



University of
New Hampshire

UNH

Domain Name Service

Overview of the University of New Hampshire DNS Operation

Scott Kitterman
stk@cs.unh.edu

- DNS at UNH
 - Authoritative
 - Delegations, Sub-Domains
 - Caching
- Dynamic DNS
- Protecting DNS

DNS Resource Records

- Name eg. www.unh.edu
- Type A PTR AAAA CNAME TXT MX
- Class IN for Internet Record
- Rdlength length in octets of Rdata
- Rdata Describes the Resource
(example : address of hostname)

Address Record example

```
dig www.unh.edu
---
;; ANSWER SECTION:
www.unh.edu.          300      IN       A       132.177.132.99
~
~
~
```

NAME	TTL	CLASS	TYPE	RDATA
www.unh.edu	300	IN	A	132.177.132.99

TXT (text) Record example

```
dig unh.edu txt
---
;; ANSWER SECTION:
unh.edu.      300      IN       TXT      "brevo-code:59b3a18744d24f960bd78166f34f87c5"
unh.edu.      300      IN       TXT      "v=spf1 include:%{i}._ip.%{h}._ehlo.%{d}._spf.vali.email ~all"
unh.edu.      300      IN       TXT      "kaLfJr0aINP1W3NsIkMJ54W1nbfYaEq+KB2Sv59vuwk+IvYl3B6oS+BZXTUWwV3sh8g0da8PKaPR06UthtKw=="
unh.edu.      300      IN       TXT      "MS=ms83123557"
unh.edu.      300      IN       TXT      "ecostruxure-it-verification=a5d461d6-381e-414f-a841-406d35adc6de"
unh.edu.      300      IN       TXT      "p97pdo41uabdp794oeslgiqm0c"
unh.edu.      300      IN       TXT      "facebook-domain-verification=365v2rdn8vcv8khorj0t2omd96cjot"
unh.edu.      300      IN       TXT      "google-site-verification=RGZA0mMI8yyY4n5P5CCjwKkFispZEjJDQ0ZPM3n0ihs"
unh.edu.      300      IN       TXT      "bCPyawUYSK6Mb3g4rkXkG8UamHfRF6oPVSuSN+Prgu9eqkpFCjbTD5/Iriv+oY/oiap0gYLVnvsknUbMv3pf5Q=="
unh.edu.      300      IN       TXT      "DZC" "T6MFEfQ"
unh.edu.      300      IN       TXT      "docusign=48670095-e238-4b1c-a4d8-46985245e60c"
unh.edu.      300      IN       TXT      "brevo-code:2234ddef09ed2b8787c6d93f0d819572"
unh.edu.      300      IN       TXT      "Sendinblue-code:160d1089769095a328703e634f5de06f"
unh.edu.      300      IN       TXT      "google-site-verification=EdWChc29r-pivLURIP1-SDQG5x_x7nn52SzSo_WaWUI"
unh.edu.      300      IN       TXT      "adobe-idp-site-verification=c72276468d8ad7daa06fc05b3fb7d859465513ffc061216675fe8bd22b236f12"
```

NAME	TTL	TYPE	RDATA
unh.edu	300	TXT	"v=spf1 include:%{i}._ip.%{h}._ehlo.%{d}._spf.vali.email ~all"
unh.edu	300	TXT	"docusign=48670095-e238-4b1c-a4d8-46985245e60c"
unh.edu	300	TXT	"DZC" "T6MFEfQ"
unh.edu	300	TXT	"facebook-domain verification=365v2rdn8vct2omd96cjot"

Resource Records

(a few of many)



TYPE	Purpose – what RR resolves
SOA	Start of Authority – admin info, primary NS and email
NS	Domain to a name of a authoritative nameserver
A	Name to IPv4 address
AAAA	Name to IPV6 address
MX	Mail eXchange, resolves mail server(s) for domain
PTR	Reverse IP address to a name (eg 99.128.177.132.in-addr.arpa.)
CNAME	Alias name to Canonical (DNS) Name

RFC1035 Early specifications for initial set of DNS Resource Records
www.rfc-editor.org/rfc/rfc1035.html

CNAME Record example

```
agate ~]$ dig unhserves.unh.edu

;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 58316
;; flags: qr rd ra; QUERY: 1, ANSWER: 5, AUTHORITY: 1, ADDITIONAL: 1

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:; udp: 65494
;; QUESTION SECTION:
;unhserves.unh.edu.          IN      A

;; ANSWER SECTION:
unhserves.unh.edu.         7081    IN      CNAME   unh.galaxydigital.com.
unh.galaxydigital.com.    58      IN      CNAME   elb15.galaxydigital.com.
elb15.galaxydigital.com.  58      IN      CNAME   galaxydigital-com-15-2023129066.us-east-1.elb.amazonaws.com.
```

NAME	TYPE	RDATA
unhserves.unh.edu.	CNAME	unh.galaxydigital.com.
unh.galaxydigital.com.	CNAME	elb15.galaxydigital.com.
elb15.galaxydigital.com.	CNAME	galaxydigital-com-15-2023129066.us-east-1.elb.amazonaws.com.
galaxydigital-com-15-2023129066.us-east-1.elb.amazonaws.com.	A	34.199.250.226 (not shown in example above)
galaxydigital-com-15-2023129066.us-east-1.elb.amazonaws.com.	A	52.44.160.248 (not shown in example above)

Name Servers

Using '**dig**' to find name servers

```
dig edu. ns
```

Return list of edu domain name servers

```
:: ANSWER SECTION:
```

```
edu.      20779  IN  NS   g.edu-servers.net.  
edu.      20779  IN  NS   b.edu-servers.net.  
edu.      20779  IN  NS   f.edu-servers.net.  
edu.      20779  IN  NS   d.edu-servers.net.  
edu.      20779  IN  NS   a.edu-servers.net.
```

```
--- CUT content ---
```

