

# IPv6 Adoption Woes

David Forrest SLUUG  
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By Vaibhav Bajpai  
Jacobs University, Bremen, Germany



Some website visitors get annoyed and a bad feeling about the companies in general when broken and inoperative links are found on their websites.

I'm one of the some.  
And I don't think I'm unreasonable either.

Full Story is here

<https://ripe72.ripe.net/archives/video/126>

We measure against ALEXA top 100 dual-stacked websites.

1. *simweb*: A tool for measuring web similarity over IPv4 and IPv6.
2. Websites (27%) have some fraction of webpage elements failing over IPv6.
3. Failure rates over IPv6 are largely due to DNS resolution error on images, js and CSS.
4. Both same-origin and cross-origin failures contribute to the failure rates over IPv6.



*To the best of our knowledge, this is the first study to:*

- ▶ Measure webpage similarity over IPv4 and IPv6.
- ▶ Investigate IPv6 adoption that goes beyond the root page of a dual-stacked website.

The paper itself is here:

<http://goo.gl/sAsDcG>

Local Link

ALEXA

<http://www.alex.com/topsites>



# Methodology | Selection of Websites

- ▶ We use the ALEXA top 100 dual-stacked websites as measurement targets [1].



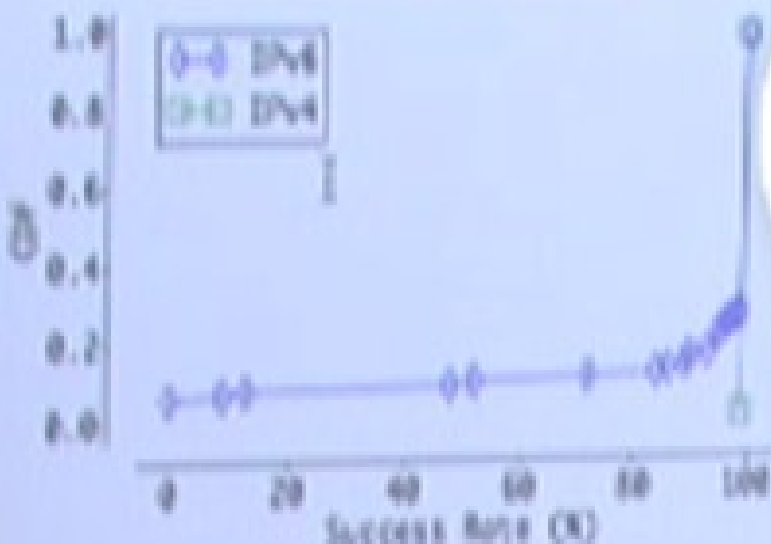
1. [www.google.com](http://www.google.com)
2. [www.facebook.com](http://www.facebook.com)
3. [www.youtube.com](http://www.youtube.com)
4. [www.yahoo.com](http://www.yahoo.com)
5. [www.wikipedia.org](http://www.wikipedia.org)
6. [www.qq.com](http://www.qq.com)
7. [www.blogspot.com](http://www.blogspot.com)
8. ..

# Results | Success Rates

## Can we fetch all webpage elements over IPv6?

- ▶ 27% of websites show some rate of failure over IPv6.
- ▶ 9% exhibit more than 50% failures over IPv6.
- ▶ 6% show complete failure (0% success) over IPv6.

