



85 | COMMUNITY
FORUM



How it Works: DNS Fundamentals

08 March 2026

Introductions

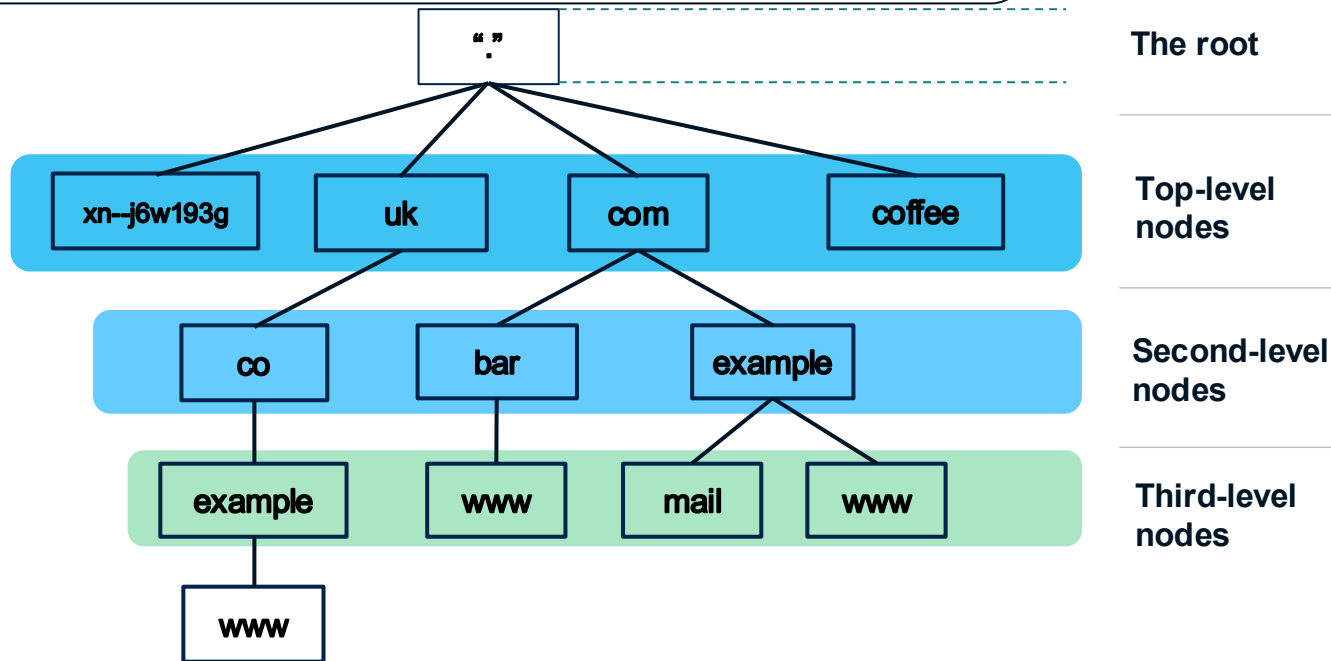
- **Nicolas Antonello**
- **Champika Wijayatunga**

The Name Space

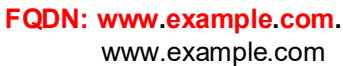
Why it is important?

The Name Space

- DNS database structure is an inverted tree called the *name space*
- Each node has a label
- The root node (and only the root node) has a null label
- The name space is divided up to allow **distributed administration**



Zones and Administrative boundaries



- www.example.co.uk

Zone File and DNS Resource Records

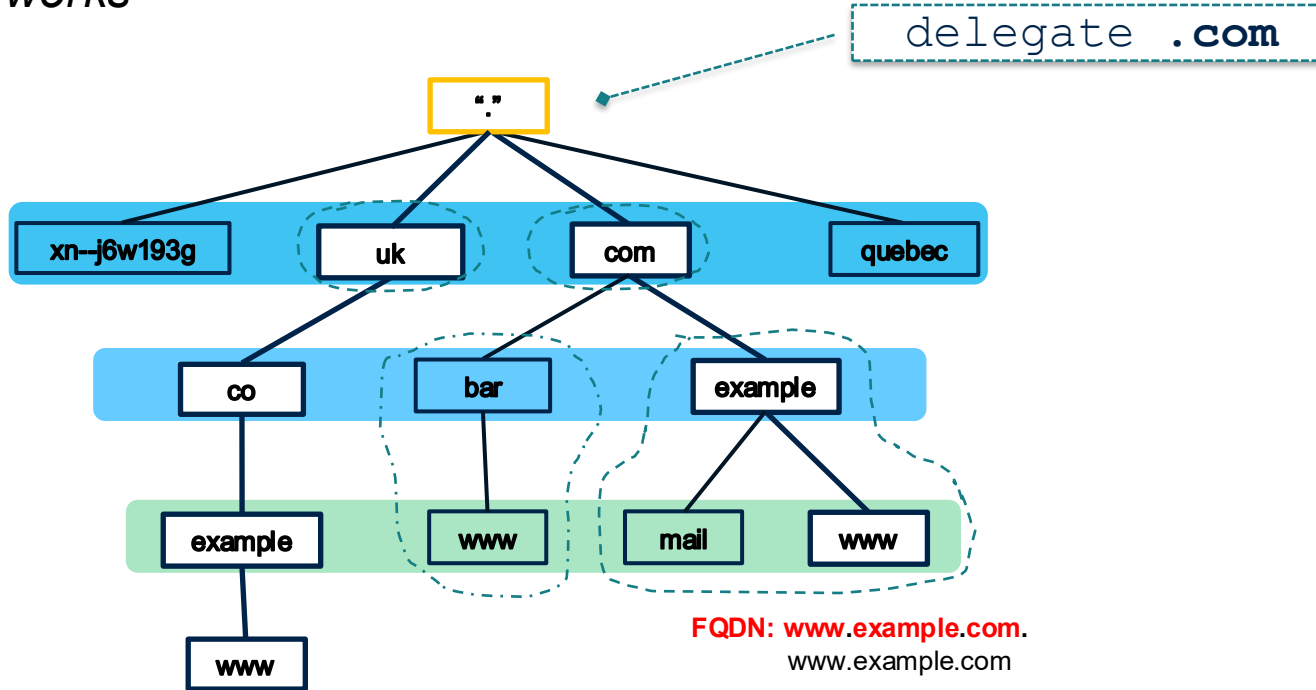
- Different kinds of data are associated with a domain name
- These data are stored in **resource records** (the records in DNS database)
 - Different record types for different type of data

A	IPv4 address
AAAA	IPv6 address
NS	Name of an authoritative name server
SOA	“Start of authority”, appears at zone apex
MX	Name of a “mail exchange server”

- Every zone will have at least one zone file associated to it
- A **zone file** contains all the data for a zone - the **resources records**

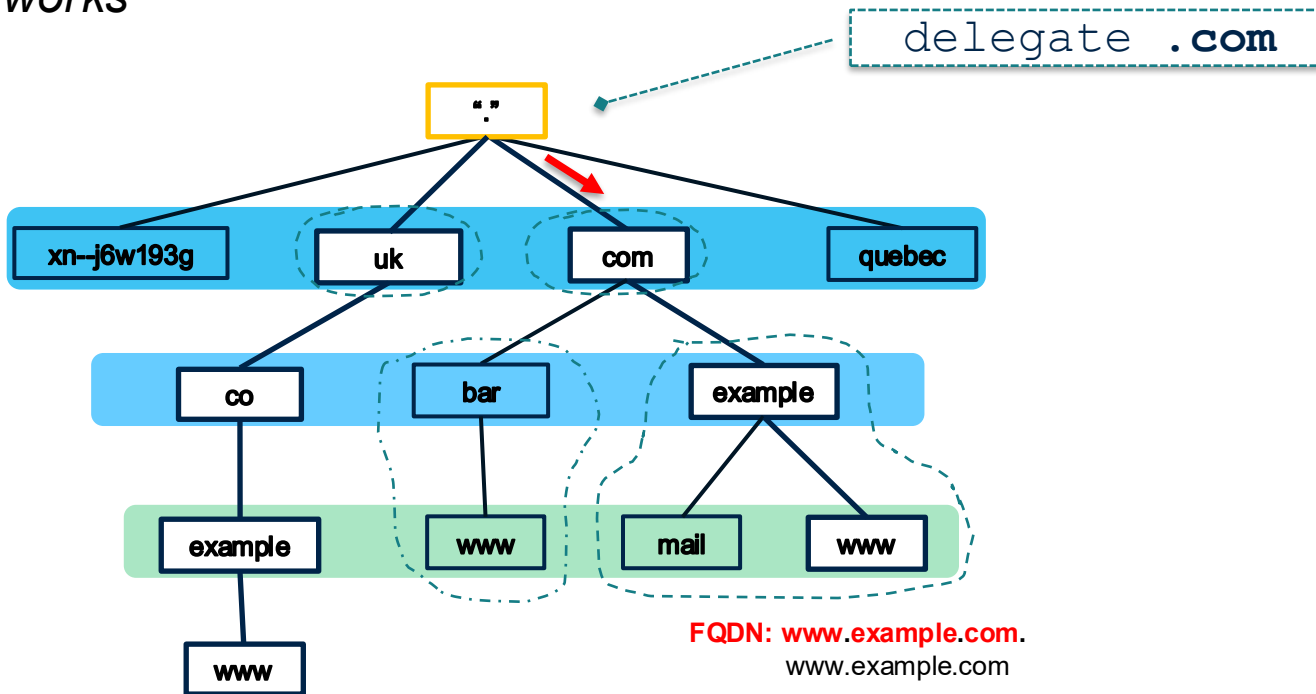
Delegation

How it works



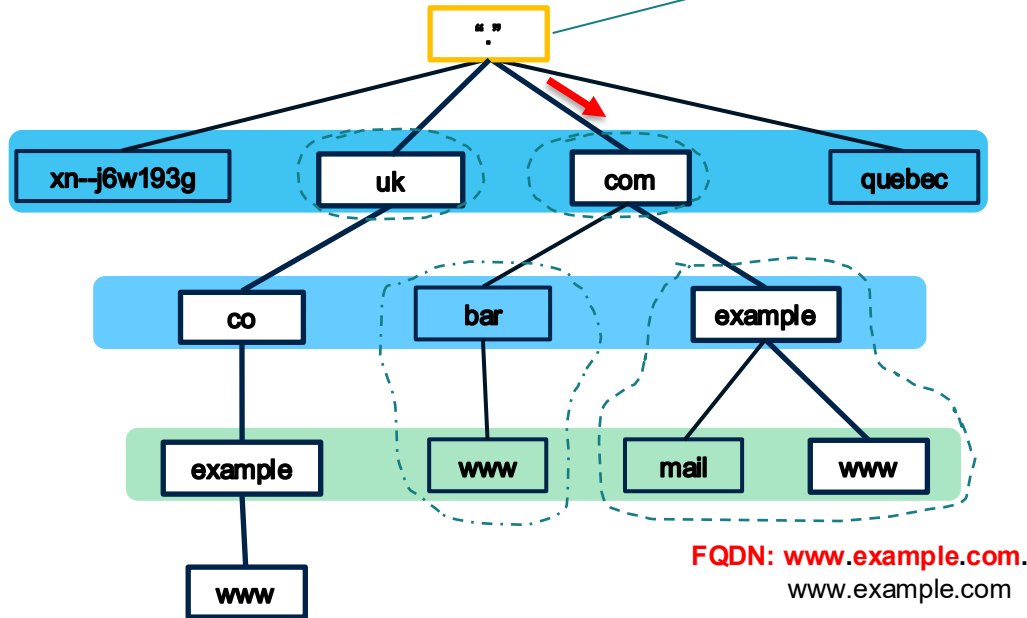
Delegation

How it works



Delegation

How it works

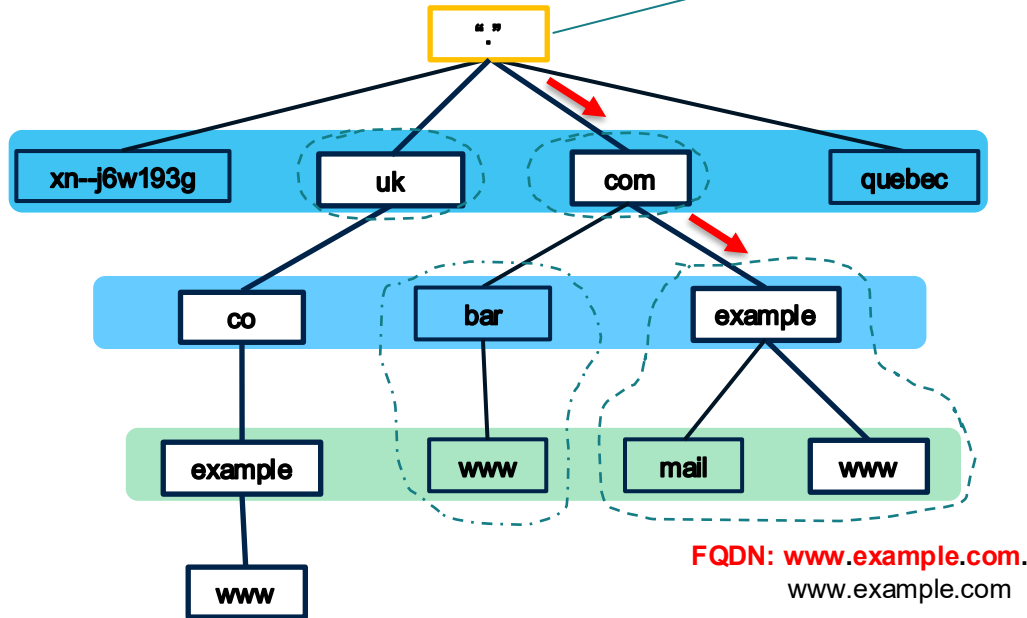


FQDN: **www.example.com.**
www.example.com

com.	NS	a.gtld-servers.net.
com.	NS	b.gtld-servers.net.
com.	NS	c.gtld-servers.net.
com.	NS	d.gtld-servers.net.
com.	NS	e.gtld-servers.net.
com.	NS	f.gtld-servers.net.
com.	NS	g.gtld-servers.net.
com.	NS	h.gtld-servers.net.
com.	NS	i.gtld-servers.net.
com.	NS	j.gtld-servers.net.
com.	NS	k.gtld-servers.net.
com.	NS	l.gtld-servers.net.
com.	NS	m.gtld-servers.net.