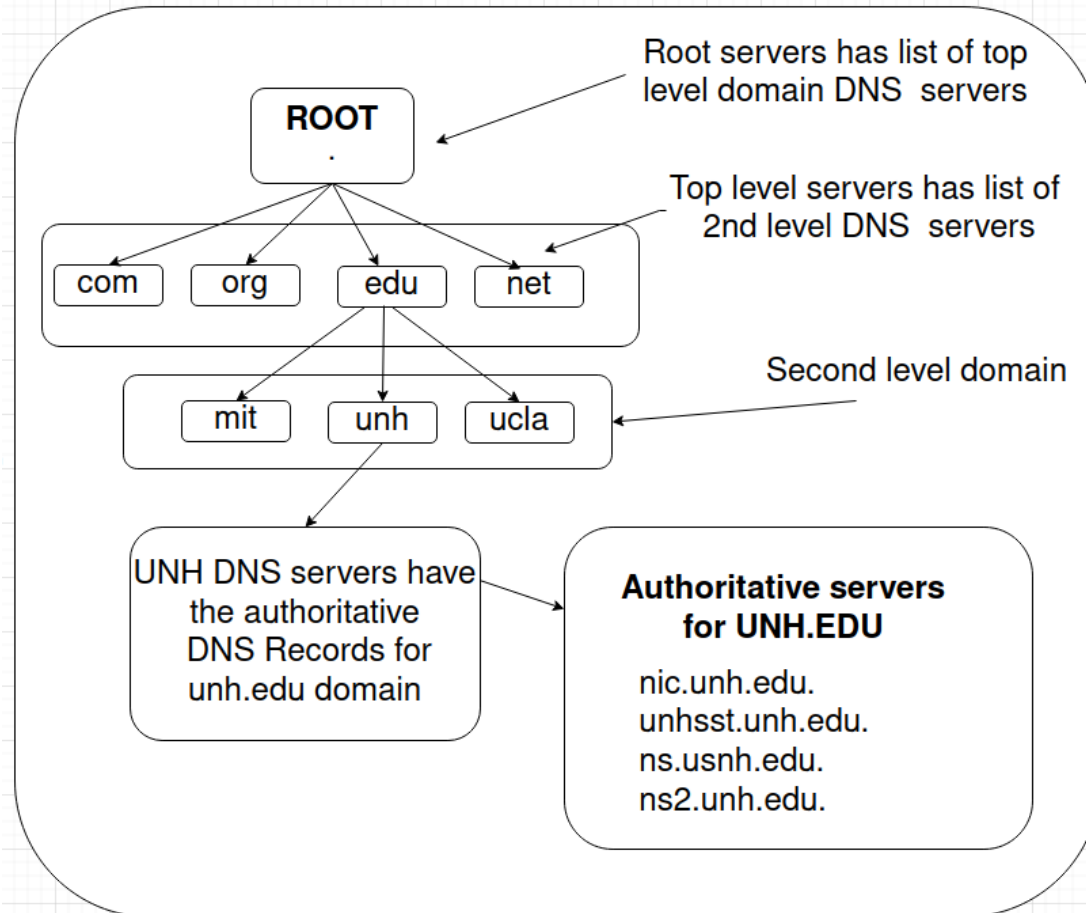
```
:: ADDITIONAL SECTION:
```

```
g.edu-servers.net. 20779 IN A 192.42.93.30  
b.edu-servers.net. 20779 IN A 192.33.14.30  
g.edu-servers.net. 20779 IN AAAA 2001:503:eea3::30
```

```
--- CUT content ---
```

Knows who name servers are for 2nd level edu domains

```
dig unh.edu. ns @nic.unh.edu
```

