

Open Recursive Nameservers

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Introduction

What we are going to tell...

- What is the problem?
- What is a Caching Open Recursive Nameserver?
- Practical Research
 - Reconnaissance work
 - DNS query (maximum UDP packet size)
 - DNS answer (TXT records)
 - UDP and DNSSEC
 - An actual DNS DDoS attack
- Defending strategies
- Do we have to be concerned of large DNS DDoS attacks using CORNS?

Once Upon A Time...

- The Internet was a happy place where it was easy to help your friends and neighbors:
 - Telnet was THE remote administration tool/protocol
 - Open SMTP relays were the norm rather than the exception
 - Nameservers were Open Recursive...
 - etc.
- In short: the Internet was build to be used by everybody – NOT abused!

But unfortunately, things change. . .

- In 2006 several high-impact Distributed Denial of Service (DDoS) attacks.
- Primary attackers: Caching Open Recursive Nameservers further revered to as CORNs.



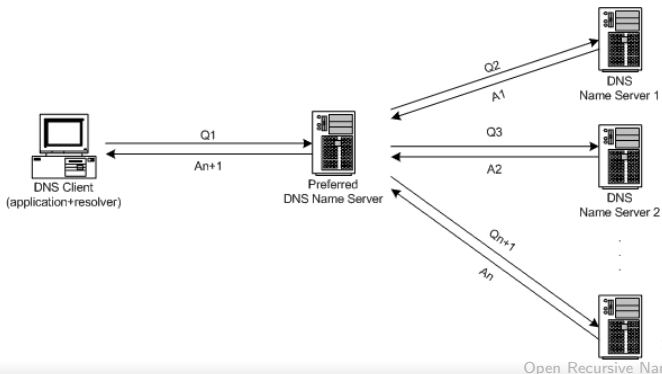
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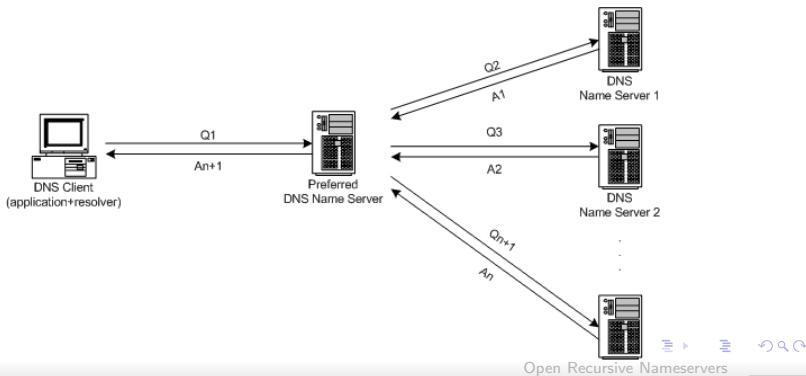
What is a CORN?

- What is a DNS server?
 - Converts FQDN to IP-addresses and vice versa
- What is a Open Recursive Nameserver (further: ORN)
 - A recursive NS for the whole wide world
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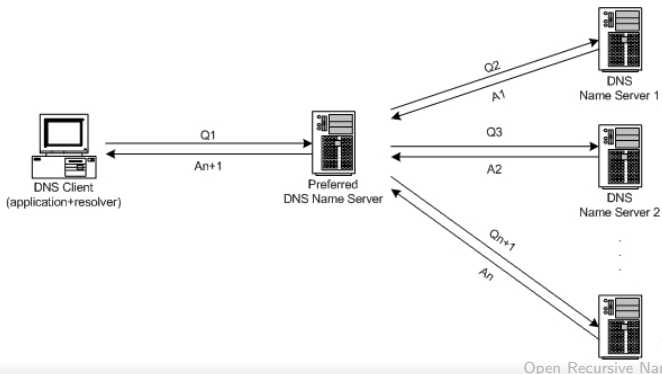
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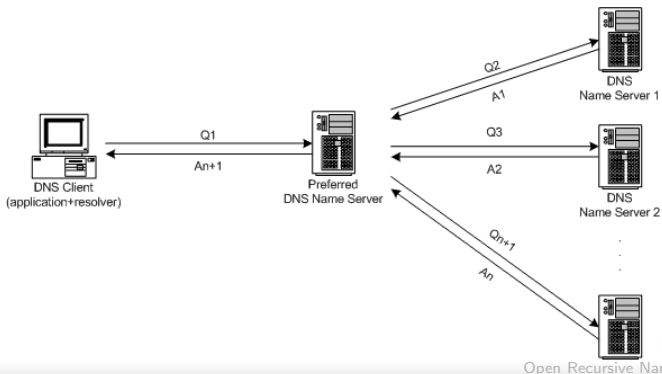
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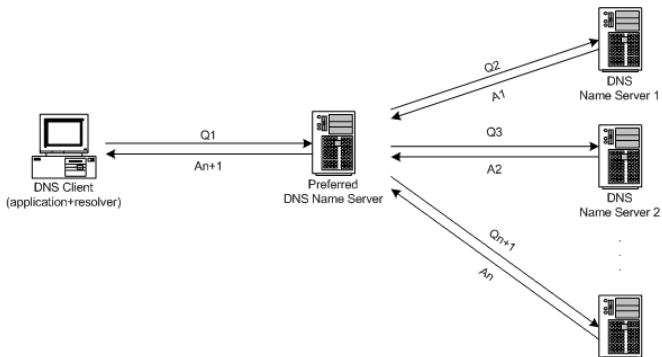
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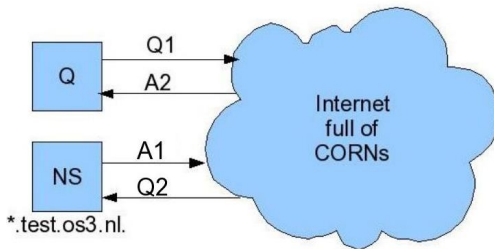
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Practical Research

