DNSSEC

Zone Management

with ZKT

DENIC DNSSEC Testbed Workshop

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Agenda

- ZKT Overview
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  - Key features
- DNSSEC Basics
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- DNSSEC in 6 Minutes

Zone Key Tool

- One of the first open source tools for dnssec management
  zkt-0.5 released Apr 1 2005; current release is zkt-0.99c
- Wrapper around BIND dnssec commands
- Contributed with BIND since 9.6.0a1
- Download via sourceforge or the project webside
  http://sourceforge.net/projects/zkt, http://www.hznet.de/dns/zkt/
- FreeBSD and OpenBSD ports available
  Maintained by Frank Behrens and Jakob Schlyter
- zkt-users mailing list (low volume)
  https://lists.sourceforge.net/lists/listinfo/zkt-users
- Supports all newer BIND versions (9.3 up to 9.6)
  BIND 9.7 is supported but currently w/o the fancy new dnssec features

ZKT Key Features

- DNSKEY state list command
- Automated key generation and rollover
  - Pre-Publish (RFC4641 used for ZSK rollover)
  - RFC5011 (KSK rollover)
  - Double Signature (RFC4641 for KSK rollover)
- Automatic serial number change
  - UNIX time (seconds since the epoch)
  - plain integer
  - date format (yyyymmddnn)
- Signs „full zone“ at once
  Per RR signing for dynamic zones only
- Dynamic zone signing support (still experimental)
  Wait for BIND 9.7 for better dynamic zone support
- File and syslog based logging

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DNSSEC Key Generation

- BIND uses two commands for DNSSEC maintenance
  a. `dnssec-keygen` for key generation
  b. `dnssec-signzone` for zone signing

- dnssec-keygen requires some options to generate a DNSSEC key

```
$ dnssec-keygen -a RSASHA1 -b 1300 -r /dev/urandom -n ZONE -f KSK example.net.
```

- ZKT uses a wrapper command plus a config file to simplify this:

```
$ sed -n "/signing/,/^$/p" dnssec.conf
#   signing key parameters
Key_algo:     RSASHA1   # (Algorithm ID 5)
KSK_lifetime: 1y        # (31536000 seconds)
KSK_bits:     1300
KSK_randfile: "/dev/urandom"
ZSK_lifetime: 12w       # (7257600 seconds)
ZSK_bits:     512
ZSK_randfile: "/dev/urandom"
SaltBits:     24

$ dnssec-zkt --ksk --create example.net.  ; generate a ksk
$ dnssec-zkt -z -C example.net.           ; generate a zsk
```

DNSSEC keyfiles

- A DNSSEC key is represented by two files (public and private part)

```
$ ls -l K*
-rw-r--r-- 1 dns dnsadm  313 2009-12-07 00:57 Kexample.net.+005+27450.key
-rw------- 1 dns dnsadm 1157 2009-12-06 17:43 Kexample.net.+005+27450.private
-rw-r--r-- 1 dns dnsadm  177 2009-11-15 16:40 Kexample.net.+005+54680.key
-rw------- 1 dns dnsadm  553 2009-11-15 18:40 Kexample.net.+005+54680.private
```

- Key infos are part of the filesystem (zone, tag, algorithm, date)
  But the type of key is coded in the flags field only

- `dnssec-zkt` is able to list DNSKEYs in a user friendly form

```
$ dnssec-zkt -a -t -f
Keyname             Tag   Typ Sta Algorit              Age Lftm
    example.net. 27450 KSK act RSASHA1   1w 2d23h34m55s<365d
    example.net. 54680 ZSK act RSASHA1   4w 3d 7h52m17s!28d
```

- Some of the options are setable via the config file

```
$ sed -n '/zkt options/,/^$/p' /var/named/dnssec.conf | grep ":"
Zonedir:        "/var/named"
Recursive:      True
PrintTime:      True
PrintAge:       False
LeftJustify:    False
```

dnssec-zkt

- List all DNSKEYs (a bit like `ls` for files)
  Sorted by domain name, key type (KSK, ZSK) and date
- List keys in subdirectories recursively (Option −r)
- A directory or a key file could be specified as argument
  Default directory is settable via `zonedir` in `dnssec.conf`.
- Option -p prints the path name where the key file was found

```
$ dnssec-zkt -r -p -l example.net.  .
Keyname                                    Tag Typ Sta Algorit Generation Time
./views/intern/example.net./
                     example.net. 00126 KSK act RSASHA1 Nov 20 2009 12:44:27
./views/extern/example.net./
                     example.net. 23553 KSK act RSASHA1 Nov 20 2009 12:49:04
./views/intern/example.net./
                     example.net. 05972 ZSK act RSASHA1 Nov 20 2009 12:44:27
./views/extern/example.net./
                     example.net. 36122 ZSK act RSASHA1 Nov 20 2009 12:49:05
                     example.net. 35744 ZSK pre RSASHA1 Dec 17 2009 23:45:27
```

dnssec-zkt (example output)

