# BIND Part 2

pschiu

# BIND Configuration – named.conf view (1)

- The "view" statement
  - Create a different view of DNS naming hierarchy for internal machines
    - Restrict the external view to few well-known servers
    - Supply additional records to internal users
  - Also called "split DNS"
  - In-order processing
    - Put the most restrictive view first
  - All-or-nothing
    - All zone statements in your named.conf file must appear in the content of view

# BIND Configuration – named.conf view (2)

- Syntax

  view view-name {
  match_clients {address_match_list};
  view_options;
  zone_statement;
  };

- Example

```
view "internal" {
    match-clients { our_nets; };
    recursion yes;
    zone "cs.nctu.edu.tw" {
        type master;
        file "named-internal-cs";
    };
};
view "external" {
    match-clients { any; };
    recursion no;
    zone "cs.nctu.edu.tw" {
        type master;
        file "named-external-cs";
    };
};
```

# BIND Configuration
# – named.conf controls

❑ The "controls" statement

- Specify how the named server listens for control message
- Syntax

  **controls** {

  **inet** ip_addr **allow** {address_match_list} **keys** {key-id;};

  };

- Example:

```
key "rndc_key" {
    algorithm  hmac-md5;
    secret "GKnELuie/G99NpOC2/AXwA==";
};
```

include "/etc/named/rndc.key";

controls {

inet 127.0.0.1 allow { 127.0.0.1; } keys { rndc_key; };

}

```
SYNOPSIS
        rndc [-c config-file] [-k key-file] [-s server] [-p port] [-
              [-y key_id] {command}
```

# Updating zone files

- ❑ Master
  - Edit zone files
    - ➢ Serial number
    - ➢ Forward and reverse zone files for single IP
  - Do “rndc reload”
    - ➢ “notify” is on, slave will be notify about the change
    - ➢ “notify” is off, refresh timeout, or do “rndc reload” in slave
- ❑ Zone transfer
  - DNS zone data synchronization between master and slave servers
  - AXFR (all zone data are transferred at once, before BIND8.2)
  - IXFR (incremental updates zone transfer)
  - TCP port 53

# Non-byte boundary (1)

❑ In normal reverse configuration:

- named.conf will define a zone statement for each reverse subnet zone and
- Your reverse db will contains lots of PTR records
- Example:

```
zone "1.168.192.in-addr.arpa." {
    type master;
    file "named.rev.1";
    allow-query {any;};
    allow-update {none;};
    allow-transfer {localhost;};
};
```

```
$TTL      3600
$ORIGIN 1.168.192.in-addr.arpa.
@         IN      SOA     lwhsu.csie.net lwhsu.lwhsu.csie.net.  (
                          2007050401      ; Serial
                          3600            ; Refresh
                          900             ; Retry
                          7D              ; Expire
                          2H )            ; Minimum
          IN      NS      ns.lwhsu.csie.net.
254       IN      PTR     ns.lwhsu.csie.net.
1         IN      PTR     www.lwhsu.csie.net.
2         IN      PTR     ftp.lwhsu.csie.net.
…
```

# Non-byte boundary (2)

- ❑ What if you want to delegate 192.168.2.0 to another sub-domain
  - Parent
    - **Remove** forward db about 192.168.2.0/24 network
      - Ex:

```
pc1.lwhsu.csie.net.   IN   A    192.168.2.35
pc2.lwhsu.csie.net.   IN   A    192.168.2.222
…
```

    - **Remove** reverse db about 2.168.192.in-addr.arpa
      - Ex:

```
35.2.168.192.in-addr.arpa.    IN   PTR   pc1.lwhsu.csie.net.
222.2.168.192.in-addr.arpa.   IN   PTR   pc2.lwhsu.csie.net.
…
```

    - Add glue records about the name servers of sub-domain
      - Ex: in zone db of "lwhsu.csie.net"

```
sub1           IN           NS    ns.sub1.lwhsu.csie.net.
ns.sub1        IN           A     192.168.2.1
```

      - Ex: in zone db of "168.192.in-addr.arpa."

```
2   IN         NS    ns.sub1.lwhsu.csie.net.
ns.sub1        IN           A     192.168.2.1
```

# Non-byte boundary (3)

- ❑ What if you want to delegate 192.168.3.0 to four sub-domains (a /26 network)
  - 192.168.3.0 ~ 192.168.3.63
    - ➢ ns.sub1.lwhsu.csie.net.
  - 192.168.3.64 ~ 192.168.3.127
    - ➢ ns.sub2.lwhsu.csie.net.
  - 192.168.3.128 ~ 192.168.3.191
    - ➢ ns.sub3.lwhsu.csie.net.
  - 192.168.3.192 ~ 192.168.3.255
    - ➢ ns.sub4.lwhsu.csie.net.

- ❑ It is easy for forward setting
  - In zone db of lwhsu.csie.net

```
➢ sub1        IN     NS   ns.sub1.lwhsu.csie.net.
➢ ns.sub1     IN     A    1921.68.3.1
➢ sub2        IN     NS   ns.sub2.lwhsu.csie.net.
➢ ns.sub2     IN     A    192.168.3.65
➢ …
```

# Non-byte boundary (4)

- Non-byte boundary reverse setting
  - Method1

```
$GENERATE 0-63       $.3.168.192.in-addr.arpa.   IN   NS    ns.sub1.lwhsu.csie.net.
$GENERATE 64-127     $.3.168.192.in-addr.arpa.   IN   NS    ns.sub2.lwhsu.csie.net.
$GENERATE 128-191    $.3.168.192.in-addr.arpa.   IN   NS    ns.sub3.lwhsu.csie.net.
$GENERATE 192-255    $.3.168.192.in-addr.arpa.   IN   NS    ns.sub4.lwhsu.csie.net.

And

zone “1.3.168.192.in-addr.arpa.” {
    type master;
    file “named.rev.192.168.3.1”;
};

; named.rev.192.168.3.1
@   IN   SOA    sub1.lwhsu.csie.net. root.sub1.lwhsu.csie.net. (1;3h;1h;1w;1h)
    IN   NS     ns.sub1.lwhsu.csie.net.
```

# Non-byte boundary (5)

- Method2

```
$ORIGIN  3.168.192.in-addr.arpa.
$GENERATE  1-63            $          IN    CNAME      $.0-63.3.168.192.in-addr.arpa.
0-63.3.168.192.in-addr.arpa.                      IN    NS            ns.sub1.lwhsu.csie.net.
$GENERATE  65-127          $                      IN    CNAME      $.64-127.3.168.192.in-
   addr.arpa.
64-127.3.168.192.in-addr.arpa.        IN    NS             ns.sub2.lwhsu.csie.net.
$GENERATE  129-191         $          IN    CNAME      $.128-191.3.168.192.in-addr.arpa.
128-191.3.168.192.in-addr.arpa.       IN    NS             ns.sub3.lwhsu.csie.net.
$GENERATE  193-255         $          IN    CNAME      $.192-255.3.168.192.in-addr.arpa.
192-255.3.168.192.in-addr.arpa.       IN    NS             ns.sub4.lwhsu.csie.net.

zone "0-63.3.168.192.in-addr.arpa." {
   type master;
   file "named.rev.192.168.3.0-63";
};
```

```
      ; named.rev.192.168.3.0-63
      @    IN    SOA    sub1.lwhsu.csie.net. root.sub1.lwhsu.csie.net. (1;3h;1h;1w;1
            IN    NS      ns.sub1.lwhsu.csie.net.
1     IN    PTR  www.sub1.lwhsu.csie.net.
2    IN    PTR  abc.sub1.lwhsu.csie.net.
…
```

# BIND Security

# Security
# – named.conf security configuration

- ❑ Security configuration

| Feature | Config. Statement | comment |
|---|---|---|
| allow-query | options, zone | Who can query |
| allow-transfer | options, zone | Who can request zone transfer |
| allow-update | zone | Who can make dynamic updates |
| blackhole | options | Which server to completely ignore |
| bogus | server | Which servers should never be queried |

# Security – With TSIG (1)

- TSIG (Transaction SIGnature)
  - Developed by IETF (RFC2845)
  - Symmetric encryption scheme to sign and validate DNS requests and responses between servers
  - Algorithm in BIND9
    - HMAC-MD5, HMAC-SHA1, HMAC-SHA224, HMAC-SHA256, HMAC-SHA384, HMAC-SHA512
  - Usage
    - Prepare the shared key with dnssec-keygen
    - Edit "key" statement
    - Edit "server" statement to use that key
    - Edit "zone" statement to use that key with:
      - allow-query
      - allow-transfer
      - allow-update

# Security
# – With TSIG (2)

- TSIG example (dns1 with dns2)

1. % dnssec-keygen –a HMAC-MD5 –b 128 –n HOST cs

```
% dnssec-keygen -a HMAC-MD5 -b 128 -n HOST cs
Kcs.+157+35993
% cat Kcs.+157+35993.key
cs.  IN KEY 512 3 157 oQRab/QqXHVhkyXi9uu8hg==
```

```
% cat Kcs.+157+35993.private
Private-key-format: v1.2
Algorithm: 157 (HMAC_MD5)
Key: oQRab/QqXHVhkyXi9uu8hg==
```

2. Edit /etc/named/dns1-dns2.key

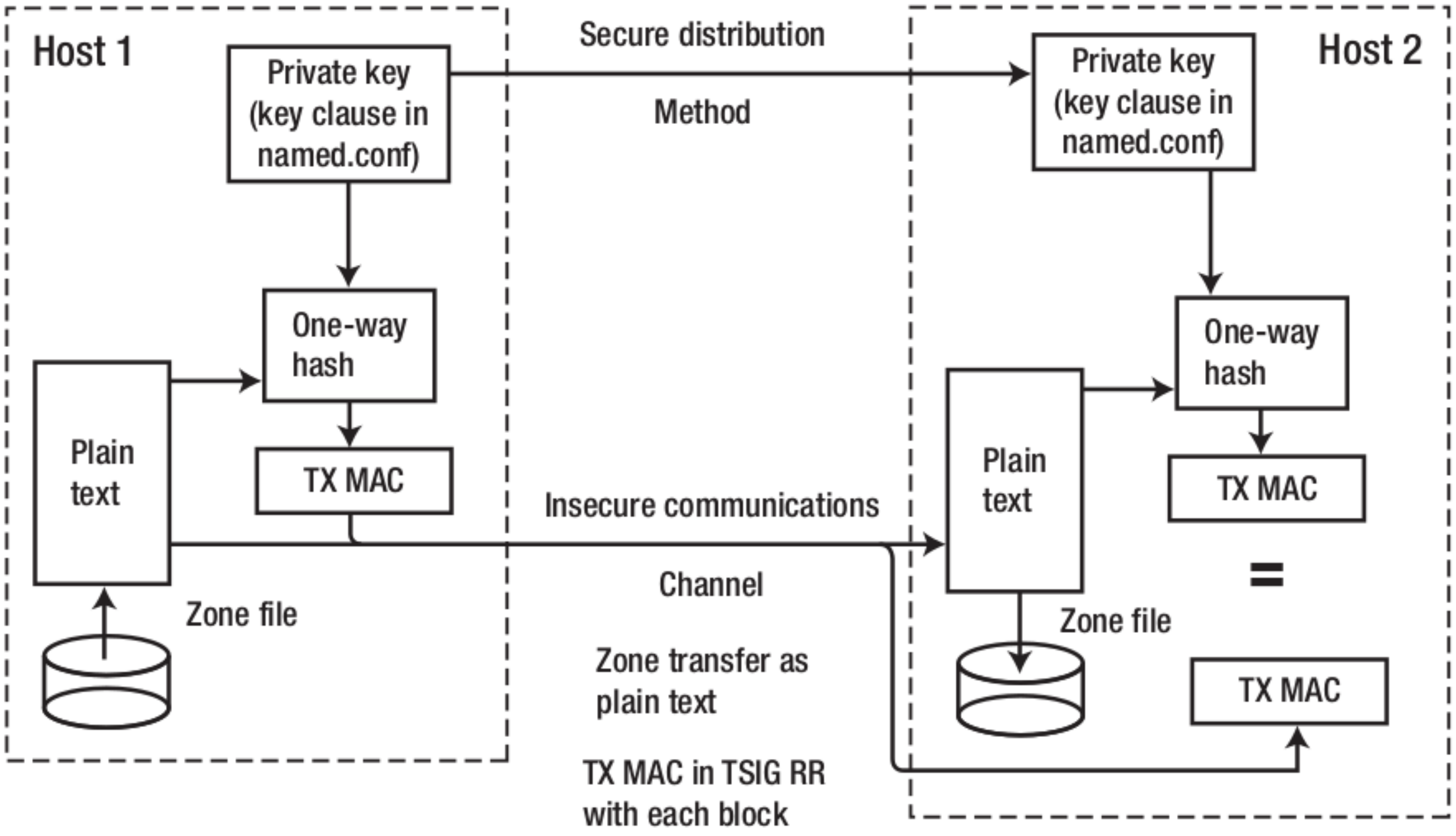
```
key dns1-dns2 {
    algorithm hmac-md5;
    secret “oQRab/QqXHVhkyXi9uu8hg==”
};
```

3. Edit both named.conf of dns1 and dns2
   - Suppose dns1 = 140.113.235.107 dns2 = 140.113.235.103

```
include  “dns1-dns2.key”
server 140.113.235.103 {
    keys {dns1-dns2;};
};
```

```
include  “dns1-dns2.key”
server 140.113.235.107 {
    keys {dns1-dns2;};
};
```

