Bootstrapping Procedure to Discover and Authenticate DoT and DoH servers

https://tools.ietf.org/html/draft-reddy-dprive-bootstrap-dns-server-02

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Agenda

- Problem Statement
- Solution overview
- Bootstrapping Phase
- Discovery Phase
- Connection handshake and DNS server certificate validation
- Questions & Comments

Problem statement

- Public DoH/DoT/DNS causes operational problems
  - Breaks split DNS (internal.example.com)
  - Breaks local names (printer.local)
  - Harms CDN localization (modulo RFC7871)

Problem statement

- Network security services cannot act on DoT/DoH traffic to block malware.
- Network security services would want to block public DoT/DoH traffic to
  - Drop traffic to port 853 (DoT)
  - Identifying DoH is far more challenging
    - Identify the domains offering DoH servers and block traffic to these domains. Public DoH servers are categorized as “Proxy / Anonymizer” content category.
- Strict privacy profile
  - No DNS service and No Internet.
- Opportunistic privacy profile
  - Fallback to clear-text or unauthenticated encrypted connection.

Problem statement

- Ramification of successfully blocking DoT/DoH traffic
  - Pervasive monitoring
  - Internal attacker can modify the DNS response to point to malicious servers.

- Ramification of failure to block DoT/DoH traffic
  - Failure to block access to malicious (malware) domains.
  - IoT firewall rules (RFC8520) based on domain names provided by the IoT Manufacturer cannot be enforced.

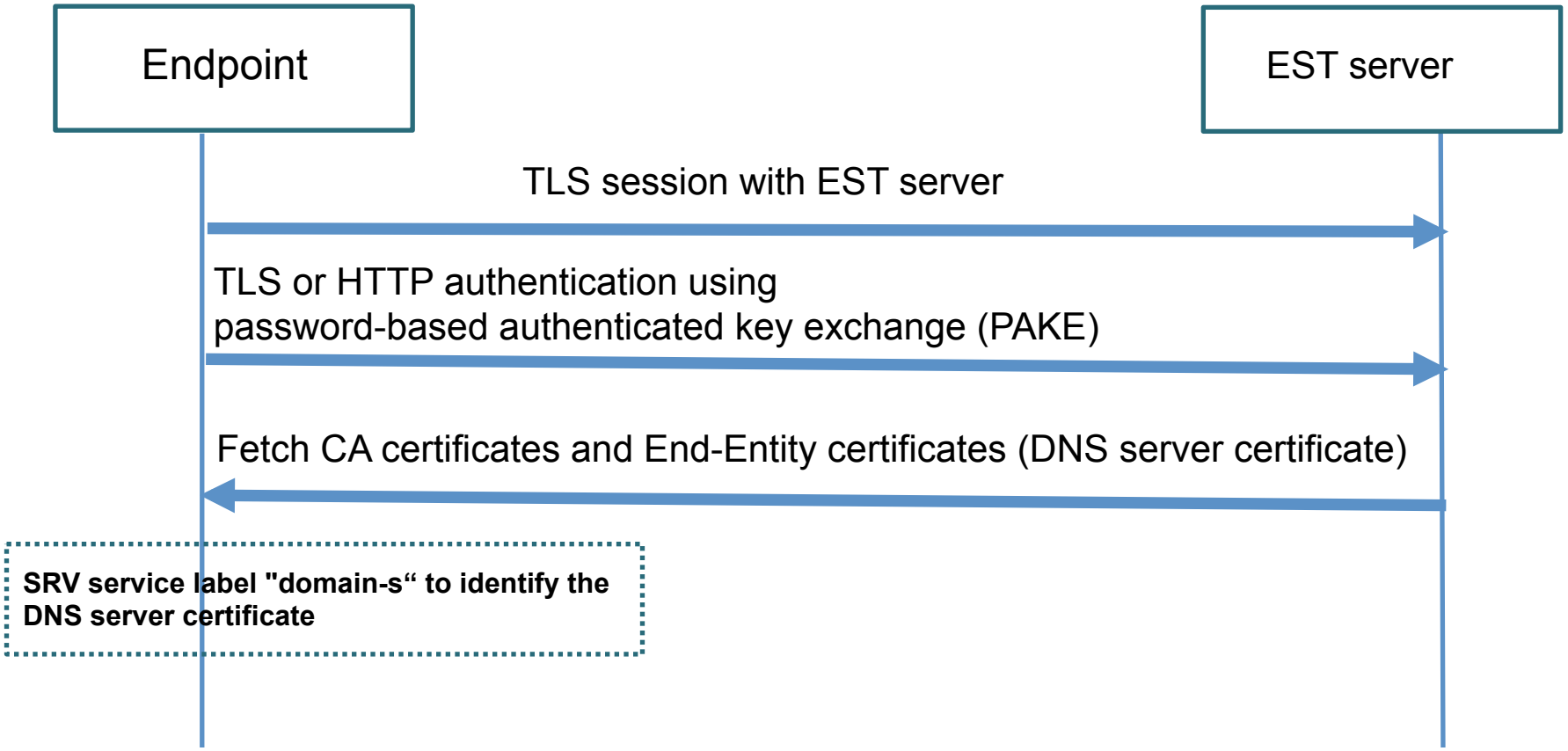
Both scenarios compromise endpoint security and privacy

Solution overview

- Provide local DoH/DoT/DNS
  - Works with split DNS (internal.example.com)
  - Works with local names (printer.local)
  - Works with CDN localization (without needing RFC7871)

