DOMAIN NAME SYSTEM (DNS)

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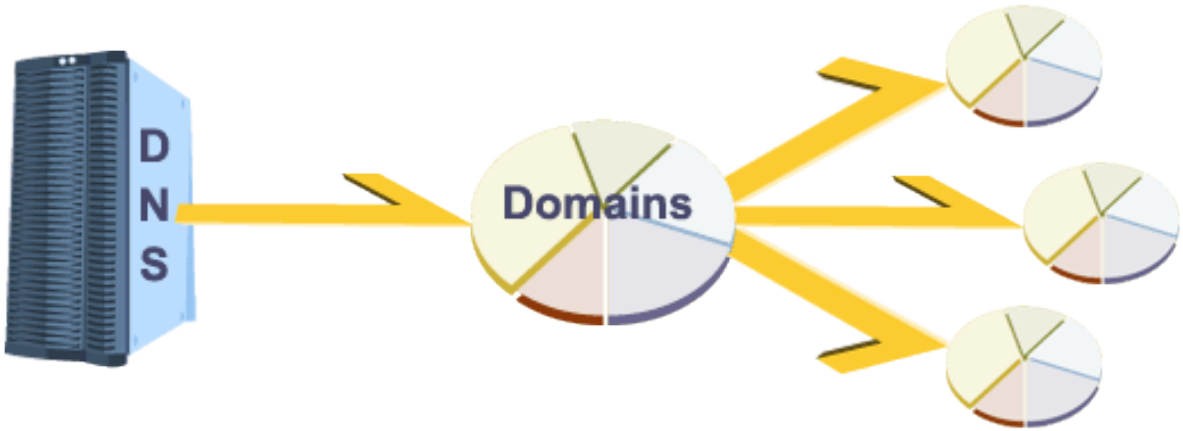
OVERVIEW

- DNS and DNS Server
- History of DNS
- DNS Architecture
- Name Resolution
- DNS Query Types



The DNS is…

- The “Domain Name System”
- What Internet users use to reference anything by name on the Internet
- Allows us to name computers on the Internet and resolve these names
- It is a system used to translate host names that can grow up to 256 characters into IP.

The DNS is…

- For example, no one currently writes Google's residence address, 74.125.29.101, in the browser.
- Instead, write the www.google.com and DNS server will forward this address to the IP address.

DNS Server is…

- The DNS server is a computer server with a database that redirects site names to IP addresses.
- Most of the existing DNS servers around the world belong to internet service providers, and providers open their servers to customers only.
- However, there are also some free DNS servers that you can use as an alternative.

DNS SERVERS

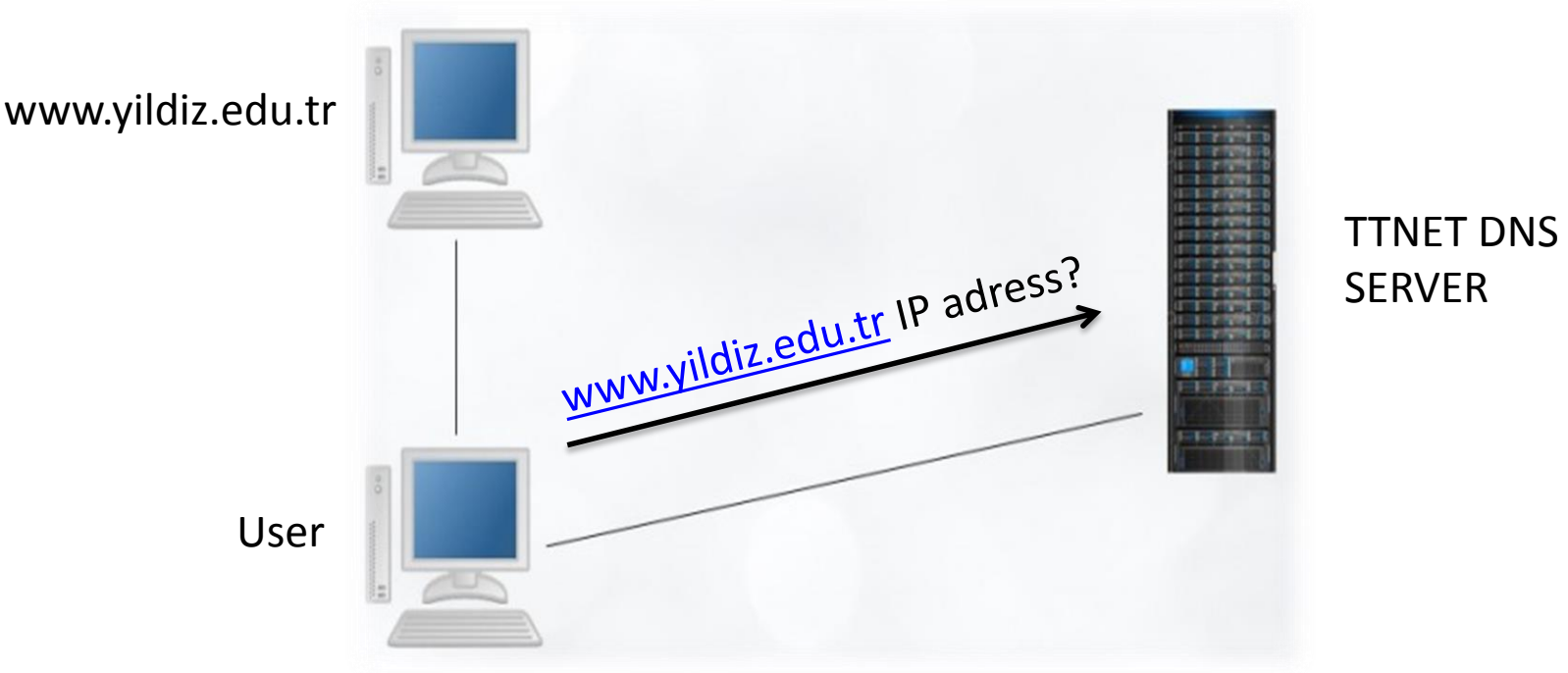
Provider	Preferred DNS Server	Other DNS Server
Level3	209.244.0.3	209.244.0.4
Google	8.8.8.8	8.8.4.4
Comodo Secure DNS	8.26.56.26	8.20.247.20
OpenDNS Home	208.67.222.222	208.67.220.220
DNS Advantage	156.154.70.1	156.154.71.1
Norton ConnectSafe	199.85.126.10	199.85.127.10

EXAMPLE

Every website is stored on a computer and has an IP address

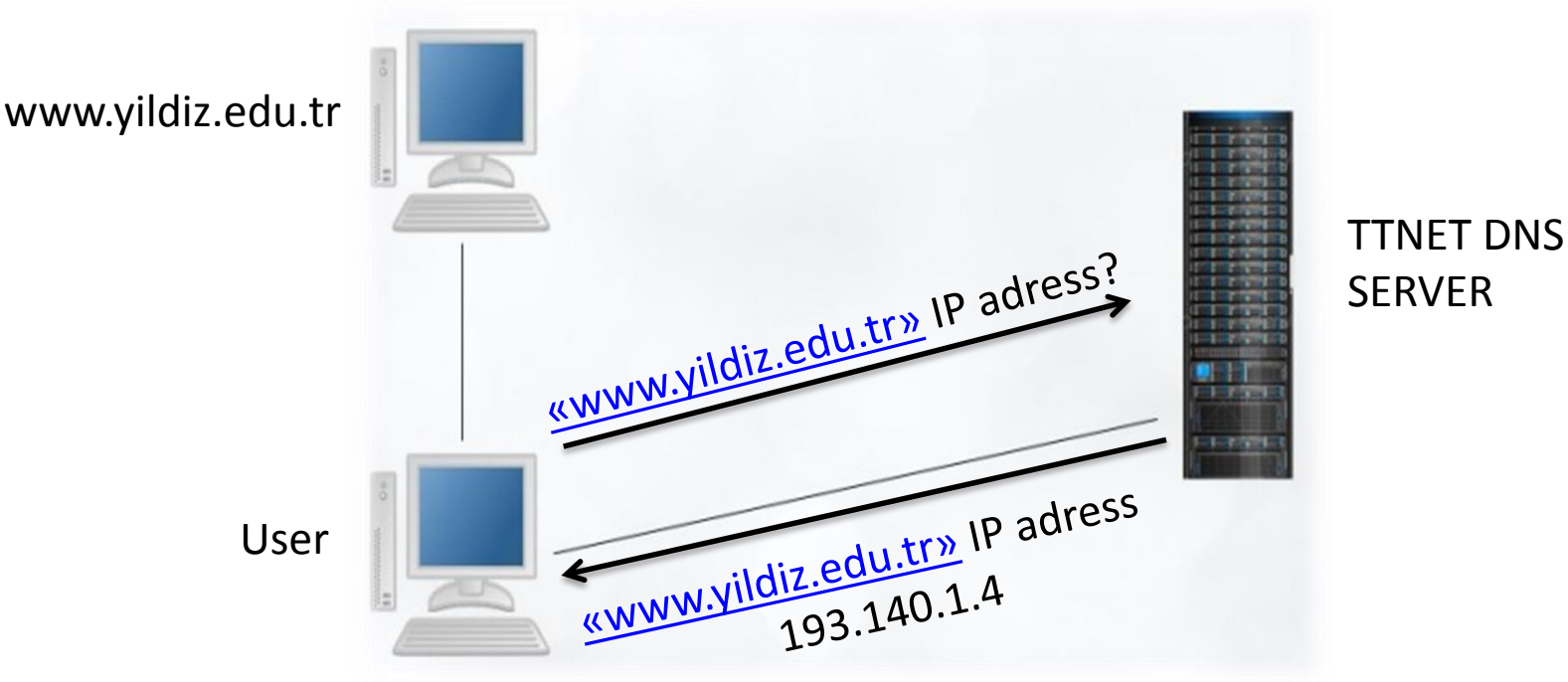
The above user has opened the browser and typed www.yildiz.edu.tr in the address line.

EXAMPLE



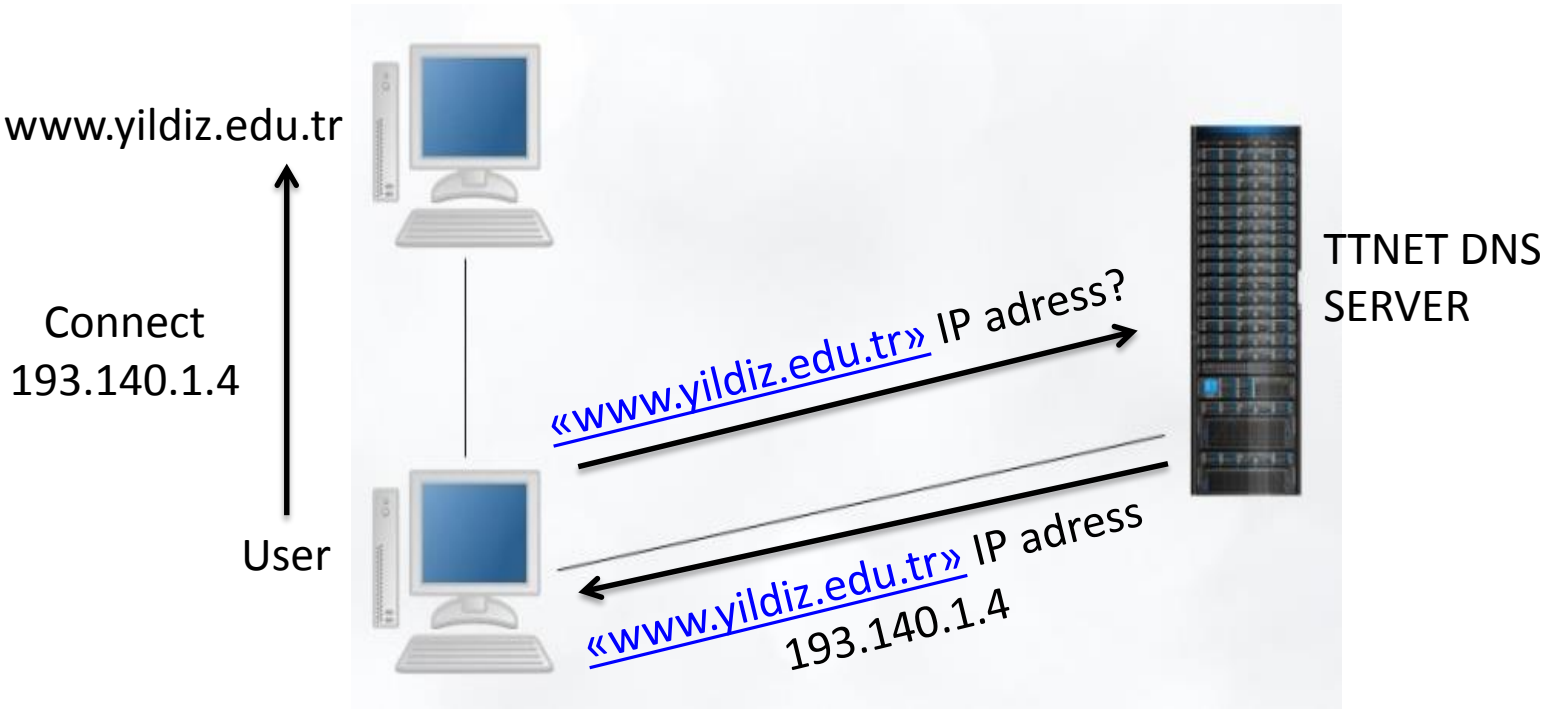
- In this case, the computer must know the IP address of www.yildiz.edu.tr in order to be able to perform the requested operation.
- The user who does not have this information also sends a query to the DNS server on the network.
- The content of the query is simple: What is the IP address of www.yildiz.edu.tr

