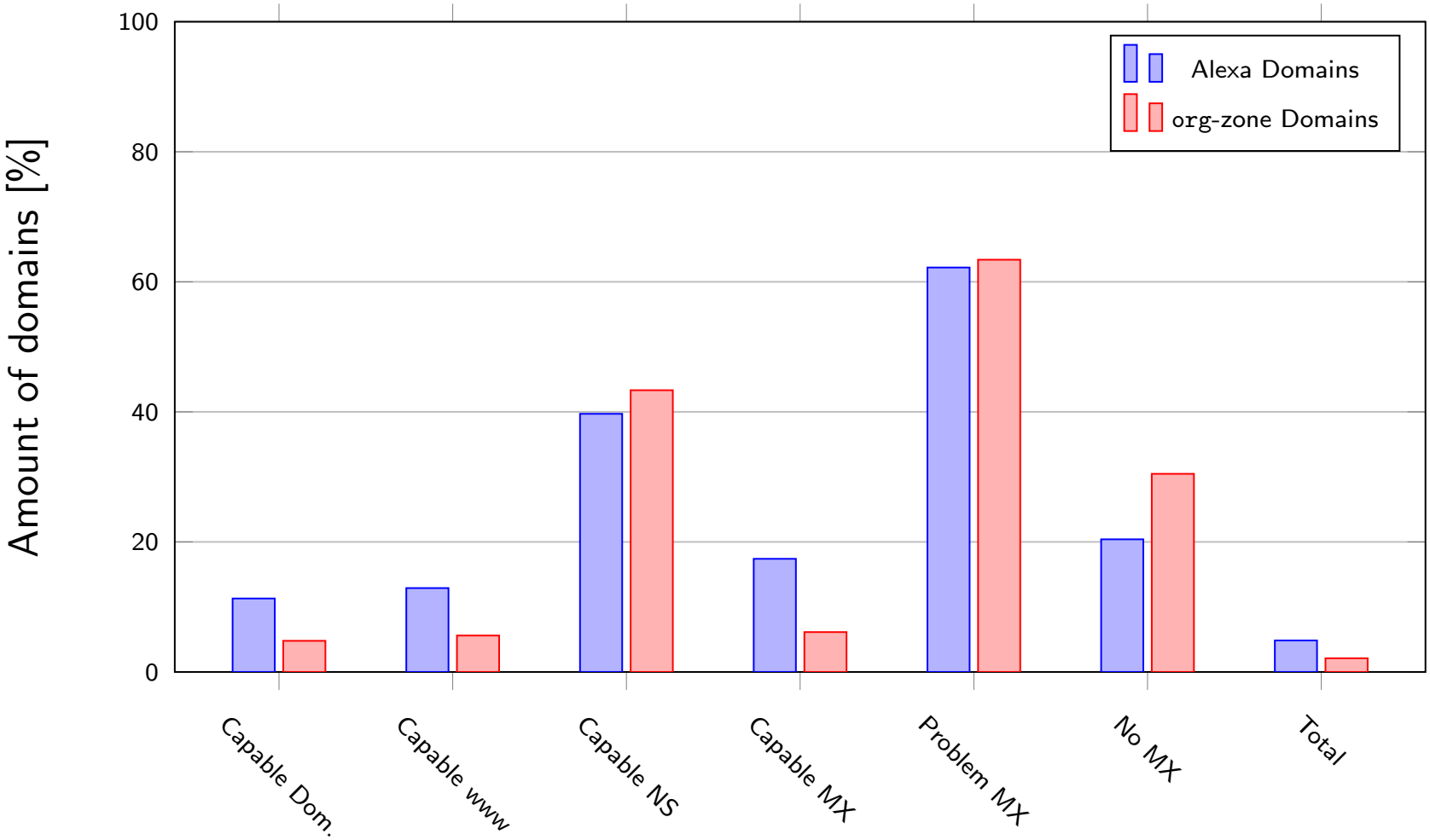

Misconfiguration or not IPv6-capable **infrastructure**. . . ?

IPv6-Capability Study

Is IPv6-capability linked to a domain's popularity?