DNS Hierarchy

root to 2nd level edu domains

```
agate ~]$ dig unh.edu ns @b.edu-servers.net
```

```
;; Got answer:
```

```
;; ->HEADER<<- opcode: QUERY, status: NOERROR, id: 38700
```

```
;; flags: qr rd; QUERY: 1, ANSWER: 0, AUTHORITY: 4, ADDITIONAL: 8
```

```
;; WARNING: recursion requested but not available
```

```
;; OPT PSEUDOSECTION: ; EDNS: version: 0, flags:; udp: 4096
```

```
;; QUESTION SECTION:
```

```
;unh.edu.                IN      NS
```

```
;; AUTHORITY SECTION:
```

```
unh.edu.                172800 IN      NS      nic.unh.edu.
```

```
unh.edu.                172800 IN      NS      unhsst.unh.edu.
```

```
unh.edu.                172800 IN      NS      ns2.unh.edu.
```

```
unh.edu.                172800 IN      NS      ns.usnh.edu.
```

```
;; ADDITIONAL SECTION:
```

```
nic.unh.edu.           172800 IN      A       132.177.128.99
```

```
nic.unh.edu.           172800 IN      AAAA    2606:4100:1800:80::8063
```

```
unhsst.unh.edu.        172800 IN      A       132.177.128.56
```

```
unhsst.unh.edu.        172800 IN      AAAA    2606:4100:1800:80::8038
```

```
ns2.unh.edu.           172800 IN      A       132.177.102.30
```

```
ns2.unh.edu.           172800 IN      AAAA    2606:4100:3fff:102::102:30
```

```
ns.usnh.edu.           172800 IN      A       158.65.126.94
```

```
;; Query time: 103 msec
```

```
;; SERVER: 2001:503:231d::2:30#53(b.edu-servers.net) (UDP)
```

```
;; WHEN: Thu Sep 14 14:49:05 EDT 2023
```

```
;; MSG SIZE rcvd: 263
```

```

agate ~]$ dig unh.edu ns @ns2.unh.edu

; <<>> DiG 9.18.17 <<>> unh.edu ns @ns2.unh.edu
;; global options: +cmd
;; Got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 18944
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 6, AUTHORITY: 0, ADDITIONAL: 9

;; OPT PSEUDOSECTION:
; EDNS: version: 0, flags:: udp: 1220
; COOKIE: 1a42ea3017dd58d22402b46965044657f475a64c8a19a3fb (good)
;; QUESTION SECTION:
;unh.edu.                                IN      NS

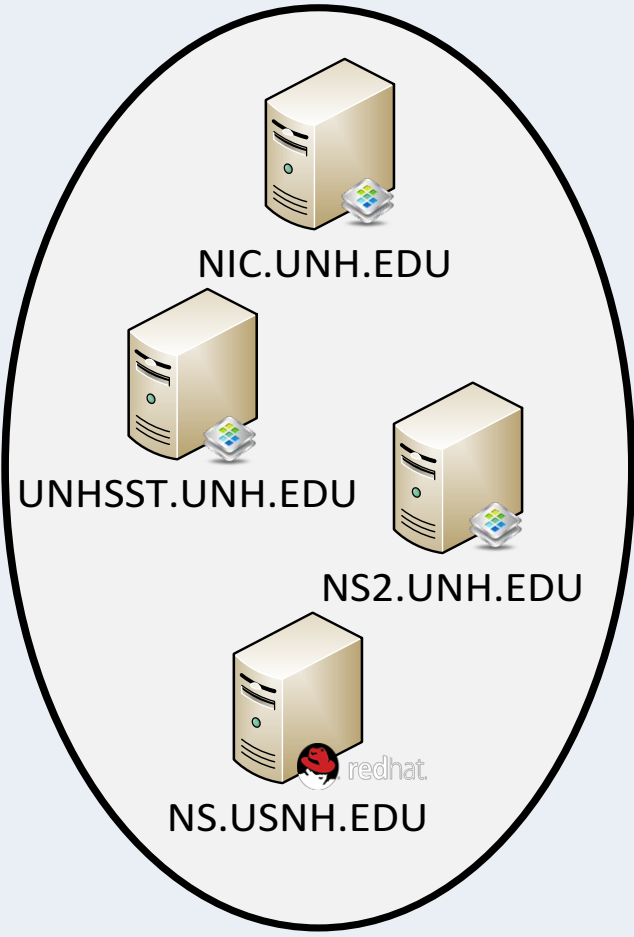
;; ANSWER SECTION:
unh.edu.      86400    IN      NS      unhsst.unh.edu.
unh.edu.      86400    IN      NS      nic.unh.edu.
unh.edu.      86400    IN      NS      ns.usnh.edu.
unh.edu.      86400    IN      NS      psu-ns2.plymouth.edu.
unh.edu.      86400    IN      NS      psu-ns1.plymouth.edu.
unh.edu.      86400    IN      NS      ns2.unh.edu.

;; ADDITIONAL SECTION:
unhsst.unh.edu.  86400    IN      AAAA    2606:4100:1800:80::8038
ns2.unh.edu.    86400    IN      AAAA    2606:4100:3fff:102::102:30
nic.unh.edu.    86400    IN      AAAA    2606:4100:1800:80::8063
psu-ns2.plymouth.edu. 28800    IN      A       158.136.1.101
psu-ns1.plymouth.edu. 28800    IN      A       158.136.1.92
unhsst.unh.edu.  86400    IN      A       132.177.128.56
ns2.unh.edu.    86400    IN      A       132.177.102.30
nic.unh.edu.    86400    IN      A       132.177.128.99

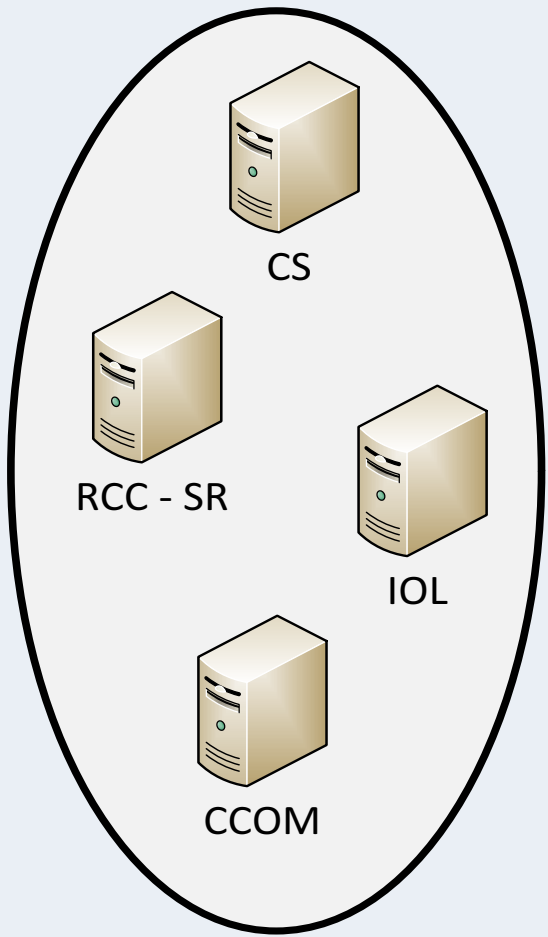
;; Query time: 2 msec
;; SERVER: 2606:4100:3fff:102::102:30#53(ns2.unh.edu) (UDP)
;; WHEN: Fri Sep 15 07:56:07 EDT 2023
;; MSG SIZE rcvd: 360

```

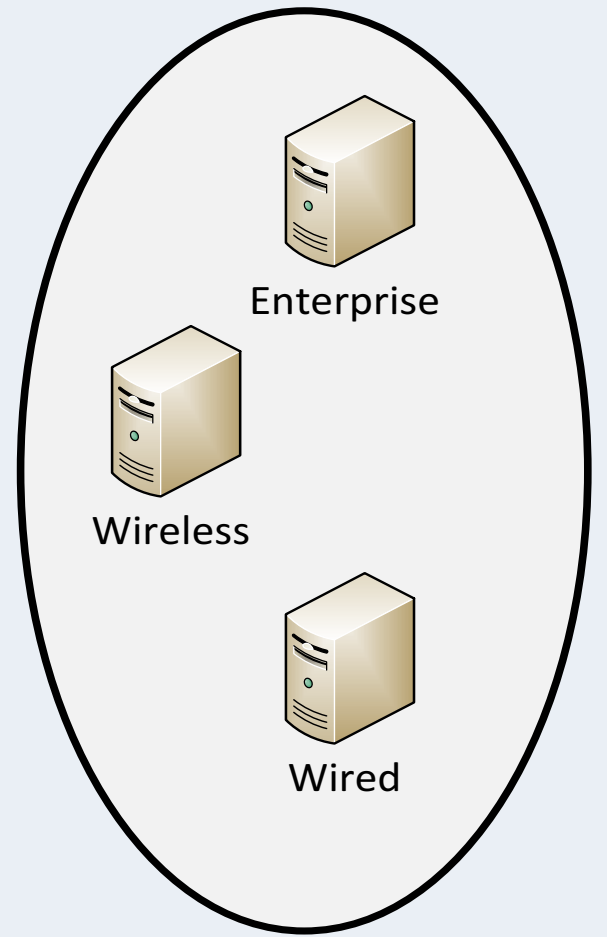
Servers and Roles



UNH
Authoritative



Delegated
Authoritative



Caching

UNH Authoritative DNS

- DNS Records originate here
 - domains - **UNH.EDU & USNH.EDU**
- Main DNS servers are appliances
 - DDI appliance (sold by infoblox.com)
- NS.USNH.EDU
 - RedHat runs BIND (isc.org)
- Delegate sub-domains
 - example – **CS.UNH.EDU & IOL.UNH.EDU**

