# Saving the Internet from doom (DNSSEC and IPv6)

Sofia, Bulgaria
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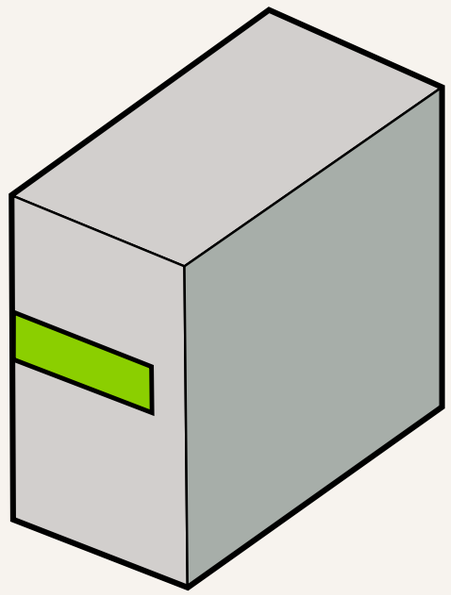
Internet Corporation for
Assigned Names & Numbers

# Agenda

- How do you attack the DNS?
- How does DNSSEC help this?
- Work IANA is doing on DNSSEC
- IPv6 and TLDs

# How do you attack the DNS?



# A typical DNS query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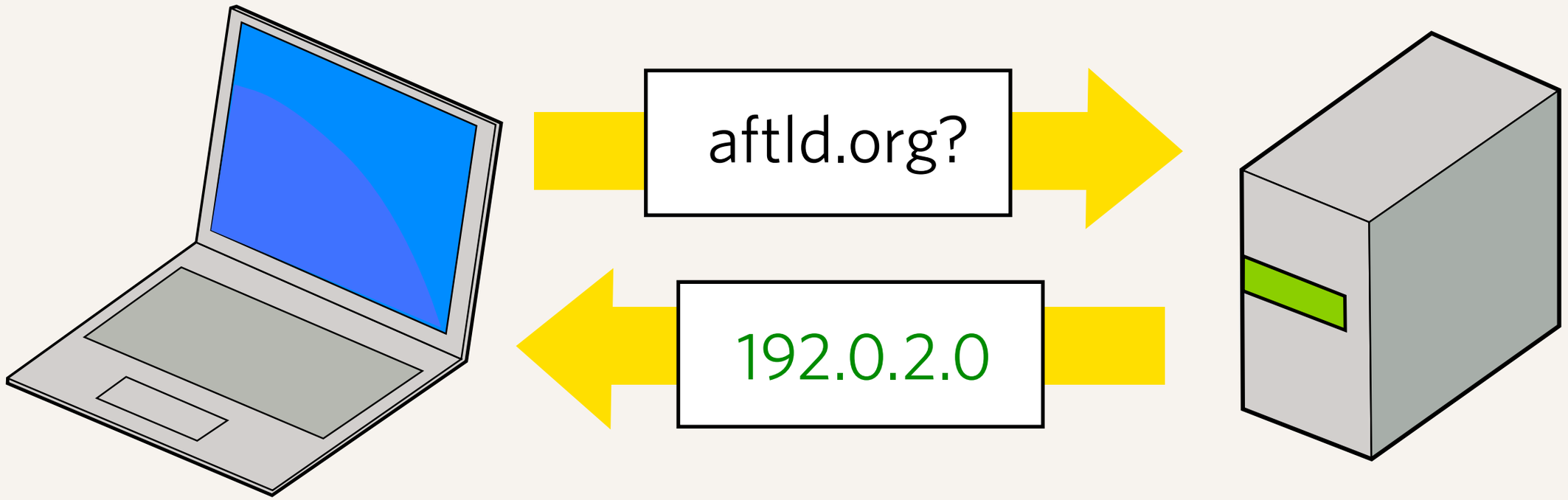
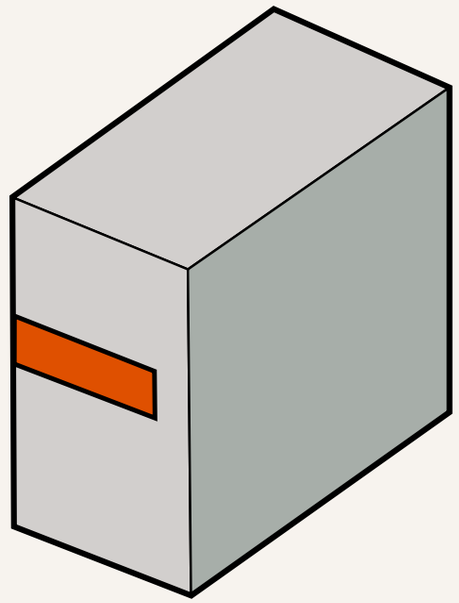



# A typical DNS query

# The DNS is not secure

- A computer sends a “question” to a DNS server, asking a question like “What is the IP address for aftld.org?”
- The computer gets an answer, and completely trusts that it is correct.
- There are multiple ways that traffic on the Internet can be intercepted and rerouted, or impersonated, so that the answer given is false.



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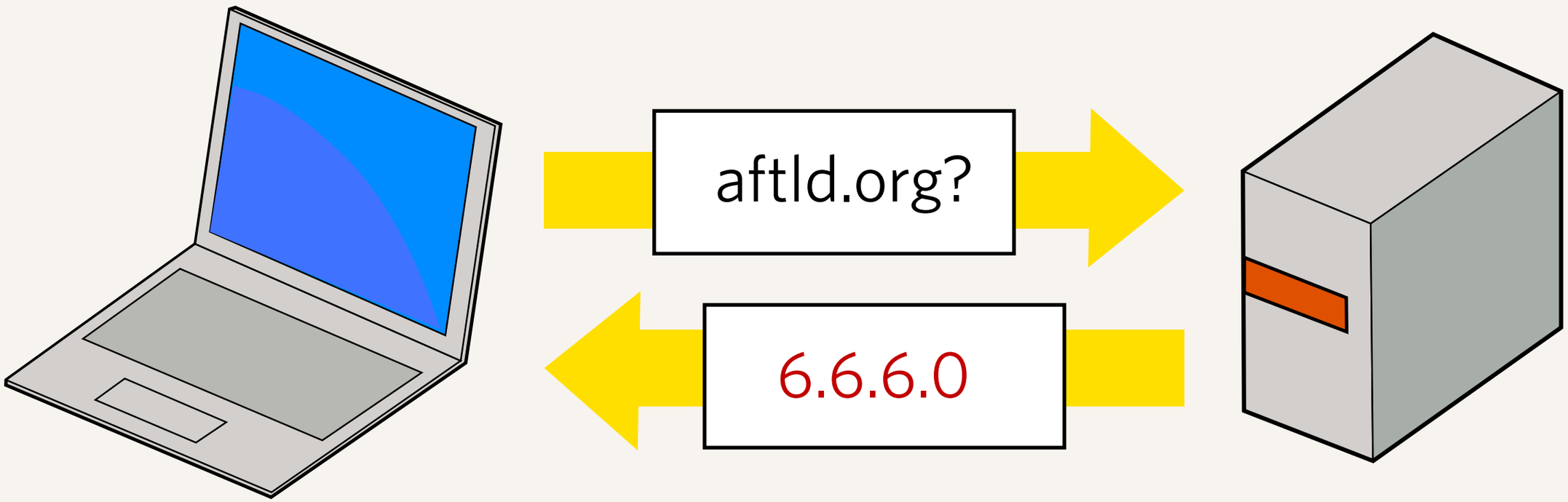