# Security
# – With TSIG (3)



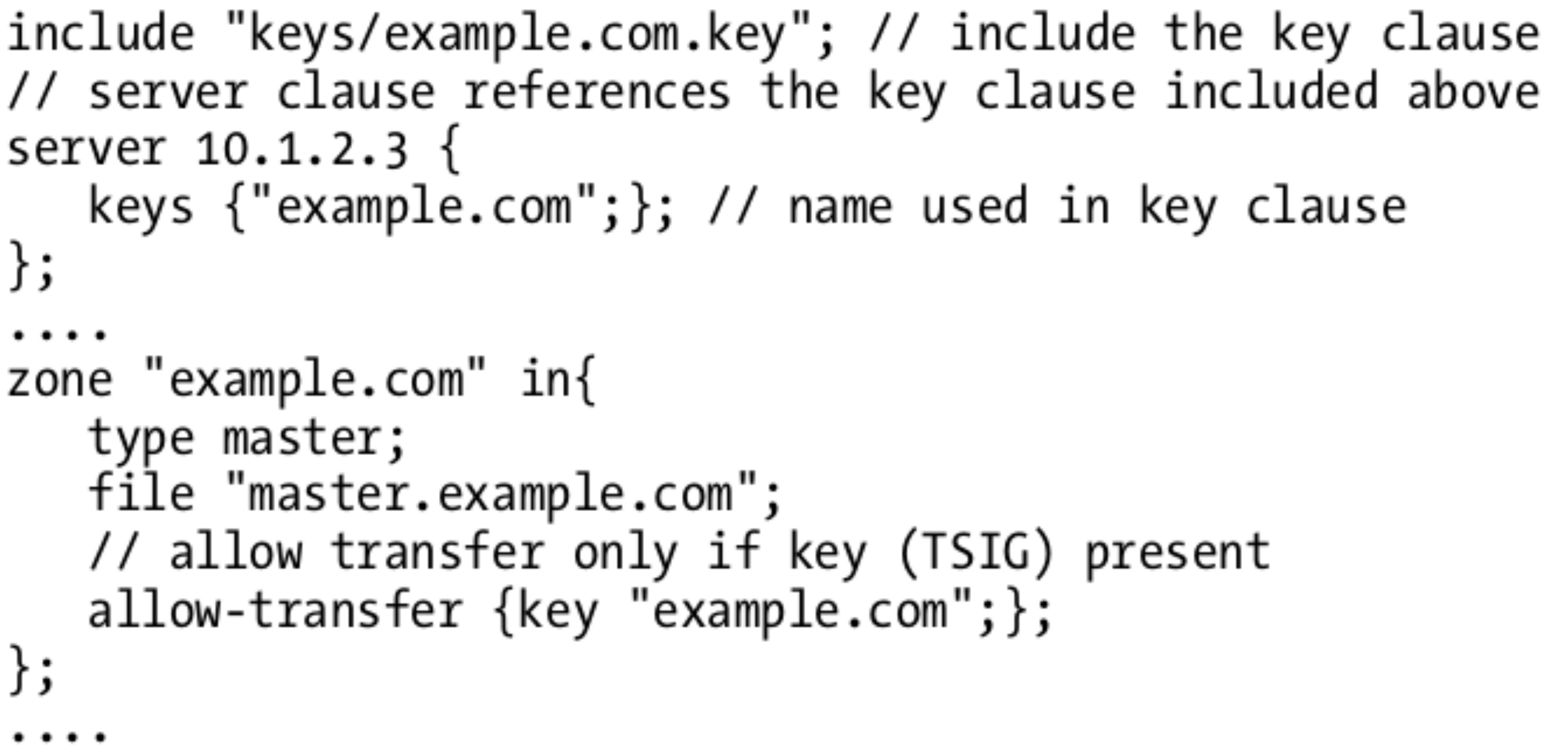
# Security
## – Securing zone transfer

❑ Securing zone transfer with ACL

```
zone “example.com” in {
        type master;
        file “host”;
        allow-transfer { trusted; 192.168.10.2; };
};
```

# Security
## – Securing zone transfer

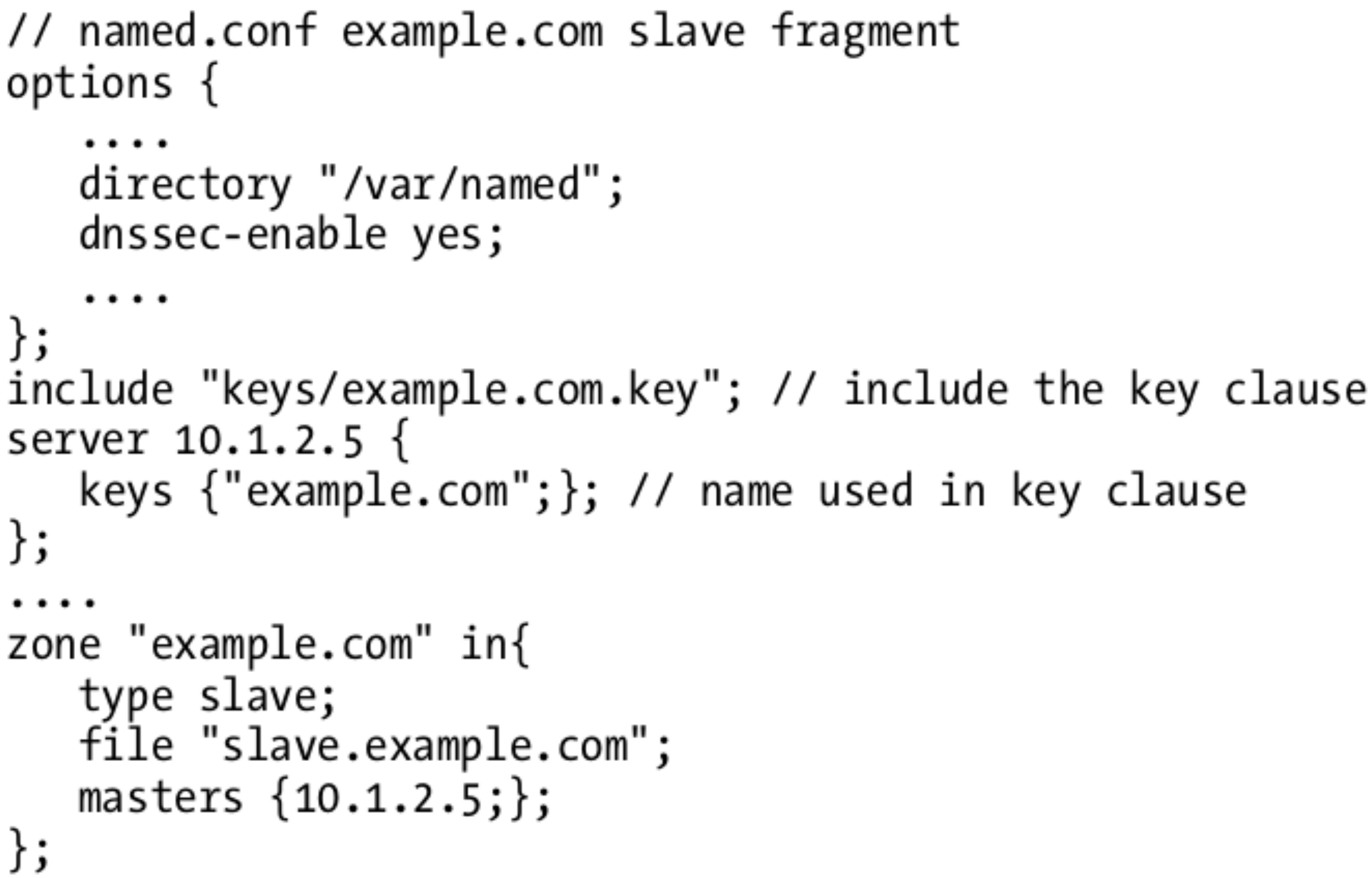
- ❑Securing zone transfer with Key (***Master***)



```
include "keys/example.com.key"; // include the key clause
// server clause references the key clause included above
server 10.1.2.3 {
   keys {"example.com";}; // name used in key clause
};
....
zone "example.com" in{
   type master;
   file "master.example.com";
   // allow transfer only if key (TSIG) present
   allow-transfer {key "example.com";};
};
....
```

# Security – Securing zone transfer

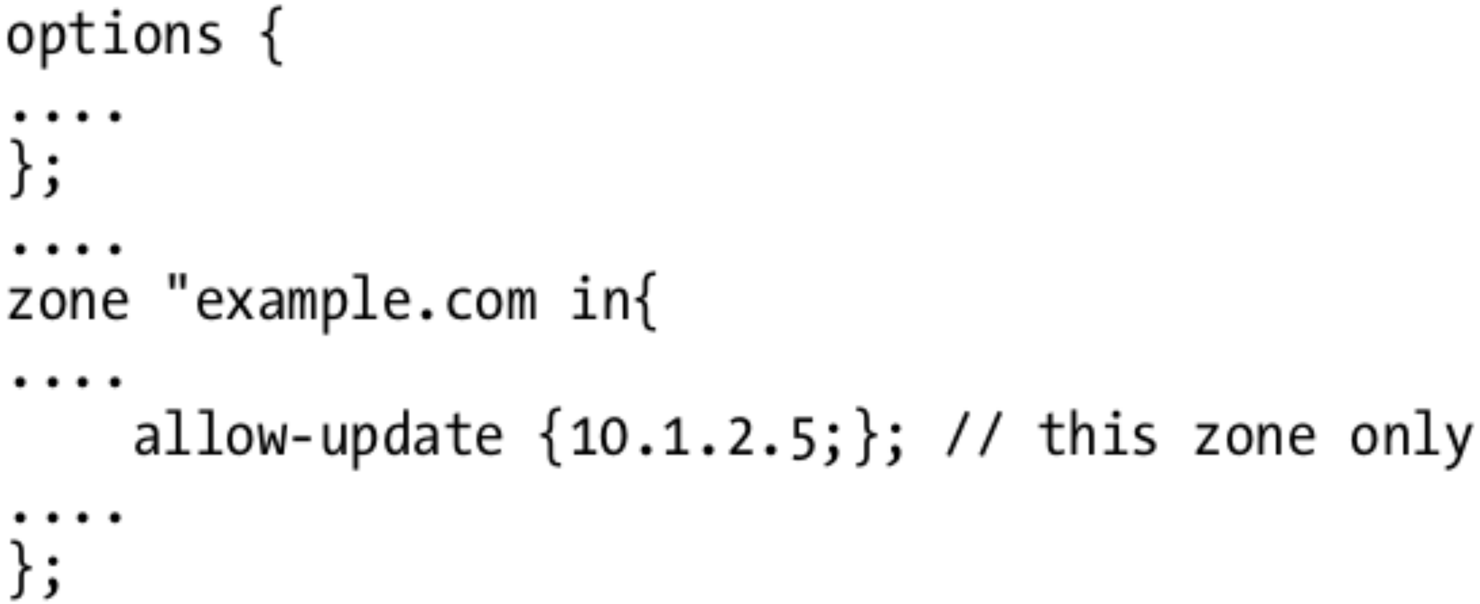
- ❑Securing zone transfer with TSIG (***Slave***)



```
// named.conf example.com slave fragment
options {
   ....
   directory "/var/named";
   dnssec-enable yes;
   ....
};
include "keys/example.com.key"; // include the key clause
server 10.1.2.5 {
   keys {"example.com";}; // name used in key clause
};
....
zone "example.com" in{
   type slave;
   file "slave.example.com";
   masters {10.1.2.5;};
};
```