UNH

Authoritative DNS

- GridMaster manages changes
- DNS servers run independent
- ns.usnh.edu Redhat
 - Disaster Recovery
 - Independent of Infoblox
- Serves
 - several EDU domains
 - com, org & more
 - Delegates to other DNS
- ns.usnh.edu
 - Secondary for Plymouth
 - Independent of Infoblox
- ns2.unh.edu
 - Secondary for Keene

Durham



GridMaster
management

NIC.UNH.EDU
2606:4100:1800:80::8063
132.177.128.99



UNHSST.UNH.EDU
2606:4100:1800:80::8038
132.177.128.56



NS2.UNH.EDU
2606:4100:3fff:102::30
132.177.102.30

Keene



NS.USNH.EDU
158.65.126.94

DNS Home > UNH

unh.edu

Authoritative Zone



Records

Subzones

Quick Filter None

Off

Filter On

[Show Filter](#)[Toggle flat view](#)

Go to

Go

<input type="checkbox"/>	Name	Type	Comment
<input type="checkbox"/>	gs.unh.edu	Authoritative	UNH-GamingDevices_fall2014
<input type="checkbox"/>	green.unh.edu	Authoritative	GREEN-Fresh-rfc1918
<input type="checkbox"/>	fd22.unh.edu	Authoritative	
<input type="checkbox"/>	exres.unh.edu	Authoritative	
<input type="checkbox"/>	dr.unh.edu	Authoritative	UNH-DR_site-Keene
<input type="checkbox"/>	csc24.unh.edu	Authoritative	
<input type="checkbox"/>	cs.unh.edu	Delegation	Computer Science
<input type="checkbox"/>	comptech.unh.edu	Delegation	UNH_Manchester-ComputerTechnology
<input type="checkbox"/>	colsa-buzzr.unh.edu	Delegation	COLSA -Phil Hammond, 2010-0330.
<input type="checkbox"/>	colsa-buzzr-dev.unh.edu	Delegation	COLSA, Phil Hammond, 2010-0330.
<input type="checkbox"/>	cmu.unh.edu	Authoritative	add for m.delgreco, stk 20140610
<input type="checkbox"/>	cat.unh.edu	Authoritative	
<input type="checkbox"/>	blue.unh.edu	Authoritative	for UNH-IT
<input type="checkbox"/>	bas.unh.edu	Authoritative	Building_Automation_Systems
<input type="checkbox"/>	backup.unh.edu	Authoritative	for_ECG_Exagrid_VLAN-670vid
<input type="checkbox"/>	avs.unh.edu	Authoritative	UNH-AT-AVS
<input type="checkbox"/>	atc.unh.edu	Authoritative	AT-Cluster-IPv6
<input type="checkbox"/>	alert.unh.edu	Authoritative	
<input type="checkbox"/>	ad.unh.edu	Authoritative	Microsoft_Active_Directory
<input type="checkbox"/>	ac.unh.edu	Authoritative	AT_Cluster_IPv6



<input type="checkbox"/> Name ▾	Type	Comment
<input type="checkbox"/> 8.e.f.ip6.arpa	Authoritative	Empty_Zone
<input type="checkbox"/> 0.0.1.4.6.0.6.2.ip6.arpa	Authoritative	NetBlock-32
<input type="checkbox"/> 168.192.in-addr.arpa	Authoritative	NIC-ONLY
<input type="checkbox"/> 65.158.in-addr.arpa	Authoritative	Keene_ARPA-Secondary
<input type="checkbox"/> 177.132.in-addr.arpa	Authoritative	
<input type="checkbox"/> 0.0.127.in-addr.arpa	Auto-created	
<input type="checkbox"/> 10.in-addr.arpa	Authoritative	NIC-ONLY
<input type="checkbox"/> yesleadership.org	Authoritative	NIC-NS2-NS
<input type="checkbox"/> whocaresaboutkelsey.com	Authoritative	
<input type="checkbox"/> webmailunhedu.webs.com	Authoritative	RPZ
<input type="checkbox"/> walpole.k12.nh.us	Authoritative	
<input type="checkbox"/> usnhgateway.org	Authoritative	
<input type="checkbox"/> usnh.edu	Authoritative	
<input type="checkbox"/> universityofnewhampshire.college	Authoritative	20150922, test xyz initiative
<input type="checkbox"/> unhtraining.com	Authoritative	
<input type="checkbox"/> unhm.net	Authoritative	UNHM
<input type="checkbox"/> unhbcoe.org	Authoritative	Hosted_By_WebSolutions
<input type="checkbox"/> unh.test	Authoritative	AT-WebSolutions
<input type="checkbox"/> unh.edu	Authoritative	
<input type="checkbox"/> unh.dev	Authoritative	AT-WebSolutions
<input type="checkbox"/> unh.college	Authoritative	20150318, stk@unh.edu

Delegating DNS

- Example CS.UNH.EDU

- add NS Records on parent (nic.unh.edu)

- cs.unh.edu. 86400 IN NS lava.cs.unh.edu.

