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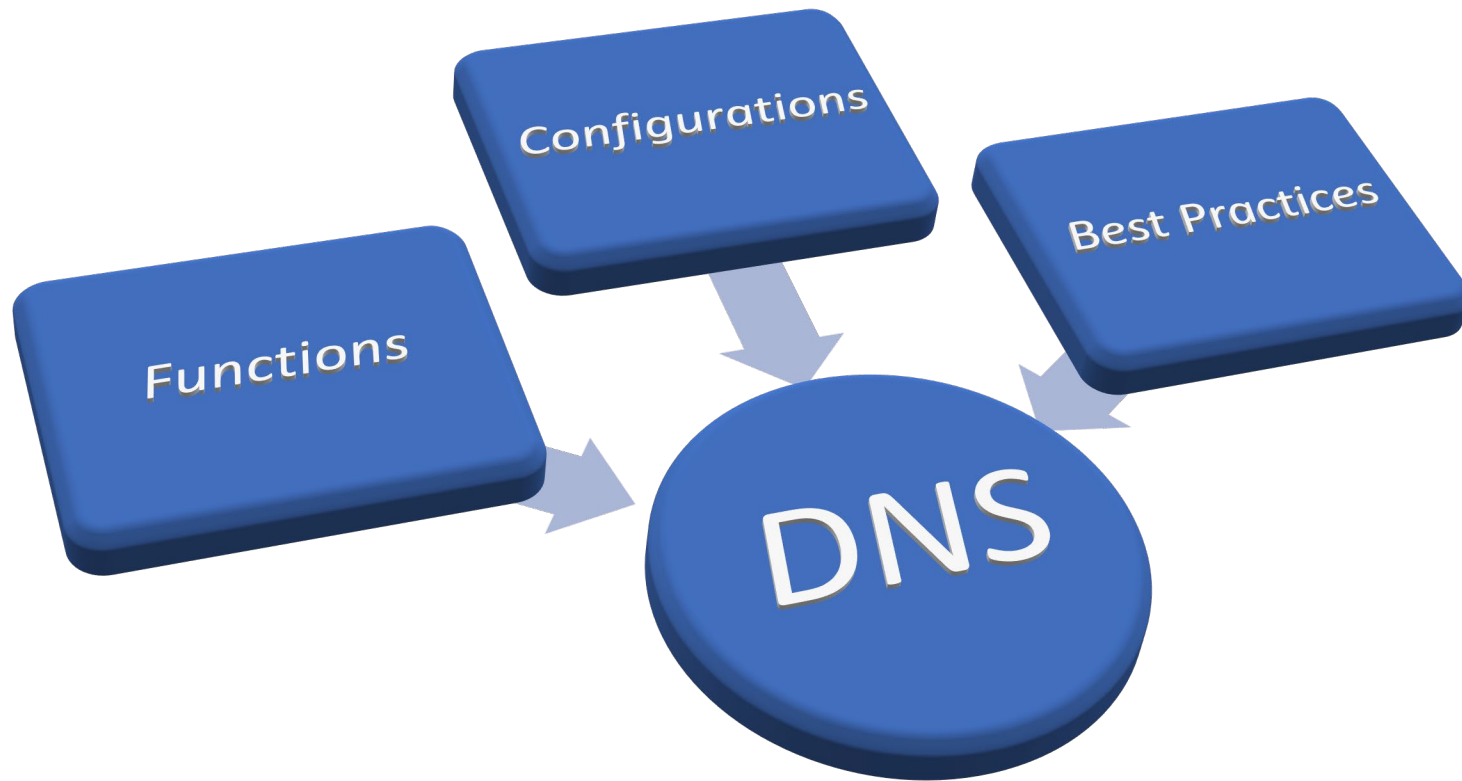
Trawsnewid Addysg, Trawsnewid Bywydau
Transforming Education, Transforming Lives

Domain Name Service

Network Operating Systems and Services
ACCA5023

Today's Discussion

Building upon our previous discussions on routing protocols, this week we shift our focus to Domain Name System (DNS). We will delve into the operations and functions of DNS, exploring its critical role in translating domain names to IP addresses and facilitating efficient communication across networks.