Delegation

How it works

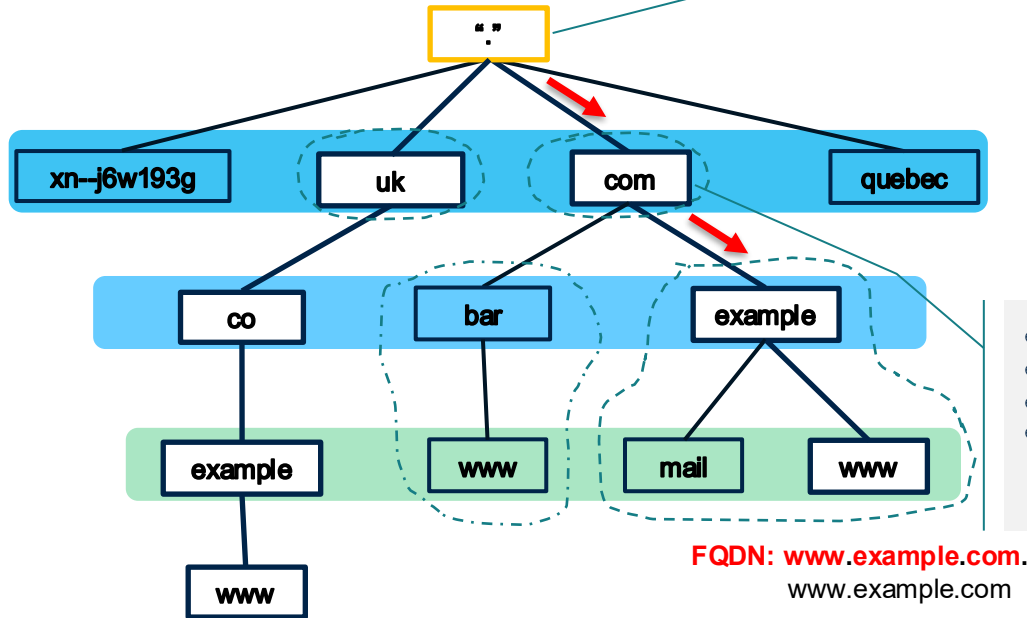


FQDN: **www.example.com.**
www.example.com

com.	NS	a.gtld-servers.net.
com.	NS	b.gtld-servers.net.
com.	NS	c.gtld-servers.net.
com.	NS	d.gtld-servers.net.
com.	NS	e.gtld-servers.net.
com.	NS	f.gtld-servers.net.
com.	NS	g.gtld-servers.net.
com.	NS	h.gtld-servers.net.
com.	NS	i.gtld-servers.net.
com.	NS	j.gtld-servers.net.
com.	NS	k.gtld-servers.net.
com.	NS	l.gtld-servers.net.
com.	NS	m.gtld-servers.net.

Delegation

How it works



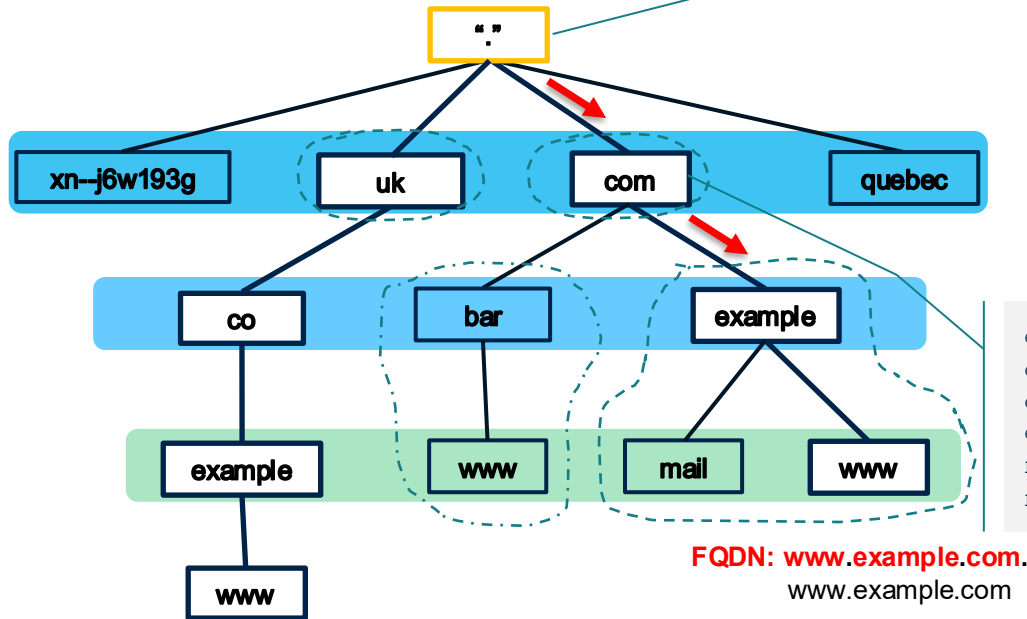
FQDN: **www.example.com.**
www.example.com

com.	NS	a.gtld-servers.net.
com.	NS	b.gtld-servers.net.
com.	NS	c.gtld-servers.net.
com.	NS	d.gtld-servers.net.
com.	NS	e.gtld-servers.net.
com.	NS	f.gtld-servers.net.
com.	NS	g.gtld-servers.net.
com.	NS	h.gtld-servers.net.
com.	NS	i.gtld-servers.net.
com.	NS	j.gtld-servers.net.
com.	NS	k.gtld-servers.net.
com.	NS	l.gtld-servers.net.
com.	NS	m.gtld-servers.net.

example.com.	NS	ns1.example.com.
example.com.	NS	ns2.example.com.
example.com.	NS	a.gtld-servers.net.
example.com.	NS	b.gtld-servers.net.

Delegation

How it works



FQDN: **www.example.com.**
www.example.com

com.	NS	a.gtld-servers.net.
com.	NS	b.gtld-servers.net.
com.	NS	c.gtld-servers.net.
com.	NS	d.gtld-servers.net.
com.	NS	e.gtld-servers.net.
com.	NS	f.gtld-servers.net.
com.	NS	g.gtld-servers.net.
com.	NS	h.gtld-servers.net.
com.	NS	i.gtld-servers.net.
com.	NS	j.gtld-servers.net.
com.	NS	k.gtld-servers.net.
com.	NS	l.gtld-servers.net.
com.	NS	m.gtld-servers.net.

example.com.	NS	ns1.example.com.
example.com.	NS	ns2.example.com.
example.com.	NS	a.gtld-servers.net.
example.com.	NS	b.gtld-servers.net.
ns1.example.com.	A	198.51.100.1
ns1.example.com.	A	203.0.113.150

Glue Records

What about the Root Zone?

Most sensible and critical part of the DNS

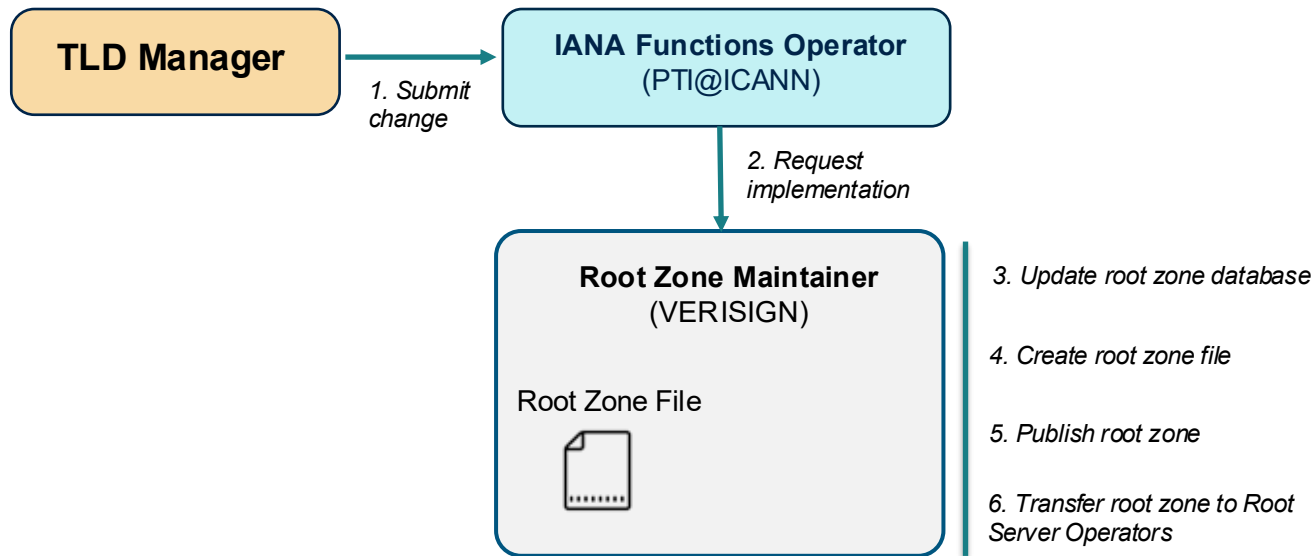
Root Zone Management

IANA Functions Operator
(PTI@ICANN)