- cs.unh.edu. 86400 IN A 132.177.4.32

- Delegate sub-domains

- ad.unh.edu

- bas.unh.edu

- 152.177.132.in-addr.arpa

- 0.C.8.3.0.0.1.4.6.0.6.2.ip6.arpa

Delegating DNS

- cs.unh.edu
 - Administrative
 - Separation
- ad.unh.edu
 - Microsoft Active Directory
 - Allow Dynamic changes
- bas.unh.edu & 68.177.132.in-addr.arpa
 - protect and/or hide from public

Check if it is Sub-domain

- Verify a sub-domain

- use `dig <sub-domain> ns`

- **`dig cs.unh.edu ns`**

;; ANSWER SECTION:

```
cs.unh.edu. 600 IN NS cs.unh.edu.
```

```
cs.unh.edu. 600 IN NS lava.cs.unh.edu.
```

- **`dig +trace cs.unh.edu ns`**

- Recursive from the root DNS servers
 - need port 53 (udp) open or fails

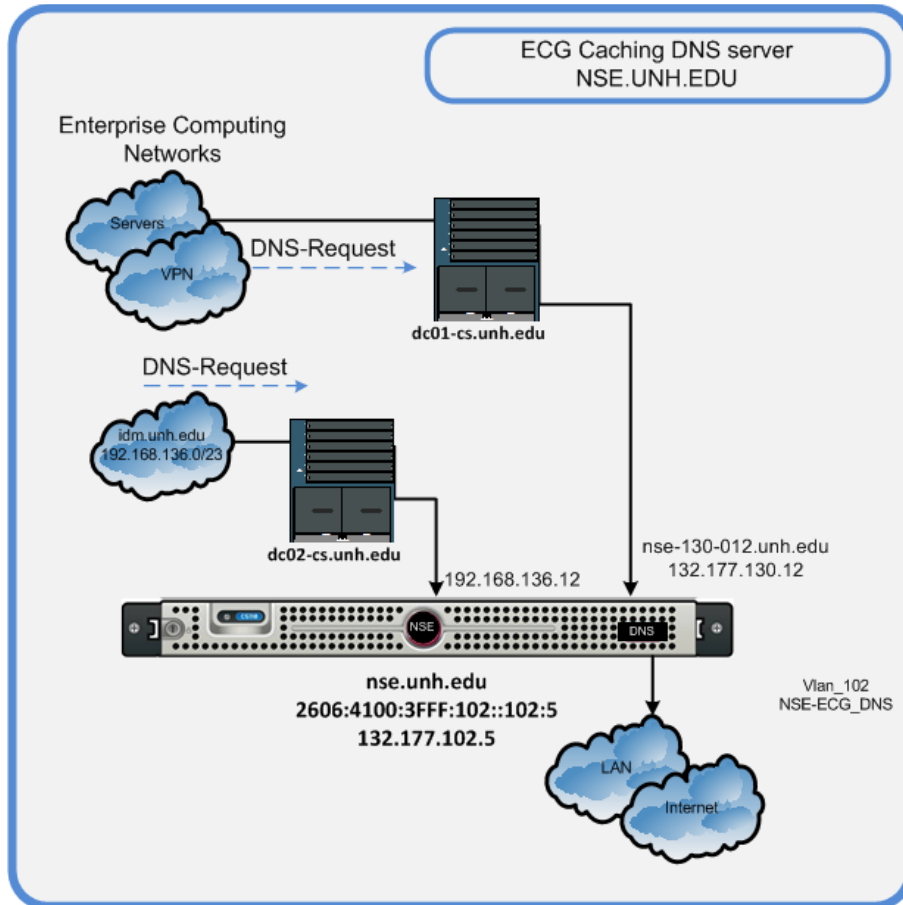
Caching DNS

- Recursive DNS –serves local
- Cache answer for TTL
- NOT Authoritative
- Separation from Auth. & Internet
- Level of protection from DDOS

Caching DNS

- Recursive DNS –
 - serves local
 - temp storage of answer
 - **NOT** Authoritative
 - Separation from Authoritative & Internet
 - some protection from DDOS

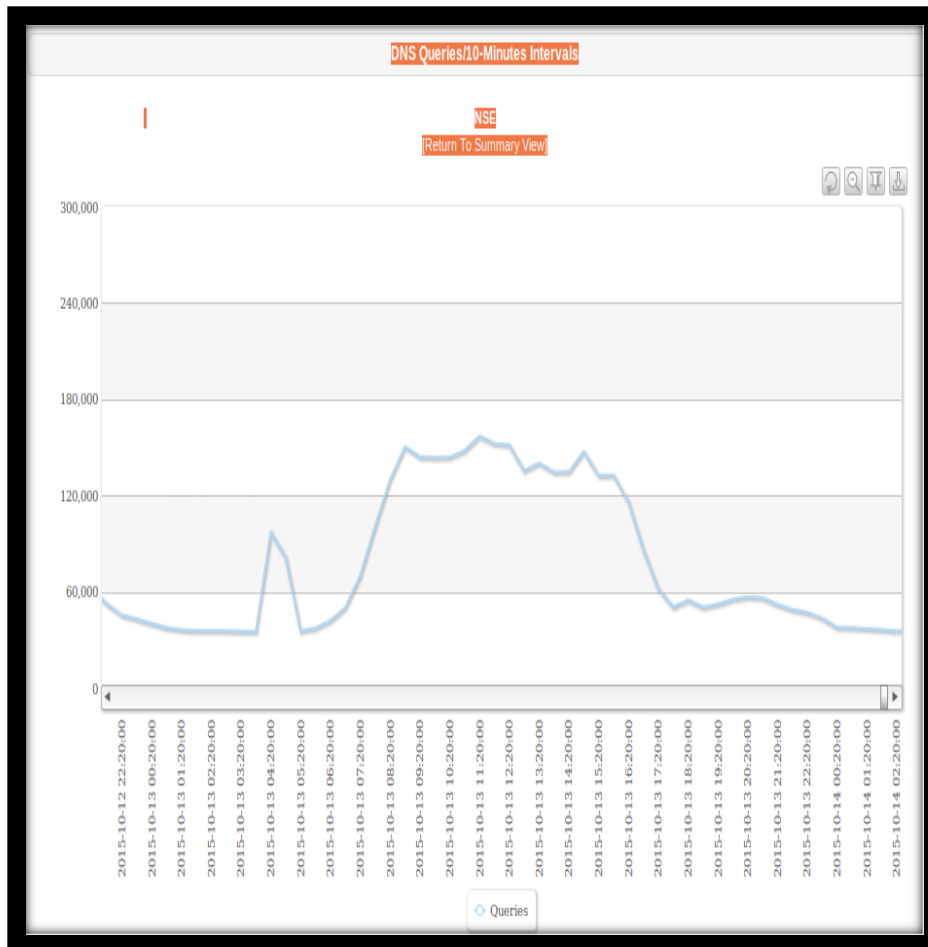
nse.unh.edu - Caching DNS



- Listens on ECG and IDM subnets
- Sends out Vlan 102
- Only internal clients can query DNS
- Location, Data center
- Local network connections

