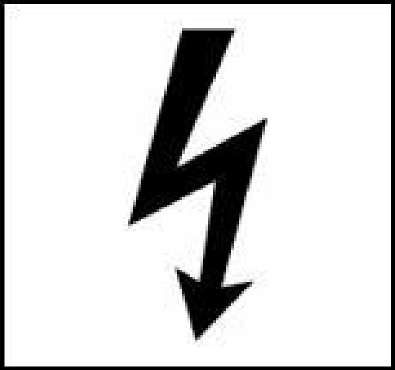
DANGER



DNS Has Been Found To Be Hazardous To Your Health

Use With Caution

Robert Stucke

bobx@rot26.net

Disclaimer: This presentation is based upon personal research that was not supported or authorized by my employer. The material being presented may be considered offensive to those with weak hearts or those highly invested in technology funds.

About Me

Phoenix @ 90K feet!

Agenda

- DNS Bit-Squatting
- Misunderstood end-point DNS behavior
- You don’t own that domain, I do
- Abandoned Botnets and Forgotten Toys

Bit-Squatting

Presented by Artem Dinaburg at Blackhat and Defcon in 2011

- **Project Page**

  http://dinaburg.org/bitsquatting.html

- **Presentation Video**

  http://youtu.be/lZ8s1JwtNas

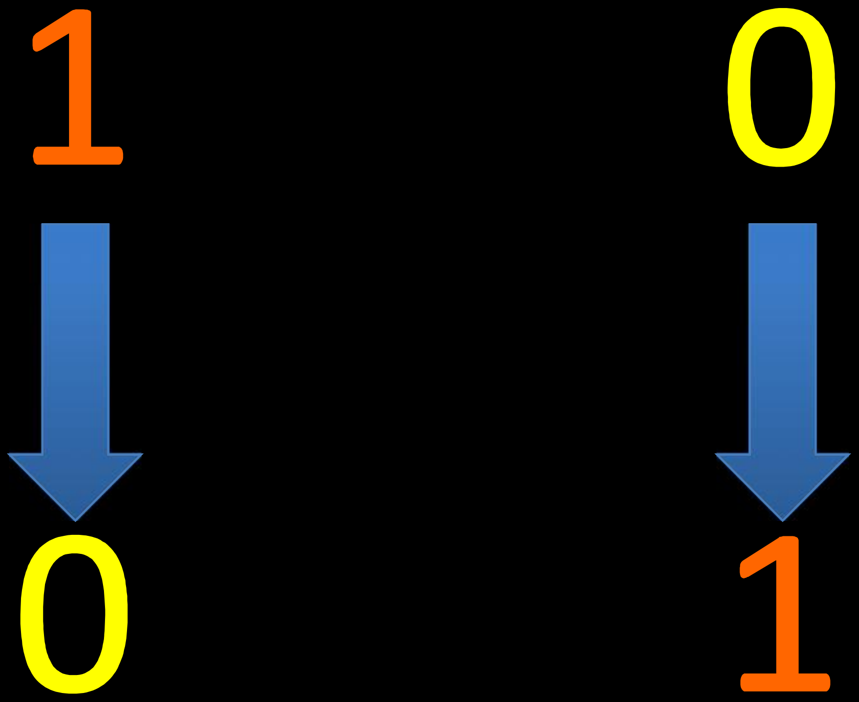
- **Presentation Slides**

  http://dinaburg.org/data/DC19_Dinaburg_Presentation.pdf

Bit-Squatting

- What is it?
- Why does it happen?
- What is the impact?

Bit-Squatting



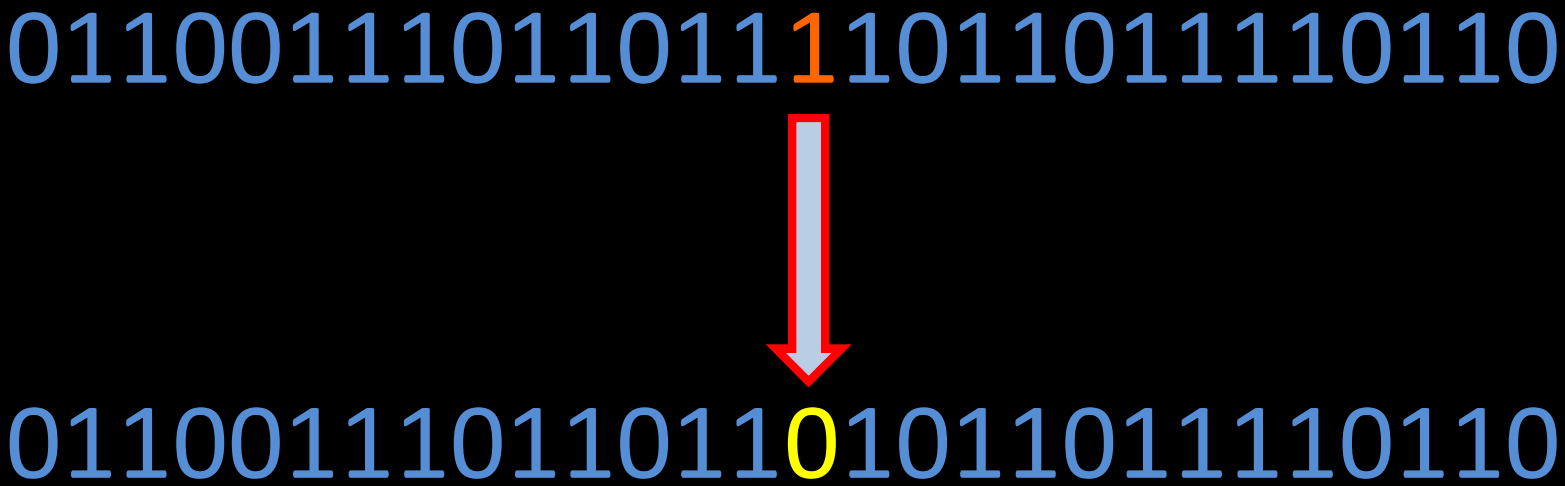
1

0

0

1

Bit-Squatting



0110011101101111011011110110

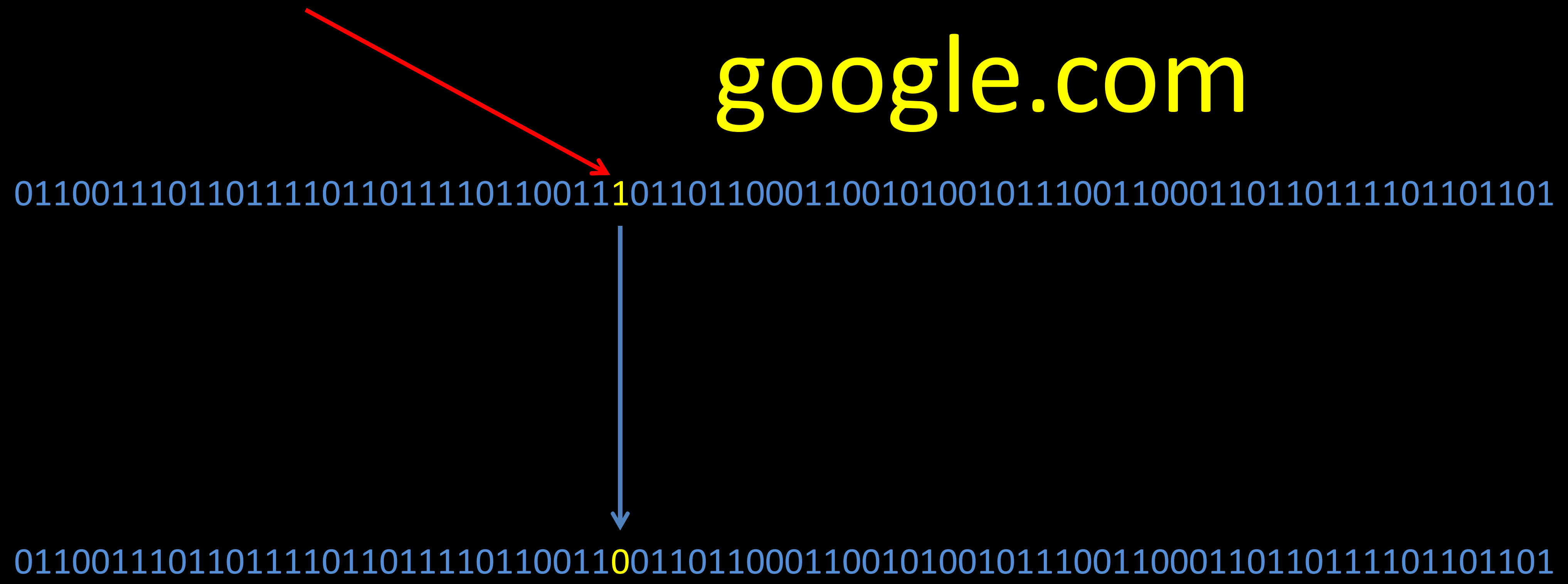
0110011101101101011011110110

Bit-Squatting

What is Bit-Squatting?

- Anticipate the way a single bit error in memory will corrupt the DNS name
- Registering those mangled domains
- Rapture, Mayhem, Yay!

Bit-Squatting



google.com

0110011101101111011011110110011**1**011011000110010100101110011000110110111101101101

0110011101101111011011110110011**0**011011000110010100101110011000110110111101101101

goofle.com

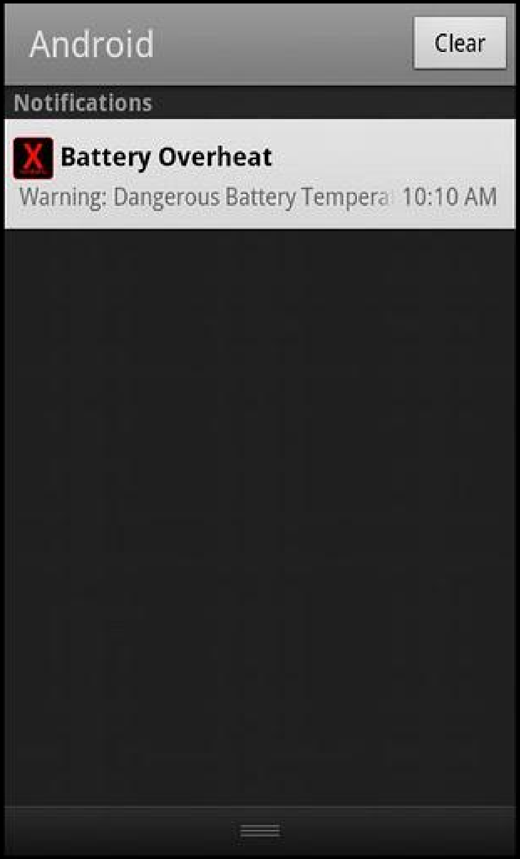
Bit-Squatting

What causes these memory errors?

- Heat
- Electrical Problems
- Radioactive Contamination
- Cosmic Rays!

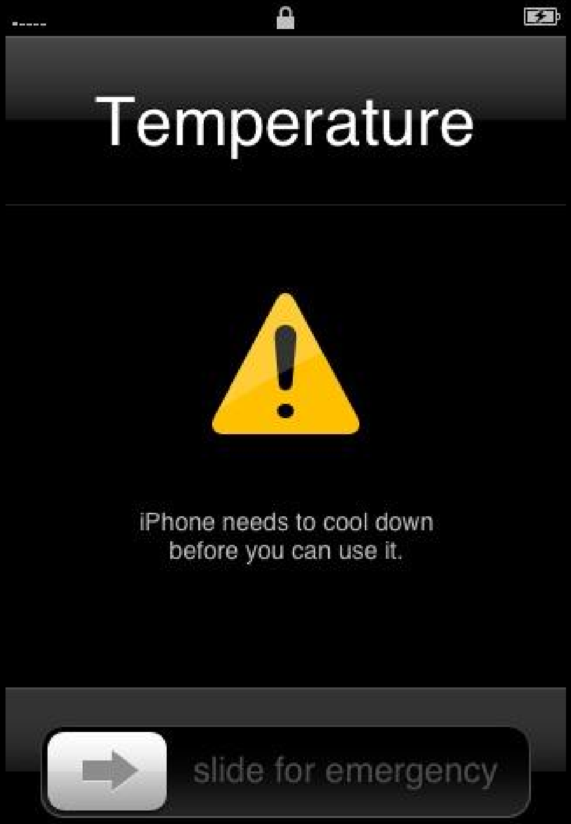
Bit-Squatting

Phones



Battery Overheat

Warning: Dangerous Battery Tempera 10:10 AM


Temperature

iPhone needs to cool down before you can use it.