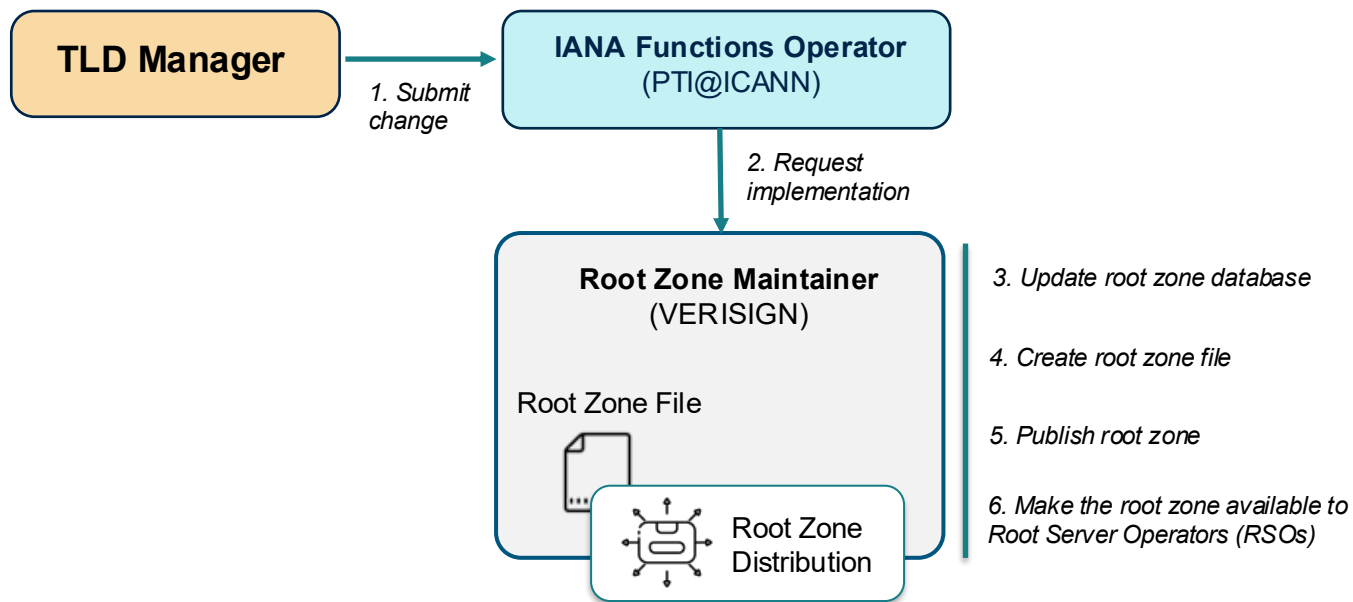
Root Zone Management



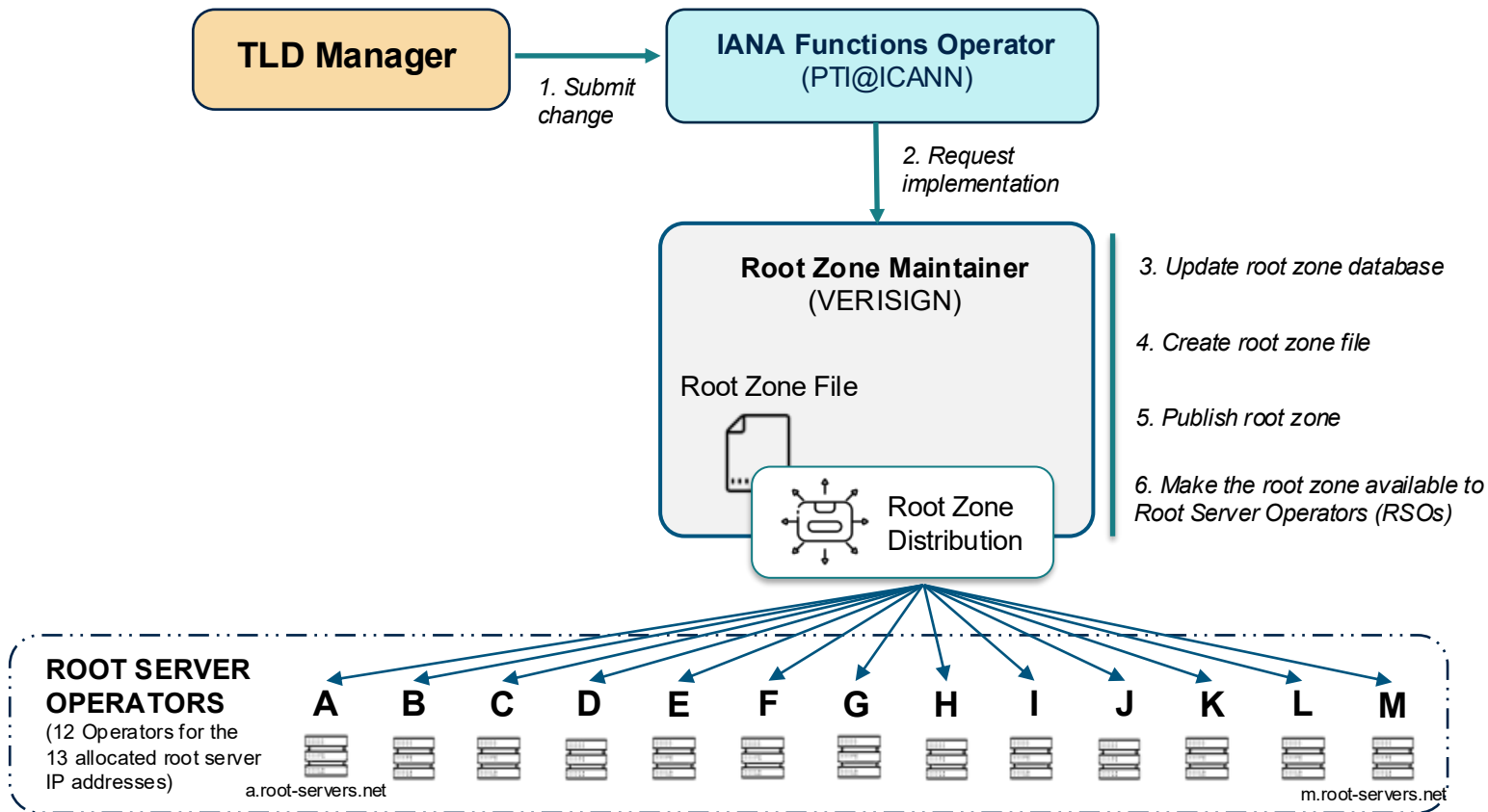
Root Zone Management



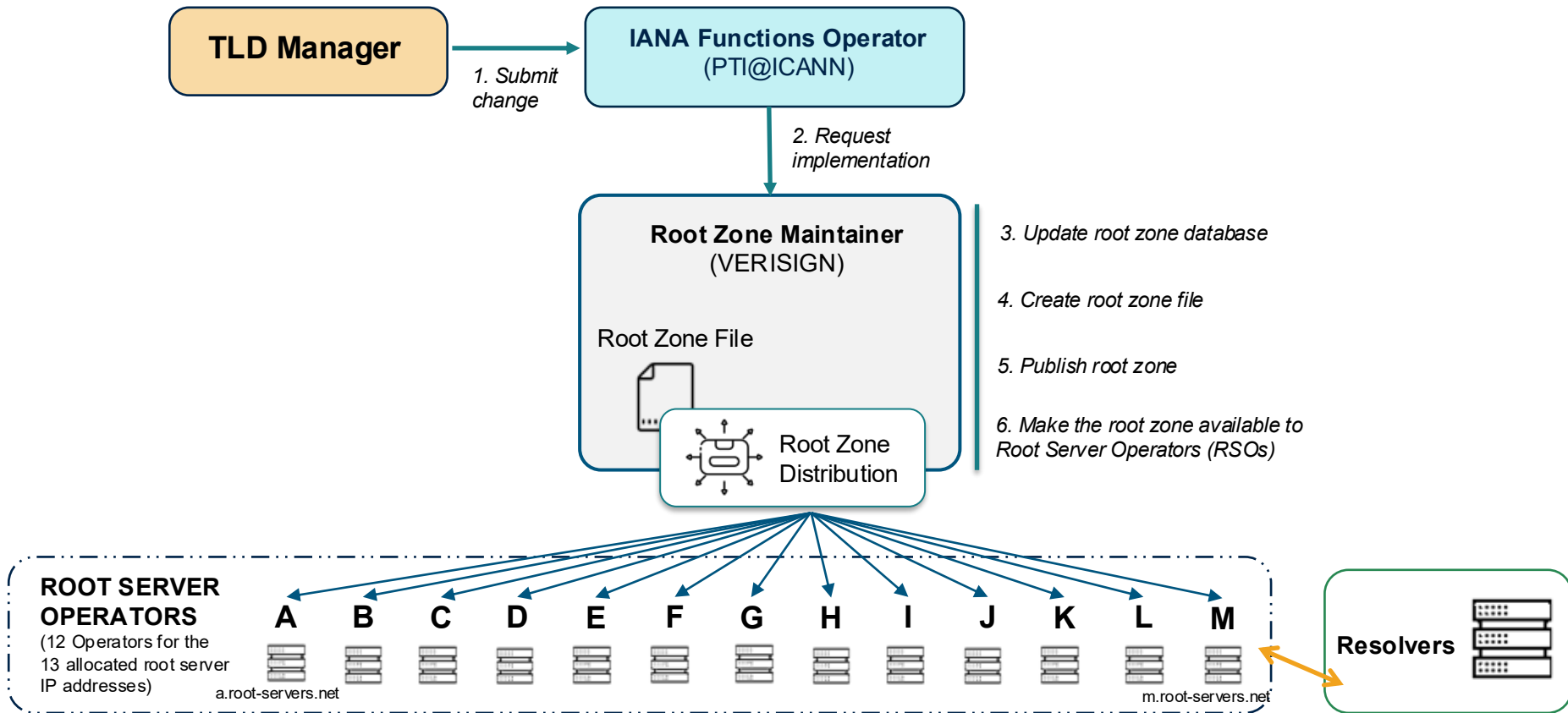
Root Zone Management



Root Zone Management



Root Zone Management

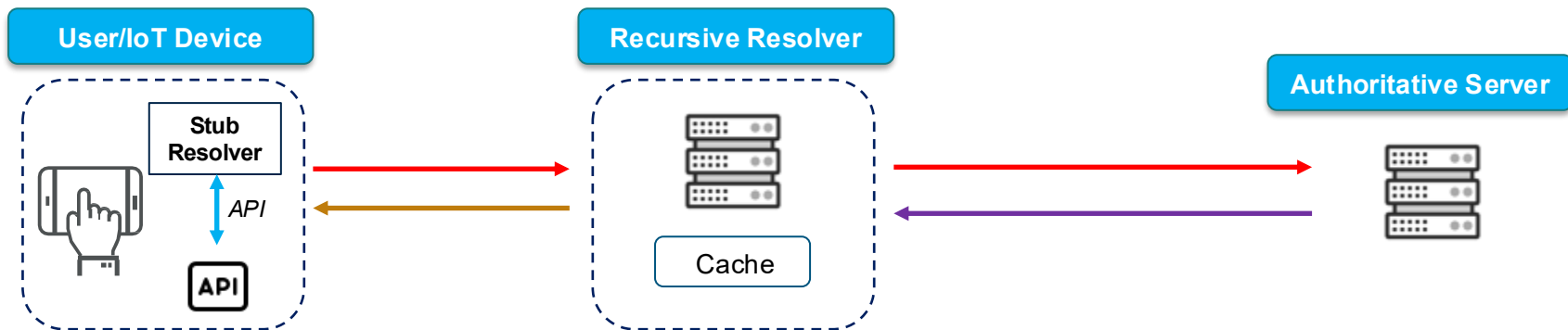


The DNS Service

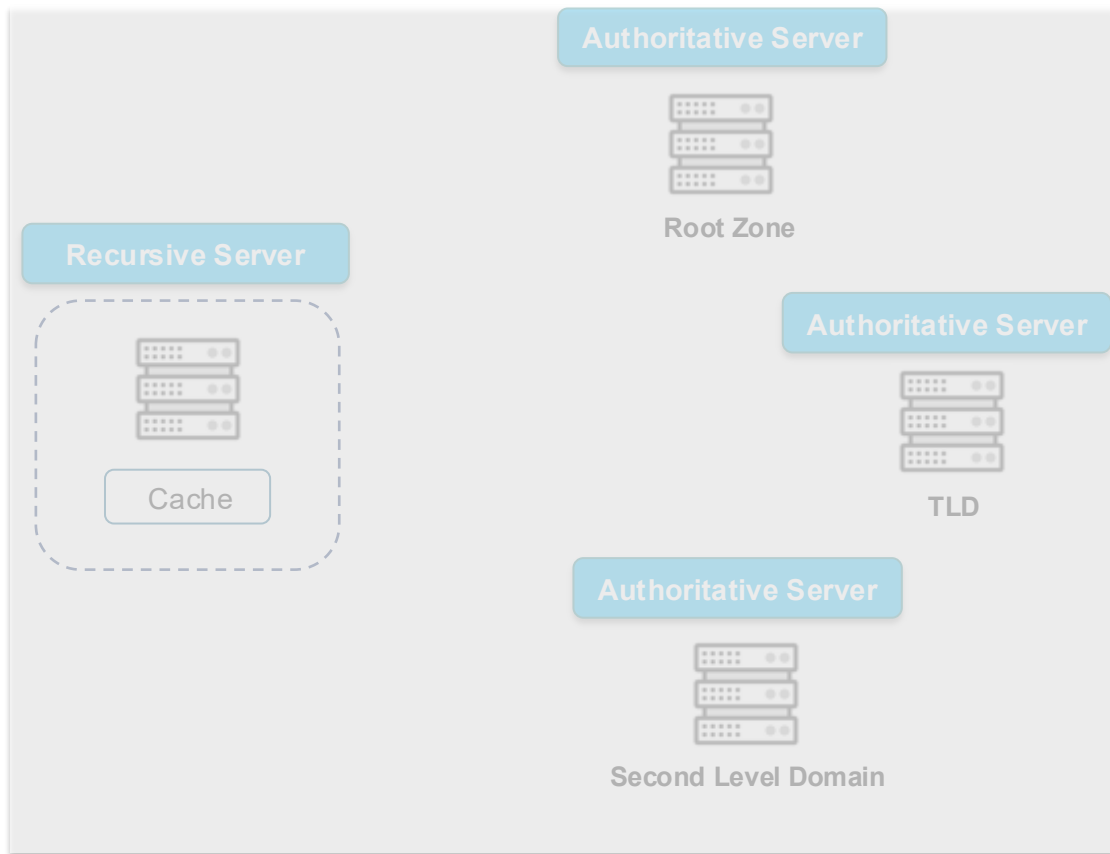
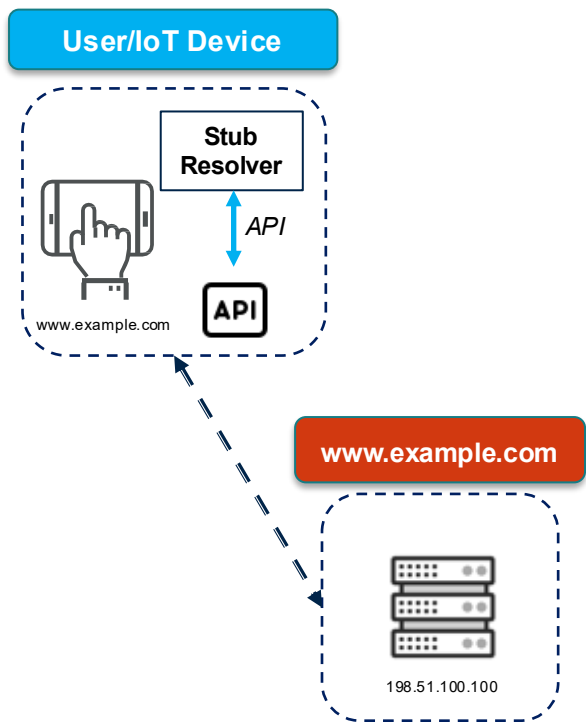
Ok, that's DNS... now, how it works?

Components of the DNS Service

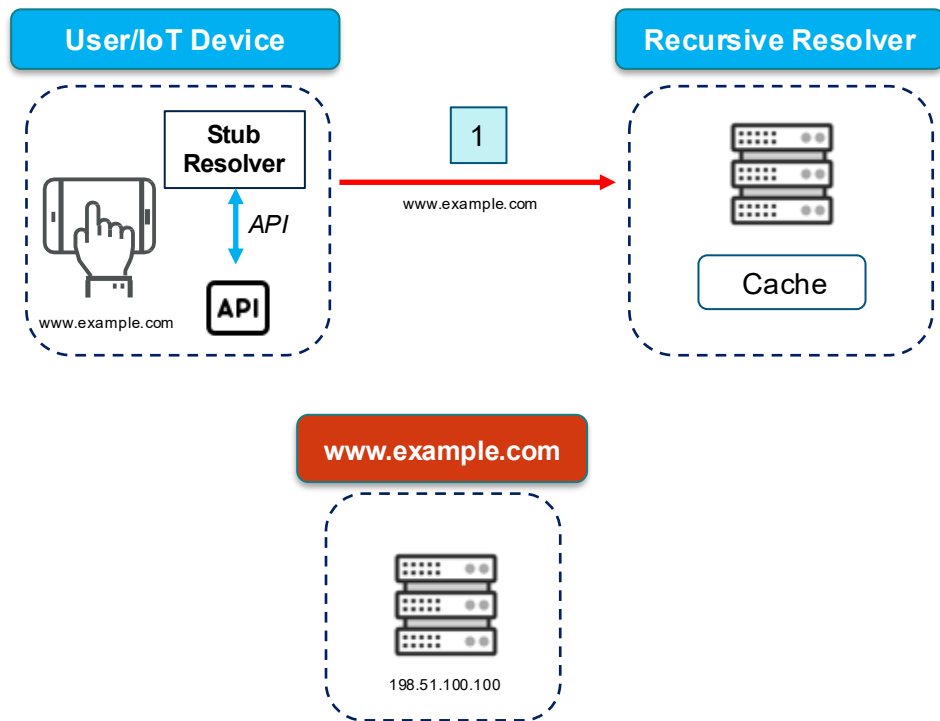
- The Stub Resolver [User device]
- The Recursive Resolver [ISP, Public, Corporate]
- The Authoritative [Name/Zone Manager / Operators]