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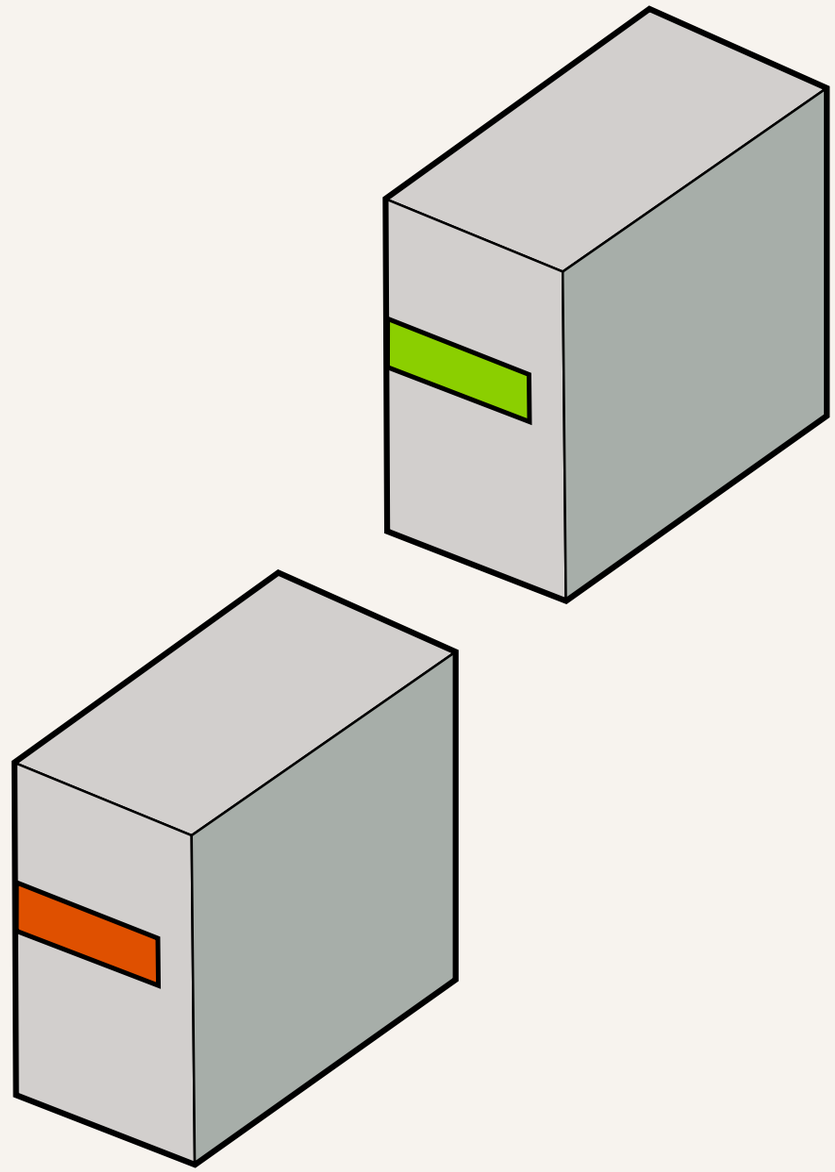

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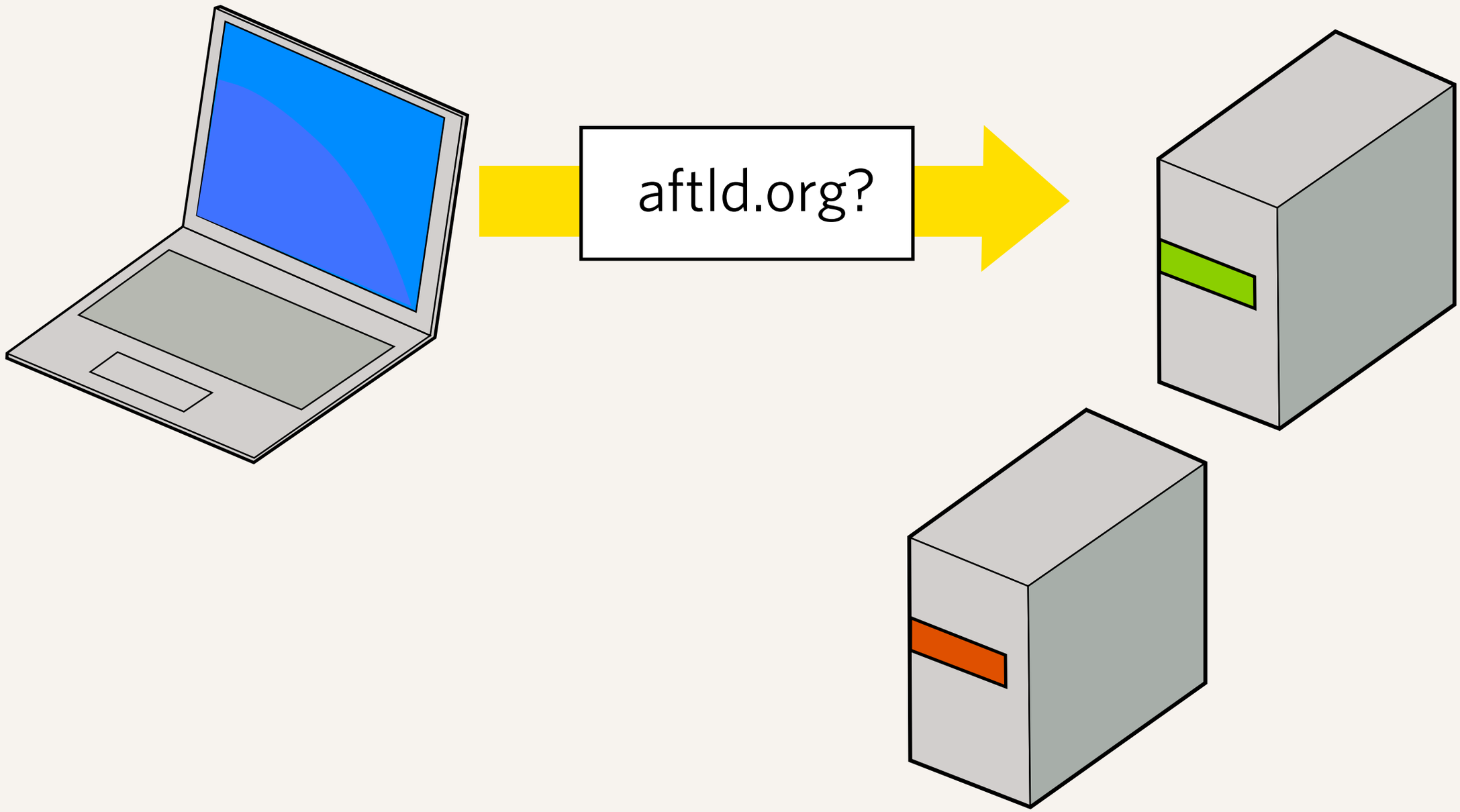
- A server on the network responds with the wrong answer, quicker than the correct server can give the right answer.

