Domain Name System (DNS)

How Computers Find One Another

As we learned in a previous class, computers are able to locate one another across the Internet because each one has its own distinct IP Address.

Last class, we learned about how our browsers send a request to a server in order to gain access to the resources there. We type a URL into our web browser, then it sends a request to the server with the appropriate domain.

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Servers are just like any other device on the Internet - they are most easily located using their IP Address. It's a huge hassle for us as people using the Internet to try and remember the IP Address for every website we want to visit, though!

Domain Name System

That's where the Domain Name System, or DNS comes in!

The DNS translates **names** of **domains** into **IP Addresses**!

Domain Name System

Every website has its own unique domain.

google.com

codehs.com

wikipedia.org

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DNS maps those **domain names** to **IP Addresses**!

google.com	172.217.18.174
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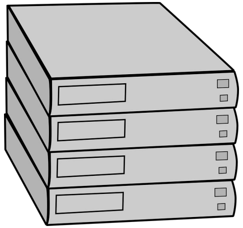
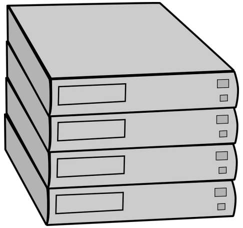
DNS is like an address book - it remembers the addresses for you, so that you only have to remember the names!

Requesting Web Resources

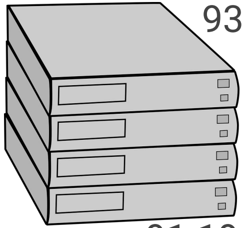
Like I mentioned earlier, every server has its own IP Address to which we need to send our requests!



172.217.18.174



93.184.216.34



91.198.174.192

Large network image: http://www.martingrandjean.ch/wp-content/uploads/2013/10/Graphe3.png by Martin Grandjean

From Name to IP

www.example.com

When you type in a URL into your browser, DNS will tell you what the IP Address for that URL's domain is, so that your request can be sent!

Step 1: Check Memory

www.example.com

The first step in trying to find the IP Address for a domain is seeing if your computer has visited that site recently. If it has, it'll remember the IP Address!

Step 1: Check ~~Memory~~ Cache

www.example.com

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The place where this information is stored is called the **Cache**.

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Step 1: Check ~~Memory~~ Cache

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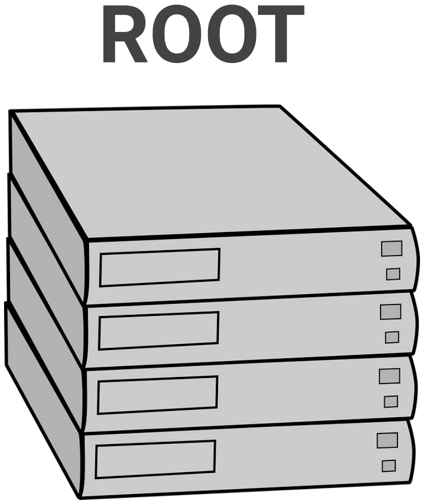
If the domain we're looking for is not found within the cache, we'll actually start using the DNS to try and locate the IP Address.

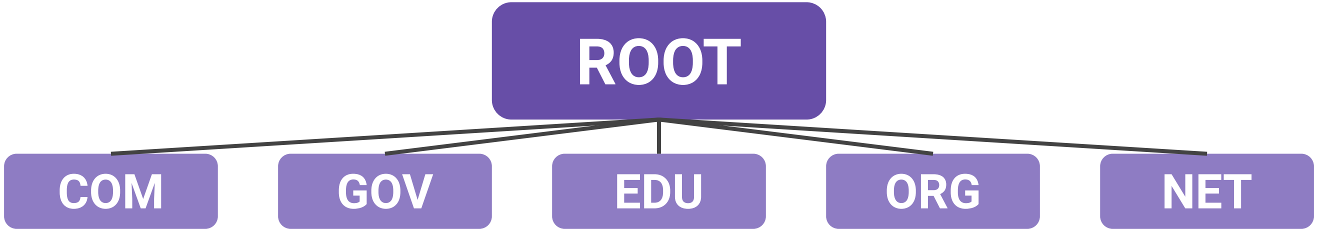
This process is going to move from the **end** of the domain to the **beginning**!