ALBA top 100 Websites



#	Website	Success Rate (%) IPv6	Success Rate (%) IPv4	Valid
81	www.bing.com	0.05	1.0	✓
82	www.dail.com	0.05	1.0	✓
83	www.engage1.com	0.05	1.0	✓
84	www.rtfy.com	0.05	1.0	✓
85	www.eg.com	0.05	1.0	✓
86	www.sikura.ne.jp	0.05	1.0	✓
87	www.flipkart.com	0.05	1.0	✓
88	www.folha.uol.com.br	0.05	1.0	✓
89	www.aol.com	0.05	1.0	✓
90	www.cocacola.net	0.05	1.0	✓
91	www.yahoo.com	0.05	1.0	✓
92	www.marilla.org	0.05	1.0	✓
93	www.orange.fr	0.05	1.0	✓
94	www.sasnet.cz	0.05	1.0	✓
95	www.mobila.de	0.05	1.0	✓
96	www.aktimedia.org	0.05	1.0	✓
97	www.t-online.de	0.05	1.0	✓
98	www.free.fr	0.05	1.0	✓
99	www.aspx.com	0.05	1.0	✓
100	www.vi.com	0.05	1.0	✓
101	www.wikipedia.org	0.05	1.0	✓
102	www.dictionary.org	0.05	1.0	✓
103	www.elmundo.es	0.05	1.0	✓
104	www.uol.com.br	0.05	1.0	✓
105	www.marca.com	0.05	1.0	✓
106	www.terra.com.br	0.05	1.0	✓
107	www.you7.com	0.05	1.0	✓