IPv6-Capability Study

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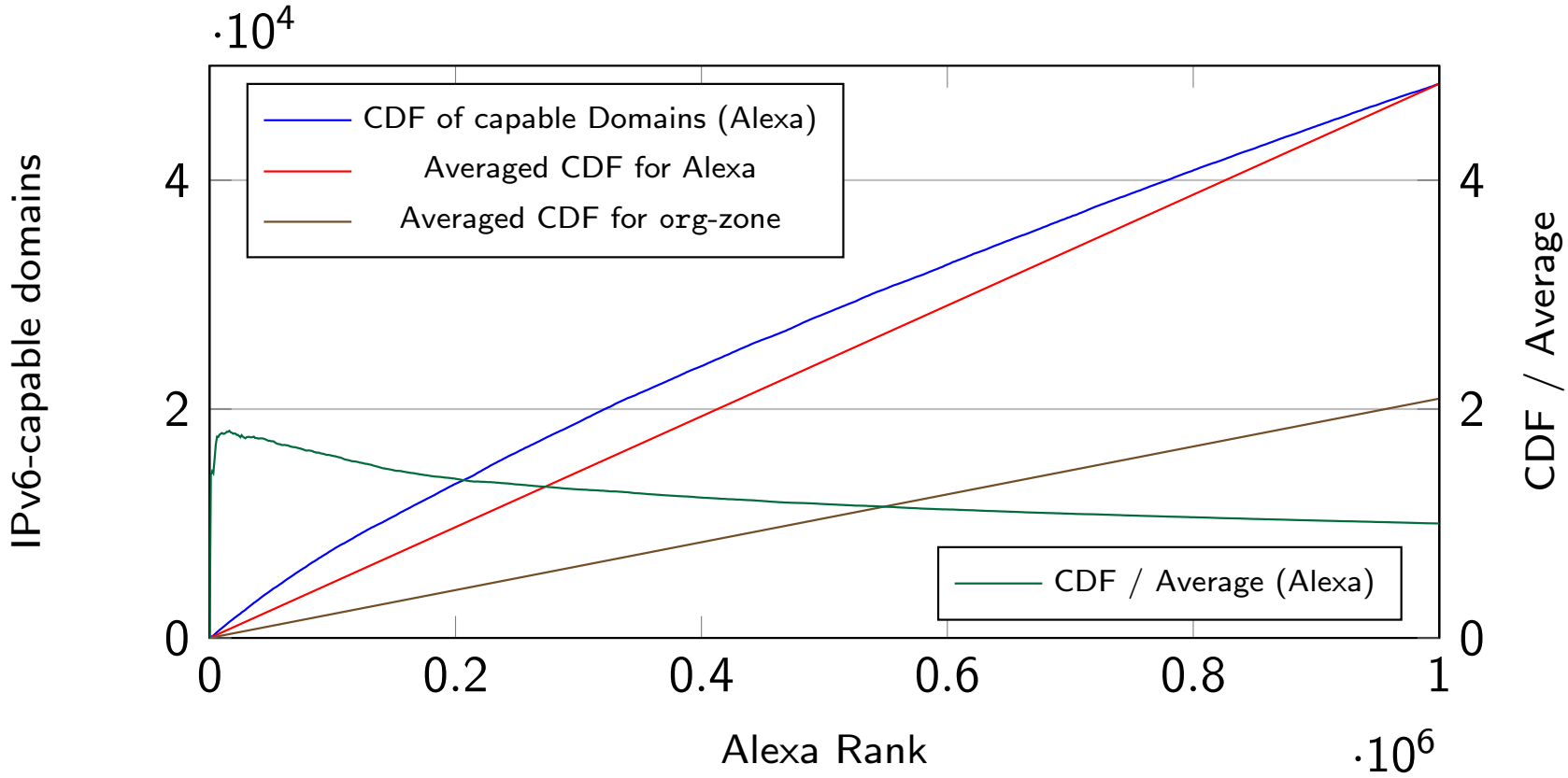

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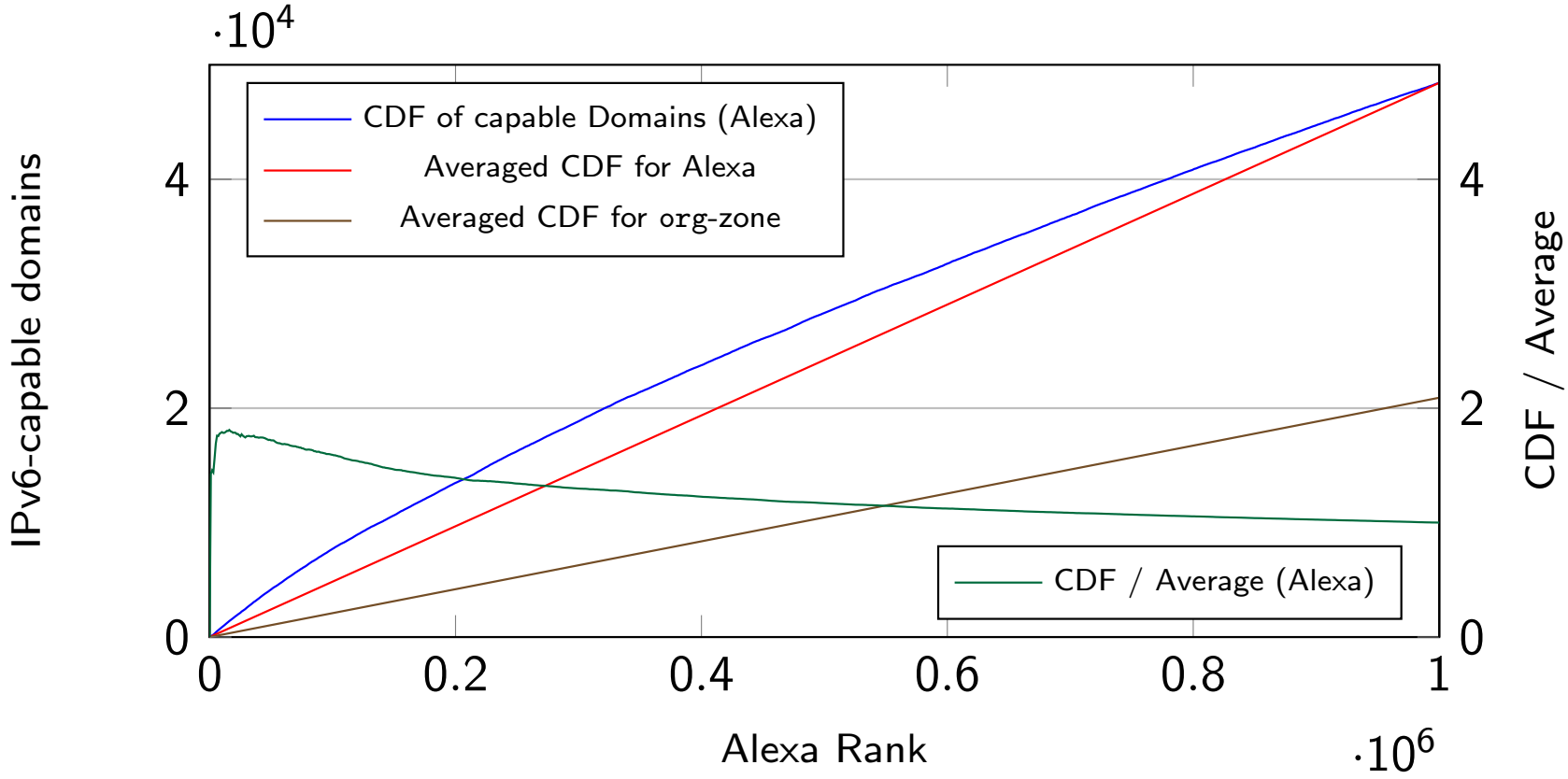