Bit-Squatting

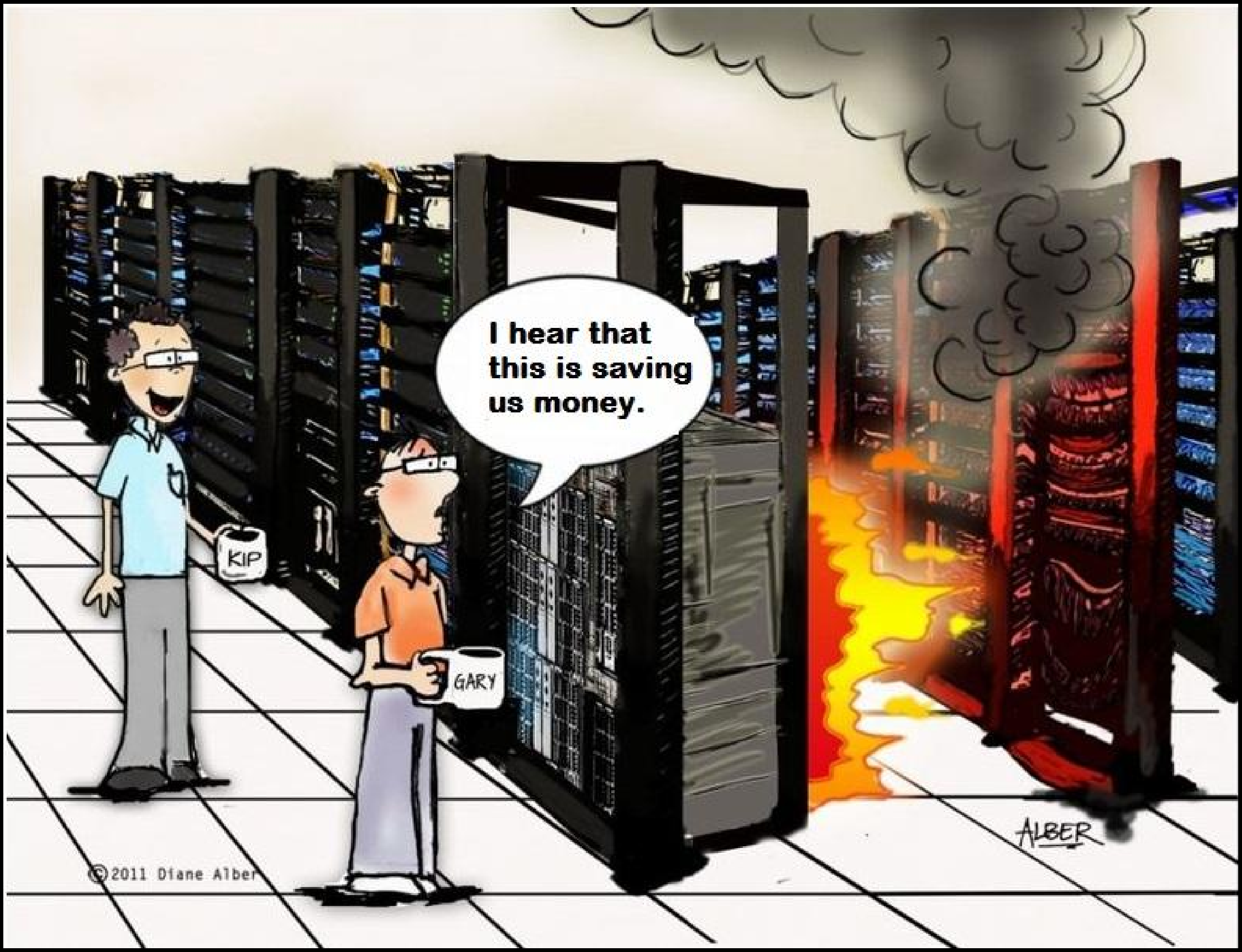
“The guidance we give to data center operators is to raise the thermostat. “

“Many data centers operate at 70 degrees or below. We’d recommend looking at going to 80 degrees”

- Erik Teetzel
Energy Program Manager at Google

The peak operating temperature Google’s Belgium data center reaches is 95 degrees Fahrenheit!

Bit-Squatting



Bit-Squatting

gstatic.com

Google domain for serving static content

CSS

Images

Javascript

XML

Bit-Squatting

gstatic.com

fstatic.com
ostatic.com
gqtatic.com
g3tatic.com
gspatic.com
gstctic.com
gstqtic.com
gstapic.com
gstathc.com
gstatac.com
gstatia.com

estatic.com
wstatic.com
gwtatic.com
gsuatic.com
gsdatic.com
gstetic.com
gstauic.com
gstadic.com
gstatkc.com
gstatyc.com
gstatig.com

cstatic.com
grtatic.com
gctatic.com
gsvatic.com
gs4atic.com
gstitic.com
gstavic.com
gsta4ic.com
gstatmc.com
gstatib.com
gstatik.com

Bit-Squatting

gstatic.com

fstatic.com
ostatic.com
gqtatic.com
g3tatic.com
gspatic.com
gstctic.com
gstqtic.com
gstapic.com
gstathc.com
gstatac.com
gstatia.com

estatic.com
wstatic.com
gwtatic.com
gsuatic.com
gsdatic.com
gstetic.com
gstauic.com
gstadic.com
gstatkc.com
gstatyc.com
gstatig.com

cstatic.com
grtatic.com
gctatic.com
gsvatic.com
gs4atic.com
gstitic.com
gstavic.com
gsta4ic.com
gstatmc.com
gstatib.com
gstatik.com

Bit-Squatting

gstatic.com

fstatic.com
ostatic.com
gqtatic.com
g3tatic.com
gspatic.com
gstctic.com
gstqtic.com
gstapic.com
gstathc.com
gstatac.com
gstatia.com

estatic.com
wstatic.com
gwtatic.com
gsuatic.com
gsdatic.com
gstetic.com
gstauic.com
gstadic.com
gstatkc.com
gstatyc.com
gstatig.com

cstatic.com
grtatic.com
gctatic.com
gsvatic.com
gs4atic.com
gstitic.com
gstavic.com
gsta4ic.com
gstatmc.com
gstatib.com
gstatik.com

Bit-Squatting

```
170.185.129.xx  "t1.gwtatic.com"

GET /images?q=tbn:ANd9GcShHkx1JNpi-DLmfnciij3_3PsiBzk_Oag_ocxD9WPkcgGcZLer

http://www.google.com/search?um=1&hl=en&safe=active&biw=1024&bih=587&tbm=isch
&sa=1&q=trisha+jones&oq=trisha+jones&aq=f&aqi=g1&aql=&gs_sm=e&gs_upl=6506l1117
0l0l11373l14l14l1l0l0l0l327l1716l2-4.2l6l0


Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; Trident/4.0; SLCC2; .NET CLR
2.0.50727; .NET CLR 3.5.30729; .NE
T CLR 3.0.30729; Media Center PC 6.0; InfoPath.2)"
```

Bit-Squatting

170.185.129.xx "**t1.gwtatic.com**"

GET /images?q=tbn:ANd9GcShHkx1JNpi-DLmfnciij3_3PsiBzk_Oag_ocxD9WPkcgGcZLer

http://www.google.com/search?um=1&hl=en&safe=active&biw=1024&bih=587&tbm=isch
&sa=1&q=trisha+jones&oq=trisha+jones&aq=f&aqi=g1&aql=&gs_sm=e&gs_upl=6506l1117
0l0l11373l14l14l1l0l0l0l327l1716l2-4.2l6l0

Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; Trident/4.0; SLCC2; .NET CLR
2.0.50727; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0; InfoPath.2)"

Bit-Squatting

170.185.129.xx "**t1.gwtatic.com**"

GET /images?q=tbn:ANd9GcShHkx1JNpi-DLmfnciij3_3PsiBzk_Oag_ocxD9WPkcgGcZLer

http://www.google.com/search?um=1&hl=en&safe=active&biw=1024&bih=587&tbm=isch
&sa=1&q=trisha+jones&oq=trisha+jones&aq=f&aqi=g1&aql=&gs_sm=e&gs_upl=6506l1117
0l0l11373l14l14l1l0l0l0l327l1716l2-4.2l6l0

Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; Trident/4.0; SLCC2; .NET CLR 2.0.50727; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0; InfoPath.2)"

Bit-Squatting

170.185.129.xx "**t1.gwtatic.com**"

GET /images?q=tbn:ANd9GcShHkx1JNpi-DLmfnciij3_3PsiBzk_Oag_ocxD9WPkcgGcZLer

http://www.google.com/search?um=1&hl=en&safe=active&biw=1024&bih=587&tbm=isch&sa=1&q=trisha+jones&oq=trisha+jones&aq=f&aqi=g1&aql=&gs_sm=e&gs_upl=6506l11170l0l11373l14l14l1l0l0l0l327l1716l2-4.2l6l0

Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; Trident/4.0; SLCC2; .NET CLR 2.0.50727; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0; InfoPath.2)"

Bit-Squatting

170.185.129.xx "**t1.gwtatic.com**"

GET /images?q=tbn:ANd9GcShHkx1JNpi-DLmfnciij3_3PsiBzk_Oag_ocxD9WPkcgGcZLer

http://www.google.com/search?um=1&hl=en&safe
=active&biw=1024&bih=587&tbm=isch
&sa=1&q=trisha+jones&oq=trisha+jones&aq=f&aqi
=g1&aql=&gs_sm=e&gs_upl=6506l11170l0l11373l
14l14l1l0l0l0l327l1716l2-4.2l6l0

Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; Trident/4.0; SLCC2; .NET CLR 2.0.50727; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0; InfoPath.2)"

Bit-Squatting

170.185.129.xx "**t1.gwtatic.com**"

GET /images?q=tbn:ANd9GcShHkx1JNpi-DLmfnciij3_3PsiBzk_Oag_ocxD9WPkcgGcZLer

http://www.google.com/search?um=1&hl=en&safe=active&biw=1024&bih=587&tbm=isch
&sa=1&q=trisha+jones&oq=trisha+jones&aq=f&aqi=g1&aql=&gs_sm=e&gs_upl=6506l1117
0l0l11373l14l14l1l0l0l0l327l1716l2-4.2l6l0

Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; Trident/4.0; SLCC2; .NET CLR 2.0.50727; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0; InfoPath.2)"

Bit-Squatting

```
170.185.129.xx  "t1.gwtatic.com"

GET /images?q=tbn:ANd9GcShHkx1JNpi-DLmfnciij3_3PsiBzk_Oag_ocxD9WPkcgGcZLer

http://www.google.com/search?um=1&hl=en&safe=active&biw=1024&bih=587&tbm=isch
&sa=1&q=trisha+jones&oq=trisha+jones&aq=f&aqi=g1&aql=&gs_sm=e&gs_
upl=6506l11170l0l11373l14l14l1l0l0l0l327l1716l2-4.2l6l0


Mozilla/4.0 (compatible; MSIE 8.0; Windows NT 6.1; Trident/4.0; SLCC2; .NET CLR
2.0.50727; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media Center PC 6.0; InfoPath.2)"
```

Bit-Squatting

200.142.133.xx "t3.gstatmc.com“

GET /images?q=tbn:ANd9GcTpBH9vsMVT7yp6aC0-
wVunxW1aIK7ICDDFjB2pMY2PKIeEOdmfNF2LpRE

"http://www.google.com.br/m/search?site=images&q=selena+gomez+photoshop
&start=14&sa=N“

Bit-Squatting

200.142.133.xx "t3.gstatmc.com“

```
GET /images?q=tbn:ANd9GcTpBH9vsMVT7yp6aC0-
wVunxW1aIK7ICDDFjB2pMY2PKIeEOdmfNF2LpRE

"http://www.google.com.br/m/search?site=images&q=selena+gomez+photoshop
&start=14&sa=N“
```

Bit-Squatting

200.142.133.xx "t3.gstatmc.com“

GET /images?q=tbn:ANd9GcTpBH9vsMVT7yp6aC0-wVunxW1alK7ICDDFjB2pMY2PKIeEOdmfNF2LpRE

"http://www.google.com.br/m/search?site=images&q=selena+gomez+photoshop&start=14&sa=N“

Bit-Squatting

200.142.133.xx "t3.gstatmc.com“

GET /images?q=tbn:ANd9GcTpBH9vsMVT7yp6aC0-
wVunxW1aIK7ICDDFjB2pMY2PKIeEOdmfNF2LpRE

"http://www.google.com.br/m/
search?site=images&q=selena+gomez+photoshop&start=14&sa=N“

Bit-Squatting

What I want to be when I grow up

emma watson
crunch
mediatakeout
mobil new eyes
wendy williams
Workspace login
Mulher melancia
wordplay

craigslist
facebook
christmas coloring pages
ombre red hair
simbolos de musica
cnn
ufc symbol
emos de 14

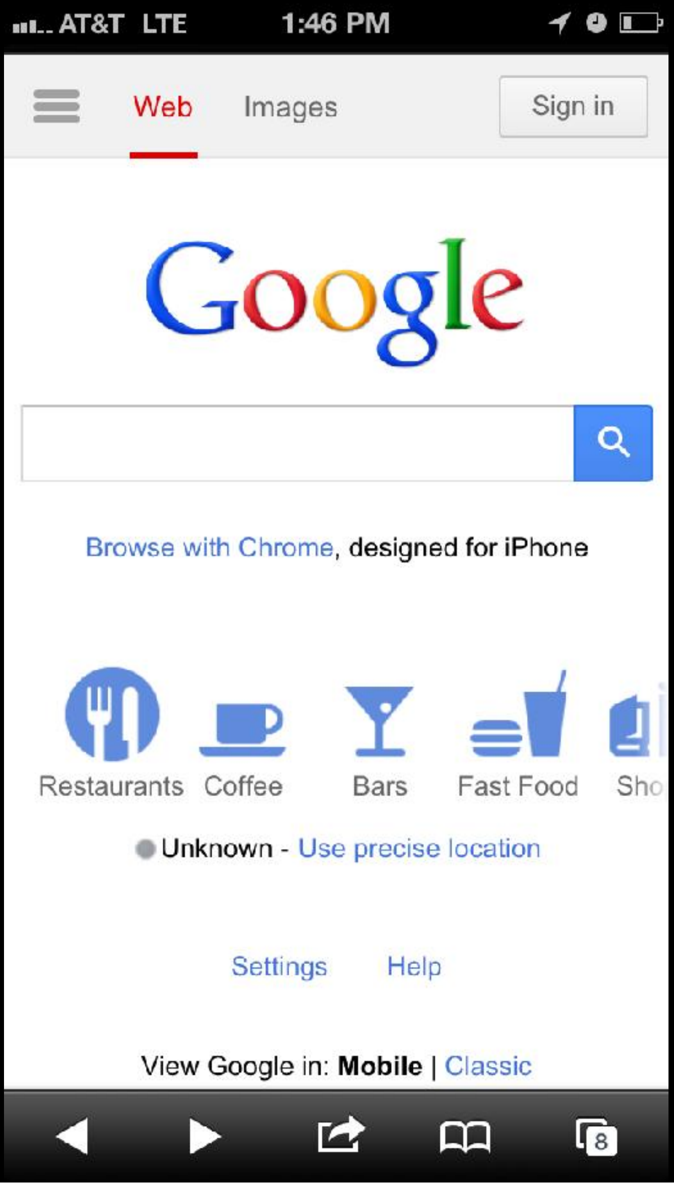
Bit-Squatting

But isn’t this just random noise?