# Security
## – Securing dynamic update

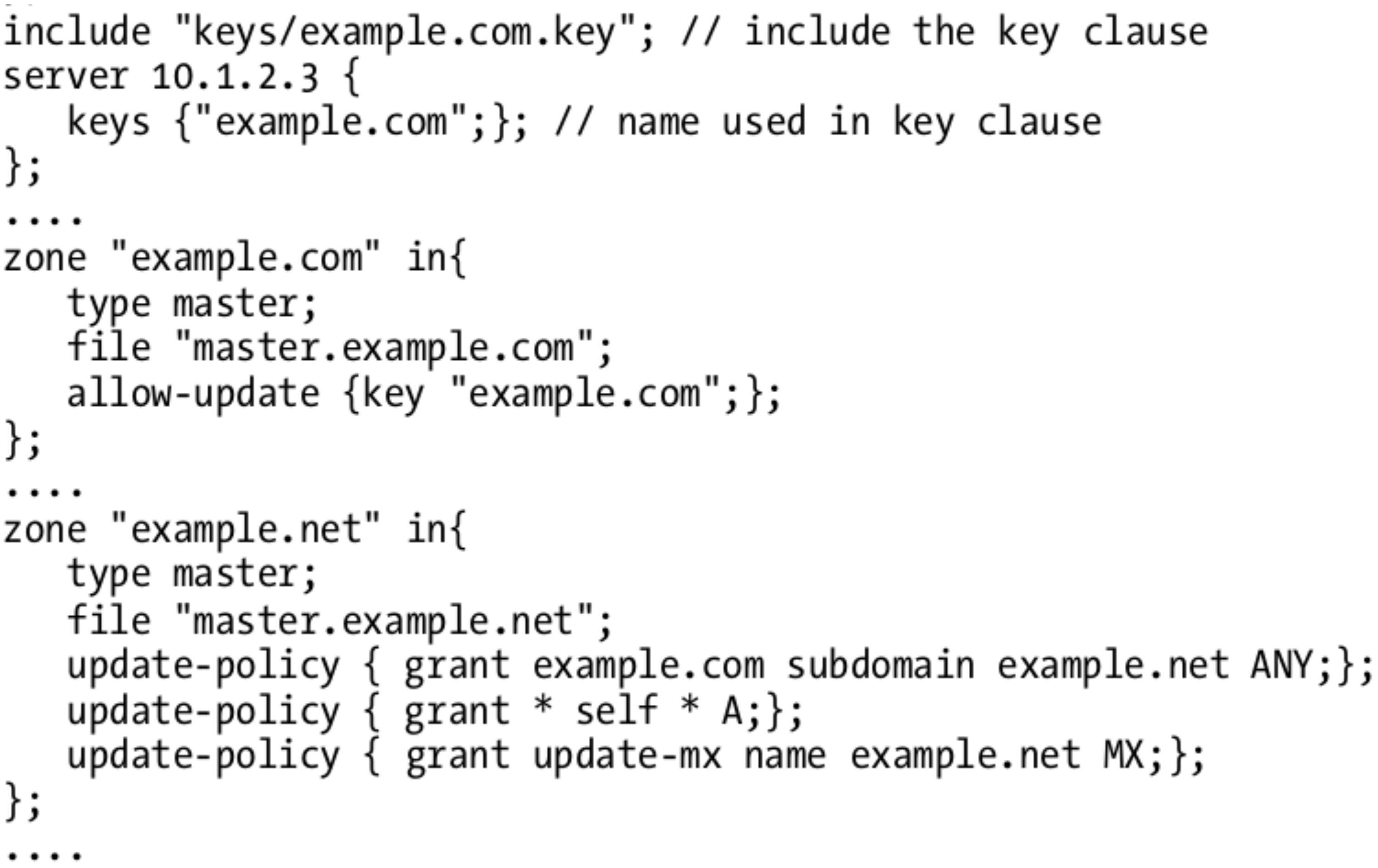
- ❑Securing dynamic update with ACL



```
options {
....
};
....
zone "example.com in{
....
    allow-update {10.1.2.5;}; // this zone only
....
};
```

# Security
## – Securing dynamic update

- ❑Securing dynamic update with TSIG



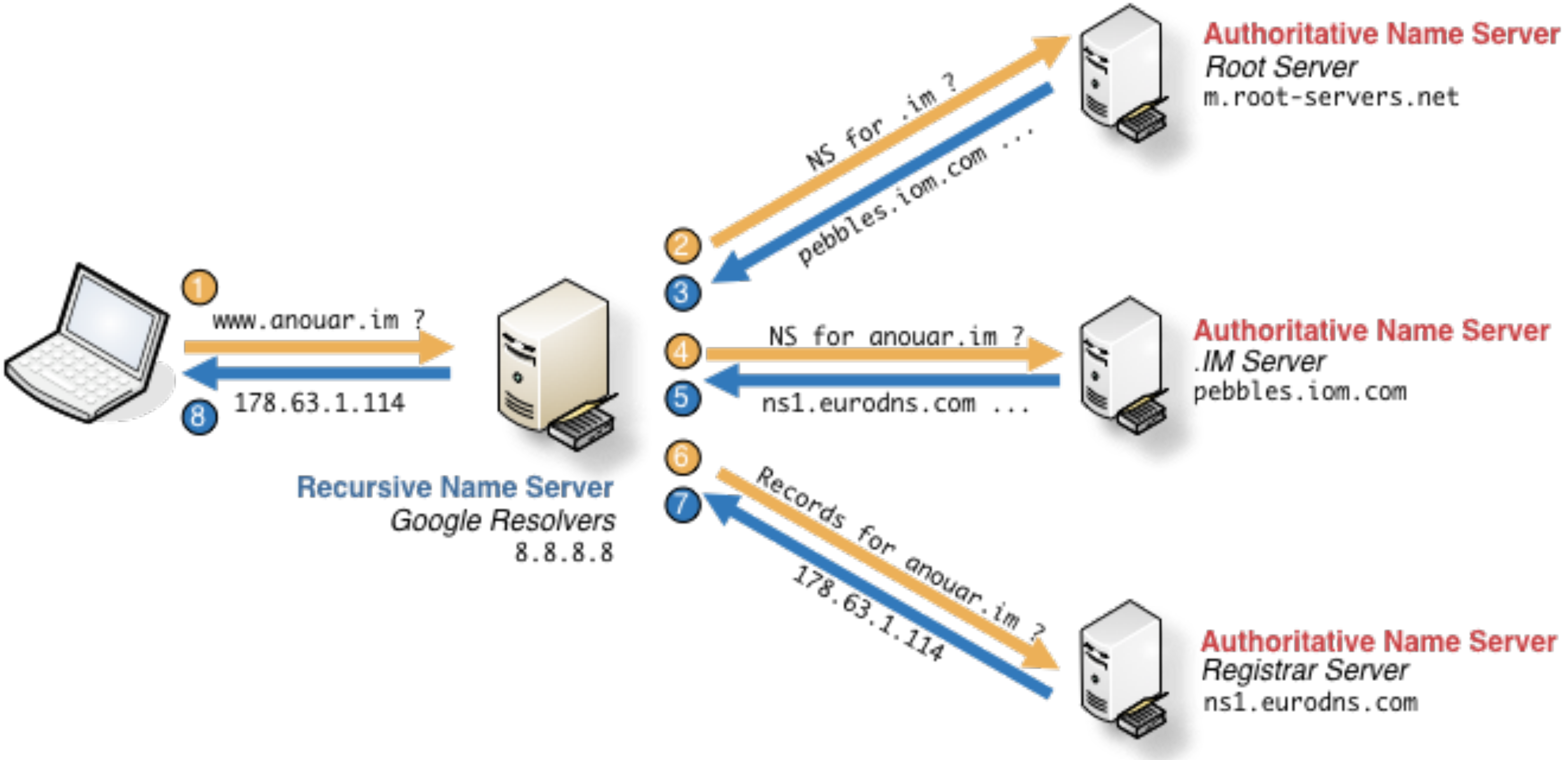
```
include "keys/example.com.key"; // include the key clause
server 10.1.2.3 {
   keys {"example.com";}; // name used in key clause
};
....
zone "example.com" in{
   type master;
   file "master.example.com";
   allow-update {key "example.com";};
};
....
zone "example.net" in{
   type master;
   file "master.example.net";
   update-policy { grant example.com subdomain example.net ANY;};
   update-policy { grant * self * A;};
   update-policy { grant update-mx name example.net MX;};
};
....
```

# Security - Attck

- Cache poisoning
- Recursion Denied of Service Attacks
- Reflection/Amplification Attacks
- Zone Transfer Attacks
- Buffer Overflow Attacks

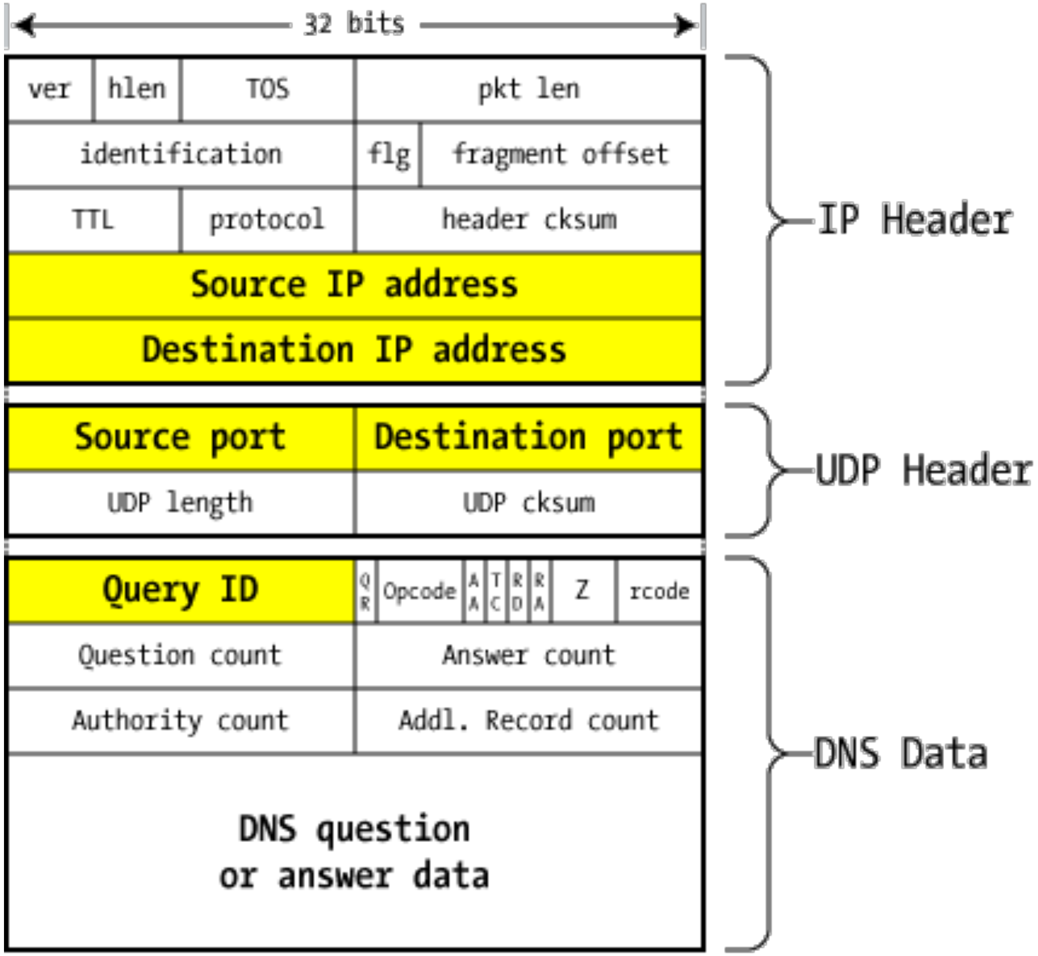
# Security – Cache poisoning

- ❑ A Normal Resolving Process



# Security – Cache poisoning

- ❑DNS packet on the wire

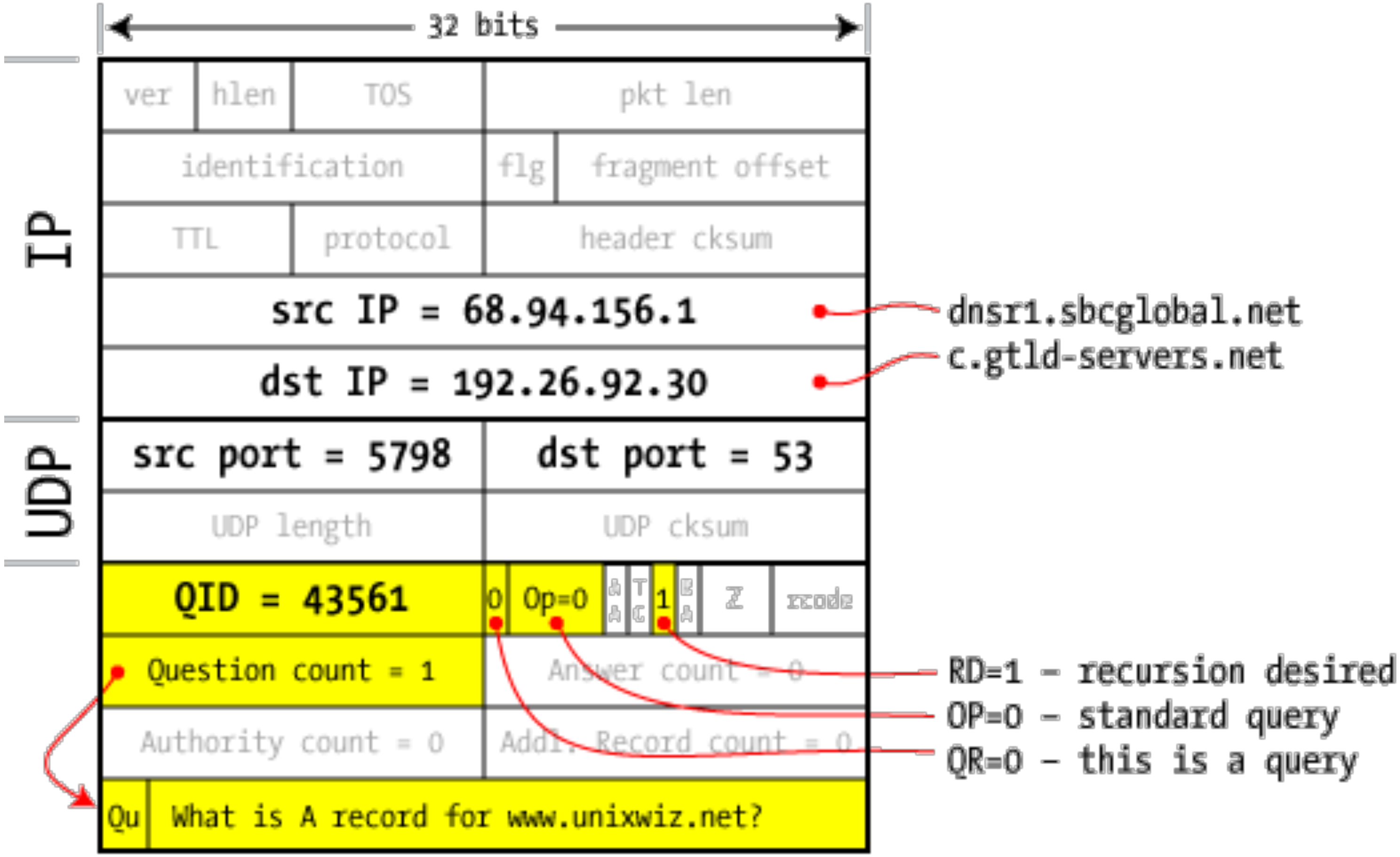


| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ver | hlen | TOS | pkt len | | | | | | | | |
| identification | | | flg | fragment offset | | | | | | | |
| TTL | | protocol | header cksum | | | | | | | | |
| Source IP address | | | | | | | | | | | |
| Destination IP address | | | | | | | | | | | |
| Source port | | | Destination port | | | | | | | | |
| UDP length | | | UDP cksum | | | | | | | | |
| Query ID | | | QR | Opcode | AA | TC | RD | RA | Z | rcode | |
| Question count | | | Answer count | | | | | | | | |
| Authority count | | | Addl. Record count | | | | | | | | |
| DNS question<br>or answer data | | | | | | | | | | | |