- Recursive key listing (sorted by domain name, key type and age)

```
$ dnssec-zkt -r -a examples
Keyname                    Tag Typ Sta Algorit Generation Time               Age
          sub.example.de. 27321 KSK act RSASHA1 Apr 15 2009 18:40:55   5w 1d 6h36m23s
          sub.example.de. 23742 ZSK pre RSASHA1 May 11 2009 23:32:01   1w 3d 1h45m17s
          sub.example.de. 29194 ZSK act RSASHA1 May 09 2009 14:05:34   1w 3d 1h45m17s
              example.de. 58635 KSK rev RSASHA1 Apr 23 2009 18:10:22   4w    9h 6m56s
              example.de. 27450 KSK act RSASHA1 May 06 2009 17:43:29   2w 1d   19m56s
              example.de. 17439 KSK sta RSASHA1 May 07 2009 00:57:22   2w 1d   19m56s
              example.de. 54680 ZSK act RSASHA1 Apr 15 2009 18:40:55   5w 1d 8h37m18s
         dyn.example.net. 09399 KSK act RSASHA1 May 16 2009 12:39:19      5d12h37m59s
         dyn.example.net. 46577 ZSK act RSASHA1 May 16 2009 12:39:19      5d12h37m59s
         sub.example.net. 54876 KSK act RSASHA1 Oct 01 2008 08:24:24  33w 2d16h52m54s
         sub.example.net. 01646 ZSK act RSASHA1 May 09 2009 13:59:11      1d13h47m16s
         sub.example.net. 26431 ZSK dep RSASHA1 May 06 2009 15:25:28      1d13h47m16s
             example.net. 41151 KSK act RSASHA1 Apr 20 2009 22:54:22   4w 3d 2h22m56s
             example.net. 01764 KSK sta RSASHA1 May 06 2009 23:26:34   2w 1d 1h37m 3s
             example.net. 05972 ZSK act RSASHA1 Nov 20 2007 12:44:27  26w 1d11h32m51s
```

- The state of a key is represented by the private key file name
  e.g. state is pre-published (or standby) if private key file ends in `.published`
  - First stage of ZSK rollover: `sub.example.de`
  - Last stage of ZSK rollover: `sub.example.net`
  - rfc5011 KSK rollover in place: `example.de`

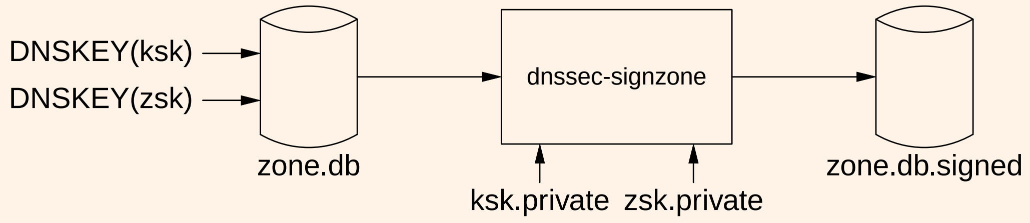
dnssec-zkt (Build in defaults)

- Print out the build in config options

```
$ dnssec-zkt -c /dev/null -Z
#       @(#) dnssec.conf vT0.99d (c) Feb 2005 - Aug 2009 Holger Zuleger hznet.de
#   dnssec-zkt options
Zonedir:       "."
Recursive:     False
PrintTime:     True
PrintAge:      False
LeftJustify:   False
#   zone specific values
ResignInterval:       1w      # (604800 seconds)
Sigvalidity:   10d     # (864000 seconds)
Max_TTL:       8h      # (28800 seconds)
Propagation:   5m      # (300 seconds)
KEY_TTL:       4h      # (14400 seconds)
Serialformat:  incremental
#   signing key parameters
Key_algo:      RSASHA1 # (Algorithm ID 5)
KSK_lifetime:  1y      # (31536000 seconds)
KSK_bits:      1300
KSK_randfile:  "/dev/urandom"
ZSK_lifetime:  12w     # (7257600 seconds)
ZSK_bits:      512
ZSK_randfile:  "/dev/urandom"
SaltBits:      24
#   dnssec-signer options
LogFile:       ""
LogLevel:      ERROR
SyslogFacility:       NONE
SyslogLevel:   NOTICE
VerboseLog:    0
Keyfile:       "dnskey.db"
Zonefile:      "zone.db"
DLV_Domain:    ""
Sig_Pseudorand:       False
Sig_GenerateDS:       True
Sig_DnsKeyKSK: False
Sig_Parameter: ""
```