- Introduction
- Background
- Methodology
- Results
- Conclusion

### Results

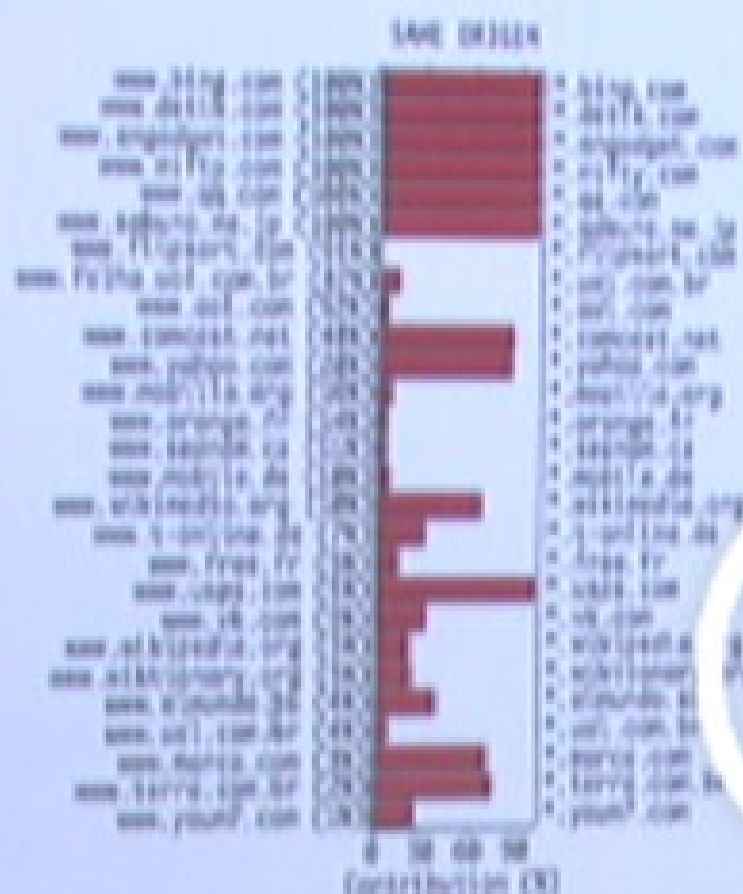
#### Summary





# Results | Causality Analysis

*What is failure contribution of same-origin sources?*

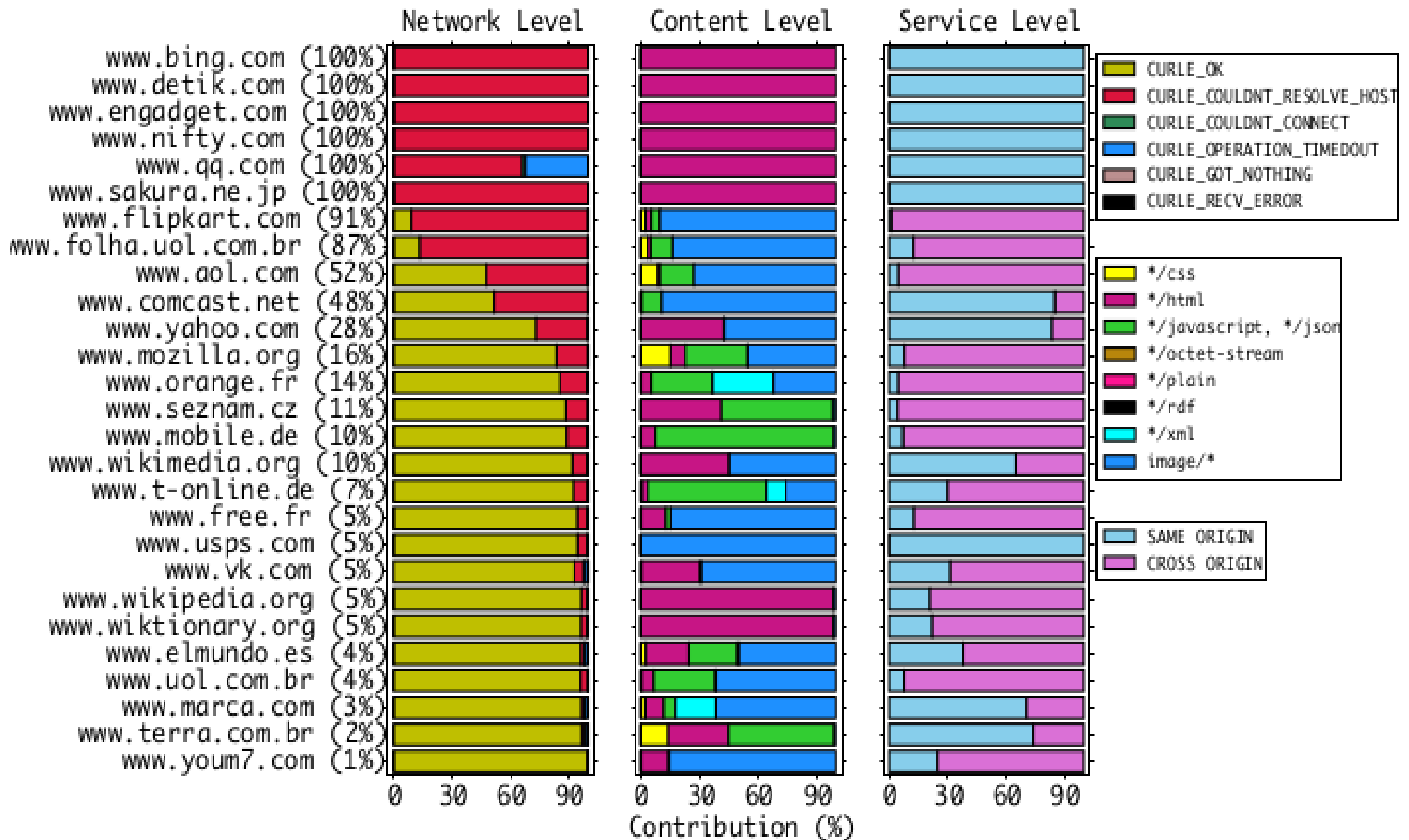


#	Website	Same Origin (%)
01	www.bing.com	100
02	www.dailymotion.com	85
03	www.engadget.com	80
04	www.rift7.com	75
05	www.usps.com	70
06	www.42.com	65
07	www.secure.net.jp	60
08	www.comcast.net	55
09	www.yahoo.com	50
10	www.terra.com.br	45
11	www.norco.com	40
12	www.wikimedia.org	35
13	www.elmundo.es	30
14	www.vt.com	25
15	www.t-online.de	20
16	www.youth.com	15
17	www.arietionary.org	10
18	www.wikipedia.org	5
19	www.free.fr	5
20	www.felha.vcl.com.br	5
21	www.mazila.org	5
22	www.vcl.com.br	5
23	www.moblie.de	5
24	www.eol.com	5
25	www.orange.fr	5
26	www.seznam.cz	5
27	www.flugkart.com	5

- ▶ 12% of websites have more than 50% webpage elements that belong to the same origin source and fall over IPv6.

