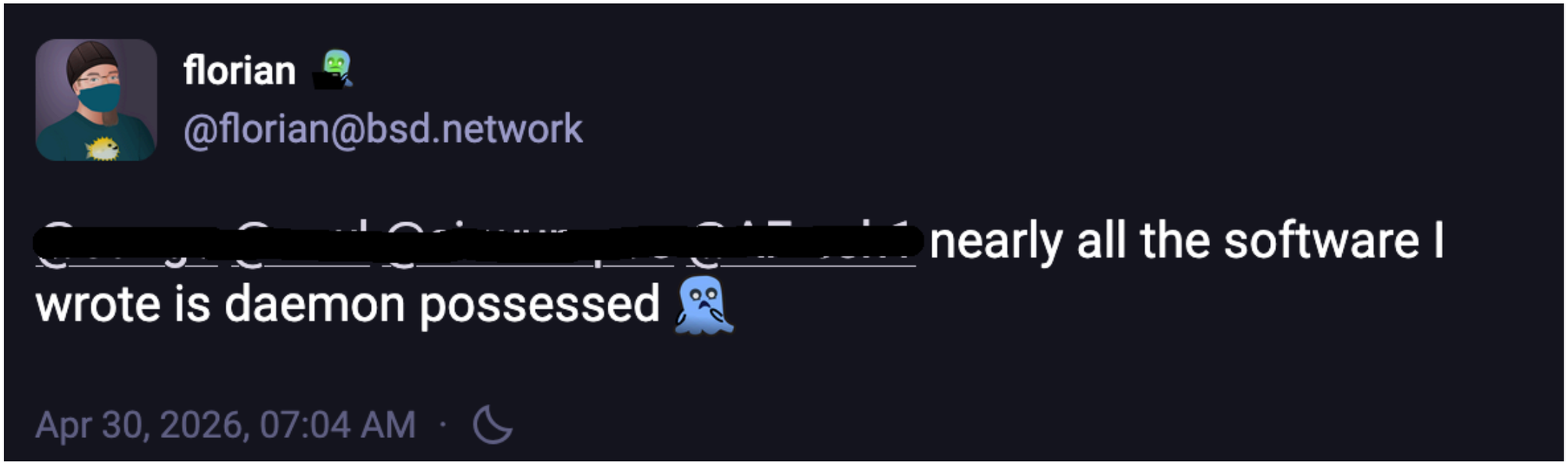
Let's find out how to get predictable IPv6 addresses assigned to OpenBSD VMs

Or: Mischa is looking for a solution...

BSD-NL Early 2026 - Florian Obser - florian @ openbsd.org

Who Am I

- OpenBSD developer for 13+ years



- to wit:
  - `dhcpleased` / `dhcp6leased` / `rad` / `slaacd` / `unwind`
- deleted 300k LoC from `usr.sbin/bind`
  - current contributions are net-negative; will retire at zero

The Problem

- How to get predictable IPv6 addresses on OpenBSD
- Smashing return in the installer:

```
$ cat /etc/hostname.vio0
inet autoconf
inet6 autoconf
```

- `ifconfig`

```
lladdr be:b4:95:d3:08:81
inet6 2001:db8::41b0:9c1d:1894:11b0 prefixlen 64 autoconf pltime 3485 vltime 7085
inet6 2001:db8::d02e:db57:6ac3:ede6 prefixlen 64 autoconf temporary pltime 3485 v
```

- autoconf: Semantically Opaque Interface Identifier (soii)
  - stable between reboots, but per prefix random IPv6 address
- temporary: completely random, doesn't make sense for servers.