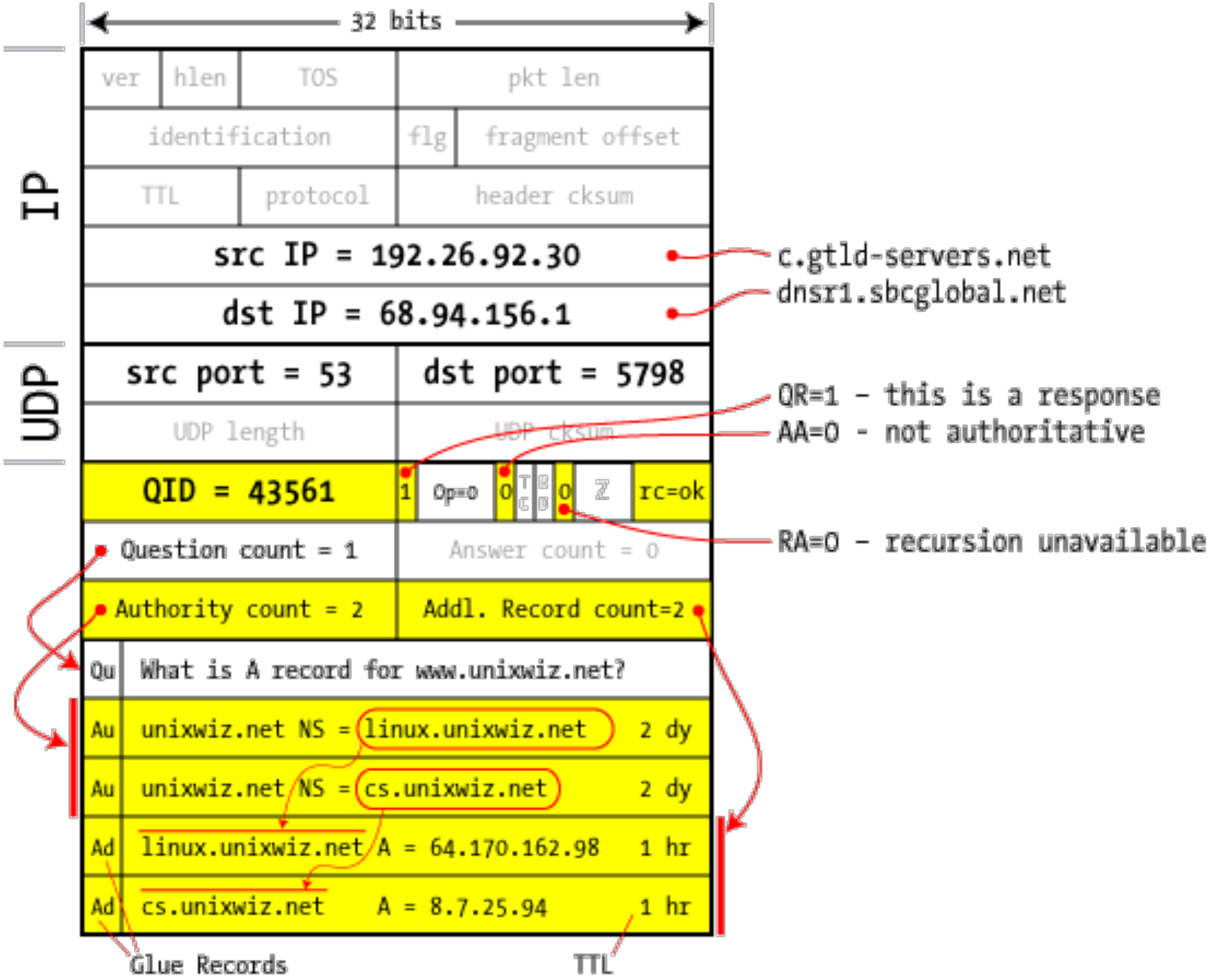
***DNS packet on the wire***

# Security
# – Cache poisoning

❑Query from resolver to NS



# Security
## – Cache poisoning



32 bits

IP

ver | hlen | TOS | pkt len

identification | flg | fragment offset

TTL | protocol | header cksum

src IP = 192.26.92.30 — c.gtld-servers.net

dst IP = 68.94.156.1 — dnsr1.sbcglobal.net

UDP

src port = 53 | dst port = 5798

UDP length | UDP cksum

QID = 43561 | 1 | Op=0 | 0 | TC | RD | 0 | Z | rc=ok

QR=1 - this is a response

AA=0 - not authoritative

RA=0 - recursion unavailable

Question count = 1 | Answer count = 0

Authority count = 2 | Addl. Record count=2

Qu | What is A record for www.unixwiz.net?

Au | unixwiz.net NS = linux.unixwiz.net | 2 dy

Au | unixwiz.net NS = cs.unixwiz.net | 2 dy

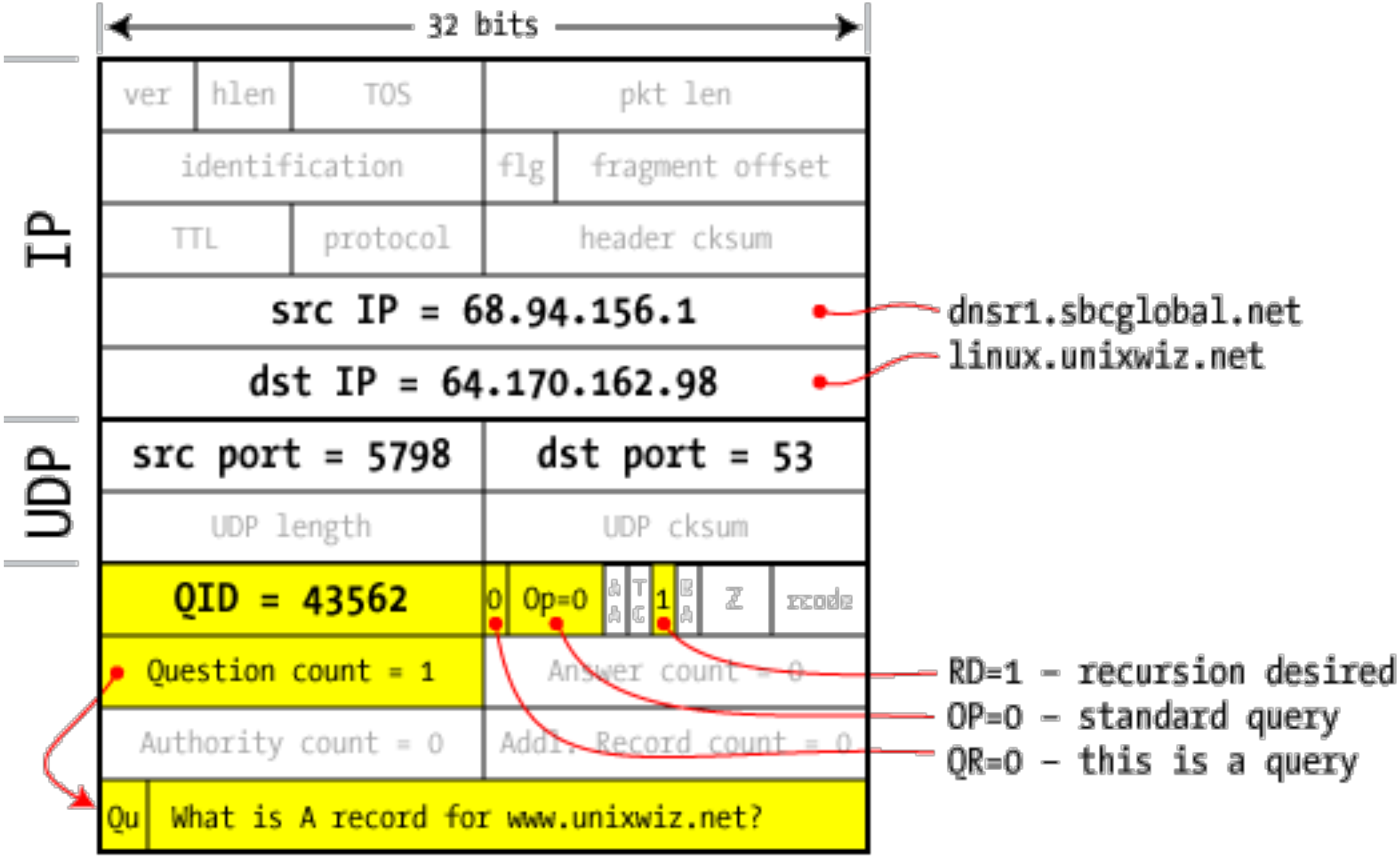
Ad | linux.unixwiz.net A = 64.170.162.98 | 1 hr

Ad | cs.unixwiz.net A = 8.7.25.94 | 1 hr

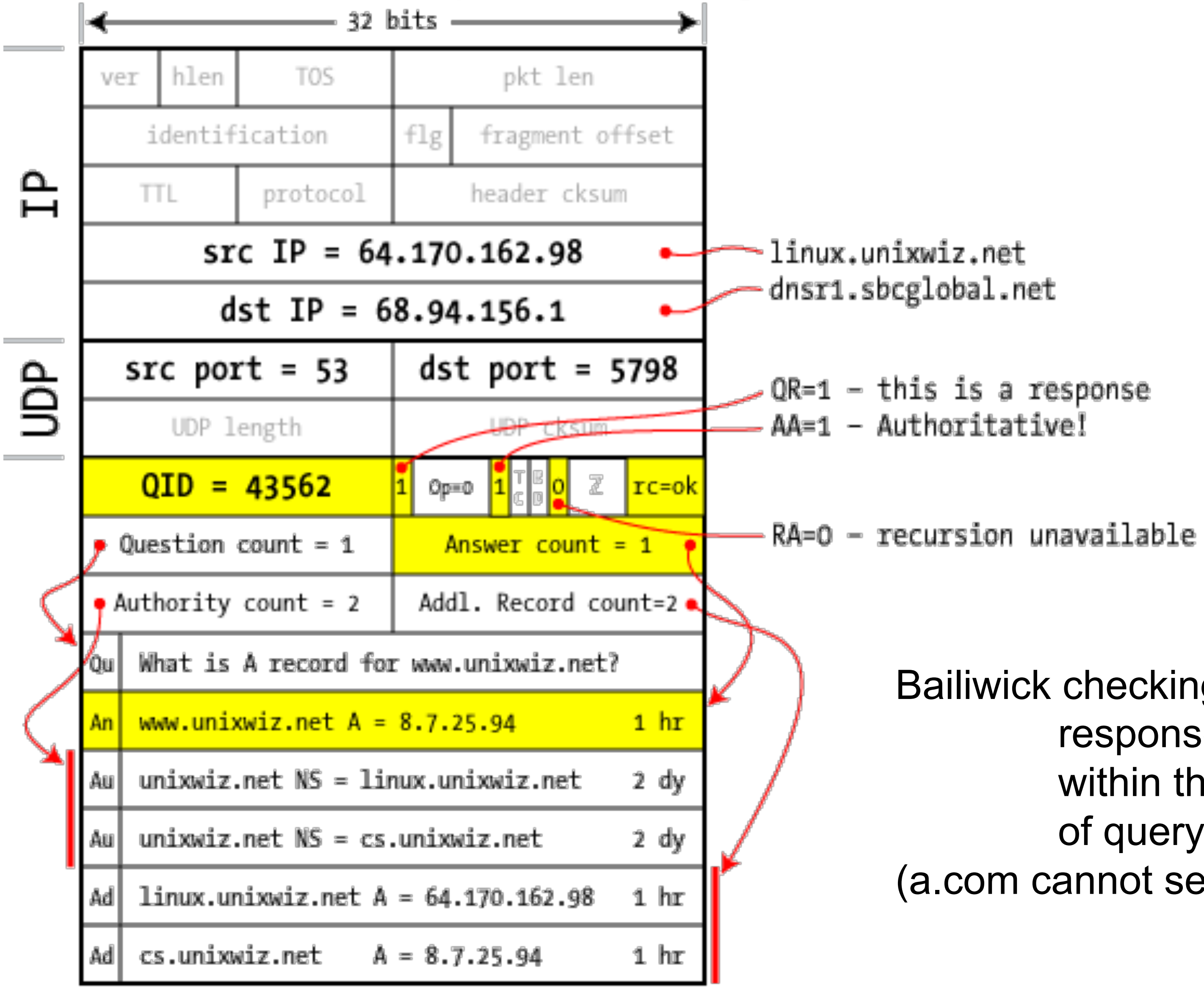
Glue Records

TTL

# Security
# – Cache poisoning



# Security
# – Cache poisoning



32 bits

IP

UDP

| ver | hlen | TOS | pkt len |
|---|---|---|---|
| identification | | flg | fragment offset |
| TTL | protocol | header cksum | |
| src IP = 64.170.162.98 | | | |
| dst IP = 68.94.156.1 | | | |
| src port = 53 | | dst port = 5798 | |
| UDP length | | UDP cksum | |
| QID = 43562 | | 1 Op=0 1 TC RD 0 Z rc=ok | |
| Question count = 1 | | Answer count = 1 | |
| Authority count = 2 | | Addl. Record count=2 | |

| | | |
|---|---|---|
| Qu | What is A record for www.unixwiz.net? | |
| An | www.unixwiz.net A = 8.7.25.94 | 1 hr |
| Au | unixwiz.net NS = linux.unixwiz.net | 2 dy |
| Au | unixwiz.net NS = cs.unixwiz.net | 2 dy |
| Ad | linux.unixwiz.net A = 64.170.162.98 | 1 hr |
| Ad | cs.unixwiz.net A = 8.7.25.94 | 1 hr |

linux.unixwiz.net

dnsr1.sbcglobal.net

QR=1 – this is a response

AA=1 – Authoritative!