EXAMPLE



The DNS server that receives this query immediately searches for this query in its database and sends the IP address of «www.yildiz.edu.tr» to the requesting computer.

EXAMPLE



The user computer that learns the IP address of the domain name that it wants to connect to successfully connects to **YILDIZ** web site using this address information.

SO DNS…

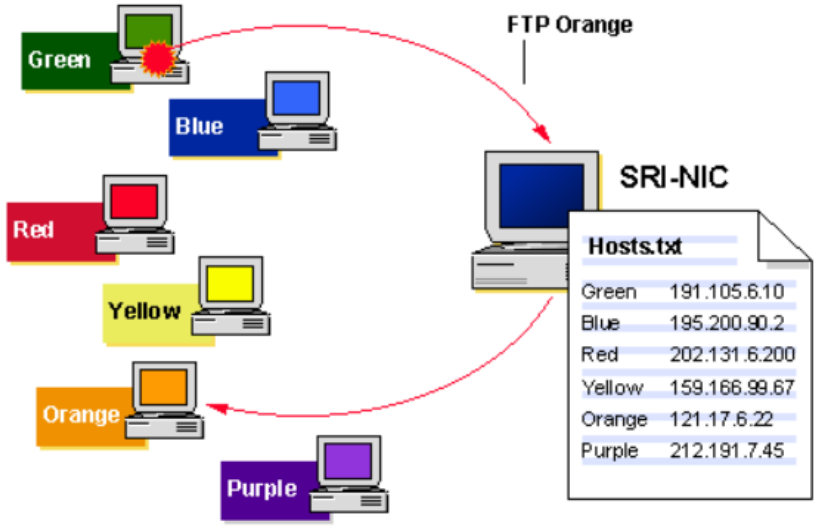
System that provides phone book service for internet by converting user friendly computer system names to IP addresses…

DNS provides bidirectional conversion between easy-to-understand and usable machine and domain names and IP addresses.

For this purpose, the "Berkeley Internet Name Domain (BIND)" software is widely used. If you want to access a site, you can determine which site is where, which IP belongs to which computer, and access it at any time.

History of DNS

- Until 1984 there was no DNS. Until then, the name-IP resolution was done with a text file called **HOSTS.TXT**.
- The names and IP addresses of the computers on the Internet were manually saved to this file. Each computer on the Internet had a copy of this file.
- When a computer wants to reach another computer, it examines this file. If that computer has a record in the file, it gets the IP address and communicates.



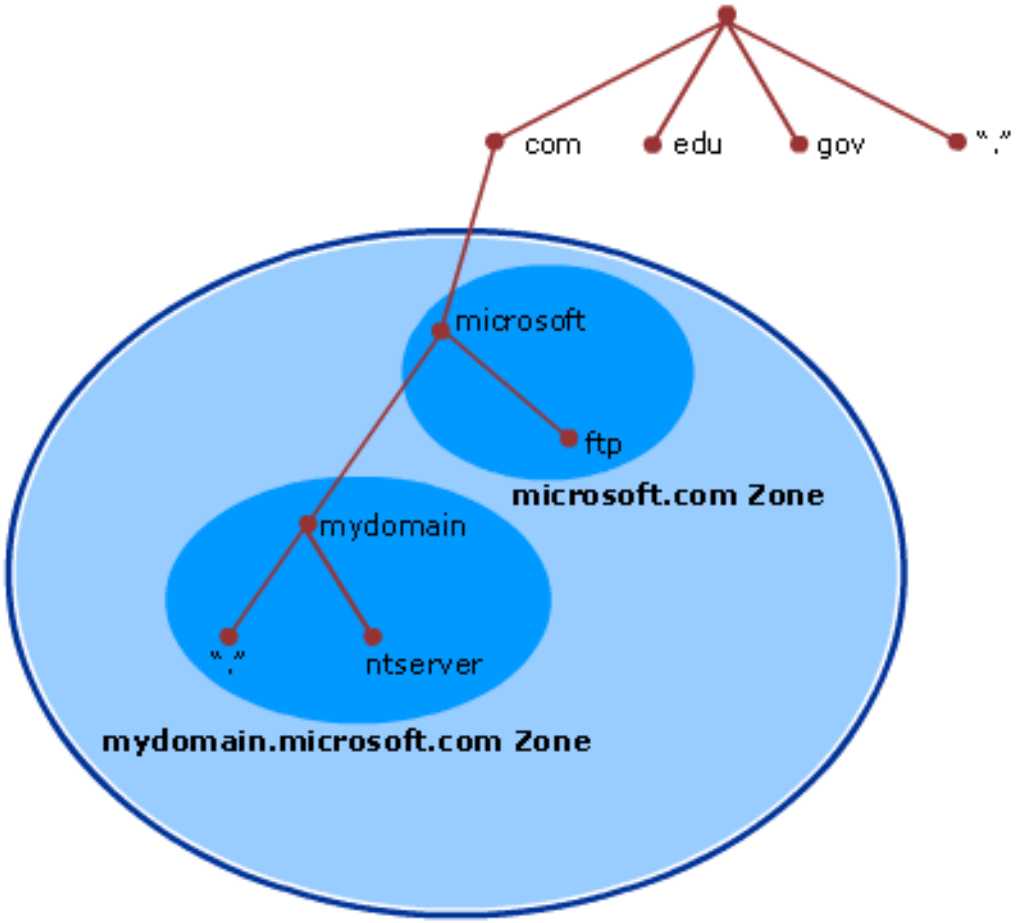
- The contents of the HOSTS file had to be kept up to date in order for this system to work well.
- To ensure this, the copy was periodically copied to Stanford University in the US where the file was originally stored

- But as the number of computers on the internet increases, the size of this file has reached an extraordinary size, and the link that computers on the Internet have made to copy the file has begun to lock down the computers in Standford

- Due to these problems, the Internet authorized bodies produced the DNS in 1984.
- **Paul Mockapetris** was assigned to do this.

DNS Architecture

- Root Servers
- Top-Level Domain Servers (TLD)
- Second Level Domain Servers
- Subdomains
- Host Name



DNS Architecture

Root Servers

- Host names-ip conversion starts first on the root servers.
- Root servers know the address of the Top-Level Domain servers and direct incoming requests to the required TLD (Top Level Domain-Top Domain) servers.
- Root servers are required for name resolution on the Internet to be accurate, reliable and continuous.
- There are 13 root servers on the world name basis.

A	198.41.0.4
B	192.228.79.201
C	192.33.4.12
D	128.8.10.90
E	192.203.230.10
F	192.5.5.241
G	192.112.36.4
H	128.63.2.53
I	192.36.148.17
J	192.58.128.30
K	193.0.14.129
L	199.7.83.42
M	202.12.27.33

root-servers.org

ARL DOD-NIC ISC NASA-ARC UMD Cogent USC-ISI Verisign
WIDE ICANN RIPE NCC Netnod

news see all news items

2016-06-29	Root DNS events of 2016-06-25
2016-02-08	The 2015 Root Server Operators' Exercise on Emergency Response
2015-12-04	Events of 2015-11-30

meeting agendas

2016-11-13	IETF 97/Seoul (PDF)
2016-07-17	IETF 96/Berlin (PDF)
2016-04-03	IETF 95/Buenos Aires (PDF)
2015-11-01	IETF 94/Japan (PDF)

The 13 root name servers are operated by 12 independent organisations.
You can find more information about each of these organisations by visiting their homepage as found in the 'Operator' field below.

DNS Architecture

Top-Level Domain Servers

- The first task sharing in the DNS domain space occurs at the level of TLDs.
- There are 20 generic TLD (gTLD) and 248 country code ccTLD (country code TLD). The main TLDs and explanations are:

com	Commercial organization	**tr**	Turkey
org	Organization other than those above	**us**	USA
mil	Military group	**gb**	England
net	Network Organization	**de**	Germany
edu	Educational Institution	**au**	Australia
gov	Government Institution	**fr**	France
int	International Organization	**it**	Italy
info	Information Service	**ca**	Canada
name	Individual Use	**ru**	Russia
tel	Internet Communication Service	**es**	Spain

DNS Architecture

Second Level Domain Servers

- For use on the Internet, the domain names are of varying length given to individuals or institutions. For example: example.com; test.com…

Subdomains

- Additional domains derived from second level domains. Subdomains help to grow the DNS tree so that it can be partitioned when requested.

Host Name

- DNS names and resource records that correspond to a leaf in the tree. They are at the very end in DNS domain naming.
- "Server Name - Hostname" corresponds to a machine name in computer networks.
- This machine may be a simple computer, a network printer, a fax machine, a modem, a storage unit, a server, and so on. It can be any device that can connect to the network. In the DNS system, the machines on the network are named with the server name and domain name combination.
- In this structure, called Fully Qualified Domain Name (FQDN), each domain name can have a maximum of 63 characters and can not exceed 255 characters in total.

Types of DNS Servers

- According to their work, DNS servers are divided into three groups.

- **Primary Name Server:** Information about the region is obtained from the zone file. The information for this file is entered manually one by one.
- **Secondary name server:** The information about the zone is taken from a DNS server that it is connected to. So you do not need to manually enter this information into this server.
- **caching-Only name server:** In itself there is no file that holds the region information. It sends the gathered information to the clients by asking the server they are connected to, and puts them in the cache.

DNS Query Types

- Dns queries can be from a client DNS server or from a DNS server to another DNS server.
- There are two types of queries: Recursive Query and Iterative Query.

DNS Query Types

Recursive Query

- The type of query that a client makes when asking the DNS server for an IP address to connect to a resource on a network or a website.
- This query has to be answered positively or negatively.
- The client queries the DNS server as a recursive query, the DNS server receives the client's query and responds.
- If the DNS server does not know the answer, it learns it by asking the other DNS server or servers and the questioning client gets the reply as positive or negative.

DNS Query Types

Iterative Query

- It is called the queries that DNS servers make between themselves.
- When the client asks for the ip address that the DNS server wants to reach, the DNS server replies if it knows this ip address.
- If the DNS server can not match the name resolution requested by the client from its database or cache, it will ask for the IP address from other DNS servers on the internet or local.
- This operation continues until the desired ip address is found.
- Iterative query requires the most healthy response that the query has made from the server.