Step 2: Ask a Root Server

www.example.com



DNS Hierarchy



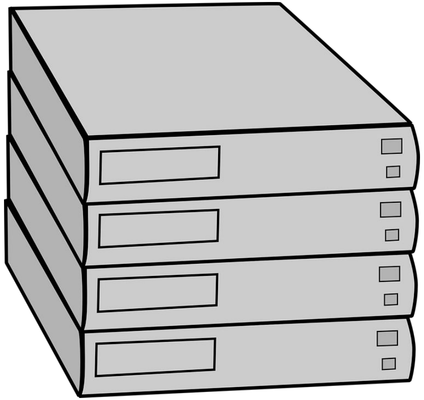
Root

Top-Level Domain

Step 2: Ask a Root Server

www.example.**com**

ROOT

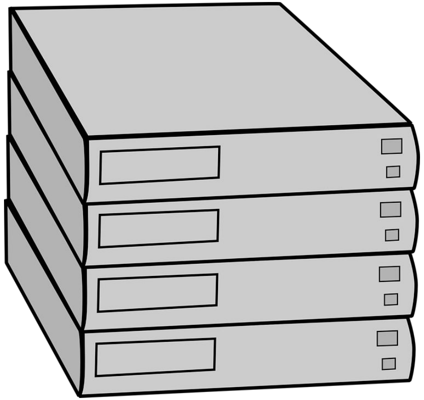


"Hey Root! Where can I go to find information about **.com** domains?"

Step 2: Ask a Root Server

www.example.com

ROOT

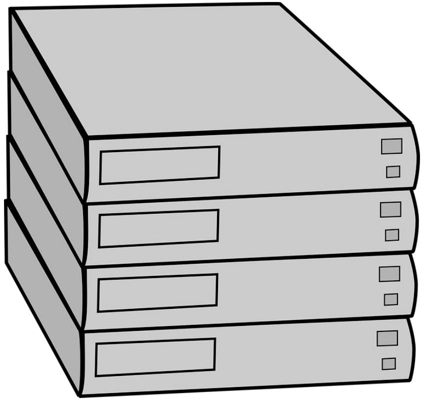


"Searching…"

Step 2: Ask a Root Server

www.example.com

ROOT



"Searching…
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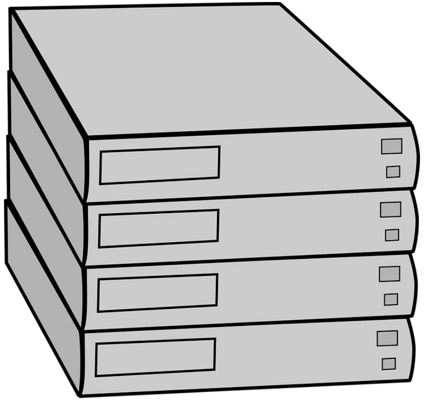
www.example.com

ROOT



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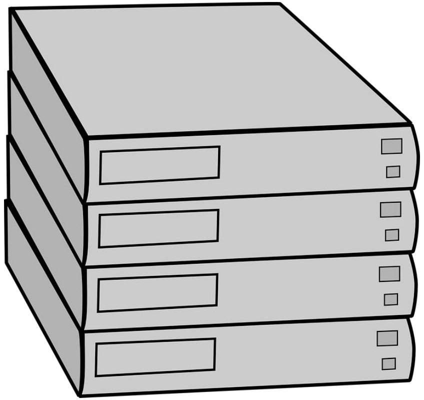
Step 2: Ask a Root Server

www.example.com

ROOT

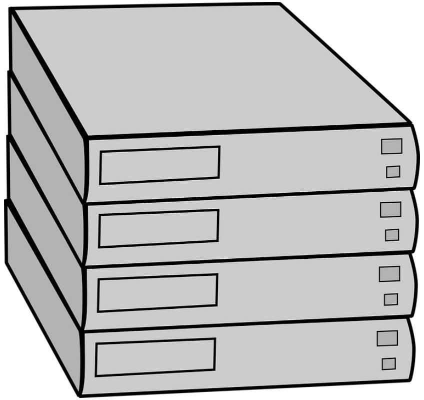


"Go check 22.124.12.8"

Step 2: Ask a Root Server

www.example.com

ROOT



"Go check 22.124.12.8"

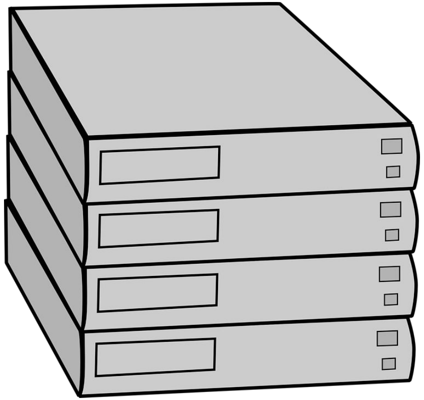
This is the IP Address for a COM name server!