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## Website failing over IPv6



27% of the 60,000 websites surveyed had some level of failure.

12% of the websites had more than 50% failure rates in referenced IPv6 elements!

**GREAT BIG OOPS!**

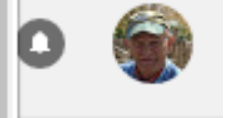


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	<b>mail.google.com</b>	<b>2607:f8b0:4009:801::2005</b>
	19.client-channel.google.com	2607:f8b0:4001:c02::bd
	24.client-channel.google.com	2607:f8b0:4001:c1c::bd
	28.client-channel.google.com	2607:f8b0:4001:c0a::bd
	accounts.google.com	2607:f8b0:4009:80e::200d
	apis.google.com	2607:f8b0:4009:801::200e
	ci3.googleusercontent.com	2607:f8b0:4009:801::2001
	ci4.googleusercontent.com	2607:f8b0:4009:801::2001
	ci5.googleusercontent.com	2607:f8b0:4009:801::2001
	ci6.googleusercontent.com	2607:f8b0:4009:801::2001
	content.googleapis.com	2607:f8b0:4009:80d::200a
	csi.gstatic.com	2a00:1450:400e:800::2003
	d2w7az12ink561.cloudfront.net	54.230.5.66
	drive.google.com	2607:f8b0:4009:801::200e
	fonts.googleapis.com	2607:f8b0:4002:c08::5f
	gm1.ggpht.com	2607:f8b0:4009:801::2001
	googleads.g.doubleclick.net	2607:f8b0:4009:80b::2002
	hangouts.google.com	2607:f8b0:4009:801::200e
	i.ytimg.com	2607:f8b0:4009:801::200e
	lh3.googleusercontent.com	2607:f8b0:4009:801::2001
	lh4.googleusercontent.com	2607:f8b0:4009:80e::2001
	lh6.googleusercontent.com	2607:f8b0:4009:801::2001
	mail-attachment.googleusercontent.com	2607:f8b0:4009:80e::2001
	people-pa.clients6.google.com	2607:f8b0:4009:80b::200a
	play.google.com	2607:f8b0:4000:801::200e
	plus.google.com	2607:f8b0:4009:801::200e
	ssl.gstatic.com	2607:f8b0:4009:801::2003
	www-gm-opensocial.googleusercontent.com	2607:f8b0:4000:80d::2001

er bookmarks



Many of the defects found related to DNS resolution problems. A referenced link from an IPv6-only browser fails its gets if they refer to IPv4 only links.

Google.com shows its traffic is approaching 14% IPv6 origination. Some parts of the world are higher.

# Takeway

- ▶ Metrics that measure IPv6 adoption should account for changes in IPv6-readiness.
- ▶ Limiting to root webpage can lead to overestimation of IPv6 adoption numbers.
- ▶ Unclear whether websites with failure rates can be deemed IPv6-ready.
- ▶ Few cross-origin sources once IPv6 enabled will help large number of websites at once.

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I



**Graduating in 2016. Currently on the job market!**

[v.bajpai@jacobs-university.de](mailto:v.bajpai@jacobs-university.de) | @bajpaivaibhav

Introduction

Research Question

Research Contribution

Methodology

Results and Implications

Selection of Websites

Measurement Setup

Measurement Tool

Results

Takeway

# Hurricane Electric Free DNS Management

Managing zone: 0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa

[New CNAME](#)
[New NS](#)
[New PTR](#)
[New TXT](#)
[Set TTL](#)