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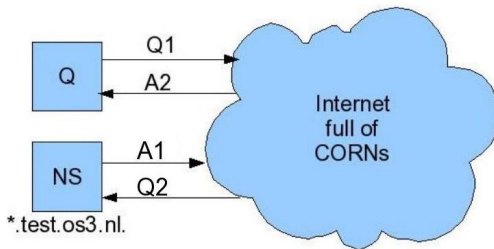
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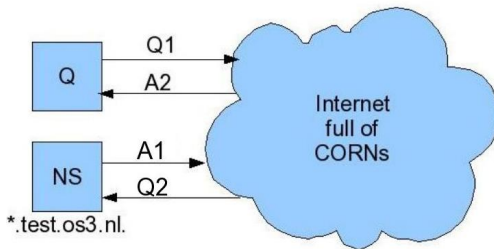
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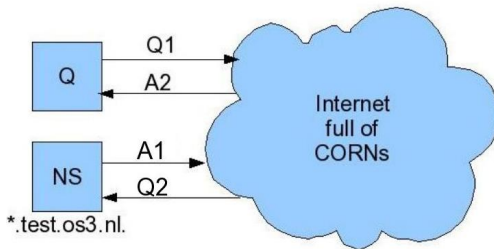
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Practical Research

Zonefile	NS	NS (without timed-out)	CORNs
.int (inside .int domain)	59	51	21 (36%)
.int (outside .int domain)	203	195	65 (32%)
.edu (inside .edu domain)	4264	3333	2142 (50%)
.edu (outside .edu domain)	5124	4552	2173 (42%)
totals	9650	8131	4401 (46%)

Table: Total numbers zonefiles statistics

DNS Measurement estimates 9.000.000 nameservers running on the Internet.

With our test results we could estimate $\sim 3.690.000$ nameservers are CORNs!

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The query (maximum DNS UDP packet sizes)...