Our discussions will encompass the implementation of DNS in a Windows Server environment, covering the setup and configuration of DNS services. We will explore the various components of DNS, including zones, records, and name resolution mechanisms, to gain a comprehensive understanding of how DNS operates within an organizational network.



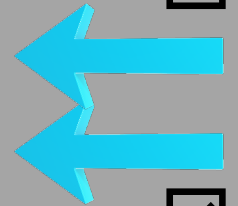
Before we dive into today's topics, let's briefly recap what we covered so far.

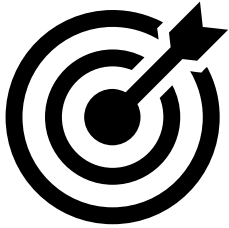
Milestone



Coursework 1:

- ✍ Choose your Hypervisor based on your research (Q.2.1)
- ✍ Download (use Evaluation Copy) and Setup your Virtual Machines – as per the topology (Q. 2.2)
- ✍ Research on IP Address (Based on the Group Discussion earlier)
- ✍ Download Debian Linux
- ✍ Configure IP Address for Windows Server and Client – Successful Ping
- ✍ Install Debian Server and Client
- ✍ **Configure IP Address for Debian Server and Client – Successful Ping**
- ✍ **Test and Troubleshoot (if required) your network.**
- ✍ Research on Routing and Network Services.
- ✍ **Submit your Coursework 1 – 03/03/2026**