DNS Query Types

- For example, there is an IPv4 address corresponding to http://google.com.tr
- The type of the inquiry is determined according to the RD (recursive required) bits sent in the inquiries.
- Servers responding to non-recursive queries give consecutive name servers in response.
- As a result, if the query is not recursive,

you may take 8.8.8.8 IP directly or

«machine not found»

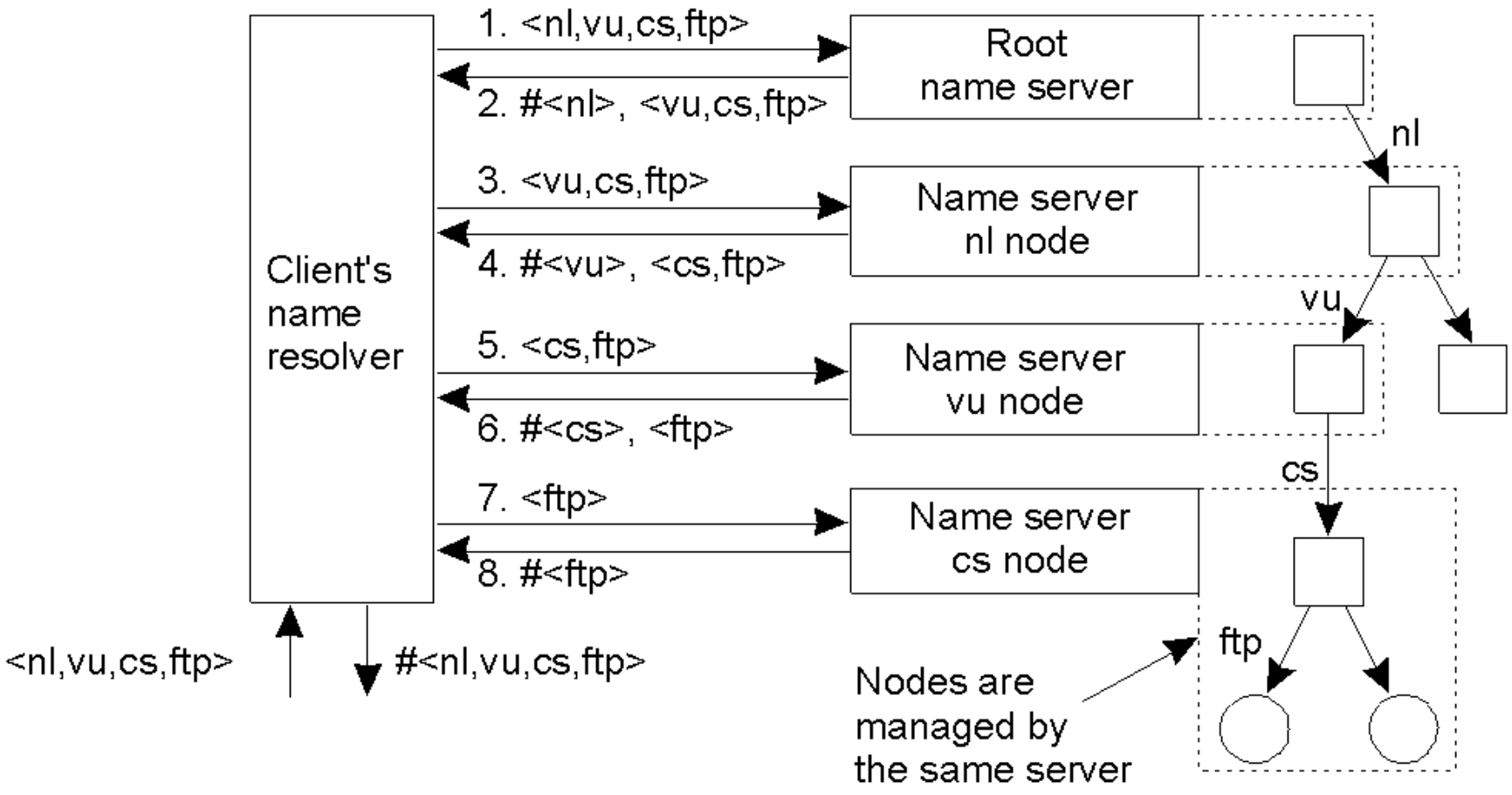
response.

- But in a recursive query,

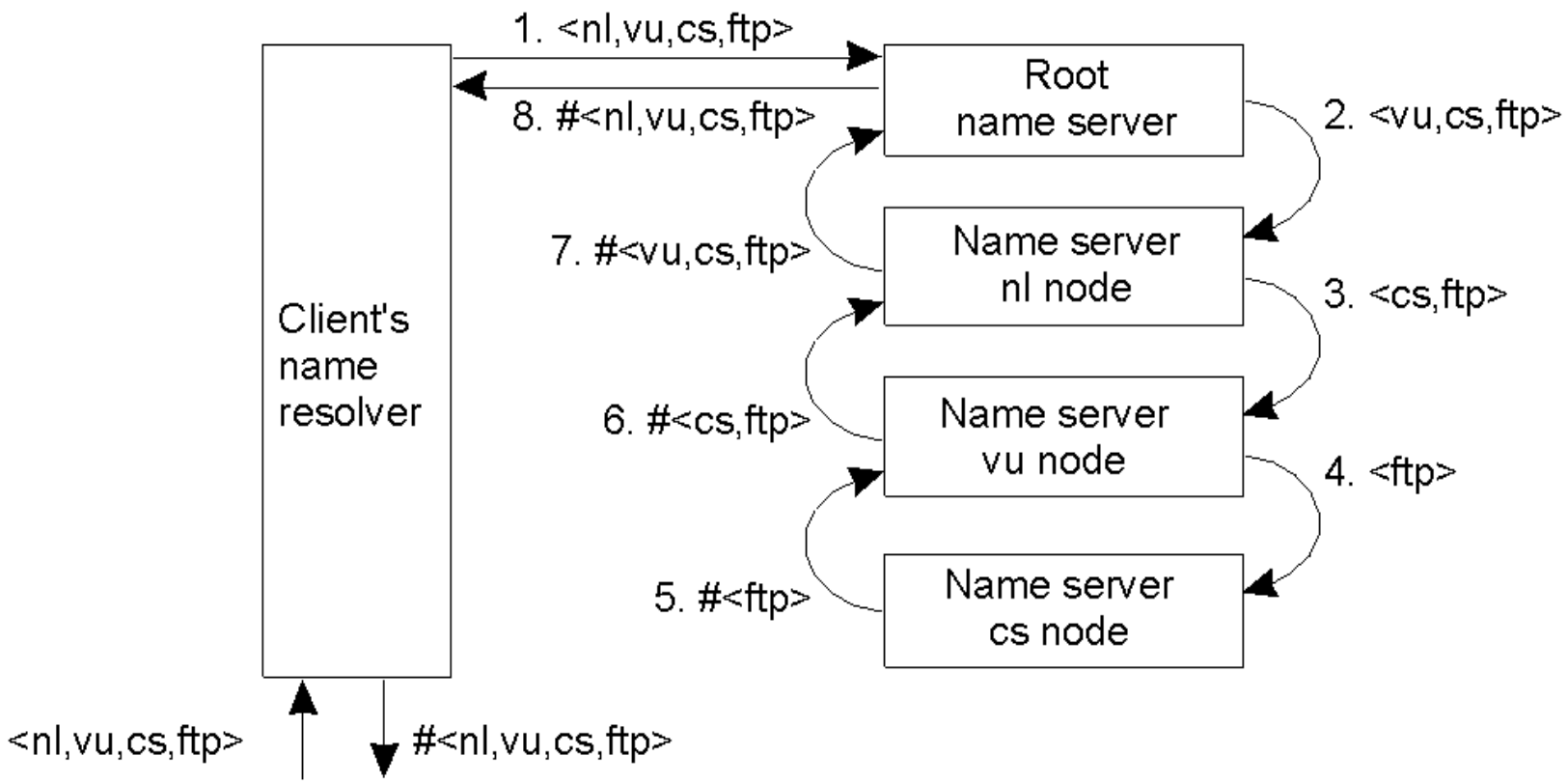
you can take the IP of another name server

to find the answer.

Iterative Name Resolution



Recursive Name Resolution (1)

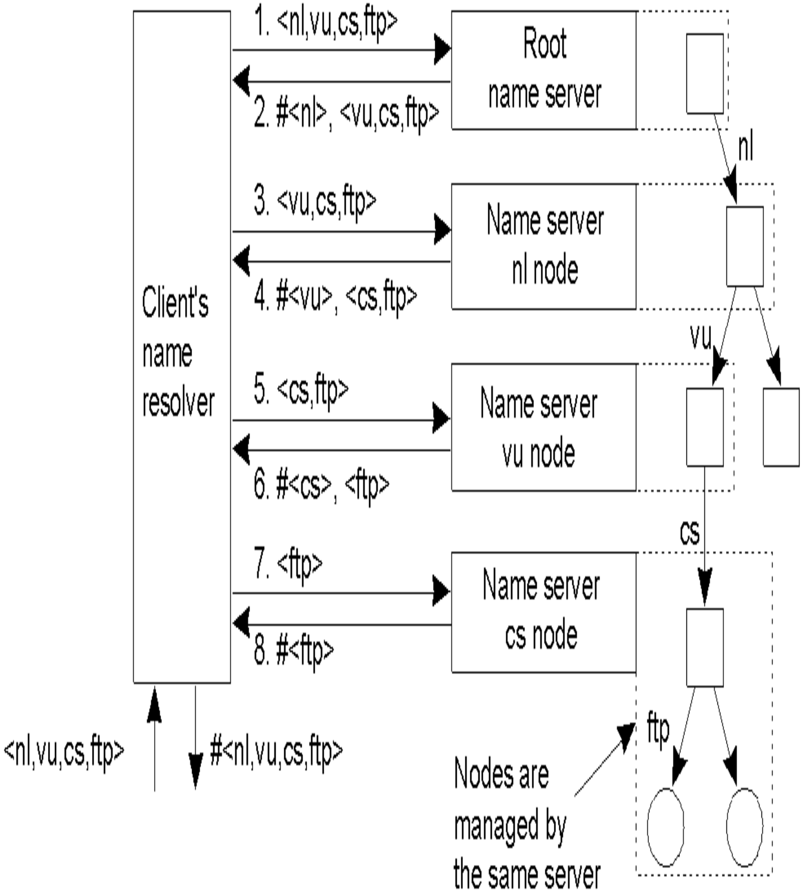


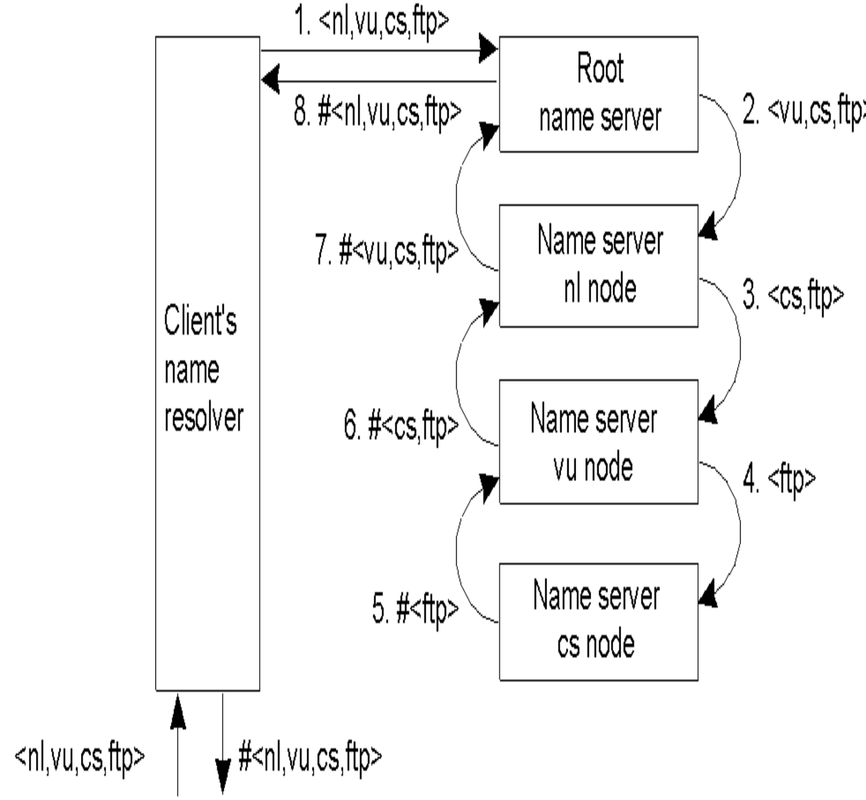
Recursive Name Resolution (2)

Server for node	Should resolve	Looks up	Passes to child	Receives and caches	Returns to requester
cs	<ftp>	#<ftp>	--	--	#<ftp>
vu	<cs,ftp>	#<cs>	<ftp>	#<ftp>	#<cs> #<cs, ftp>
nl	<vu,cs,ftp>	#<vu>	<cs,ftp>	#<cs> #<cs,ftp>	#<vu> #<vu,cs> #<vu,cs,ftp>
root	<nl,vu,cs,ftp>	#<nl>	<vu,cs,ftp>	#<vu> #<vu,cs> #<vu,cs,ftp>	#<nl> #<nl,vu> #<nl,vu,cs> #<nl,vu,cs,ftp>

- Recursive name resolution of <*nl, vu, cs, ftp*>. Name servers cache intermediate results for subsequent lookups.