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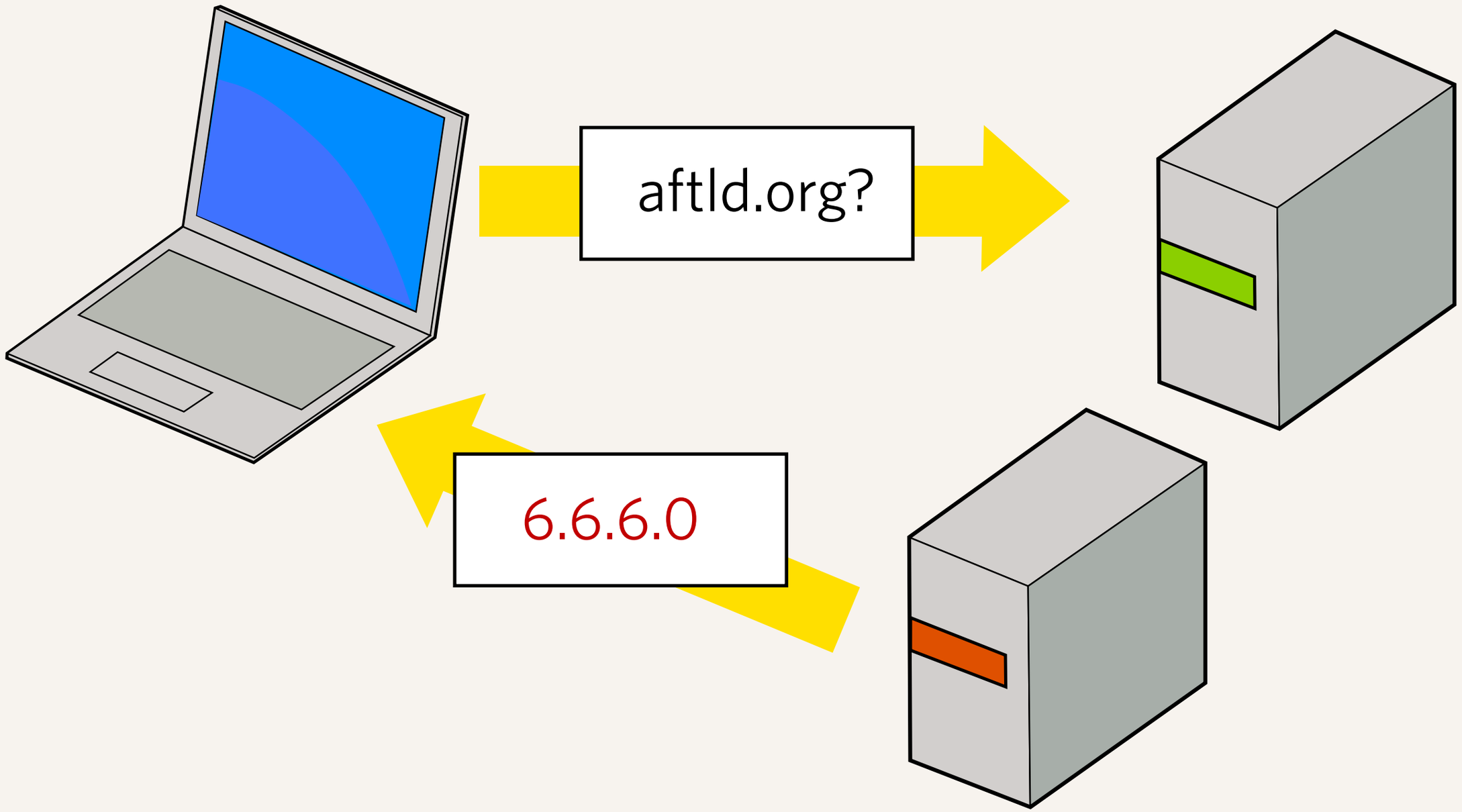


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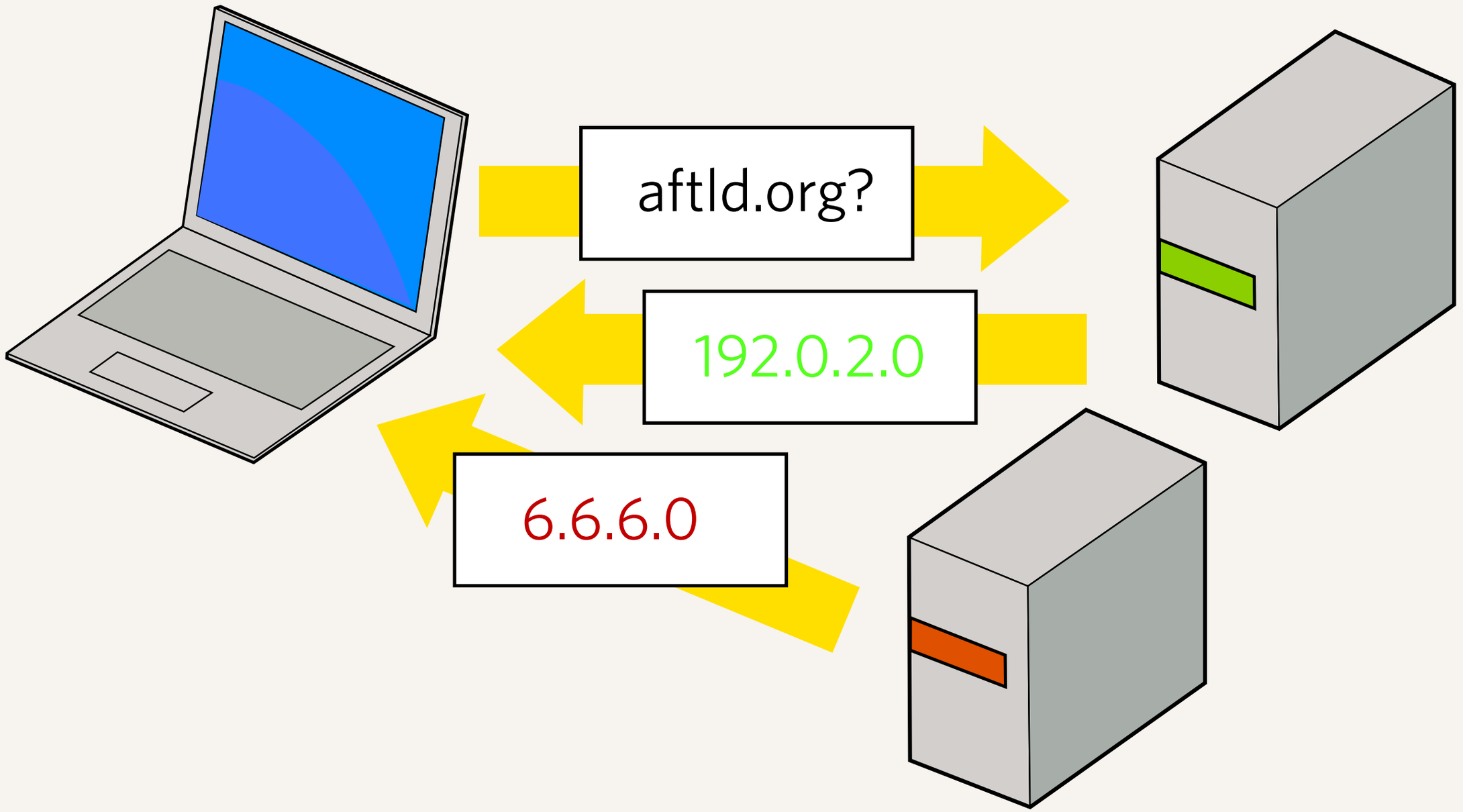


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# Cache poisoning

- If the answers are stored in a cache, the wrong answer gets remembered and served to future lookups.
  - This is the typical configuration at ISPs, etc.
  - One successful cache poisoning attack with therefore affect many users.