NSE caching queries per second

Normal weekday queries



Normal queries

Peak approx. 2500/second

Top client Queries 11:20 – 11:29

Client DB server (8037)

- - 13 queries/second

VPN client (2833)

- 5 queries/second

nse.unh.edu query log

13-Oct-15 11:50:01.994 q: client 132.177.161.193#22479 query: lb3-black.unh.edu

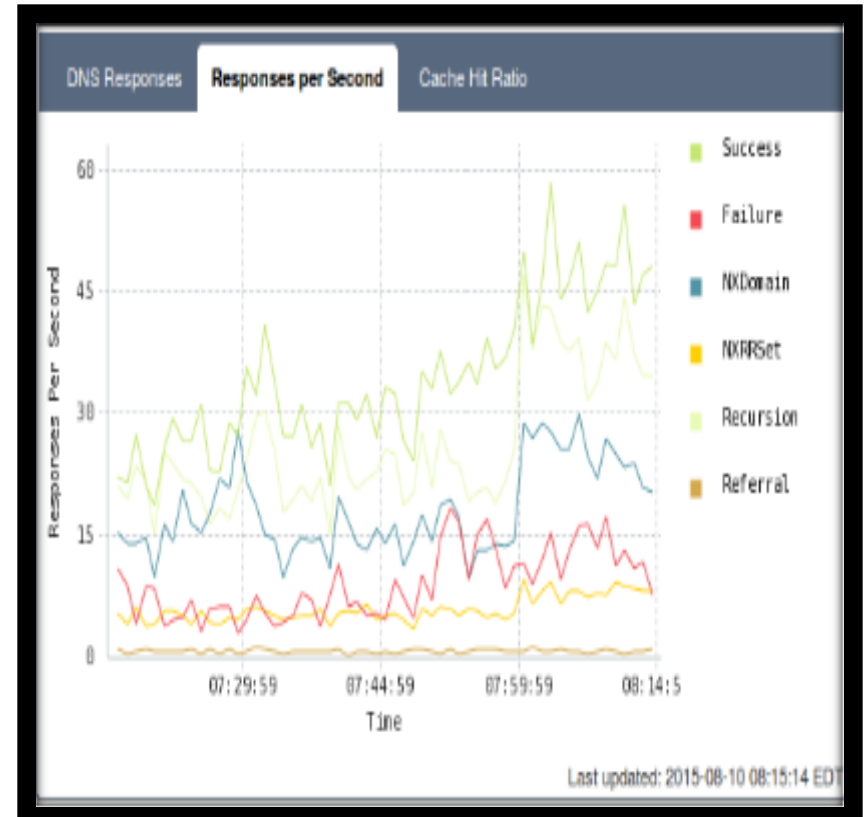
11:50:01.968 132.177.161.193#39875 (180.161.177.132.in-addr.arpa) Q: 180.161.177.132.in-addr.arpa IN PTR + (192.168.102.5)
11:50:01.994 132.177.161.193#22479 (lb3-black.unh.edu) Q: lb3-black.unh.edu IN A + (192.168.102.5)
11:50:02.130 132.177.161.193#22860 (lb3-black.unh.edu) Q: lb3-black.unh.edu IN A + (192.168.102.5)
11:50:02.250 132.177.161.193#30147 (lb3-black.unh.edu) Q: lb3-black.unh.edu IN A + (192.168.102.5)
11:50:02.361 132.177.161.193#28911 (lb3-black.unh.edu) Q: lb3-black.unh.edu IN A + (192.168.102.5)
11:50:02.467 132.177.161.193#21597 (lb3-black.unh.edu) Q: lb3-black.unh.edu IN A + (192.168.102.5)
11:50:02.569 132.177.161.193#52978 (lb3-black.unh.edu) Q: lb3-black.unh.edu IN A + (192.168.102.5)
11:50:02.673 132.177.161.193#50610 (lb3-black.unh.edu) Q: lb3-black.unh.edu IN A + (192.168.102.5)
11:50:02.753 132.177.161.193#52939 (lb3-black.unh.edu) Q: lb3-black.unh.edu IN A + (192.168.102.5)
11:53:01.900 132.177.161.193#34319 (pencil.unh.edu) Q: pencil.unh.edu IN AAAA + (192.168.102.5)
11:53:01.901 132.177.161.193#22062 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:01.913 132.177.161.193#46408 (pencil.unh.edu) Q: pencil.unh.edu IN AAAA + (192.168.102.5)
11:53:01.914 132.177.161.193#52382 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:01.964 132.177.161.193#41402 (52.161.177.132.in-addr.arpa) Q: 52.161.177.132.in-addr.arpa IN PTR + (192.168.102.5)
11:53:01.966 132.177.161.193#30622 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:01.968 132.177.161.193#24242 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:01.969 132.177.161.193#44205 (52.161.177.132.in-addr.arpa) Q: 52.161.177.132.in-addr.arpa IN PTR + (192.168.102.5)
11:53:01.971 132.177.161.193#42586 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:01.972 132.177.161.193#34541 (52.161.177.132.in-addr.arpa) Q: 52.161.177.132.in-addr.arpa IN PTR + (192.168.102.5)
11:53:01.973 132.177.161.193#53834 (52.161.177.132.in-addr.arpa) Q: 52.161.177.132.in-addr.arpa IN PTR + (192.168.102.5)
11:53:01.974 132.177.161.193#18784 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:01.974 132.177.161.193#22564 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:01.975 132.177.161.193#26878 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:01.976 132.177.161.193#52517 (52.161.177.132.in-addr.arpa) Q: 52.161.177.132.in-addr.arpa IN PTR + (192.168.102.5)
11:53:01.977 132.177.161.193#33120 (52.161.177.132.in-addr.arpa) Q: 52.161.177.132.in-addr.arpa IN PTR + (192.168.102.5)
11:53:01.982 132.177.161.193#43594 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:01.983 132.177.161.193#30019 (52.161.177.132.in-addr.arpa) Q: 52.161.177.132.in-addr.arpa IN PTR + (192.168.102.5)
11:53:01.985 132.177.161.193#37300 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:01.986 132.177.161.193#28130 (52.161.177.132.in-addr.arpa) Q: 52.161.177.132.in-addr.arpa IN PTR + (192.168.102.5)
11:53:02.094 132.177.161.193#51282 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:02.097 132.177.161.193#28778 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:02.128 132.177.161.193#18951 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:02.130 132.177.161.193#40745 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)
11:53:02.134 132.177.161.193#27932 (pencil.unh.edu) Q: pencil.unh.edu IN A + (192.168.102.5)