Bit-Squatting

```
91.217.185.104  "www.g3tatic.com" GET /m/images/logo_small.gif
"Nokia5130c-2/2.0 (07.91) Profile/MIDP-2.1 Configuration/CLDC-1.1“

125.235.49.56   "www.g3tatic.com" GET /m/images/logo_small.gif
"GIONEE-D6/SW1.0.0/WAP2.0“

196.201.208.32  "www.g3tatic.com" GET /m/images/logo_small.gif
"Alcatel-OT-305/1.0 ObigoInternetBrowser/Q03C“

125.235.49.55   "www.g3tatic.com" GET /m/images/logo_small.gif
"LG-GB270 Obigo/WAP2.0 MIDP-2.0/CLDC-1.1“

200.89.84.90    "www.g3tatic.com" GET /m/images/logo_small.gif
"ZTE-G_R221/WAP2.0"
```

Bit-Squatting



AT&T LTE 1:46 PM

Web Images Sign in

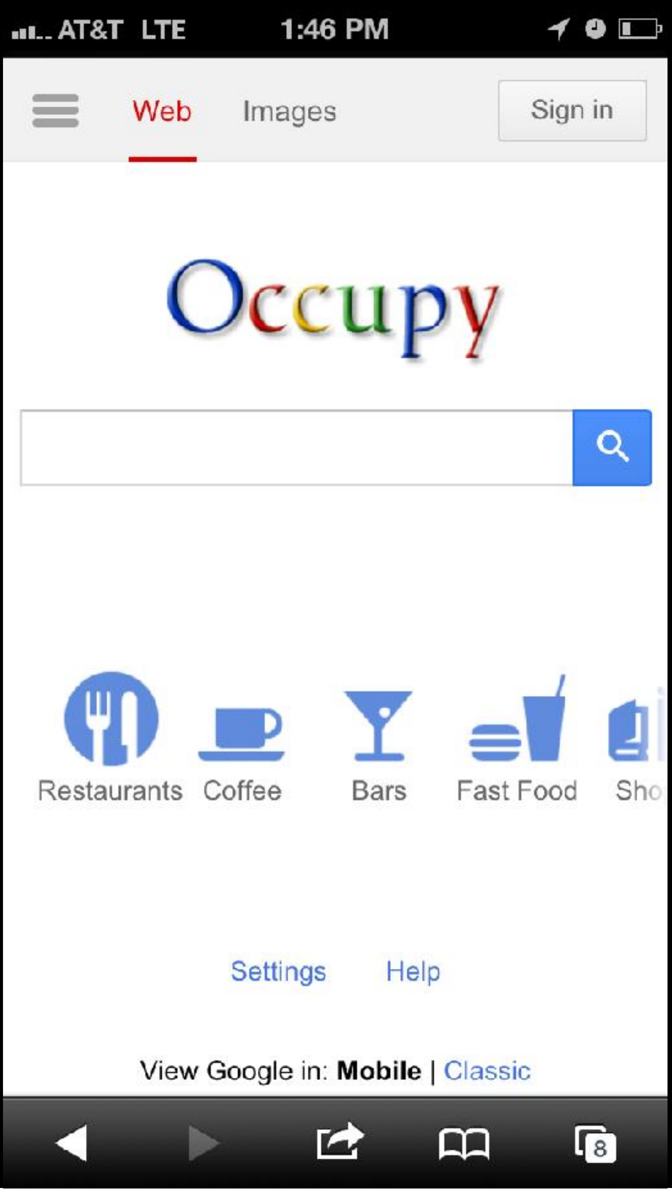
Browse with Chrome, designed for iPhone

Unknown - Use precise location

Settings Help

View Google in: **Mobile** | Classic

Bit-Squatting



AT&T LTE 1:46 PM

Web Images Sign in

Occupy

Restaurants Coffee Bars Fast Food Sho

Settings Help

View Google in: **Mobile** | Classic

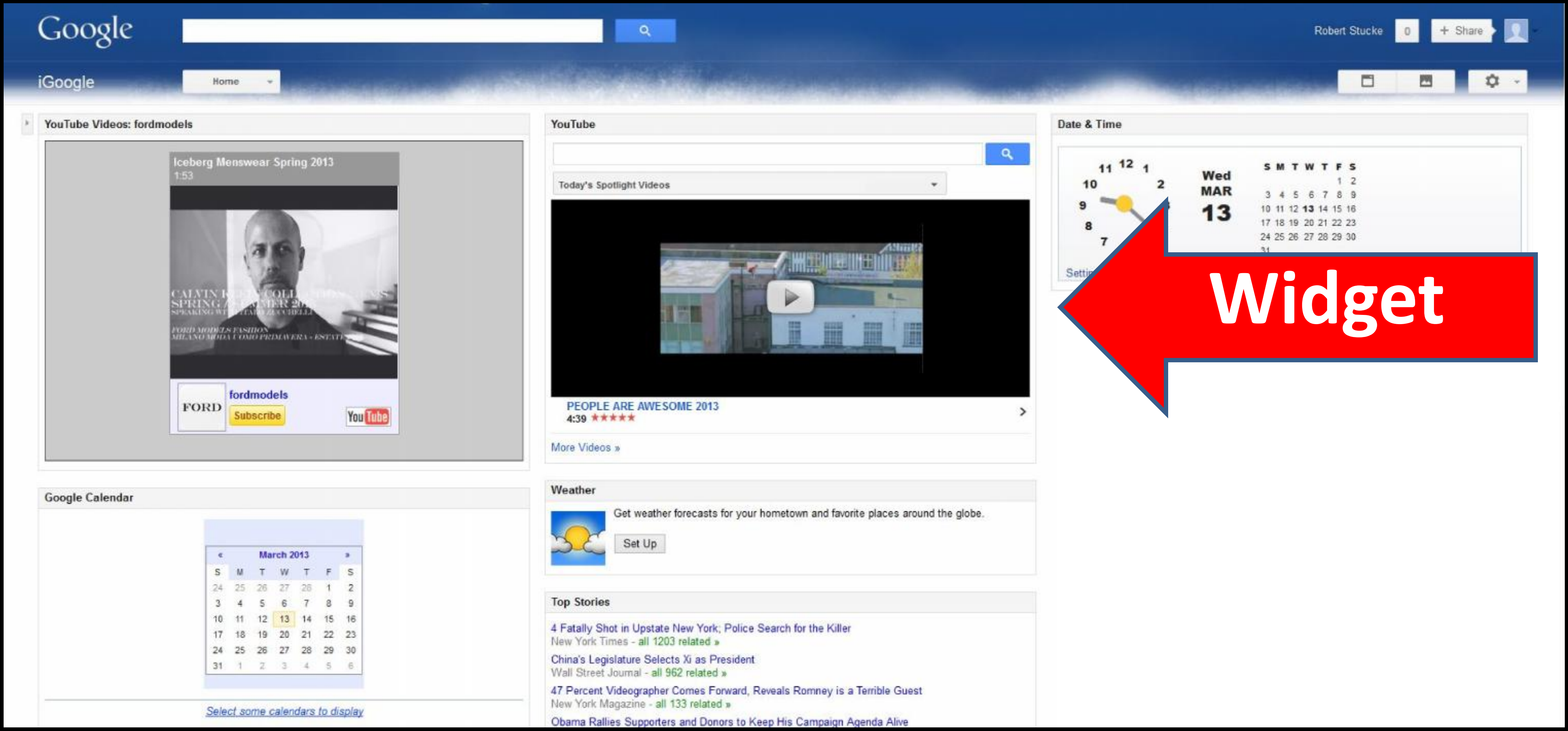
Bit-Squatting

What else is that heat doing to Google servers?

Bit-Squatting

```
209.85.226.83 "www.gwtatic.com"
/igomodules/youtube/v3/youtufe.xml "Feedfetcher-Google”

209.85.224.96 "www.gstqtic.com"
/ig/modules/youtube/v3/youtube.xml "Feedfetcher-Google”

209.85.226.89 "www.gstctic.com"
/ig/modules/tabnews/kennedy/tabnews.xml "Feedfetcher-
Google”

209.85.228.82 "www.gstatmc.com"
/ig/modules/wikipedia/kennedy/wikipedia.xml "Feedfetcher-
```

Bit-Squatting



YouTube Videos: fordmodels

Iceberg Menswear Spring 2013
1:53

fordmodels

YouTube

PEOPLE ARE AWESOME 2013
4:39 ★★★★★

More Videos »

Date & Time

Wed
MAR
13

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	**13**	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Widget

Google Calendar

« March 2013 »

S	M	T	W	T	F	S
24	25	26	27	28	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

Select some calendars to display

Weather

Get weather forecasts for your hometown and favorite places around the globe.

Top Stories

4 Fatally Shot in Upstate New York; Police Search for the Killer
New York Times - all 1203 related »

China's Legislature Selects Xi as President
Wall Street Journal - all 962 related »

47 Percent Videographer Comes Forward, Reveals Romney is a Terrible Guest
New York Magazine - all 133 related »

Obama Rallies Supporters and Donors to Keep His Campaign Agenda Alive

Bit-Squatting

```
<?xml version="1.0" encoding="UTF-8" ?>
<Module>
    <ModulePrefs
       title="__MSG_title__"
       directory_title="__MSG_title__"
       title_url="//maps.google.com/maps?q=__UP_location__"
      description="__MSG_description__"
      author="Mark L."
      author_affiliation="Google"
      author_location="Santa Barbara, CA"
      default_value="false"/>

…
```

`<![CDATA[` ***The goods are in here!***

Bit-Squatting

```
background-image:url(‘

http://www.grtatic.com/ig/modules/gadgetfacto
ry/v2/search-white.cache.png

‘)
```

Bit-Squatting

```
62.30.127.40  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
62.30.90.211  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
62.31.197.88  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
77.101.112.66  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
77.101.54.41  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
77.103.212.102  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
77.96.107.165  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
77.96.68.59  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
77.96.94.150  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
77.98.65.88  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
80.195.240.134  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
80.195.240.140  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
80.195.240.66  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
80.195.28.42  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
82.38.119.43  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
82.41.181.77  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
82.41.183.91  "www.grtatic.com" "GET /ig/modules/gadgetfactory/v2/search-white.cache.png"
```

Bit-Squatting

GB,	62.30.127.40,	Virgin Media
GB,	62.30.90.211,	Virgin Media
GB,	62.31.197.88,	Virgin Media
GB,	77.101.112.66,	Virgin Media
GB,	77.101.54.41,	Virgin Media
GB,	77.103.212.102,	Virgin Media
GB,	77.96.107.165,	Virgin Media
GB,	77.96.68.59,	Virgin Media
GB,	77.96.94.150,	Virgin Media
GB,	77.98.65.88,	Virgin Media
GB,	80.195.240.134,	Virgin Media
GB,	80.195.240.140,	Virgin Media
GB,	80.195.240.66,	Virgin Media
GB,	80.195.28.42,	Virgin Media
GB,	82.38.119.43,	Virgin Media
GB,	82.41.181.77,	Virgin Media
GB,	82.41.183.91,	Virgin Media
GB,	82.46.238.196,	Virgin Media

Bit-Squatting

Fun with Postini

```
$ dig mozilla.org. mx +short
400 mozilla.com.s5b2.psmtp.com.
100 mozilla.com.s5a1.psmtp.com.
200 mozilla.com.s5a2.psmtp.com.
300 mozilla.com.s5b1.psmtp.com.
```

Bit-Squatting

about.com.mail11.prmtp.com
acterna.com.s7b2.prmtp.com
aeecorp.com.s5a1.prmtp.com
aggintl.com.s9a2.prmtp.com
ahrcnyc.org.s8a2.prmtp.com
aireco.com.mail6.prmtp.com
airties.com.s0b2.prmtp.com
alaska.com.mail5.prmtp.com
alston.com.mail5.prmtp.com
amg-inc.com.s7a2.prmtp.com
ams-pmt.com.s5a1.prmtp.com
archenv.com.s7a1.prmtp.com
ashbyco.com.s7b1.prmtp.com
ashland.com.s5a1.prmtp.com
asurion.com.s9a1.prmtp.com
atcomhq.com.s8b2.prmtp.com
auracom.com.s6a1.prmtp.com
autogas.com.s7a1.prmtp.com
bardadv.com.s5a2.prmtp.com
baseinc.com.s8b2.prmtp.com
b-bachs.com.s5a1.prmtp.com
bbinswa.com.s6a1.prmtp.com
bbrslaw.com.s8b1.prmtp.com
bbt.co.uk.s200a2.prmtp.com
bc.pitt.edu.s7b1.prmtp.com
bda-inc.com.s7a1.prmtp.com
braden.com.s10b2.prmtp.com
bridge.nl.s200a1.prmtp.com
brofort.com.s8b2.prmtp.com
brunico.com.s9a1.prmtp.com
bryant.edu.s10a2.prmtp.com
bslogin.com.s9a1.prmtp.com
bwnoise.com.s7b2.prmtp.com
cableone.net.mail6.prmtp.com
calarts.edu.s9a1.prmtp.com
capital.net.s6b2.prmtp.com
cch-lis.com.s5a1.prmtp.com
charity.org.s5a2.prmtp.com
chouest.com.s5a1.prmtp.com
cinmach.com.s8b2.prmtp.com
conxxus.com.s6b2.prmtp.com
cvcvbc.aw46z.prmtp.com
cwl-inc.com.s5b2.prmtp.com
dbigolf.com.s6b2.prmtp.com

Bit-Squatting

dcsdk12.org.s9a2.prmtp.com
dcshoes.com.s5b2.prmtp.com
deloitte.dk.s7b1.prmtp.com
denvest.com.s9a1.prmtp.com
desales.edu.s8a2.prmtp.com
detnews.com.s7a1.prmtp.com
digitel.net.s7a1.prmtp.com
dlvbbdo.com.s7b1.prmtp.com
dnata.com.s201b2.prmtp.com
duralee.com.s7a2.prmtp.com
dvicomm.com.s9b2.prmtp.com
Ecomdss.com.s8b1.prmtp.com
ecsdnv.net.s10b1.prmtp.com
educate.com.s5a1.prmtp.com
ee.pitt.edu.s7b1.prmtp.com
eknikl.ldoy2.prmtp.com
e-m.co.uk.s200a1.prmtp.com
emerson.com.s7a2.prmtp.com
eritter.net.s6b2.prmtp.com
esedona.net.s6a1.prmtp.com
fordham.edu.s8a2.prmtp.com
futurestep.com.s8b2.prmtp.com
galileo.com.s8a1.prmtp.com
gannett.com.s7a1.prmtp.com
gdjpud.vsnad.prmtp.com
genpact.com.s8a1.prmtp.com
glcomp.com.mail6.prmtp.com
hal-pc.org.mail1.prmtp.com
herguth.com.s7a1.prmtp.com
hklaw.com.mail12.prmtp.com
hocking.net.s5b2.prmtp.com
hpdsoftware.com.s200b2.prmtp.com
ici-llc.com.s5b2.prmtp.com
infoave.net.s5a2.prmtp.com
infonxx.com.s8b1.prmtp.com
infopia.com.s7a1.prmtp.com
innovex.com.s8a1.prmtp.com
itronix.com.s8b2.prmtp.com
jaxbank.com.s5a1.prmtp.com
jcurran.com.s7b1.prmtp.com
jennmar.com.s9a2.prmtp.com
jet-web.com.s9a2.prmtp.com
jfshea.com.s10a2.prmtp.com
juniper.net.s7a1.prmtp.com
kdlegal.com.s8a1.prmtp.com
koenigs.com.s5a1.prmtp.com
kpmg.com.hk.s8a1.prmtp.com

