

Hands on *getdns*

Unbound security

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Labs

#JCSA17

— *afnic* —

JOURNÉE DU
CONSEIL SCIENTIFIQUE
DE L'AFNIC
JEUDI 6 JUILLET 2017

Hands on *getdns* Overview

- What is the getdns API
- What can the getdns library do for you
- Guided tour of the API
- Examples uses (code!)
- Demo of Stubby (time permitting)

but first...



installation on ubuntu

```
willem@bonobo: ~/afnic
willem@bonobo: ~/afnic 80x24
willem@bonobo:~/afnic$ apt search getdns
Sorting... Done
Full Text Search... Done
getdns-utils/zesty 1.1.0~a2-1 amd64
  modern asynchronous DNS API (utils)

libgetdns-dev/zesty 1.1.0~a2-1 amd64
  modern asynchronous DNS API (development)

libgetdns1/zesty 1.1.0~a2-1 amd64
  modern asynchronous DNS API (shared library)

python-getdns/zesty 1.0.0~b1-1 amd64
  modern asynchronous DNS API (python bindings)

python-getdns-doc/zesty,zesty 1.0.0~b1-1 all
  modern asynchronous DNS API (documentation)

python3-getdns/zesty 1.0.0~b1-1 amd64
  modern asynchronous DNS API (python 3 bindings)

willem@bonobo:~/afnic$ sudo apt install getdns-utils python-getdns libgetdns-dev
█
```



installation on MacOS

```
willem — ssh ieniemienie — 80x25
ieniemienie:~ willem$ brew info getdns
[getdns: stable 1.1.1 (bottled), HEAD
Modern asynchronous DNS API
https://getdnsapi.net
/usr/local/Cellar/getdns/1.1.1 (99 files, 1.7MB) *
  Poured from bottle on 2017-07-04 at 09:58:55
From: https://github.com/Homebrew/homebrew-core/blob/master/Formula/getdns.rb
==> Dependencies
Required: openssl ✓
Recommended: unbound ✓, libidn ✓, libevent ✓
Optional: libuv ✗, libev ✗
==> Options
--with-libev
    Build with libev support
--with-libuv
    Build with libuv support
--without-libevent
    Build without libevent support
--without-libidn
    Build without libidn support
--without-unbound
    Build without unbound support
--HEAD
    Install HEAD version
ieniemienie:~ willem$ brew install getdns
```



installation from tarball

```
$ wget https://getdnsapi.net/dist/getdns-1.1.2.tar.gz
```

```
--2017-07-04 10:20:20-- https://getdnsapi.net/dist/getdns-1.1.2.tar.gz
Resolving getdnsapi.net (getdnsapi.net)... 2a04:b900:0:100::37, 185.49.141.37
Connecting to getdnsapi.net (getdnsapi.net)|2a04:b900:0:100::37|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 948941 (927K) [application/x-gzip]
Saving to: 'getdns-1.1.2.tar.gz'
getdns-1.1.2.tar.gz      100%[=====>] 926.70K  --.-KB/s    in 0.08s
2017-07-04 10:20:20 (11.9 MB/s) - 'getdns-1.1.2.tar.gz' saved [948941/948941]
```

```
$ tar xzf getdns-1.1.2.tar.gz
```

```
$ cd getdns-1.1.2/
```

```
$ ./configure --enable-stub-only --without-libidn
```

```
checking for gcc... gcc
checking whether the C compiler works... yes
checking for C compiler default output file name... a.out
checking for suffix of executables...
checking whether we are cross compiling... no
```

```
$ make
```

```
$ sudo make install
```



installation from repository

```
$ git clone https://github.com/getdnsapi/getdns
```

```
Cloning into 'getdns'...
```

```
remote: Counting objects: 13781, done.
```

```
remote: Compressing objects: 100% (165/165), done.
```

```
remote: Total 13781 (delta 167), reused 158 (delta 85), pack-reused 13531
```

```
Receiving objects: 100% (13781/13781), 8.86 MiB | 7.94 MiB/s, done.
```

```
Resolving deltas: 100% (10541/10541), done.
```

```
$ cd getdns
```

```
$ git checkout features/zeroconf-dnssec
```

```
Branch features/zeroconf-dnssec set up to track remote branch features/zeroconf-dnssec from origin.
```

```
Switched to a new branch 'features/zeroconf-dnssec'
```

```
$ git submodule update --init
```

```
Submodule 'src/test/jsmn' (https://github.com/getdnsapi/jsmn.git) registered for path 'src/jsmn'
```

```
Submodule 'src/yxml' (git://g.blicky.net/yxml.git) registered for path 'src/yxml'
```

```
Cloning into '/home/willem/getdns/getdns/src/jsmn'...
```

```
Cloning into '/home/willem/getdns/getdns/src/yxml'...
```

```
Submodule path 'src/jsmn': checked out '868c22e35ec223fc26ddefdb9ca83901dc6e2534'
```

```
Submodule path 'src/yxml': checked out '10f968b0e78b9aeee357d0de81a46b445c3fb27b'
```




installation from repository

```
$ autoreconf -fi
```

```
libtoolize: putting auxiliary files in '..'.  
libtoolize: copying file './ltmain.sh'  
libtoolize: putting macros in AC_CONFIG_MACRO_DIRS, 'm4'.  
libtoolize: copying file 'm4/libtool.m4'  
libtoolize: copying file 'm4/ltoptions.m4'  
libtoolize: copying file 'm4/ltsugar.m4'  
libtoolize: copying file 'm4/ltversion.m4'  
libtoolize: copying file 'm4/lt~obsolete.m4'  
libtoolize: Consider adding '-I m4' to ACLOCAL_AMFLAGS in Makefile.am.
```

```
$ glibtoolize -ci
```

```
libtoolize: putting auxiliary files in '..'.  
libtoolize: copying file './config.guess'  
libtoolize: copying file './config.sub'  
libtoolize: copying file './install-sh'  
libtoolize: Consider adding '-I m4' to ACLOCAL_AMFLAGS in Makefile.am.
```

```
$ ./configure --enable-stub-only --without-libidn
```

```
$ make
```

```
$ sudo make install
```

installation

try out getdns_query

```
$ getdns_query -h
```

```
usage: getdns_query [<option> ...] \
[@<upstream> ...] [+<extension> ...] ['{ <settings> }'] [<name>] [<type>]
```

default mode: recursive, synchronous resolution of NS record
using UDP with TCP fallback

upstreams: @<ip>[%<scope_id>][@<port>][#<tls port>][~<tls name>][^<tsig spec>]
 <ip>@<port> may be given as <IPv4>:<port>
 or '['<IPv6>[%<scope_id>]']':<port> too

tsig spec: [<algorithm>:]<name>:<secret in Base64>

extensions:

+add_warning_for_bad_dns	+edns_cookies
+dnssec_return_status	+return_both_v4_and_v6
+dnssec_return_only_secure	+return_call_reporting
+dnssec_return_all_statuses	+sit=<cookie> Send along cookie OPT
+dnssec_return_validation_chain	with value <cookie>
+dnssec_return_full_validation_chain	+specify_class=<class>
+dnssec_roadblock_avoidance	+0 Clear all extensions



installation

try out getdns_query

```
$ getdns_query -i
```

```
$ getdns_query -k
```

```
$ getdns_query -s . DNSKEY +dnssec_return_status
```

```
$ getdns_query -k
```

```
$ ls -l $HOME/.getdns
```

```
$ getdns_query -s @185.49.141.37~getdnsapi.net \  
               -l LTU +return_call_reporting
```

```
$ getdns_query -s _443._tcp.www.afnic.fr TLSA \  
               +dnssec_return_validation_chain
```

The *getdns* API is:

- A *DNS API* specification (for resolving)
by and for application developers (for application)

motivation

- `getaddrinfo()` does not fit standards* any more
 - Protocol signalling in non-address records:
SSHFP, TLSA, OPENPGPKEY, SMIMEA,
URI, CAA, HIP, CDS, CDNSKEY, CSYNC, etc.
 - Asynchronous standards (Happy Eyeballs)
 - App. level DNSSEC validation (for DANE)
 - DNS Privacy

The *getdns* API is:

- A *DNS API* specification (for resolving)
by and for application developers (for application)

From API design considerations:

motivation

*... There are other DNS APIs available,
but there has been very little uptake ...*

... talking to application developers

*... the APIs were developed by and for DNS people,
not application developers ...*

... create a natural follow-on to `gettadrinfo()` ...

The *getdns* API is:

- A *DNS API* specification (for resolving)
by and for application developers (for application)
- First edited by Paul Hoffman
- First published in April 2013
- Currently published at
<https://getdnsapi.net/documentation/spec/>
- Maintained by *the getdns team*

The *getdns* library is:

- An implementation of the *getdns* API
- A *DNS API* specification (for resolving)
by and for application developers (for application)
- First implementation initiative by Allison Mankin



- Initially a collaboration of VERISIGN™ LABS, NLnet Labs, Melinda Shore and sinodun



The *getdns* library is:

- 26 February 2014: getdns-0.1.0 release
- 23 July 2015: took over editor role of the API specification
- 22 October 2015: New API specification release introducing JSON-pointers
- 2016: 2 getdns-1.0.0 beta releases
2 getdns-1.1.0 alpha releases
- 17 January 2017: getdns-1.0.0 released
100% specification complete
- 3 July 2017: getdns-1.1.2 released (latest)
many non-API functions

non-API doc: <https://getdnsapi.net/doxygen/modules.html>

The *getdns* library is:

- An implementation of the *getdns* API

Claus Assman, Theogene Bucuti, Andrew Cathrow, Neil Cook, Saúl Ibarra Corretgé, Craig Despeaux, John Dickinson, **Sara Dickinson**, Robert Edmonds, Angelique Finan, Simson Garfinkel, Daniel Kahn Gillmor, Neel Goyal, Bryan Graham, Robert Groenenberg, Jim Hague, Paul Hoffman, Scott Hollenbeck, **Christian Huitema**, **Shumon Huque**, Jelte Janssen, Guillem Jover, Shane Kerr, Anthony Kirby, Olaf Kolkman, Sanjay Mahurpawar, **Allison Mankin**, Sai Mogali, Linus Nordberg, **Benno Overeinder**, **Joel Purra**, Tom Pusateri, Prithvi Ranganath, **Hoda Rohani**, Rushi Shah, Vinay Soni, **Melinda Shore**, Bob Steagall, Andrew Sullivan, Ondřej Surý, **Willem Toorop**, Gowri Visweswaran, **Wouter Wijngaards**, Glen Wiley, Paul Wouters

- Weekly meetings with the *getdns* core team

The *getdns* library

- Core team active in IETF and at IETF hackathons:
 - “Best in Show” prize at IETF93
DNSSEC roadblock detection, start of DNS over TLS
 - “Best internet security” at IETF94
edns0-client-subnet privacy election, start of padding
 - IETF95 – start of TLS DNSSEC auth. chain ext.
 - IETF96 – start of DNS64 work
 - IETF97 – Stubby interoperability testing
 - IETF98 – Start of Zero Configuration DNSSEC
and...

The *getdns* library

- Core team active in IETF and at IETF hackathons:
 - IETF98 – **DNS over TLS monitoring plugin by Stephane Bortzmeyer**
 - **Blog** : <https://www.bortzmeyer.org/monitor-dns-over-tls.html>
 - **Git** : <https://github.com/bortzmeyer/monitor-dns-over-tls>
 - **In use at dnsprivacy.org:**
<https://dnsprivacy.org/jenkins/job/dnsprivacy-monitoring/>

dnsprivacy-monitoring [Jenkins] - Mozilla Firefox

dnsprivacy-monitoring x +

https://dnsprivacy.org/jenkins/job/c Zoeken

Jenkins dnsprivacy-monitoring ENABLE AUTO REFRESH

		over TLS	Name only	- SPKI only	expiry gt 0 days	gt 14 days	minimisation used
getdnsapi.net	v6	✓	✓	✓	✓	✓	✓
	v4	✓	✓	✓	✓	✓	✓
dnsovertls.sinodun.com	v6	✓	✓	✓	✓	!	!
	v4	✓	✓	✓	✓	!	!
dnsovertls1.sinodun.com	v6	✓	✓	✓	✓	!	!
	v4	✓	✓	✓	✓	!	!
dns.cmrg.net	v6	✓	✓	✓	✓	✓	✓
	v4	✓	✓	✓	✓	✓	✓
tls-dns-u.odvr.dns-oarc.net	v6	!	!	!	!	!	!
	v4	!	!	!	!	!	!
dns-resolver.yeti.eu.org	v6	✓	✓	✓	✓	✓	✓
	v4	●	●	●	●	●	●
yeti-rr.datev.net	v6	!	!	!	!	!	!
	v4	●	●	●	●	●	●
unicast.censurfridns.dk	v6	✓	✓	●	✓	✓	!
	v4	✓	✓	●	✓	✓	!
dns-tls.openbsd.se	v6	●	●	●	●	●	●
	v4	✓	✓	✓	✓	✓	!