Step 2: Ask a Root Server

www.example.com

"K thanks"

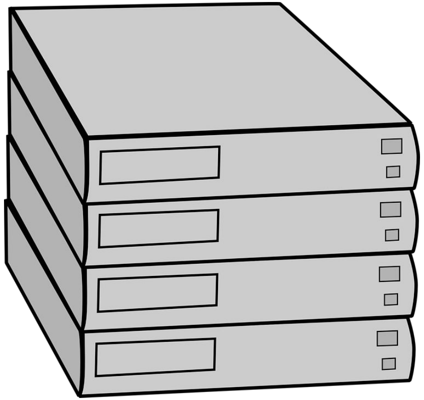
ROOT



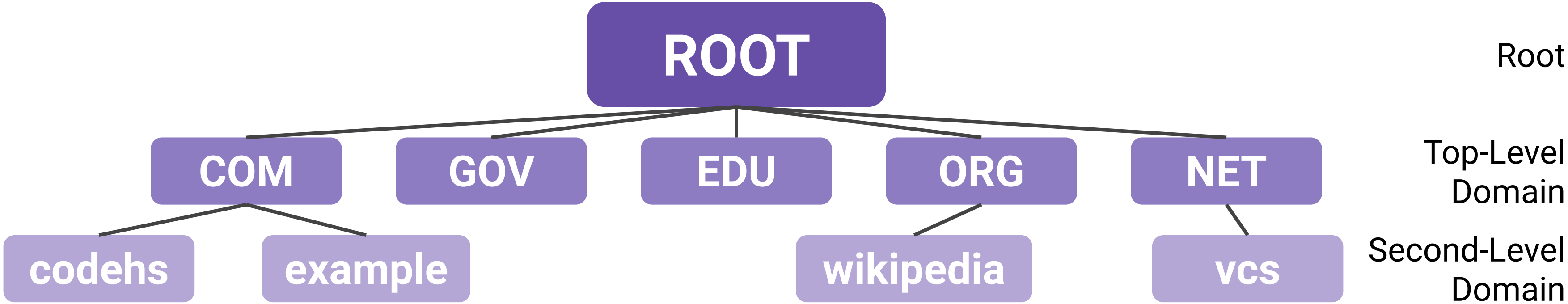
Step 3: Ask a TLD Server

www.example.com

COM



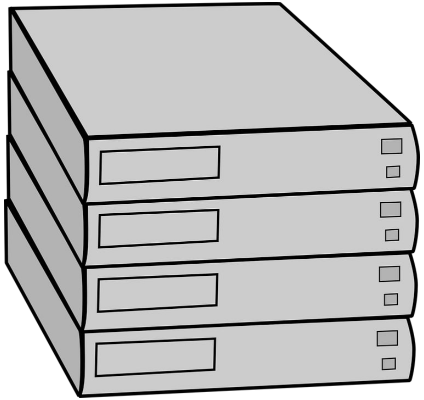
DNS Hierarchy



Step 3: Ask a TLD Server

www.example.com

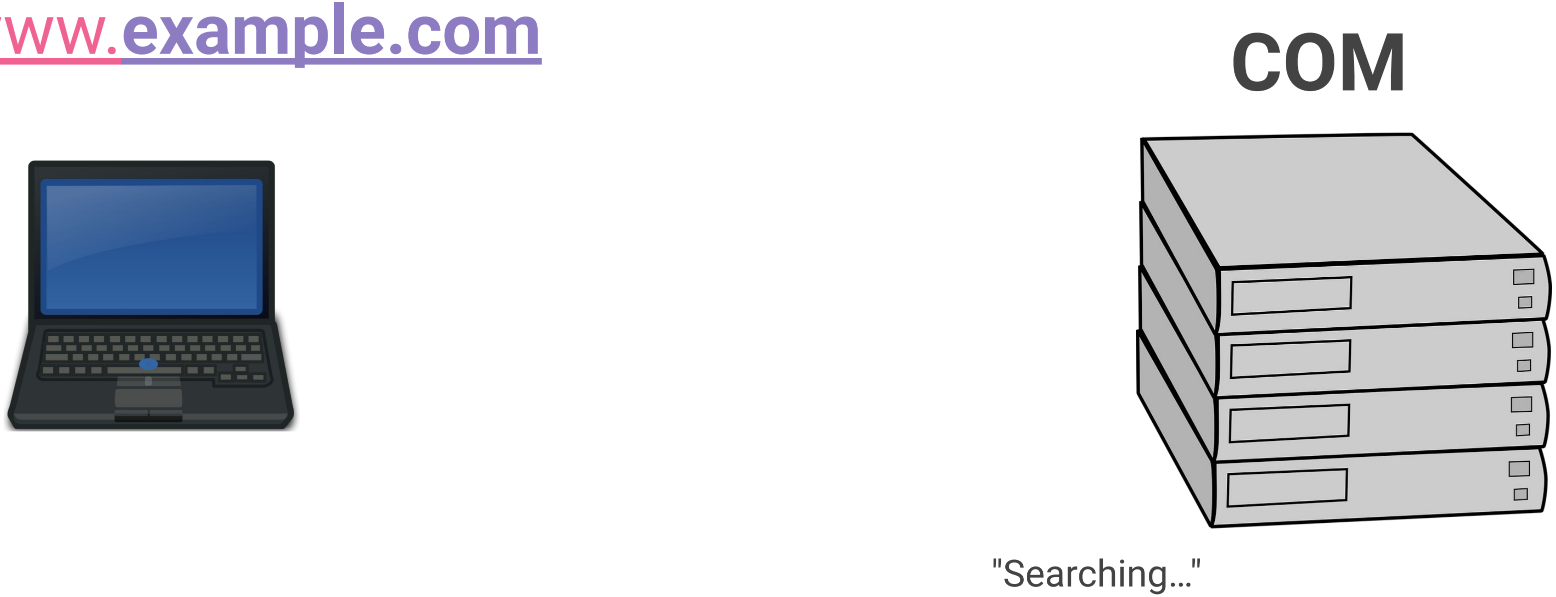