Bit-Squatting

lakemac.net.s6a2.prmtp.com
laser27.com.s8b2.prmtp.com
lchcnet.org.s8a1.prmtp.com
lesspub.com.s9a1.prmtp.com
lexmark.com.s8b1.prmtp.com
lfstaff.com.s8a2.prmtp.com
liebert.com.s7a1.prmtp.com
lifeway.com.s5a1.prmtp.com
limitlessny.s8a1.prmtp.com
limitlessny.s8a2.prmtp.com
lindal.com.s10a1.prmtp.com
maciejn.com.s7a1.prmtp.com
mag-ias.com.s8a1.prmtp.com
markany.com.s7a1.prmtp.com
mendes.com.mail5.prmtp.com
minpack.com.s5b2.prmtp.com
mozilla.com.s5a1.prmtp.com
mpitime.com.s7b2.prmtp.com
mq.edu.au.s200a1.prmtp.com
mudlake.net.s8b1.prmtp.com
muskoka.com.s5a1.prmtp.com
myexcel.com.s6a1.prmtp.com
netptc.net.mail8.prmtp.com
netsync.net.s9a1.prmtp.com
newport.com.s8a2.prmtp.com
nominum.com.s7a2.prmtp.com
nqlc.com.au.s9a1.prmtp.com
opm-llc.com.s8a1.prmtp.com
orkla.com.s200a2.prmtp.com
pacific.net.s5a1.prmtp.com
pacrelo.com.s8b2.prmtp.com
pccpllc.com.s9a1.prmtp.com
perlick.com.s8a1.prmtp.com
pickpro.com.s7a1.prmtp.com
pogolaw.com.s8a1.prmtp.com
postini.com.s8a1.prmtp.com
prupref.com.s9a1.prmtp.com
qed-inc.com.s9a1.prmtp.com
re4u.net.s8a2.prmtp.com
regions.com.s6a1.prmtp.com
remax-lx.ca.s7a1.prmtp.com
rivkin.com.mail5.prmtp.com
rodale.com.mail5.prmtp.com
rosetti.com.s6b1.prmtp.com
route24.net.s9b2.prmtp.com

Bit-Squatting

rubloff.com.s9b1.prmtp.com
seabox.com.s10b2.prmtp.com
silanis.com.s5a1.prmtp.com
smkdlaw.com.s6b1.prmtp.com
sscotti.org.s7b2.prmtp.com
stevens.edu.s9a2.prmtp.com
stryker.com.s8a1.prmtp.com
swassoc.com.s8a2.prmtp.com
tctwest.net.s5a1.prmtp.com
undss.org.s201b2.prmtp.com
vss.fsi.com.s5a1.prmtp.com
yaskawa.com.s5a1.prmtp.com

sage.com.au.s7b1.prmtp.com
shawinc.com.s6b1.prmtp.com
seattle.gov.s8b1.prmtp.com
smythnora.com.s8a2.prmtp.com
state.pa.us.s7a1.prmtp.com
stibo.com.s200a1.prmtp.com
studeo.com.s10a1.prmtp.com
swisher.com.s8b2.prmtp.com
thomson.net.s7a2.prmtp.com
unomaha.edu.s5a2.prmtp.com
wctatel.net.s6a1.prmtp.com
zachry.com.s10b1.prmtp.com

sbolive.com.s5a1.prmtp.com
sig-ins.com.s7a2.prmtp.com
smlperu.com.s6b2.prmtp.com
solusii.com.s7a1.prmtp.com
stena.com.s200b2.prmtp.com
stroock.com.s6a2.prmtp.com
surfari.net.s8b1.prmtp.com
talent2.com.s9a1.prmtp.com
udayton.edu.s9b2.prmtp.com
uwc.ac.za.s200a1.prmtp.com
weshred.net.s8b1.prmtp.com

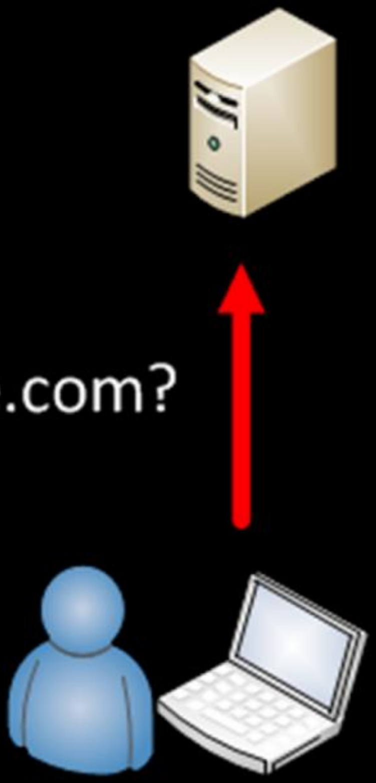
Bit-Squatting

Explore how this kind of thing could affect you.

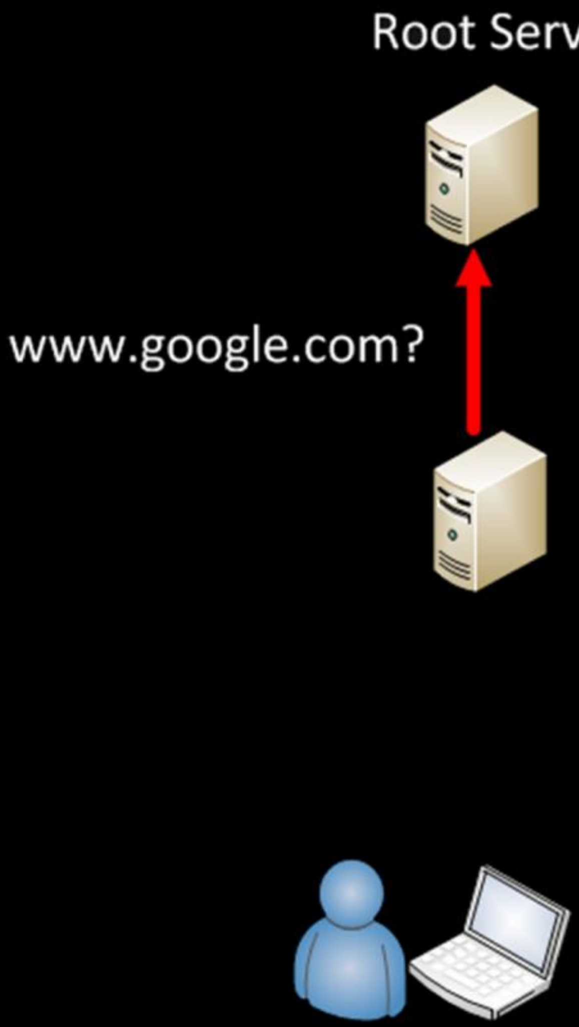
Misunderstood End-Point Behavior

- Expected resolver behavior
- DNS suffix search paths
- Poorly documented behavior
- Observations and lessons learned