# Cross pollination

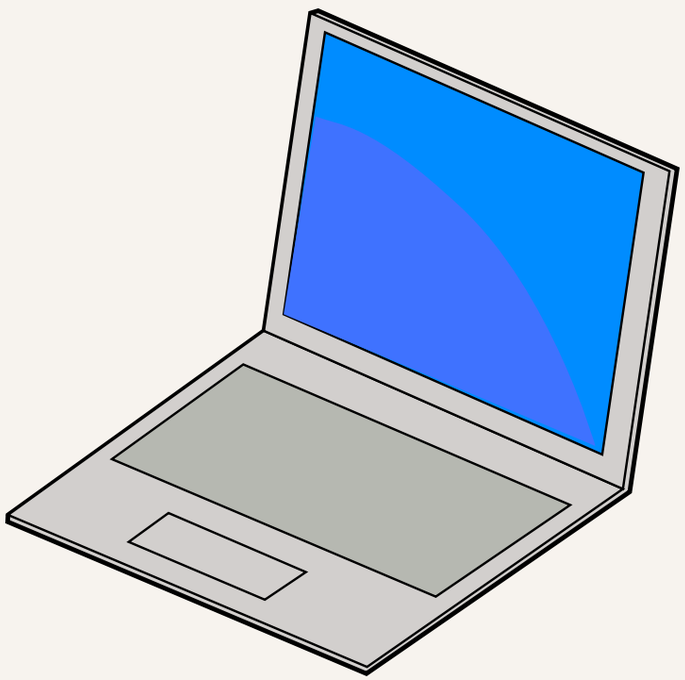
- If the cache is also authoritative for a domain, it can also give the wrong answers for answers within that domain.

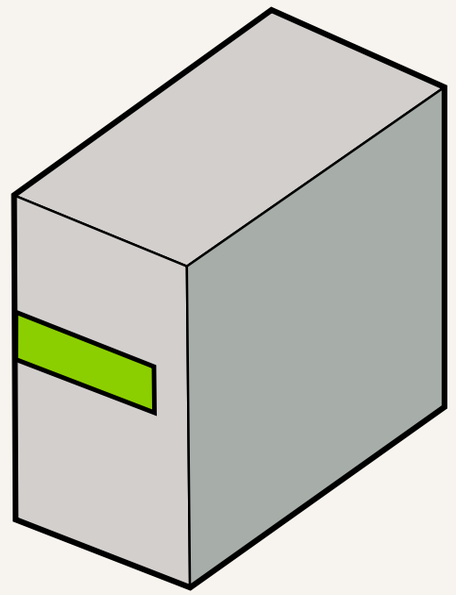
# What do I do?

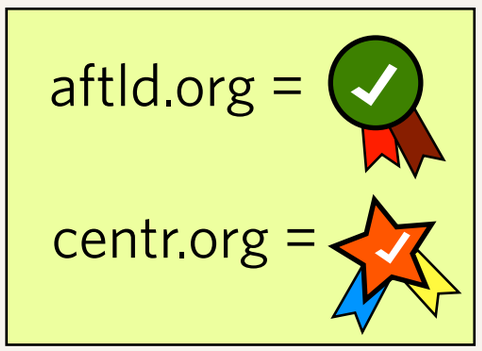
- Short term
  - Do not offer open recursive name servers
  - Definitely do not offer open recursive name servers that are also authorities at the same time
    - Patch recursive name servers for maximum entropy (source port randomisation, etc.)
    - http://recursive.iana.org/
- Longer term
  - Introduce security to the DNS…

# What DNSSEC provides

- DNSSEC provides proof that the data has not been modified in transit from the DNS zone publisher (the registry) to the end-user
- It does this by providing additional information, something like a “seal of origin”, that can be verified as being correct or not.

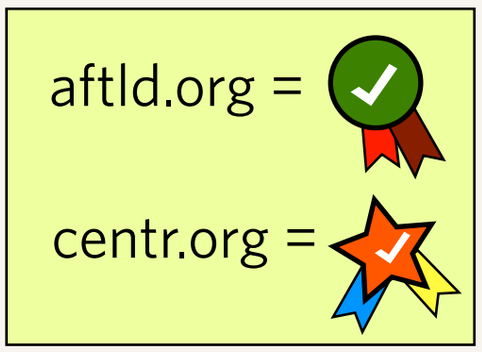







# A DNSSEC secured transaction

- Check against a known set of signatures, and if there is a match, is a valid answer.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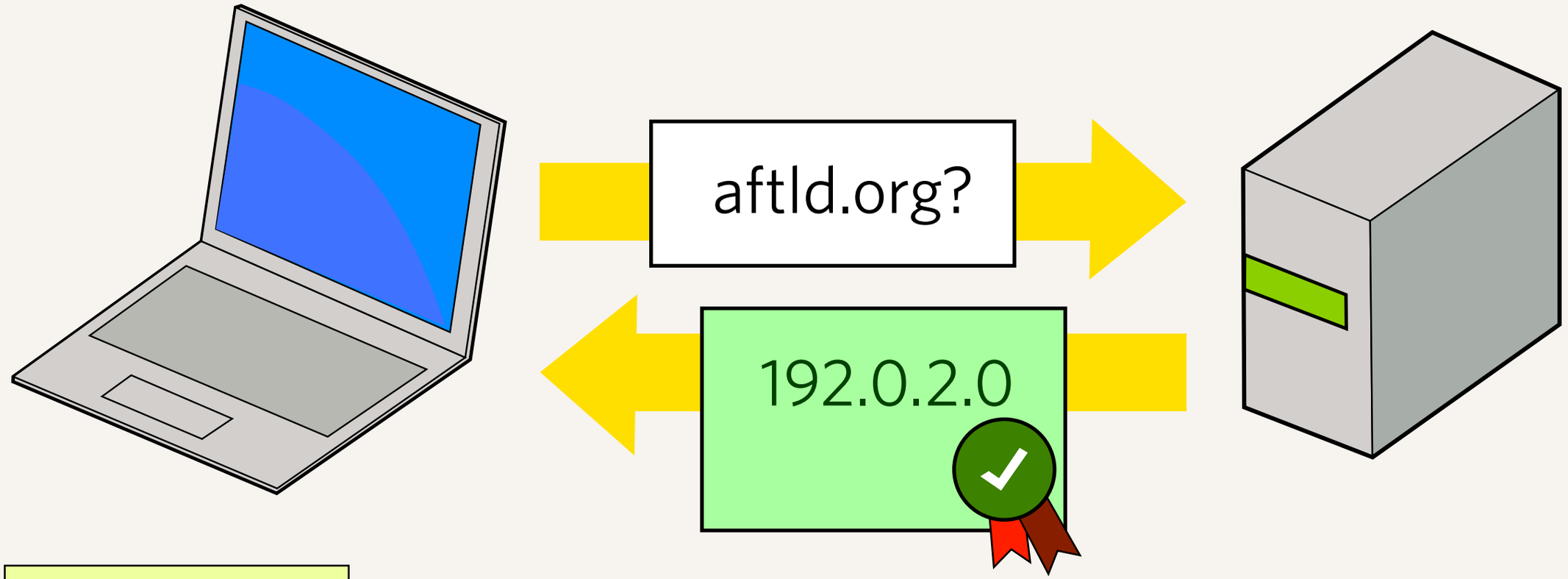


