It's Time To Lie
The DNS TTL Mismatch Problem

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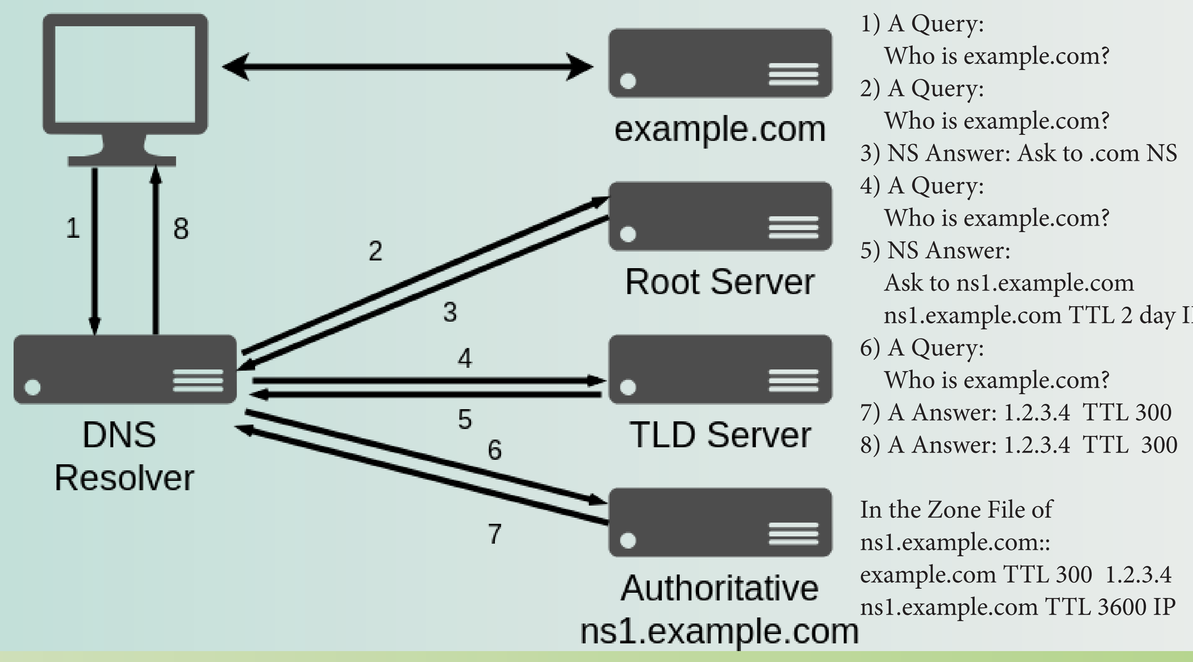
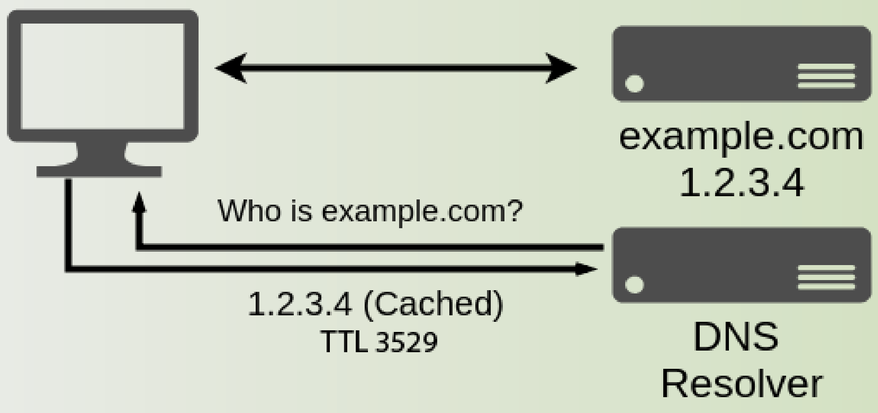
Introduction

The Domain Name System provides the fundamental service of translation of human-readable names into IP addresses.