RA=0 – recursion unavailable

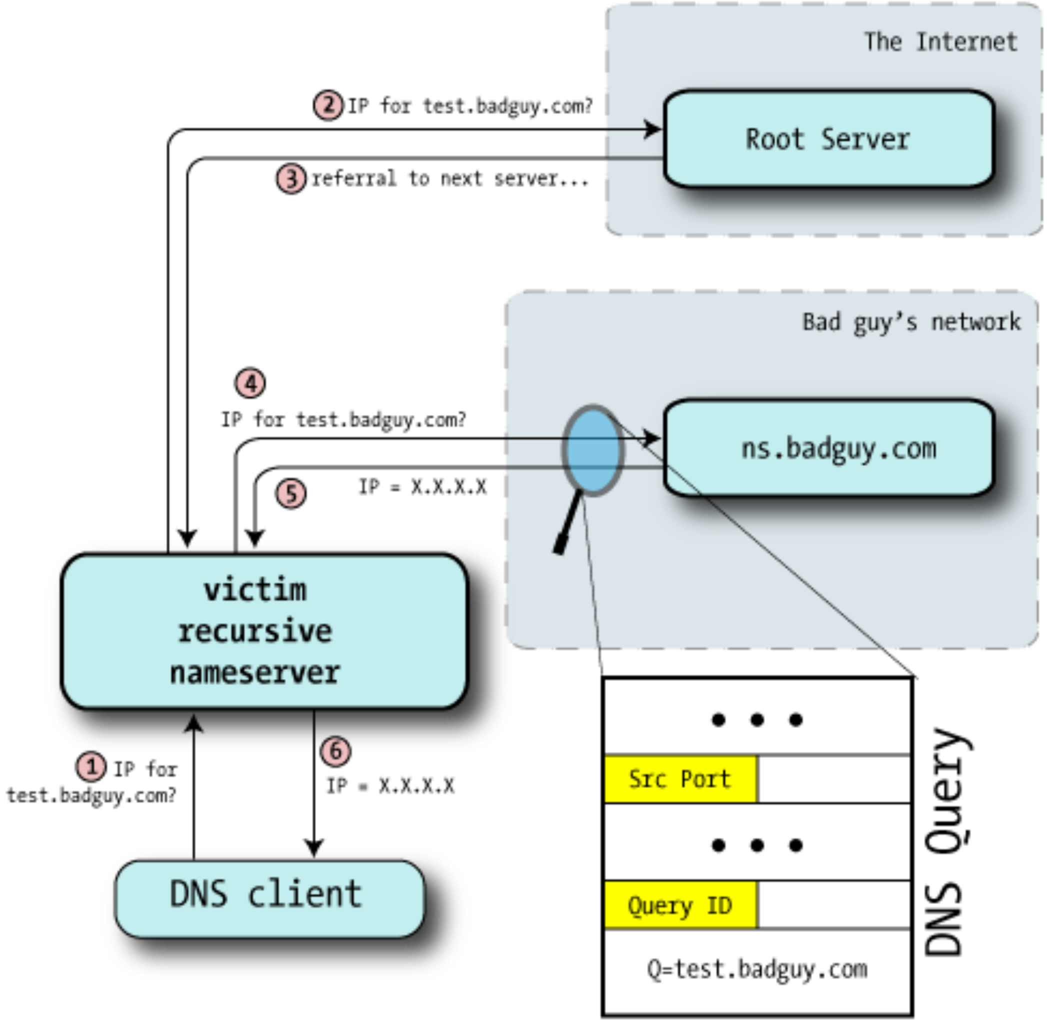
Bailiwick checking:

response is cached if i
within the same domai
of query

(a.com cannot set NS for b.com

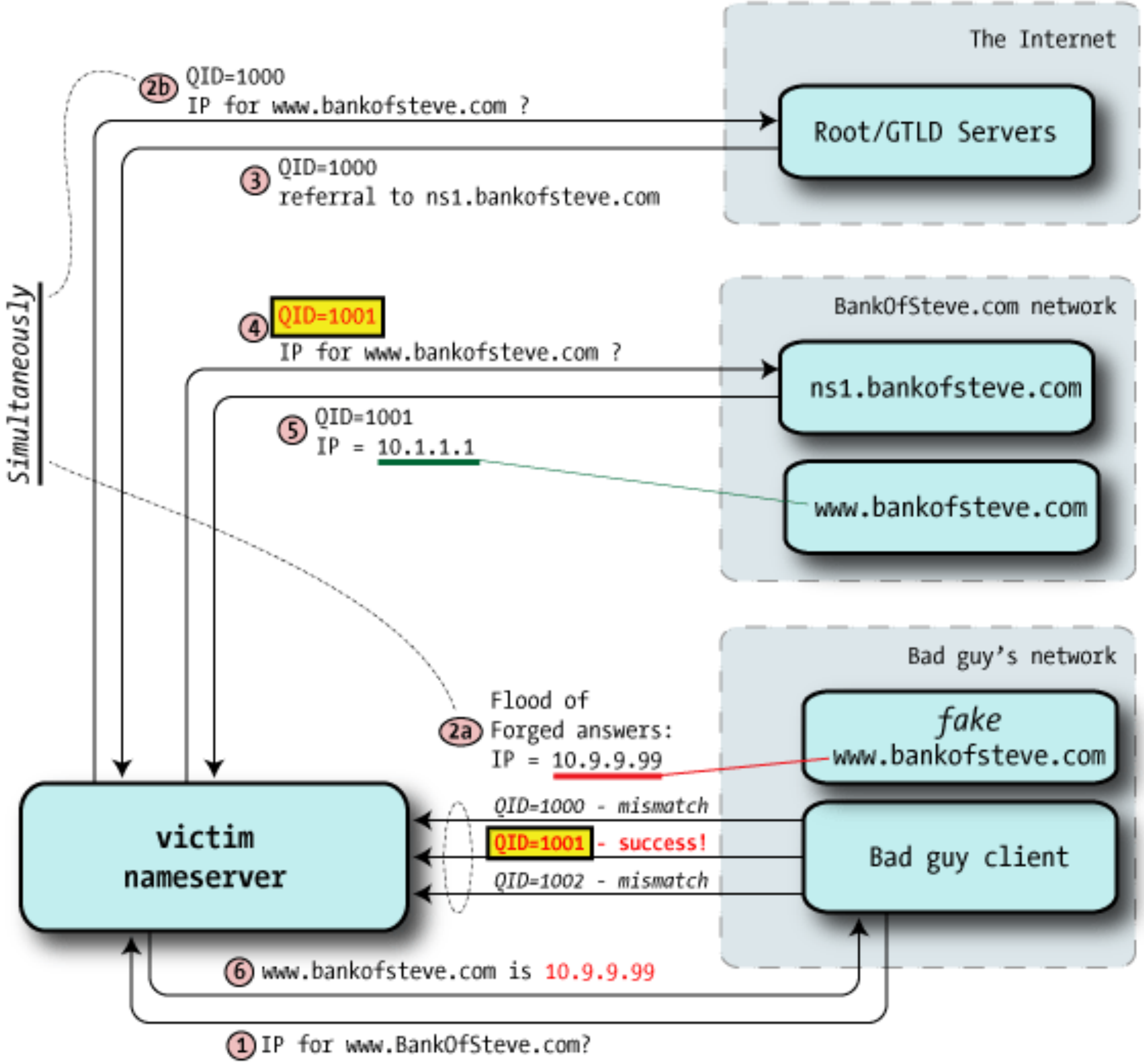
# Security
# – Cache poisoning

Guessing Query ID



# Security
# – Cache poisoning

Flooding



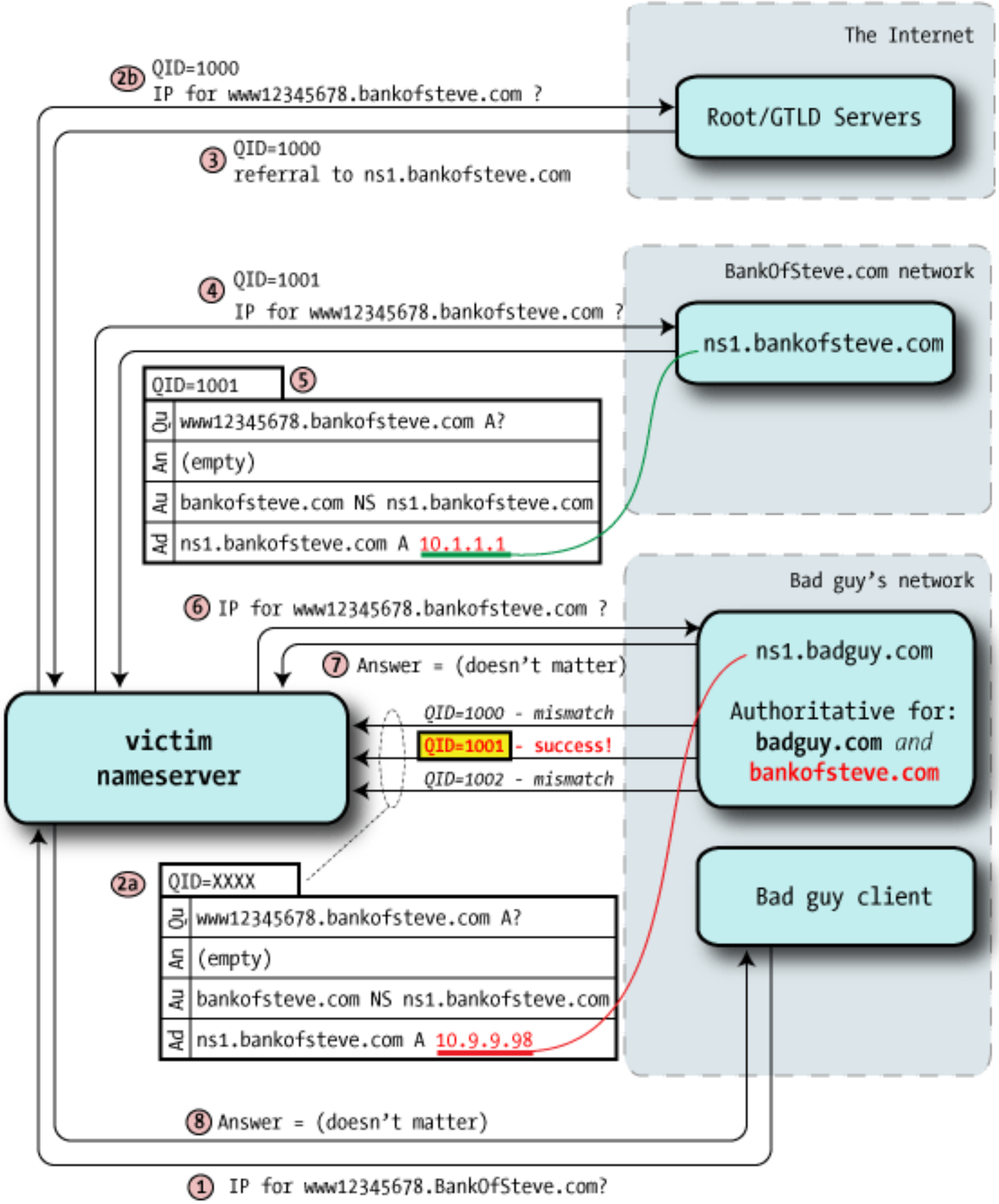
# Security
# – Cache poisoning

- ❑ Easier to understand
  - https://www.checkpoint.com/defense/advisories/public/dnsvideo/

# Security – Cache poisoning

❑Kaminsky Attack

- Poison cache for NS record instead
- Take over all of second level domain



(5)

| QID=1001 | |
|---|---|
| Qu | www12345678.bankofsteve.com A? |
| An | (empty) |
| Au | bankofsteve.com NS ns1.bankofsteve.com |
| Ad | ns1.bankofsteve.com A 10.1.1.1 |

(2a)

| QID=XXXX | |
|---|---|
| Qu | www12345678.bankofsteve.com A? |
| An | (empty) |
| Au | bankofsteve.com NS ns1.bankofsteve.com |
| Ad | ns1.bankofsteve.com A 10.9.9.98 |

# Security
# – Cache poisoning

- Defense
  - Randomized query ID
  - Randomized UDP port
  - **DNSSEC**
    - Cryptographically sign DNS responses

# Security
## - Recursion Denied of Service Attacks

❑ Problem

- DDoS of DNS service.