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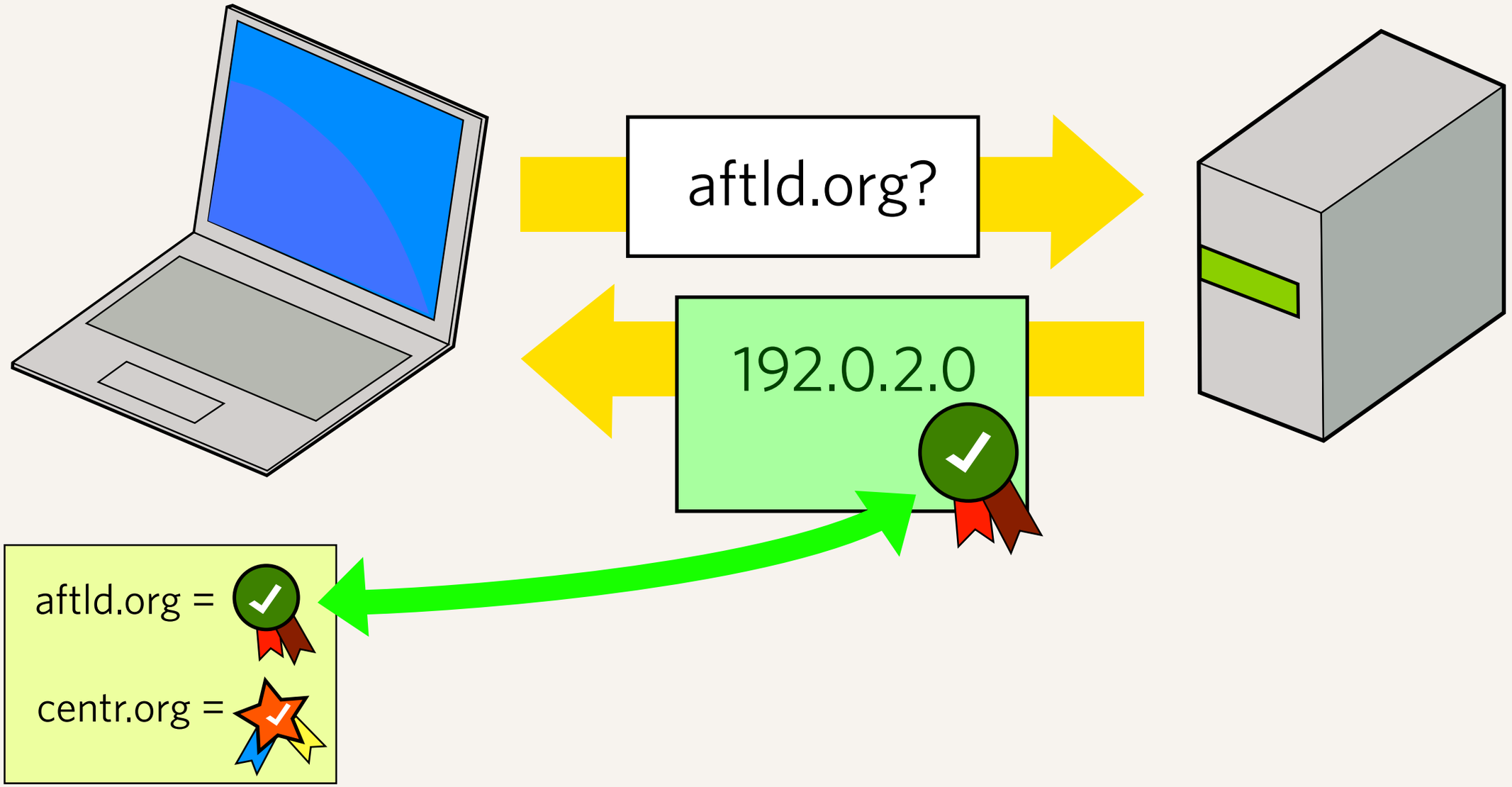


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# Maintaining a list of signatures for every domain does not scale

- How could every computer maintain a list of every certificate for every domain it needs to verify?
- There needs to be a better way...

aftld.org =

centr.org =

iana.org?

192.0.2.0

# Using a chain of trusted certificates

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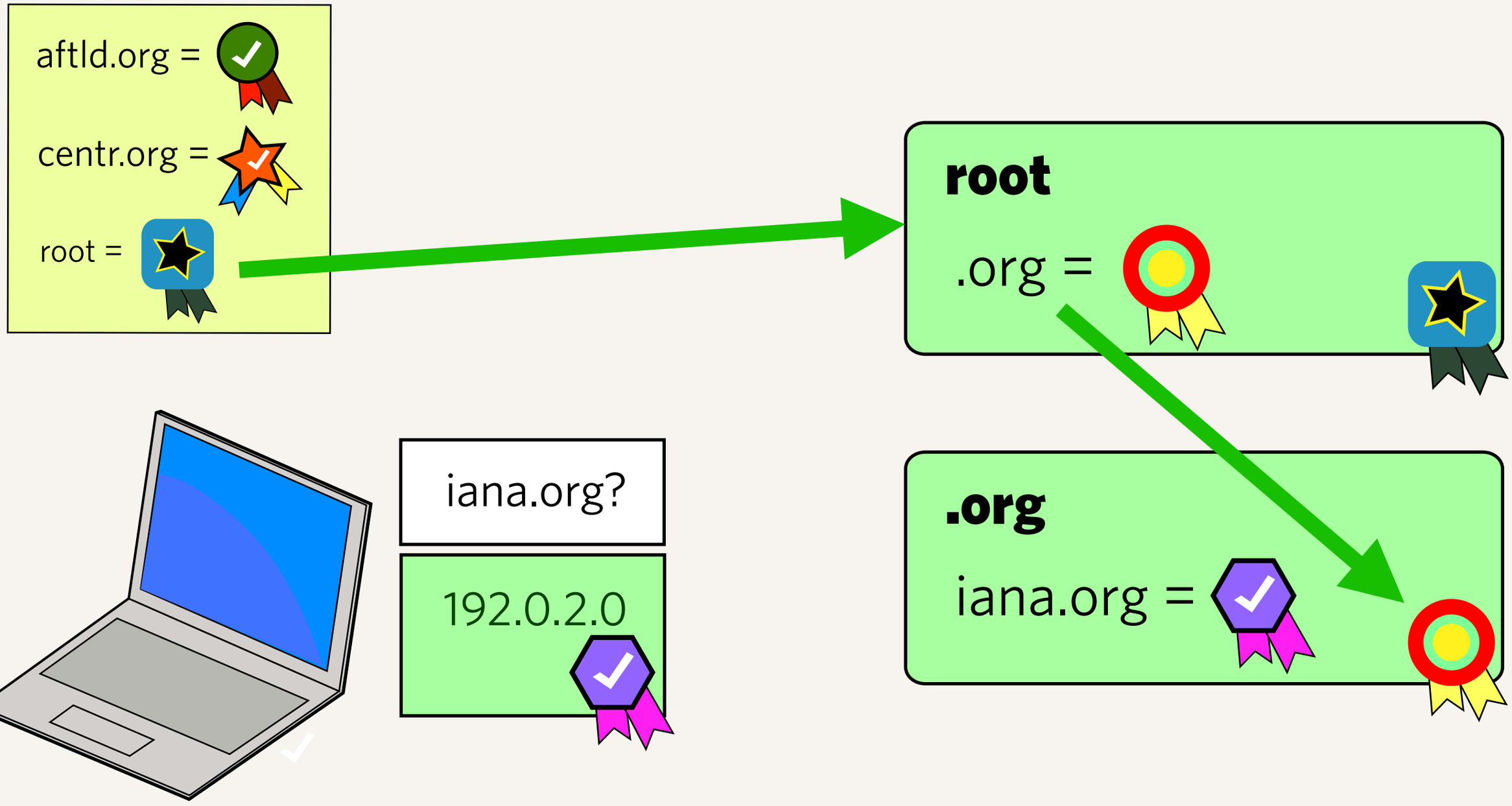