Query per seconds

Flooding queries



Normal queries



Dynamic DNS

- Add, Delete, Modify DNS Records
- By some type of ACL
 - IP address range (eg. 132.177.154.0/24)
 - TSIG, Key based method, pub/private
 - DHCP – allowed, uses TXT KEYs for authorization
- What are the benefits?
- What problems might this introduce?

DYNAMIC Records added by DHCP Servers

android-20e04ff00aa41224.yfi.unh.edu. 1800 IN A 10.20.117.120

android-20e04ff00aa41224.yfi.unh.edu. 1800 IN TXT "31a6d863566147dadeac47a2f9d05cef42"

android-20e04ff00aa43438.yfi.unh.edu. 1800 IN A 10.20.192.133

android-20e04ff00aa43438.yfi.unh.edu. 1800 IN TXT "316898c737fa8f778f3beae80fa193e7ef"

bobs-iphone.yfi.unh.edu. 1800 IN TXT "31c661ed44d84143bce6e889e83d28e6aa"

bobs-iphone.yfi.unh.edu. 1800 IN A 10.20.177.222

stevesiphone.yfi.unh.edu. 900 IN TXT "31f48b06e39b39862c10d685379f634ae4"

stevesiphone.yfi.unh.edu. 900 IN A 10.20.43.69

canoe.ad.unh.edu. 1800 IN TXT "31c99b6c34d7bcfa38dd2005ccb93baefd"

canoe.ad.unh.edu. 1800 IN A 132.177.214.205

DNS Security Extensions

Authenticity & Integrity of answer

Adds six new DNS Record Records

Public Private Key pair

chain of trust (must trust ROOT DNS)

RRSIG (digital signature)	NSEC (proof of nonexistence)
DNSKEY (public key)	NSEC3 (proof of nonexistence)
DS (parent-child)	NSEC3PARAM (proof of nonexistence)

DNS Security Extensions

```
dig @8.8.8.8 www.it710.net A +dnssec +multiline
```

Answer – Address Record

```
www.it710.net.      300 IN A   132.177.132.99
```

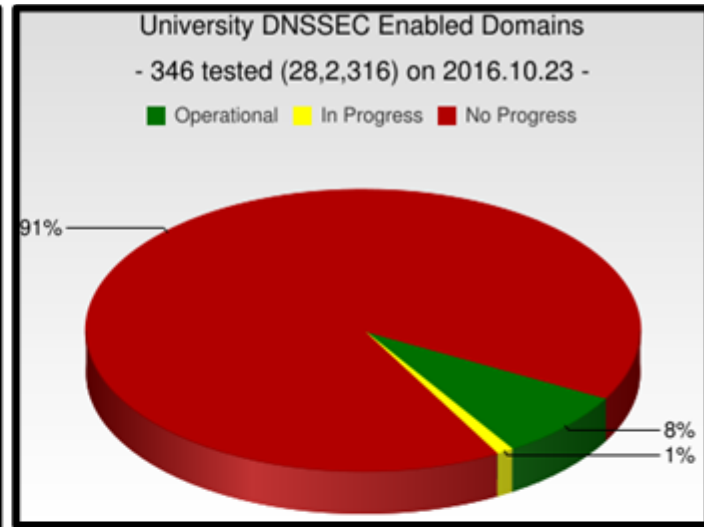
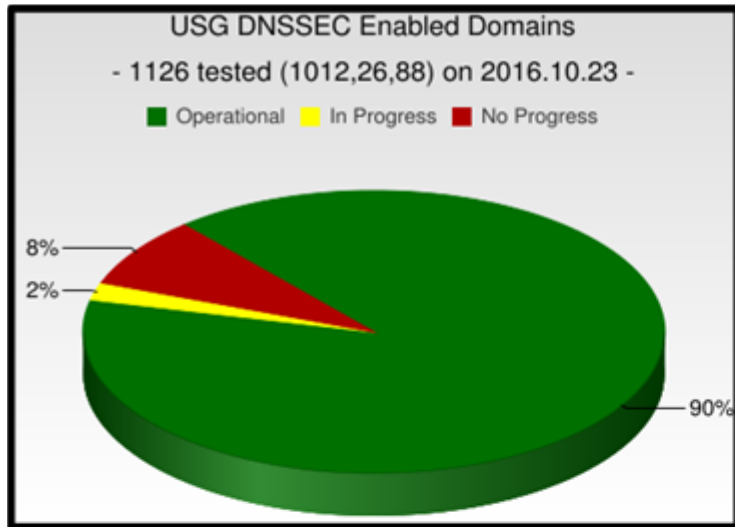
```
=====
```

RR Signature

```
www.it710.net.      300 IN RRSIG A 5 3 300 (
20161028003420 20161024001451 10863 it710.net.
```