Solving Problems

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3. Organize a conference and nerd-snipe someone to give a presentation

autoinstall(8)

- Net boot
- Answer file is fetched from `http://$next_server/MAC_address-install.conf`
- Get example answer file by installing once by hand and check root's mailbox.

```
System hostname = openbsd-install
Network interface to configure = vio0
IPv4 address for vio0 = autoconf
IPv6 address for vio0 = 2001:db8::42
IPv6 prefix length for vio0 = 64
Network interface to configure = done
IPv6 default router = fe80::1%vio0
[...]
```

- see install.site(5) for even more control
  - per-host tgz & `/install.site` script

config management system du jour

- ansible, ~~puppet~~ OpenVox, salt…
- manage `/etc/hostname.vio0`
- or, collect IP addresses and populate DNS

disable temporary & soii for IPv6

```
cat <<END > /etc/hostname.vio0
inet autoconf
inet6 autoconf -temporary -soii
up
END
```

- EUI64 address, formed from mac address
  - `lladdr be:b4:95:d3:08:81` → `inet6 2001:db8::bcb4:95ff:fed3:881`

/128 per vlan

- `rad.conf`

```
interface vlan42 {
	no auto prefix
	prefix 2001:db8::42/128
}
```

- yes, this works with `slaacd(8)`
  - … but not much else

DHCPv6

- `dhcp6leased(8)`
- only implements DHCPv6 prefix delegation
- `dhcp6leased.conf`

```
request prefix delegation on vio0 for {
    vio1/64
}
```

`dhcp6leased(8)` Overview

1. main process (dhcp6leased)
    - parses & reloads config
    - reads, writes & parses lease file
    - spins up other processes
    - configures network
    - open UDP sockets
2. frontend
    - talks to the network & control socket
3. engine
    - tells the frontend to send a packet
    - parses answer packet (received from frontend)
    - tells main processes to configure network

A few more hints

- DHCPv6 is specified in RFC 8415.
- DHCPv6 state-machine is the same for all address options
  - Identity Association for Prefix Delegation (IA_PD)
  - Identity Association for Non-temporary Addresses (IA_NA)
  - [Identity Association for Temporary Addresses (IA_TA)]
- DHCPv6 options on-wire formats are described in chapter 21.

Your mission, should you choose to accept it…

- … transmogrify IA_PD into IA_NA.
- Remember the configuration: `request prefix delegation on vio0 for {`

```
$ git grep -i 'request prefix delegation'
dhcp6leased.conf.5:A list of interfaces on which to request prefix delegation:
dhcp6leased.conf.5:.It Ic request prefix delegation on Ar name Ic for [...]
parse.y:ia_pd           : REQUEST PREFIX DELEGATION ON STRING FOR {
printconf.c:                    printf("request prefix delegation on %s for {"
printconf.c:                    printf("request prefix delegation on %s for {\n",
```

- ~~Documentation~~
- Lexer / Parser
- ~~Print configuration for `dhcp6leased -nv`~~

parse.y

- contains lexer + yacc(1) based parser
- add rule for `"request address for INTERFACE"`

parse.y

```
ia_pd           : REQUEST PREFIX DELEGATION ON STRING FOR {
                        iface_conf = conf_get_iface($5);
                        iface_ia_conf = calloc(1, sizeof(*iface_ia_conf));
                        if (iface_ia_conf == NULL)
                                err(1, "%s: calloc", __func__);
                        iface_ia_conf->id = iface_conf->ia_count++;
                        if (iface_conf->ia_count > MAX_IA) {
                                yyerror("Too many prefix delegation requests");
                                YYERROR;
                        }
                        SIMPLEQ_INIT(&iface_ia_conf->iface_pd_list);
                        SIMPLEQ_INSERT_TAIL(&iface_conf->iface_ia_list,
                            iface_ia_conf, entry);
                } iface_block {
                        iface_conf = NULL;
                        iface_ia_conf = NULL;
                }
                ;
```

parse.y

```
ia_na           : REQUEST ADDRESS FOR STRING {
                        iface_conf = conf_get_iface($4);
                        iface_conf->ia_na = 1;
                        iface_conf = NULL;
                }
                ;
```

parse.y

- hook it up to the grammar

```
grammar         : /* empty */
                | grammar '\n'
                | grammar varset '\n'
                | grammar conf_main '\n'
                | grammar ia_pd '\n'
                | grammar error '\n'            { file->errors++; }
                ;
```