moni ^ v Alles markeren Hoofdlettergevoelig Hele woorden 1 van 1 overeenkomst

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The *getdns* library motivation

From the README.md:

- ... DNSSEC offers a unique global infrastructure for establishing cryptographic trust relations ...*
- ... offer application developers a modern and flexible way that enables end-to-end trust in the DNS architecture ...*
- ... inspire application developers towards innovative security solutions ...*

The *getdns* library motivation

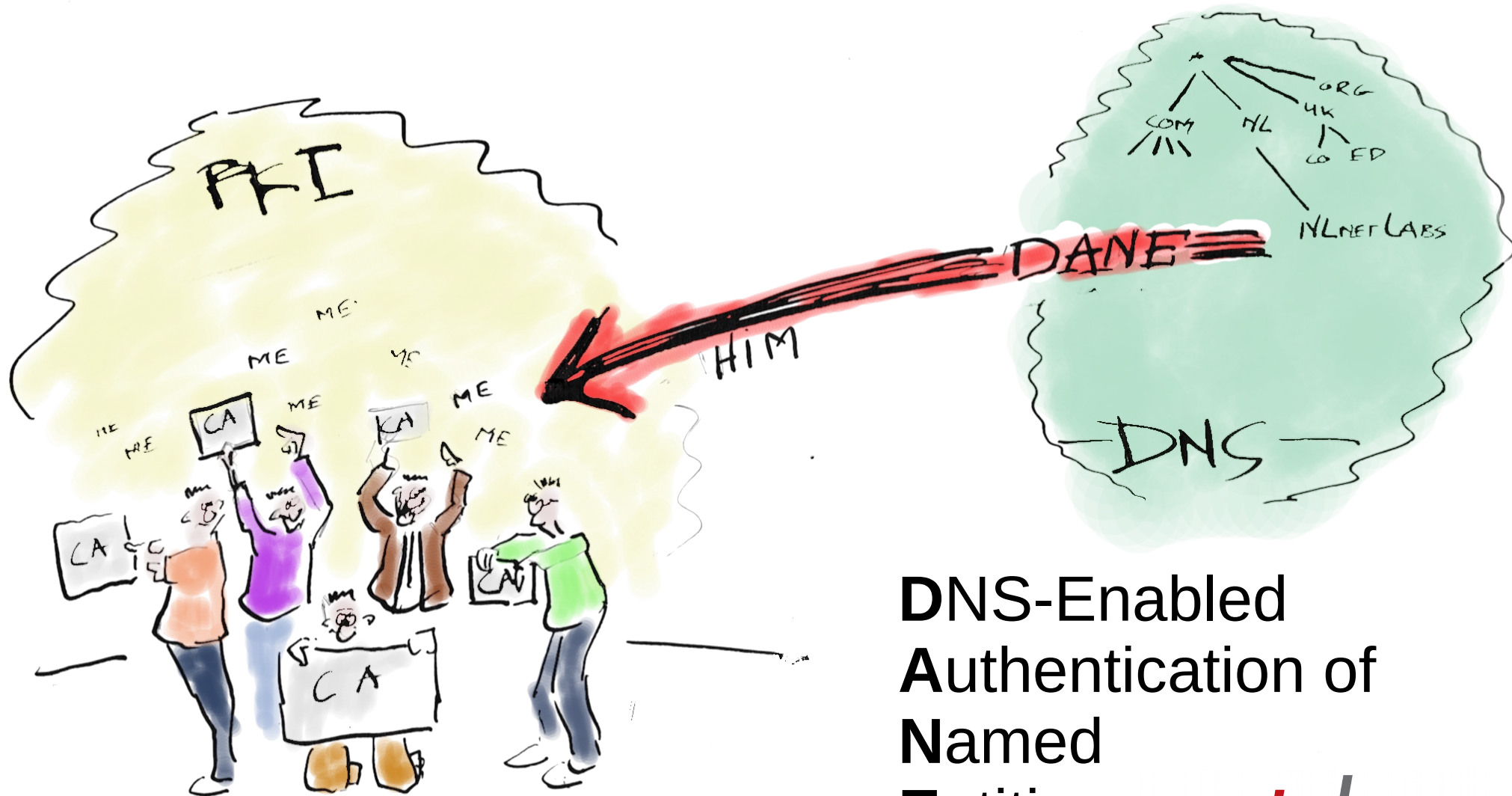
Regular PKI is flawed

Any Certificate Authority
(3000+)

Can vouch for **any** name

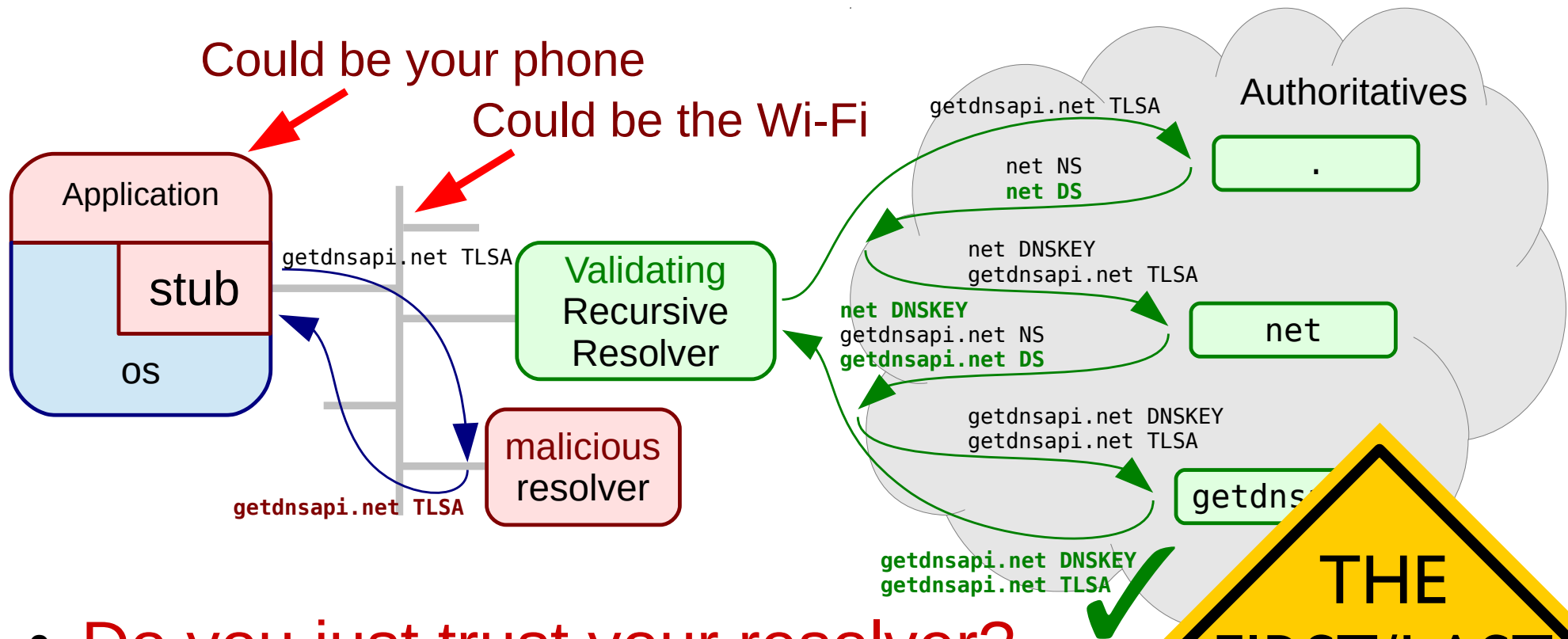


The *getdns* library motivation



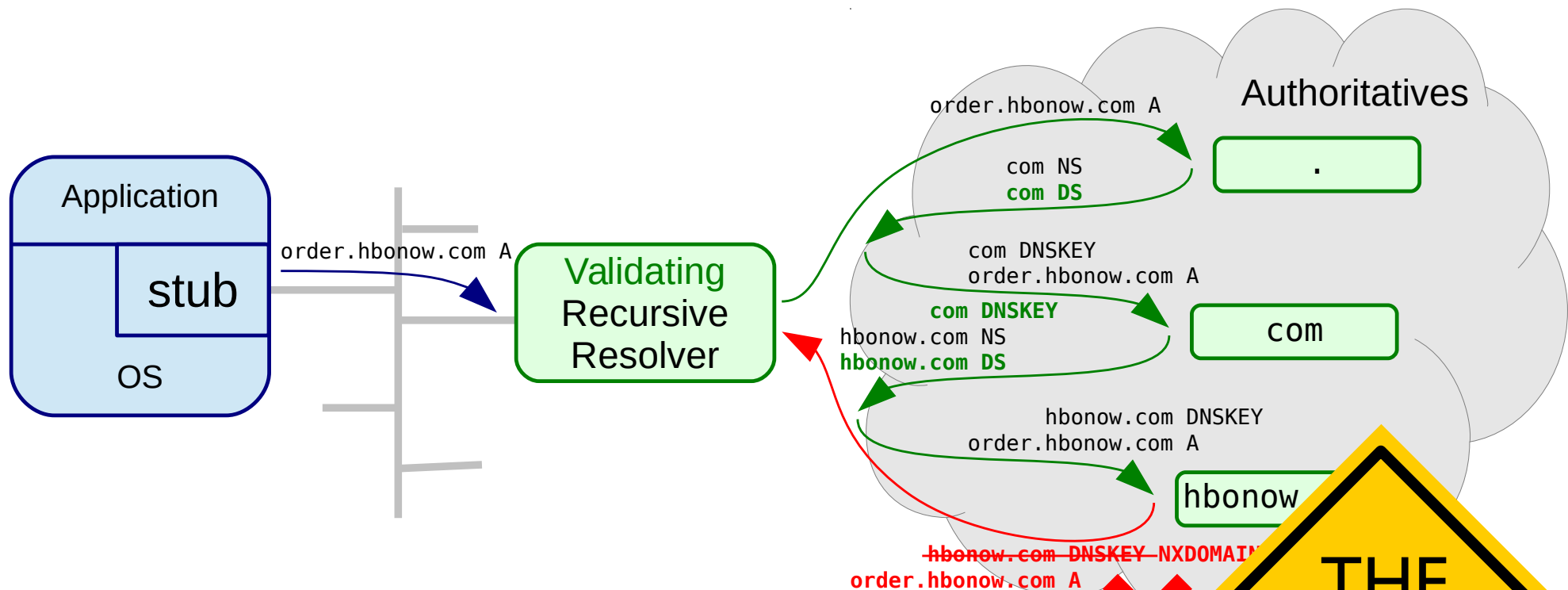
DNS-Enabled
Authentication of
Named
Entities

The *getdns* library motivation



- Do you just trust your resolver?

The *getdns* library motivation



- Do you just trust your resolver?
- **Who's to blame**

The *getdns* library motivation

Application
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OS

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THE FIRST/LAST MILE

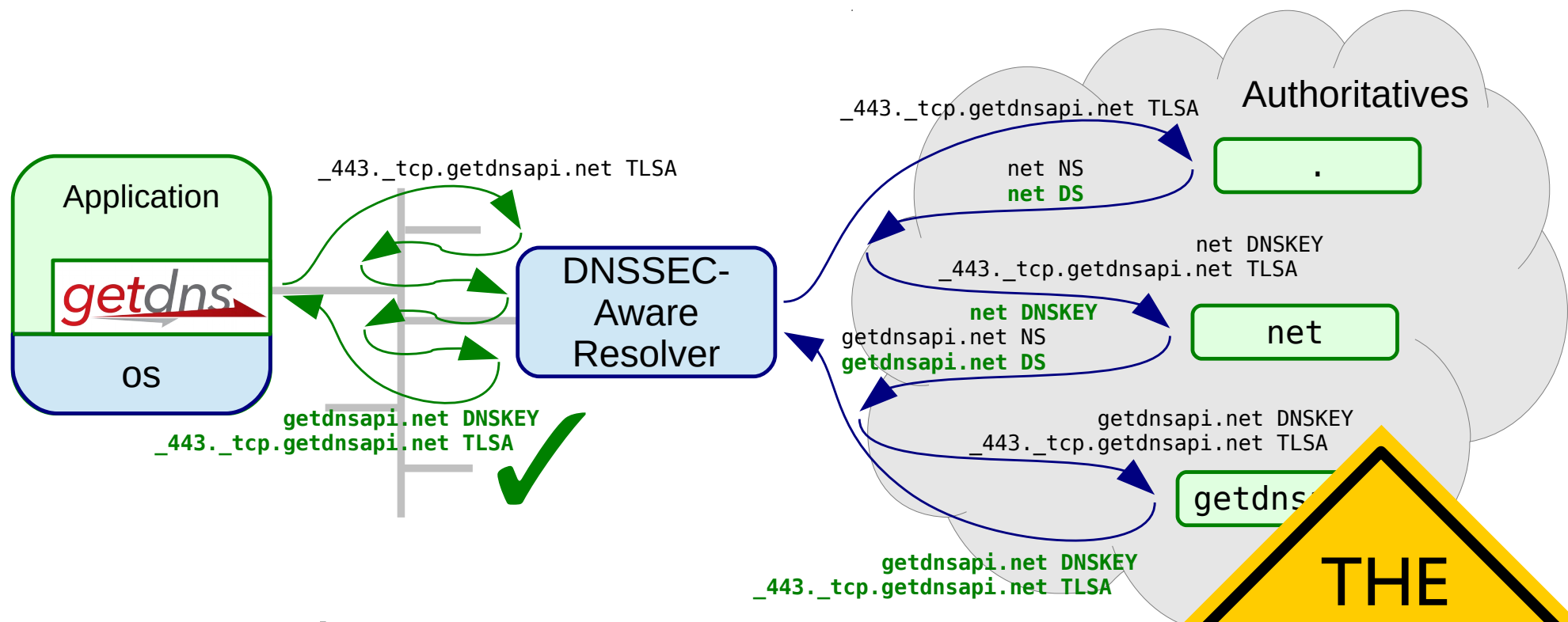
- Do you just trust your resolver?
- **Who's to blame**