❑ Defense

- Restrict recursion source

# Security
## - Reflection/Amplification Attacks

❑ Defense

- Query rate-limiting

```
options {
        directory "/usr/local/etc/named/working";
        ...
        rate-limit {
          responses-per-second 10;
          log-only yes;
       };
    };
```

# Security
## - Zone Transfer

❑ Problem

- Information leak

❑ Defense

- Restrict allow-transfer

# Security
## - Buffer Overflow Attacks

❑ Problem

- Any possible.

❑ Defense

- Always update to date your software

# Security – DNSSEC

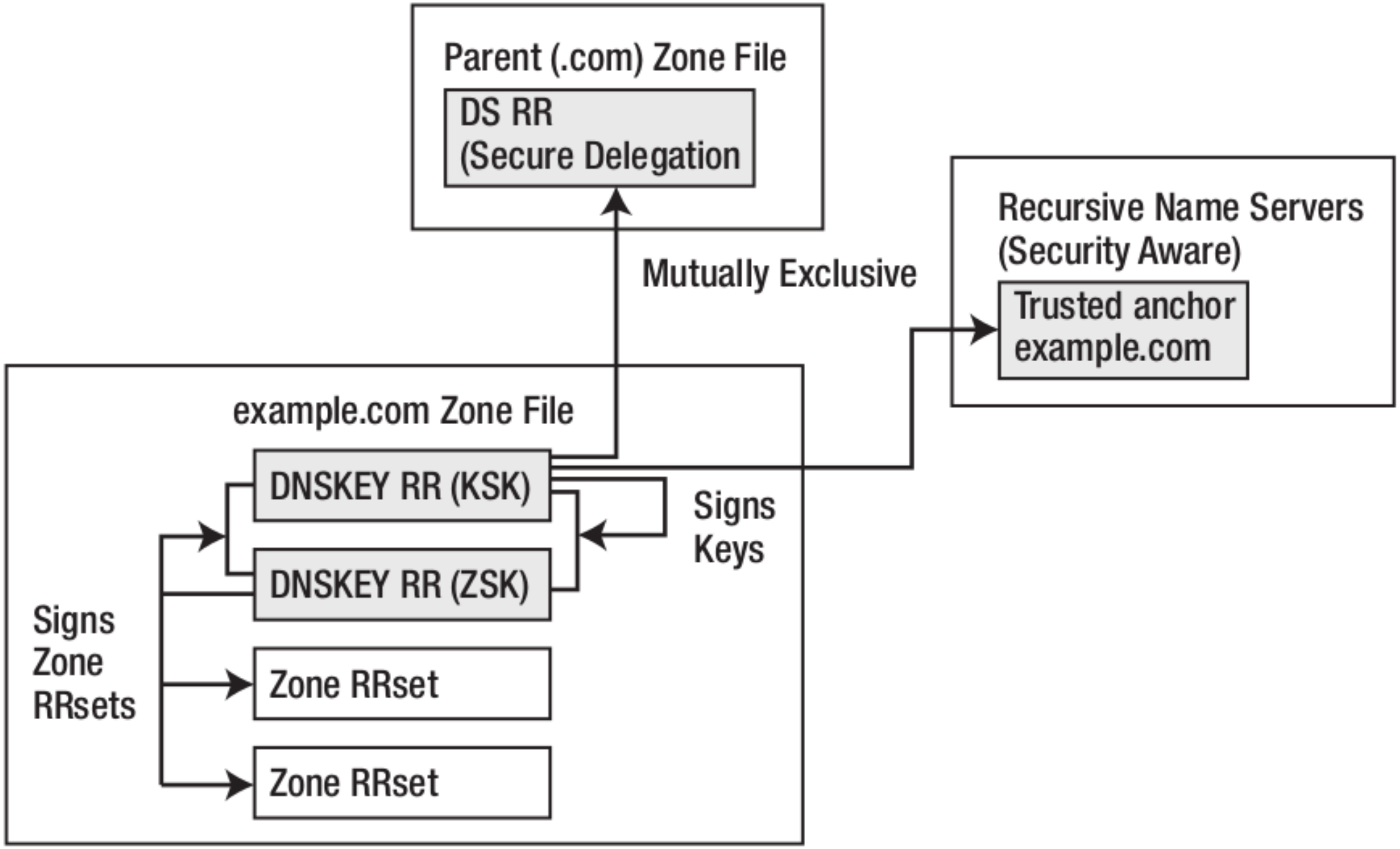
- What is DNSSEC?
  - Using Public-key crypto (asymmetric)
  - Follow the delegation of authority model
  - Data authenticity and integrity
    - Signing the RRSets with private key
    - Public DNSKEYs are published, used to verify RRSIGs
    - Children sign their zones with private key
      - The private key is authenticated by parent’s signing hash(DS) of the child zone’s key

# Security – DNSSEC

- Resource Records
  - RRSIG
    - Crypto signatures for A, AAAA, NS, etc.
    - Tracks the type and number at each node.
  - NSEC/NSEC3
    - Confirms the NXDOMAIN response.
  - DNSKEY
    - Public keys for the entire zone.
    - Private side is used generate RRSIGs
  - DS Record
    - Handed up to parent zone to authenticate the NS record

# Security
# – DNSSEC

- ZSK and KSK



# Security – DNSSEC Implementation

q Generate ZSK (Zone signing key)

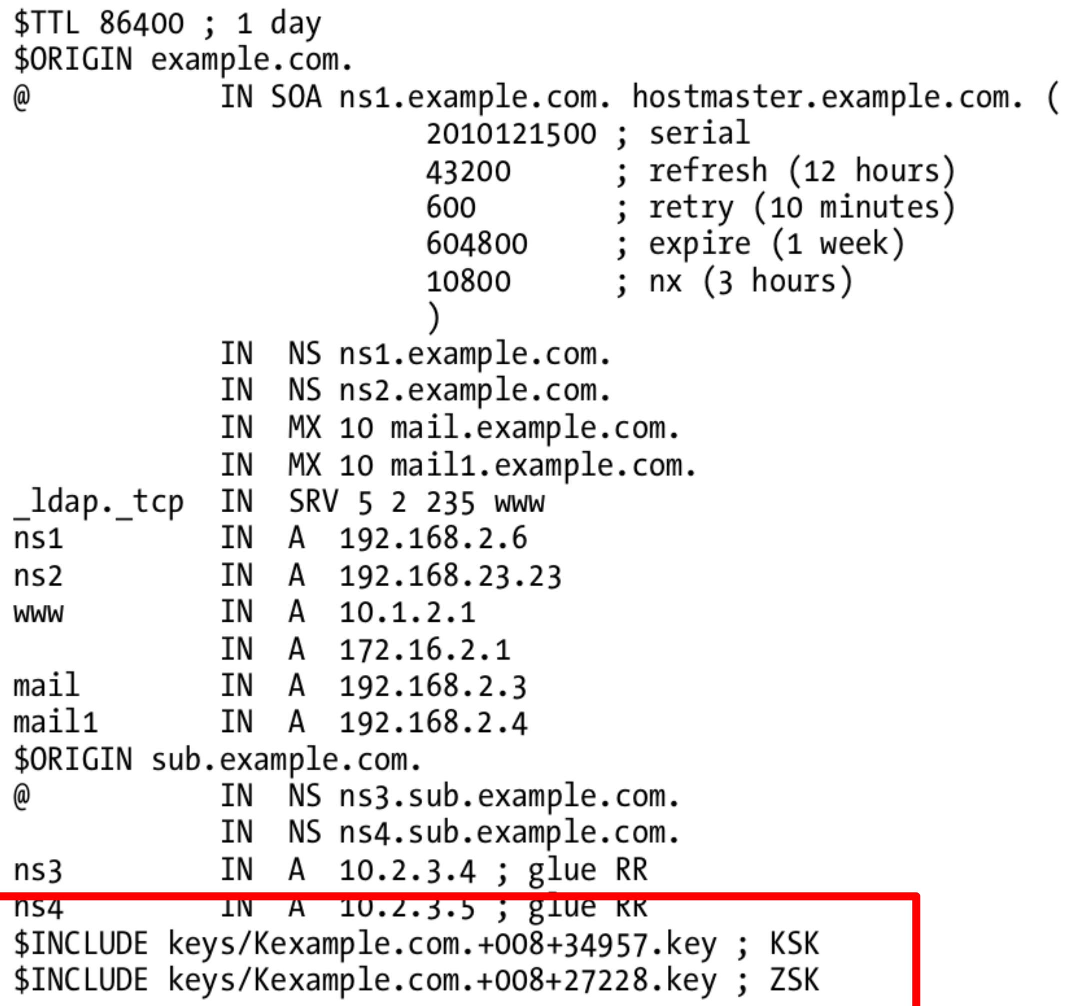
```
$dnssec-keygen -a rsasha256 -b 2048 -n zone \
          example.com
Kexample.com.+008+27228
```

❑Generate KSK (Key signing key)

```
$dnssec-keygen -a rsasha256 -b 2048 -f KSK -n zone \
          example.com
Kexample.com.+008+34957
```

# Security – DNSSEC Implementation

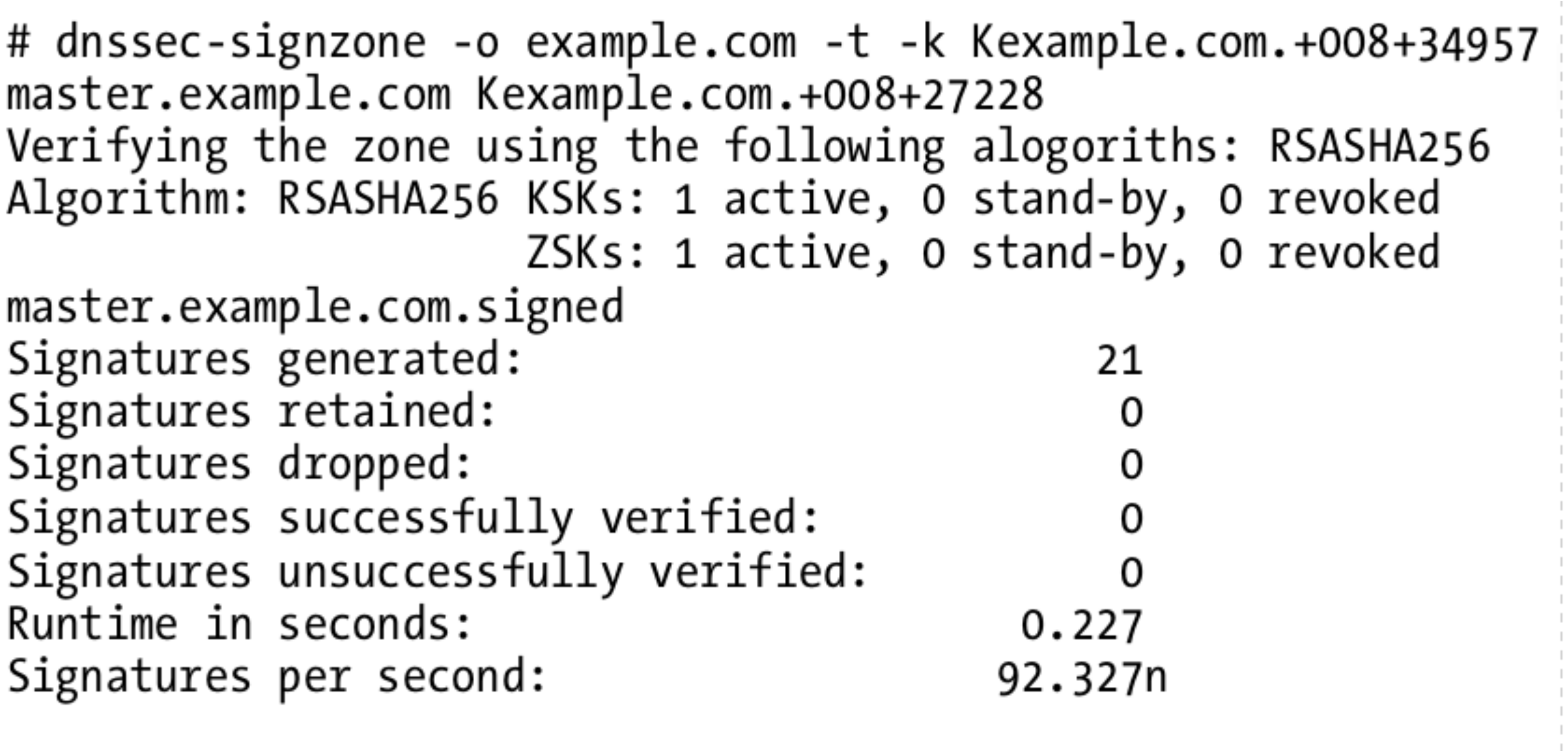
- In zone file



```
$TTL 86400 ; 1 day
$ORIGIN example.com.
@           IN SOA ns1.example.com. hostmaster.example.com. (
                        2010121500 ; serial
                        43200      ; refresh (12 hours)
                        600        ; retry (10 minutes)
                        604800     ; expire (1 week)
                        10800      ; nx (3 hours)
                        )
            IN  NS ns1.example.com.
            IN  NS ns2.example.com.
            IN  MX 10 mail.example.com.
            IN  MX 10 mail1.example.com.
_ldap._tcp  IN  SRV 5 2 235 www
ns1         IN  A  192.168.2.6
ns2         IN  A  192.168.23.23
www         IN  A  10.1.2.1
            IN  A  172.16.2.1
mail        IN  A  192.168.2.3
mail1       IN  A  192.168.2.4
$ORIGIN sub.example.com.
@           IN  NS ns3.sub.example.com.
            IN  NS ns4.sub.example.com.
ns3         IN  A  10.2.3.4 ; glue RR
ns4         IN  A  10.2.3.5 ; glue RR
$INCLUDE keys/Kexample.com.+008+34957.key ; KSK
$INCLUDE keys/Kexample.com.+008+27228.key ; ZSK
```