Name	Type	TTL	Priority	Data	DDNS	Delete
0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	SOA	86400	0	ns1.he.net. hostmaster.he.net. 2015062600 28800 7200 604800 600		
0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	NS	86400	-	ns1.he.net		
3.5.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	dmz.maplepark.com.		
3.e.c.f.f.5.e.f.f.f.5.6.f.6.e.1.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	pati.maplepark.com.		
4.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	maplepark.com.		
4.6.8.6.4.9.e.f.f.f.4.7.a.9.e.e.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	hp946864.maplepark.com.		
6.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	drflaptop.maplepark.com.		
8.8.1.5.9.1.f.a.6.4.9.7.a.a.d.6.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	chromedrf.maplepark.com.		
9.2.9.9.2.b.3.6.0.0.0.0.0.0.0.0.0.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	-	home.maplepark.com		
9.2.9.9.2.b.3.6.0.0.0.0.0.0.0.0.0.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	maplepark.com.		
a.5.6.6.8.a.0.c.0.0.0.0.0.0.0.0.0.0.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	pati.maplepark.com.		
a.a.a.7.b.3.e.f.f.f.7.4.8.f.2.e.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	drf5n.maplepark.com.		
b.5.1.5.f.2.2.6.f.3.a.d.2.5.d.9.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	Chromecast.maplepark.com.		
d.d.1.7.b.3.e.f.f.f.8.c.0.8.2.0.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	pati.maplepark.com.		
e.0.3.4.b.1.e.f.f.f.9.3.0.0.2.0.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	wind2.maplepark.com.		
e.d.3.f.a.c.b.f.9.b.7.a.1.f.5.0.0.4.6.8.f.0.0.0.8.7.9.4.1.0.0.2.ip6.arpa	PTR	86400	0	wind.maplepark.com.		

[Raw Zone](#)



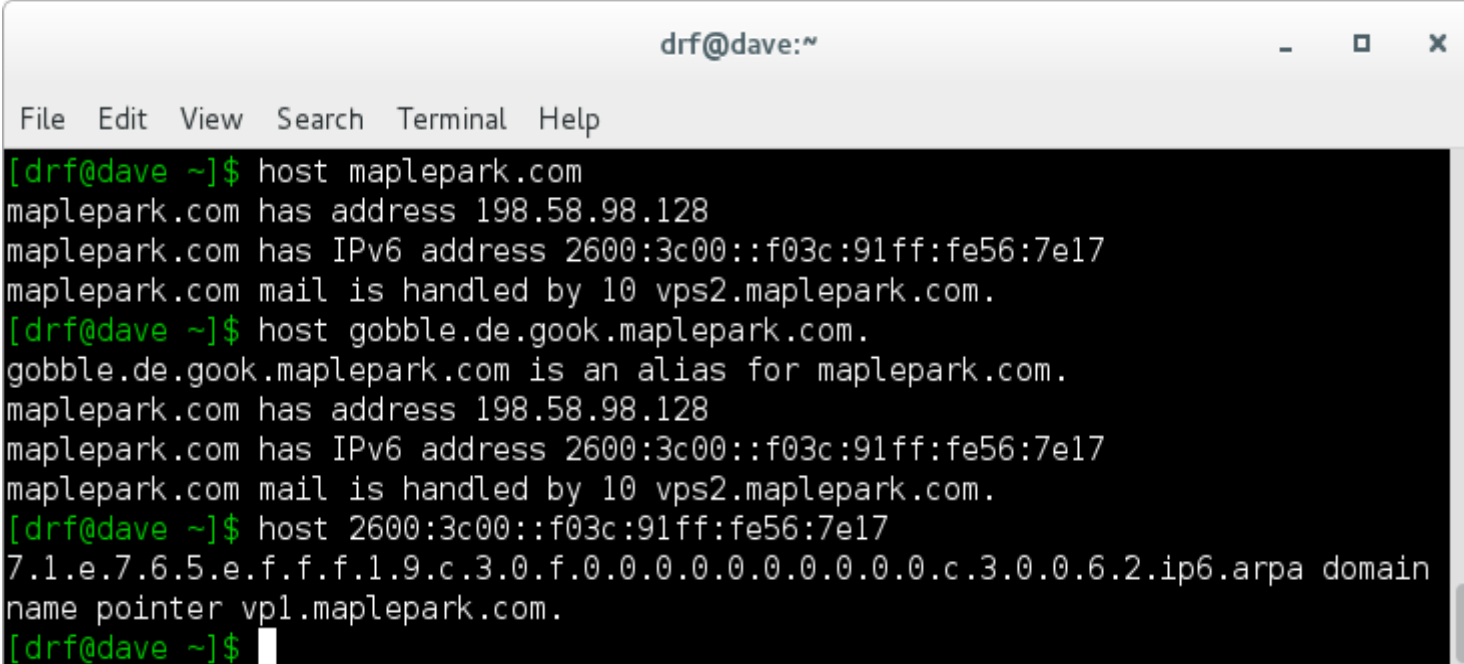
# Hurricane Electric Free DNS Management