Sara Dickinson & Willem Toorop
#JCSA17 6 July 2017

Hands on *getdns*

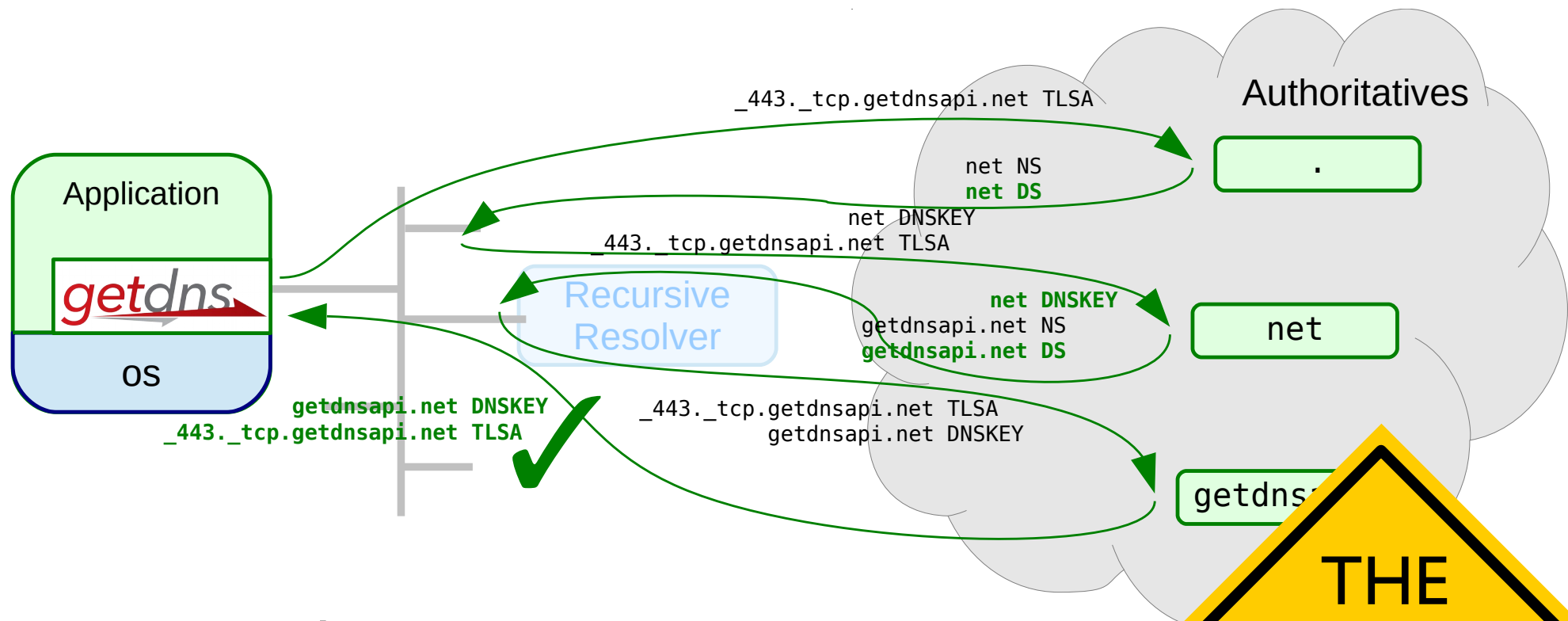
24/93 *getdns* Unbound security

The *getdns* library features



- Do you just trust your resolver?
- Who's to blame
- **DNSSEC resolution as Stub**

The *getdns* library features

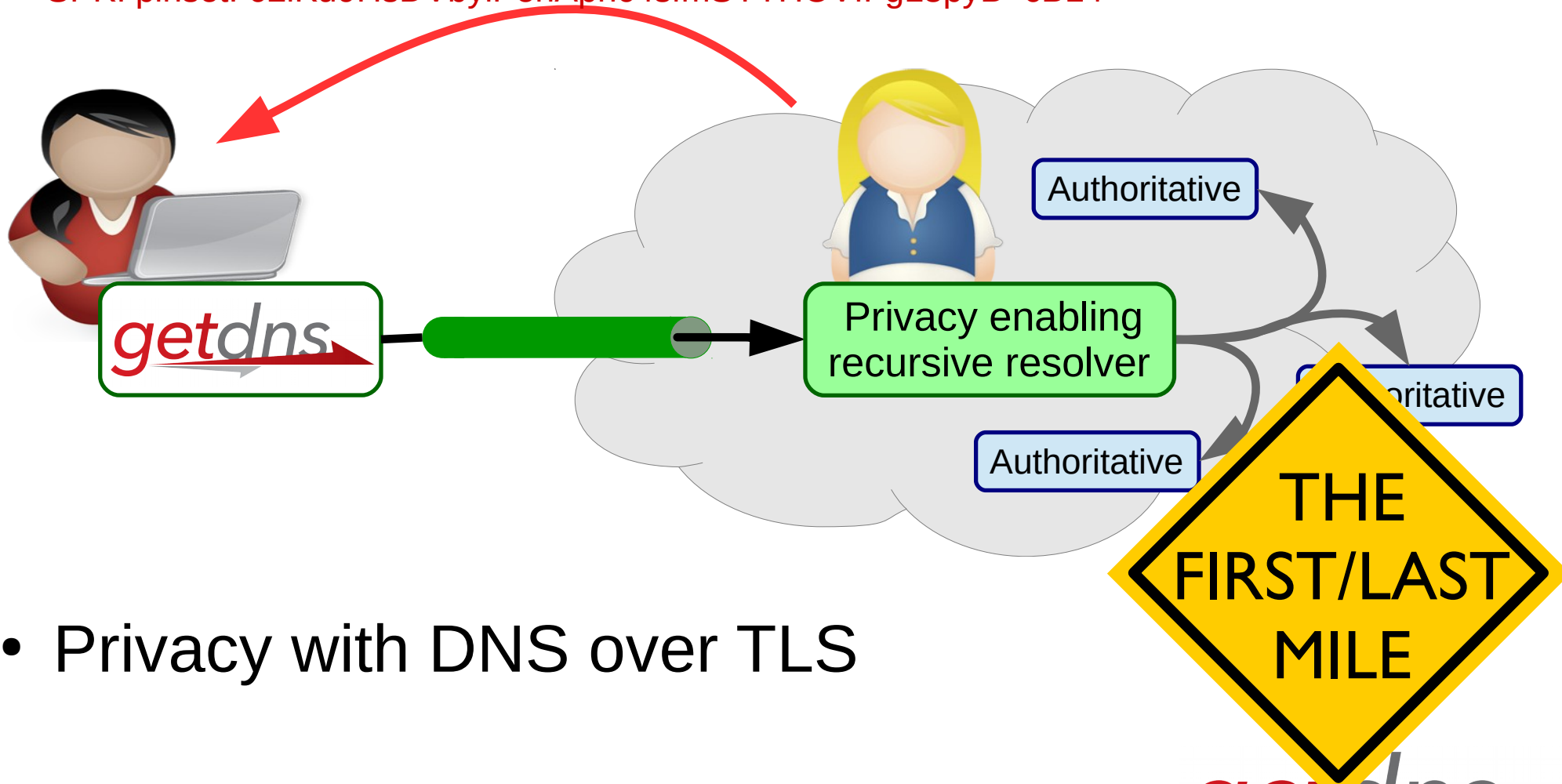


- Do you just trust your resolver?
- DNSSEC resolution as Stub
- **DNSSEC Roadblock avoidance**



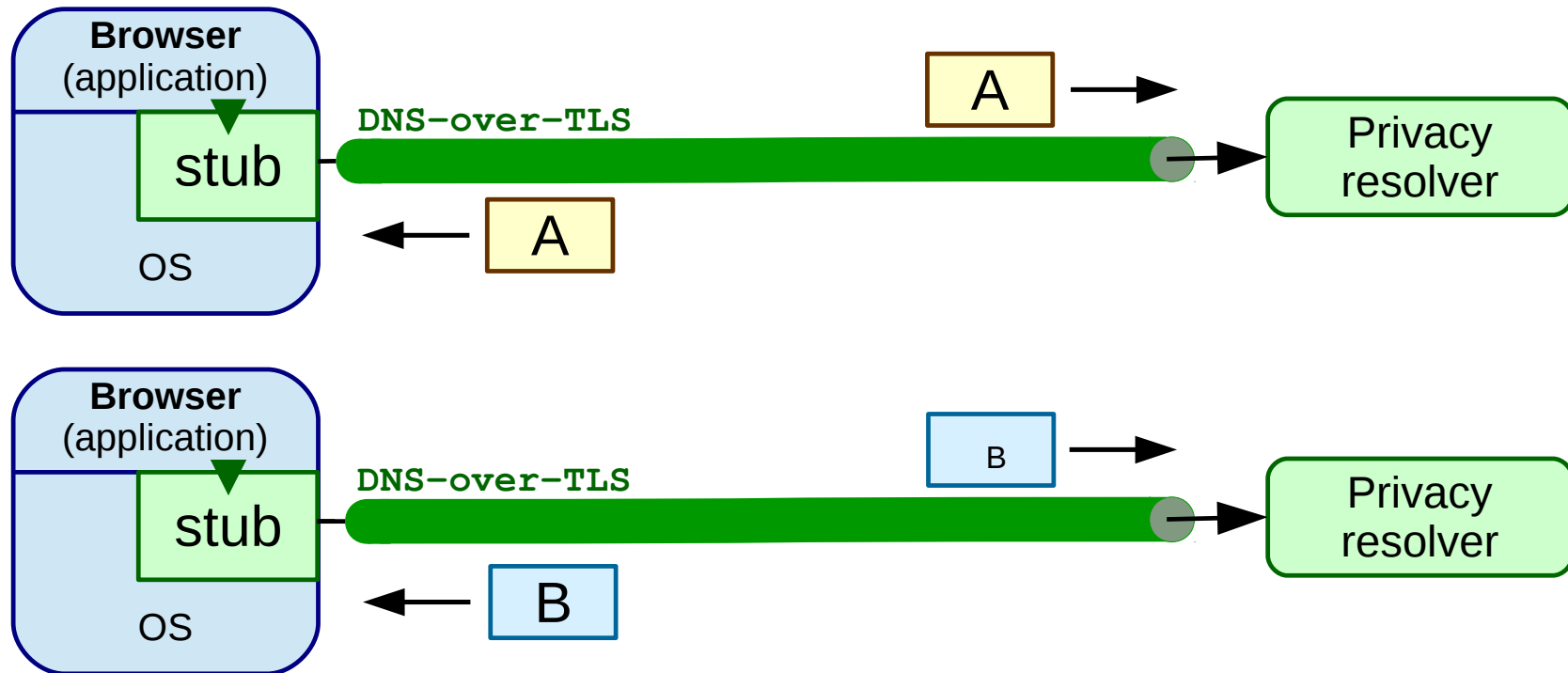
The *getdns* library features

IP address: 2001:610:1:40ba:145:100:185:15
SPKI pinset: 62IKu9HsDVbyiPenApnc4sfmSYTHOVfFgL3pyB+cBL4=



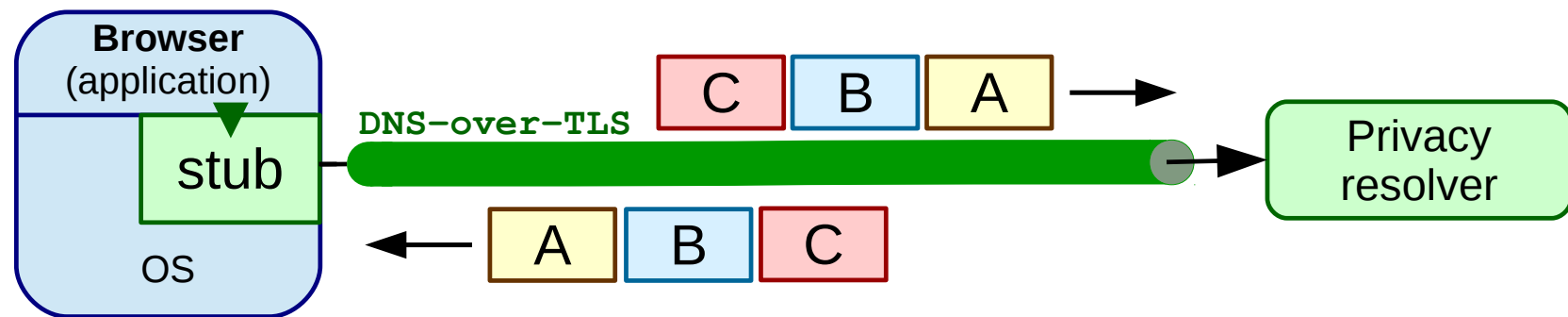
- Privacy with DNS over TLS

The *getdns* library features



- TCP fastopen (*optional*)
 - Connection reuse
 - EDNS0 keepalive
 - EDNS0 padding
- RFC7413
RFC7766
RFC7828
RFC7830