# Security – DNSSEC Implementation

- Signing the zone

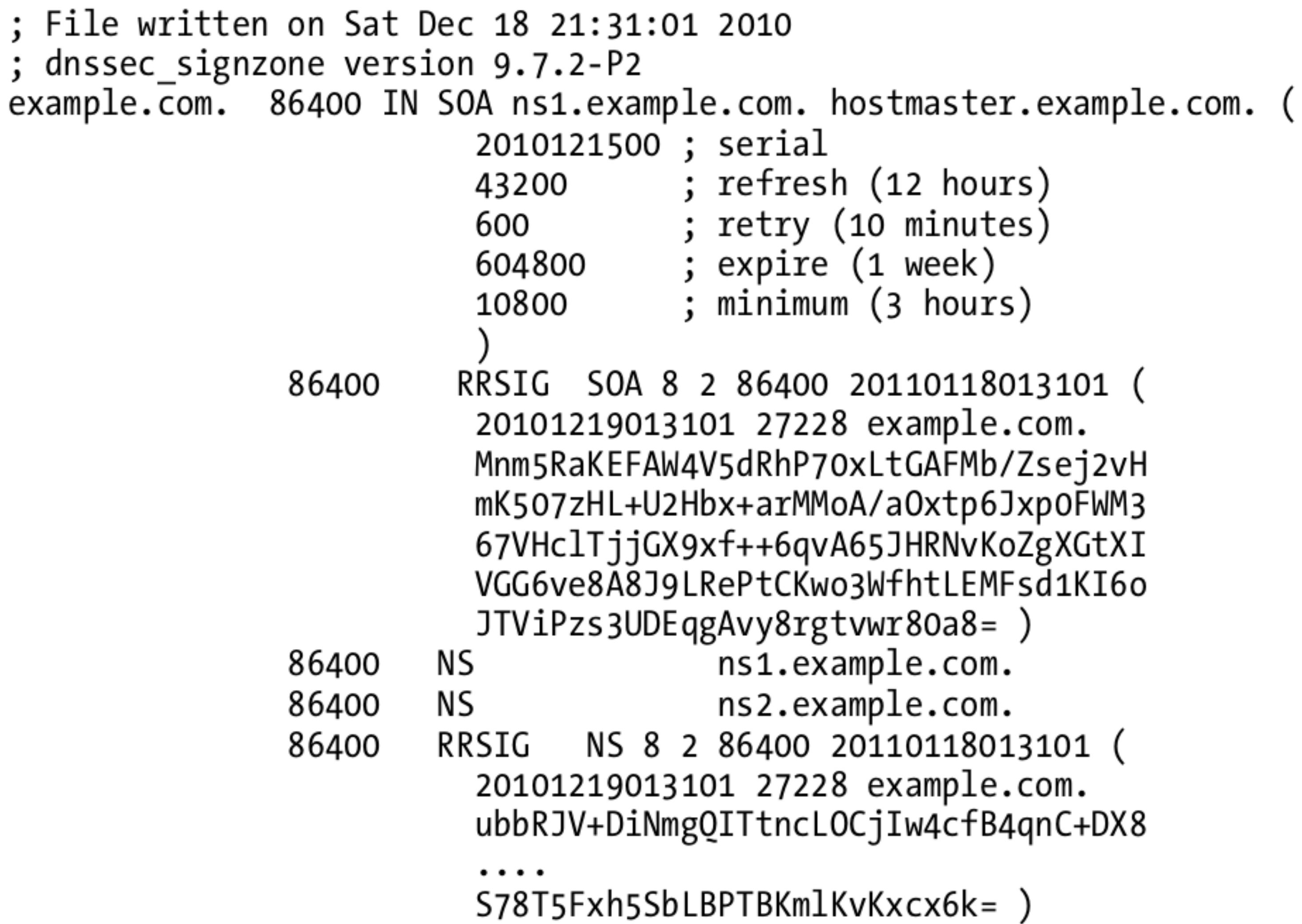


```
# dnssec-signzone -o example.com -t -k Kexample.com.+008+34957
master.example.com Kexample.com.+008+27228
Verifying the zone using the following alogoriths: RSASHA256
Algorithm: RSASHA256 KSKs: 1 active, 0 stand-by, 0 revoked
                     ZSKs: 1 active, 0 stand-by, 0 revoked
master.example.com.signed
Signatures generated:                             21
Signatures retained:                               0
Signatures dropped:                                0
Signatures successfully verified:                  0
Signatures unsuccessfully verified:                0
Runtime in seconds:                            0.227
Signatures per second:                        92.327n
```

When signing the zone with only ZSK, just omit the -k parameter

# Security
# – DNSSEC Implementation

- ❑Signing the zone (example.com.signed)



```
; File written on Sat Dec 18 21:31:01 2010
; dnssec_signzone version 9.7.2-P2
example.com.  86400 IN SOA ns1.example.com. hostmaster.example.com. (
                         2010121500 ; serial
                         43200      ; refresh (12 hours)
                         600        ; retry (10 minutes)
                         604800     ; expire (1 week)
                         10800      ; minimum (3 hours)
                         )
               86400    RRSIG  SOA 8 2 86400 20110118013101 (
                         20101219013101 27228 example.com.
                         Mnm5RaKEFAW4V5dRhP7OxLtGAFMb/Zsej2vH
                         mK5O7zHL+U2Hbx+arMMoA/aOxtp6JxpOFWM3
                         67VHclTjjGX9xf++6qvA65JHRNvKoZgXGtXI
                         VGG6ve8A8J9LRePtCKwo3WfhtLEMFsd1KI6o
                         JTViPzs3UDEqgAvy8rgtvwr8Oa8= )
               86400   NS             ns1.example.com.
               86400   NS             ns2.example.com.
               86400   RRSIG   NS 8 2 86400 20110118013101 (
                         20101219013101 27228 example.com.
                         ubbRJV+DiNmgQITtncLOCjIw4cfB4qnC+DX8
                         ....
                         S78T5Fxh5SbLBPTBKmlKvKxcx6k= )
```

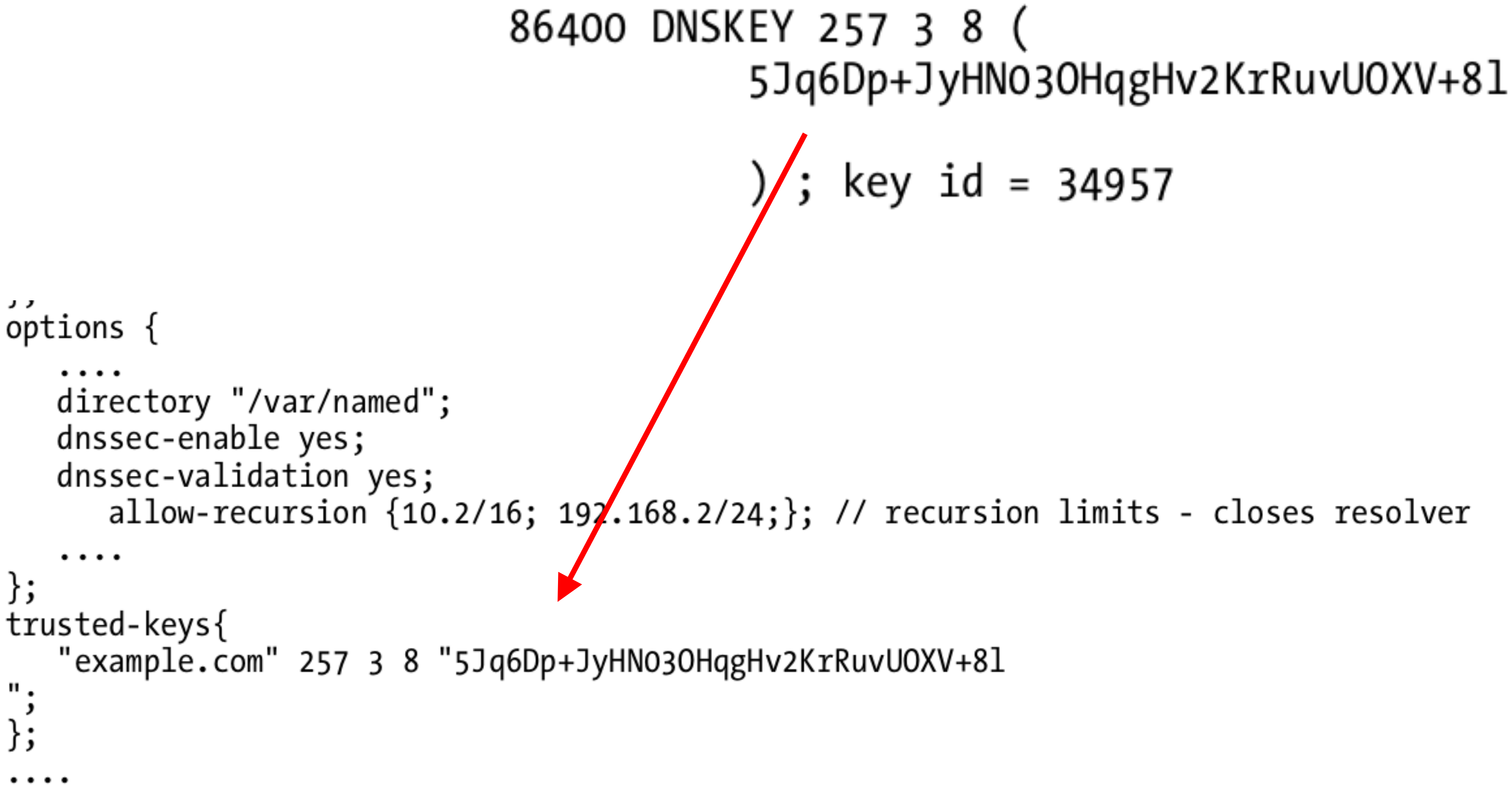
# Security
# – DNSSEC Implementation

❑Update the Zone clause to use the signed zone

```
zone "example.com" {
        type master;
        file "example.com.signed”;
        masters {ip_addr; ip_addr;};
        allow-query {address_match_list};
        allow-transfer { address_match_list};
        allow-update {address_match_list};
};
```

# Security – DNSSEC Implementation

- Create Trust Anchor



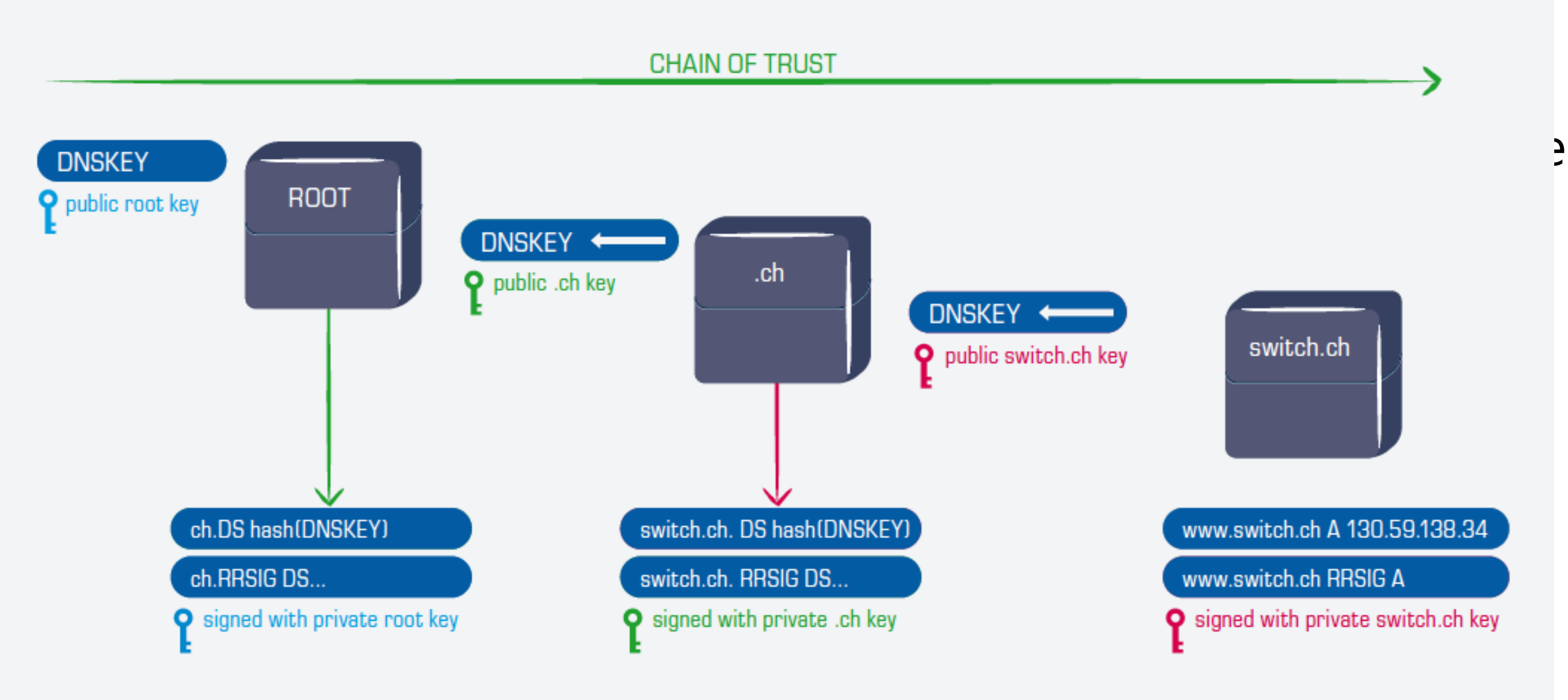
```
86400 DNSKEY 257 3 8 (
        5Jq6Dp+JyHNO3OHqgHv2KrRuvUOXV+8l

        ) ; key id = 34957
```

```
options {
   ....
   directory "/var/named";
   dnssec-enable yes;
   dnssec-validation yes;
      allow-recursion {10.2/16; 192.168.2/24;}; // recursion limits - closes resolver
   ....
};
trusted-keys{
   "example.com" 257 3 8 "5Jq6Dp+JyHNO3OHqgHv2KrRuvUOXV+8l
";
};
....
```