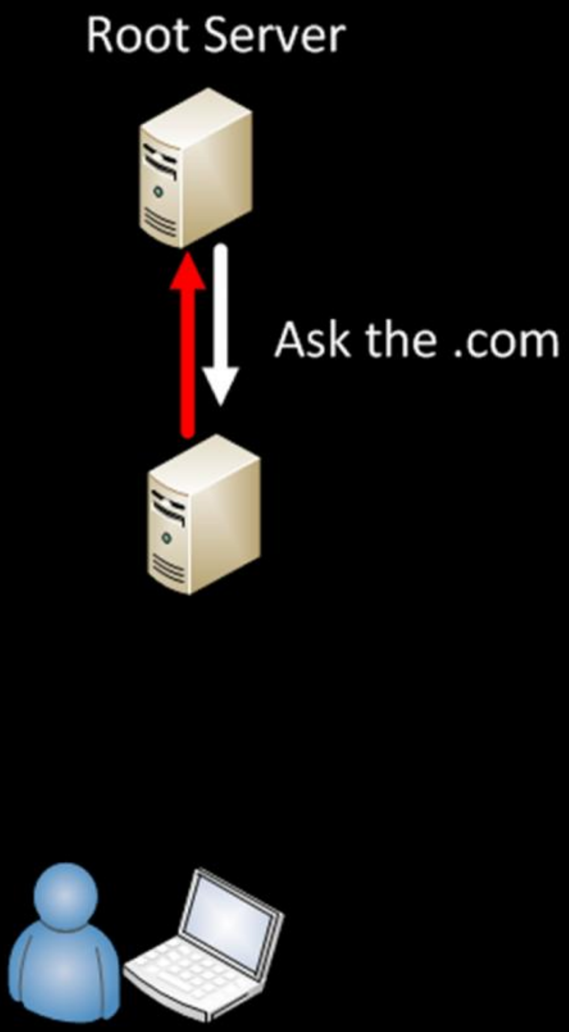
Misunderstood End-Point Behavior



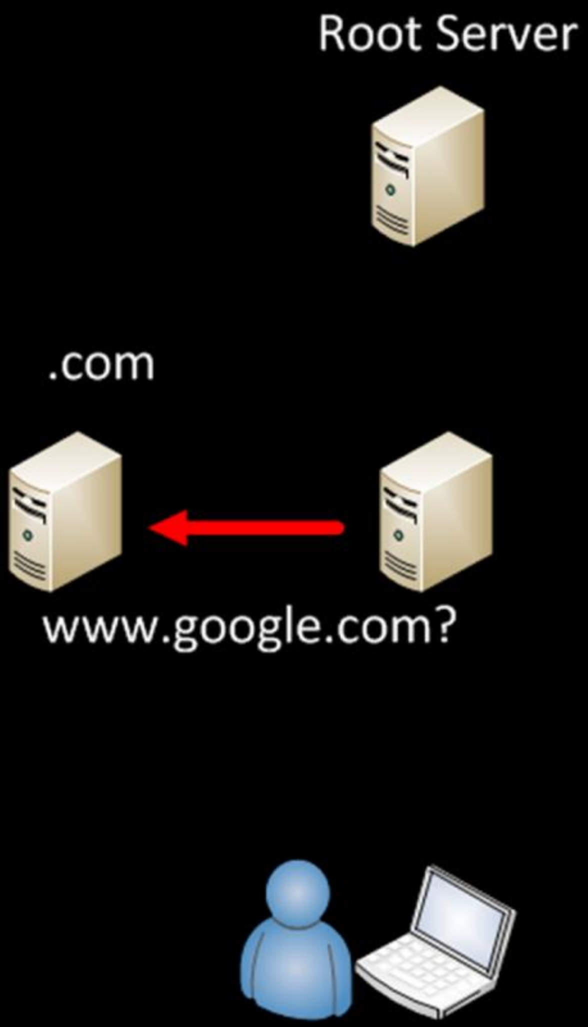
Misunderstood End-Point Behavior



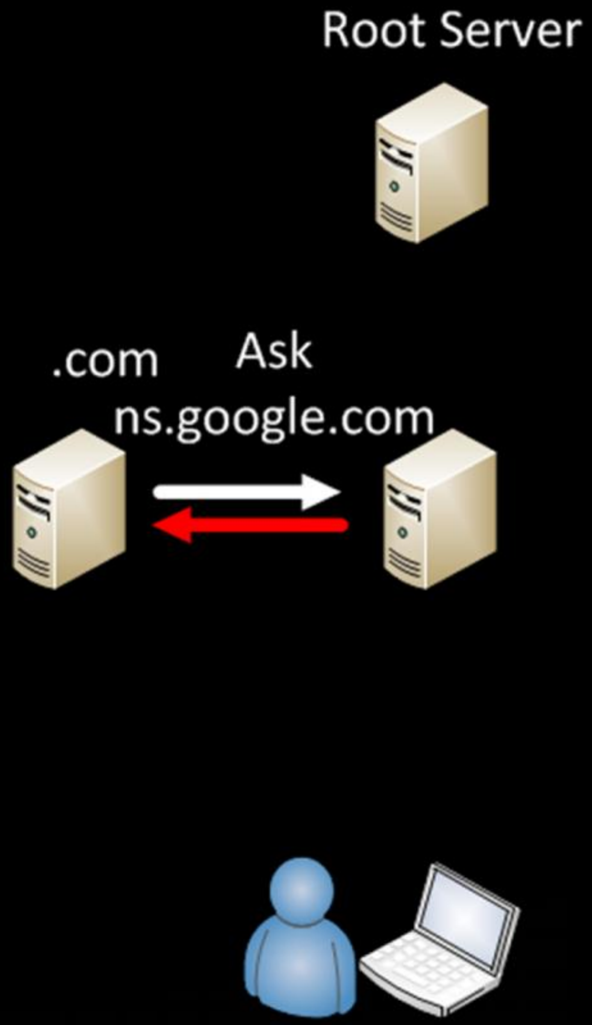
Misunderstood End-Point Behavior



Misunderstood End-Point Behavior



Misunderstood End-Point Behavior



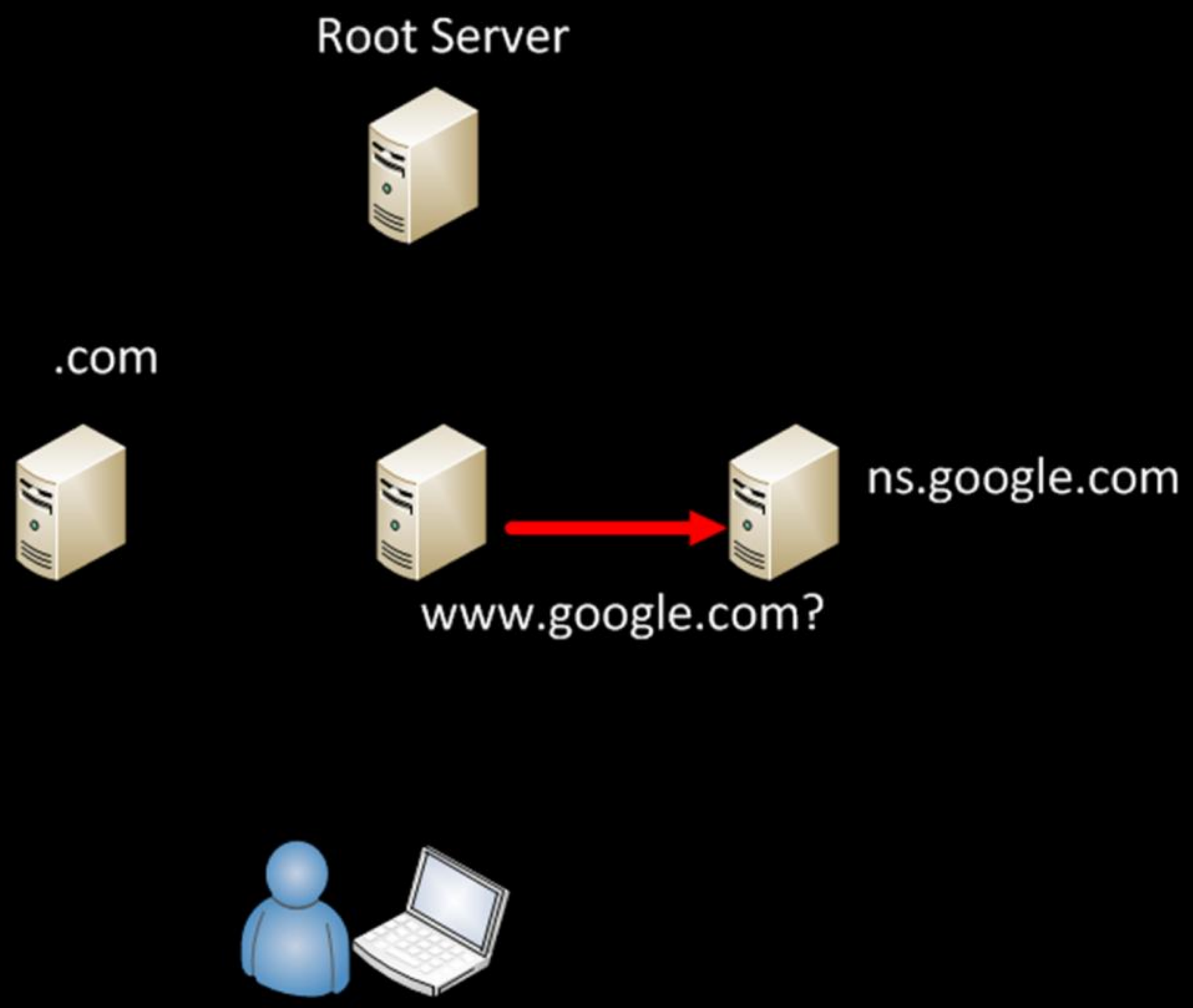
Root Server

.com

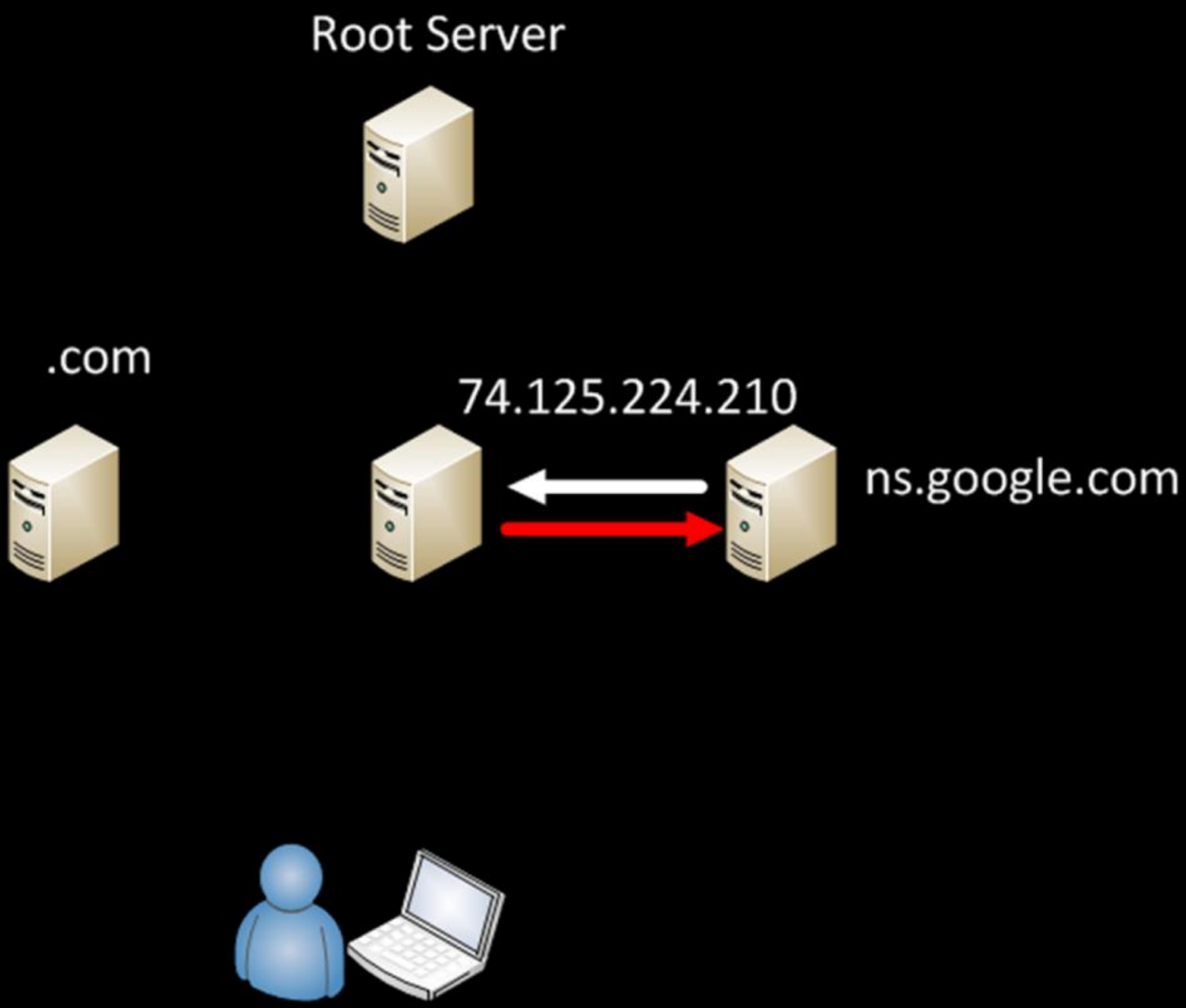
Ask

ns.google.com

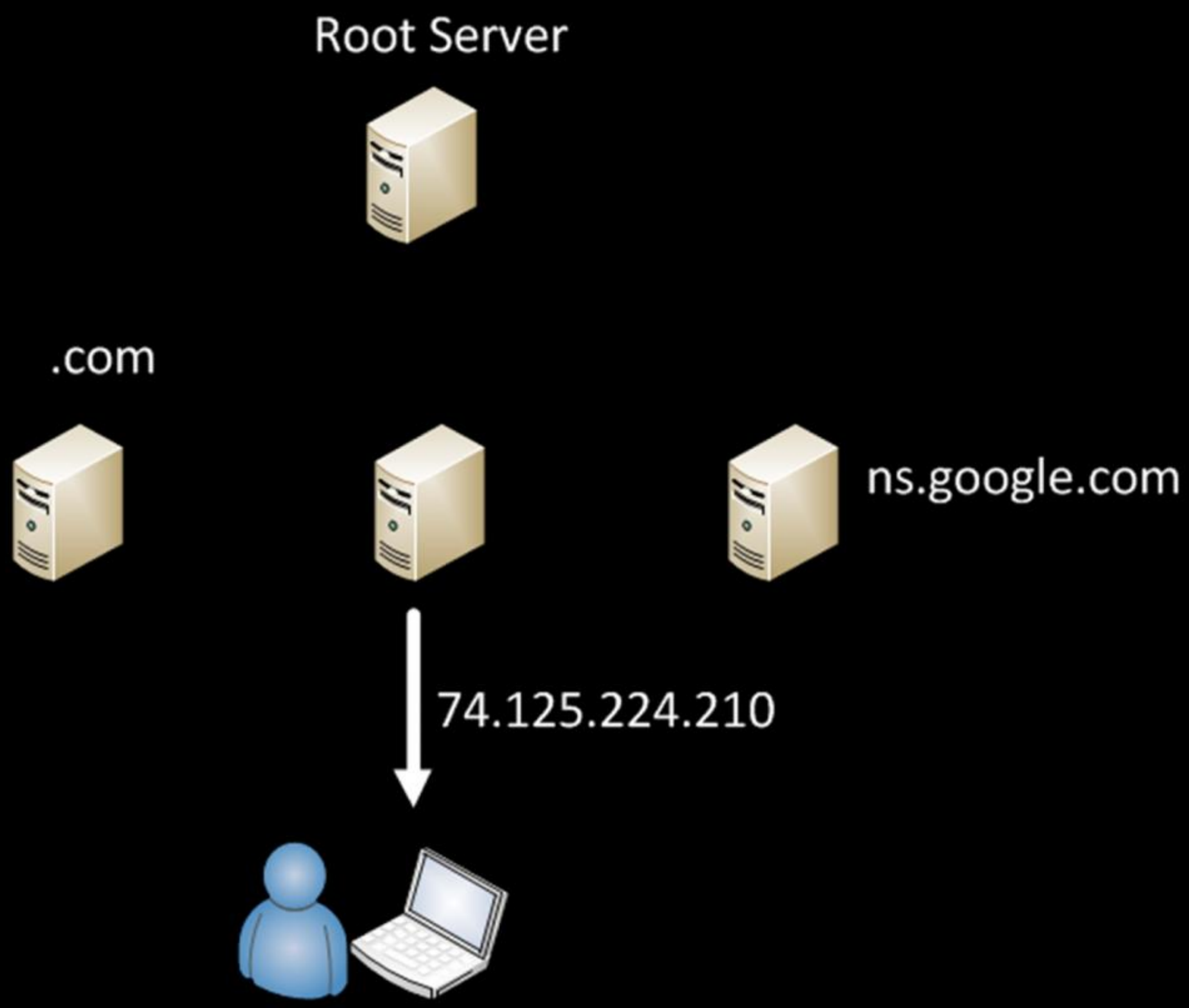
Misunderstood End-Point Behavior



Misunderstood End-Point Behavior



Misunderstood End-Point Behavior



Misunderstood End-Point Behavior

www.google.com

Misunderstood End-Point Behavior

www.google.com.

Misunderstood End-Point Behavior

www.google.com
google.com
www
www.google.com.

Misunderstood End-Point Behavior

- Suffix Search Paths
- DNS Devolution

Misunderstood End-Point Behavior

Suffix Search Paths

Foo Inc.

- ad.foo.com
- foo.com

Misunderstood End-Point Behavior

Suffix Search Paths

XP Behavior

DNS Query -> www.ad.foo.com
DNS Query -> www.foo.com

NetBIOS Query -> www

Misunderstood End-Point Behavior

Suffix Search Paths

XP Behavior

DNS Query -> www.phx
DNS Query -> www.phx.ad.foo.com
DNS Query -> www.phx.foo.com

NetBIOS Query -> www.phx

Misunderstood End-Point Behavior

Suffix Search Paths

Post-XP Behavior

DNS Query -> www.phx

NetBIOS Query -> www.phx

Misunderstood End-Point Behavior

DNS Devolution

XP Behavior

Connection Specific Domain – **phx.ad.foo.com**

Misunderstood End-Point Behavior

DNS Devolution

XP Behavior

Connection Specific Domain – **phx.ad.foo.com**

DNS Query –> www.phx.ad.foo.com

Misunderstood End-Point Behavior

DNS Devolution

XP Behavior

Connection Specific Domain – **phx.ad.foo.com**

DNS Query –> www.phx.ad.foo.com
DNS Query –> www.ad.foo.com

Misunderstood End-Point Behavior

DNS Devolution

XP Behavior

Connection Specific Domain – **phx.ad.foo.com**

DNS Query –> www.phx.ad.foo.com
DNS Query –> www.ad.foo.com
DNS Query –> www.foo.com

Misunderstood End-Point Behavior

DNS Devolution

XP Behavior

Connection Specific Domain – **phx.ad.foo.com**

DNS Query –> www.phx.ad.foo.com
DNS Query –> www.ad.foo.com
DNS Query –> www.foo.com
DNS Query –> www.com

Misunderstood End-Point Behavior

DNS Devolution

XP Behavior

Connection Specific Domain – **ad.foo.co.uk**

DNS Query –> www.ad.foo.co.uk
DNS Query –> www.foo.co.uk
DNS Query –> www.co.uk

Misunderstood End-Point Behavior

DNS Devolution

XP Behavior

Connection Specific Domain – **ad.foo.co.uk**

DNS Query –> www.ad.foo.co.uk
DNS Query –> www.foo.co.uk
~~DNS Query –> www.co.uk~~