Iterative versus Recursive Resolution (1)



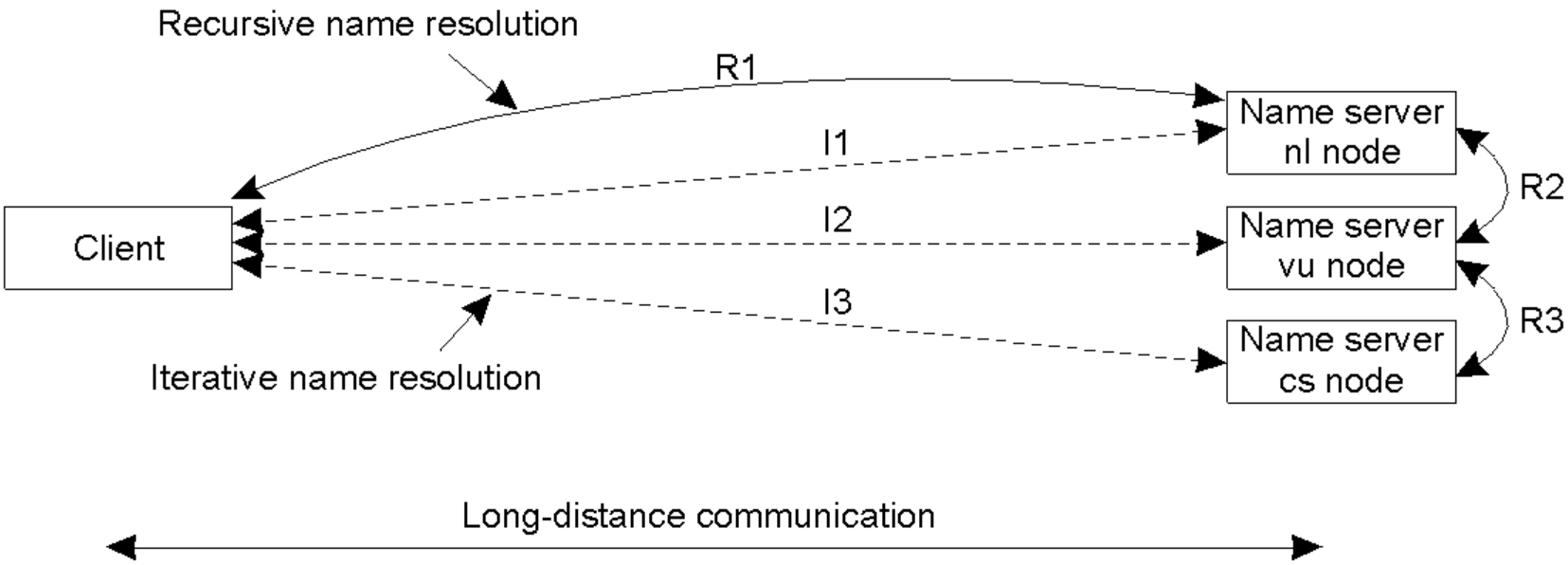


Which one is better?
How about with caching?
Performance, resource cost?

Iterative versus Recursive Resolution (2)

- Performance-wise, which is better?
  - Recursive method puts higher performance demand on each name server
- Which works better with caching?
  - Recursive method works better with caching
- How about communication cost?
  - Recursive method can reduce communication cost

Iterative versus Recursive Resolution (3)



- The comparison between recursive and iterative name resolution with respect to communication costs.

Name Resolution

- *Name resolution* is the process by which resolvers and name servers cooperate to find data in the name space
- Closure mechanism for DNS?
  - Starting point: the names and IP addresses of the name servers for the root zone (the “root name servers”)
  - The root name servers know about the top-level zones and can tell name servers whom to contact for all TLDs

Name Resolution

- A DNS query has three parameters:
  - A domain name (e.g., *www.nominum.com*),
    - Remember, every node has a domain name!
  - A class (e.g., *IN*), and
  - A type (e.g., *A*)
  - http://network-tools.com/nslook/
- Upon receiving a query from a resolver, a name server
  - 1) looks for the answer in its authoritative data and its cache
  - 2) If step 1 fails, the answer must be looked up

The Resolution Process

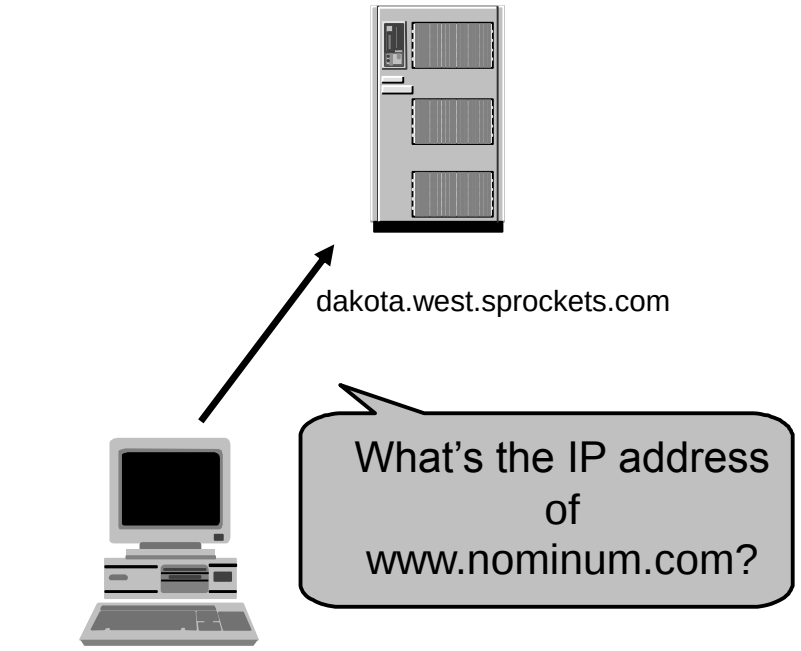
- Let’s look at the resolution process step-by-step:

annie.west.sprockets.com

```
ping www.nominum.com.
```

The Resolution Process

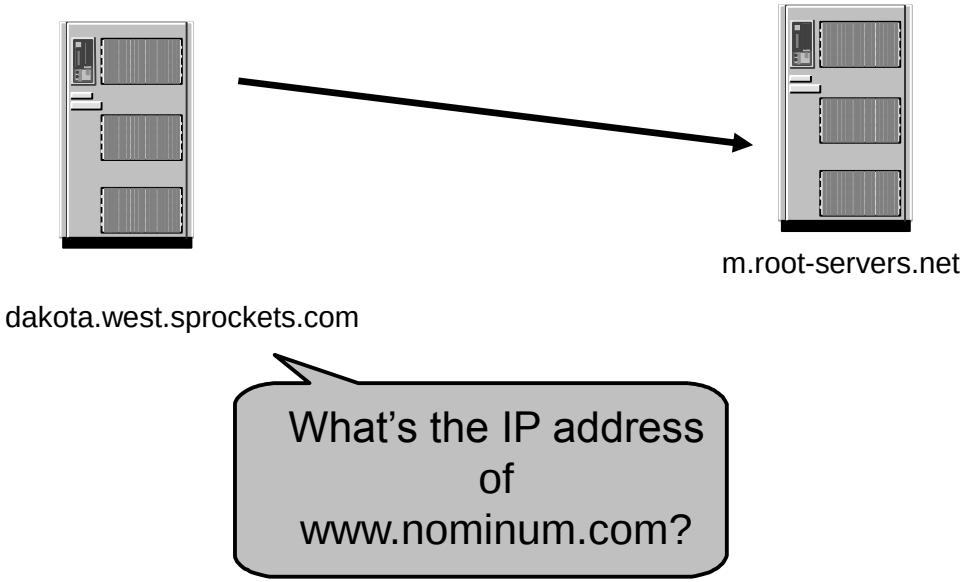
- The workstation *annie* asks its configured name server, *dakota,* for *www.nominum.com's* address




```
ping www.nominum.com.
```

The Resolution Process

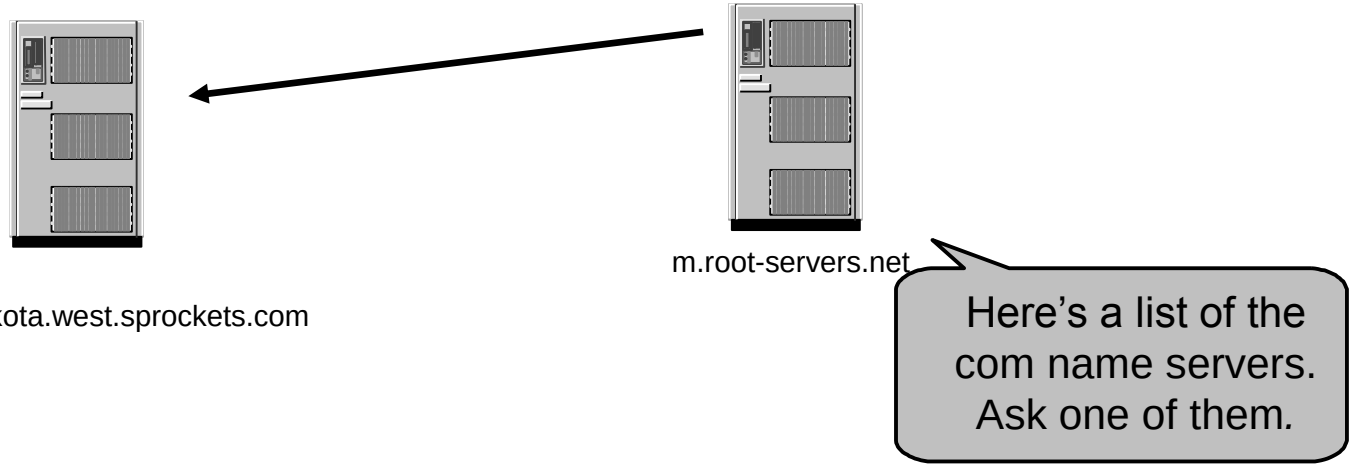
- The name server *dakota* asks a root name server, *m*, for *www.nominum.com's* address




```
ping www.nominum.com.
```