Managing zone: maplepark.com

New A		New AAAA		New CNAME		New MX		New NS		New TXT		Additional		Set TTL	
Name	Type	TTL	Priority	Data	DDNS										
maplepark.com	SOA	86400	-	ns1.he.net. hostmaster.he.net. 2016092401 10800 1800 604800 86400											
maplepark.com	NS	7200	-	ns1.he.net											
maplepark.com	NS	7200	-	ns2.he.net											
maplepark.com	NS	7200	-	ns3.he.net											
maplepark.com	NS	7200	-	ns5.he.net											
maplepark.com	NS	7200	-	ns4.he.net											
aton.maplepark.com	A	7200	-	107.170.92.4											
dave.maplepark.com	A	7200	-	99.26.132.228											
maple.maplepark.com	A	7200	-	99.26.132.228											
maplepark.com	A	7200	-	198.58.98.128											
ns1.maplepark.com	A	7200	-	99.26.132.228											
vp.maplepark.com	A	3600	-	209.208.111.202											
vp1.maplepark.com	A	7200	-	198.58.98.128											
vps2.maplepark.com	A	7200	-	107.170.92.4											
www.aton.maplepark.com	A	7200	-	107.170.92.4											
www.maplepark.com	A	7200	-	198.58.98.128											
aton.maplepark.com	AAAA	7200	-	2600:3c00::f03c:91ff:fe56:7e17											
dave.maplepark.com	AAAA	7200	-	2001:4978:f:8640:e23f:49ff:fe7f:ad78											
littleeee.maplepark.com	AAAA	7200	-	2001:4978:f:869e:1e4b:d6ff:fe7f:f251											
maplepark.com	AAAA	7200	-	2600:3c00::f03c:91ff:fe56:7e17											
ns1.maplepark.com	AAAA	7200	-	2001:4978:f:8640::63b2:9929											
pati.maplepark.com	AAAA	7200	-	2001:4978:f:8640:1e6f:65ff:fe5f:fce3											
vp1.maplepark.com	AAAA	7200	-	2600:3c00::f03c:91ff:fe56:7e17											
www.maplepark.com	AAAA	7200	-	2600:3c00::f03c:91ff:fe56:7e17											
maplepark.com	MX	7200	10	vps2.maplepark.com											
maplepark.com	MX	3600	50	ns1.maplepark.com											
maplepark.com	MX	3600	40	vp1.maplepark.com											
dave.maplepark.com	SPF	7200	-	"v=spf1 ip6:2001:4978:f:8640::63b2:9929 ip...											
ns1.maplepark.com	SPF	7200	-	"v=spf1 ip6:2602:306:31a8:4e40::63b2:9929 ...											
ns1.maplepark.com	SPF	7200	-	"v=spf1 ip6:2001:4978:f:8640::63b2:9929 ip...											
vp1.maplepark.com	SPF	7200	-	"v=spf1 ip6:2001:4978:f:8640::63b2:9929 ip...											
vps2.maplepark.com	SPF	7200	-	"v=spf1 ip4:107.170.92.4 ip6:2604:a880:0:1...											
gobble.de.gook.maplepark.com	CNAME	7200	-	maplepark.com											
7.1.e.7.6.5.e.f.f.1.9.c.3.0.f.0.0.0.0.0.0.0.0.0.0.c.3.0.0.6.2.ip6.arpa.maplepark.com	PTR	7200	-	vp1.maplepark.com											
dave.maplepark.com	TXT	7200	-	"v=spf1 ip6:2001:4978:f:8640::63b2:9929 ip...											
ns1.maplepark.com	TXT	7200	-	"v=spf1 ip6:2602:306:31a8:4e40::63b2:9929 ...											
vps2.maplepark.com	TXT	7200	-	"v=spf1 ip4:107.170.92.4 ip6:2604:a880:0:1...											
maplepark.com	LOC	7200	-	38 34 17.880 N 90 25 42.540 W 197.20m 1m 3m 3m											