Misunderstood End-Point Behavior

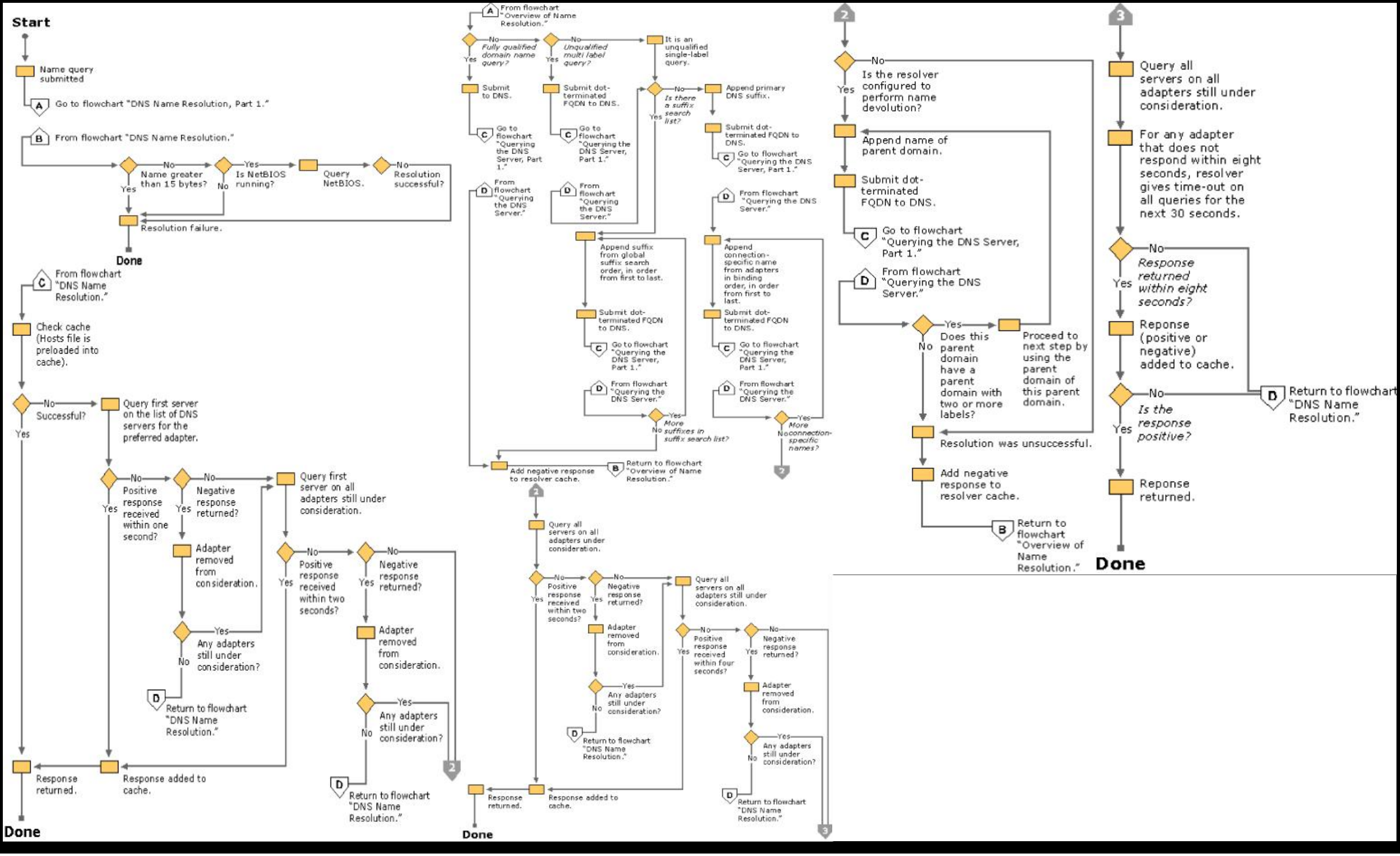
DNS Devolution

XP Behavior

Connection Specific Domain – **phx.ad.foo.com**

DNS Query –> www.phx.ad.foo.com
DNS Query –> www.ad.foo.com
~~DNS Query –> www.foo.com~~

Misunderstood End-Point Behavior



Start
Name query submitted
A Go to flowchart "DNS Name Resolution, Part 1."
B From flowchart "DNS Name Resolution."
No
Yes
Name greater than 15 bytes?
Yes
No
Is NetBIOS running?
Query NetBIOS.
No
Resolution successful?
Resolution failure.
Done
C From flowchart "DNS Name Resolution."
Check cache (Hosts file is preloaded into cache).
No
Successful?
Yes
Query first server on the list of DNS servers for the preferred adapter.
No
Yes
Positive response received within one second?
No
Yes
Negative response returned?
Adapter removed from consideration.
Yes
No
Any adapters still under consideration?
D Return to flowchart "DNS Name Resolution."
Query first server on all adapters still under consideration.
No
Yes
Positive response received within two seconds?
No
Yes
Negative response returned?
Adapter removed from consideration.
Yes
No
Any adapters still under consideration?
D Return to flowchart "DNS Name Resolution."
2
Response returned.
Response added to cache.
Done
A From flowchart "Overview of Name Resolution."
No
Yes
Fully qualified domain name query?
No
Yes
Unqualified multi label query?
It is an unqualified single-label query.
Submit to DNS.
C Go to flowchart "Querying the DNS Server, Part 1."
D From flowchart "Querying the DNS Server."
Submit dot-terminated FQDN to DNS.
C Go to flowchart "Querying the DNS Server, Part 1."
D From flowchart "Querying the DNS Server."
No
Yes
Is there a suffix search list?
Append primary DNS suffix.
Submit dot-terminated FQDN to DNS.
C Go to flowchart "Querying the DNS Server, Part 1."
D From flowchart "Querying the DNS Server."
Append suffix from global suffix search order, in order from first to last.
Submit dot-terminated FQDN to DNS.
C Go to flowchart "Querying the DNS Server, Part 1."
D From flowchart "Querying the DNS Server."
Yes
No
More suffixes in suffix search list?
Append connection-specific name from adapters in binding order, in order from first to last.
Submit dot-terminated FQDN to DNS.
C Go to flowchart "Querying the DNS Server, Part 1."
D From flowchart "Querying the DNS Server."
Yes
No
More connection-specific names?
2
Add negative response to resolver cache.
B Return to flowchart "Overview of Name Resolution."
1
Query all servers on all adapters under consideration.
No
Yes
Positive response received within two seconds?
No
Yes
Negative response returned?
Adapter removed from consideration.
Yes
No
Any adapters still under consideration?
D Return to flowchart "DNS Name Resolution."
Query all servers on all adapters still under consideration.
No
Yes
Positive response received within four seconds?
No
Yes
Negative response returned?
Adapter removed from consideration.
Yes
No
Any adapters still under consideration?
D Return to flowchart "DNS Name Resolution."
3
Response returned.
Response added to cache.
Done
2
No
Yes
Is the resolver configured to perform name devolution?
Append name of parent domain.
Submit dot-terminated FQDN to DNS.
C Go to flowchart "Querying the DNS Server, Part 1."
D From flowchart "Querying the DNS Server."
Yes
No
Does this parent domain have a parent domain with two or more labels?
Proceed to next step by using the parent domain of this parent domain.
Resolution was unsuccessful.
Add negative response to resolver cache.
B Return to flowchart "Overview of Name Resolution."
3
Query all servers on all adapters still under consideration.
For any adapter that does not respond within eight seconds, resolver gives time-out on all queries for the next 30 seconds.
No
Yes
Response returned within eight seconds?
Reponse (positive or negative) added to cache.
No
Yes
Is the response positive?
D Return to flowchart "DNS Name Resolution."
Reponse returned.
Done

Misunderstood End-Point Behavior

DNS Devolution

XP Behavior

Connection Specific Domain – **phx.ad.foo.com**

DNS Query –> www.phx.ad.foo.com
DNS Query –> www.ad.foo.com
~~DNS Query –> www.foo.com~~
~~DNS Query –> www.com~~

Misunderstood End-Point Behavior

DNS Devolution

XP Behavior

Connection Specific Domain – **phx.ad.foo.com**

DNS Query –> www.phx.ad.foo.com

DNS Query –> www.ad.foo.com

DNS Query –> www.foo.com

~~DNS Query –> www.com~~

Misunderstood End-Point Behavior

DNS Devolution

XP Behavior

Connection Specific Domain – **phx.ad.foo.com**

DNS Query –> www.phx.ad.foo.com
DNS Query –> www.ad.foo.com
DNS Query –> www.foo.com
DNS Query –> www.com

Misunderstood End-Point Behavior

DNS Devolution

Windows 7 Behavior

Connection Specific Domain – **phx.ad.foo.com**

DNS Query –> www.phx.ad.foo.com

DNS Query –> www.ad.foo.com

DNS Query –> www.foo.com

~~DNS Query –> www.com~~

Misunderstood End-Point Behavior

Fixed?

Misunderstood End-Point Behavior

BYOD

Mobile

Broken XP

Misunderstood End-Point Behavior

sipinternal.com

proxy-phoenix.com
set-proxy.com

Misunderstood End-Point Behavior

wsus.com	-	Taken
sms.com	-	Taken
wpad.com	-	Taken
sipinternal.com	**-**	**Mine**

Misunderstood End-Point Behavior

sipinternal.com

```
REGISTER sip:com SIP/2.0
Via: SIP/2.0/TCP 199.41.198.254:33663
Max-Forwards: 70
From: <sip:com>;tag=e72f0d4ce7;epid=895120c8c2
To: <sip:com>
Call-ID: 53b3ec1c2e0547ab9b72ab97ed17c8b0
CSeq: 1 REGISTER
Contact: <sip:199.41.198.254:33663;transport=tcp;ms-opaque=8300f99968>;methods="INVITE, MESSAGE, INFO,
OPTIONS, BYE, CANCEL, NOTIFY, ACK, REFER, BENOTIFY";proxy=replace;+sip.instance="<urn:uuid:D964A4BE-
A17A-50DD-9D69-836911E33E95>"
User-Agent: UCCAPI/3.5.6907.221 OC/3.5.6907.221 (Microsoft Office Communicator 2007 R2)
Supported: gruu-10, adhoclist, msrtc-event-categories
Supported: ms-forking
ms-keep-alive: UAC;hop-hop=yes
Event: registration
Content-Length: 0
```

Misunderstood End-Point Behavior

proxy-phoenix.com

Misunderstood End-Point Behavior

set-proxy.com

```
170.249.6.88  "set-proxy.com" "GET /bin/setup.proxy"
170.249.6.88  "set-proxy.com" "GET /bin/setup.proxy"
170.249.6.88  "set-proxy.com" "GET /bin/setup.proxy"
170.249.6.88  "set-proxy.com" "GET /bin/setup.proxy"
170.249.6.88  "set-proxy.com" "GET /bin/setup.proxy"
170.249.6.88  "set-proxy.com" "GET /bin/setup.proxy"
```

```
NetRange:       170.249.0.0 - 170.250.255.255
OrgName:        Arthur Andersen
OrgId:          ARTHUR-15
```

Misunderstood End-Point Behavior

set-proxy.com

```
170.252.248.200  "GET /bin/setup.proxy" "mstreamd/1 CFNetwork/548.1.4 Darwin/11.0.0"
170.252.248.200  "GET /bin/setup.proxy" "WordsWithFriendsPaid/4.12.1 CFNetwork/548.1.4 Darwin
170.252.248.200  "GET /bin/setup.proxy" "itunesstored (unknown version) CFNetwork/548.1.4 Darwin
170.252.248.200  "GET /bin/setup.proxy" "Mail/53 CFNetwork/548.1.4 Darwin/11.0.0"
170.252.248.200  "GET /bin/setup.proxy" "GeoServices/84 CFNetwork/548.1.4 Darwin/11.0.0"
170.252.248.200  "GET /bin/setup.proxy" "Maps/1.0 CFNetwork/548.1.4 Darwin/11.0.0"
170.252.248.200  "GET /bin/setup.proxy" "itunesstored (unknown version) CFNetwork/548.1.4 Darwin
170.252.248.200  "GET /bin/setup.proxy" "dataaccessd (unknown version) CFNetwork/548.1.4 Darwin
170.252.248.200  "GET /bin/setup.proxy" "mstreamd/1 CFNetwork/548.1.4 Darwin/11.0.0"
170.252.248.200  "GET /bin/setup.proxy" "itunesstored (unknown version) CFNetwork/548.1.4 Darwin
```

```
NetRange:       170.251.0.0 - 170.252.255.255
OrgName:        Accenture
OrgId:          ACCENT-10
```

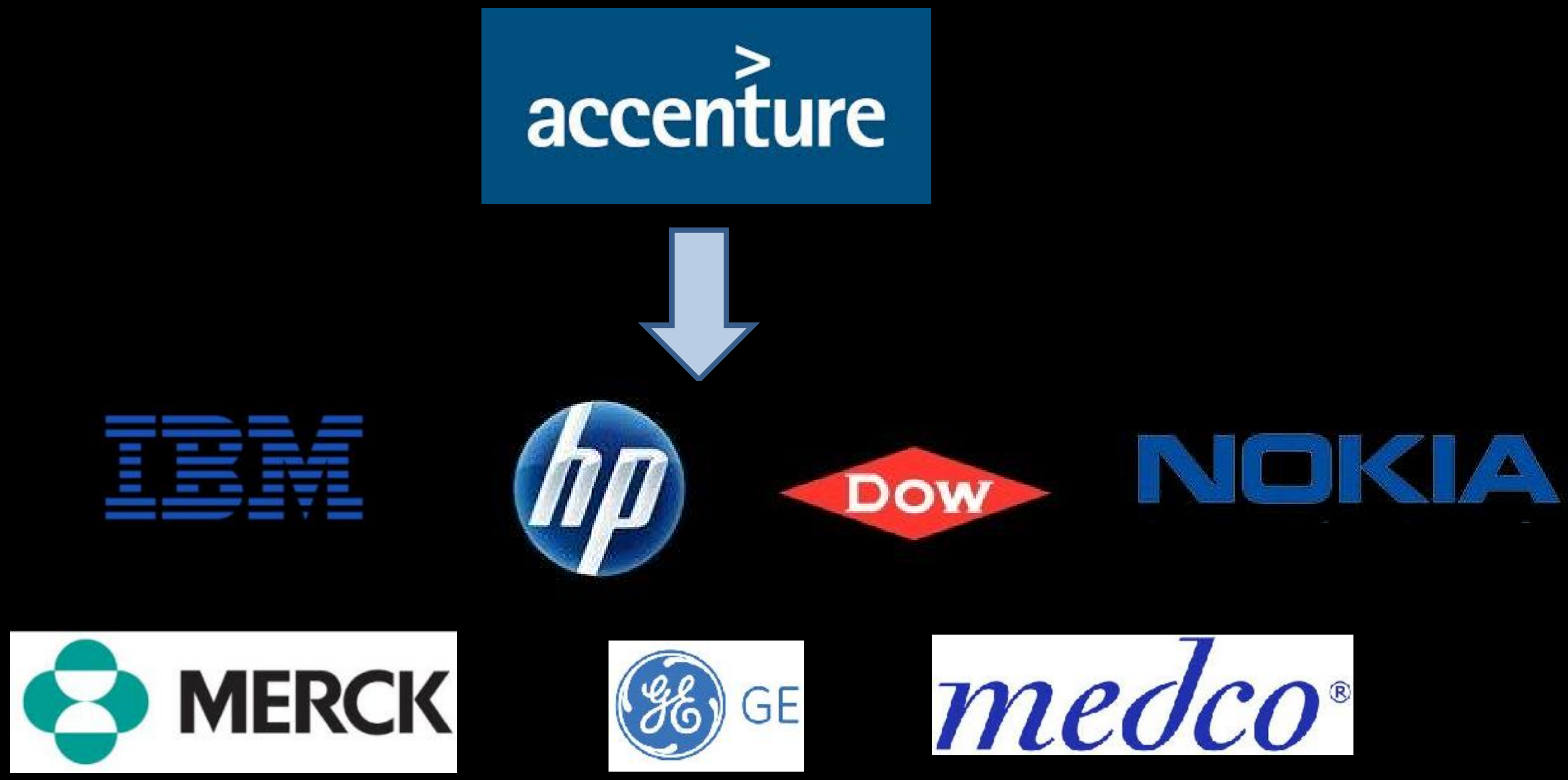
Misunderstood End-Point Behavior

set-proxy.com

accenture

Misunderstood End-Point Behavior

set-proxy.com



Misunderstood End-Point Behavior

Don’t trust expectations based upon on how things used to work, monitor and understand what normal DNS traffic looks like on your network.

