Understanding DNSCurve

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Disclaimer: I haven’t released DNSCurve software yet.

But you can try prototypes: @mdempsky’s DNSCurve cache, @hhavt’s CurveDNS server.

See also related projects: NaCl, DNSCrypt, CurveCP, MinimaLT. Varying release levels.
DNS in a nutshell

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twitter.com?
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- Maybe browser doesn’t know where .com server is.
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- Maybe browser doesn’t know where .com server is. Has to ask root server.
- twitter.com server name is actually ns2.p34.dynect.net. Is browser allowed to accept ns2.p34.dynect.net address from the .com server? Does it have to ask .net?
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- twitter.com server name is actually ns2.p34.dynect.net. Is browser allowed to accept ns2.p34.dynect.net address from the .com server? Does it have to ask .net?

- Browser actually pulls from a laptop-wide DNS cache. Or a site-wide DNS cache.
DNS in the real world

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The user wants to pull tweets from Twitter, push tweets to Twitter.
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The big picture:

DNS is just one small part of any real Internet protocol.

Typical examples:
HTTP starts with DNS.
SMTP starts with DNS.
SSH starts with DNS.
Real Internet protocol example:
User asks browser for

Many levels of redirection:
root DNS → .com DNS → .theguardian.com DNS →

And then the hard work begins: browser receives page, displays page for user.
What does DNS security mean?

Crypto goals: confidentiality, integrity, and availability for the user’s communication.

Security for IP addresses is irrelevant unless it helps protect user communication.
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Reality: What DNSSEC signs is an IP-address redirection: isc.org A 149.20.64.69. This is meaningless for users.
Example of bogus “security”:

“You can’t trust online servers. Our DNS data is signed offline by a Hardware Security Module in a fortress in Maryland protected by machine guns. Signing procedure requires 3 out of 16 smart cards held by VeriSign Trust Managers.”
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Does this protect users? No! The web server is online, and most web pages are dynamic. The mail server is online. The shell server is online.
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By insisting on signatures, DNSSEC creates problems for lookups of dynamic DNS data; lookups of nonexistent names; speed; robustness; availability; freshness; confidentiality.
Analogy: imagine HTTPSEC.
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All client data is authenticated + encrypted to server’s public key from client’s public key.

All server data is authenticated + encrypted to client’s public key from server’s public key.
Crypto layer is very close to network layer.

Each packet is authenticated + encrypted just before it is sent. Each packet is verified + decrypted immediately after it is received.
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Separate authenticator on every packet also improves availability. No more RST attacks.
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Server sneaks public key into that mechanism.
How does server obtain client’s public key? Client sends it with first packet.

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No extra packets. Serious crypto for each packet, but state-of-the-art crypto (Curve25519, Salsa20, Poly1305) easily keeps up with the network.