- *Domain Name System is a hierarchical, decentralized and distributed database.*
- *Like every distributed database systems is important to keeps state of the information stored and served coherent.*
- *The information available in the DNS are supposed to be coherent through the whole hierarchy.* ***Is really always the case?***
- *DNS is managed by different entities:* ***Probably also from you?***





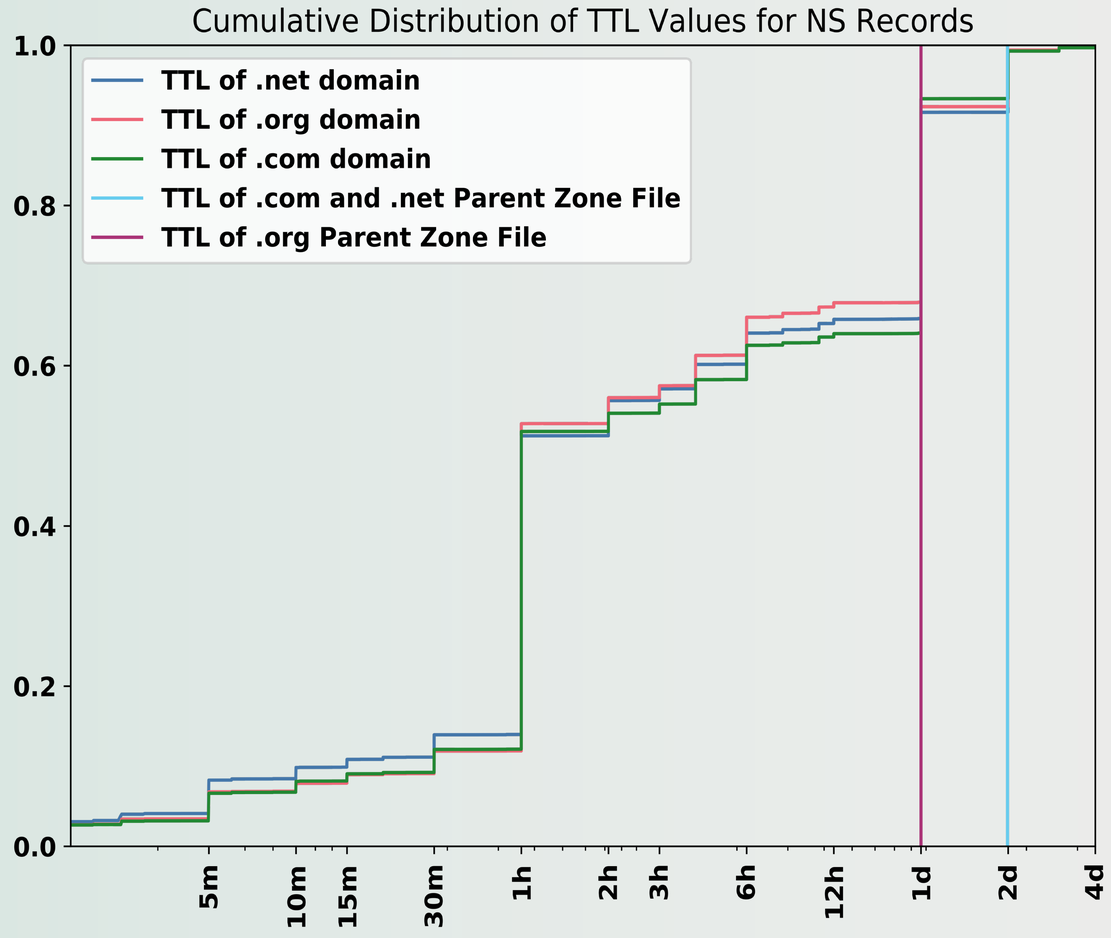
The Time To Live Field

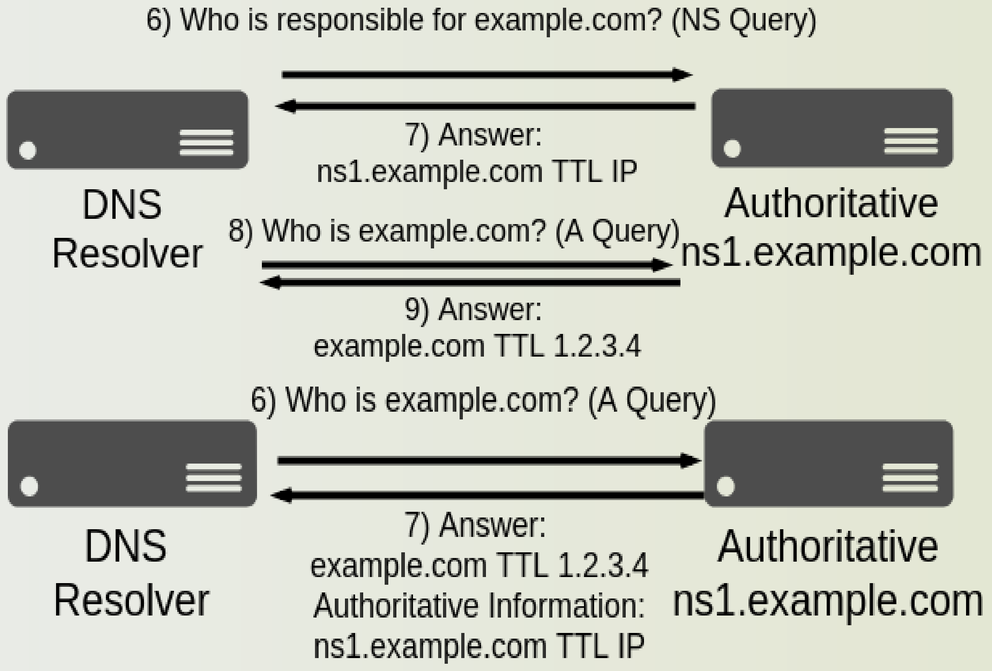
- *The NS records maintain information about the delegation of a domain. Each query results in a resolution against a chain of nameservers linked by NS records.*
- *The Time to Live field tells the recursive server or the local resolver how long the record should be kept in the cache.*
- *Higher TTL values make our system more resilient against DDoS Attack. A lack of availability of Authoritative Nameservers has a minor impact on resolvers that can use the data available in their cache.*
- *Higher TTL values also result in higher propagation time of DNS data changes.*

The Problem

- *There is a widespread mismatch in TTL values of NS (Nameserver) Records between parent and child zone!*
- *In our case of study, the parent zones are the Top Level Domain zones, while the child zones are the customer managed zones.*
- *The mismatch happens because TLD registers use a fixed value as TTL Value for NS records.*
- *RFC2181 (section 5.2 and 5.4) states that resolvers should use and cache only information from an authoritative source.*
- *In practice, the resolvers keep in their cache the TTL value of a not-authoritative source:* ***the TTL of the parent zone***

Resovers	BIND	KNOT	PDNS	UNBOUND	WINDOWS
Minimal Response	✗	✗	✗	✗	✗
Complete Response	!	✓	✓	✓	✓





Possible Countermeasures and Solutions

1. *~~Use the same TTL of the parent zone.~~ Unfeasible! -> No Flexibility*
2. *~~Update TTL of records in the parent zone with the same one of the child zone.~~ Unfeasible! -> Too much complexity*
3. *Make an explicit NS Query (Some software still keep in the cache the information obtained with the old query).*
4. *Disable Response Minimization (The answer to A query will contain also the Authoritative Section with Authoritative Nameserver Information).*
5. *Mix approach 3 and 4 and patch misbehaving software.*

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DACS Design and Analysis of Communication Systems
NWO Netherlands Organisation for Scientific Research
U.S. Department of Homeland Security