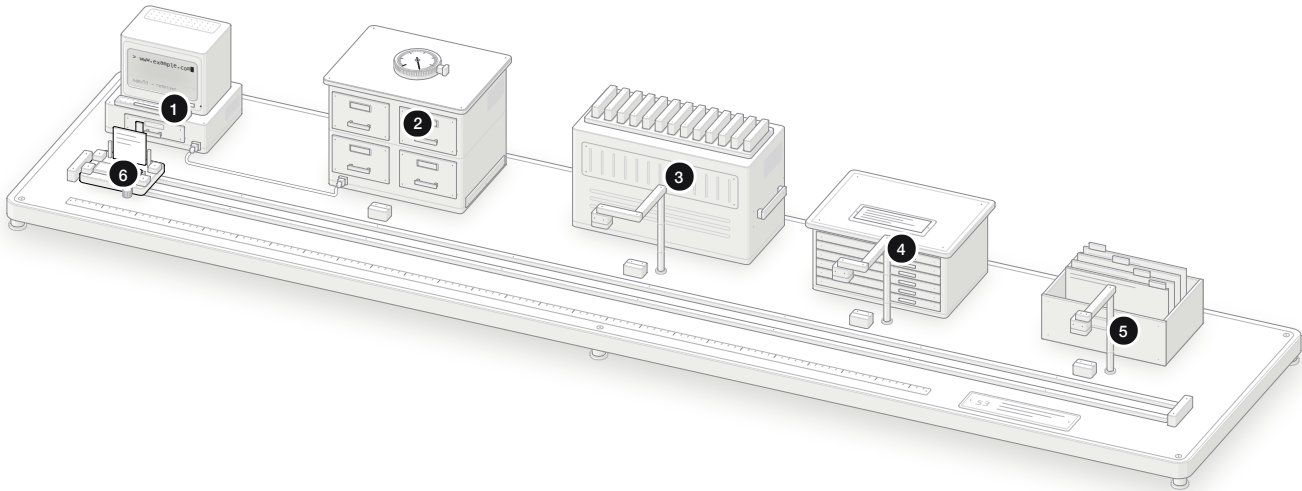


DNS lookup

AN-DNS
HOW IT WORKS
WWW.EXAMPLE.COM, STEP BY STEP



How does your computer find the address for a name?

141 ms
FIRST LOOKUP, COLD CACHE

8 hops
NETWORK MESSAGES, COLD

172800 s
DELEGATION TTL (2 DAYS)

21 ms
SAME NAME AGAIN, FROM CACHE

13
ROOT SERVER IDENTITIES, A-M

Why so many servers?

No single server knows every name. The root knows only who runs each top-level domain, .com knows only who runs each domain, and the domain's own server holds its records. Caching at the resolver means most lookups skip all three.

It asks one recursive resolver. On a cache miss the resolver asks a root server, then the .com server, then the domain's authoritative server, each pointing it one level closer. It caches every answer for its TTL, so the next lookup never leaves the resolver.

STEP BY STEP

- 01 Ask a root server**
On a cache miss the resolver asks a.root-servers.net. The root does not know the answer; it refers the resolver to the .com servers, with their addresses as glue.
- 02 Ask the .com server**
a.gtld-servers.net refers the resolver on to ns1.example.com, the name server example.com delegated to, again with glue.
- 03 Authoritative answer**
ns1.example.com holds the zone and answers www.example.com A 203.0.113.10 with the AA flag set.
- 04 Cache every record**
The resolver files each record for its own TTL: two days for the delegations, one hour for the answer.
- 05 Answer returned**
The resolver replies to your computer with RA=1, and the browser connects to 203.0.113.10. Cold, it took about 141 ms.
- 06 Next time: cache hit**
Ten minutes later another lookup is answered straight from the resolver's cache, TTL now 3000 s, in about 21 ms.

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|---|--|--|
| 01 Your computer
Checks the browser and OS cache, then sends one recursive query (RD=1). | 03 Root server
13 identities a-m on many anycast instances; refers the resolver to .com. | 05 Authoritative server
Holds the example.com zone; answers with AA=1. |
| 02 Recursive resolver
Does the legwork; its drawers are the cache and the dial counts down TTL. | 04 .com TLD server
Run by Verisign; refers the resolver to example.com's name server, with glue. | 06 Query shuttle
Carries the question; referral and answer tags ride back on it. |