You don’t own that domain

I do >:)

You don’t own that domain

“HKLM\System\CurrentControlSet\Services\TCPIP\Parameters\SearchList”

Or

“Windows IP Configuration” + “DNS Suffix Search List”

You don’t own that domain

```
Windows IP Configuration

   Host Name . . . . . . . . . . . . :      AN990107196
   Primary Dns Suffix  . . . . . . . :   quanta.corp
   Node Type . . . . . . . . . . . . :      Hybrid
   IP Routing Enabled. . . . . . . . :  No
   WINS Proxy Enabled. . . . . . . . : No
   DNS Suffix Search List. . . . . . : quanta.corp
                                       rsquanta.com
                                       quantacn.com
```

You don’t own that domain

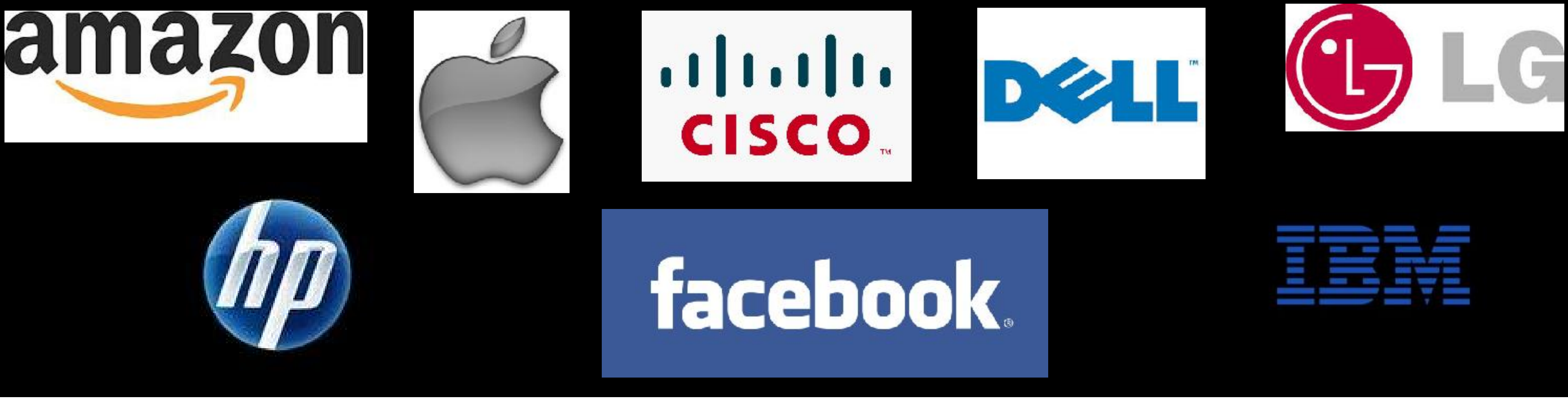
```
Windows IP Configuration

   Host Name . . . . . . . . . . . . . :      AN990107196
   Primary Dns Suffix  . . . . . . . :   quanta.corp
   Node Type . . . . . . . . . . . . . :      Hybrid
   IP Routing Enabled. . . . . . . . :  No
   WINS Proxy Enabled. . . . . . . . : No
   DNS Suffix Search List. . . . . . : quanta.corp
                                        rsquanta.com
                                        quantacn.com
```

You don’t own that domain

“Quanta Computer”

60,000 employees worldwide

manufactures hardware for



You don’t own that domain

myproxy.rsquanta.com
proxycn.rsquanta.com
proxy.rsquanta.com
wpad.rsquanta.com

wsus01.rsquanta.com
wsus-cq.rsquanta.com
wsus-sh1.rsquanta.com
SMS_SLP.rsquanta.com

mailbx01.rsquanta.com
mailbx02.rsquanta.com
mailbx03.rsquanta.com
mailhub04.rsquanta.com
mailhub05.rsquanta.com

FTP-CHT.rsquanta.com
ftp.rsquanta.com
nb1ftp.rsquanta.com
nb5-ftp.rsquanta.com
f1ftp02.rsquanta.com
ftp01.rsquanta.com

You don’t own that domain

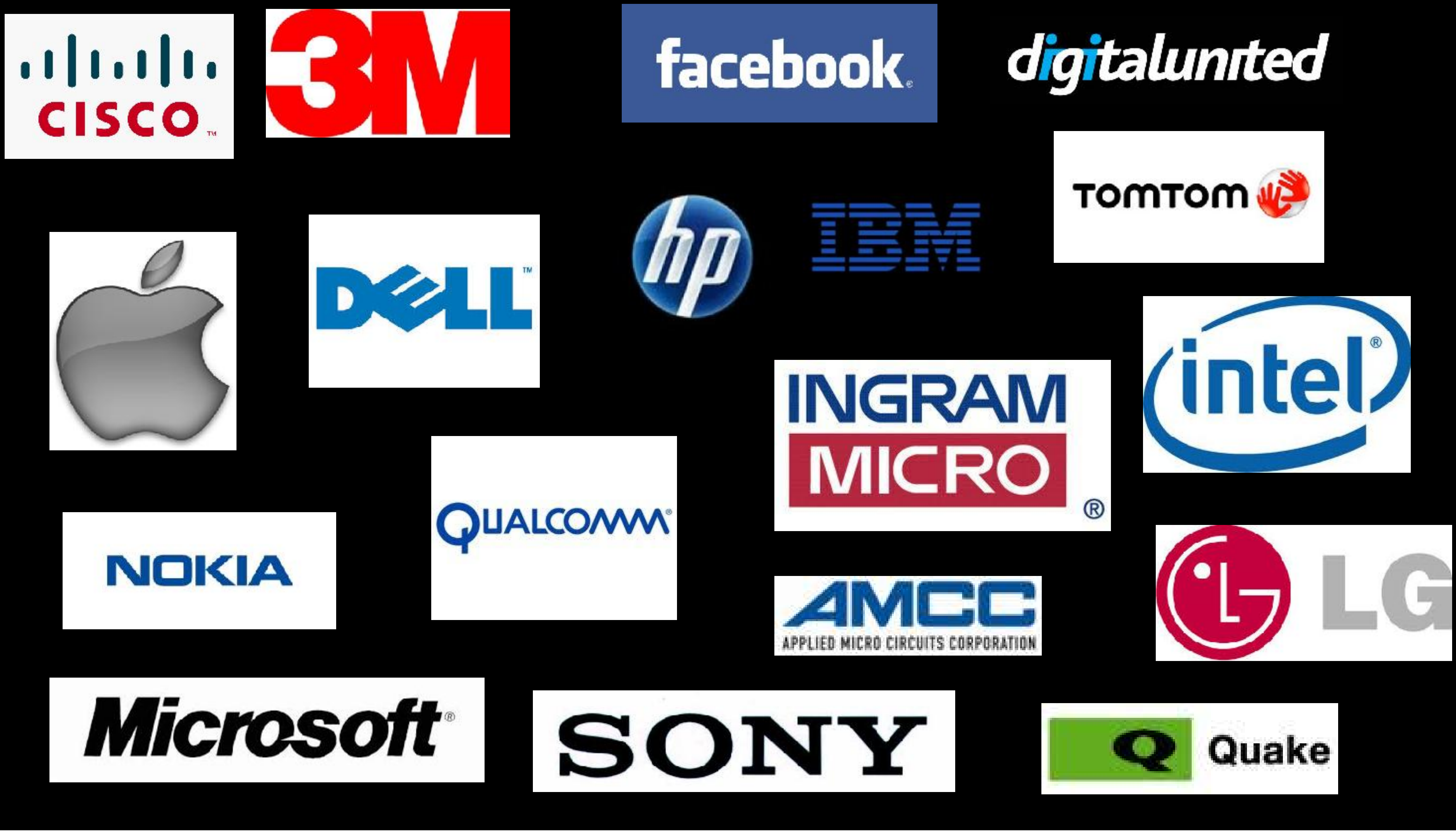
173.37.87.155: view external-in: query: **proxy.rsquanta.com**
171.70.168.155: view external-in: query: **QRDCOFC05.rsquanta.com**
171.70.168.167: view external-in: query: **wpad.rsquanta.com**

17.254.0.23: view external-in: query: **wpad.rsquanta.com**
17.254.0.23: view external-in: query: **wsus01.rsquanta.com**
17.254.0.23: view external-in: query: **proxy.rsquanta.com**

136.229.2.57: view external-in: query: **proxy.rsquanta.com**
136.229.2.56: view external-in: query: **qrdcprt02.rsquanta.com**
136.229.2.57: view external-in: query: **QRDCOFC03.quanta.corp.rsquant**

143.166.82.252: view external-in: query: **wpad.rsquanta.com**
143.166.224.3: view external-in: query: **SMS_SLP.rsquanta.com**
143.166.224.11: view external-in: query: **proxy.rsquanta.com**

You don’t own that domain



You don’t own that domain

Best Dry Cleaners	99.59.76.38: query: wpad.rsquanta.com
San Francisco International Airport	216.9.98.80: query: wpad.rsquanta.com
Venetian Resort Hotel Casino	64.79.144.10: query: wpad.rsquanta.com
MGM Mirage	69.162.4.53: query: wpad.rsquanta.com

You don’t own that domain

- Please verify your configurations
- Monitor the internet for details of your internal configuration
    - Pastebin
    - Bleeping Computer
- Monitor your DNS logs to verify your clients and the clients of your onsite partners and vendors are querying what you expect

Abandoned Botnets and Forgotten Toys

- Expired Command and Control Domains
- Botnet remnants
- Abandoned Botnets
- Detection

Abandoned Botnets and Forgotten Toys

microsoft-windows-security.com

Win32:EyeStye

268 remaining infections

Uses form grabbing to steal credentials

Abandoned Botnets and Forgotten Toys

```
--55372666816118
Content-Disposition: form-data; name="data"

bot_guid=138BFC5C-8C31-4415-92D0B382B5550E0D
process_name=iexplore.exe
hooked_func=HttpSendRequestW
func_data=POST /login.php?login_attempt=1 HTTP/1.1

lsd=AVoCccq2&email=steve*******@yahoo.com&pass=*******&default_persistent=0&timezone=240&lgnrnd=183641_PjES&lgnjs=1363743523&locale=en_US
--55372666816118--
```

Abandoned Botnets and Forgotten Toys

Remaining Infections

simrako.com	14162 infected
ms-stats.info	2979 infected
myrestricted.info	2203 infected
zapalinfo.info	2111 infected
ntpupdatedomain.com	1571 infected
rapeisntfunny.info	844 infected

Abandoned Botnets and Forgotten Toys

b.354782.InfO

"POST /b/i.asp HTTP/1.1”

Content-Disposition: form-data; name="InSfo”

txtUserId::Gupta

txtPassword::*******

Content-Disposition: form-data; name="BasicSInfo”

192.168.50.26|192.168.50.26|8.0000|**00-1C-C0-EB-E9-34**|BC01-0920

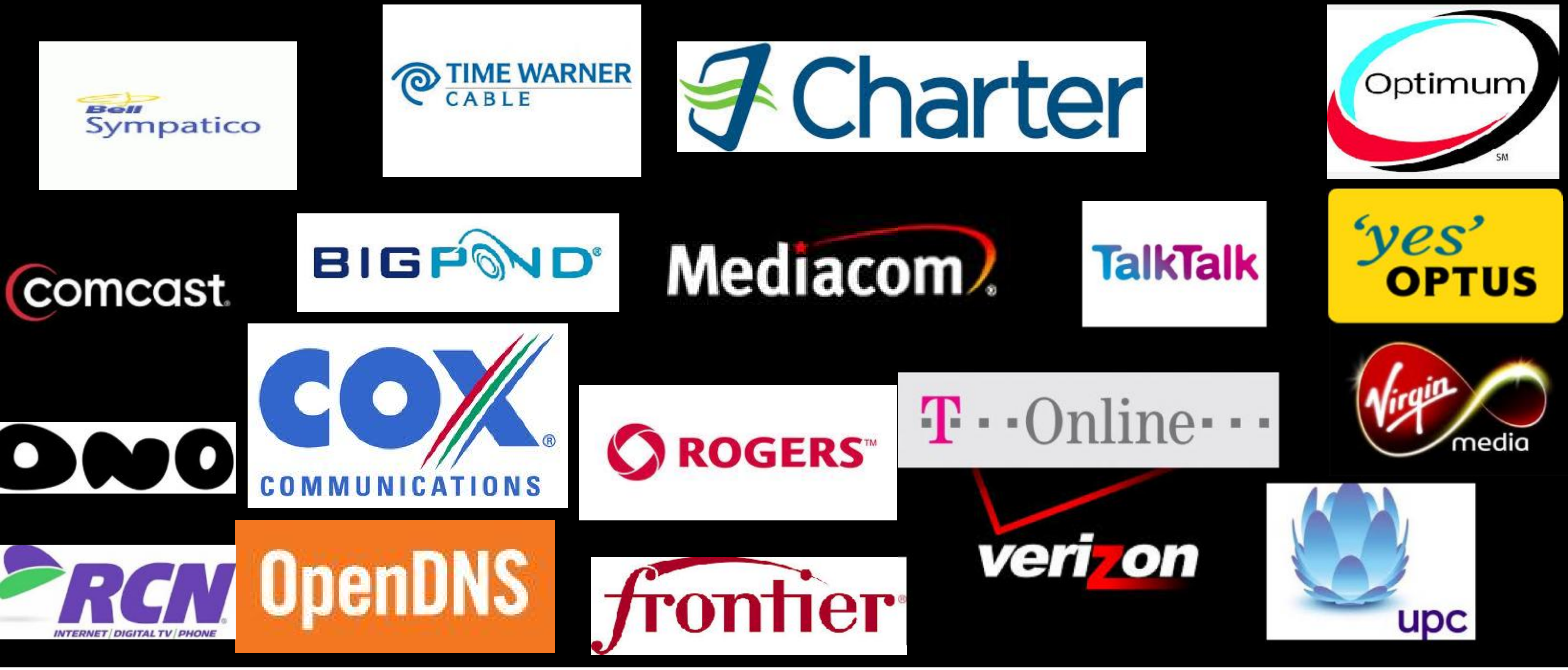
Abandoned Botnets and Forgotten Toys

ET_product::**SSIM**
ET_component::**BACKEND**
ET_version::**4.8**
ET_target_version::**4.8**
ET_assigned_to::**gaurav_pratap**
ET_type::**DEFECT**
ET_state::**CLOSED**
ET_reporter::**gaurav_pratap**
ET_severity::**2**
ET_priority::**2**
ET_resolution::**SOURCE_CHANGE**
ET_user_defined_list::**FILES**
ET_user_defined_list2::**SECURITY**
ET_build::**153**
ET_target_build::**184**