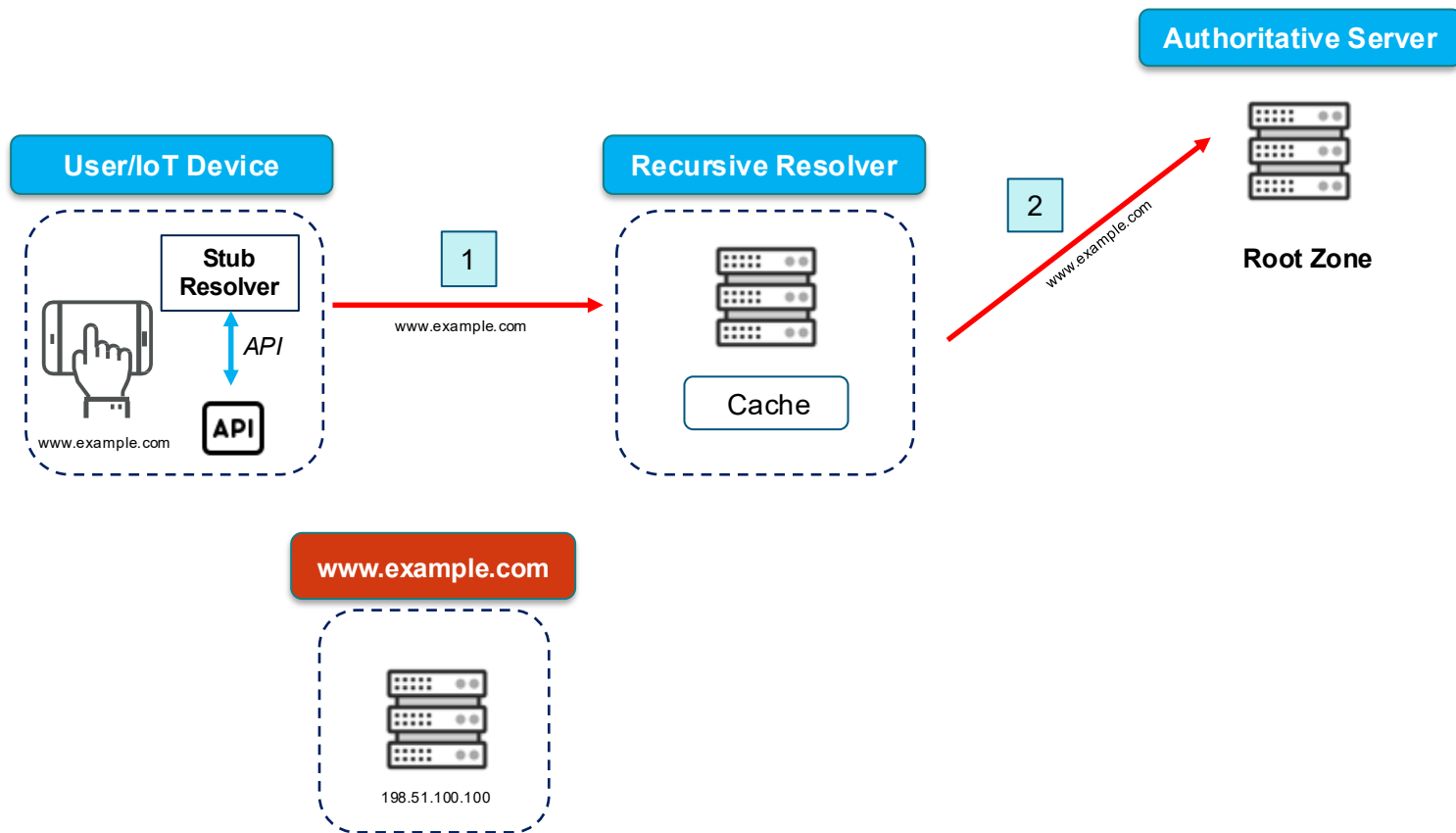
Resolution



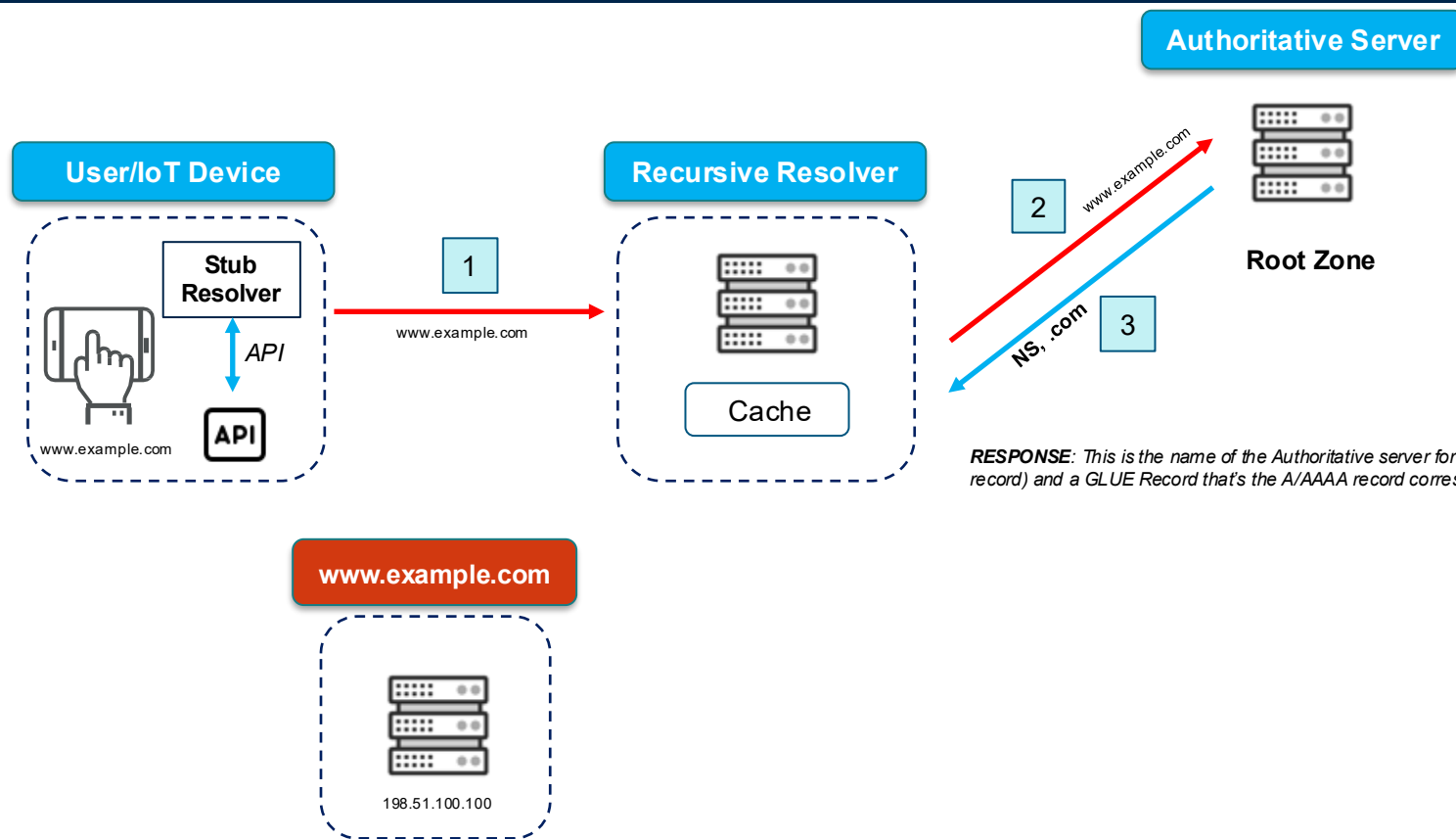
Resolution



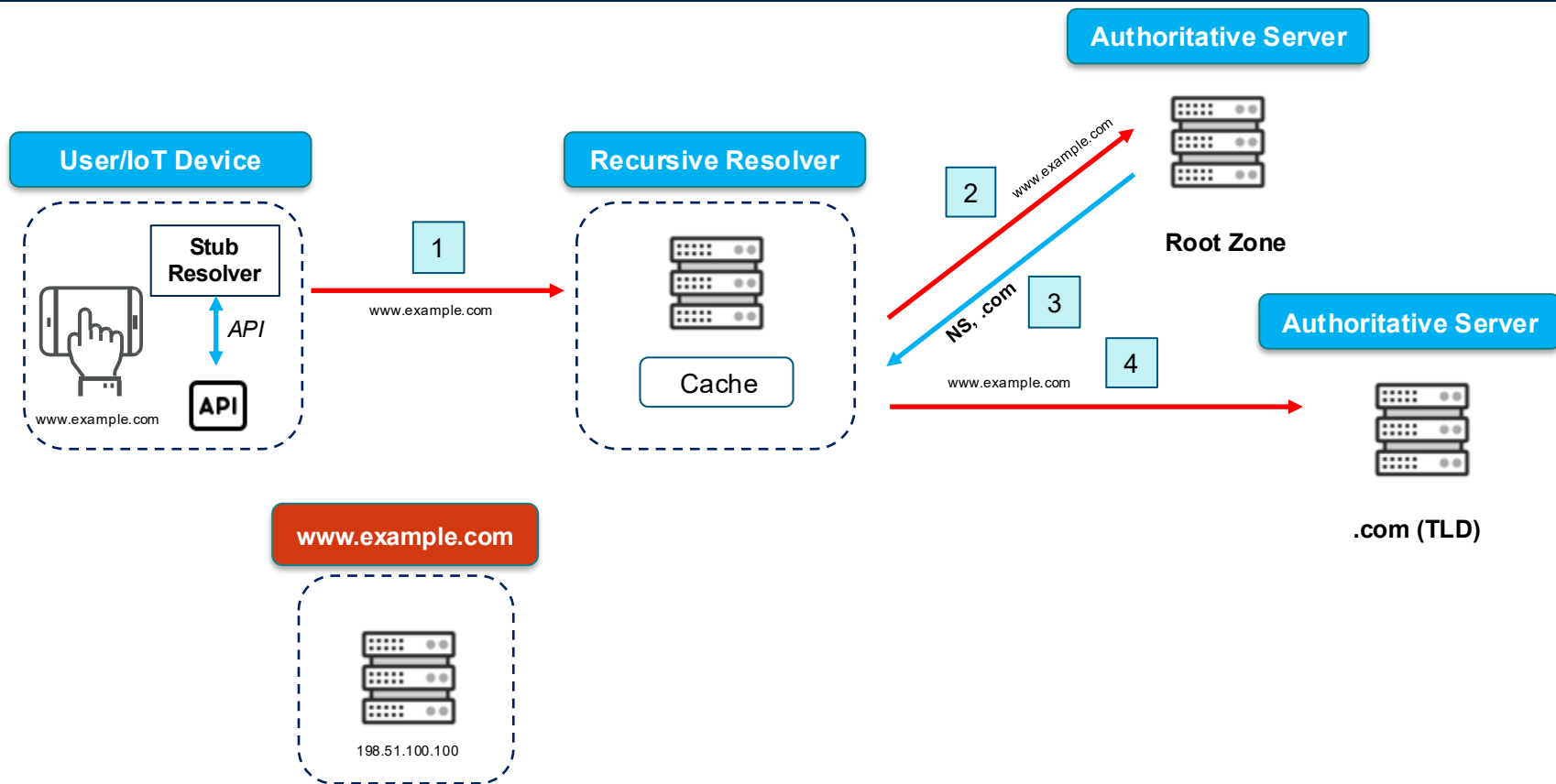
Resolution



Resolution

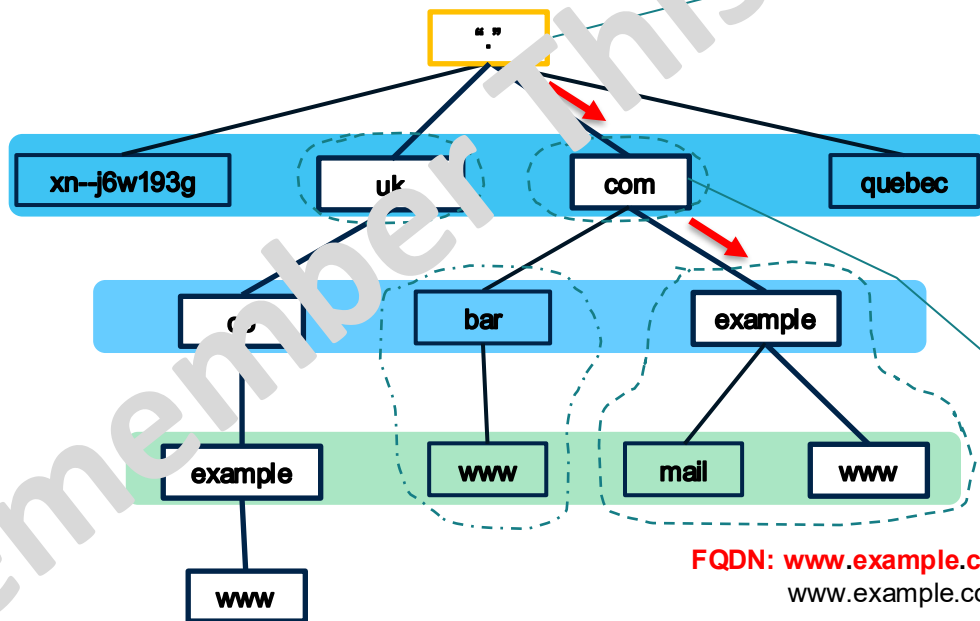


Resolution



Delegation

How it works



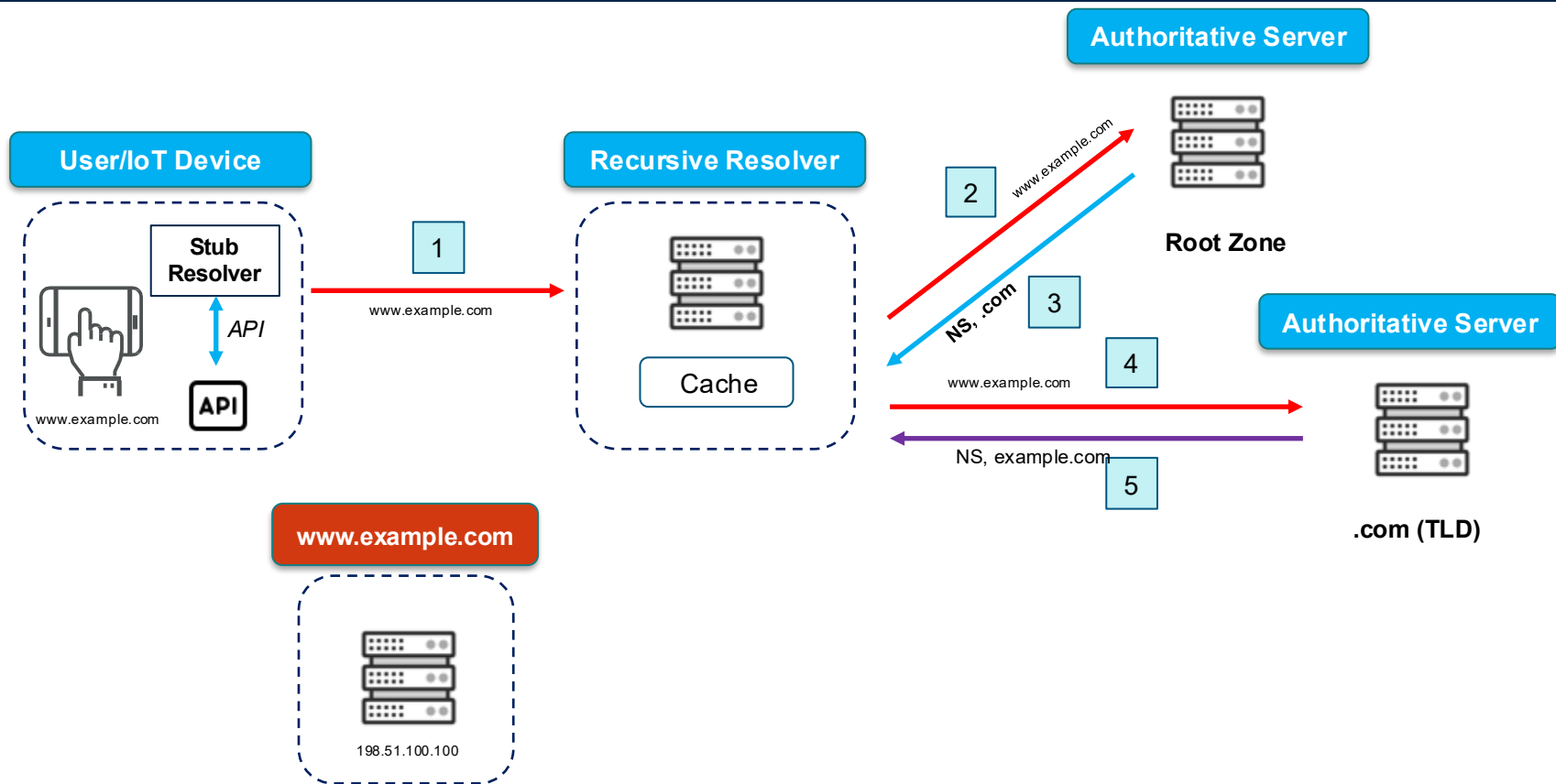
FQDN: **www.example.com.**
www.example.com

com.	NS	a.gtld-servers.net.
com.	NS	b.gtld-servers.net.
com.	NS	c.gtld-servers.net.
com.	NS	d.gtld-servers.net.
com.	NS	e.gtld-servers.net.
com.	NS	f.gtld-servers.net.
com.	NS	g.gtld-servers.net.
com.	NS	h.gtld-servers.net.
com.	NS	i.gtld-servers.net.
com.	NS	j.gtld-servers.net.
com.	NS	k.gtld-servers.net.
com.	NS	l.gtld-servers.net.
com.	NS	m.gtld-servers.net.