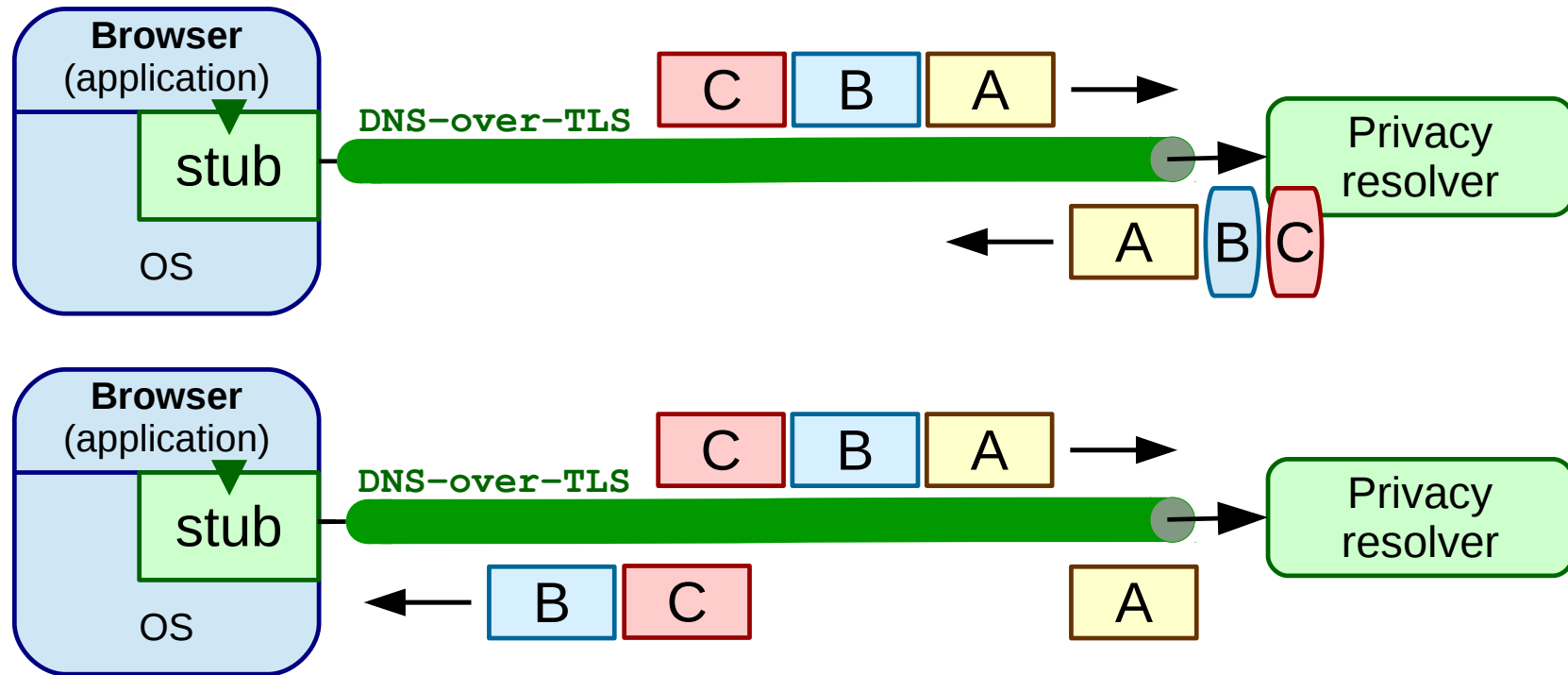
The *getdns* library features



- Connection reuse
- Pipe-lining of queries

$(A_Q/A_R, B_Q/B_R, C_Q/C_R)$
 $(A_Q, B_Q, C_Q, A_R, B_R, C_R)$

The *getdns* library features



- Connection reuse
- Pipe-lining of queries
- Process Out-Of-Order-Responses

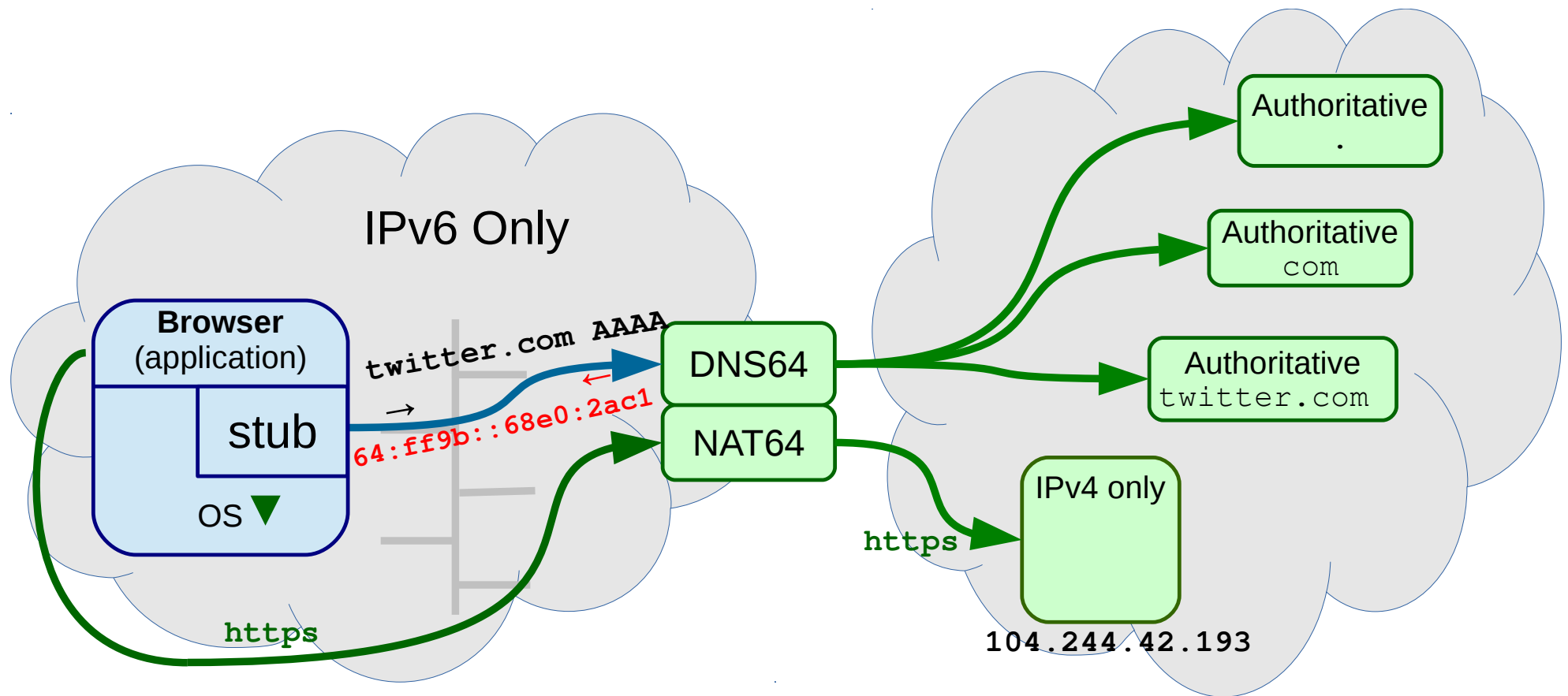
$(A_Q/A_R, B_Q/B_R, C_Q/C_R)$
 $(A_Q, B_Q, C_Q, A_R, B_R, C_R)$
 $(A_Q, B_Q, C_Q, B_R, C_R, A_R)$

The *getdns* library on the roadmap

- For 1.2.0 (during IETF99)
- Zero configuration DNSSEC (built in unbound-anchor)
- KSK tracking (RFC5011 like)
Taking the “user space library” setting into account
 - Running with user permissions
 - Not running as a daemon