So the "big players" are v6-ready, right?

IPv6-Capability Study

Global Top Sites

- Google, Facebook, MSN, Yahoo, Bing, Twitter, Wikipedia, Amazon, Linkedin, ...

IPv6-Capability Study

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IPv6-Capability Study

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- Only 18 out of the top 300 domains are IPv6-ready (6%)

IPv6-Capability Study

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Which aspects are affected? (NS, MX, ...)

IPv6-Capability Study

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- Only 18 out of the top 300 domains are IPv6-ready (6%)

Which aspects are affected? (NS, MX, ...)
Is this just a **misconfiguration**?

Google's IPv6-Capability

The domain `google.com`

Google's IPv6-Capability

The domain `google.com`

`AAAA`-record

`AAAA`-record for `www`

`AAAA`-record for any `MX`

`AAAA`-record for any `NS`

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`google.com`	`172.217.22.238`	Yes	15169
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IPv6-Capability Study

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Worth repeating and improving these studies!

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  - Validate IPv6 addresses
  - Improve casual analysis of non-capable domains

Thank You!

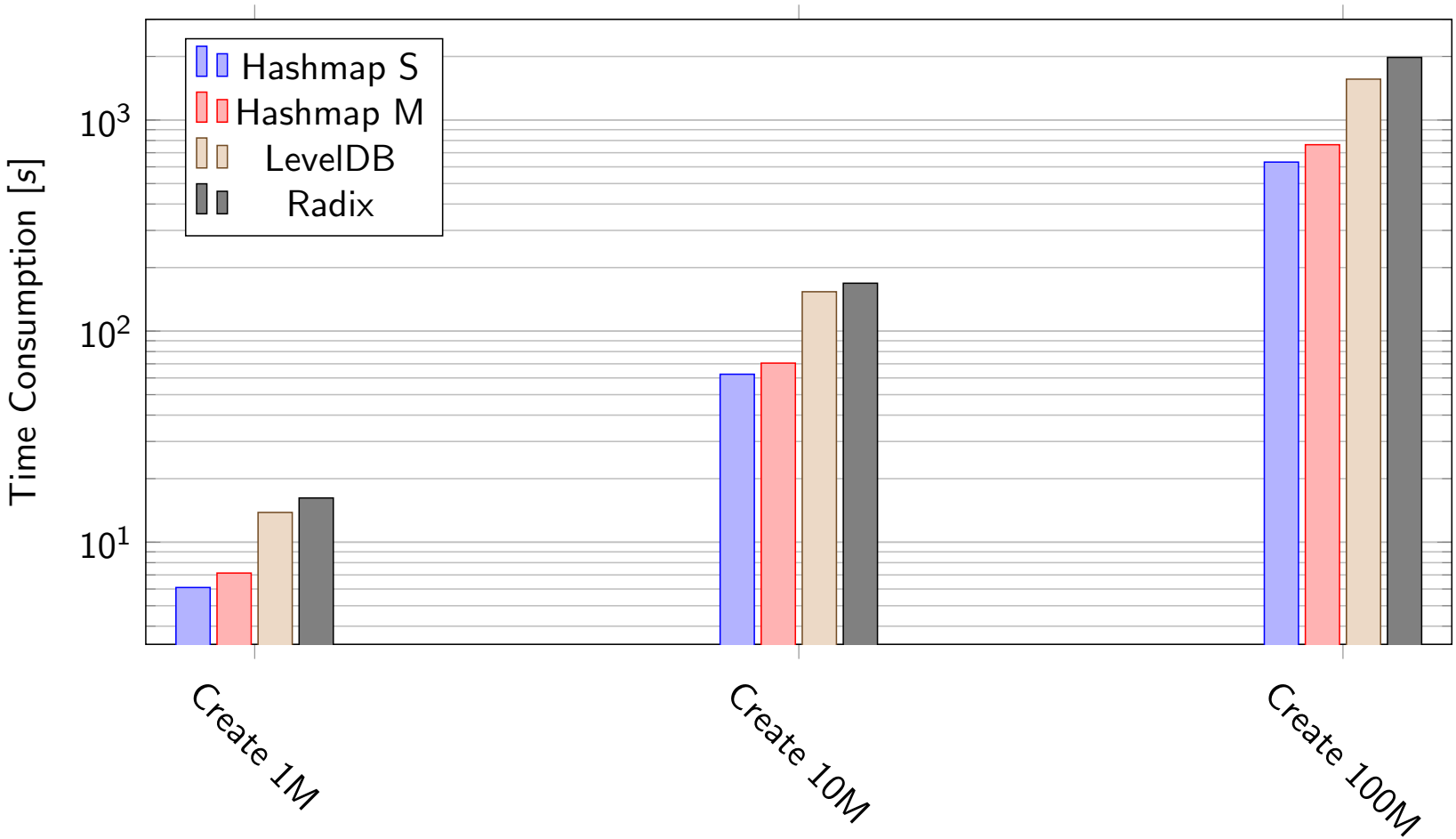
Thank you for your attention!