- extend lexer

```
lookup(char *s)
{
        /* This has to be sorted always. */
        static const struct keywords keywords[] = {
                {"commit",      COMMIT},
                {"delegation",  DELEGATION},
                {"for",         FOR},
                {"on",          ON},
                {"prefix",      PREFIX},
                {"rapid",       RAPID},
                {"request",     REQUEST},
        };
[...]
```

printconf.c

- Left as an exercise.
- Fill in missing bits in `printconf.c`
- Create `dhcp6leased.conf` with `request address for vio0`
- run `make obj; make; obj/dhcp6leased -nvf ./dhcp6leased.conf`

Requesting a lease

- DHCPv6 is a request - response protocol
- Statemachine for IA_NA is the same as for IA_PD
- We need to send a solicit packet → frontend.

frontend.c

```
__dead void      frontend_shutdown(void);
void             frontend_sig_handler(int, short, void *);
void             frontend_startup(void);
void             update_iface(uint32_t);
void             route_receive(int, short, void *);
void             handle_route_message(struct rt_msghdr *, struct sockaddr **);
void             get_rtaddrs(int, struct sockaddr *, struct sockaddr **);
void             udp_receive(int, short, void *);
int              get_flags(char *);
struct iface    *get_iface_by_id(uint32_t);
struct iface    *get_iface_by_name(const char *);
void             remove_iface(uint32_t);
void             set_udpsock(int, uint32_t);
void             iface_data_from_imsg(struct iface*, struct imsg_req_dhcp *);
ssize_t          build_packet(uint8_t, struct iface *, char *);
void             send_packet(uint8_t, struct iface *);
int              iface_conf_cmp(struct iface_conf *, struct iface_conf *);
```