# Security
# – DNSSEC Implementation

- ❑Create Chain of Trust
  - Extract DNSKEY RR and use dnssec-dsfromkey
  - Add -g parameter when signing zone using dnssec-signzone
  - dnssec-signzone -g ….
    - ➢ ds-set.example.com
      - – contains DS record that you should hand to parent

# Security – DNSSEC Implementation



# BIND Debugging and Logging

# Logging (1)

- ❑ Terms
  - Channel
    - ➢ A place where messages can go
    - ➢ Ex: syslog, file or /dev/null
  - Category
    - ➢ A class of messages that named can generate
    - ➢ Ex: answering queries or dynamic updates
  - Module
    - ➢ The name of the source module that generates the message
  - Facility
    - ➢ syslog facility name
  - Severity
    - ➢ Priority in syslog
- ❑ Logging configuration
  - Define what are the channels
  - Specify where each message category should go
- ❑ When a message is generated
  - It is assigned a “category”, a “module”, a “severity”
  - It is distributed to all channels associated with its category

# Logging (2)

- ❑ The ‶logging″ statement
  - Either “file” or “syslog” in channel sub-statement
    - ➢ size:
      - – ex: 2048, 100k, 20m, 15g, unlimited, default
    - ➢ facility:
      - – ex: local0 ~ local7
    - ➢ severity:
      - – critical, error, warning, notice, info, debug, dynamic

```
logging {
        channel_def;
        channel_def;
        …
        category category_name {
                channel_name;
               channel_name;
                …
        };
};
```

```
channel channel_name {
        file path [versions num|unlimited] [size siznum];
        syslog facility;

        severity severity;
        print-category yes|no;
        print-severity yes|no;
        print-time yes|no;
};
```

# Logging (3)

- ❑ Predefined channels

| | |
|---|---|
| default_syslog | Sends severity info and higher to syslog with facility daemon |
| default_debug | Logs to file “named.run”, severity set to dynamic |
| default_stderr | Sends messages to stderr or named, severity info |
| null | Discards all messages |

- ❑ Available categories

| | |
|---|---|
| default | Categories with no explicit channel assignment |
| general | Unclassified messages |
| config | Configuration file parsing and processing |
| queries/client | A short log message for every query the server receives |
| dnssec | DNSSEC messages |
| update | Messages about dynamic updates |
| xfer-in/xfer-out | zone transfers that the server is receiving/sending |
| db/database | Messages about database operations |
| notify | Messages about the “zone changed” notification protocol |
| security | Approved/unapproved requests |
| resolver | Recursive lookups for clients |

# Logging (4)

- ❑ Example of logging statement

```
logging {
    channel security-log {
        file ″/var/named/security.log″ versions 5 size 10m;
        severity info;
        print-severity yes;
        print-time yes;
    };
    channel query-log {
        file ″/var/named/query.log″ versions 20 size 50m;
        severity info;
        print-severity yes;
        print-time yes;
    };
    category default         { default_syslog; default_debug; };
    category general         { default_syslog; };
    category security        { security-log; };
    category client          { query-log; };
    category queries         { query-log; };
    category dnssec          { security-log; };
};
```

# Debug

❑ Named debug level

- From 0 (debugging off) ~ 11 (most verbose output)
- % named -d2 (start named at level 2)
- % rndc trace (increase debugging level by 1)
- % rndc trace 3 (change debugging level to 3)
- % rndc notrace (turn off debugging)

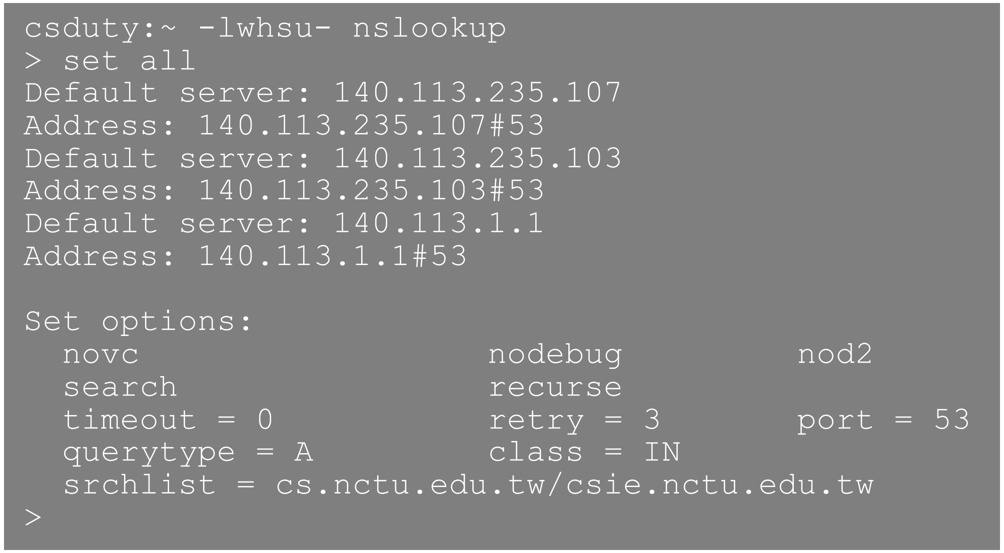
❑ Debug with “logging” statement

- Define a channel that include a severity with “debug” keyword
  - ➢ Ex: severity debug 3
  - ➢ All debugging messages up to level 3 will be sent to that particular channel

# Tools

# Tools – nslookup

- ❑ Interactive and Non-interactive
  - Non-Interactive
    - % nslookup cs.nctu.edu.tw.
    - % nslookup –type=mx cs.nctu.edu.tw.
    - % nslookup –type=ns cs.nctu.edu.tw. 140.113.1.1
  - Interactive
    - % nslookup
    - > set all
    - > set type=any
    - > set server host
    - > set lserver host
    - > set debug
    - > set d2



```
csduty:~ -lwhsu- nslookup
> set all
Default server: 140.113.235.107
Address: 140.113.235.107#53
Default server: 140.113.235.103
Address: 140.113.235.103#53
Default server: 140.113.1.1
Address: 140.113.1.1#53

Set options:
  novc                  nodebug         nod2
  search                recurse
  timeout = 0           retry = 3       port = 53
  querytype = A         class = IN
  srchlist = cs.nctu.edu.tw/csie.nctu.edu.tw
>
```

# Tools – dig

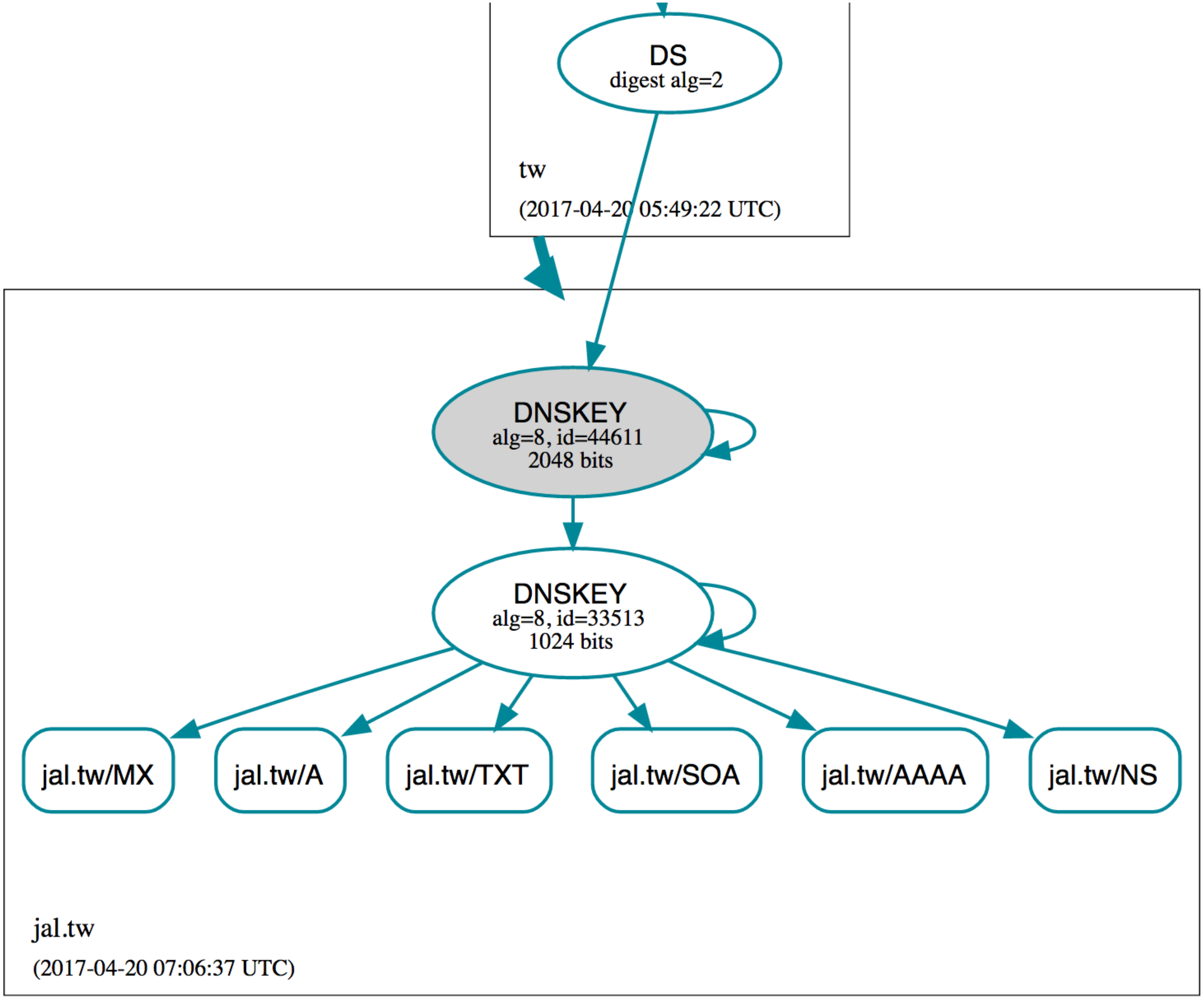
❑ Usage

- % dig cs.nctu.edu.tw
- % dig cs.nctu.edu.tw mx
- % dig @ns.nctu.edu.tw cs.nctu.edu.tw mx
- % dig -x 140.113.209.3
  - Reverse query
- % dig +dnssec jal.tw

❑ Find out the root servers

- % dig @a.root-servers.net . ns

# Online Check Tools – http://dnsviz.net



# Miscellaneous

# SSHFP record

- ❑ RFC4255
- ❑ ssh_config
  - VerifyHostKeyDNS ask
- ❑ dns/sshfp

```
knight:~ -lwhsu- dig anoncvs.tw.freebsd.org sshfp

;; ANSWER SECTION:
anoncvs.tw.freebsd.org. 259200  IN      CNAME   freebsd.cs.nctu.edu.tw.
freebsd.cs.nctu.edu.tw. 3600    IN      SSHFP   2 1 2723C6CF4EF655A6A5BE86CC9E039F1762450FE9

knight:~ -lwhsu- cvs -d anoncvs@anoncvs.tw.freebsd.org:/home/ncvs co ports
The authenticity of host 'anoncvs.tw.freebsd.org (140.113.17.209)' can't be established.
DSA key fingerprint is e8:3b:29:7b:ca:9f:ac:e9:45:cb:c8:17:ae:9b:eb:55.
Matching host key fingerprint found in DNS.
Are you sure you want to continue connecting (yes/no)?
```

# DNS Accept filters

❑ accf_dns(9)

- buffer incoming DNS requests until the whole first request is present

```
options INET
options ACCEPT_FILTER_DNS
kldload accf_dns
```

❑ Currently only on 8-CURRENT

❑ /boot/loader.conf

- `accf_dns_load="YES"`

# Other references & tools

❑ Administrator's Reference Manual

- https://www.isc.org/software/bind/documentation

❑ FAQ

- https://www.isc.org/faq/bind

❑ DNS for Rocket Scientists

- http://www.zytrax.com/books/dns/

❑ Swiss army knife internet tool

- http://www.robtex.com/

❑ DNS Network Tools

- http://dnsstuff.com/