Do you have any questions?

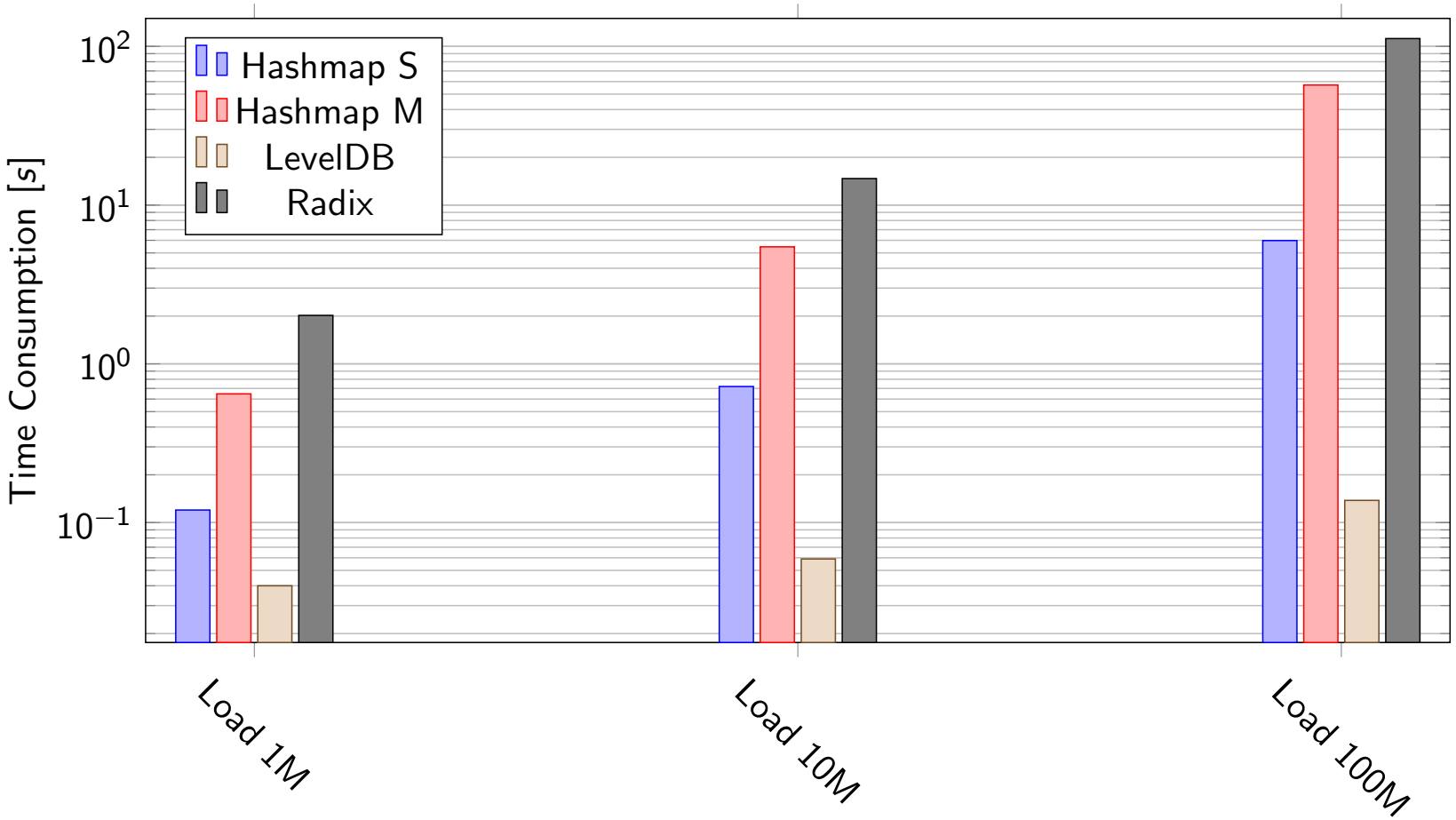
A: Reactive Queuing

```
{
    "rules": [
        {
            "desc": "AAAA for all A Records",
            "status": ["NOERROR"],
            "type": ["A"],
            "cont": [],
            "ncont": [],
            "format": [
                "{0} AAAA"
            ],
            "flags": [],
            "nflags": ["@ns", "@mx"]
        },
        {
            "desc": "MX for all A Records",
            "status": ["NOERROR"],
            "type": ["A"],
            "cont": [],
            "ncont": ["www."],
            "format": [
                "{0} MX"
            ],
            "flags": [],
            "nflags": ["@mx", "@ns"]
        },
    ...
    ]
}
```