Site::**engtools.engba.symantec.com**
Mac::**00-24-E8-4A-ED-A3**
Ver::**BC01-0920**

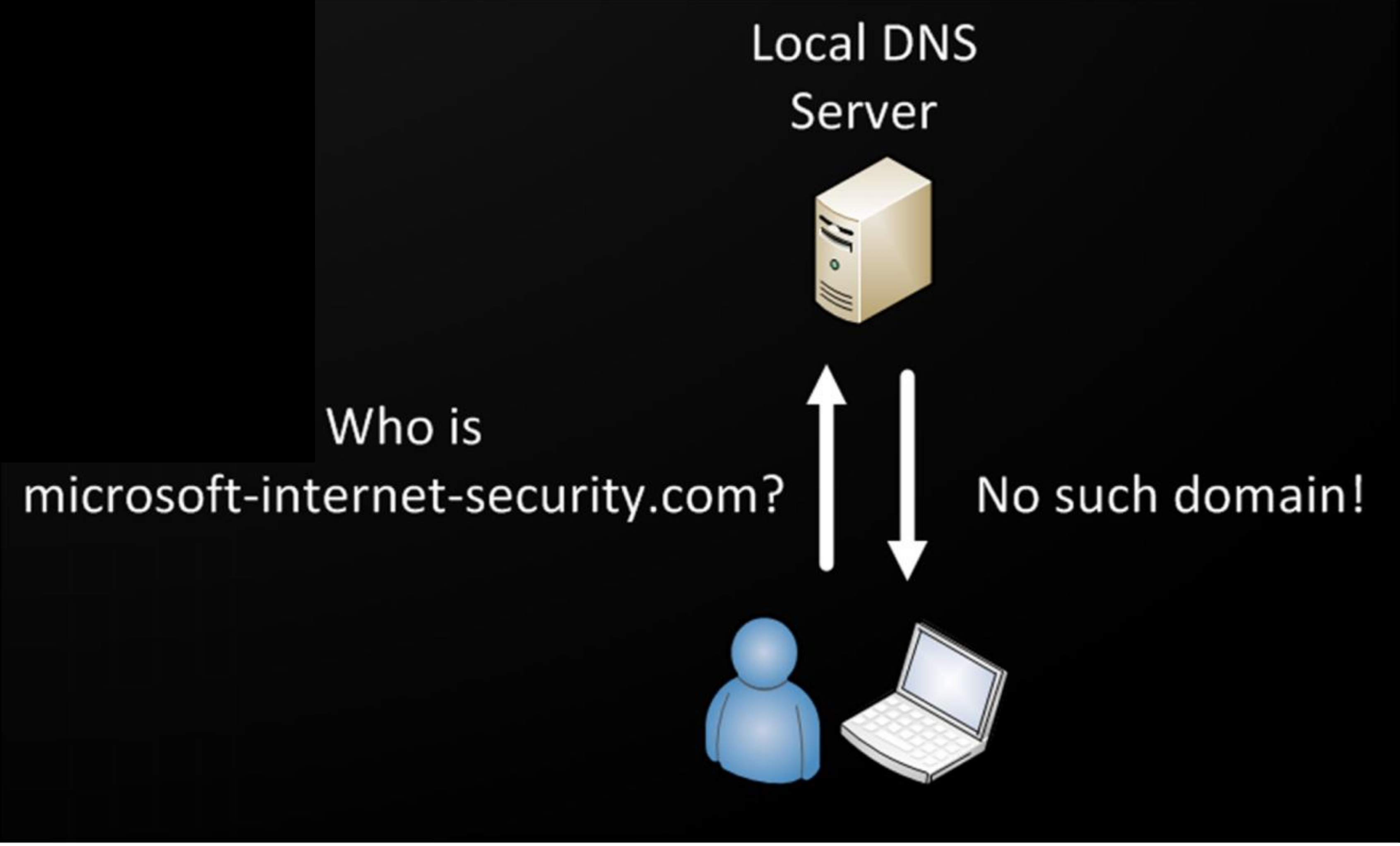
Abandoned Botnets and Forgotten Toys

NXDOMAIN Hijacking



Abandoned Botnets and Forgotten Toys

NXDOMAIN Hijacking



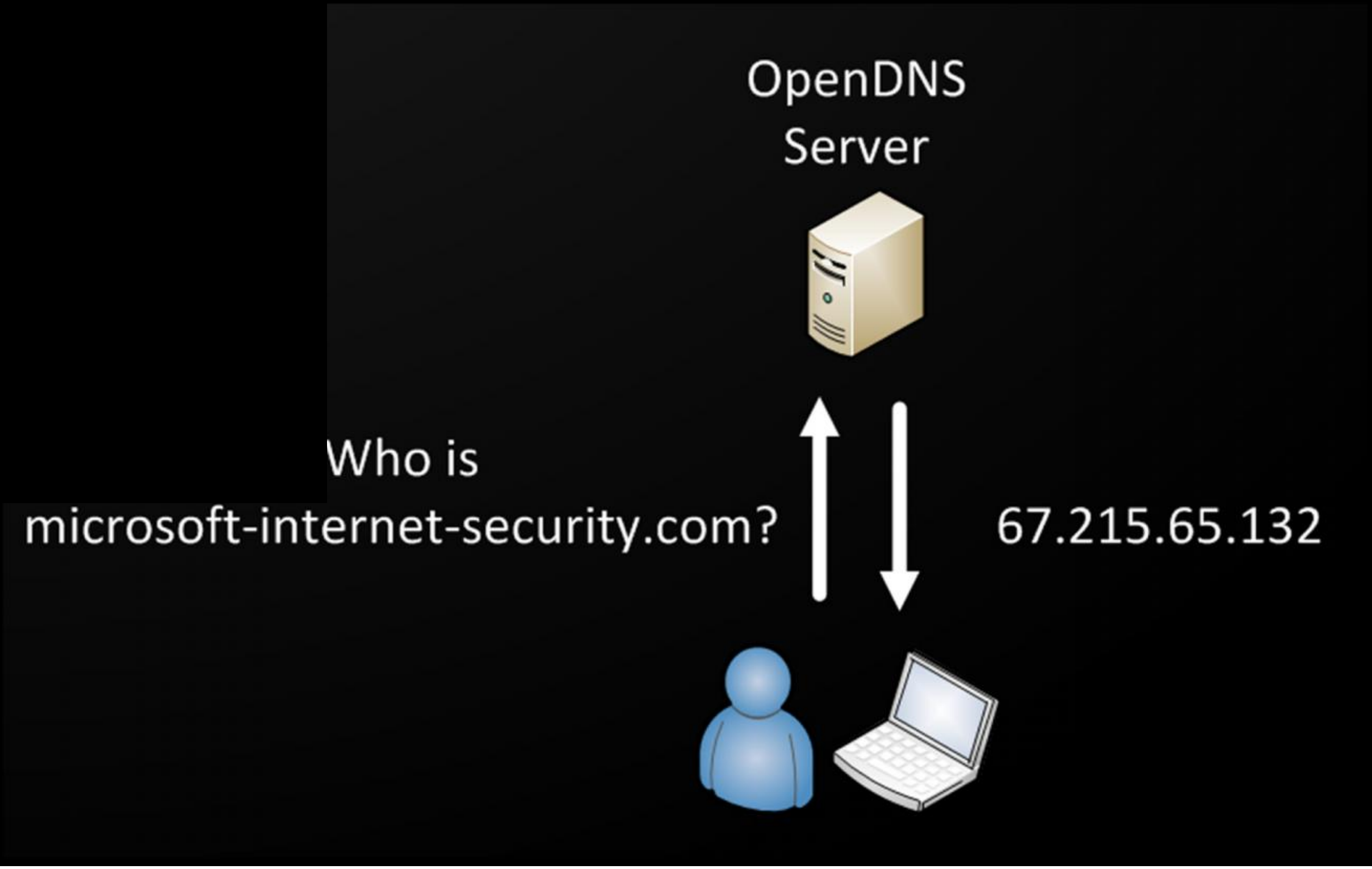
Local DNS Server

Who is microsoft-internet-security.com?

No such domain!

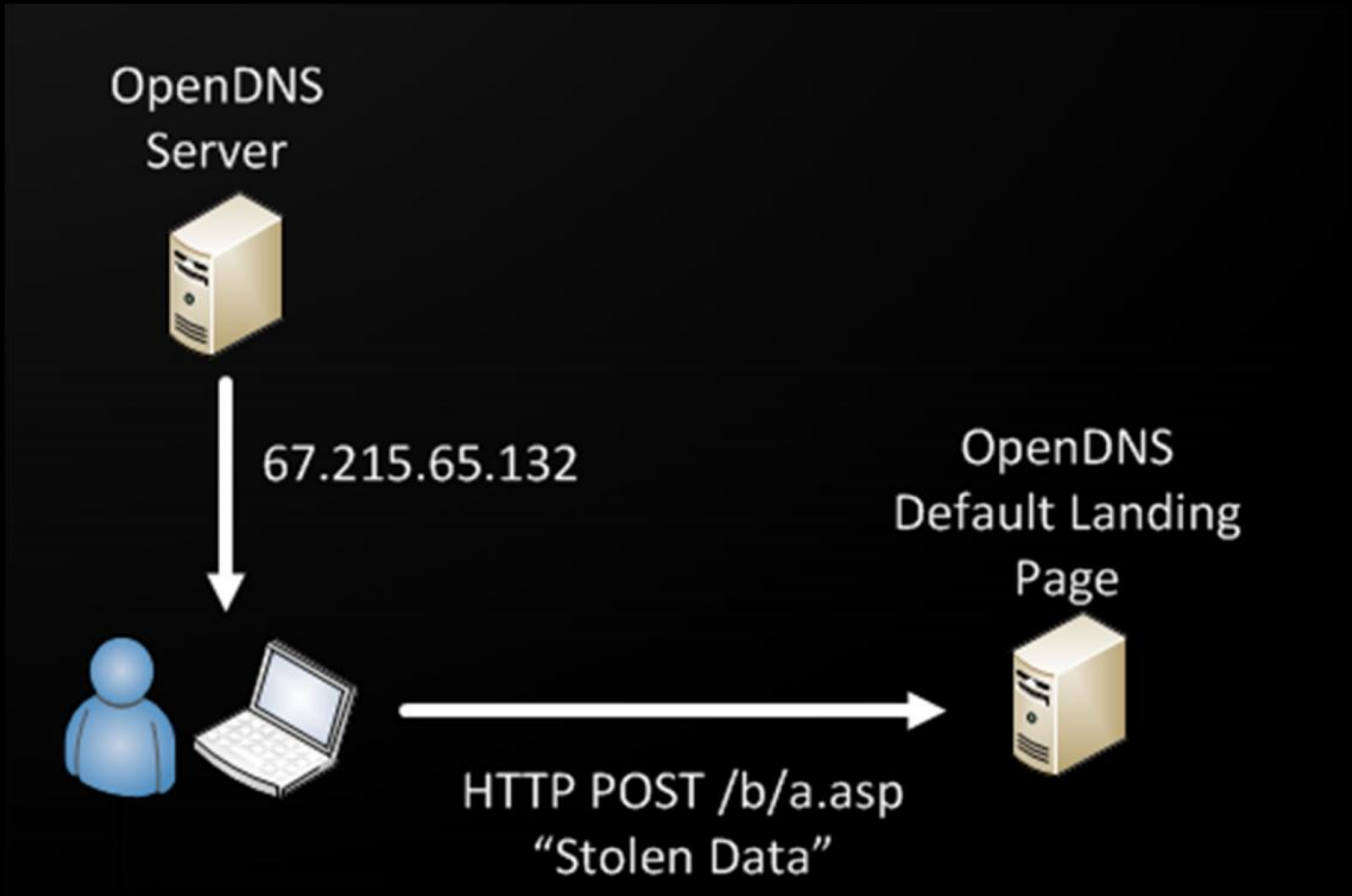
Abandoned Botnets and Forgotten Toys

NXDOMAIN Hijacking



Abandoned Botnets and Forgotten Toys

NXDOMAIN Hijacking



Abandoned Botnets and Forgotten Toys

Detection

- Collect your DNS logs into a database
- Regularly extract names being queried for the first time in your environment
- Look for names only being queried by a single client
- Look up the registration dates and owners
- Look for anything resolving to 127.0.0.1

Abandoned Botnets and Forgotten Toys

Resources

- Bro – http://www.bro.org
- DNS Anomaly Detection - http://code.google.com/p/security-onion/wiki/DNSAnomalyDetection
- Passive DNS - https://github.com/gamelinux/passivedns
- Response Policy Zones (RPZ)
- DNS Sinkholes - http://handlers.sans.edu/gbruneau/sinkhole.htm

Abandoned Botnets and Forgotten Toys

White Papers

- Passive Monitoring of DNS Anomalies

http://www.caida.org/publications/papers/2007/dns_anomalies/dns_anomalies.pdf

- Detecting Malware Domains at the Upper DNS Hierarchy

https://www.usenix.org/legacy/event/sec11/tech/full_papers/Antonakakis.pdf

- Mining DNS for Malicious Domain Registration

http://www.mcafee.com/us/resources/white-papers/wp-mining-dns-for-malicious-domain-regist.pdf

- Preprocessing DNS Log Data for Effective Data Mining

http://www.ccs.neu.edu/home/koods/papers/snyder09preprocessing.pdf

- Detecting Botnet Activities Based on Abnormal DNS Traffic

http://arxiv.org/pdf/0911.0487v1.pdf

Questions?

bobx@rot26.net

Please contact me with any questions, comments, or opportunities :)

Thank You!