COM



"Hey COM! Where can I go to find information about **example.com** domains?"

Step 3: Ask a TLD Server

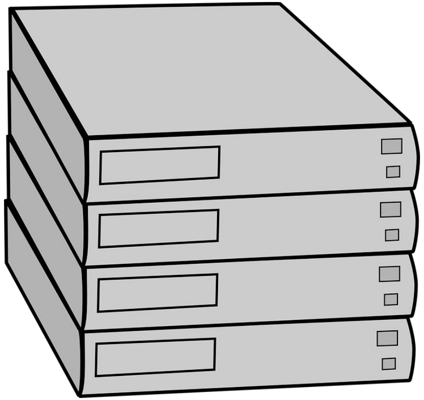
www.example.com



Step 3: Ask a TLD Server

www.example.com

COM



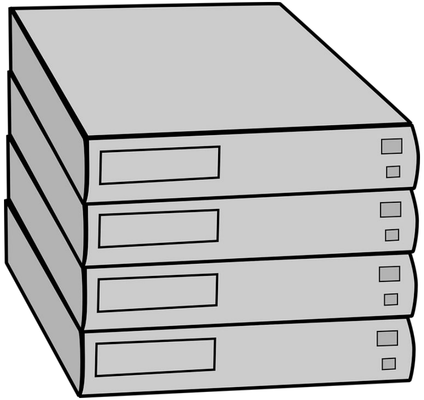
"Go check 12.82.9.8"

Step 3: Ask a TLD Server

www.example.com

"K thanks"