The Resolution Process

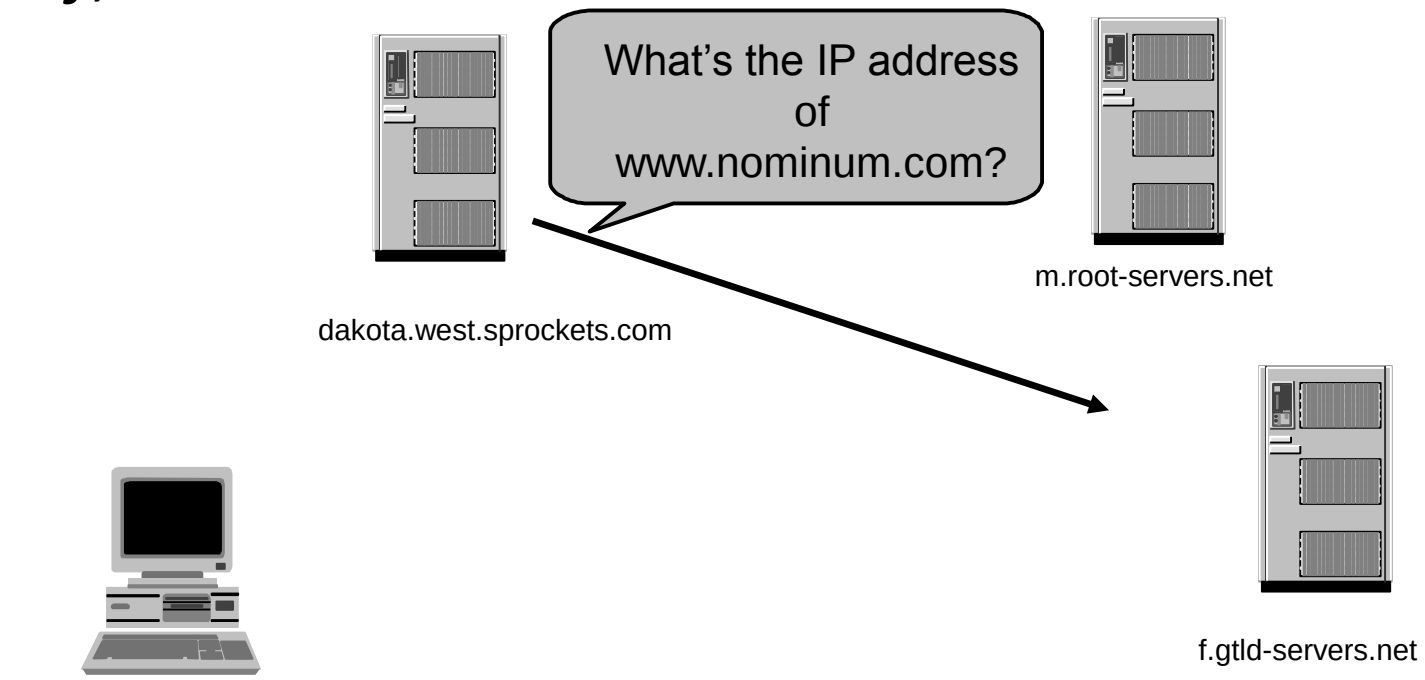
- The root server *m* refers *dakota* to the *com* name servers
- This type of response is called a “referral”




```
ping www.nominum.com.
```

The Resolution Process

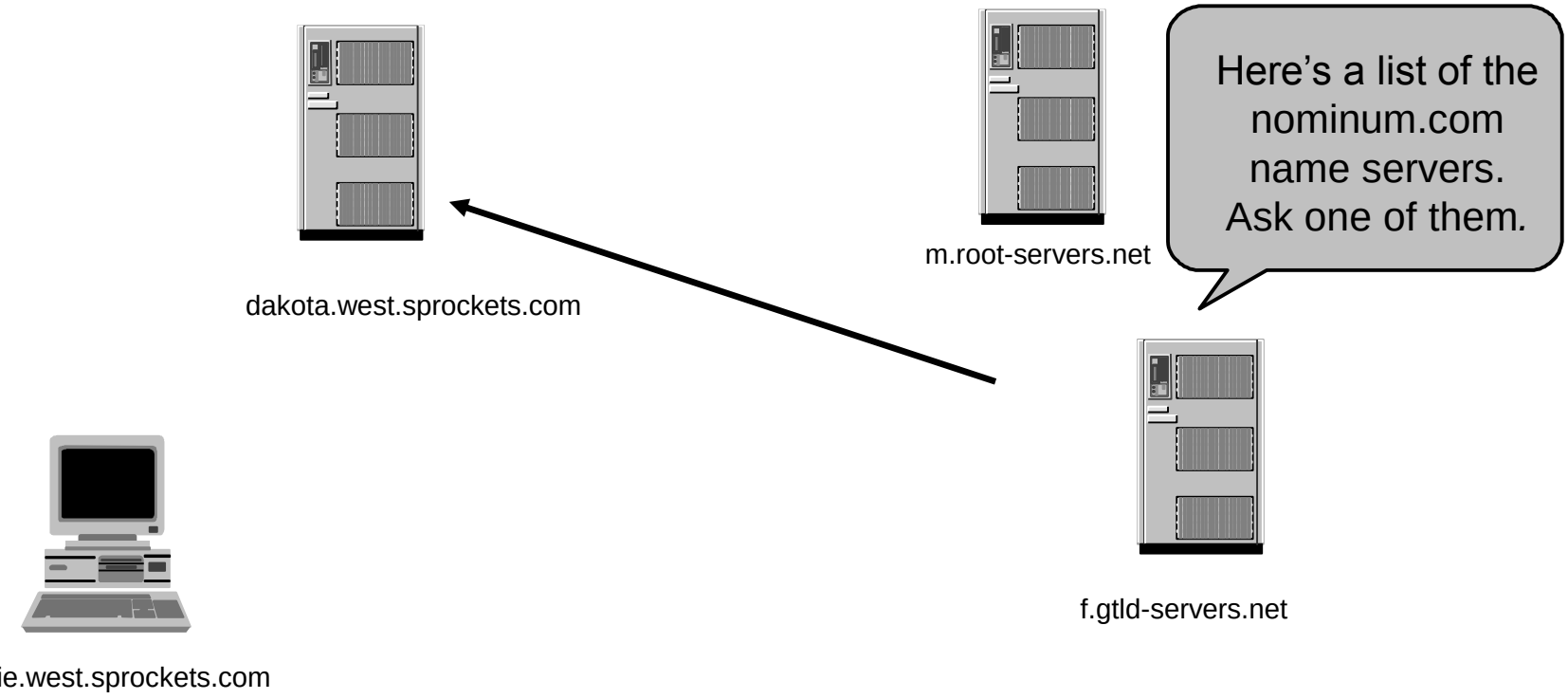
- The name server *dakota* asks a *com* name server, *f*, for *www.nominum.com's* address




```
ping www.nominum.com.
```

The Resolution Process

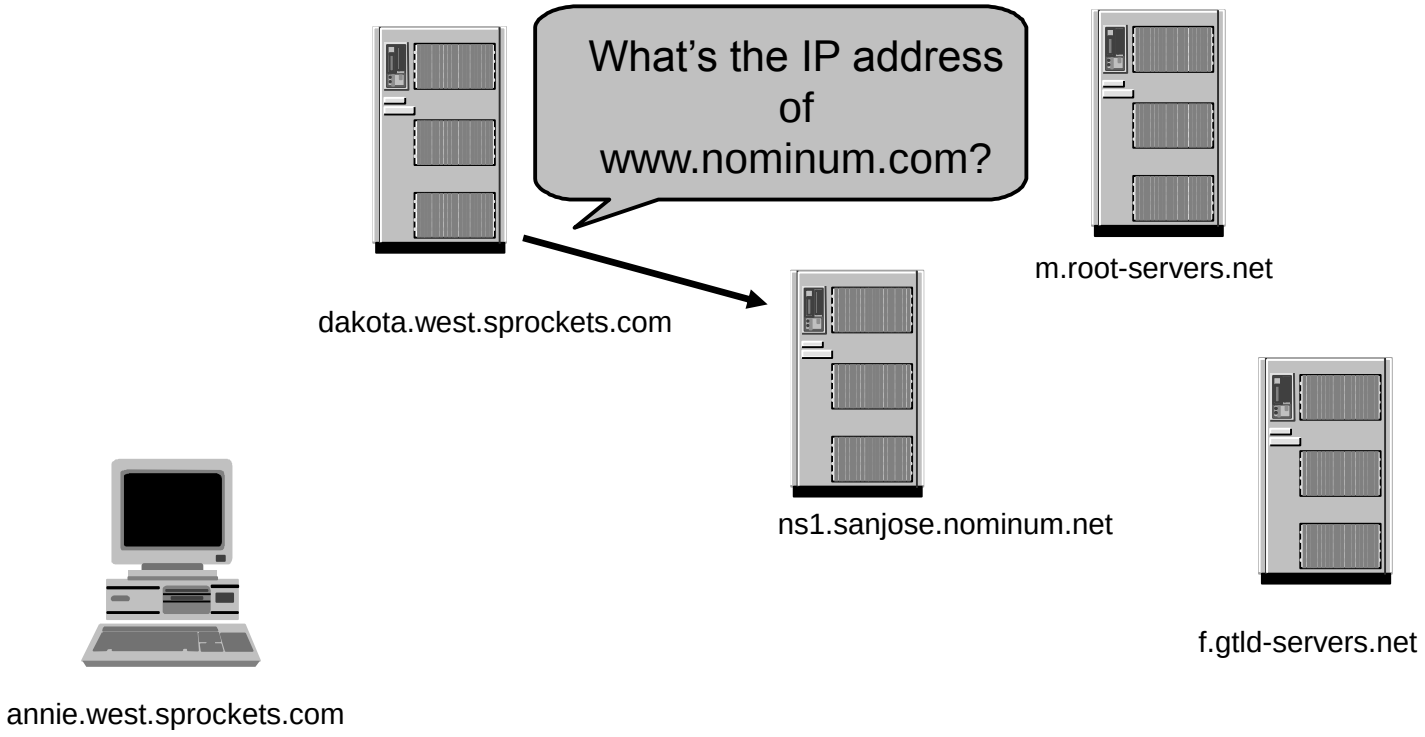
- The *com* name server *f* refers *dakota* to the *nominum.com* name servers




```
ping www.nominum.com.
```

The Resolution Process

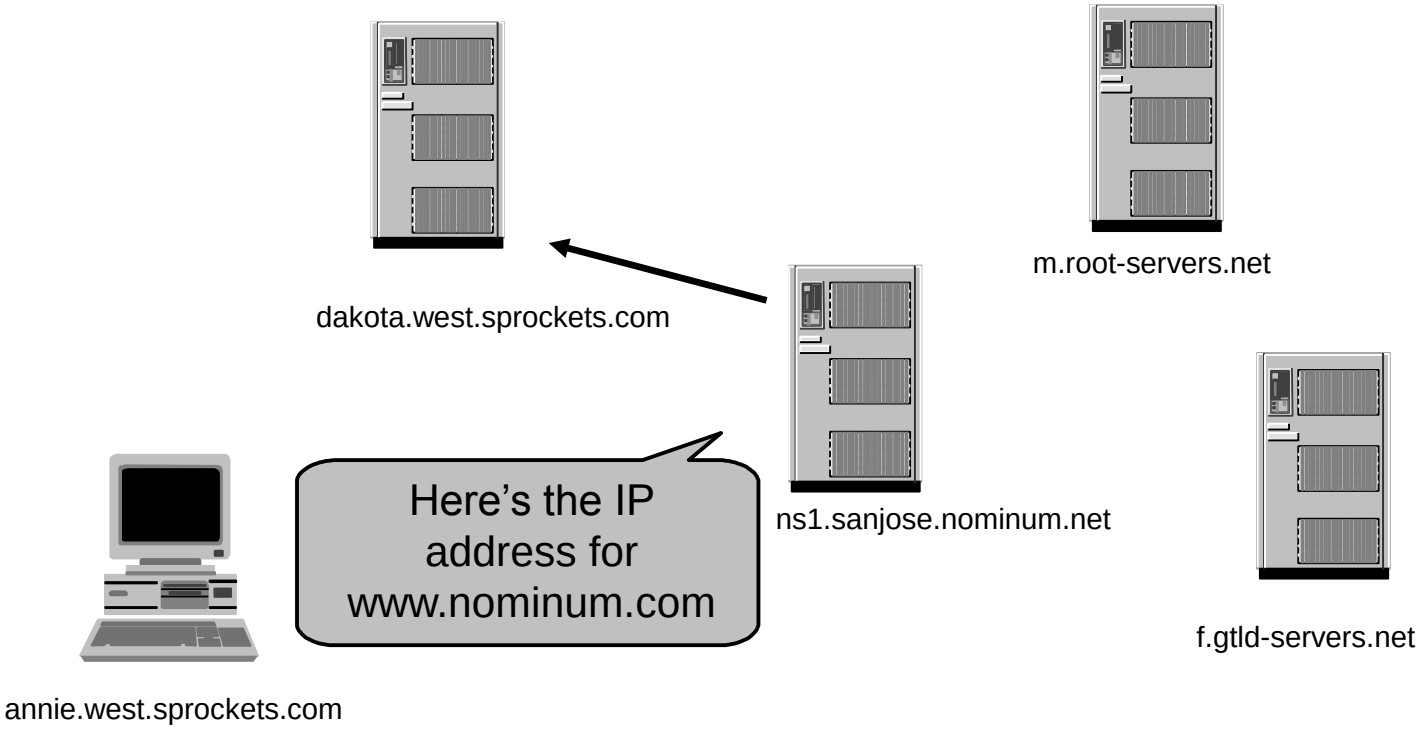
- The name server *dakota* asks a *nominum.com* name server, *ns1.sanjose*, for *www.nominum.com's* address




```
ping www.nominum.com.
```