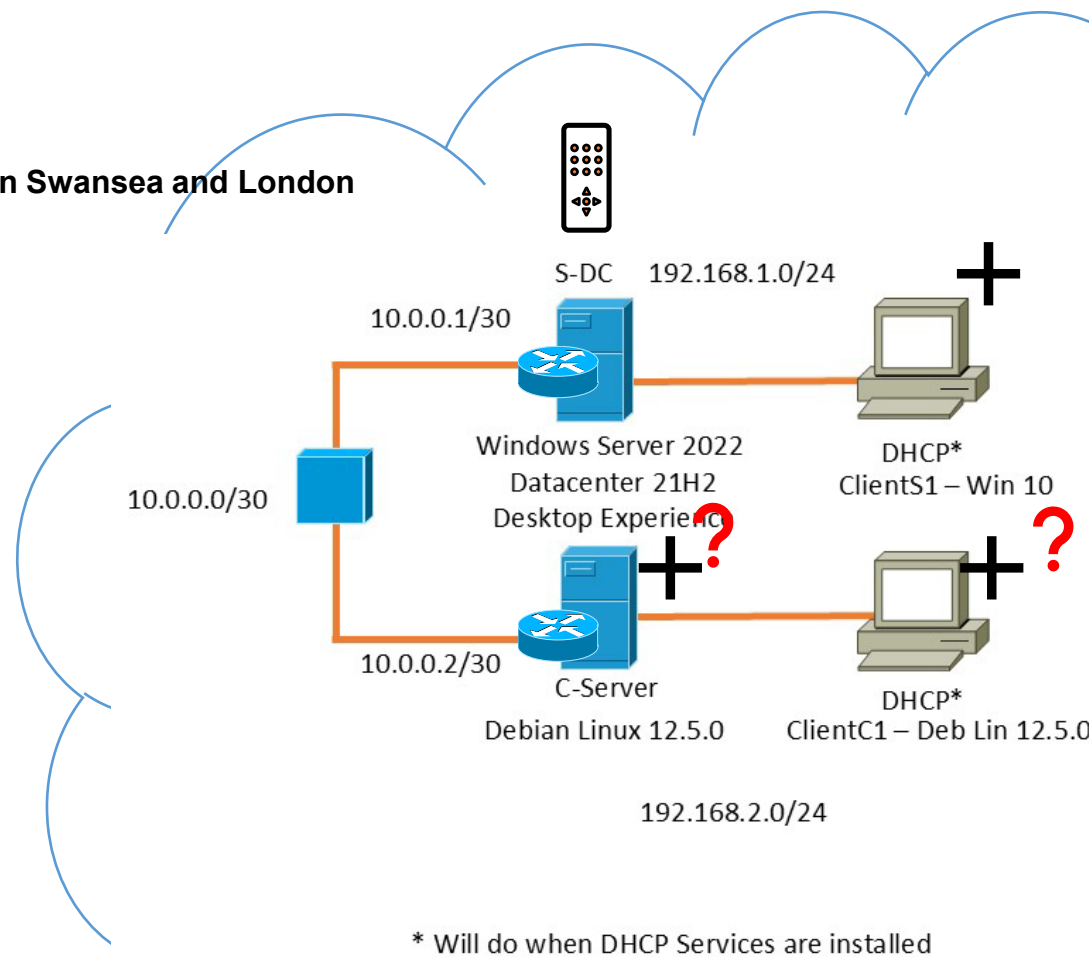


Coursework 2:

- ✍ Coursework 2 – Walkthrough
- ✍ Plan to work on your Topology – Gantt Chart !!! (Reading Week)
- ✍ Continue with your Topology – Firewall Rules/ Policies
- ✍ Installing RRAS Services, AD-DC, DNS, S2S VPN
- ✍ Configuring DHCP, Mount Second Disk, Export/ Create User Accounts
- ✍ Work on other Aspects (Sharing Disk Drive, IIS Server, RDS)
- ✍ Troubleshoot if necessary
- ✍ Submit your Coursework 2 – **11/05/2026** (Submission: 1500)



1. **Routing:**
2. **Domain Server (Swansea)**
3. **Encrypted Connection between Swansea and London**
4. **Users**
5. **Domain Membership**
6. **DHCP Server**
7. **Disk Drive**



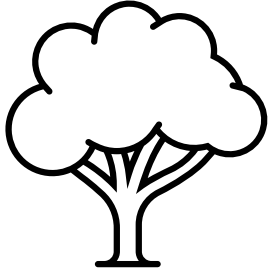
- Create a Domain and Promote DC
- Join Client S1 to the Domain
- RRAS
- S2S VPN
- IP Forwarding in Debian Server
- S2S VPN - Establish Connectivity between all devices
- Simultaneously, Firewalls, DNS could be done.
- Join Cardiff Network to your Domain (both Server and Client)
- Configure DHCP
- Mount disk drive to D:\SwanseaFiles
- User Accounts

- Sharing Disk Drive
- IIS Server
- RDS

* Will do when DHCP Services are installed

DOMAIN NAME SYSTEM

***Aged concept – From ARPANET age since 1960's.
Knowing names for numbers (here IP Addresses). In
1980's, DNS was documented in RFC***

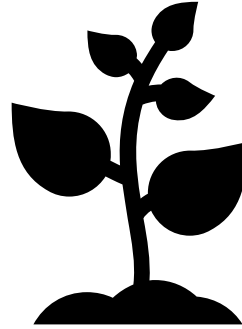


- DNS – Tree Structure (Hierarchical)
 - It is Hierarchical → name queries are passed up a “tree” of DNS servers until resolved
- Branch and Leaf
 - Each branch is a Root Zone, and Each leaf has one or more resource records