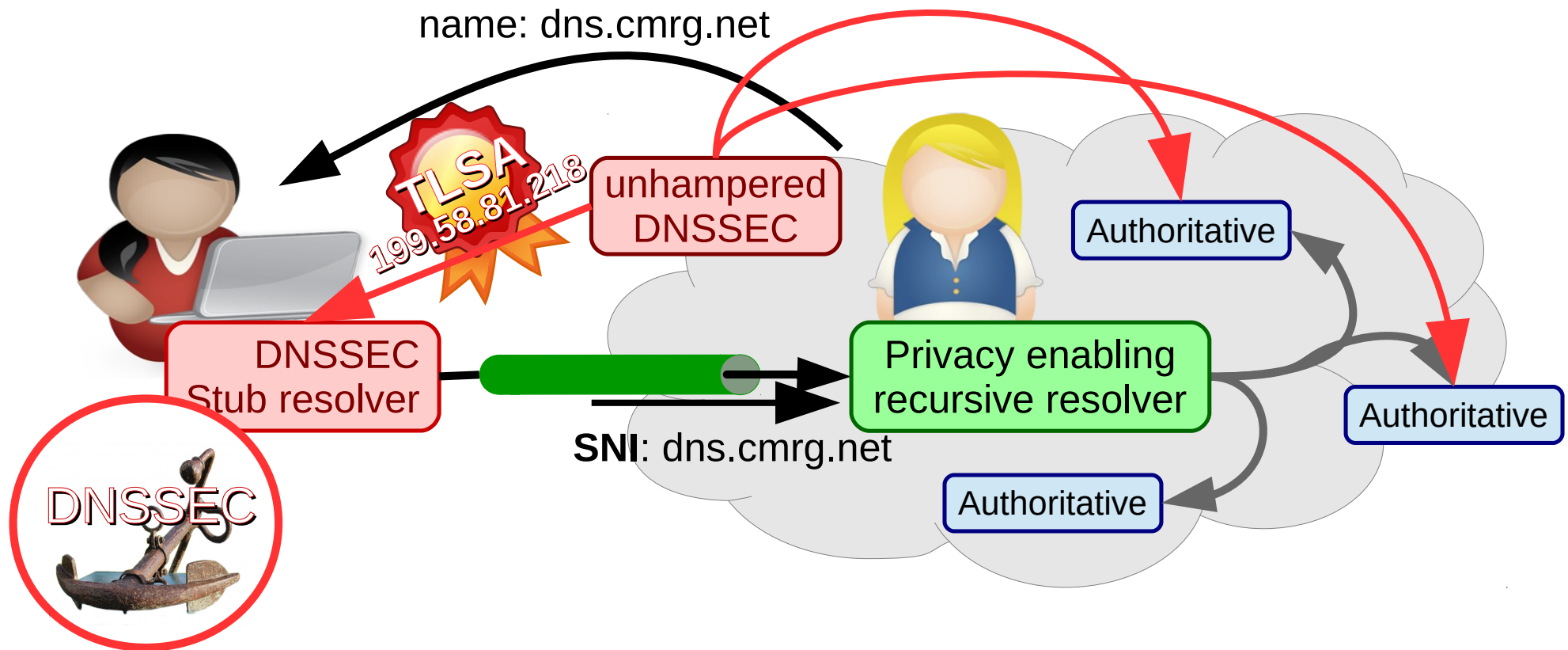
The *getdns* library on the roadmap



- DNS64 prefix discovery

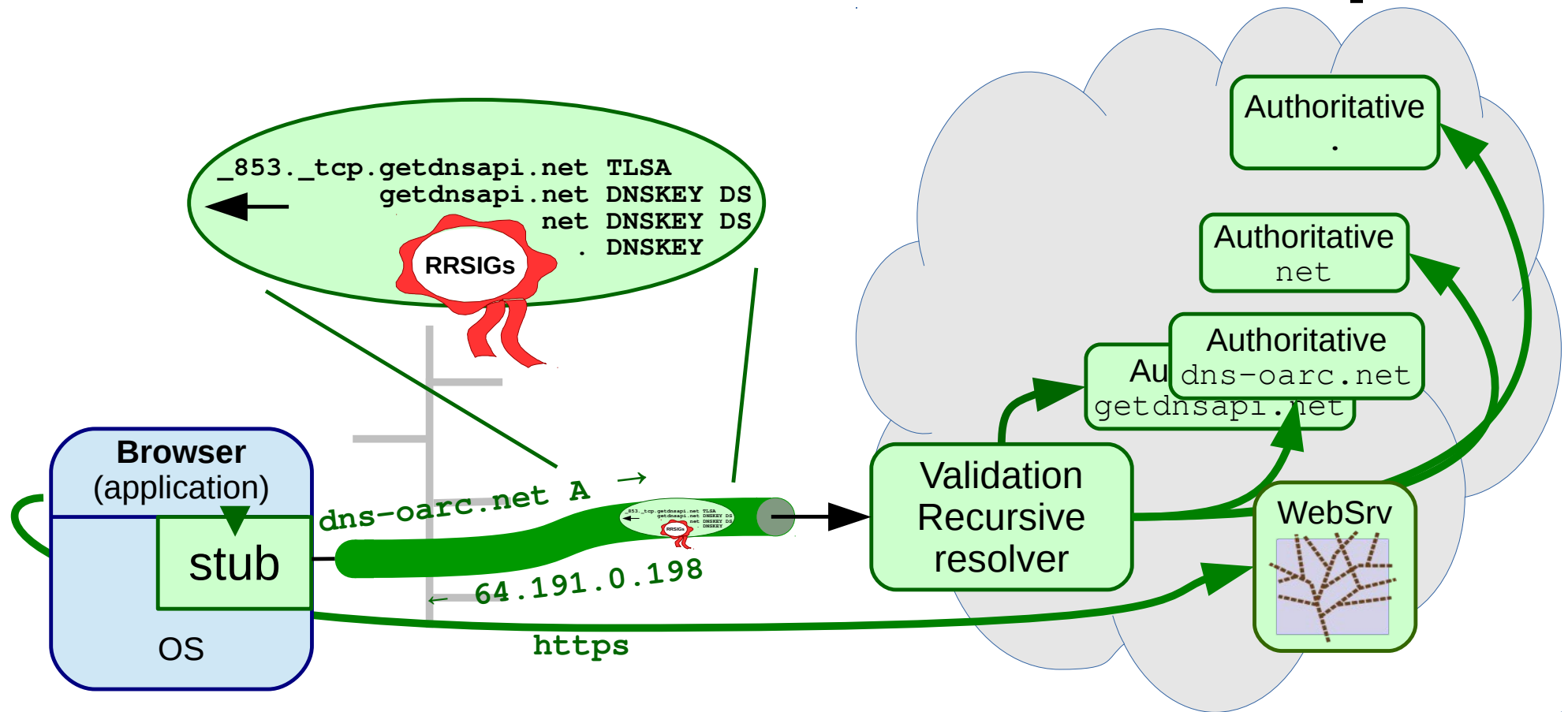
(RFC7050)

The *getdns* library on the roadmap



- DANE authenticated DNS over TLS

The *getdns* library on the roadmap



- DANE authenticated DNS over TLS
- DNSSEC authentication chain in TLS extension



related research and projects

- The role of a versatile stub in *from the ground up* privacy (and security)
- DNSSEC for legacy applications (i.e. a dnssec-trigger follow up, with signalling)
- How can getdns benefit from a system component
 - i.e. share stateful connections to upstreams
 - have feedback on level of privacy

*get*dns

related research
and projects



Stubby



look & feel data structures

- *getdns* is not your typical C library

```
typedef struct getdns_dict getdns_dict;  
typedef struct getdns_list getdns_list;  
typedef struct getdns_bindata { size_t size;  
                                uint8_t *data; } getdns_bindata;
```

- Script like data structures are used to represent:
 - DNS responses
 - Resource Records
 - Rdata fields
- Formatted as JSON-like strings by

```
char *getdns_pretty_print_dict(getdns_dict *dict);  
char *getdns_pretty_print_list(getdns_list *list);
```



look & feel data structures

- *getdns* is not your typical C library

response dict

```
{ "answer_type": GETDNS_NAMETYPE_DNS,  
  "status": GETDNS_RESPSTATUS_GOOD  
  "canonical_name": <bindata for afnic.fr.>,  
  "just_address_answers": [  
    { "address_data": <bindata for 192.134.5.25>,  
      "address_type": <bindata of "IPv4"> },  
    { "address_data": <bindata for 2001:67c:2218:30::5>,  
      "address_type": <bindata of "IPv6"> }  
  ],  
  "replies_full": [  
    <bindata of 0x7a2f81b000010002000400010561666e...>,  
    <bindata of 0xa40581b000010002000400010561666e...>  
  ],  
  "replies_tree": [{ ... first reply ... }, { ... second reply ... }]  
}
```




look & feel data structures

- *getdns* is not your typical C library

reply

```
{ "answer_type": GETDNS_NAMETYPE_DNS,  
  "canonical_name": <bindata for afnic.fr.>,  
  "dnssec_status": GETDNS_DNSSEC_SECURE,  
  "header": { "id": 50407,  
              "qr": 1, "opcode": GETDNS_OPCODE_QUERY,  
              "aa": 0, "tc": 0, "rd": 1, "ra": 1,  
              "z" : 0, "ad": 1, "cd": 1,  
              "rcode": GETDNS_RCODE_NOERROR,  
              "qdcount": 1, "ancount": 2,  
              "nscount": 4, "arcount": 1  
            },  
  "question": { "qclass": GETDNS_RRCLASS_IN,  
                "qname" : <bindata for afnic.fr.>,  
                "qtype" : GETDNS_RRTYPE_A  
              },
```



look & feel data structures

- *getdns* is not your typical C library

reply

```
"answer": [  
  { "name" : <bindata for afnic.fr.>,  
    "type" : GETDNS_RRTYPE_A,  
    "class": GETDNS_RRCLASS_IN,  
    "ttl"   : 31,  
    "rdata": { "ipv4_address": <bindata for 192.134.5.25>,  
               "rdata_raw": <bindata of 0xc0860519>  
            }  
  },  
  { "name" : <bindata for afnic.fr.>,  
    "type" : GETDNS_RRTYPE_RRSIG,  
    "rdata": { "type_covered": GETDNS_RRTYPE_A,  
               "algorithm": 8, "labels": 2,  
               "original_ttl": 600,  
               "signature_expiration": 1500960505,  
               "signature_inception": 1498356836,  
               "key_tag": 16774,  
               "signers_name": <bindata for afnic.fr.>,  
               "signature": <bindata for 0xc0860519>  
            }  
  }  
]
```

Do a Query - Mozilla Firefox

Do a Query x +

https://getdnsapi.net/query/?hostname=afnic Zoeken

getdns Quick Start Documentation Presentations Releases

Do a Query

afnic.fr A Query »

Extensions

☒ return_both_v4_and_v6	☒ dnssec_return_status
☐ return_call_reporting	☐ dnssec_return_only_secure
☐ add_warning_for_bad_dns	☐ dnssec_return_validation_chain
☐ dns64	☐ dnssec_return_all_statuses

Transport

Transport order:	UDP, TCP
TLS resolver IP:	185.49.141.38
TLS auth name:	getdnsapi.net

SYNC response:

```
{
  "answer_type": GETDNS_NAMETYPE_DNS,
  "canonical_name": <bindata for afnic.fr.>,
  "just_address_answers":
  [
    {
      "address_data": <bindata for 192.134.5.25>,
      "address_type": <bindata of "IPv4">
    }
  ]
}
```



look & feel data structures

- reading getdns_dicts:

```
getdns_return_t getdns_dict_get_dict(  
    const getdns_dict *dict, const char *name, getdns_dict **answer);
```

```
getdns_return_t getdns_dict_get_list(  
    const getdns_dict *dict, const char *name, getdns_list **answer);
```

```
getdns_return_t getdns_dict_get_bindata(  
    const getdns_dict *dict, const char *name, getdns_bindata **answer);
```

```
getdns_return_t getdns_dict_get_int(  
    const getdns_dict *dict, const char *name, uint32_t *answer)
```

```
getdns_return_t getdns_dict_get_data_type(  
    const getdns_dict *dict, const char *name, getdns_data_type *answer);
```

```
getdns_return_t getdns_dict_get_names(  
    const getdns_dict *dict, getdns_list **answer);
```



look & feel data structures

- reading getdns_lists:

```
getdns_return_t getdns_list_get_dict(  
    const getdns_list *list, size_t index, getdns_dict **answer);  
  
getdns_return_t getdns_list_get_list(  
    const getdns_list *list, size_t index, getdns_list **answer);  
  
getdns_return_t getdns_list_get_bindata(  
    const getdns_list *list, size_t index, getdns_bindata **answer);  
  
getdns_return_t getdns_list_get_int(  
    const getdns_list *list, size_t index, uint32_t *answer);  
  
getdns_return_t getdns_list_get_data_type(  
    const getdns_list *list, size_t index, getdns_data_type *answer);  
  
getdns_return_t getdns_list_get_length(  
    const getdns_list *this_list, size_t *answer);
```



look & feel data structures

- Creating/writing to getdns_dicts:

```
getdns_dict * getdns_dict_create();

getdns_return_t getdns_dict_set_dict(
    getdns_dict *dict, const char *name, const getdns_dict *child_dict);

getdns_return_t getdns_dict_set_list(
    getdns_dict *dict, const char *name, const getdns_list *child_list);

getdns_return_t getdns_dict_set_bindata(
    getdns_dict *dict, const char *name, const getdns_bindata
    *child_bindata);

getdns_return_t getdns_dict_set_int(
    getdns_dict *dict, const char *name, uint32_t child_uint32)

void getdns_dict_destroy(getdns_dict *dict);
```



look & feel data structures

Response object dict

```
{  
  "answer_type": GETDNS_NAMETYPE_DNS,  
  "status": GETDNS_RESPSTATUS_GOOD,  
  "canonical_name": <bindata of "www.getdnsapi.net.">,  
  "just_address_answers":  
  [ { "address_data": <bindata for 185.49.141.37>,  
      "address_type": <bindata of "IPv4">  
    }  
  ],  
  "replies_full": [ <bindata of 0x000081800000100020004...> ],  
  "replies_tree": [ { ... first reply ... } ],  
}
```

```
if ((r = getdns_address_sync(ctx, "getdnsapi.net", ext, &resp)))  
    return r;  
else if ((r = getdns_list_get_bindata(  
    addr_dict, "/just_address_answers/0/address_data", &addr)))  
    return r;
```



look & feel data structures

```
if ((r = getdns_address_sync(ctx, "getdnsapi.net", ext, &resp)))  
    return r;  
else if ((r = getdns_list_get_bindata(  
    addr_dict, "/just_address_answers/0/address_data", &addr)))  
    return r;
```

- Natural in script languages

- Python

```
resp = ctx.address('getdnsapi.net')  
addr = resp.just_address_answers[0]['address_data']
```

- Nodejs

```
function callback(err, resp) {  
    var addr = resp.just_address_answers[0].address_data;  
}  
ctx.getAddress('getdnsapi.net', callback);
```




look & feel data structures

- The alternative would introduce a lot of new types:

- Python:

```
addr = resp.replies_tree[0]['answer'][0]['rdata']['ipv6_address']
```

- C now

```
r = getdns_dict_get_bindata(  
    resp, "/replies_tree/0/answer/rdata/ipv6_address", &addr))
```

- C otherwise (ldns like)

```
getdns_response *resp; getdns_reply *reply;  
getdns_rrs *rrs; getdns_rr *rrs;  
getdns_rdata *rdata; struct sockaddr_storage addr;  
if ((r = getdns_response_get_reply(resp, 0, &reply)))  
    return r;  
else if ((r = getdns_reply_get_answer_section(reply, &rrs)))  
    return r;  
else if ((r = getdns_rrs_get_rr(rrs, &rr)))  
    return r;  
else if ((r = getdns_rr_get_rdata(rr, &rdata)))  
    return r;  
else if ((r = getdns_rdata_get_rdatafield_address(rdata, 0, &addr)))  
    return r;
```



look & feel data structures

- *getdns* is not your typical C library
- Natural in script languages
- The alternative would introduce a lot of new types.
- With current approach, the library can easily grow
- New rdata fields or new extensions without a new API (*dns cookies, roadblock avoidance, client subnet, etc.*)
- Just in time parsing of wireformat data on the roadmap (*internally already iterator like accessor types for wireformat data*)
- Still... “C bindings” on the roadmap



look & feel lookup functions

```
getdns_return_t getdns_general(  
    getdns_context      *context,  
    const char          *name,  
    uint16_t            request_type,  
    getdns_dict         *extensions,  
    void               *userarg,  
    getdns_transaction_t *transaction_id,  
    getdns_callback_t   callbackfn  
);
```

- **context** contains configuration parameters
 - Stub or recursive modus operandi, timeout values, root-hints, forwarders, trust anchor, search path etc.)
- **context** contains the resolver cache
- ```
getdns_return_t getdns_context_create(
 getdns_context **context, int set_from_os)
```



# look & feel lookup functions

```
getdns_return_t getdns_general(
 getdns_context *context,
 const char *name,
 uint16_t request_type,
 getdns_dict *extensions,
 void *userarg,
 getdns_transaction_t *transaction_id,
 getdns_callback_t callbackfn
);
```

- context contains configuration parameters
- **name** and **request\_type** the name and type to lookup