The Resolution Process

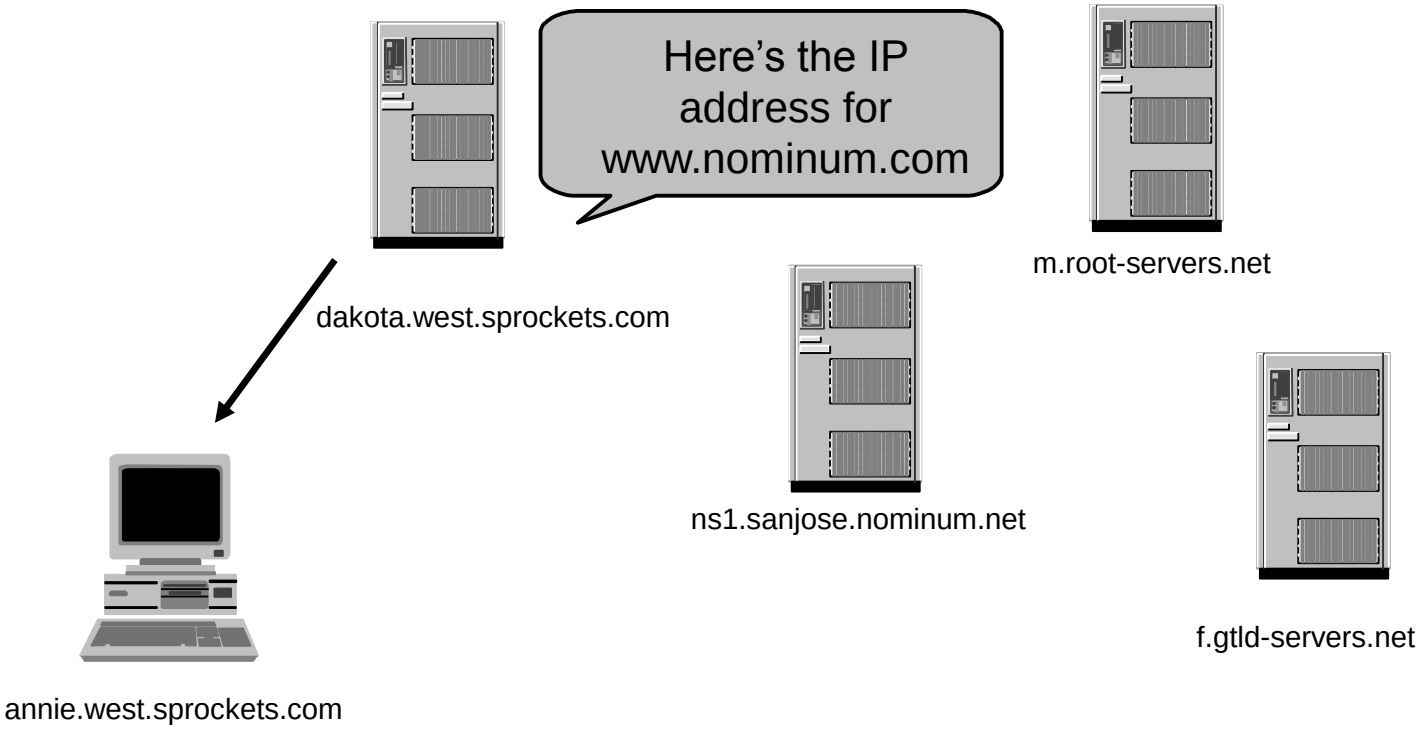
- The *nominum.com* name server *ns1.sanjose* responds with *www.nominum.com's* address




```
ping www.nominum.com.
```

The Resolution Process

- The name server *dakota* responds to *annie* with *www.nominum.com's* address




```
ping www.nominum.com.
```

Resolution Process (Caching)

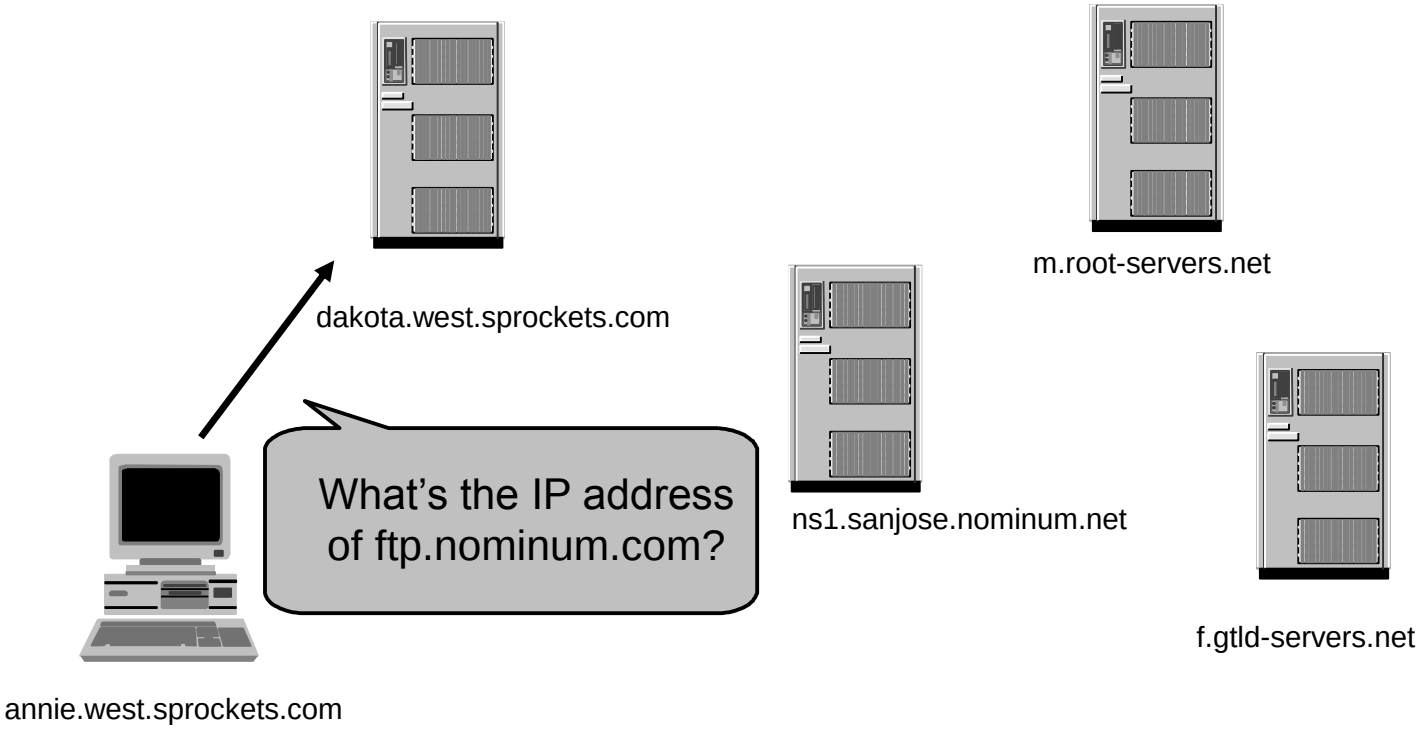
- After the previous query, the name server *dakota* now knows:
  - The names and IP addresses of the *com* name servers
  - The names and IP addresses of the *nominum.com* name servers
  - The IP address of *www.nominum.com*
- Let's look at the resolution process again

annie.west.sprockets.com

```
ping ftp.nominum.com.
```

Resolution Process (Caching)

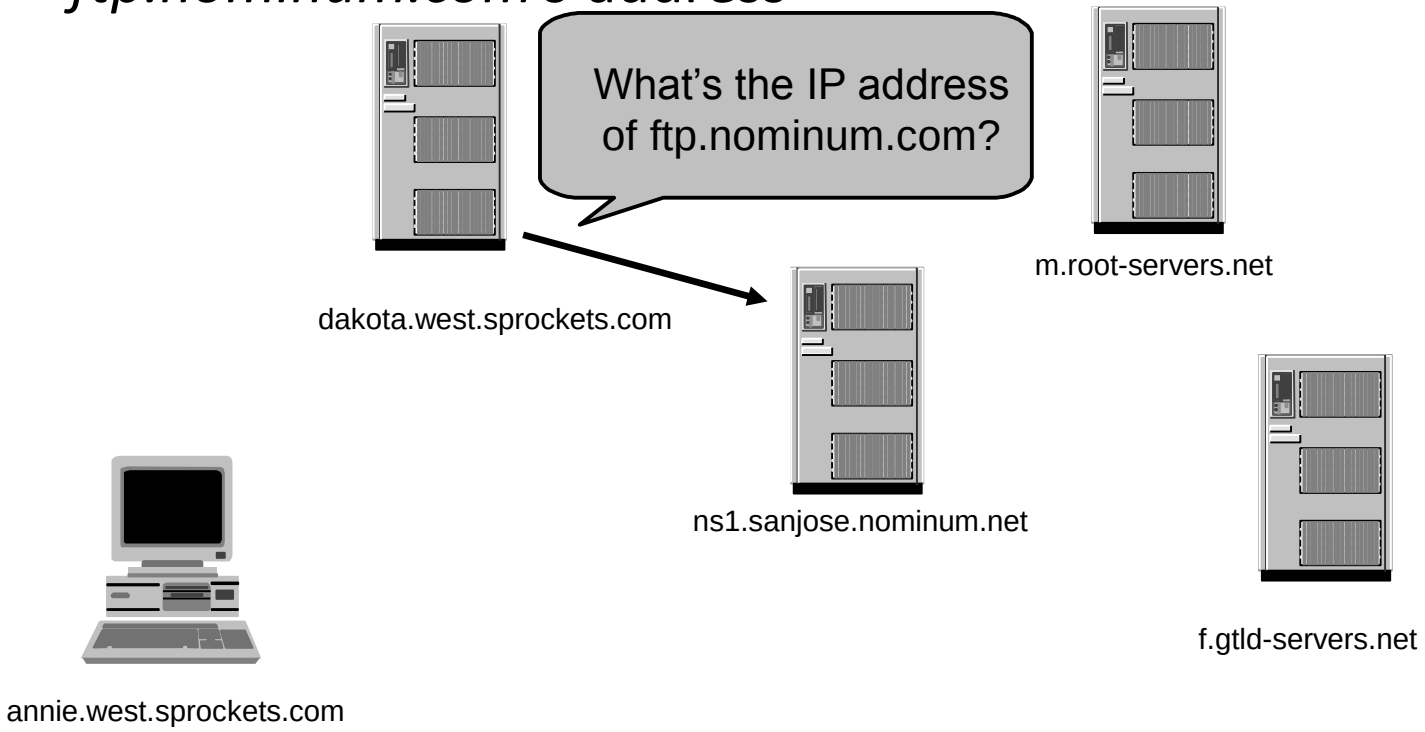
- The workstation *annie* asks its configured name server, *dakota,* for *ftp.nominum.com's* address




```
ping ftp.nominum.com.
```