Zone

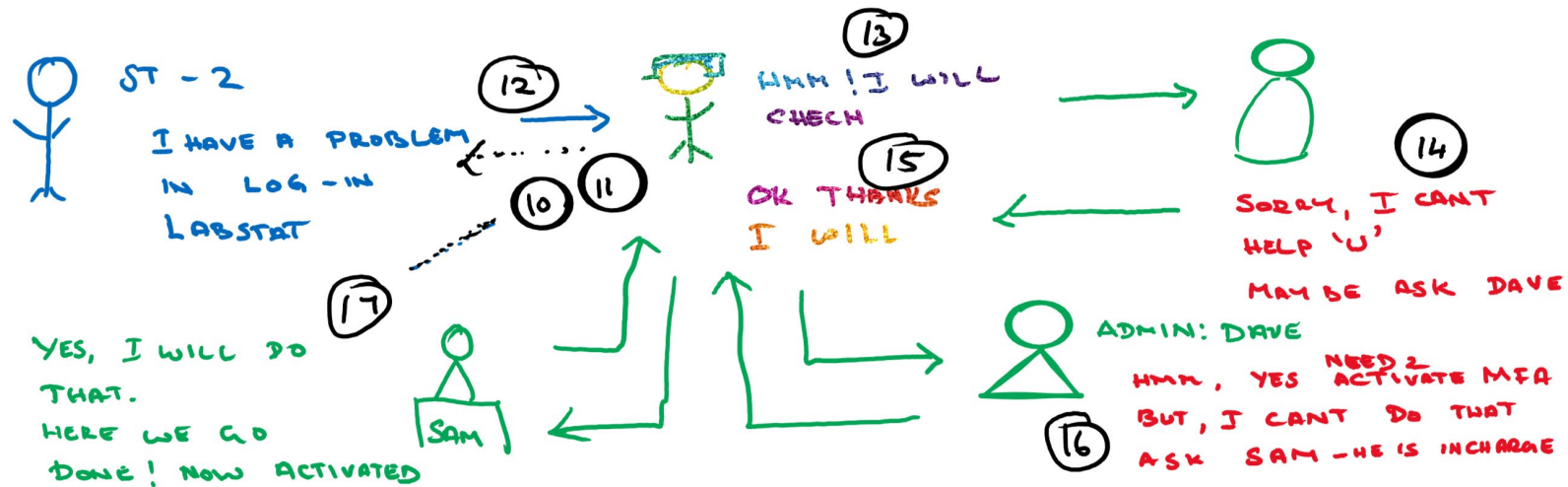
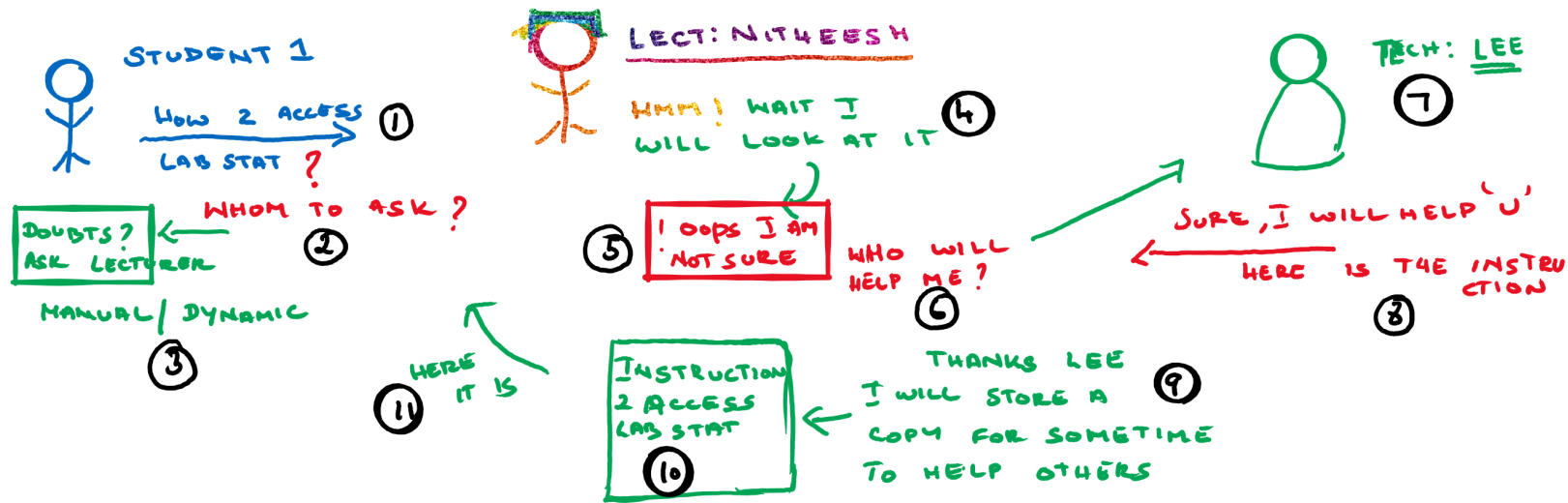
- Each zone represents a root domain or multiple domains and sub-domains.