# look & feel lookup functions

```
getdns_return_t getdns_general(
 getdns_context *context,
 const char *name,
 uint16_t request_type,
 getdns_dict *extensions,
 void *userarg,
 getdns_transaction_t *transaction_id,
 getdns_callback_t callbackfn
);
```

- context contains configuration parameters
- name and request\_type the name and type to lookup
- **extensions** additional parameters specific for this lookup
  - **return\_both\_v4\_and\_v6**, **dnssec\_return\_status**,  
**specify\_class**, **add\_opt\_parameter**



# look & feel extensions

- `dnssec_return_validation_chain`

```
- { # Response object
 "validation_chain":
 [{ "name" : <bindata for .>, "type": GETDNS_RRTYPE_DNSKEY, ... },
 { "name" : <bindata for .>, "type": GETDNS_RRTYPE_DNSKEY, ... },

 { "name" : <bindata for .>, "type": GETDNS_RRTYPE_RRSIG,
 "rdata": { "signers_name": <bindata for .>,
 "type_covered": GETDNS_RRTYPE_DNSKEY, ... }, ... },

 { "name" : <bindata for net.>, "type": GETDNS_RRTYPE_DS, ... },
 { "name" : <bindata for net.>, "type": GETDNS_RRTYPE_RRSIG,
 "rdata": { "signers_name": <bindata for .>,
 "type_covered": GETDNS_RRTYPE_DS, ... }, ... },
```

- Can be fed as support\_records with companion function:

```
- getdns_return_t
 getdns_validate_dnssec(getdns_list *to_validate
 , getdns_list *support_records
 , getdns_list *trust_anchors);
```



# look & feel lookup functions

```
getdns_return_t getdns_general(
 getdns_context *context,
 const char *name,
 uint16_t request_type,
 getdns_dict *extensions,
 void *userarg,
 getdns_transaction_t *transaction_id,
 getdns_callback_t callbackfn
);
```

- context contains configuration parameters
- name and request\_type the name and type to lookup
- extensions additional parameters specific for this lookup
- **userarg** is passed in on the call to **callbackfn**
- **transaction\_id** is set to a unique value that is also passed in on the call to **callbackfn**



# look & feel lookup functions

```
getdns_return_t getdns_general(
 getdns_context *context,
 const char *name,
 uint16_t request_type,
 getdns_dict *extensions,
 void *userarg,
 getdns_transaction_t *transaction_id,
 getdns_callback_t callbackfn
);

typedef void (*getdns_callback_t)(
 getdns_context *context,
 getdns_callback_type_t callback_type,
 getdns_dict *response,
 void *userarg,
 getdns_transaction_t transaction_id
);
// callback_type = complete, cancel, timeout or error
```





# look & feel lookup functions

```
getdns_return_t getdns_general(
 getdns_context *context,
 const char *name,
 uint16_t request_type,
 getdns_dict *extensions,
 void *userarg,
 getdns_transaction_t *transaction_id,
 getdns_callback_t callbackfn
);
```

```
getdns_return_t getdns_general_sync(
 getdns_context *context,
 const char *name,
 uint16_t request_type,
 getdns_dict *extensions,
 getdns_dict **response
);
```



# look & feel lookup functions

```
getdns_return_t getdns_address(
 getdns_context *context,
 const char *name,
 getdns_dict *extensions,
 void *userarg,
 getdns_transaction_t *transaction_id,
 getdns_callback_t callbackfn
);
```

- **getdns\_address** also lookups in other name systems
  - local files, mDNS (not implemented yet)
- When name is found in the DNS, **getdns\_address** returns both IPv4 and IPv6



# look & feel lookup functions

```
getdns_return_t getdns_hostname(
 getdns_context *context,
 getdns_dict *address,
 getdns_dict *extensions,
 void *userarg,
 getdns_transaction_t *transaction_id,
 getdns_callback_t callbackfn
);
```

- With **address**:  

```
{ "address_type": <bindata of "IPv4">,
 "address_data": <bindata for 185.49.141.37>
}
```

will lookup 37.141.49.185.in-addr.arpa PTR



# look & feel lookup functions

```
getdns_return_t getdns_service(
 getdns_context *context,
 getdns_dict *name,
 getdns_dict *extensions,
 void *userarg,
 getdns_transaction_t *transaction_id,
 getdns_callback_t callbackfn
);
```

- Provides a partly randomly sorted list (by weight and priority) of service addresses and ports (RFC2782)

```
"canonical_name": <bindata for _jabber._tcp.nl.netlabs.nl.>
"srv_addresses":
[{ "address_data": <bindata for 2a04:b900::1:0:0:10>,
 "domain_name": <bindata for open.nl.netlabs.nl.>,
 "port": 5269 },
 { "address_data": <bindata for 185.49.140.10>,
 "domain_name": <bindata for open.nl.netlabs.nl.>,
 "port": 5269 }
],
```



# look & feel event libraries

- libevent

Include : **#include** <getdns/getdns\_ext\_libevent.h>  
Use : **getdns\_extension\_set\_libevent\_base**(context, base);  
Link : -lgetdns -lgetdns\_ext\_event

- libev

Include : **#include** <getdns/getdns\_ext\_libev.h>  
Use : **getdns\_extension\_set\_libev\_loop**(context, loop);  
Link : -lgetdns -lgetdns\_ext\_ev

- libuv

Include : **#include** <getdns/getdns\_ext\_libuv.h>  
Use : **getdns\_extension\_set\_libuv\_loop**(context, loop);  
Link : -lgetdns -lgetdns\_ext\_uv



# look & feel example query

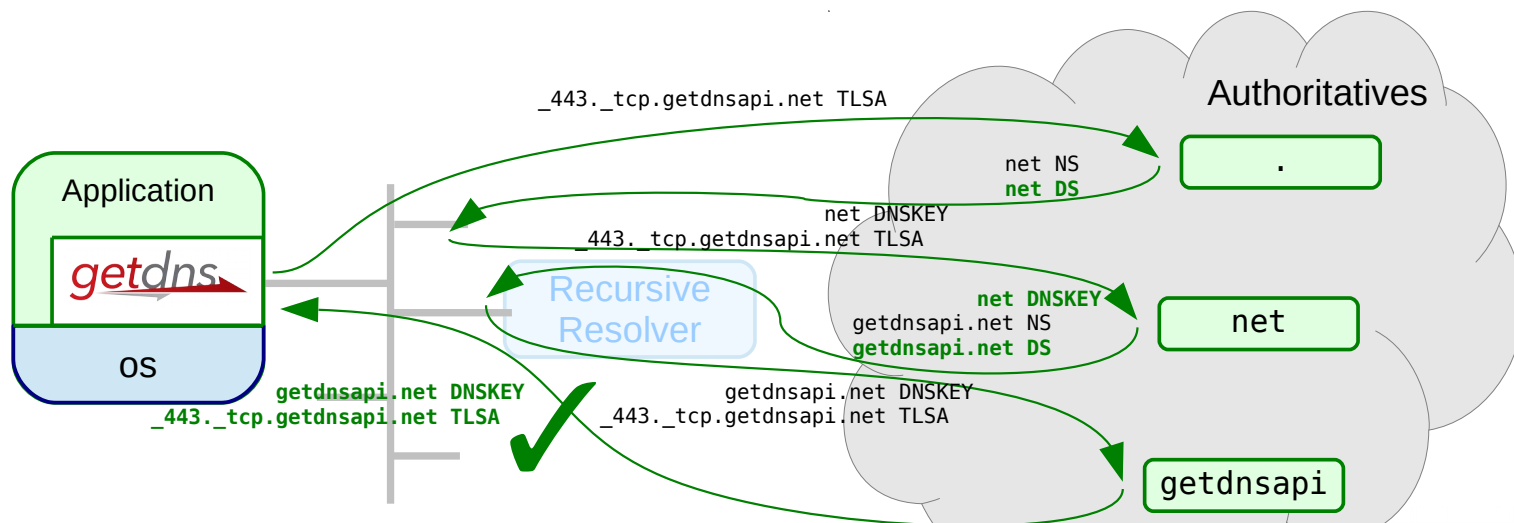
```
from getdns import *
```

```
ctx = Context()
```

```
ext = { "dnssec_return_only_secure": EXTENSION_TRUE }
```

```
res = ctx.general('_443._tcp.getdnsapi.net', RRTYPE_TLSA, ext)
```

```
if res['status'] == RESPSTATUS_GOOD:
 # Process TLSA RRs
```





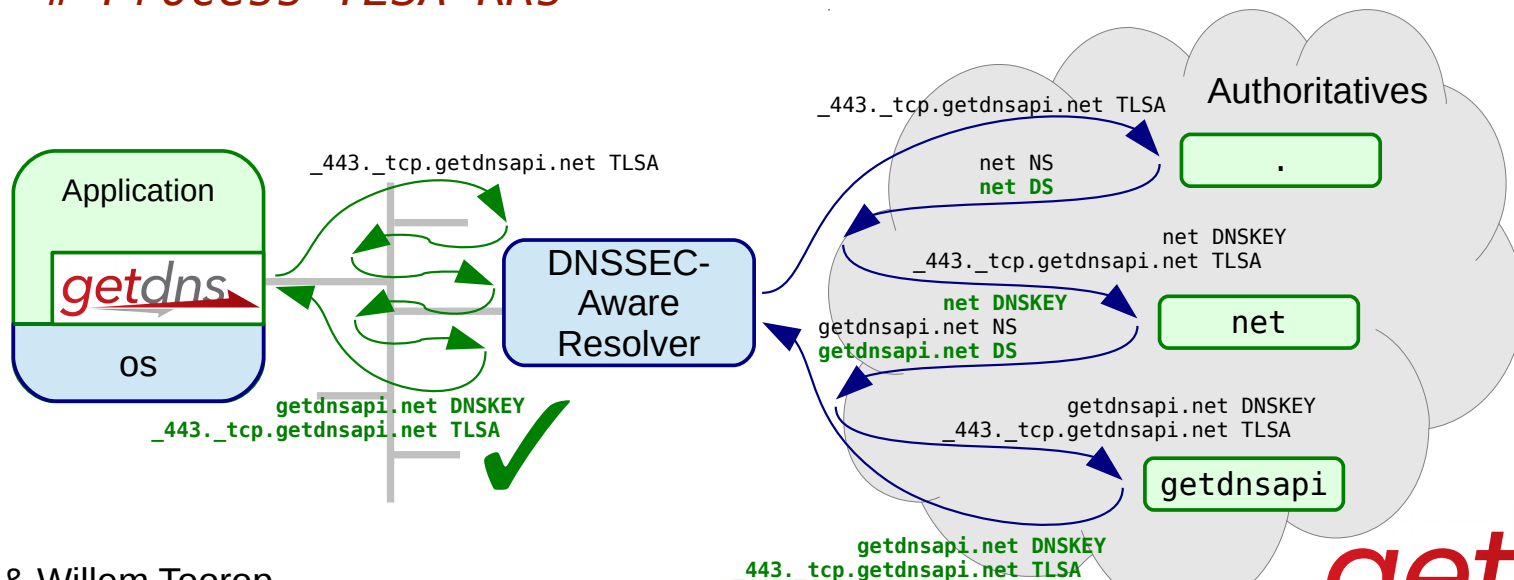
# look & feel example query

```
from getdns import *
```

```
ctx = Context()
ctx.resolution_type = RESOLUTION_STUB
```

```
ext = { "dnssec_return_only_secure": EXTENSION_TRUE }
res = ctx.general('_443._tcp.getdnsapi.net', RRTYPE_TLSA, ext)
```

```
if res['status'] == RESPSTATUS_GOOD:
 # Process TLSA RRs
```