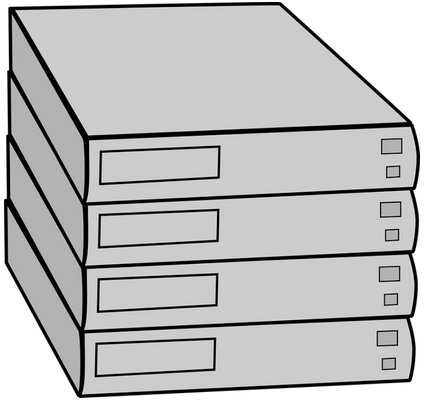
COM



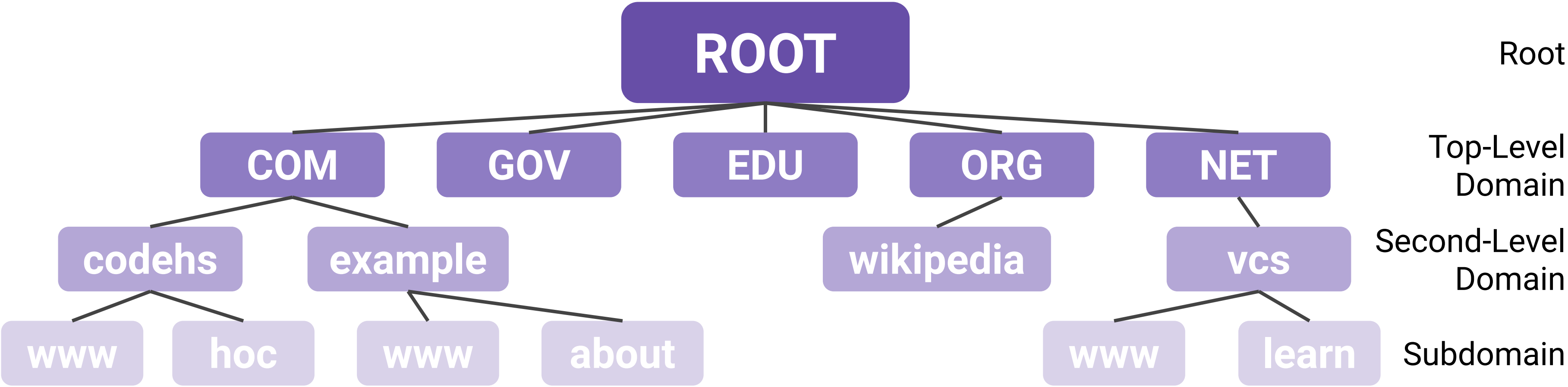
Step 4: Ask a Hosting Server

www.example.com

EXAMPLE.COM



DNS Hierarchy

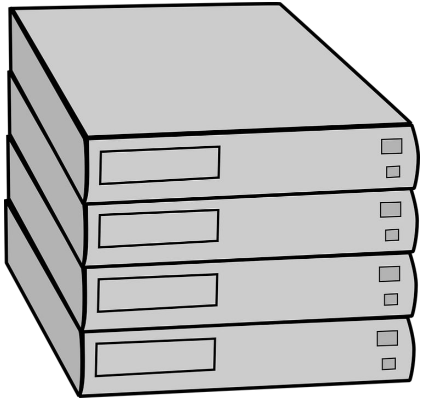


Step 4: Ask a Hosting Server

www.example.com

"Hey example.com! Where is www.example.com?"

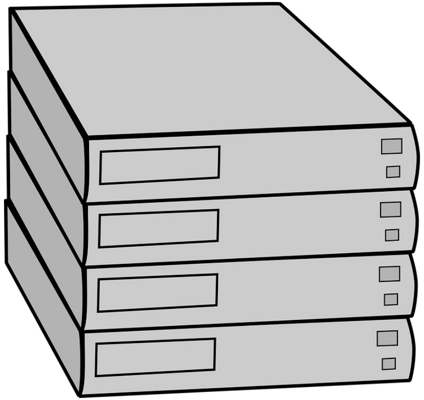
EXAMPLE.COM



Step 4: Ask a Hosting Server

www.example.com

EXAMPLE.COM

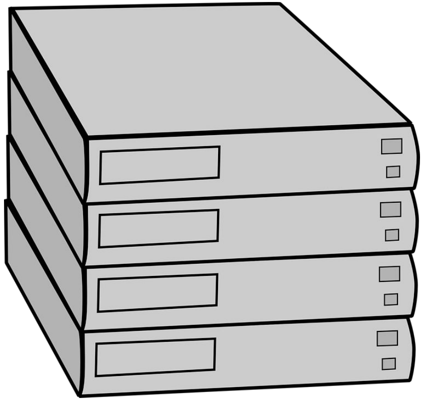


"Oh yeah, WWW! You can find that at 98.184.216.34!

Step 4: Ask a Hosting Server

www.example.com

EXAMPLE.COM



"K thanks"