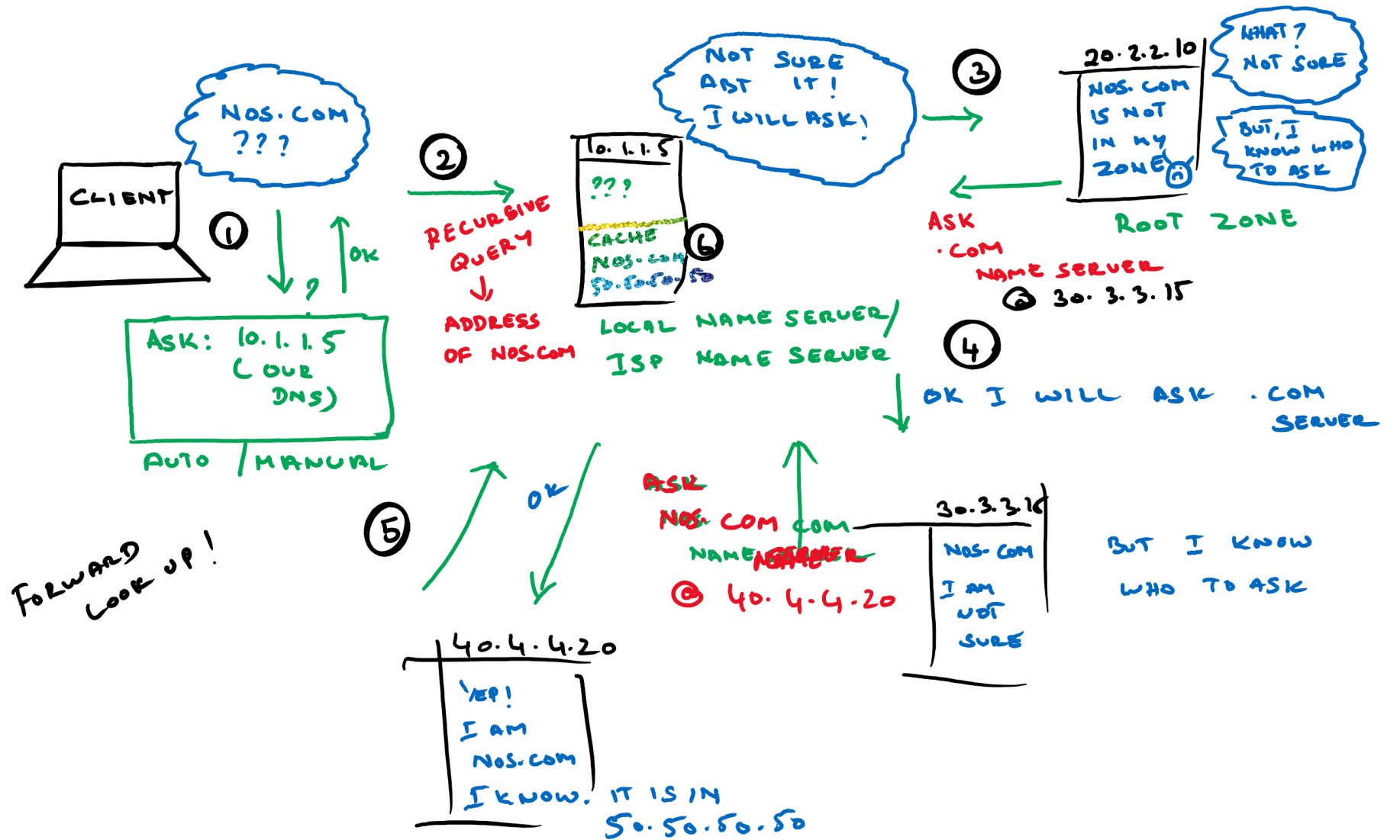
Portions of the Domain name space and domain name registration are the responsibility of InterNIC (Internet Network Information Centre)