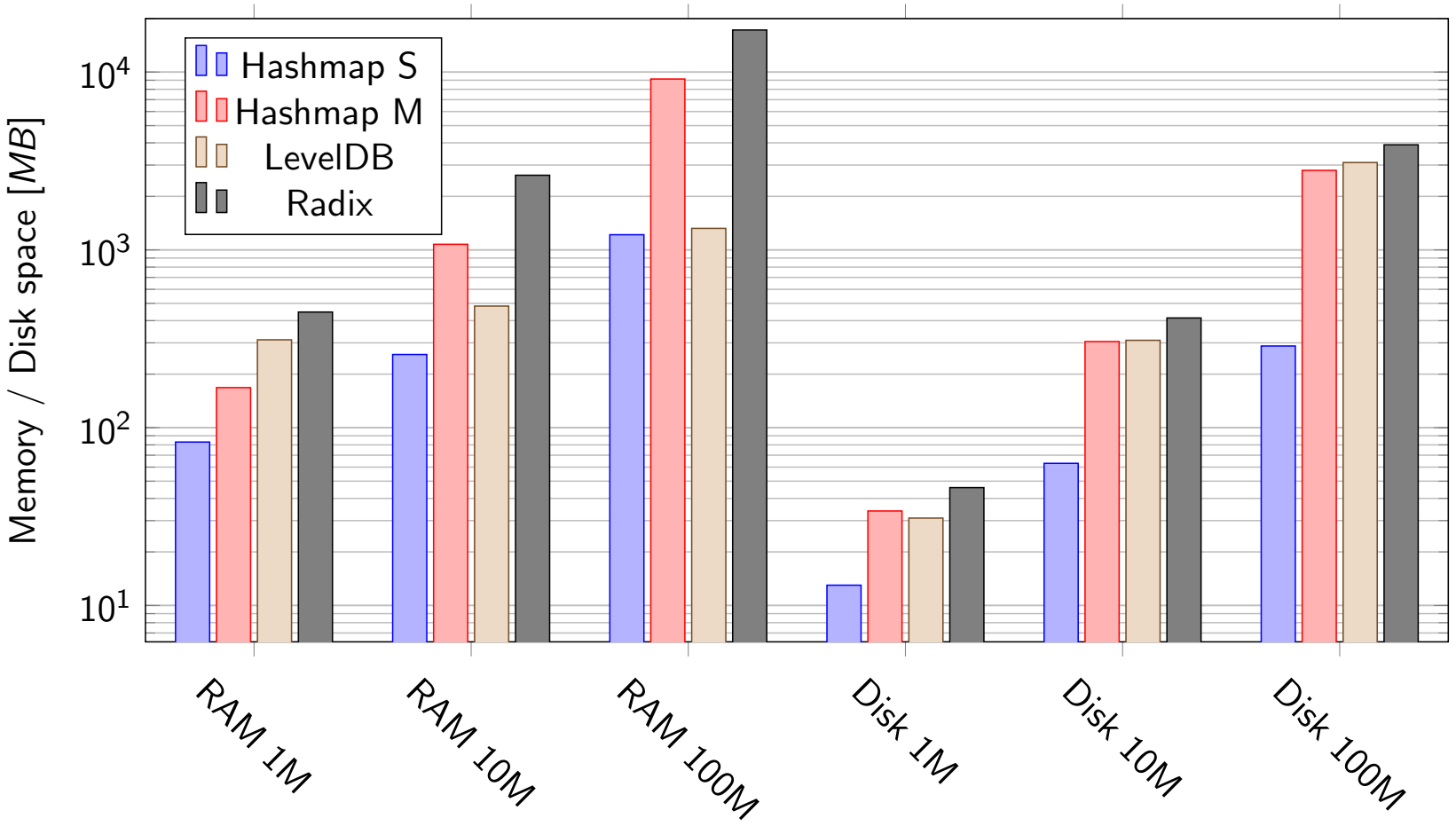
A: DB Create Performance



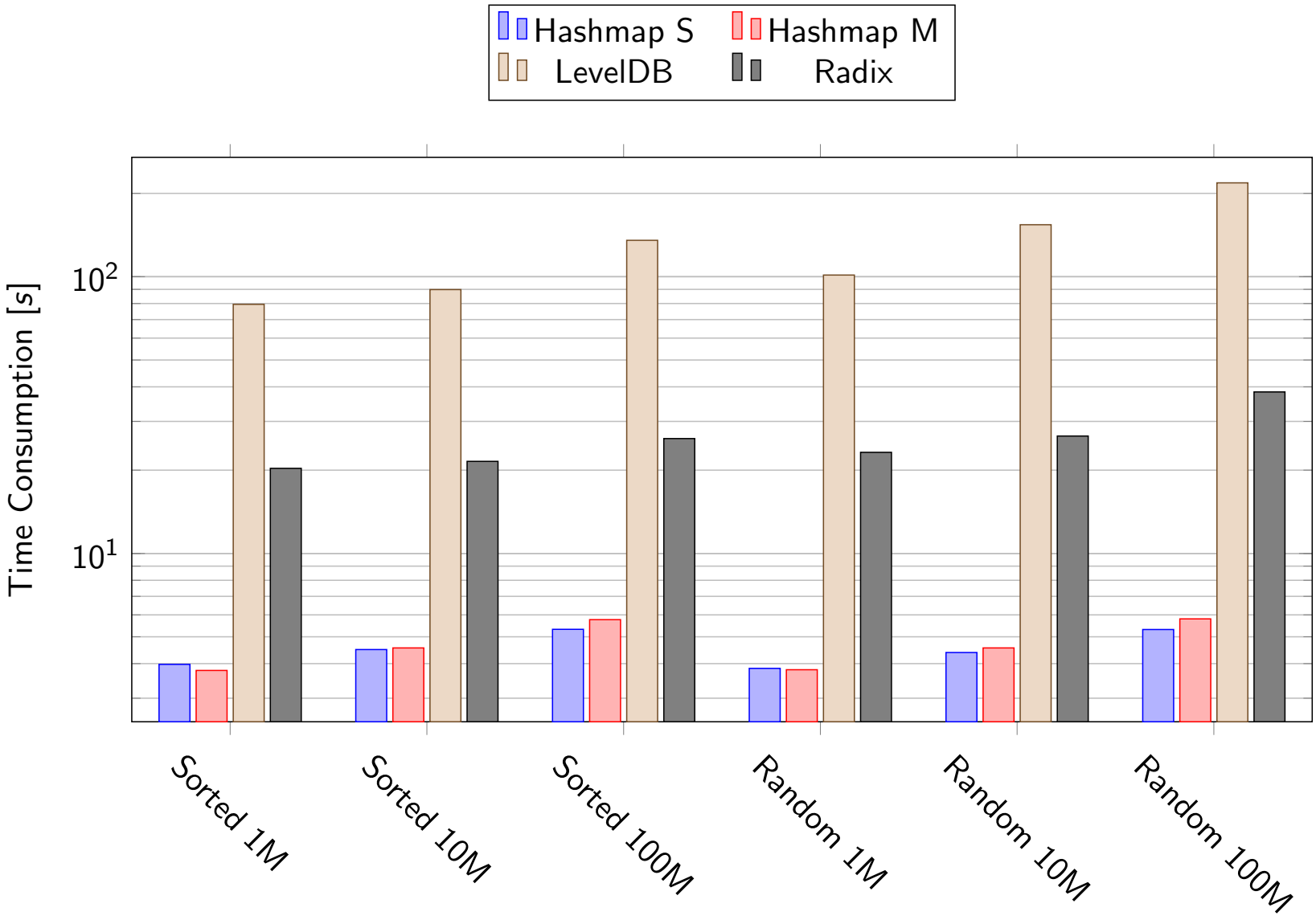
A: DB Load Performance



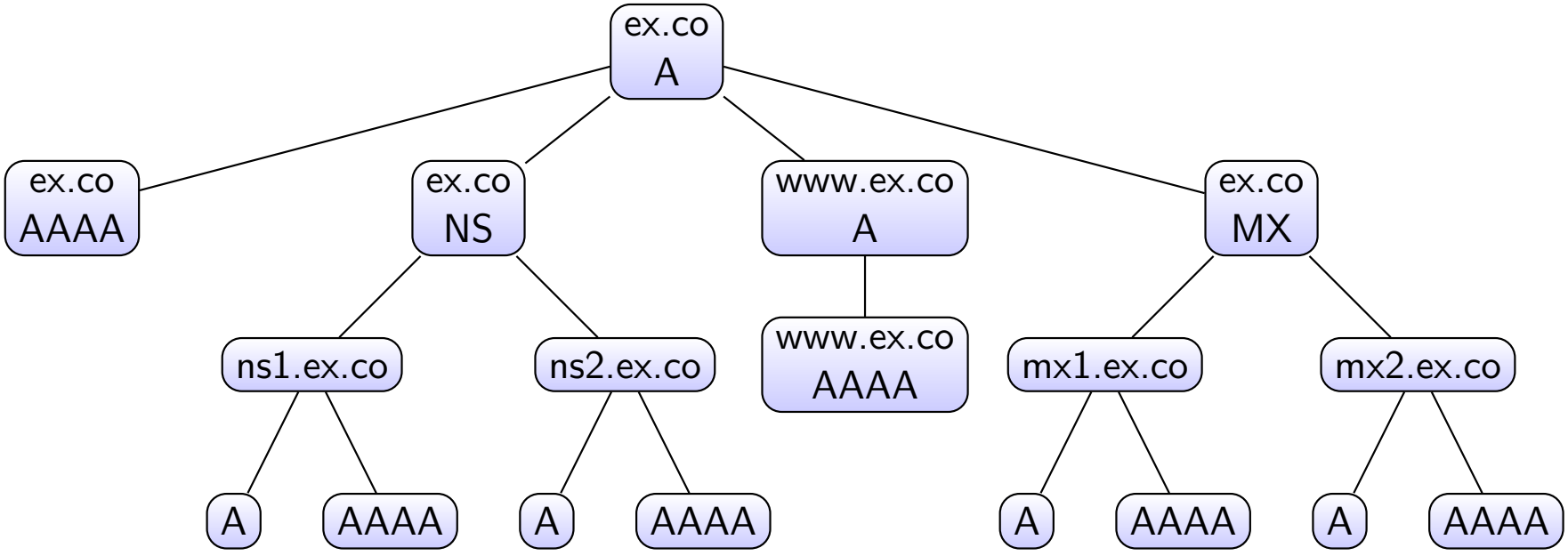
A: DB Memory Requirements



A: DB Query Performance



A: IPv6 Lookup Tree



A: MX Distribution (Org)

POS	Name (SLD)	V6	V4	V6 All	V4 All	DNUM	NSNUM
0	secureserver.net	False	True	False	False	2617311	203
1	google.com	True	True	False	False	302777	518
2	ctmail.com	True	True	False	False	235980	3
3	googlemail.com	True	True	False	False	228364	161
4	1and1.com	True	True	False	False	167140	17
5	outlook.com	True	True	False	False	127770	128052
6	GOOGLE.COM	True	True	False	False	124513	294
7	registrar-servers.com	False	True	False	False	109200	19
8	ovh.net	True	True	False	False	97814	109
9	co.uk	True	True	False	False	94123	2115
10	localhost	False	True	False	True	84105	1
11	GOOGLEMAIL.COM	True	True	False	False	81705	95
12	kundenserver.de	False	True	False	True	79481	5
13	rzone.de	True	True	False	True	63592	5