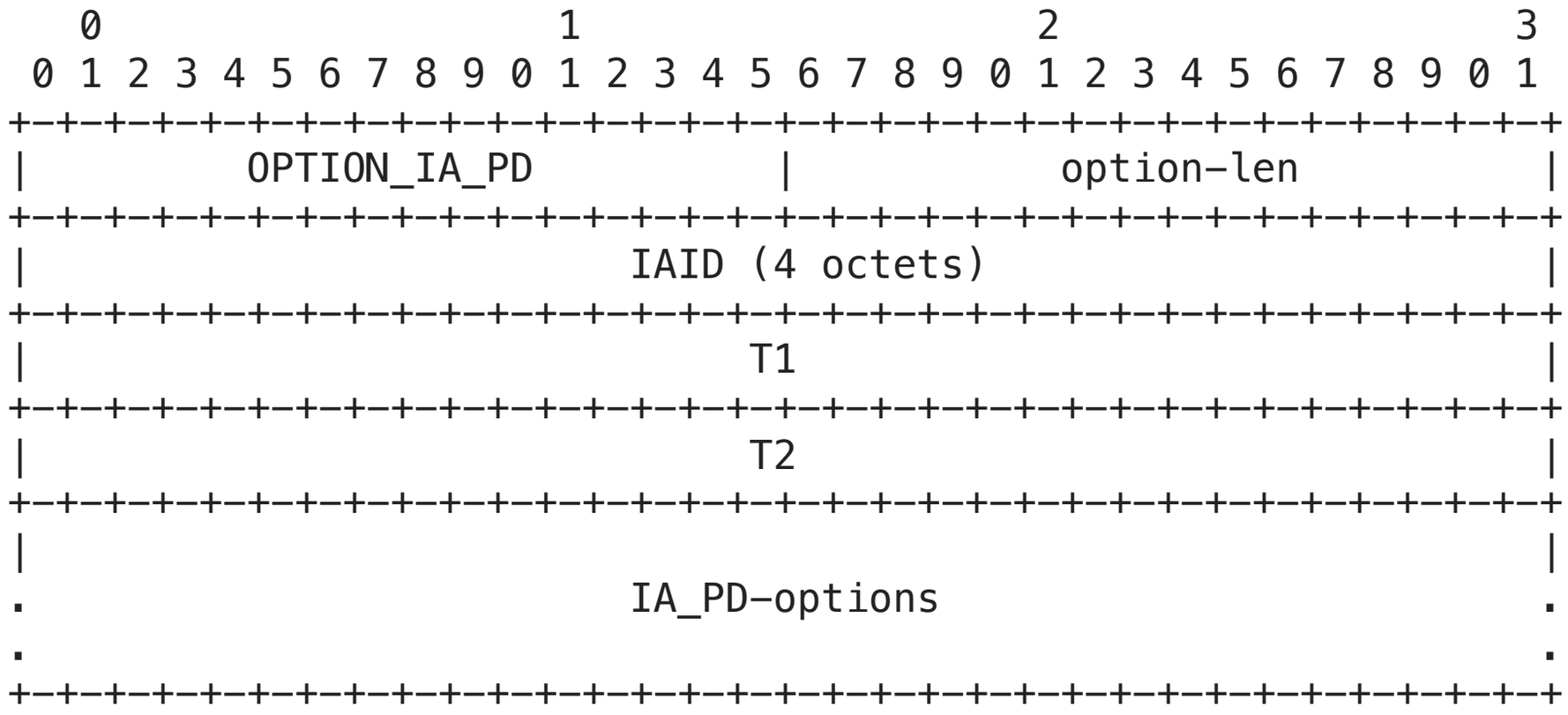
`frontend.c – build_packet`

- fills in global `dhcp_packet`
  - dhcp header
  - required options (client ID, maybe server ID)
- loops over IA_PD in `struct iface_conf`
  - adds option header
  - adds IA_PD option

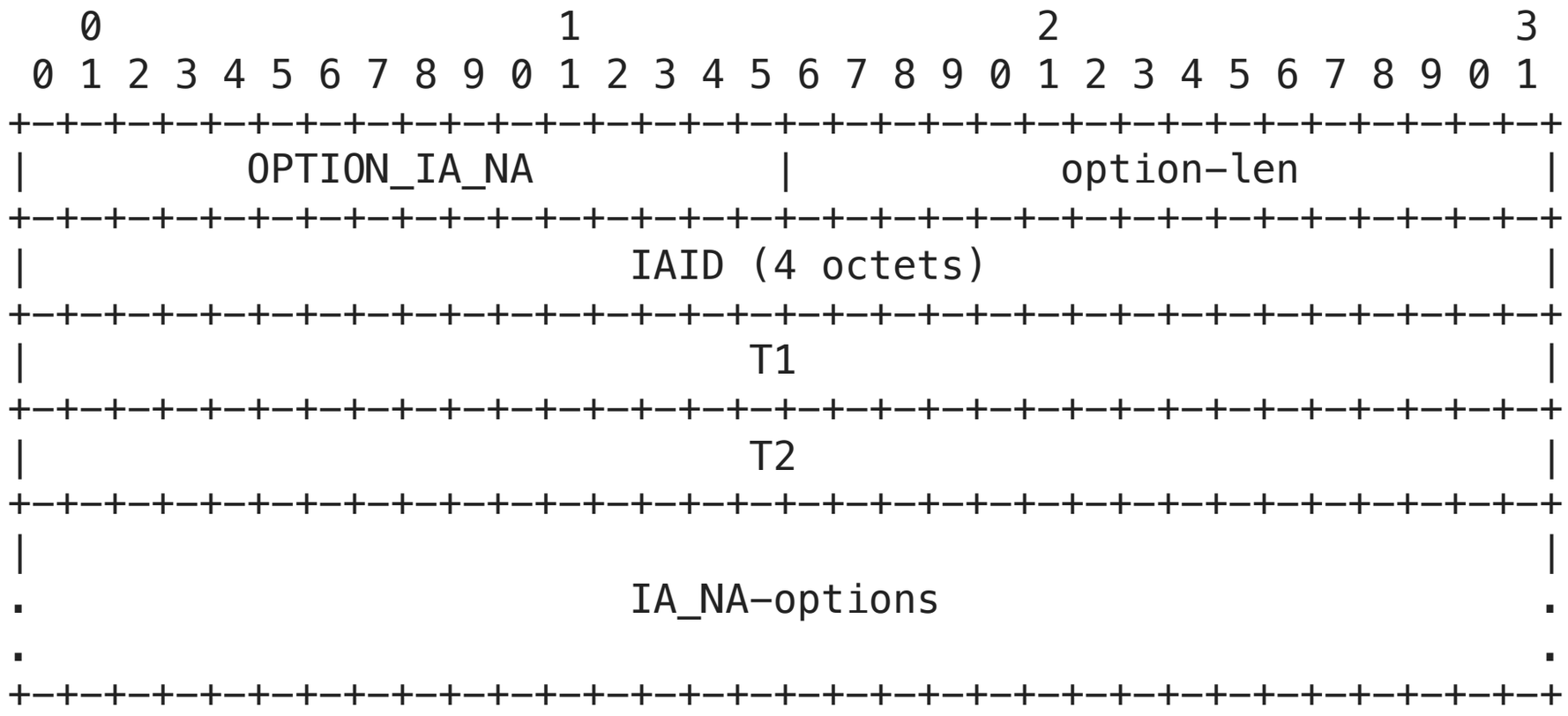
```
SIMPLEQ_FOREACH(ia_conf, &iface_conf->iface_ia_list, entry) {
        struct prefix *pd;

        opt_hdr.code = htons(DHO_IA_PD);
[...]
}
```