Step 5: Save in the Cache

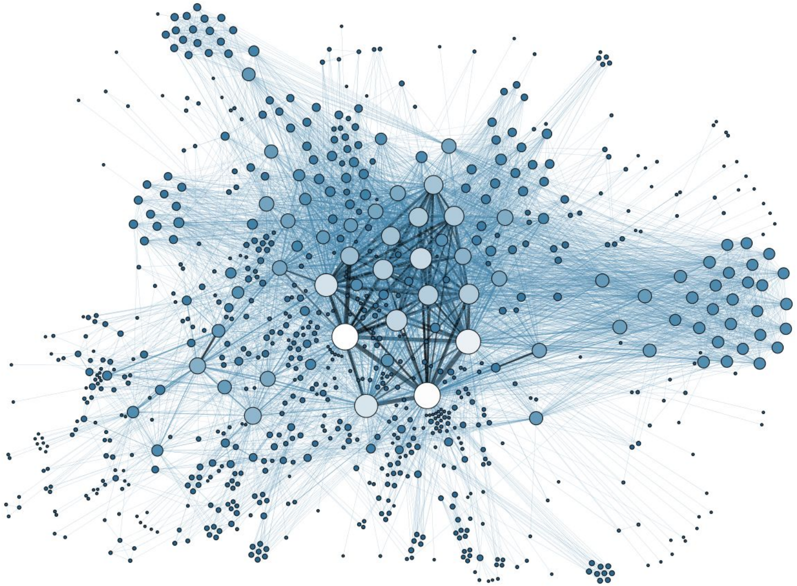
www.example.com

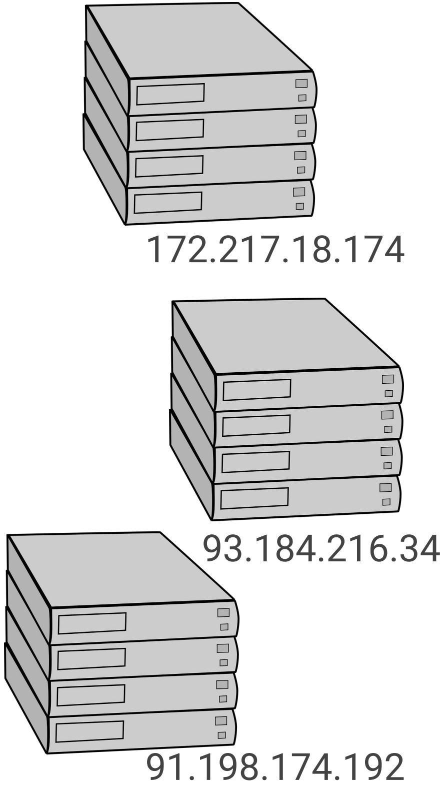
www.google.com	172.217.18.174
www.codehs.com	93.184.216.34
www.wikipedia.org	91.198.174.192
www.example.com	93.184.216.34

Once you have the IP Address for the site you want to visit, your computer will save it into its cache so that it can quickly find it next time, and avoid having to ask all those servers again!