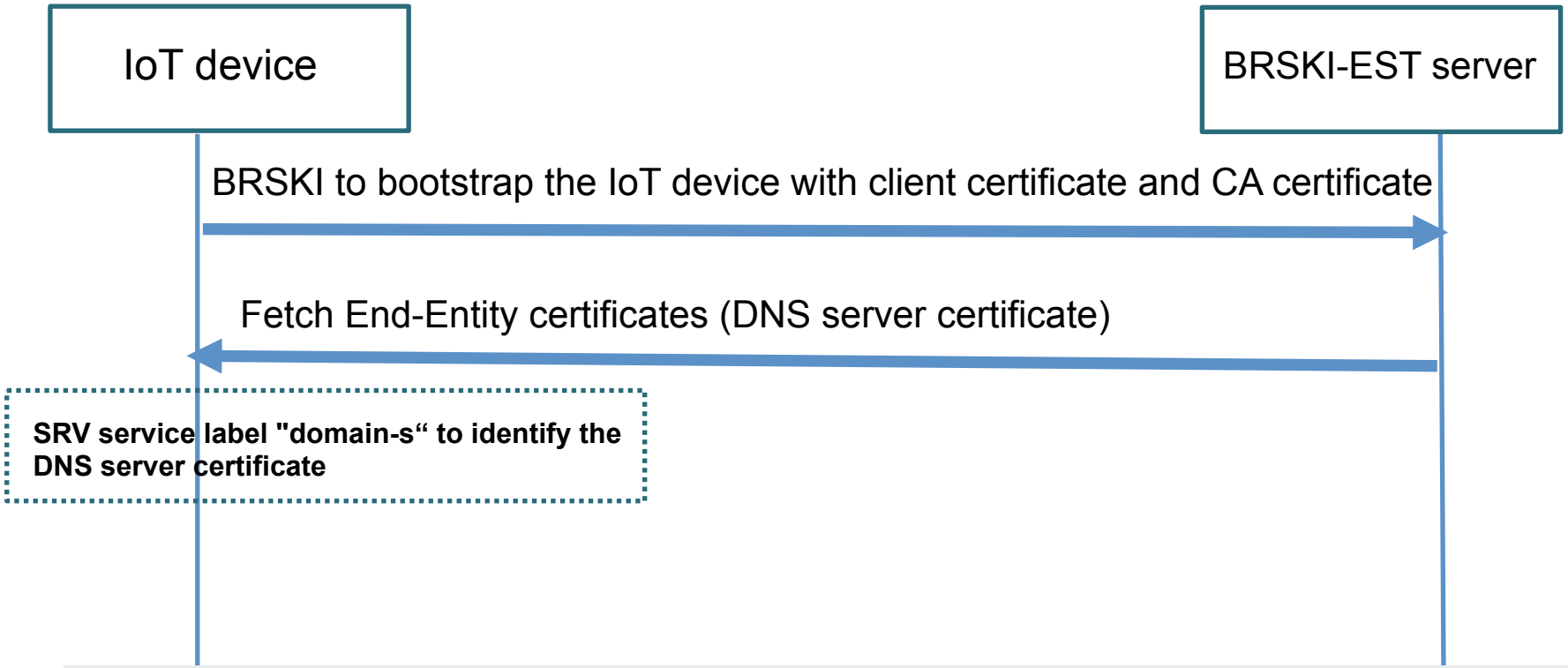
The draft discusses mechanisms to bootstrap endpoints to discover and authenticate local DNS-over-(D)TLS and DNS-over-HTTPS servers.

Bootstrapping Endpoint Devices



RFC5054: Secure Remote Password (SRP) protocol for TLS authentication
RFC8120: Mutual Authentication for HTTPS
RF7030: Enrollment over Secure Transport

Bootstrapping IoT Devices and CPE



Bootstrapping Remote Secure Key Infrastructures (BRSKI) draft-ietf-anima-bootstrapping-keyinfra provisions credentials to access networks.

- BRSKI provides an automated mechanism for the bootstrap distribution of CA certificates from the EST server.

Discovery Phase

- S-NAPTR lookup to learn DoT and DoH protocols supported by the DNS server and the DNS privacy protocol preferred by the DNS server administrators

```
example.net.
IN NAPTR 100 10 "" DPRIVE:dns.tls  "" dns1.example.net.
IN NAPTR 200 10 "" DPRIVE:dns.dtls "" dns2.example.net.

dns1.example.net.
IN NAPTR 100 10 S DPRIVE:dns.tls "" _domain-s._tcp.example.net.

dns2.example.net.
IN NAPTR 100 10 S DPRIVE:dns.dtls "" _domain-s._udp.example.net.

_domain-s._tcp.example.net.
IN SRV   0 0 853 a.example.net.

_domain-s._udp.example.net.
IN SRV   0 0 853 a.example.net.

a.example.net.
IN A       192.0.2.1
```

Discovery Phase

- If DNS-over-HTTPS protocol is supported by the DNS server, discover the URI templates using one of the mechanisms discussed in “Associating a DoH server with a resolver” (draft-ietf-doh-resolver-associated-doh).

Connection handshake and DNS server certificate validation

- Match the certificate in TLS handshake with the DNS server certificate downloaded from EST server.
- Validate the certificate using the Explicit trust anchor database entries.

Privacy considerations

- A new privacy certificate extension that identifies the privacy preserving data policy of the DNS server.
  - The extension will contain a URL that points to the privacy preserving data policy.

Security considerations

- The Explicit trust anchor can be used to perform DNSSEC validation of the responses from local DNS server.
- User can enable the discovery mechanism in trusted networks.
- If the user trusts the network, the user can enable strict privacy profile with the DNS-over-(D)TLS or DNS-over-HTTPS server discovered in the network.

draft-reddy-dprive-bootstrap-dns-server-02

- Comments and suggestions are welcome