Zone signing with BIND

- BIND provides the `dnssec-signzone` command for zone signing
  The commands adds RRSIG and NSEC/NSEC3 records to a zone



- Please add DNSKEY RRs to the zone file before signing
  At best via `$INCLUDE` directive
- Corresponding `.private` files in the curr dir will be used for signing
- Lifetime of RRSIG record is configurable (default is 30 days)

```
$ dnsses-signzone -r /dev/urandom -g -e +172800 -o example.net zone.db
```

- Please increment the SOA serial number before signing
  Since bind 9.4 serial number is settable with „-N unixtime“ to the current time
- You have to resigning the zone before the signature expire

Zone signing with ZKT

- A wrapper command (`dnssec-signer`) is used for zone signing
  - — The wrapper increments the serial number by itself
    Supports plain integer, YYYYMMDDnn and unixtime (BIND9.4) format
  - — Adds all necessary DNSKEY RR into a „database“ (`dnskey.db`)
    Please include this file into the zonefile `$INCLUDE dnskey.db` file
  - — Signing parameters are specified via `dnssec.conf` file
  - — Starts the signing process only if needed (a bit like `make`)
    Update on zone file, refresh of RRSIG, new keys added, etc.
  - — Triggers a key rollover if necessary
- Example Zone file

```
$TTL    7200
;       The serial number is left justified in a field of at least 10 chars!!
@       IN SOA  ns1.example.net. hostmaster.example.net.  (
                                244       ; Serial
                                43200   ; Refresh
                                1800    ; Retry
                                2W      ; Expire
                                7200 )  ; Minimum
$INCLUDE dnskey.db
```

dnssec-signer options

- Be silent or very verbose (`-v -v`)
- Option `-f` forces a re-signing of the zone
- Four „mode of operation“
  a. Signing of a single zone (in the current directory)
  ```
  $ dnssec-signer -v -v -o example.net.
  ```
  b. Signing of all zones below „Zonedir“
  ```
  $ dnssec-signer -v -v
  ```
  c. Sign all master zones (`.signed`) in `named.conf`
  ```
  $ dnssec-signer -v -v -N /var/named/named.conf
  ```
  d. Signing of all zones below a given directory
  ```
  $ dnssec-signer -v -v -D /var/named/zones/de.
  ```
- Use option `-r` to trigger a reload of the zone (via `rndc`)
  The reload will be triggered only if it's necessary (new `.signed` file)

ZKT logging

- Logging is independent of (verbose) output to stdout
  But could be logged as well (Verboselog: 0|1|2)

- Several log level supported
  debug, info, notice, warning, error, fatal; „none“ turns logging of

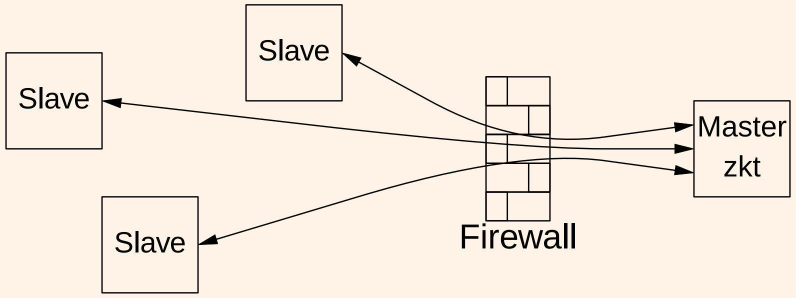
- Logging to a log *file* or *directory* (LogFile, LogLevel)
  - A file will be overwritten by each dnssec-signer run
  - If a directory is specified, different files for logging will be used
  - File name looks like zkt−*YYYY*−*mm*−*dd*T*hhmmss*Z.log (UTC)

- Syslog logging with configurable facility and loglevel

- Exit code of dnssec-signer reflects number of errors:
  - 0: no error
  - 1-64: The number of errors occured (or more than 63)
  - 127: Fatal error

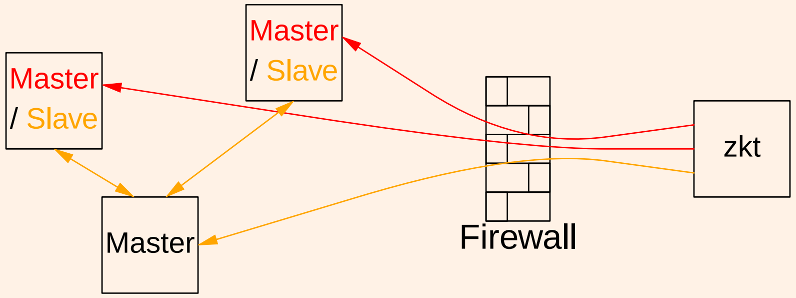
ZKT / Bind Setup

- The most simple setup:
  - ZKT is running on the master name server
  - Every zone has it's own directory with all the keys in it
  - Zone transfer to slave name server via [A|I]XFR
  - This setup is also good for dynamic zones
- If this is too risiky use a stealth master (hidden primary) setup
  - ZKT is running on the stealth master
  - Master is behind a firewall
  - Zone transfer to visible slave name server via [A|I]XFR
  - More secure but also a bit more complex