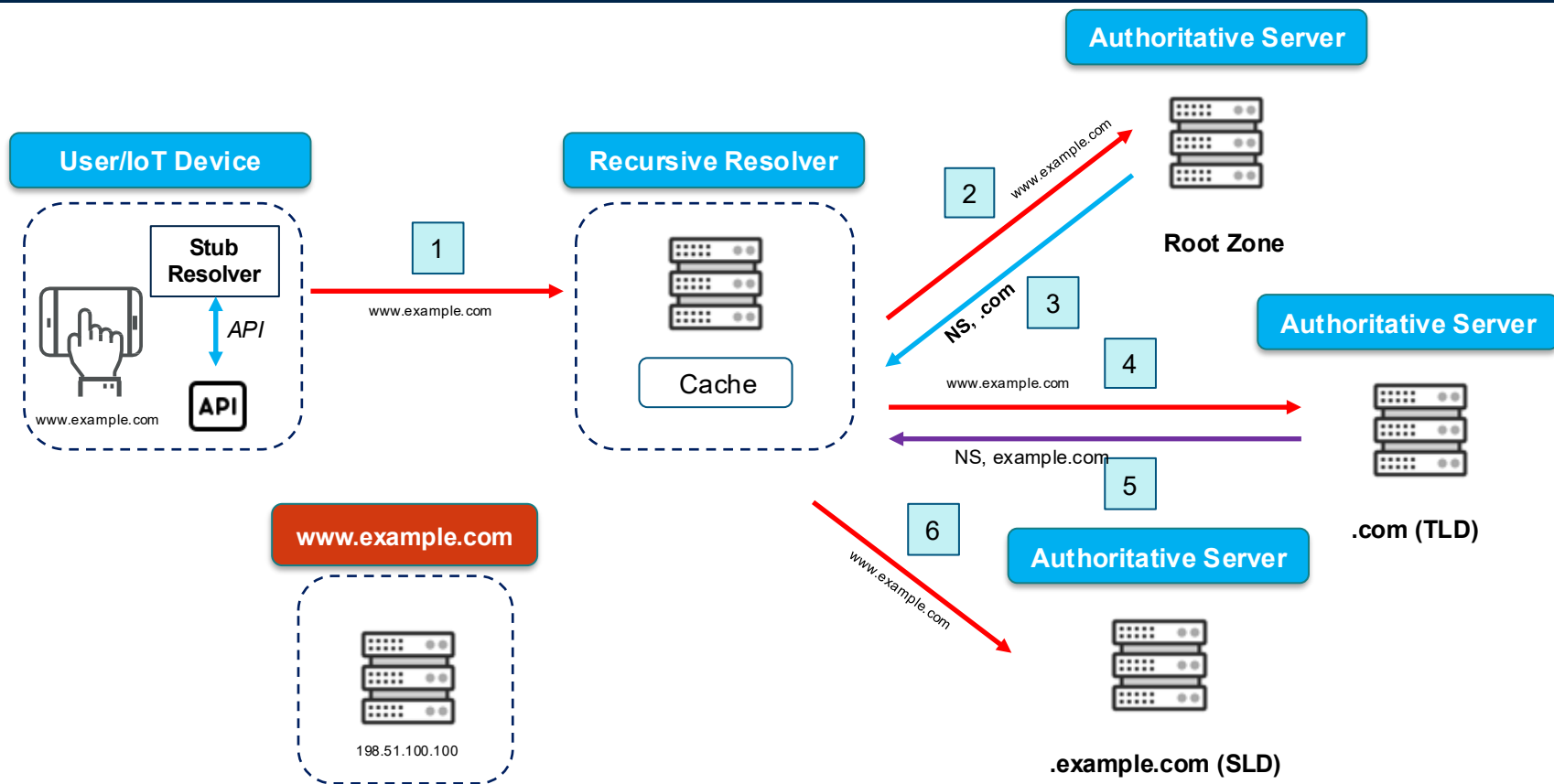
example.com.	NS	ns1.example.com.
example.com.	NS	ns2.example.com.
example.com.	NS	a.gtld-servers.net.
example.com.	NS	b.gtld-servers.net.
ns1.example.com.	A	198.51.100.1
ns1.example.com.	A	203.0.113.150