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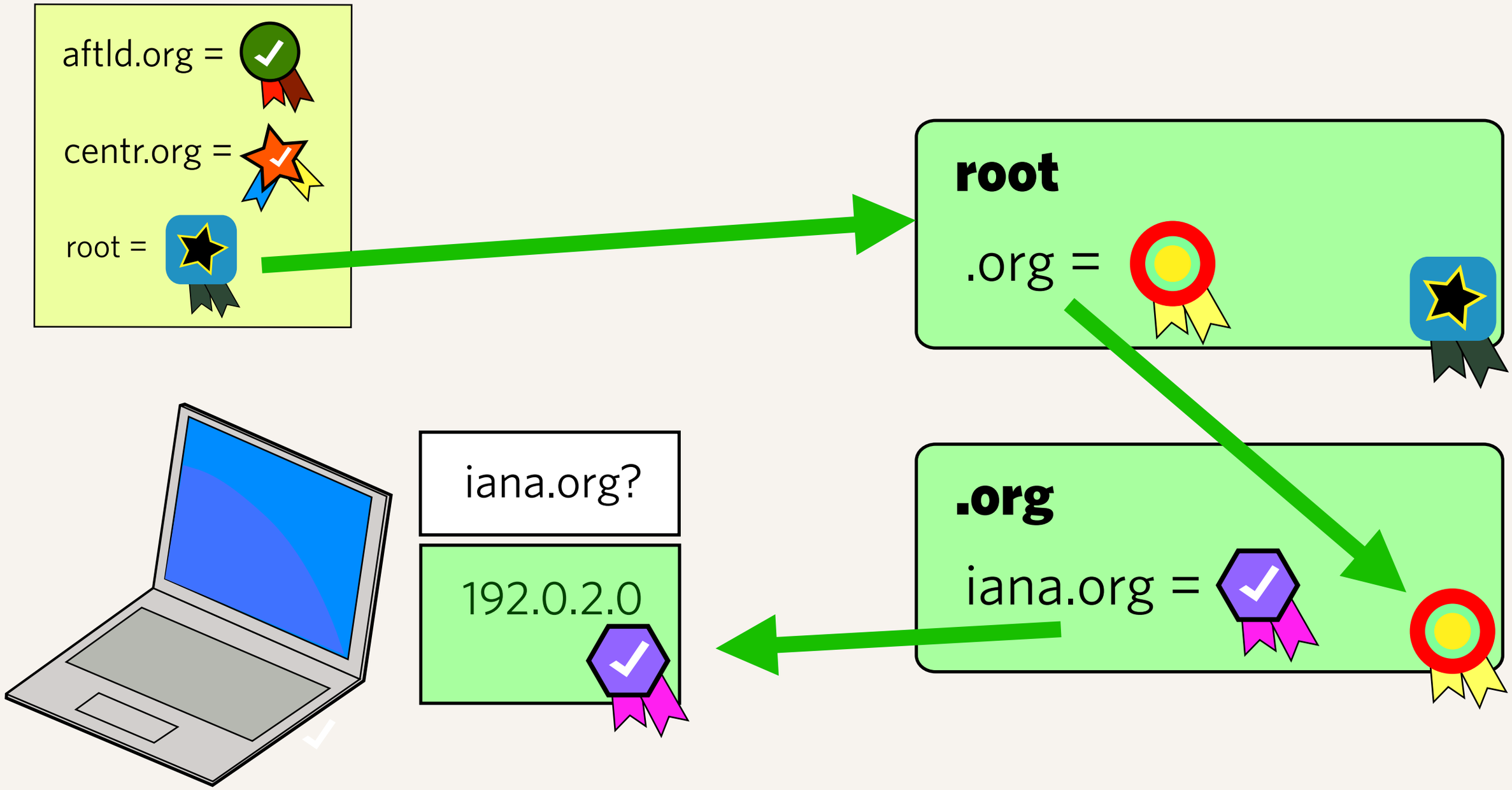



# Using a chain of trusted certificates

# The chain of trust

- By using the hierarchical property of the DNS, you can use DNSSEC to check certificates without knowing the certificate of every single domain
  - Computers can learn certificates by tracing from a trusted key down the DNS delegation chain
- Of course, this only works if each level of the DNS deploys DNSSEC…
  - For this to work, registries need to keep a list of signatures of its child zones, and publish them in their own signed zone