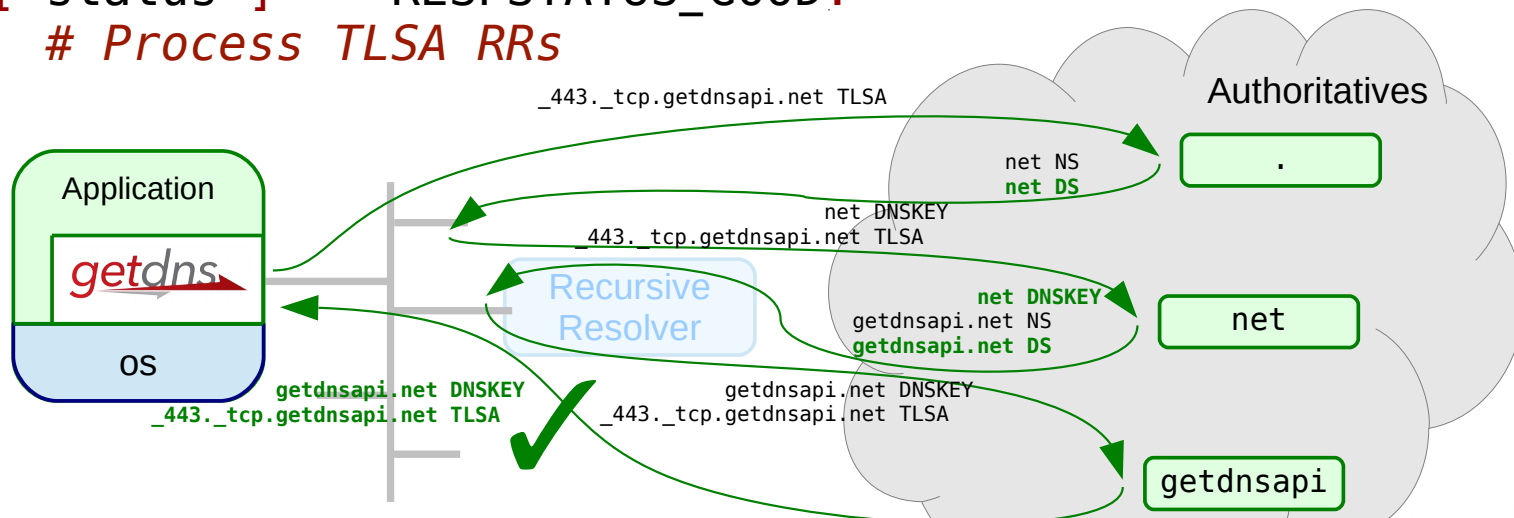
# look & feel example query

```
from getdns import *
```

```
ctx = Context()
ctx.resolution_type = RESOLUTION_STUB
```

```
ext = { "dnssec_return_only_secure" : EXTENSION_TRUE
 , "dnssec_roadblock_avoidance": EXTENSION_TRUE}
res = ctx.general('_443._tcp.getdnsapi.net', RRTYPE_TLSA, ext)
```

```
if res['status'] == RESPSTATUS_GOOD:
 # Process TLSA RRs
```







# look & feel example query

```
from getdns import *

def process_tlsa_rrs(ttype, result, userarg, tid):
 ctx = userarg
 if ttype == CALLBACK_COMPLETE:
 # Process TLSA RRs
 pass
 elif ttype == CALLBACK_TIMEOUT:
 # Handle timeout
 pass

ctx = Context()
ctx.resolution_type = RESOLUTION_STUB

ext = { "dnssec_return_only_secure" : EXTENSION_TRUE
 , "dnssec_roadblock_avoidance": EXTENSION_TRUE}
tid = ctx.general('_443._tcp.getdnsapi.net', RRTYPE_TLSA, ext
 , userarg = ctx, callback = process_tlsa_rrs)

ctx.run()
```



# look & feel example query

```
var getdns = require('getdns');

function process_tlsa_rrs(err, res)
{
 if (err) {
 console.log(err)
 } else {
 // Process TLSA RRs
 }
}

ctx = getdns.createContext();
ctx.general(' _443._tcp.getdnsapi.net', getdns.RRTYPE_TLSA
 , { dnssec_return_only_secure : true
 , dnssec_roadblock_avoidance: true }
 , function(err, res) { process_tlsa_rrs(ctx, err, res); });
```

# Hands on DANE authenticated TLS connect (*python*)

```
from getdns import *
from M2Crypto import SSL, X509
import sys
from socket import *
import hashlib

if len(sys.argv) > 1:
 hostname = sys.argv[1]
 port = int(sys.argv[2]) if len(sys.argv) > 2 else 443
else:
 print('%s <hostname> [<port>]' % sys.argv[0])
 sys.exit(0)

ctx = Context()
ctx.resolution_type = RESOLUTION_STUB
ext = { "dnssec_return_only_secure" : EXTENSION_TRUE }
, "dnssec_roadblock_avoidance": EXTENSION_TRUE }

Correctly query and process DANE records
res = ctx.general('_%d._tcp.%s' % (port, hostname), RRTYPE_TLSA, ext)
```

```
if res.status == RESPSTATUS_GOOD:
 # Process TLSA Rrs
 tlsas = [answer for reply in res.replies_tree
 for answer in reply['answer']
 if answer['type'] == RRTYPE_TLSA]

elif res.status == RESPSTATUS_ALL_TIMEOUT:
 print('Network error trying to get DANE records for %s' % hostname)
 sys.exit(-1);

elif res.status == RESPSTATUS_ALL_BOGUS_ANSWERS:
 print('DANE records for %s were BOGUS' % hostname)
 sys.exit(-1);

else:
 tlsas = None
 # Conventional PKIX without DANE processing
```

# Hands on DANE authenticated TLS connect (*python*)

- Find the CA vouching for the connection for PKIX-TA and DANE-TA usages.

```
ca_cert = None
def get_ca(ok, store):
 global ca_cert
 if store.get_current_cert().check_ca():
 ca_cert = store.get_current_cert()
 return ok

Now TLS connect to each address and verify the cert (or CA)
for address in ctx.address(hostname).just_address_answers:
 sock = socket(AF_INET if address['address_type'] == 'IPv4'
 else AF_INET6, SOCK_STREAM)
 socket.setsockopt(sock, SOL_SOCKET, SO_REUSEADDR, 1)
 print('Connecting to %s' % address['address_data']);
 ssl_ctx = SSL.Context()
 ssl_ctx.load_verify_locations(capath = '/etc/ssl/certs')
 ssl_ctx.set_verify(SSL.verify_none, 10, get_ca)
 connection = SSL.Connection(ssl_ctx, sock=sock)
```

# Hands on DANE authenticated TLS connect (*python*)

- Just two more household affairs...

```
set TLS SNI extension
connection.set_tlsext_host_name(hostname)

Per RFC7671, for DANE-EE usage, certificate identity checks are
based solely on the TLSA record, so we ignore name mismatch
conditions in the certificate.
try:
 connection.connect((address['address_data'], port))

except SSL.Checker.WrongHost:
 pass
```

# Hands on DANE authenticated TLS connect (*python*)

- Without TLSA RRs, fall back to old fashioned PKIX

```
if not tlsas:
 print('No TLSAS. Regular PKIX validation '
 + ('succeeded' if connection.verify_ok() else 'failed'))
 continue # next address
```

- But with TLSA RRs, try each TLSA RR in turn. First one matching makes the day!
- Note that for PKIX-TA (0) and DANE-TA (2) we set cert to the CA.

```
cert = connection.get_peer_cert()
TLSA_matched = False
for tlsa in tlsas:
 rdata = tlsa['rdata']
 if rdata['certificate_usage'] in (0, 2):
 cert = ca_cert
```

# Hands on DANE authenticated TLS connect (*python*)

- Put certdata into selector and the matching\_type shape

```
if rdata['selector'] == 0:
 certdata = cert.as_der()
elif rdata['selector'] == 1:
 certdata = cert.get_pubkey().as_der()
else:
 raise ValueError('Unkown selector')

if rdata['matching_type'] == 1:
 certdata = hashlib.sha256(certdata).digest()
elif rdata['matching_type'] == 2:
 certdata = hashlib.sha512(certdata).digest()
else:
 raise ValueError('Unkown matching type')
```



# Hands on DANE authenticated TLS connect (*python*)

- And see if certdata matches TLSA certificate association data
- With usages PKIX-TA (0) and PKIX-EE (1) we need to PKIX validate too (i.e. `connection.verify_ok()`)

```
if str(certdata) == str(rdata['certificate_association_data'])\
and (rdata['certificate_usage'] > 1 or connection.verify_ok()):
 TLSA_matched = True
 print('DANE validated successfully')
 break # from "for tlsa in tlsas:" (first one wins!)
```

```
if not TLSA_matched:
 print('DANE validation failed')
```

# Hands on DANE authenticated TLS connect (*python*)

- Our DANE example in action:

```
willem@bonobo:~/jcsa17$./dane-connect.py www.afnic.fr
Connecting to 2001:67c:2218:30::24
DANE validated successfully
Connecting to 192.134.5.24
DANE validated successfully
```

```
willem@bonobo:~/jcsa17$./dane-connect.py www.sidn.nl
Connecting to 2001:7b8:606:294::3
DANE validated successfully
Connecting to 212.114.98.233
DANE validated successfully
```

```
willem@bonobo:~/jcsa17$./dane-connect.py www.nominet.uk
Connecting to 2400:cb00:2048:1::6814:e3d
No TLSAS. Regular PKIX validation succeeded
Connecting to 104.20.14.61
No TLSAS. Regular PKIX validation succeeded
```

# Hands on C API – How to do a simple query

- Use API and non-API functions
- Do a synchronous request (one at a time).
- Extract data from the response dict
- Do asynchronously requests
- Use an event loop libraries
- Use extension dictionaries
- <https://getdnsapi.net/blog/simple-lookup/>
- <https://getdnsapi.net/static/getdns-jcsa17-examples-0.1.0.tar.gz>
- <https://github.com/getdnsapi/getdns-jcsa17>

# Hands on *getdns* C API – How to do a simple query

## setup context

```
#include <getdns/getdns_extra.h>
#include <stdio.h>
```

```
int main()
{
 getdns_return_t r;
 getdns_context *ctxt = NULL;

 if ((r = getdns_context_create(&ctxt, 1)))
 fprintf(stderr, "Could not create context: %s\n"
 , getdns_get_errorstr_by_id(r));

 if (ctxt)
 getdns_context_destroy(ctxt);

 return r ? EXIT_FAILURE : EXIT_SUCCESS;
}
```

- GETDNS\_RETURN\_SUCCESS == 0
- getdns\_get\_errorstr\_by\_id() is a non-API function
- getdns\_context\_create() does not touch ctxt on failure

# Hands on *getdns* C API – How to do a simple query

```
#include <getdns/getdns_extra.h>
#include <stdio.h>
```

```
int main()
{
 getdns_return_t r;
 getdns_context *ctxt = NULL;
 getdns_dict *resp = NULL;

 if ((r = getdns_context_create(&ctxt, 1)))
 fprintf(stderr, "Could not create context: %s\n"
 , getdns_get_errorstr_by_id(r));

 else if ((r = getdns_address_sync(ctxt, "getdnsapi.net.", NULL, &resp)))
 fprintf(stderr, "Unable to do an address lookup: %s\n"
 , getdns_get_errorstr_by_id(r));

 if (resp)
 getdns_dict_destroy(resp);
 if (ctxt)
 getdns_context_destroy(ctxt);

 return r ? EXIT_FAILURE : EXIT_SUCCESS;
}
```

# Hands on *getdns* C API – How to do a simple query

```
#include <getdns/getdns_extra.h>
#include <stdio.h>
```

```
int main()
{
 getdns
 getdr
 getdr

 if (!(r = getdns_context_create(&ctxt))) {
 if (!(r = getdns_address_sync(ctxt, ..., &resp))) {
 if ((
 getdns_dict_destroy(resp);
 }
 else
 ; /* error handling */
 getdns_context_destroy(ctxt);
 } else
 ; /* error handling */
 }

 if (r
 if (ct
 getc

 return r ? EXIT_FAILURE : EXIT_SUCCESS;
}
```

# Hands on *getdns* C API – How to do a simple query

```
#include <getdns/getdns_extra.h>
#include <stdio.h>

int main()
{
 getdns_ctx_t ctx;
 getdns_dict_t resp;

 if ((r = getdns_context_create(&ctx, 1)))
 goto escape;

 if ((r = getdns_address_sync(ctx, ..., &resp)))
 goto escape_destroy_context;

 if ((r = getdns_something(...)))
 goto escape_destroy_resp;

escape_destroy_resp:
 getdns_dict_destroy(resp);

escape_destroy_context:
 getdns_context_destroy(ctx);

escape:
 return r ? EXIT_FAILURE : EXIT_SUCCESS;

return 0;
}
```

# Hands on *getdns* C API – How to do a simple query

```
#include <getdns/getdns_extra.h>
#include <stdio.h>
```

```
int main()
{
```

```
 if (!(r = getdns_context_create(&ctxt, 1))
 && !(r = getdns_address_sync(ctxt, ..., &resp))
 && !(r = getdns_something(...))
 && !(r = getdns_something_else(...))) {
```

```
 /* The happy path */
 } else
 fprintf(stderr, "Something went wrong somewhere: %s\n"
 , getdns_get_errorstr_by_id(r));
```

```
 if (resp) getdns_dict_destroy(resp);
 if (ctxt) getdns_dict_destroy(ctxt);
```

```
 return r ? EXIT_FAILURE : EXIT_SUCCESS;
```

```
}
```



# Hands on *getdns* C API – How to do a simple query

## get data

```
getdns_bindata *address;
char address_str[1024];

if ((r = getdns_context_create(&ctxt, 1)))
 fprintf(stderr, "Could not create context: %s\n",
 getdns_get_errorstr_by_id(r));

else if ((r = getdns_address_sync(ctxt, "getdnsapi.net.", NULL, &resp)))
 fprintf(stderr, "Unable to do an address lookup: %s\n",
 getdns_get_errorstr_by_id(r));

else if ((r = getdns_dict_get_bindata(resp,
 "/just_address_answers/0/address_data", &address)))
 fprintf(stderr, "Unable to get an address from the response: %s\n",
 getdns_get_errorstr_by_id(r));

else if (address->size != 4 && address->size != 16)
 fprintf(stderr, "Unable to determine type of this address\n");

else if (! inet_ntop(address->size == 4 ? AF_INET : AF_INET6
 , address->data, address_str, sizeof(address_str)))
 fprintf(stderr, "Could not convert address to string\n");
else
 printf("An address of getdnsapi.net is: %s\n", address_str);
```