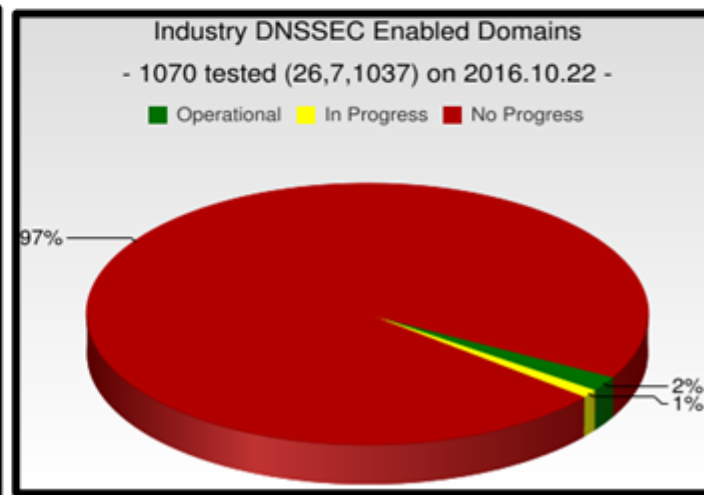
```
lLhTy/mx911GHyaGHhGxqi8SD8NuQfN1YdB2GfKAELgw
zmyHNlC4uyyg5Zpzclp0qHuYlWm2LSXU09ypsw+hdG4M
h7lMMmlhkxw2mXucMsSVo5NIhjjifDlwgvsEeDJE/Wc
mGJD90Nq21NgsXbm5LmjlkAPiAdX3Rd9m3YoJL4=)
```

DNSSEC statistics - nist.gov

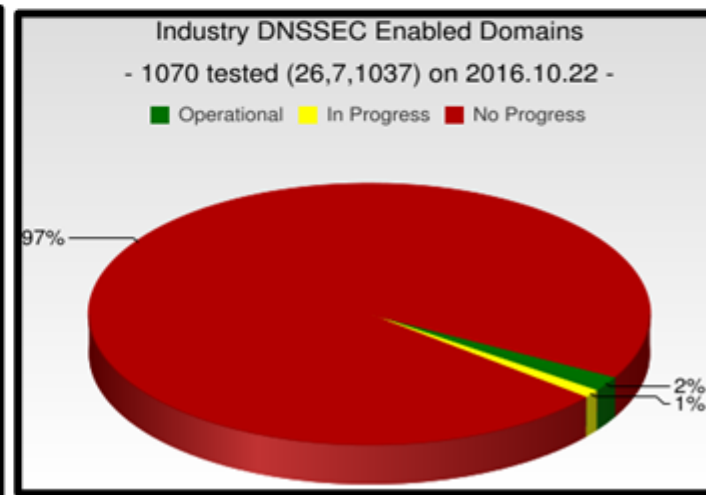
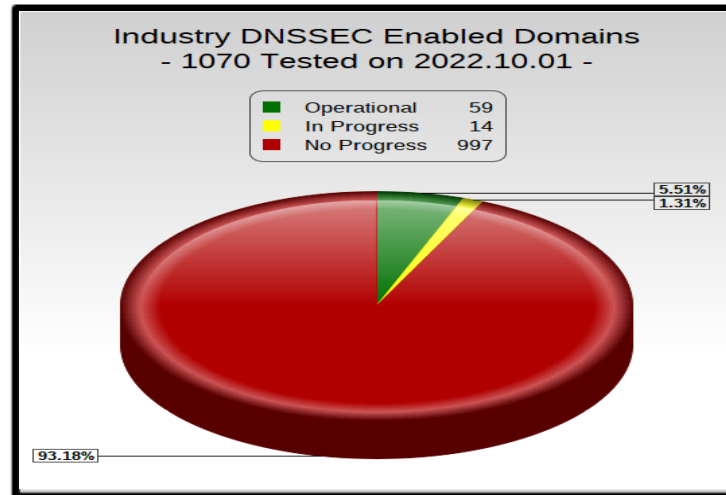
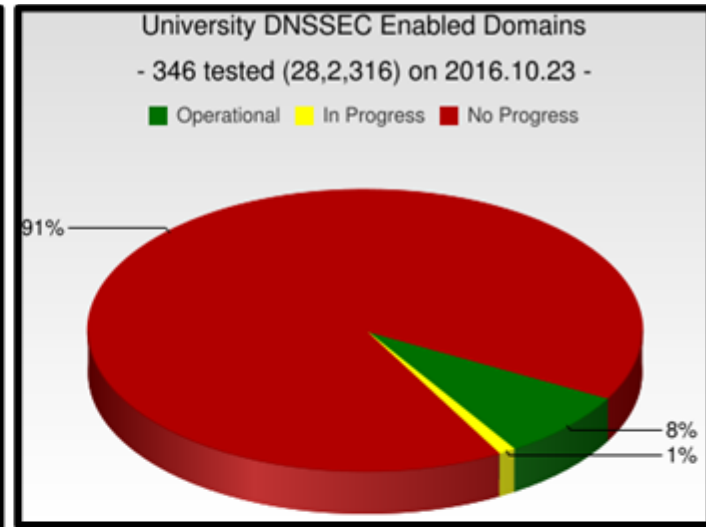
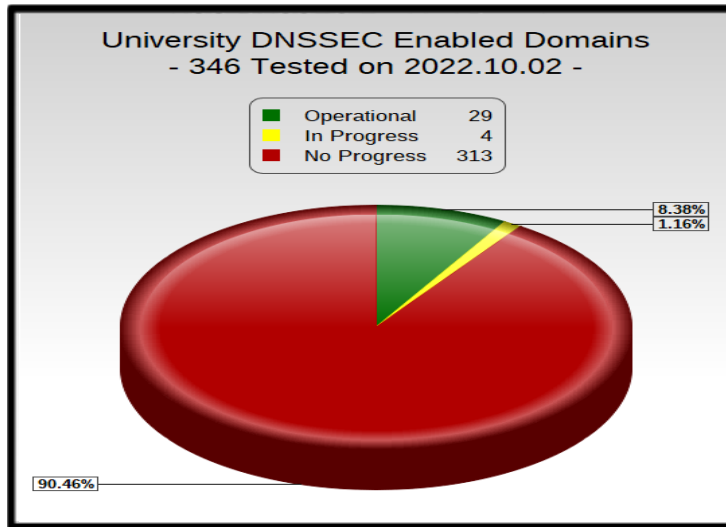


DNSSEC Progress October 2016

ORG	working	Progress	None
USG	90%	2%	8%
University	8%	1%	91%
Industry	2%	1%	97%



DNSSEC 2022 compare 2016





University of
New Hampshire

University of New Hampshire

DNS Overview

Thank You

Scott Kitterman

stk@cs.unh.edu