14	hostedemail.com	False	True	False	False	63415	28803
15	gandi.net	True	True	False	False	48952	13
16	m1bp.com	False	True	False	True	39871	6
17	mb5p.com	False	True	False	True	39775	6
18	dreamhost.com	False	True	False	False	36432	48
19	yahoodns.net	False	True	False	False	34638	8
20	1and1.fr	True	True	False	True	31171	4
21	udag.de	False	True	False	True	30622	6
22	one.com	False	True	False	True	30072	15
23	h-email.net	False	True	False	True	28233	1
24	emailsrvr.com	False	True	False	False	27695	21

A: NS Distribution (Org)

POS	Name (SLD)	V6	V4	V6 All	V4 All	DNUM	NSNUM
0	domaincontrol.com	True	True	False	False	2831306	118
1	worldnic.com	False	True	False	False	258121	105
2	co.uk	True	True	False	False	180370	6178
3	name-services.com	True	True	False	True	153477	7
4	registrar-servers.com	False	True	False	False	144099	184
5	1and1-dns.com	True	True	True	True	140994	9
6	1and1-dns.org	True	True	True	True	140073	9
7	bluehost.com	False	True	False	False	131958	78
8	wixdns.net	False	True	False	True	110342	24
9	cloudflare.com	True	True	False	False	105453	393
10	ovh.net	True	True	False	False	99184	840
11	register.com	True	True	False	False	98207	774
12	1and1.com	True	True	False	False	97133	18
13	1and1-dns.de	True	True	True	True	96183	2
14	hostgator.com	False	True	False	False	93570	5890
15	dreamhost.com	False	True	False	False	91566	6
16	sedoparking.com	False	True	False	True	83935	12
17	1and1-dns.biz	True	True	False	False	73603	9
18	1and1-dns.us	True	True	False	False	68904	2
19	wordpress.com	True	True	False	True	67070	16
20	gandi.net	True	True	False	False	61120	146
21	name.com	True	True	False	True	59780	135
22	cashparking.com	False	True	False	True	59309	2
23	rzone.de	True	True	True	True	55991	40
24	uniregistrymarket.link	False	True	False	True	55705	4

A: Misconfigured Domains

Motivation

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- Reserved IP address spaces

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- Reserved IP address spaces
  (`127.0.0.1`, `192.168.0.0/16`, ...)