# Hands on *getdns* C API – How to do a simple query

## get data

```
getdns_bindata *address;
char address_str[1024];
```

- JSON-pointer introduced into the API by us
- *getdns* returns "network" format IPv4 and IPv6 addresses
- No data is converted, response dicts brings you to the spot

```
else if ((r = getdns_dict_get_bindata(resp,
 "/just_address_answers/0/address_data", &address)))
 fprintf(stderr, "Unable to get an address from the response: %s\n"
 , getdns_get_errorstr_by_id(r));

else if (address->size != 4 && address->size != 16)
 fprintf(stderr, "Unable to determine type of this address\n");

else if (! inet_ntop(address->size == 4 ? AF_INET : AF_INET6
 , address->data, address_str, sizeof(address_str)))
 fprintf(stderr, "Could not convert address to string\n");
else
 printf("An address of getdnsapi.net is: %s\n", address_str);
```

# Hands on *getdns* C API – How to do a simple query asynchronous

```
#include <getdns/getdns_extra.h>
#include <stdio.h>
```

```
void callback(getdns_context *ctxt, getdns_callback_type_t cb_type,
 getdns_dict *resp, void *userarg, getdns_transaction_t trans_id) {}
```

```
int main()
{
 getdns_return_t r;
 getdns_context *ctxt = NULL;

 if ((r = getdns_context_create(&ctxt, 1)))
 fprintf(stderr, "Could not create context: %s\n"
 , getdns_get_errorstr_by_id(r));

 else if ((r = getdns_address(ctxt, "getdnsapi.net.", 0, 0, 0, callback)))
 fprintf(stderr, "Unable to schedule an address lookup: %s\n"
 , getdns_get_errorstr_by_id(r));

 else
 getdns_context_run(ctxt);

 if (ctxt)
 getdns_context_destroy(ctxt);
 return r ? EXIT_FAILURE : EXIT_SUCCESS;
}
```

# Hands on *getdns* C API – How to do a simple query **asynchronous**

```
#include <getdns/getdns_extra.h>
#include <stdio.h>
```

```
void callback(getdns_context *ctxt, getdns_callback_type_t cb_type,
 getdns_dict *resp, void *userarg, getdns_transaction_t trans_id) {}
```

```
int main()
{
```

- A request is *scheduled*
- A callback function is *registered*
- `getdns_context_run()` is **not** an API function

```
else if ((r = getdns_address(ctxt, "getdnsapi.net.", 0, 0, 0, callback)))
 fprintf(stderr, "Unable to schedule an address lookup: %s\n",
 getdns_get_errorstr_by_id(r));
```

```
else
 getdns_context_run(ctxt);
```

```
if (ctxt)
 getdns_context_destroy(ctxt);
return r ? EXIT_FAILURE : EXIT_SUCCESS;
```

```
}
```

Hands  
on



# C API – How to do a simple query async libuv

```
int main() {
 getdns_return_t r;
 getdns_context *ctxt = NULL;
 uv_loop_t loop;

 if (uv_loop_init(&loop)) {
 fprintf(stderr, "Could not initialize event loop\n");
 return EXIT_FAILURE;
 }
 else if ((r = getdns_context_create(&ctxt, 1)))
 fprintf(stderr, "Could not create context: %s\n"
 , getdns_get_errorstr_by_id(r));

 else if ((r = getdns_extension_set_libuv_loop(ctxt, &loop)))
 fprintf(stderr, "Unable to set the event loop: %s\n"
 , getdns_get_errorstr_by_id(r));

 else if ((r = getdns_address(ctxt, "getdnsapi.net.", 0, 0, 0, callback)))
 fprintf(stderr, "Unable to schedule an address lookup: %s\n"
 , getdns_get_errorstr_by_id(r));
 else
 uv_run(&loop, UV_RUN_DEFAULT);

 if (ctxt) getdns_context_destroy(ctxt);
 return r ? EXIT_FAILURE : EXIT_SUCCESS;
}
```

# Header and Compilation

- #include <uv.h>

- cc -o 05-libuv-query -lgetdns -lgetdns\_ext\_libuv -luv

```
uv_loop_t loop;
```

```
if (uv_loop_init(&loop)) {
 fprintf(stderr, "Could not initialize event loop\n");
 return EXIT_FAILURE;
}
```

```
else if ((r = getdns_context_create(&ctxt, 1)))
 fprintf(stderr, "Could not create context: %s\n"
 , getdns_get_errorstr_by_id(r));
```

```
else if ((r = getdns_extension_set_libuv_loop(ctxt, &loop)))
 fprintf(stderr, "Unable to set the event loop: %s\n"
 , getdns_get_errorstr_by_id(r));
```

```
else if ((r = getdns_address(ctxt, "getdnsapi.net.", 0, 0, 0, callback)))
 fprintf(stderr, "Unable to schedule an address lookup: %s\n"
 , getdns_get_errorstr_by_id(r));
```

```
else
 uv_run(&loop, UV_RUN_DEFAULT);
```

```
if (ctxt) getdns_context_destroy(ctxt);
return r ? EXIT_FAILURE : EXIT_SUCCESS;
```

```
}
```



# Hands on *getdns* C API – How to do a simple query

## get data 2

```
void callback(getdns_context *ctxt, getdns_callback_type_t cb_type,
getdns_dict *resp, void *userarg, getdns_transaction_t tra)
{
 getdns_return_t r;
 getdns_list *jaa; /* The just_address_answers list */
 size_t i; /* Variable to iterate over the jaa list */
 getdns_dict *ad; /* A dictionary containing an address */

 if (cb_type != GETDNS_CALLBACK_COMPLETE)
 fprintf(stderr, "Something went wrong with this query: %s\n",
 , getdns_get_errorstr_by_id(cb_type));

 else if ((r = getdns_dict_get_list(resp, "just_address_answers", &jaa)))
 fprintf(stderr, "No addresses in the response dict: %s\n",
 , getdns_get_errorstr_by_id(r));

 else for (i = 0; !getdns_list_get_dict(jaa, i, &ad); i++) {

 getdns_bindata *address;
 char address_str[1024];

 if ((r = getdns_dict_get_bindata(ad, "address_data", &address)))
 fprintf(stderr, "Could not get address_data: %s\n",
 , getdns_get_errorstr_by_id(r));
 }
}
```

works with all constants

stop for when != 0



# Hands on *getdns* C API – How to do a simple query get data 2

```
else if ((r = getdns_dict_get_list(resp, "just_address_answers", &jaa)))
 fprintf(stderr, "No addresses in the response dict: %s\n"
 , getdns_get_errorstr_by_id(r));

else for (i = 0; !getdns_list_get_dict(jaa, i, &ad); i++) {

 getdns_bindata *address;
 char address_str[1024];

 if ((r = getdns_dict_get_bindata(ad, "address_data", &address)))
 fprintf(stderr, "Could not get address_data: %s\n"
 , getdns_get_errorstr_by_id(r));

 else if (address->size != 4 && address->size != 16)
 fprintf(stderr, "Unable to determine address type\n");

 else if (! inet_ntop(address->size == 4 ? AF_INET : AF_INET6,
 address->data, address_str, sizeof(address_str)))
 fprintf(stderr, "Could not convert address to string\n");
 else
 printf("An address of getdnsapi.net is: %s\n", address_str);
}
getdns_dict_destroy(resp); /* Safe, because resp is NULL on error */
}
```

# Hands on *getdns* C API – How to do a simple query multiple queries

```
struct dane_query_st {
 getdns_dict *addrs_response;
 getdns_transaction_t addrs_transaction_id;
 getdns_dict *tlsas_response;
 getdns_transaction_t tlsas_transaction_id;
};

int main()
{
 getdns_return_t r;
 getdns_context *ctxt = NULL;
 uv_loop_t loop;
 getdns_dict *ext;
 struct dane_query_st state = { NULL, 0, NULL, 0 };

 -----//-----

 else if ((r = getdns_context_set_resolution_type(
 ctxt, GETDNS_RESOLUTION_STUB)))
 fprintf(stderr, "Could not set stub resolution modus: %s\n"
 , getdns_get_errorstr_by_id(r));

 else if ((r = getdns_address(ctxt, "getdnsapi.net.", NULL
 , &state
 , &state.addrs_transaction_id
 , addresses_callback)))
 fprintf(stderr, "Unable to schedule an address lookup: %s\n"
 , getdns_get_errorstr_by_id(r));
```

void \*  
userarg

# Hands on *getdns* C API – How to do a simple query multiple queries

```
else if (!(ext = getdns_dict_create())) {
 fprintf(stderr, "Could not allocate extensions dict\n");
 r = GETDNS_RETURN_MEMORY_ERROR;
}
else if ((r = getdns_dict_set_int(ext, "dnssec_return_only_secure"
 , GETDNS_EXTENSION_TRUE))
 || (r = getdns_dict_set_int(ext, "dnssec_roadblock_avoidance"
 , GETDNS_EXTENSION_TRUE)))
 fprintf(stderr, "Could not populate extensions dict: %s\n"
 , getdns_get_errorstr_by_id(r));

else if ((r = getdns_general(ctxt, "_443._tcp.getdnsapi.net."
 , GETDNS_RRTYPE_TLSA, ext
 , &state
 , &state.tlsas_transaction_id
 , tlsas_callback)))
 fprintf(stderr, "Unable to schedule a TLSA lookup: %s\n"
 , getdns_get_errorstr_by_id(r));
else
 uv_run(&loop, UV_RUN_DEFAULT);
```

void \*  
userarg

- Create & populate extensions the API way

Hands  
on



# C API – How to do a simple query multiple queries

```
else if ((r = getdns_str2dict(
 "{ dnssec_return_only_secure : GETDNS_EXTENSION_TRUE "
 ", dnssec_roadblock_avoidance: GETDNS_EXTENSION_TRUE }", &ext)))

 fprintf(stderr, "Could not create/populate extensions dict: %s\n"
 , getdns_get_errorstr_by_id(r));

else if ((r = getdns_general(ctxt, "_443._tcp.getdnsapi.net."
 , GETDNS_RRTYPE_TLSA, ext
 , &state
 , &state.tlsas_transaction_id
 , tlsas_callback)))

 fprintf(stderr, "Unable to schedule a TLSA lookup: %s\n"
 , getdns_get_errorstr_by_id(r));

else
 uv_run(&loop, UV_RUN_DEFAULT);
```

void \*  
userarg

- Create & populate extensions the unofficial non-API way

Hands  
on



# C API – How to do a simple query multiple queries

```
void addresses_callback(getdns_context *ctxt, getdns_callback_type_t cb_type,
 getdns_dict *resp, void *userarg, getdns_transaction_t trans_id)
{
 struct dane_query_st *state = (struct dane_query_st *)userarg;

 if (cb_type != GETDNS_CALLBACK_COMPLETE) {
 /* Something went wrong,
 * Cancel the TLSA query if it hasn't finished yet.
 * Then abort the connection.
 */
 if (! state->tlsas_response)
 (void) getdns_cancel_callback(
 ctxt, state->tlsas_transaction_id);

 abort_connection(state);
 return;
 }
 state->addrs_response = resp;
 if (state->tlsas_response)
 setup_connection(state);
 else
 ; /* Wait for TLSA lookup to complete */
}
```

# Hands on C API – How to do a simple query **multiple queries**

```
void tlsas_callback(getdns_context *ctxt, getdns_callback_type_t cb_type,
 getdns_dict *resp, void *userarg, getdns_transaction_t trans_id)
{
 struct dane_query_st *state = (struct dane_query_st *)userarg;

 if (cb_type != GETDNS_CALLBACK_COMPLETE) {
 /* Something went wrong,
 * Cancel the TLSA query if it hasn't finished yet.
 * Then abort the connection.
 */
 if (! state->addrs_response)
 (void) getdns_cancel_callback(
 ctxt, state->addrs_transaction_id);

 abort_connection(state);
 return;
 }
 state->tlsas_response = resp;
 if (state->addrs_response)
 setup_connection(state);
 else
 ; /* Wait for address lookup to complete */
}
```

# Hands on C API – How to do a simple query

## multiple queries

```
void abort_connection(struct dane_query_st *state)
{
 getdns_dict_destroy(state->addrs_response);
 getdns_dict_destroy(state->tlsas_response);
 fprintf(stderr, "DNS failure\n");
}

void setup_connection(struct dane_query_st *state)
{
 uint32_t status;

 if (getdns_dict_get_int(state->tlsas_response, "status", &status)
 || status == GETDNS_RESPSTATUS_ALL_BOGUS_ANSWERS) {

 abort_connection(state);
 return;
 }
 printf("DNS lookups were successful!\n");

 /* Schedule opening the TLS connection to the addresses (if any)
 * and verification with the received TLSAs (if any)
 * i.e. uv_tcp_connect(connect, socket, dest, callback);
 */
}
```