ZKT running w/o BIND

- Run ZKT on your provisioning system without a name server
- Provisioning system is behind a firewall
- Send signed zone files to master name server via (e.g.) `scp`
- Reload zone via `ssh` or `rndc`
- Single- or multi master setup possible



- Configure ZKT to use a distribute command

```
Distribute_Cmd: /var/named/distribute.sh
```

Example script is part of zkt

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DNSSEC in 6 Minutes

(by Alan Clegg from ISC: http://www.isc.org/files/DNSSEC_in_6_minutes.pdf)

- Create a sidewide `dnssec.conf` file (e.g. for unix timestamp support)

```
$ cd /var/named
$ dnssec-zkt -O "Serialformat: unixtime; Zonedir: /var/named/zones" -Z > dnssec.conf
```

- Create a new directory and copy your existing zone file into it

```
$ mkdir -p zones/example.de; cd zones/example.de
$ cp /var/named/db.example.de zone.db
```

- Include the dnskey database into the zone file

```
$ echo "\$INCLUDE dnskey.db" >> zone.db
```

- Create an (even empty) signed zone file

```
$ cat /dev/null > zone.db.signed
```

- Change the name of the zone file in `named.conf`

```
zone "example.de." in {
     type master;
     file "example.de/zone.db.signed";
};
```

DNSSEC in 6 Minutes (2)

- Run the ZKT signer command and reload the zone

```
$ dnssec-signer -r -v -o example.de.
parsing zone "example.de." in dir "."
        Check RFC5011 status
        Check KSK status
        No active KSK found: generate new one
        Check ZSK status
        No active ZSK found: generate new one
        Re-signing necessary: Modfied zone key set
        Writing key file "./dnskey.db"
        Signing zone "example.de."
        Signing completed after 0s.
        Reload zone "example.de."
```

- Run the signer command in regular intervals
  Use cron for this, but turn off verbose output

```
$ dnssec-signer -r -v -N /var/named/named.conf
parsing zone "example.de." in dir "/var/named/zones/example.de"
        Check RFC5011 status
        Check KSK status
        Check ZSK status
        Re-signing not necessary!
```

- Done!

Fragen ?

DNSsec, VoIPsec, IPsec, XMPPsec, SMTPsec, WLANsec ...

... DKIM, Kerberos, IMAP, LDAP, ENUM, SIP, ...

... NTP, DNS, DHCP, IPv6, Routing, Switching

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Backup Slides

Double Signature (KSK) Rollover

- If lifetime of KSK is over
  1. Generate a new KSK; Use both ksk for key signing
     Wait until new key is known by resolver (propagation time + old key TTL)
  2. Send new DSset (or keyset) to the parent
     Wait until the DS is propagated + TTL of the old DS−RR
  3. Remove the old key
- Step two is under discussion
  How to send the DS or DNSKEY to the parent?
- Automatic ksk rollover if parent is under control of zkt on the same host
  Use a hierachical directory structure with child dir below the parent
- Otherwise a warning message is written into logfile if ksk is expired
- Use manual KSK rollover feature of dnssec-zkt then

```
$ dnssec-zkt --ksk-roll-phase1 example.net.      $ dnssec-zkt --ksk-newkey example.net.
$ dnssec-zkt --ksk-roll-phase2 example.net.      $ dnssec-zkt --ksk-publish example.net.
$ dnssec-zkt --ksk-roll-phase3 example.net.      $ dnssec-zkt --ksk-delkey example.net.
```

RFC5011 KSK rollover

- Create a „standby“ key manually
  A standby key is a pre published KSK not used for signing

  $ dnssec-zkt --ksk --create test.example.net.

- If the lifetime of the active KSK is over
  a. A new standby key will be created
  b. The old standby key will be activated
  c. The old active key will be revoked
  d. After 30 days, revoked key will be removed from zone apex

- Revoking a key means to set bit 8 in the flags field

```
example.de. IN DNSKEY  385  3 5 BQEAAAABDAEYYP2lsGo...= ;
                      /     \
                     110000001
```

- Pay attention: Changing the flag field results in a new key tag(id)

```
$ dnssec-zkt --nohead --list-dnskey --ksk -l example.de.
example.de. IN DNSKEY  385 3 5 (
                      BQEAAAABDAEYYP2lsGob0e77EYYDqsr ...  wQ==
               ) ; key id = 58763 (original key id = 58635)
```

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