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- Domains using reserved IP addresses?

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  (`127.0.0.1`, `192.168.0.0/16`, ...)
- Domains using reserved IP addresses?
  $\Rightarrow$ might indicate misconfiguration

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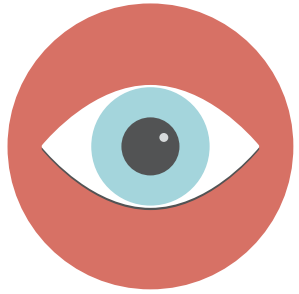
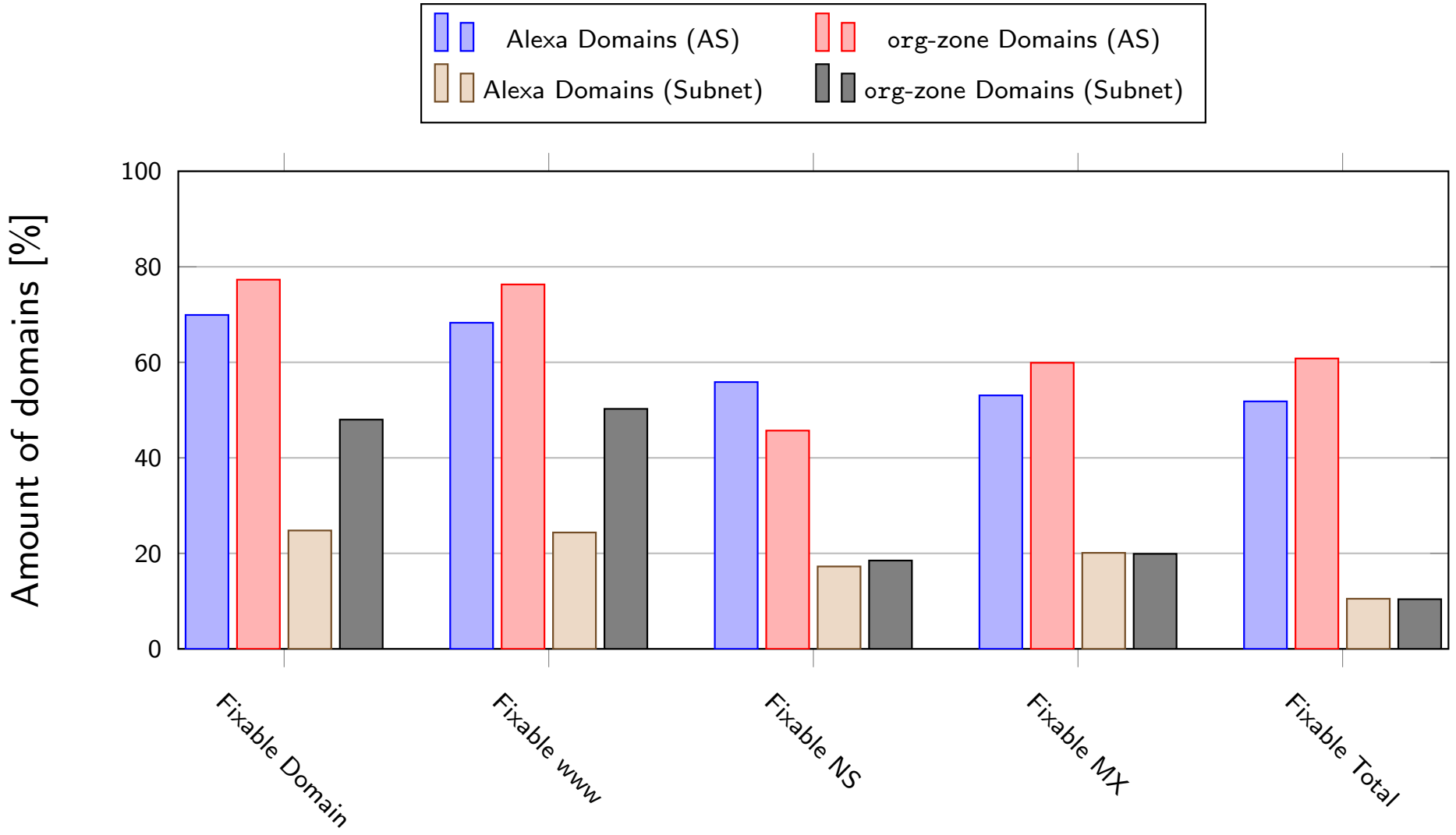
$\Rightarrow$ Misconfiguration does not just "disappear"



A: IPv6-Capability Study (Fixable Domains)



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