Resolution Process (Caching)

- *dakota* has cached a NS record indicating *ns1.sanjose* is an *nominum.com* name server, so it asks it for *ftp.nominum.com's* address




```
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```
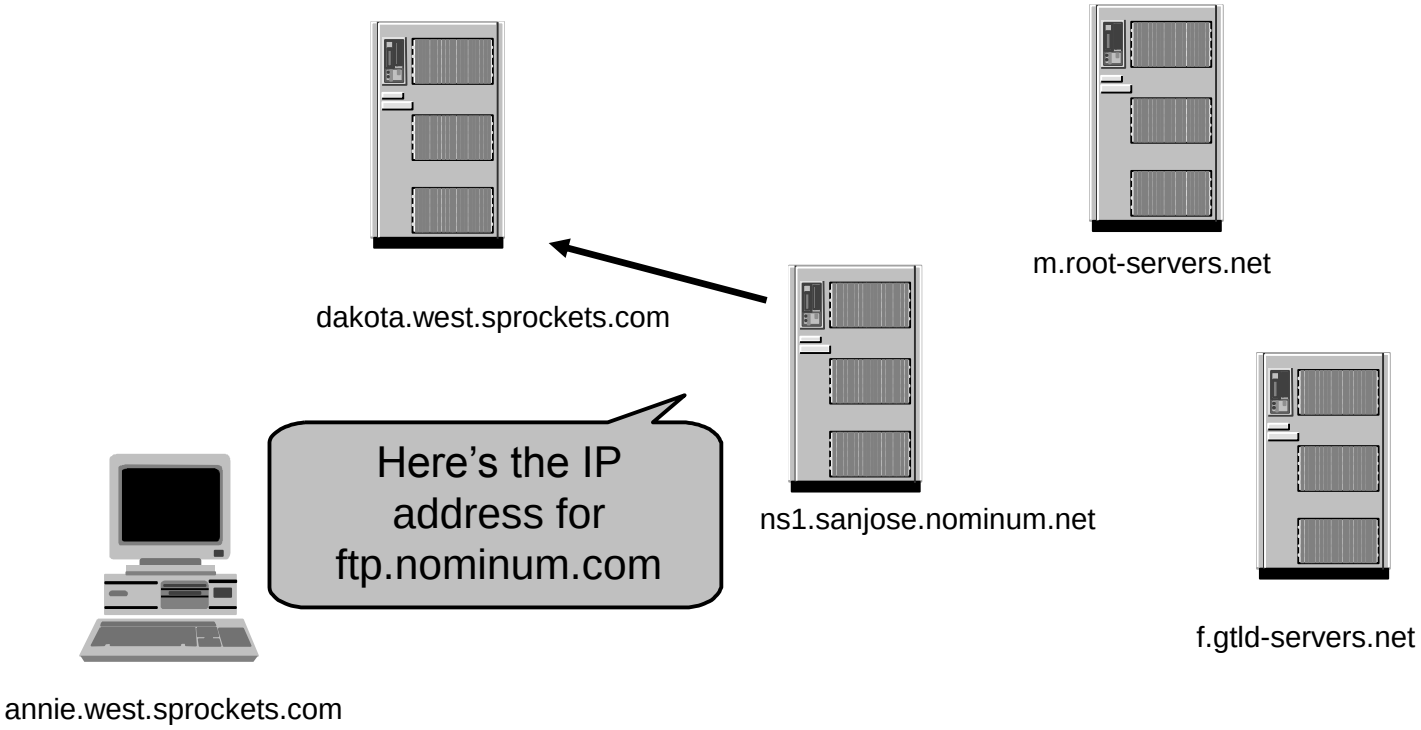

Resolution Process (Caching)

- The *nominum.com* name server *ns1.sanjose* responds with *ftp.nominum.com's* address

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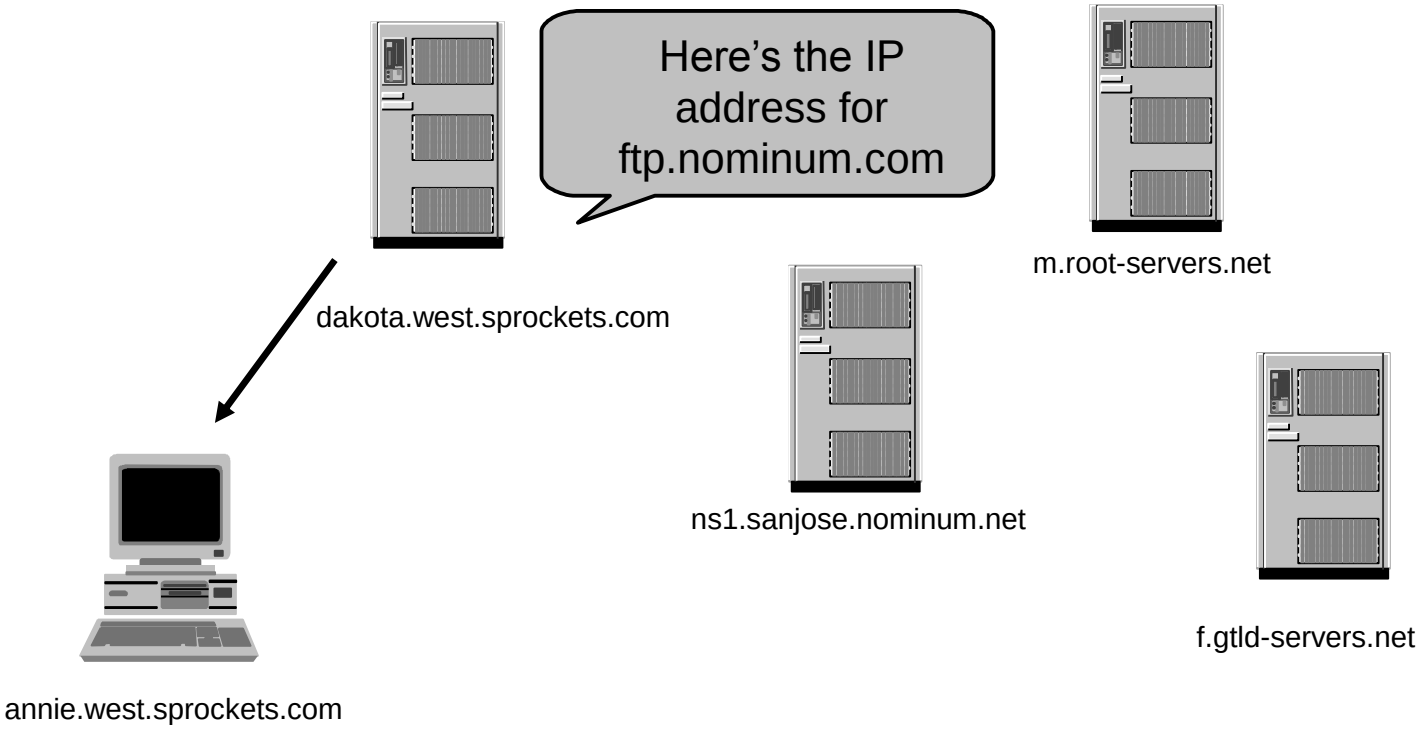
Resolution Process (Caching)

- The name server *dakota* responds to *annie* with *ftp.nominum.com's* address

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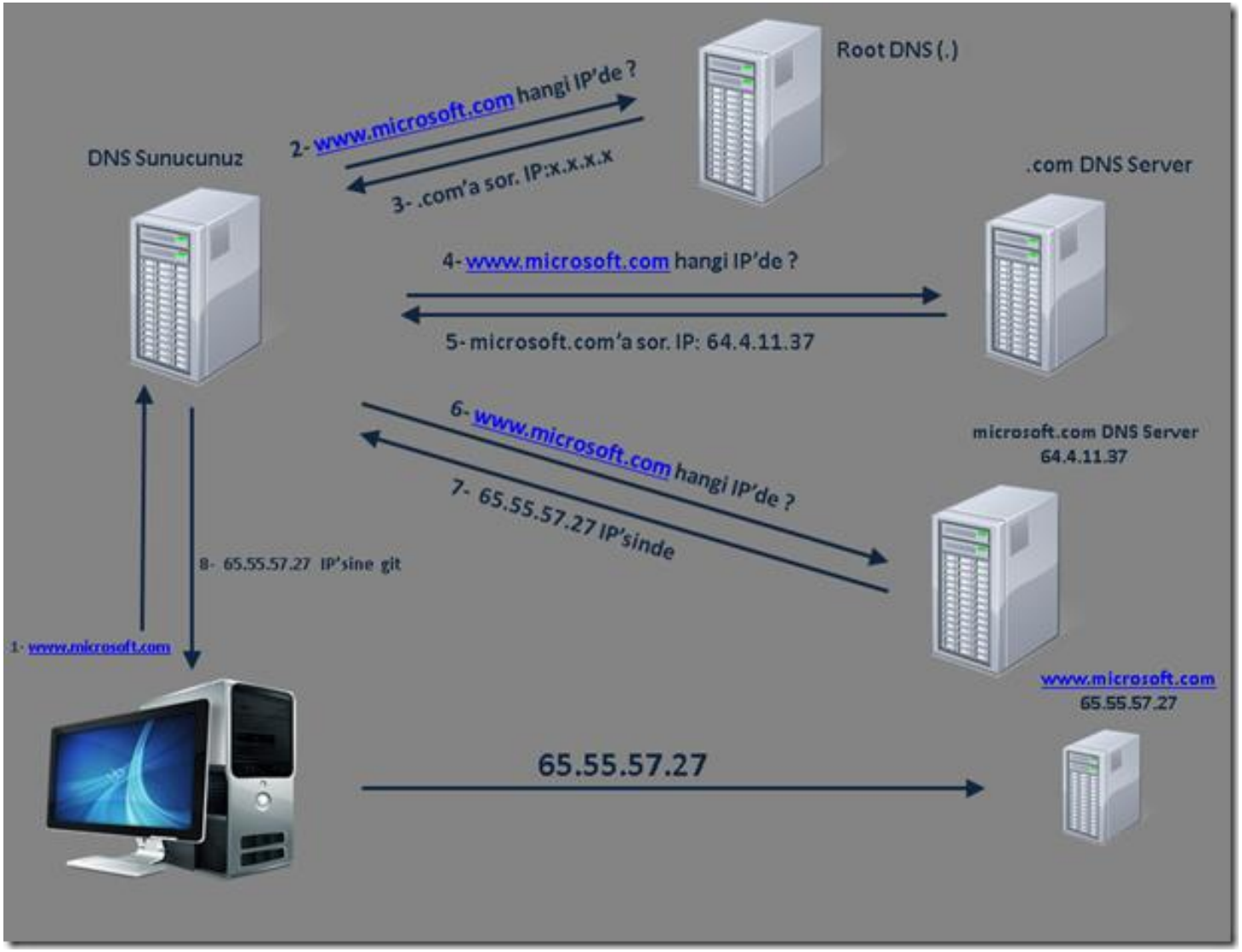
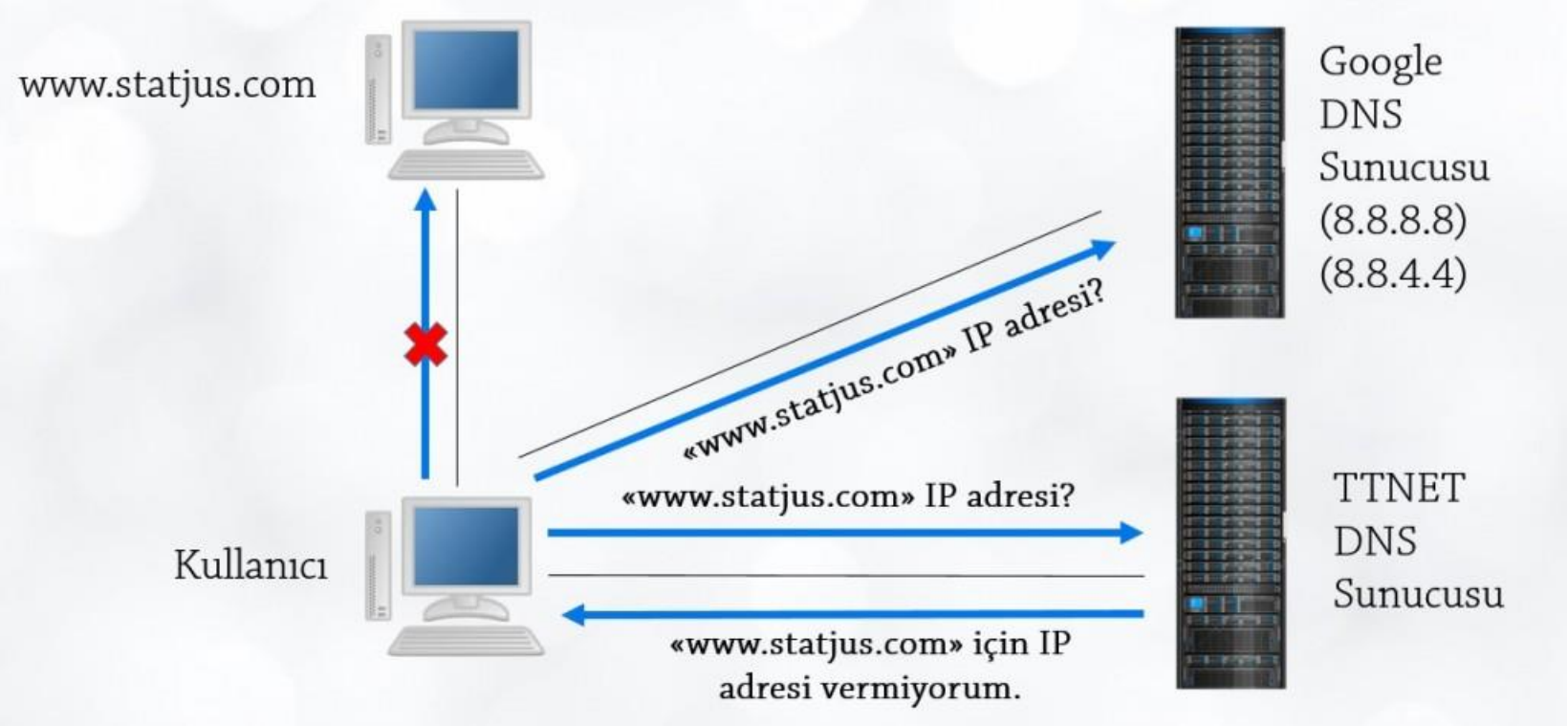
DNS | Name Resolution



Why Do We Need DNS Change?

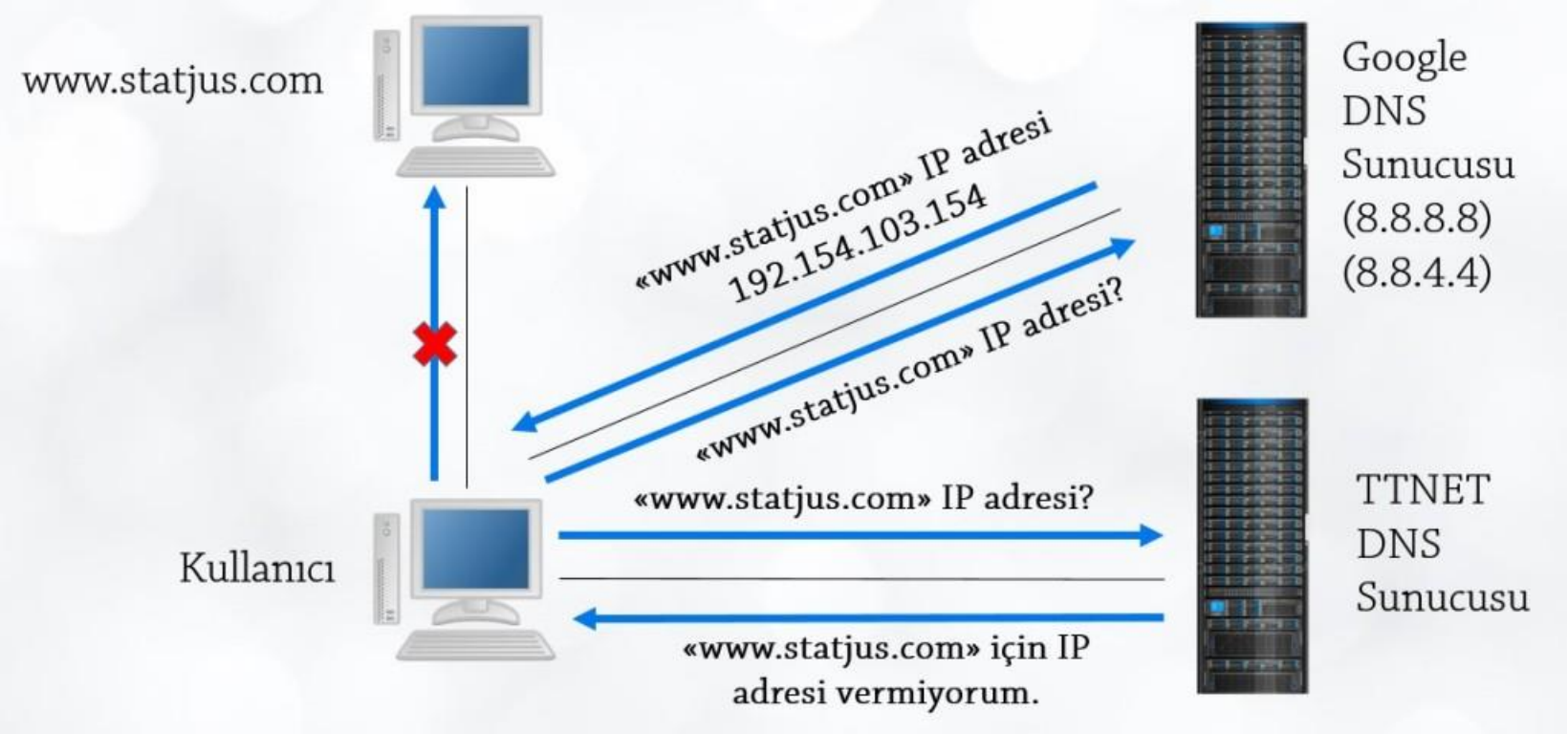
- When you connect to the Internet, your computer or modem requests via DHCP the primary and secondary DNS servers that your service provider assigns to you.
- By this means, you can surf the web by typing web site name instead of web site IP address.