Glue Records

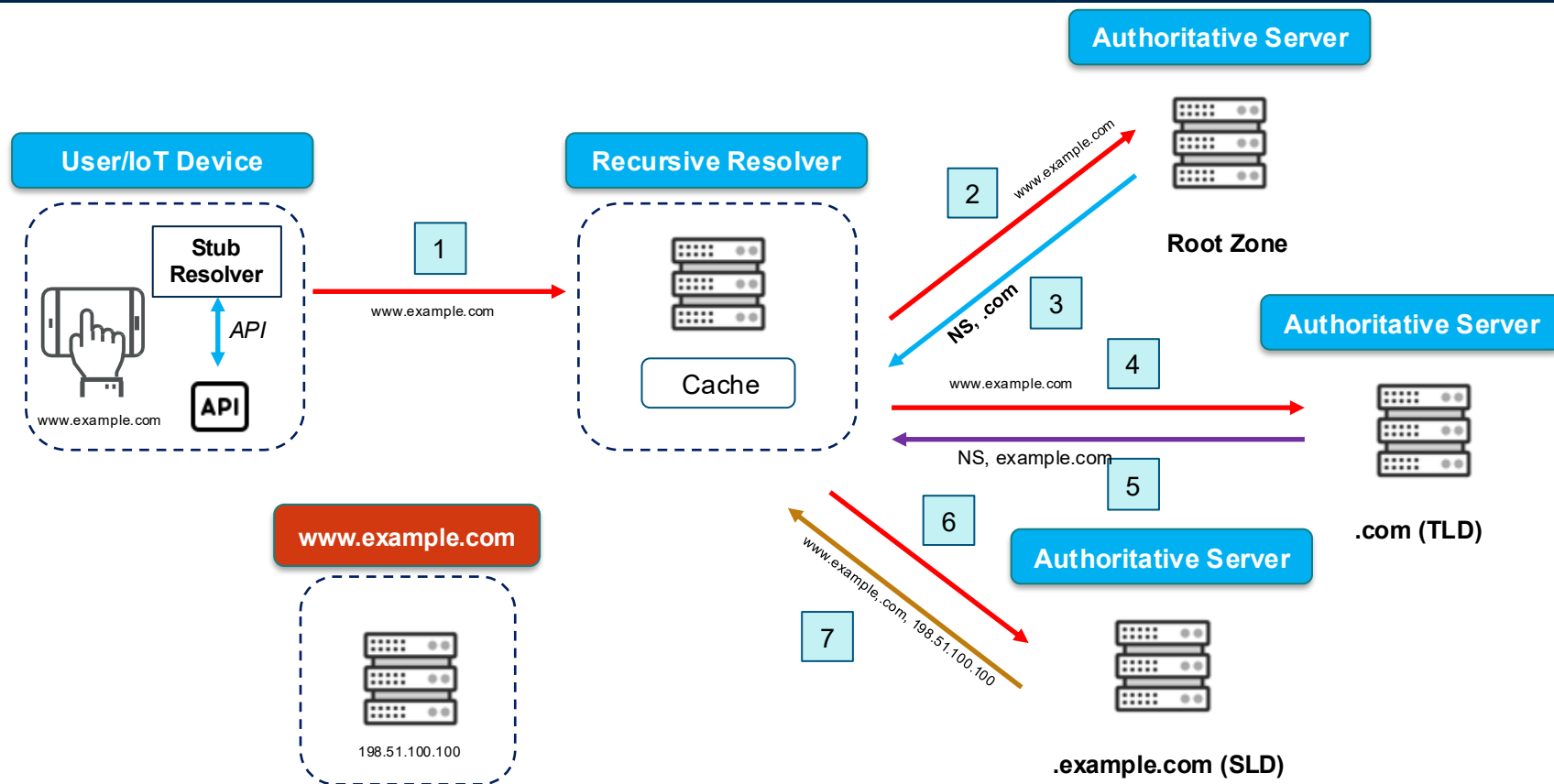
Resolution



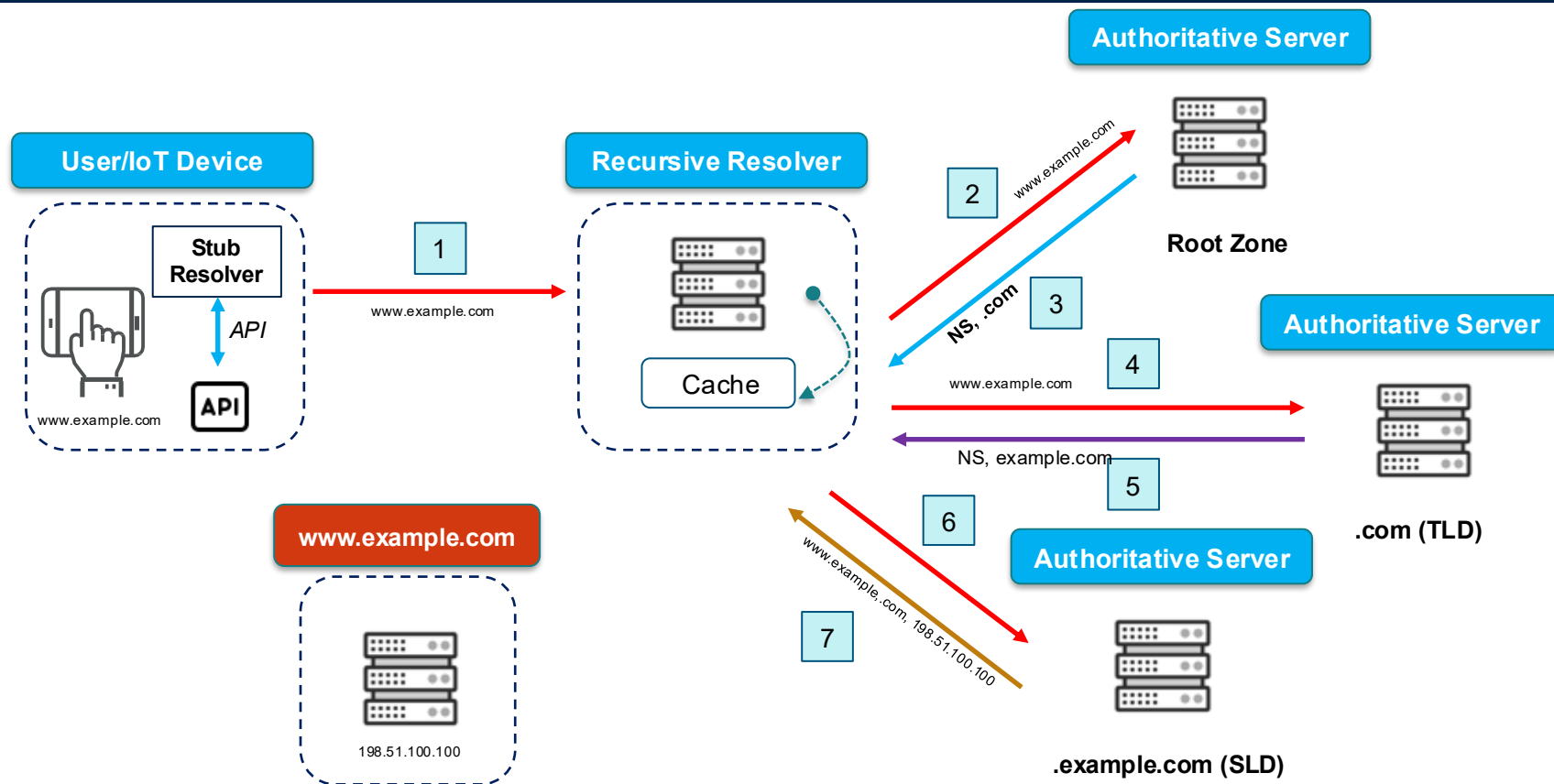
Resolution



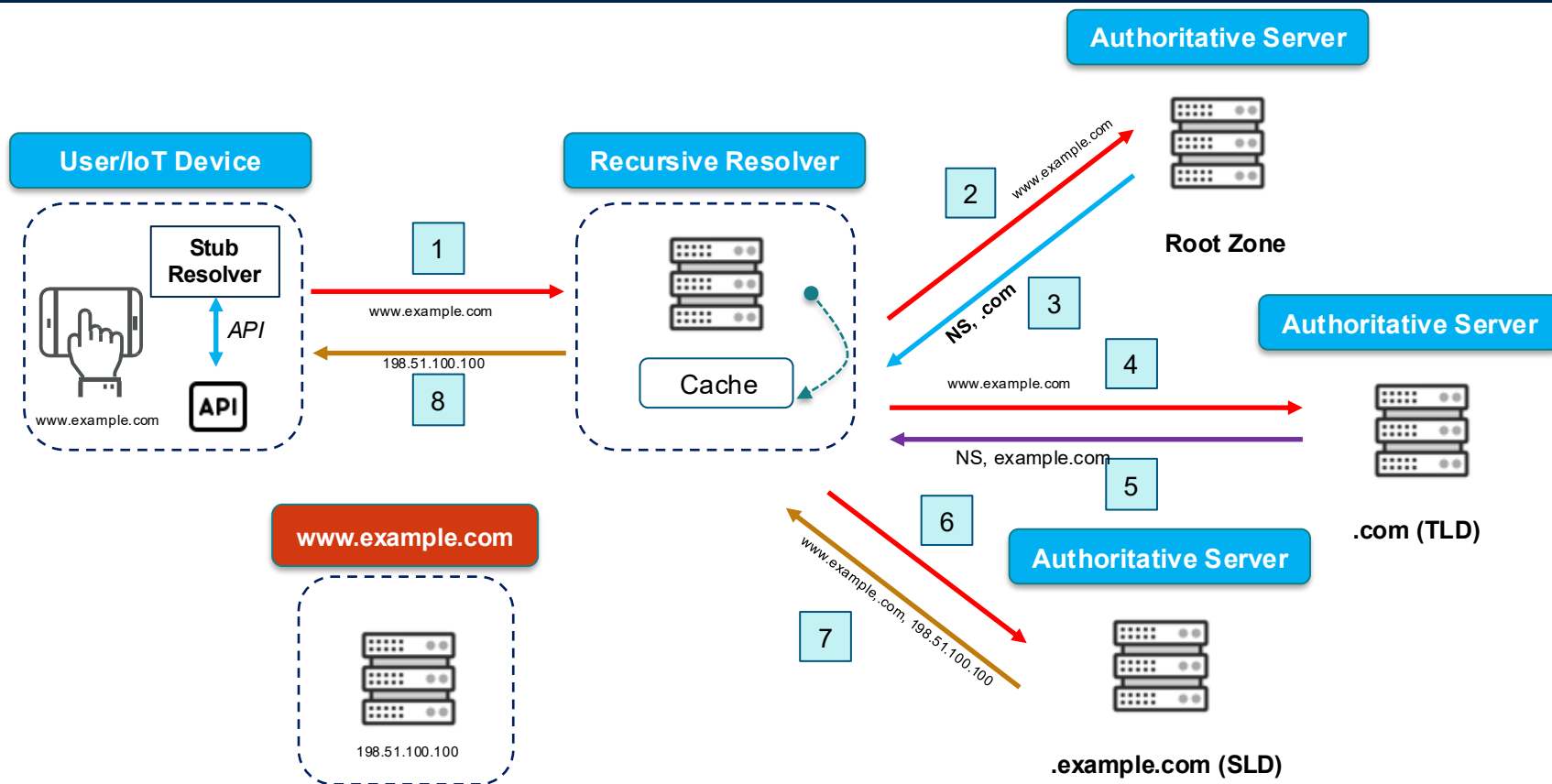
Resolution



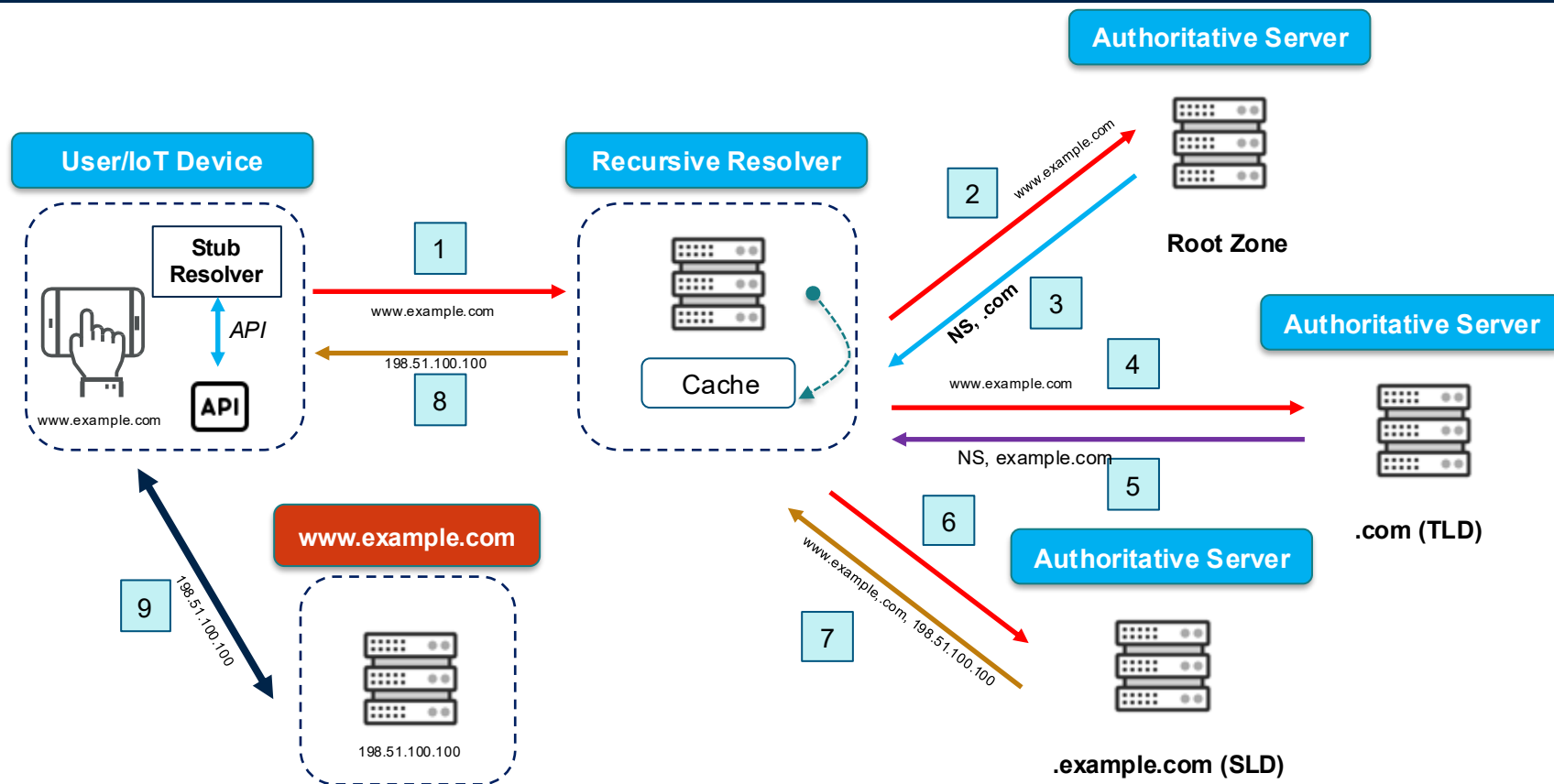
Resolution



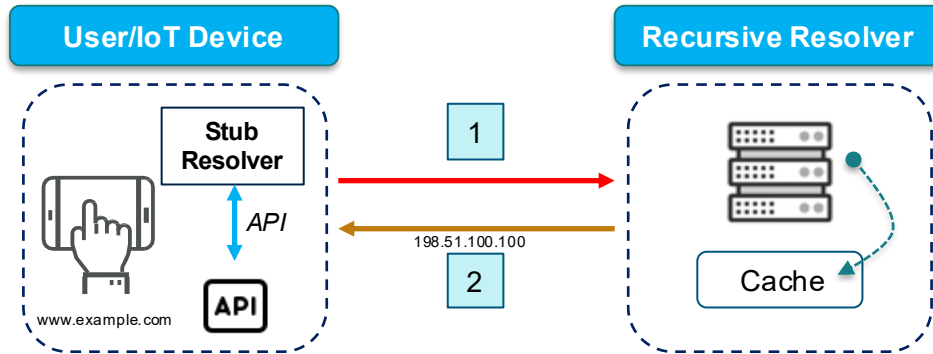
Resolution



Resolution

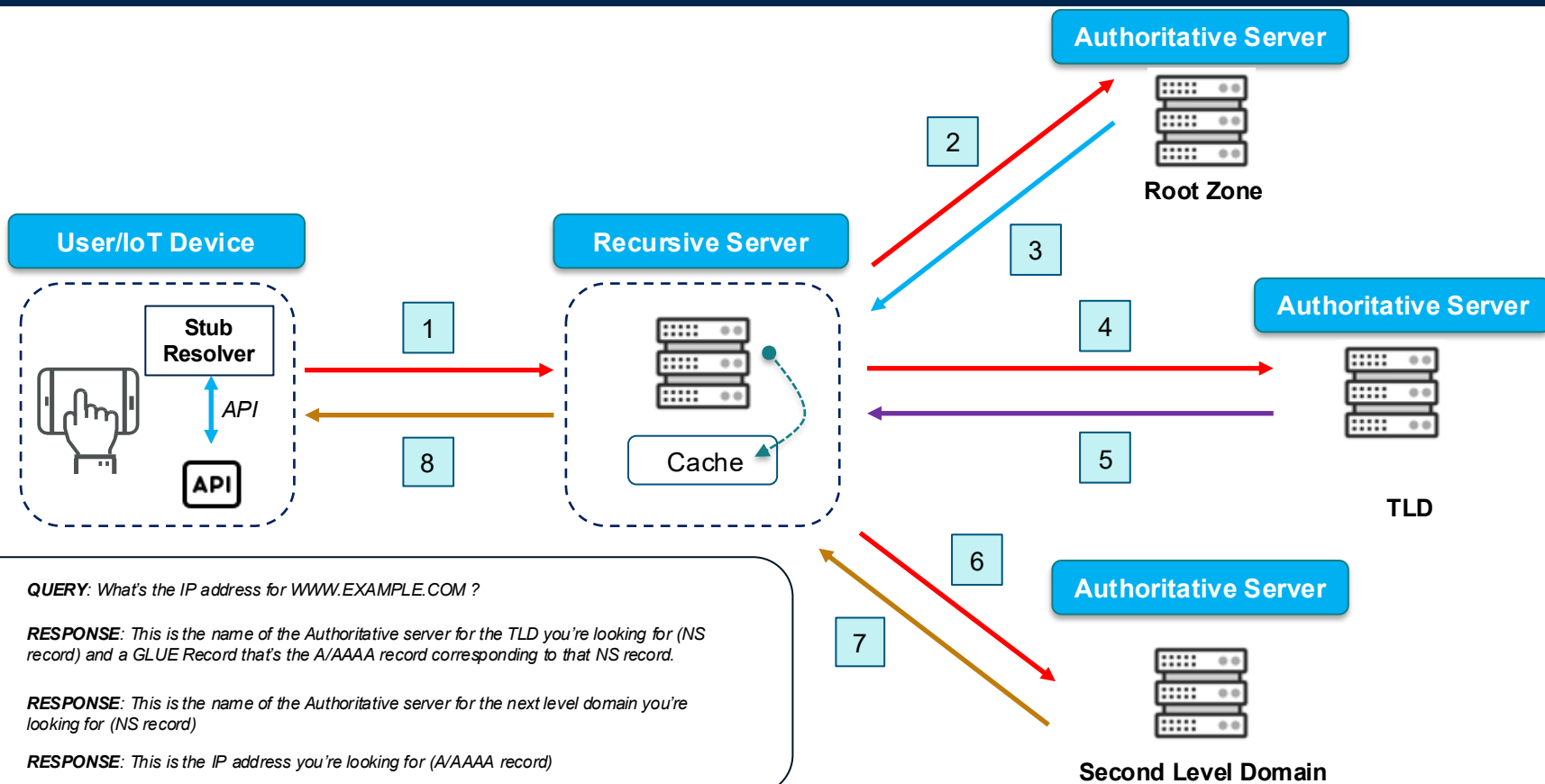


Caching



Next time someone using the same resolver ask the question, things are going to be different

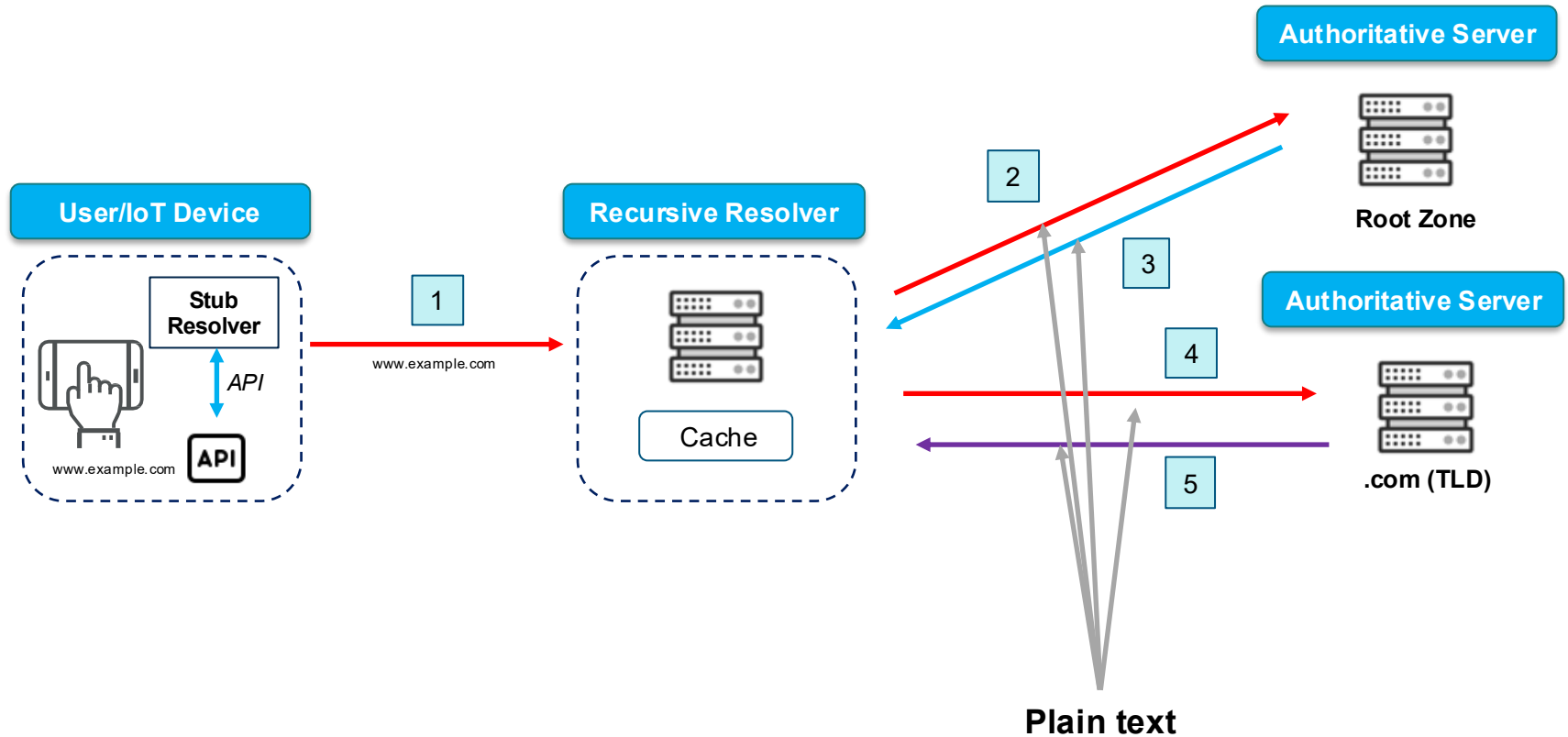
The Service



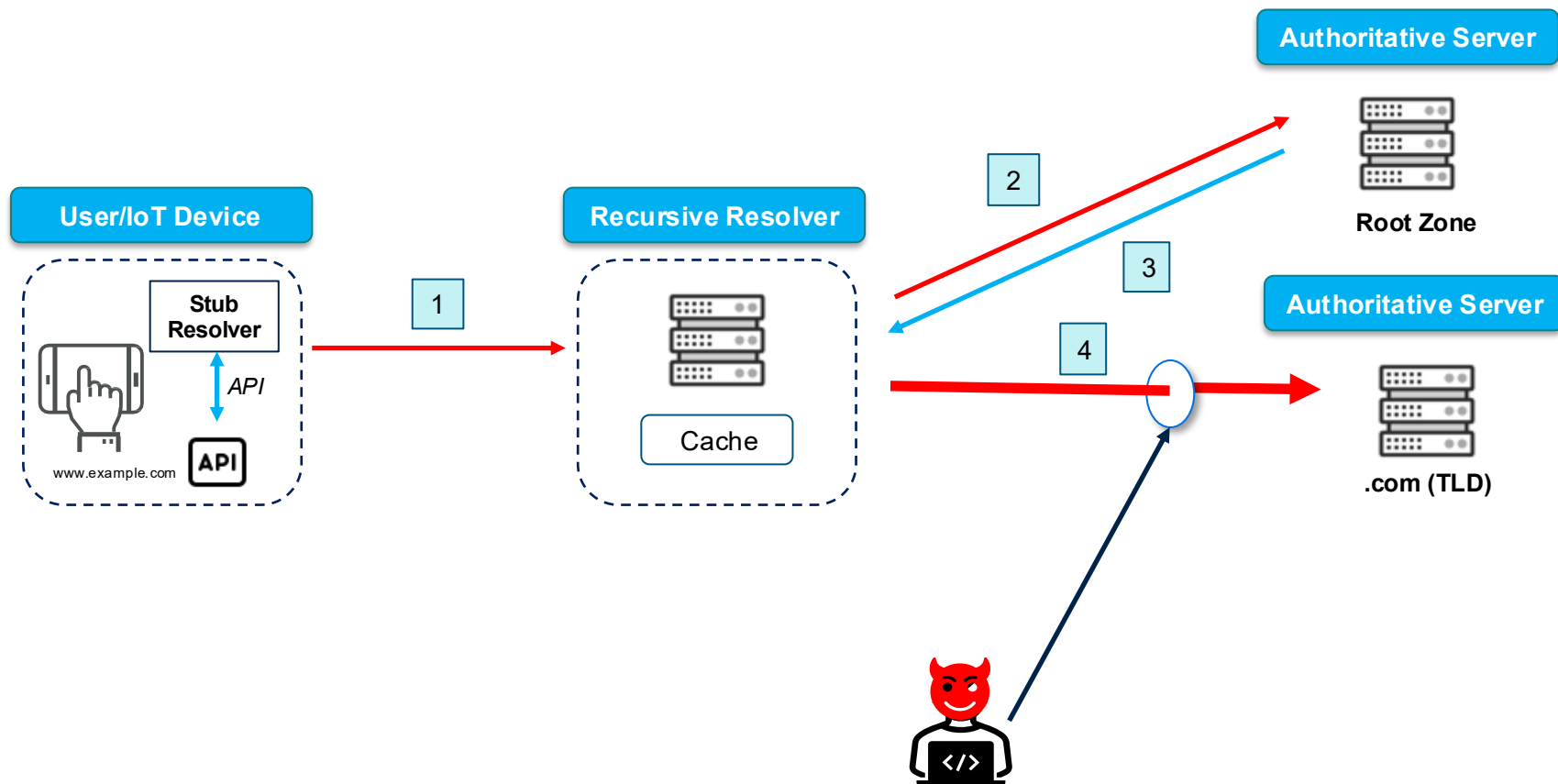
Is this all secure at all?

Well ... kind of ...