# In summary:

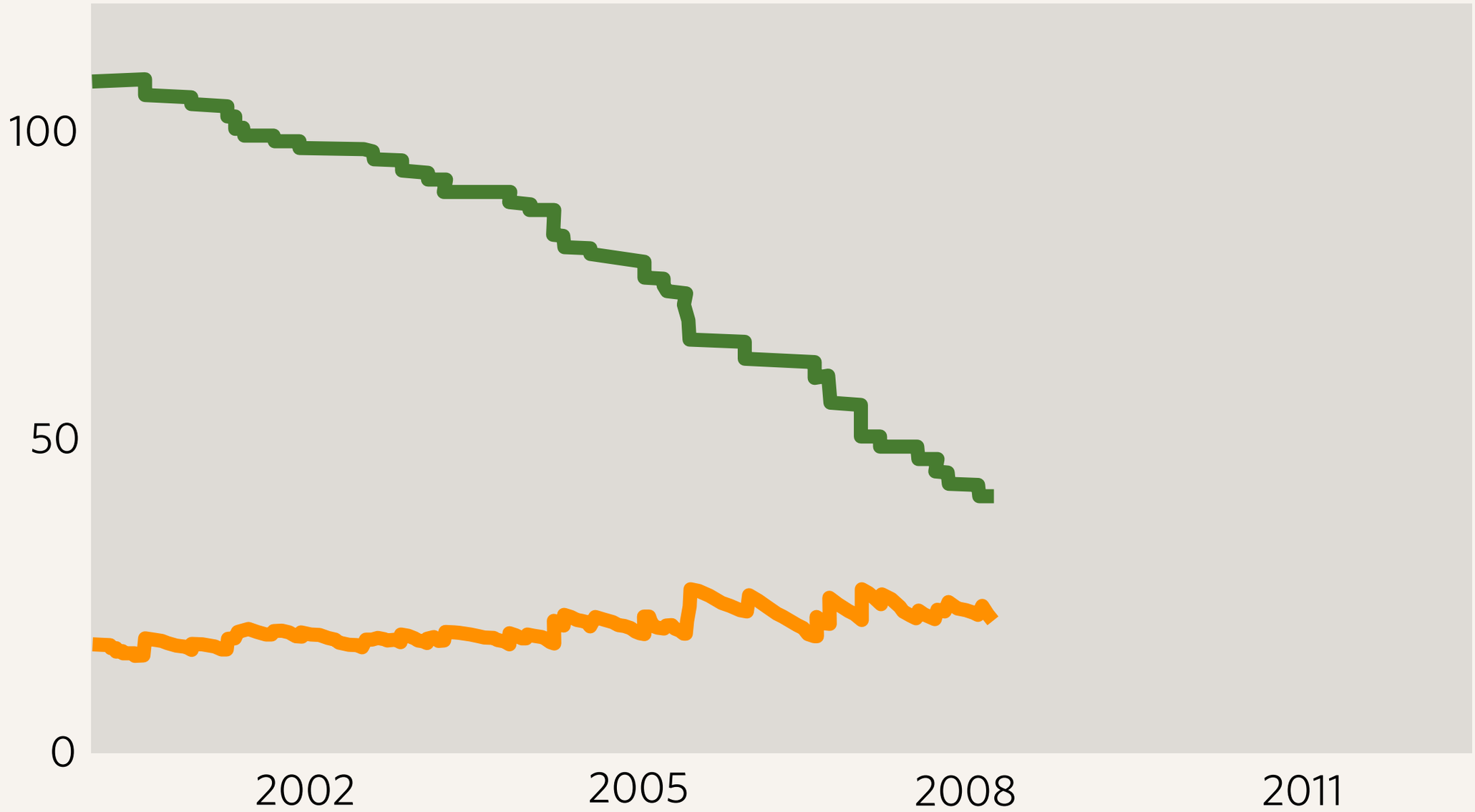
- To deploy DNSSEC fully, zone managers need to:
  - Sign their zone with a certificate
  - Publish the certificates of their child zones
  - Share their certificate with their parent zone
- The administration of these is much of the reason why DNSSEC has been difficult to deploy
  - And why “signing the root” is considered so important — it theoretically allows a single signature to verify the whole DNS!

# Signing the root

# IANA has been asked to sign the root zone

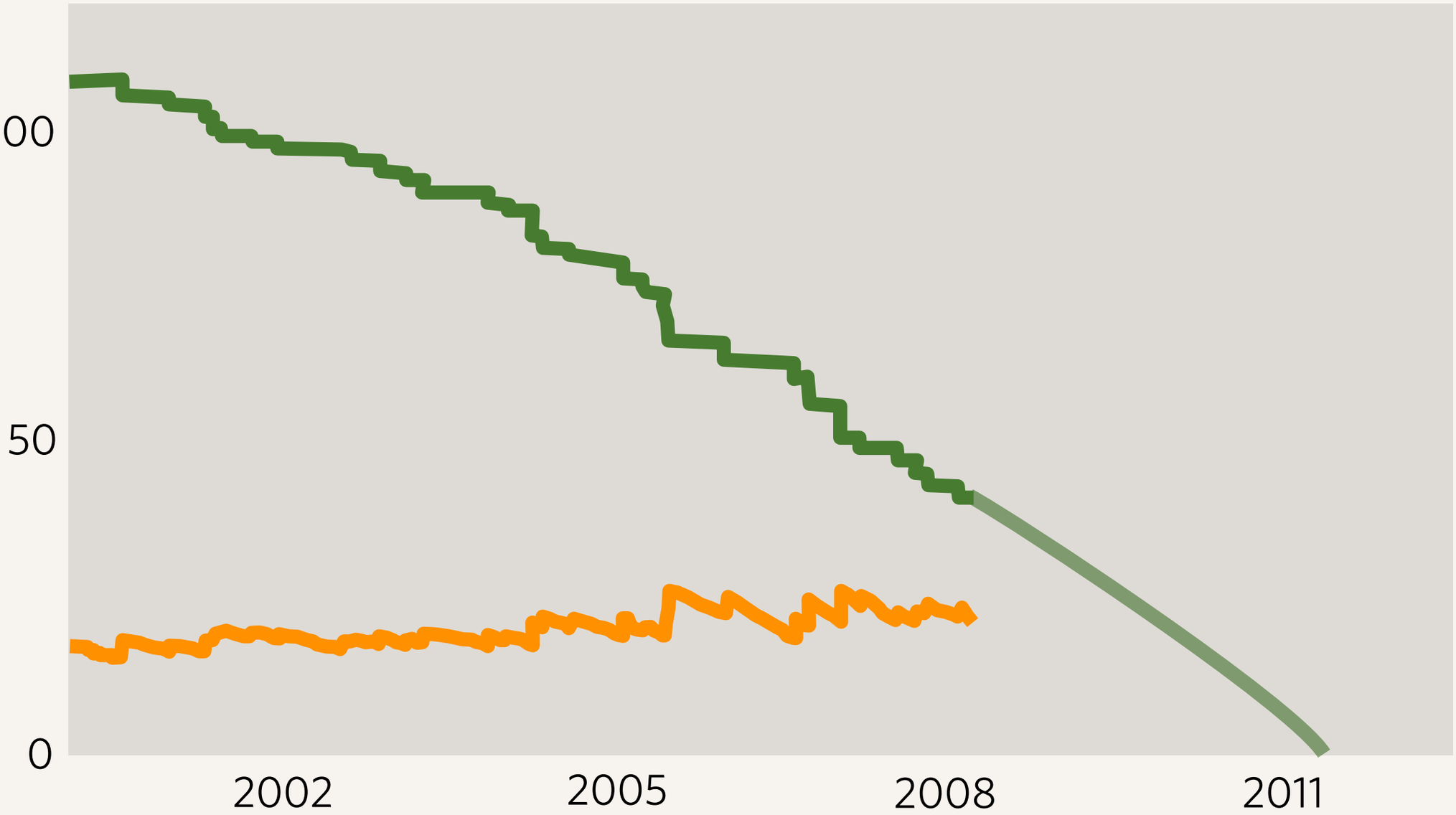
- Several entities have formally asked ICANN to sign the root zone (RIPE, .SE, APNIC)
- IANA has been signing the root experimentally for over a year
- However, as IANA does not directly publish the root, it can not currently make this a production service
- Working on obtaining permission from USDOC to let us sign the root zone

# IPv6




# IPv4 Availability

- Dwindling stocks ...