RFC 8415 - 21.21. Identity Association for Prefix Delegation Option



RFC 8415 - 21.4. Identity Association for Non-temporary Addresses Option



frontend.c – build_packet

- add IA_NA option

```
if (iface_conf->ia_na) {
        opt_hdr.code = htons(DHO_IA_NA);
[...]
}
```

frontend.c – build_packet

- replace `struct dhcp_iapd` with `struct dhcp_iana` (even if it's the same)
- old

```
iapd.iaid = htonl(ia_conf->id);
iapd.t1 = 0;
iapd.t2 = 0;
memcpy(p, &iapd, sizeof(struct dhcp_iapd));
p += sizeof(struct dhcp_iapd);
```

- new

```
iana.iaid = htonl(1);
iana.t1 = 0;
iana.t2 = 0;
memcpy(p, &iana, sizeof(struct dhcp_iana));
p += sizeof(struct dhcp_iana);
```

- leave out `IA_NA-options` we don't have any (yet).

Test

- run `tshark -nl -i vio0 -V -Y dhcpv6 'port 546 or port 547'`
- run `dhcp6leased -dv`
- `tshark` should show a `SOLICIT` message going out and `ADVERTISE` or `REPLY` message coming in.
- `dhcp6leased` should print "unhandled option: 3"

unhandled option: 3

- 3: `OPTION_IA_NA`

```
grep -l 'unhandled option:'
engine.c
```

- `parse_dhcp()`

```
[...]
case DHO_IA_PD:
[...]
        break;
case DHO_RAPID_COMMIT:
[...]
        break;
default:
        log_debug("unhandled option: %u", opt_hdr.code);
        break;
```

- You know the drill, transmogrify `case DHO_IA_PD` into `case DHO_IA_NA`.

Draw the rest of the owl!

- define new structs & constants
- pass address hints between engine & frontend
  - goes into `IA_NA-options`
- configure IPv6 address
  - the code is there for the PD case
- write lease & parse lease
- `dhcp6leasectl`
- everything else I forgot.

Questions?

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