Step 6: Send the Request

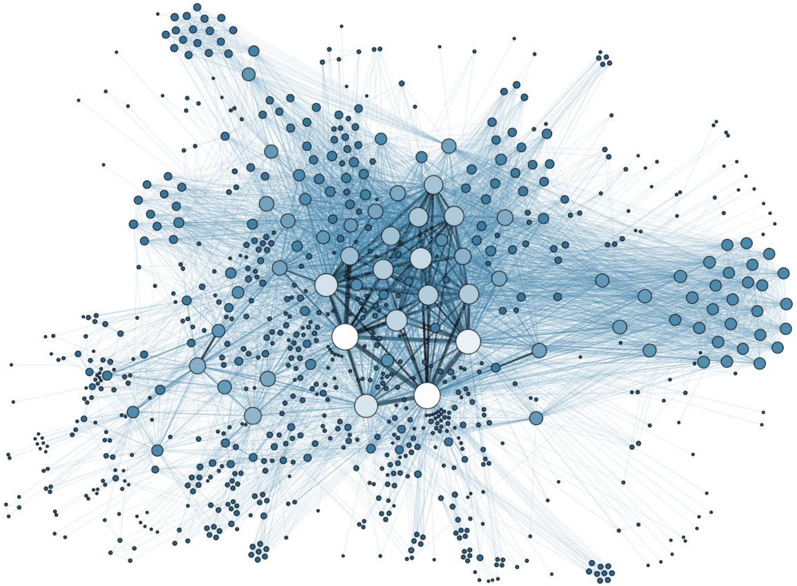
www.example.com

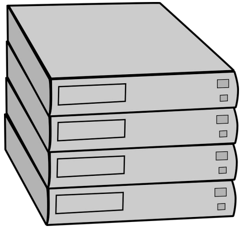




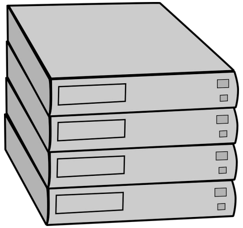
Step 6: Send the Request

91.198.174.192

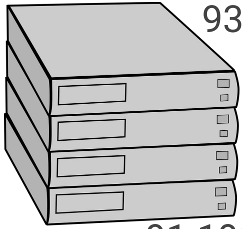




172.217.18.174



93.184.216.34

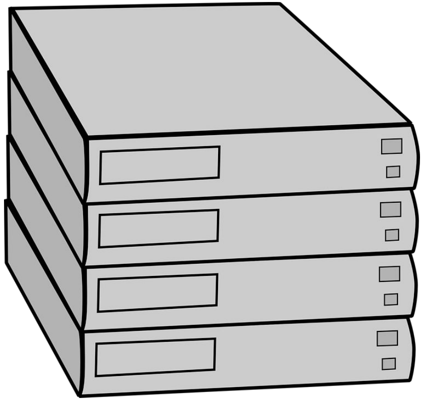


91.198.174.192

Step 6: Send the Request

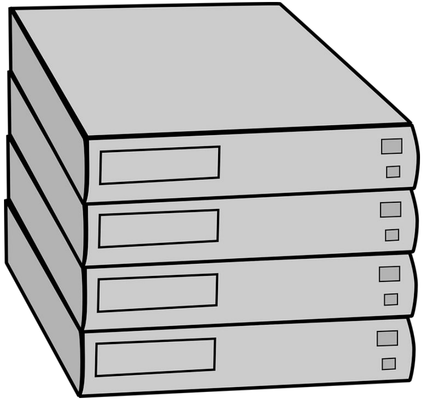
"Hey, 91.198.174.192! Please send me your homepage.html file!"

91.198.174.192

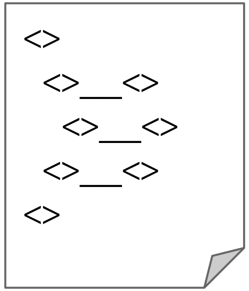


Step 6: Send the Request

91.198.174.192



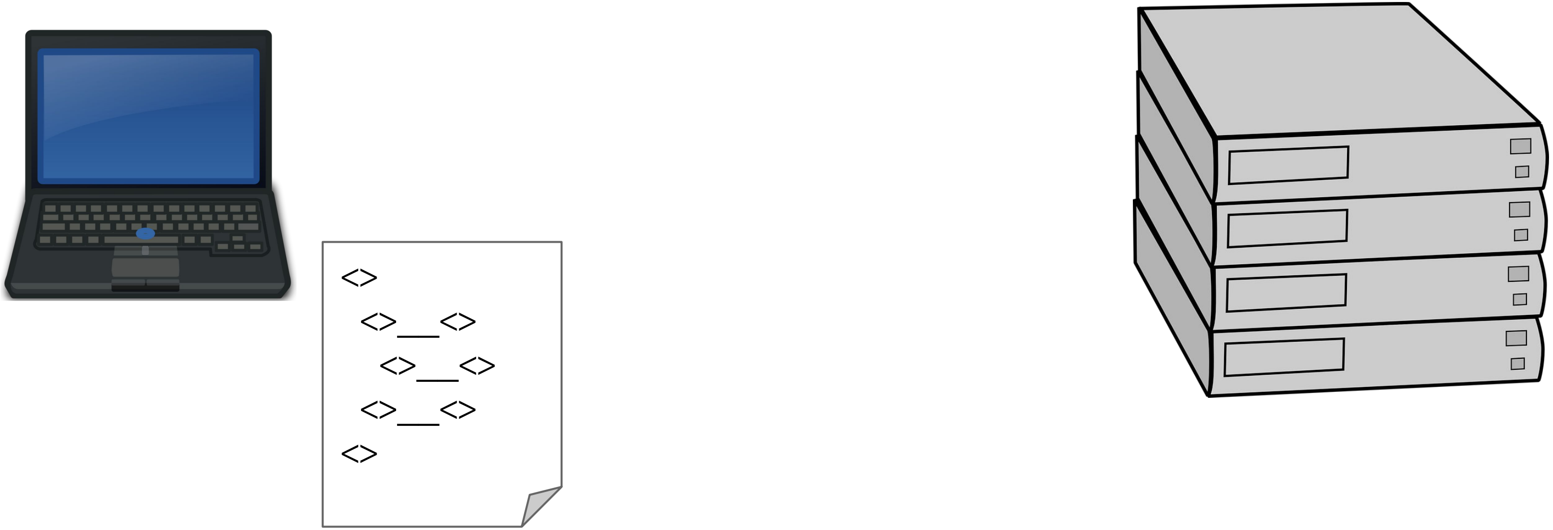
"You got it, boss!"