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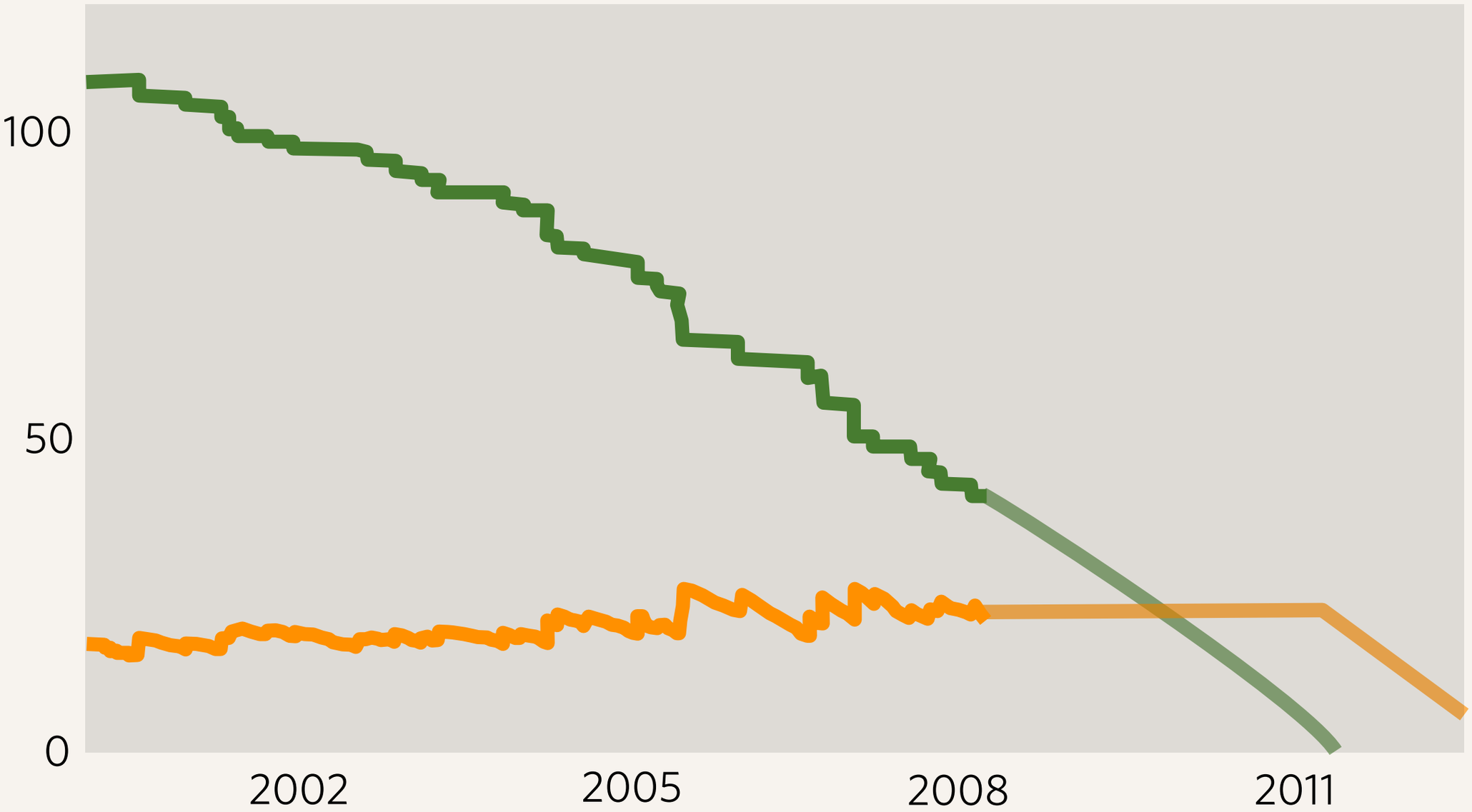


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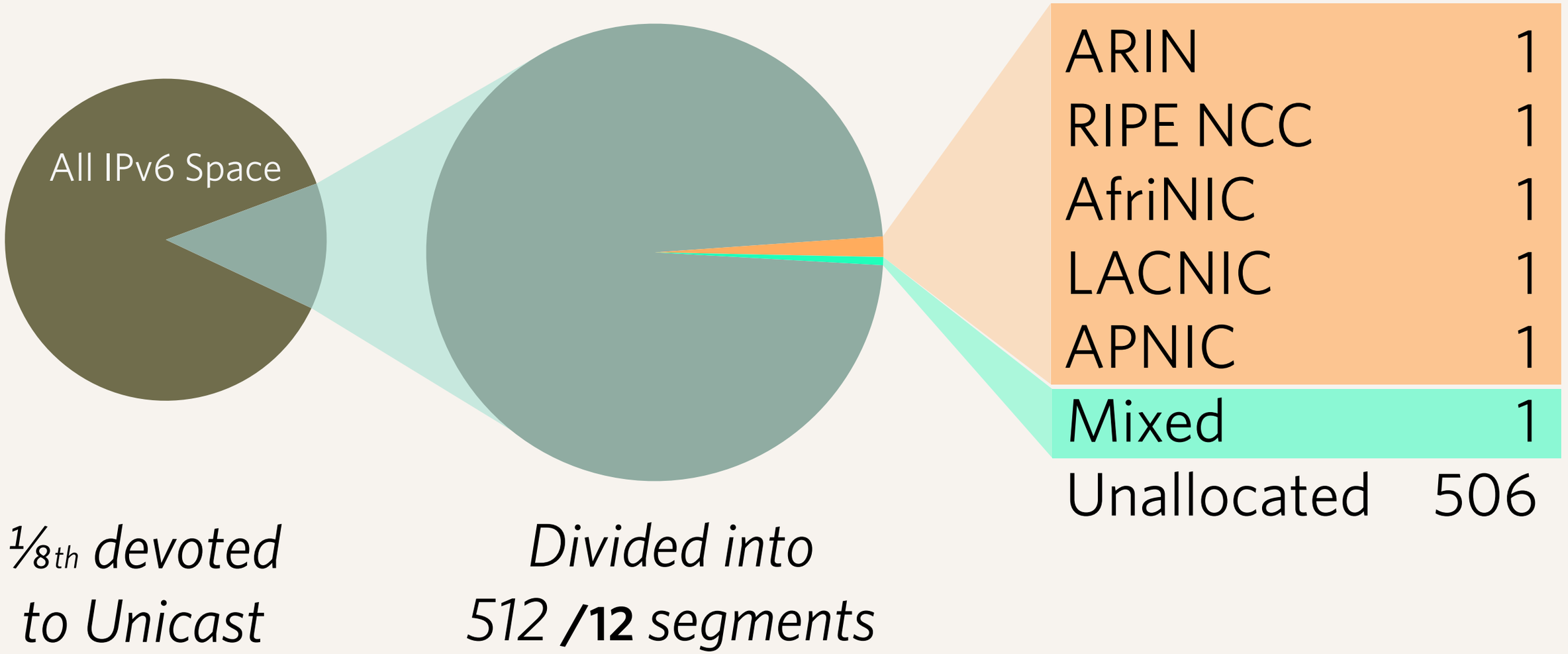
# IPv6 in a nutshell

- 128-bit address space
  - 340,282,366,920,938,463,463,374,607,431,768,211,456 addresses
- IANA still has lots in reserve




*1/8th devoted to Unicast*

*Divided into 512 **/12** segments*

# IPv6 Availability

- Approximately 1% of Unicast designated space is allocated to RIRs.

# IPv6: the short story

- IPv4 address space is running out
  - Current estimates, next couple of years
- IPv6 is the new numbering technology that will provide for growth of IP addressing needs
- The two numbering technologies are not mutually compatible, you must support IPv6 in addition to IPv4 to be accessible to IPv6 clients.

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  - Would not meet IANA minimum diversity requirements for production deployment for IPv4
- 155 TLDs have no IPv6 authorities at all!

# Don't be a hindrance to IPv6 adoption

- Allow AAAA glue records in your zone
- Provide your zone over IPv6 transit
- Encourage registrars to allow AAAA glue records from registrants
  - It is no use if your registry supports it, if your registrars do not.
  - Registry support is bad, registrar support is worse!

# Thanks!

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