- However, in some cases the DNS servers assigned by your service provider may cause problems.
- In such cases, you can get rid of DNS-related connectivity problems by entering one of your free DNS servers into your computer or modem.
- Another situation that you may need to change your DNS is that your current DNS server has no access to some sites.
- A significant number of such barriers can be resolved by changing the DNS server again.

Example



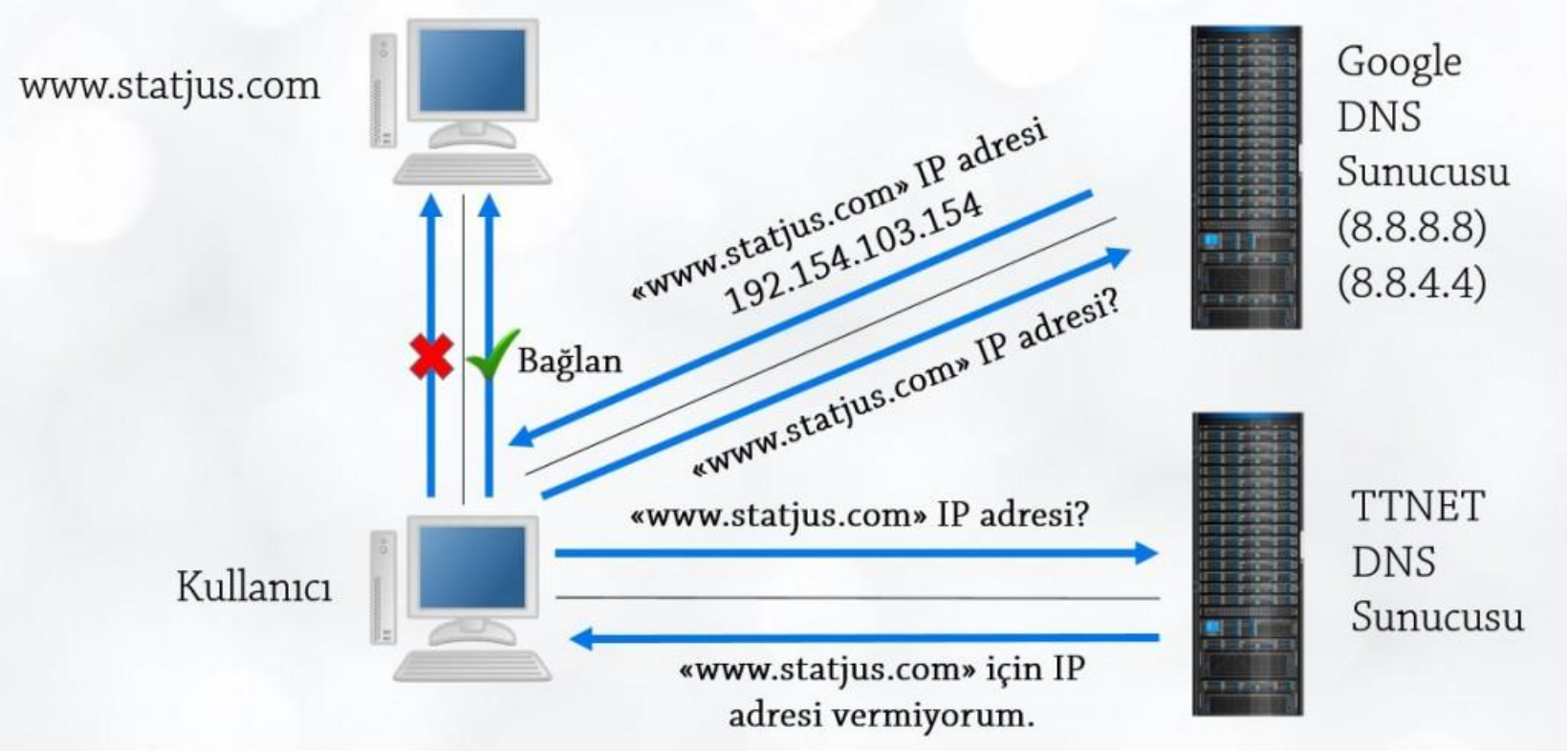
- Let's consider a Turkey where access to Statjus is blocked.
- For example, if a user who uses TTNET as a service provider requests Statjus's IP address from the default DNS address, this request will be rejected.

Example



In this case, the user who fixed the DNS address with Google DNS will send the domain query to Google and easily get the desired response from here.

Example



The user using the actual IP address obtained will be able to access Statjus seamlessly.

Questions?

ÖNEMLİ

Bu projeler lisansüstü öğrencilerinin hazırladığı çalışmalar olup tüm sorumluluk hazırlayan öğrencilere aittir. Öğrenciler hazırladığı projeye göre not almışlardır.