homepage.html

Step 6: Send the Request

91.198.174.192

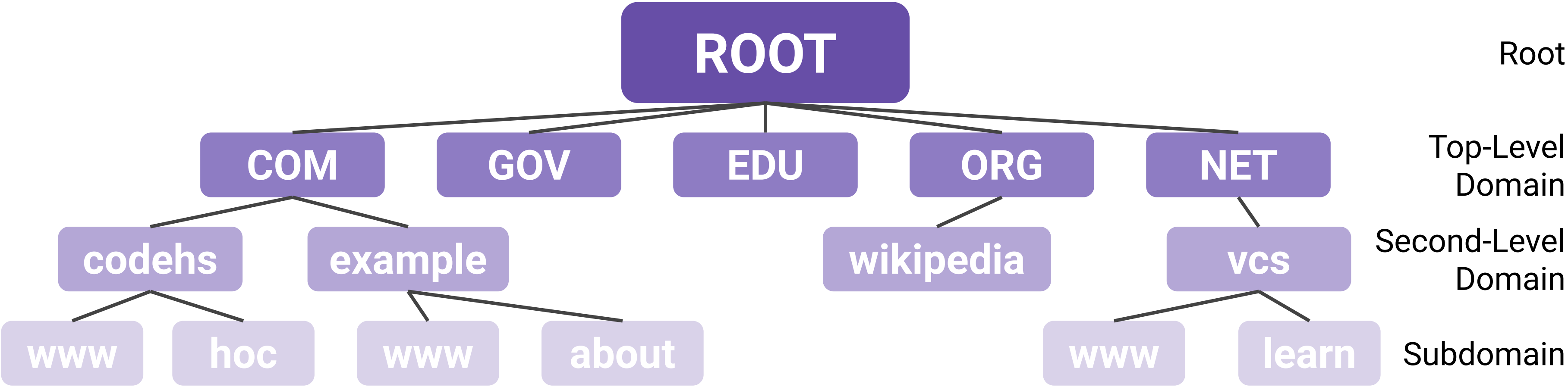


homepage.html

Step 6: Send the Request

91.198.174.192

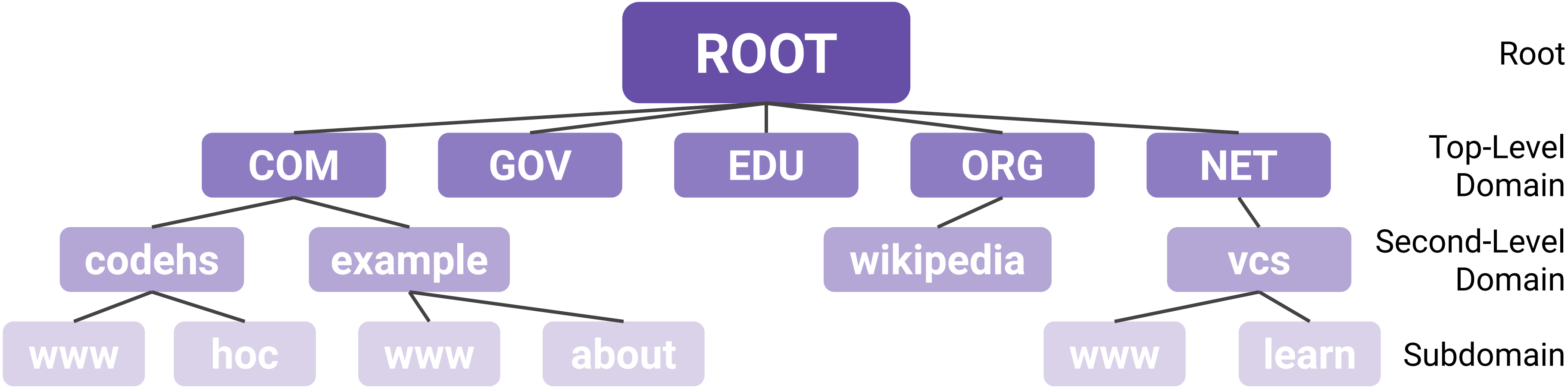
DNS Hierarchy



This system of hierarchy makes the system **scalable**. Since each layer is only in charge of a small amount of information, it's easy to add a single element to a layer, as well as add a new sub-layer entirely!

In addition to that, searching through one layer is **much** faster than searching *every single possible domain*!

DNS Hierarchy



The big takeaway from this is that DNS allows the Internet to map the names of domains, which are easy for us to remember, to IP Addresses, which are much more useful for actually locating things on the Internet!