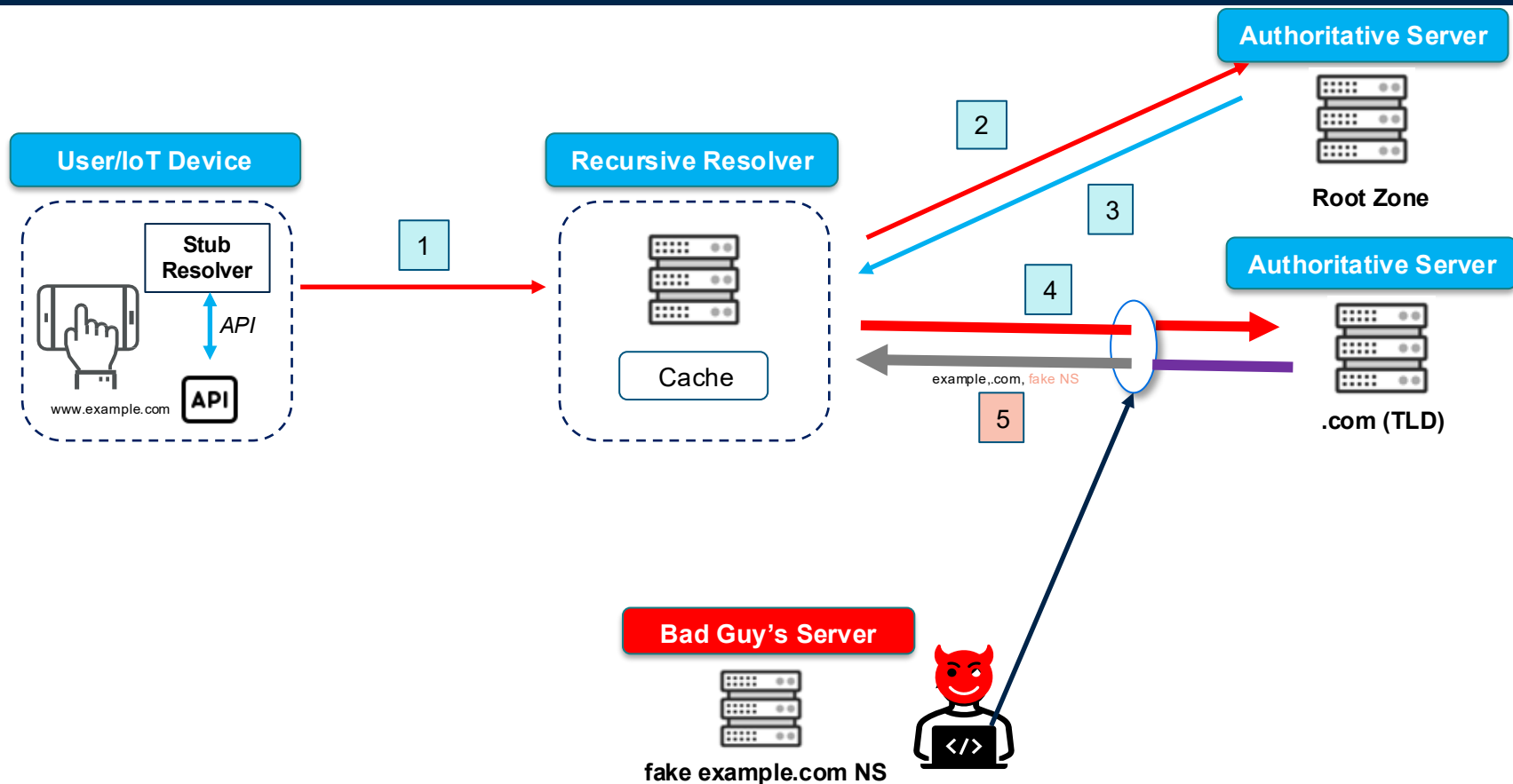
Problem



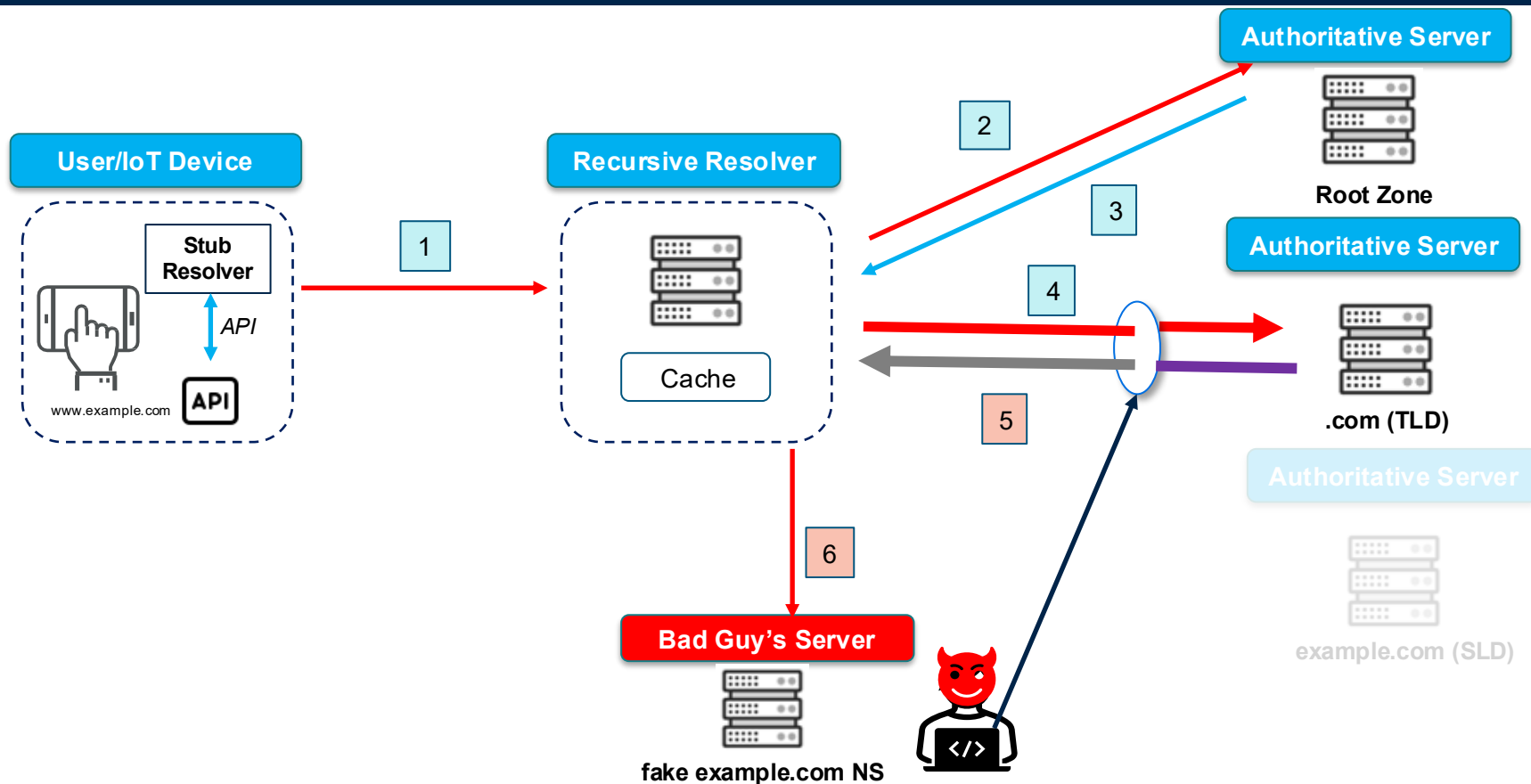
Weakness



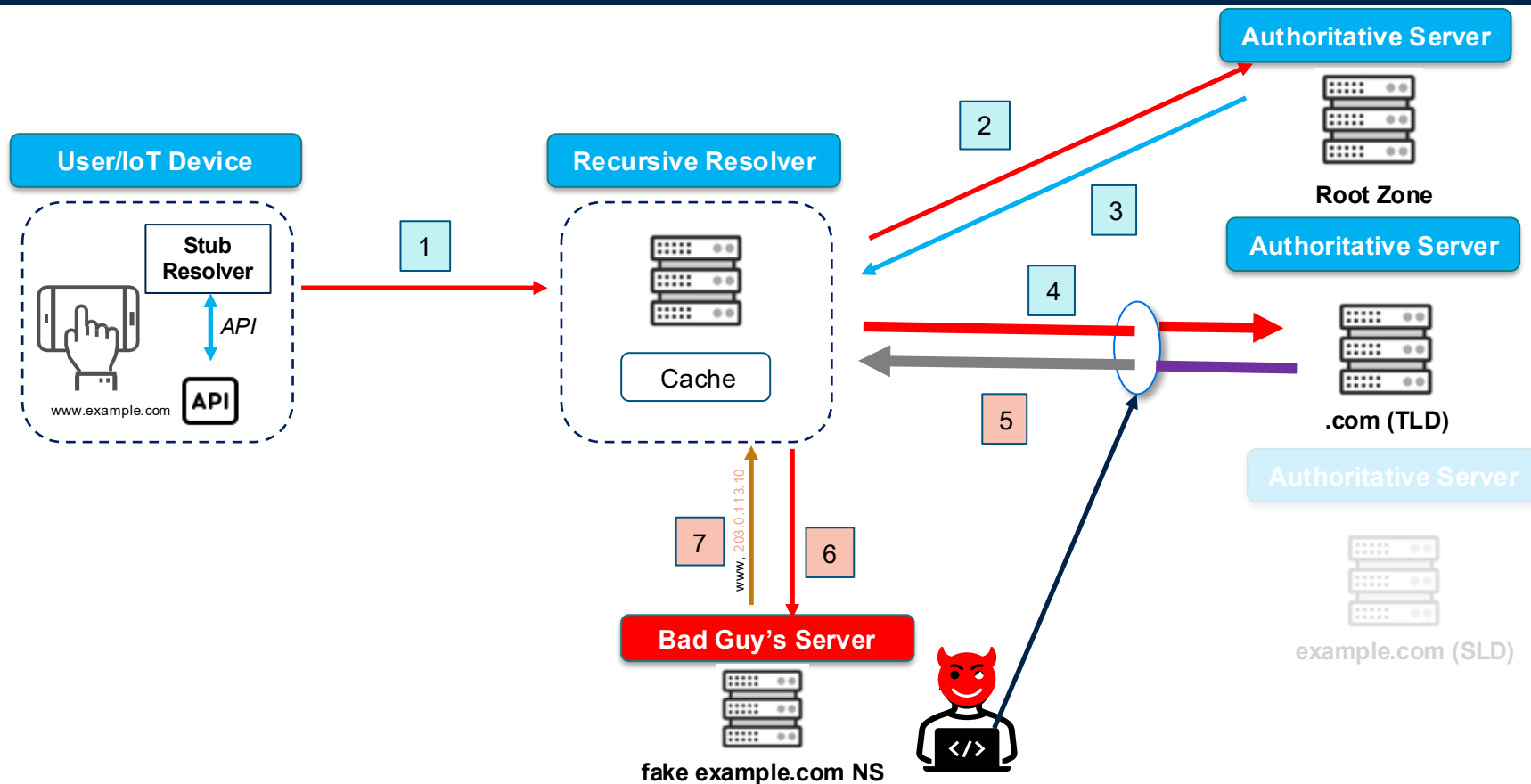
Weakness



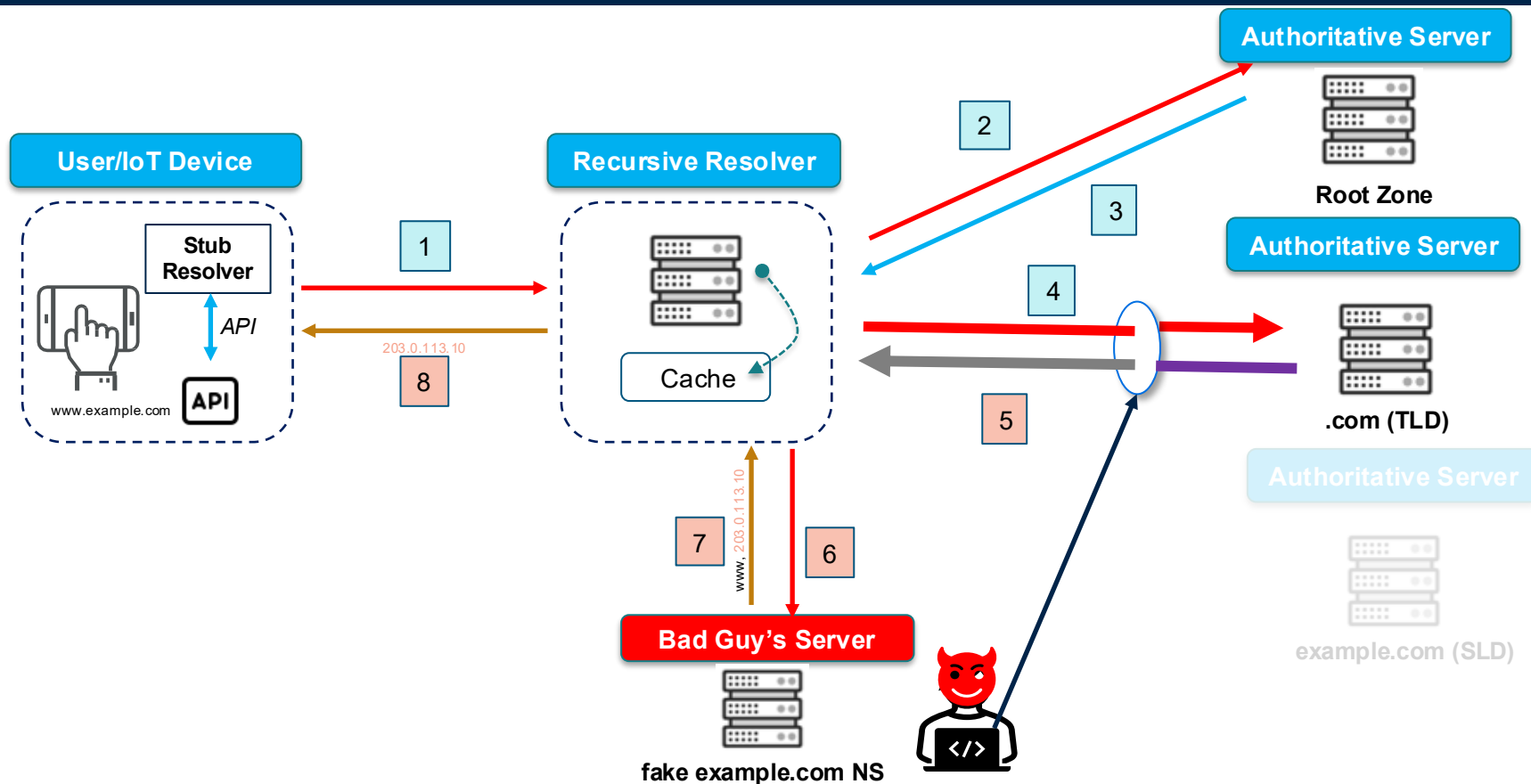
Weakness



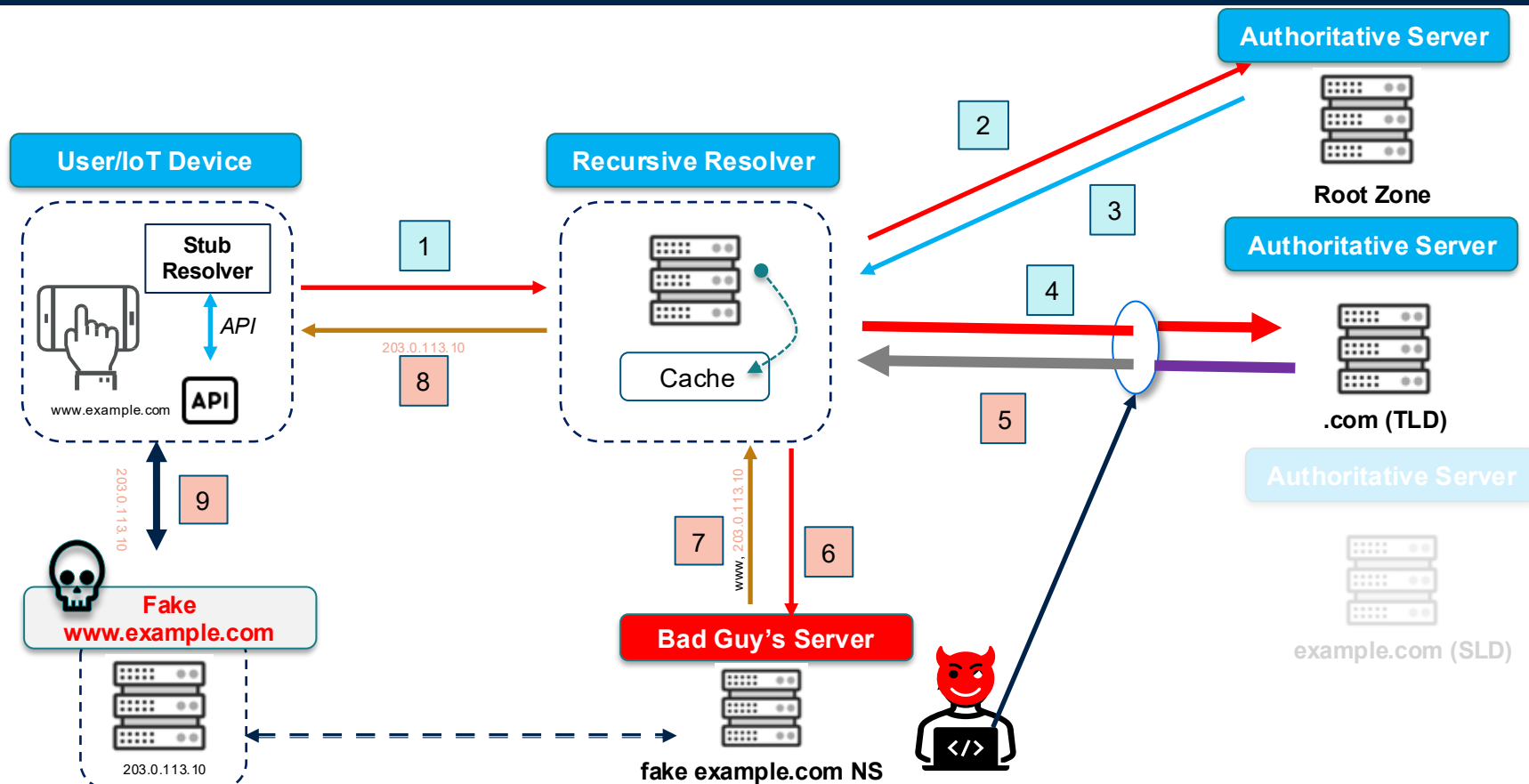
Weakness



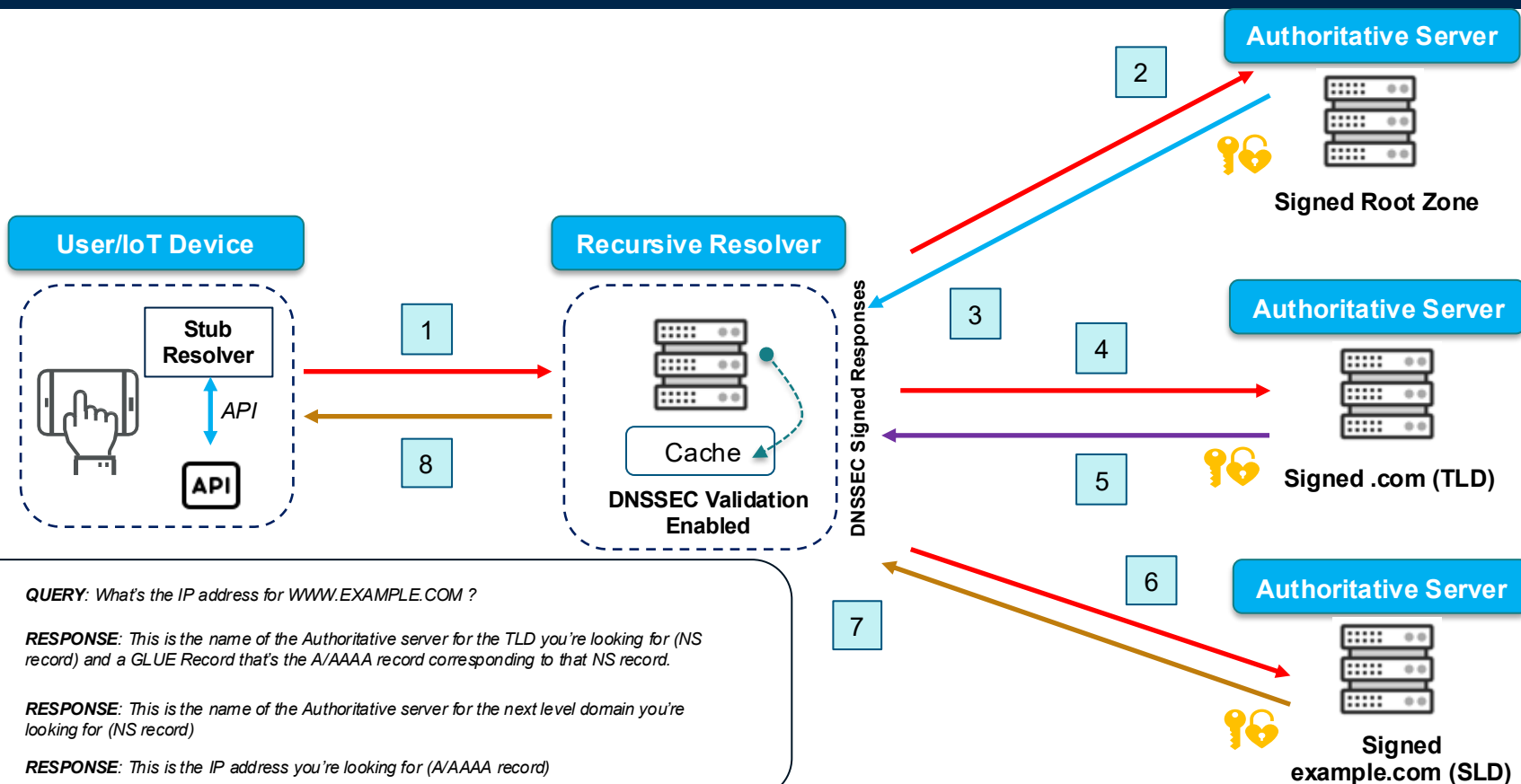
Weakness



Weakness

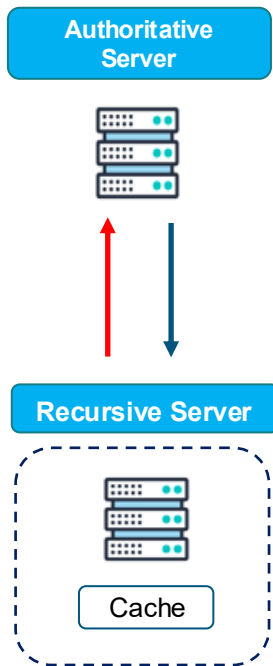


A detour to DNSSEC

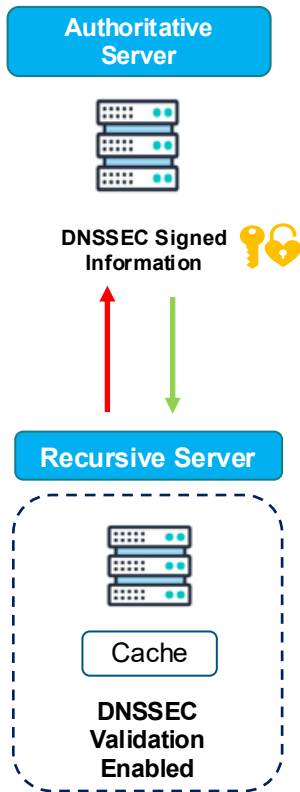


DNSSEC

Without DNSSEC



With DNSSEC



QUERY: What's the IP address for WWW.EXAMPLE.COM ?

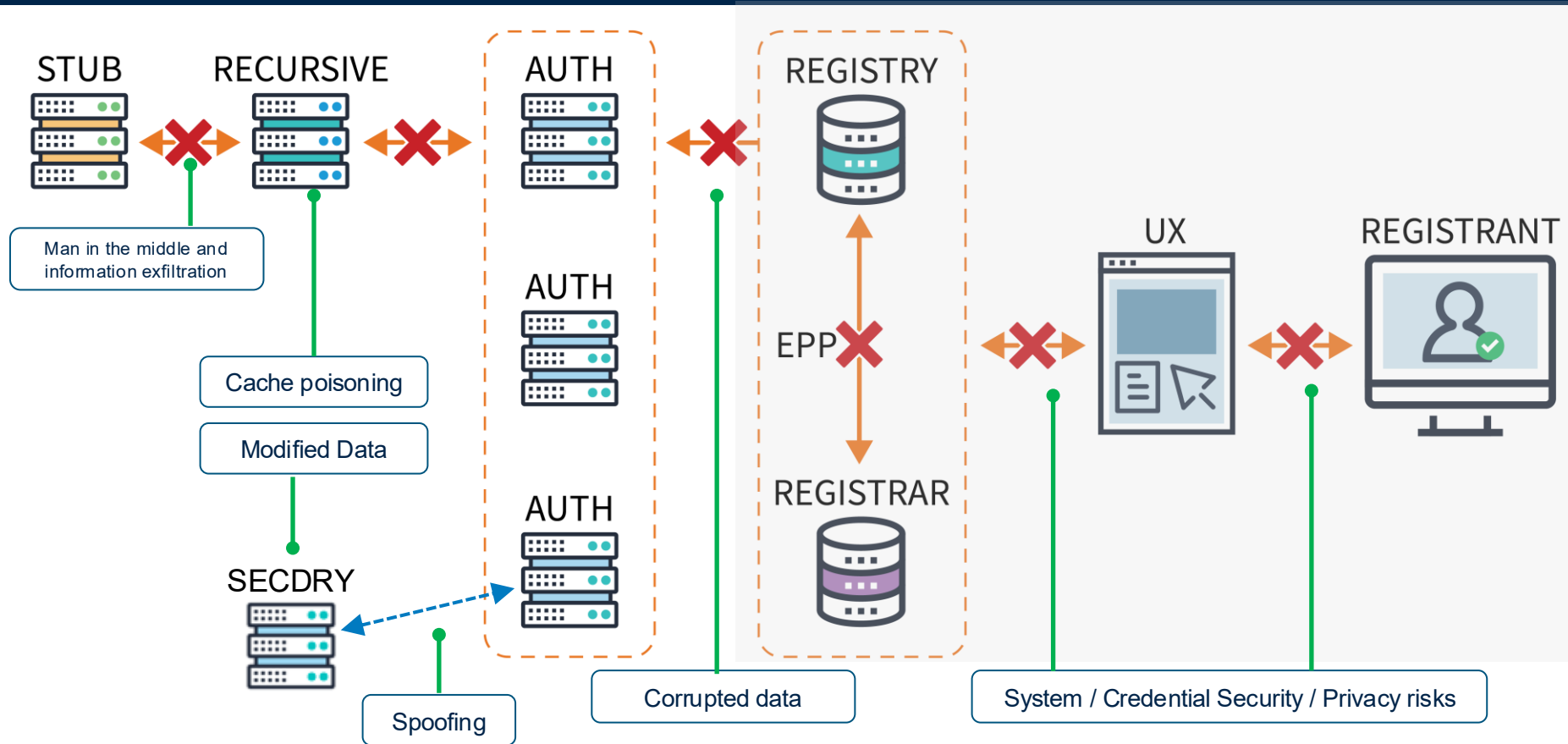