- Maximum DNS UDP packet size: 512 bytes
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Practical Research

```

patrick@patrick-desktop: /media/sdb5/rp1/code
File Edit View Terminal Tabs Help
<<<> DIG 9.3.2 <<<> 0.test.pvabswoude.practicum.os3.nl @pvabswoude.practicum.os3.nl TXT +dnssec
; (1 server found)
;; global options: printed
;; Got answer:
-->HEADER<<- opcode: QUERY, status: NOERROR, id: 50891
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 1, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
EDNS: version: 0, flags: do; udp: 4096
;; QUESTION SECTION:
;0.test.pvabswoude.practicum.os3.nl. IN TXT

;; ANSWER SECTION:
0.test.pvabswoude.practicum.os3.nl. 3600 IN TXT "This is a test by SNE students of the University of Amsterdam, more information is available at www.os3.nl/~ptavener" "hgdtEZENCUSWYGW05CfLy1Aaw3T1d1g0ctccU8T8us8VkhW6V5s10Ue8uJHkVpYTF5yw2RUK7b6xciKayunA0q9hhMBT2X4ly0pep7Pj6q6TBE600tnjMxR1x34u6aw4KwzW0g856PRAX3HrzC07b2gl15RY4ljWzVz1dZx0kMkdupF9wHn2Ips8eLw20shFKYmH" "LPn0XhooovNkpxKxL0xZAOxmXUGpaqY4w08v769mmHLSm6nLKRe1aDu50Pbqf0JtcPVks5H0FhpRsonoTkZu0P6PKAZMHubuLZHL1YRF9qJ0eRz7aEGNeSutS9cOZIH4Unfh3l8U823e0JMQHuFdxRpe1P042TnNuxieC9led2085V8uhLAt9Ule1j1c8GxxAK" "heF5TeWYKYLwq0Maskj60vcpmallbvlYdkpHe8uXiy1Pzaf6nTgrLj0w50s9pNnyvZL7M9wdsue3LkVdh4M2FvKvL2U0R0BIH8LJYGFgZLDYTOJHh1IwaL88R0N0p2k811UAXU1CAt fvkKwL8B215Px0IHHK2w554IzFq0gZHW7061tn047c53DU00vTKYms" "TFwCgJ9B0G46FH9pN3xWdyHXUHNPNtVve0M0GfXnATJ3h49dqrc2BxC5XIZ1B26J1duUTFI0FB0ATSv9wPA07IMFAT6p81eK8nrQaxvN8Khs0u51qAbJf1EBIq78uAMSL8505b1wZvF0bwmF1jB9S16EYEGXW6b1vBtn20V5z10P1zauh2AmB0qLEFFp0c0n0VvJu" "x52kvaFgg4DpC21G64zPTL15TmsBrqp2eLLPld0gYqKfbuGAYCjvXaLByMGA3L19HYYN0EeBTDbCe1TBD50noC02csPvUkRKU1kktJg767tUI5DTSM9Z5Rxl103mXAWsXq88qy2F1WjUhyX3te9caAVB1G44NpD1mL7Umqs0TRgaPDRwB0vDJ5Ff27ueVxApN5F" "y4pZ55Wqoz21ewZvfd00ERHUKLmR00LVRqZjcpWS1Y0YIVGvBvt5W6f5ovZ69a03K6Kj1CvH104ahTeq45Z5VvX2GYctC38VL4WP50XKwrf6w8z7mfY8XwoB03vc2FvGPNME9ICzqHNEtKtnRaUg0z2m1PmNoL0RRQ058ewh5raanU2qIG0vQu7R5VFPF" "xvjWea2Ld0bJFF5490xrRjgE8IwV0P0K900CwBmuCYAZxHsz1IzppV6yPEKofDzph31E1p0ZV2koGs1x7atvJYUGZMNCVaxLLGLhL8540CRI440qGXVgYtqA3F1GDUrKfvy51RhyDzoJuxPevdxUvuEwL5ctTjKsBZU00dgmYXJjR05J62CITRLEyFSPY0ugMT" "UENA0GKHVahD2b9wC51K6W1ljzTvtN9W1PSDI8VE10o0f84Y4EzKjRl1MNgkXZLjkwN8x3xnhV5G785u0AX1FuG6wIk0m6skHpKMe55LH3Zb422qu4xvuxvRuz1RZDNyplHDEIT5q9vHmE0sNagvycW5by0HABA51YVYREs04XwqcE4Xr0v86FblZw5X08qUME" "lTWpWuXlybys6TISZDWhBPLp212hP9C6poA2FvBp50WFvPMBYntIU1nA0fZcdmGk1B7J04f001b13k64uZmD01aiaP4Leu367uHahsaW1718d07R033GF40J6Dx2mvV4xEgdGXMMH4ufel0w4mvuFkhXU1G08Vpoe5081q234vaddPvsr9LJyp0eM1q5CD7xb2" "A6F0nCn0utECp5Tefm9pUGLpnyhN"

;; AUTHORITY SECTION:
pvabswoude.practicum.os3.nl. 3600 IN NS ns1.pvabswoude.practicum.os3.nl.

;; Query time: 45 msec
;; SERVER: 145.92.25.11#53(145.92.25.11)
;; WHEN: Sun Jan 28 15:31:40 2007
;; MSG SIZE rcvd: 2048

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Figure: DNSSEC and UDP

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Figure: Authority section zoomed in

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An actual DNS DDoS attack...

- We conducted 3 tests.
- Following statistics gathered from our own CORN.

incoming: 148KB/s – outgoing: 5430 KB/s

incoming: 151KB/s – outgoing: 5670 KB/s

incoming: 149KB/s – outgoing: 5441 KB/s

- Each byte that comes in (the query) the victim will get a answer that is **36-38 times greater!**
- You need about 2.7 - 2.8% bandwidth of the victim you attack.

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Defending strategies

- Nameserver config solutions
 - Disable Open Recursion
 - Use Access Control Lists
 - Create Views
 - Get your logging straight
- –NOT– nameserver config solutions (firewall, routers etc.)

Further Research

- How many servers have DNSSEC enabled?
- Are there any CORNs behind forwarders?
- Is there a way to conduct this kind of attack with other RRs?
- Could you use ORNs and still stay undetected?

Question to the audience...

Do we have to be concerned of large DNS DDoS attacks?

Our opinion: **YES!**
and definitely with the upcoming of DNSSEC

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