Some DNS app failures result from the virtual hosting feature of servers. Some sites enable IPv6 for the entry page but neglect to check for AAAA or ip6.arpa records to resolve the internal links.

A big OOPS if the visitor is IPv6 only.



```
drf@dave:~  
File Edit View Search Terminal Help  
[drf@dave ~]$ host maplepark.com  
maplepark.com has address 198.58.98.128  
maplepark.com has IPv6 address 2600:3c00::f03c:91ff:fe56:7e17  
maplepark.com mail is handled by 10 vps2.maplepark.com.  
[drf@dave ~]$ host gobble.de.gook.maplepark.com.  
gobble.de.gook.maplepark.com is an alias for maplepark.com.  
maplepark.com has address 198.58.98.128  
maplepark.com has IPv6 address 2600:3c00::f03c:91ff:fe56:7e17  
maplepark.com mail is handled by 10 vps2.maplepark.com.  
[drf@dave ~]$ host 2600:3c00::f03c:91ff:fe56:7e17  
7.1.e.7.6.5.e.f.f.f.1.9.c.3.0.f.0.0.0.0.0.0.0.0.0.0.c.3.0.0.6.2.ip6.arpa domain  
name pointer vp1.maplepark.com.  
[drf@dave ~]$
```

# Rsyncing

My crontab solution to cross-origin problems:

```
10 * * * * rsync -a --rsh='ssh -p?????' /home/drf/Desktop/IPv6Adoption/IPv6Adoption.*  
/home/drf/Desktop/IPv6Adoption/dualstack-*  
ns1.maplepark.com:/home/drf/public_html/gobbledegook/
```

## This presentation:

<http://gobble.de.gook.maplepark.com/IPv6Adoption.pdf>

<http://gobble.de.gook.maplepark.com/IPv6Adoption.ppt>

<http://gobble.de.gook.maplepark.com/IPv6Adoption.odp>

(The .odp and .ppt have the slide notes that I used tonight)

## TELUS Presentation:

<https://www.youtube.com/watch?v=361IEgkf3TI>

## The tool they used:

<https://github.com/steffiejacob/simweb>

Thanks for hearing me out.

Any questions?

# results for **gobble.de.gook.maplepark.com**

## IPv4

## IPv6

### DNS servers

216.66.1.2  
216.66.80.18  
216.218.130.2  
216.218.131.2  
216.218.132.2

2001:470:200::2  
2001:470:300::2  
2001:470:400::2  
2001:470:500::2

### IPv6-only DNS

Works

### Mail exchangers

107.170.92.4  
198.58.98.128  
99.26.132.228

2600:3c00::f03c:91ff:fe56:7e17  
2001:4978:f:8640::63b2:9929

### **gobble.de.gook.maplepark.com**

198.58.98.128

2600:3c00::f03c:91ff:fe56:7e17

### **www.gobble.de.gook.maplepark.com**

No AAAA records for www.gobble.de.gook.maplepark.com

**gobble.de.gook.maplepark.com is not a domain name (CNAME)**