RESPONSE: The response is sent without any additional information.

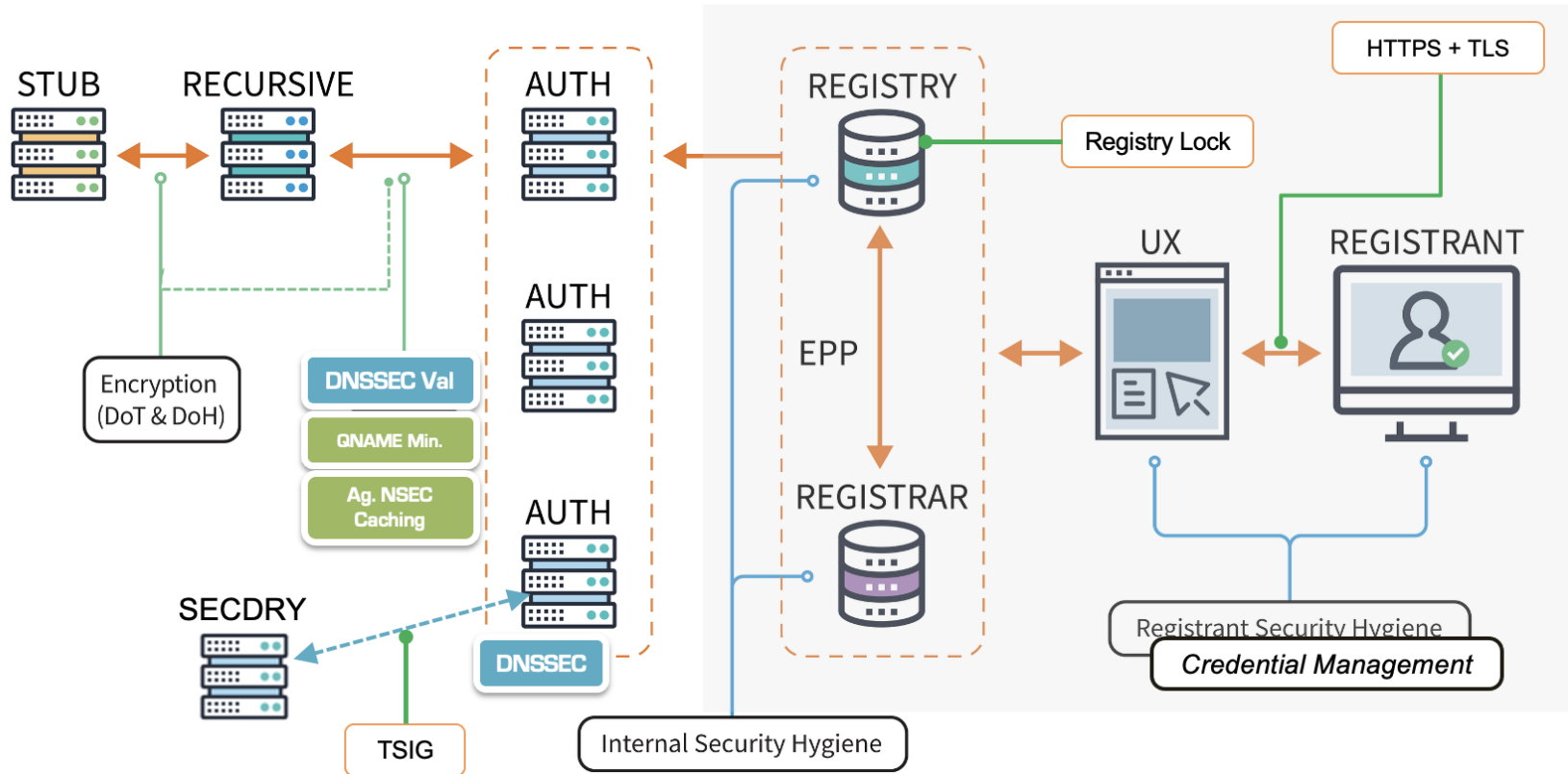


RESPONSE: The response is sent along with a digital signature of each record sent plus all the info needed for the Resolver to validate that signature.

Some other security challenges



Securing the DNS Ecosystem



ICANN Webpage and Social Media Links



icann.org



[@icann](https://twitter.com/icann)



facebook.com/icannorg



youtube.com/icannnews



flickr.com/icann



linkedin.com/company/icann



instagram.com/icannorg