- ✓ The name of the domains has labels separated by period. (nos.com)
- ✓ Resolves text names (nos.com) into IP addresses
- ✓ DNS is maintained by Database
 - ✓ The Database uses client/server architecture
 - ✓ The network hosts represents server's name
- ✓ Name to IP address mapping stored in a database that is distributed amongst many DNS servers
- ✓ Its size is unlimited → solving problem of very large host files
- ✓ Performance doesn't degrade as number of servers increases
- ✓ Localizes update traffic

DOMAIN NAME SYSTEM





DOMAIN NAME SYSTEM

Add Roles and Features Wizard

Select server roles

DESTINATION SERVER
WebServer

Before You Begin
Installation Type
Server Selection
Server Roles
Features
DNS Server
Confirmation
Results

Select one or more roles to install on the selected server.

Roles	Description
☐ Active Directory Certificate Services	Domain Name System (DNS) Server provides name resolution for TCP/IP networks. DNS Server is easier to manage when it is installed on the same server as Active Directory Domain Services. If you select the Active Directory Domain Services role, you can install and configure DNS Server and Active Directory Domain Services to work together.
☐ Active Directory Domain Services	
☐ Active Directory Federation Services	
☐ Active Directory Lightweight Directory Services	
☐ Active Directory Rights Management Services	
☐ Device Health Attestation	
☐ DHCP Server	
☒ DNS Server	
☐ Fax Server	
▸ ☒ File and Storage Services (1 of 12 installed)	
☐ Host Guardian Service	
☐ Hyper-V	
☐ Network Policy and Access Services	
☐ Print and Document Services	
☐ Remote Access	
☐ Remote Desktop Services	
☐ Volume Activation Services	
☐ Web Server (IIS)	
☐ Windows Deployment Services	
☐ Windows Server Update Services	

< Previous Next > Install Cancel

A delegation for this DNS server cannot be created because the authoritative parent zone cannot be found... Show more X

Deployment Configuration
Domain Controller Options
DNS Options
Additional Options
Paths
Review Options
Prerequisites Check
Installation
Results

Specify DNS delegation options
☐ Create DNS delegation

More about DNS delegation

< Previous Next > Install Cancel

```
DNS Servers . . . . . : 79.79.79.79
                        79.79.79.80
```

```
GNU nano 7.2 /etc/resolv.conf *
domain localdomain
search localdomain
nameserver 192.168.1.1
nameserver 8.8.8.8_
```

Internet Protocol Version 4 (TCP/IPv4) Properties

General

You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

☐ Obtain an IP address automatically

☒ Use the following IP address:

IP address: 192 . 168 . 1 . 10

Subnet mask: 255 . 255 . 255 . 0

Default gateway: . . .

☐ Obtain DNS server address automatically

☒ Use the following DNS server addresses:

Preferred DNS server: 192 . 168 . 1 . 1

Alternate DNS server: 8 . 8 . 8 . 8

☐ Validate settings upon exit

Advanced...

OK Cancel

```
GNU nano 7.2 /etc/network/interfaces *
# This file describes the network interfaces available on your system
# and how to activate them. For more information, see interfaces(5).

source /etc/network/interfaces.d/*

# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
# This is the NAT Interface
allow-hotplug ens33
iface ens33 inet dhcp

#This is the External Network connected to SWDC
allow-hotplug ens34
iface ens34 inet static
address 10.0.0.2
netmask 255.255.255.252

#This is the Internal Network connected to Linux Client
allow-hotplug ens35
iface ens35 inet static
address 192.168.2.1
netmask 255.255.255.0
dns-nameservers 192.168.1.1 8.8.8.8_
```

Internet Protocol Version 4 (TCP/IPv4) Properties

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You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.

☐ Obtain an IP address automatically

☒ Use the following IP address:

IP address: 192 . 168 . 1 . 1

Subnet mask: 255 . 255 . 255 . 0

Default gateway: . . .

☐ Obtain DNS server address automatically

☒ Use the following DNS server addresses:

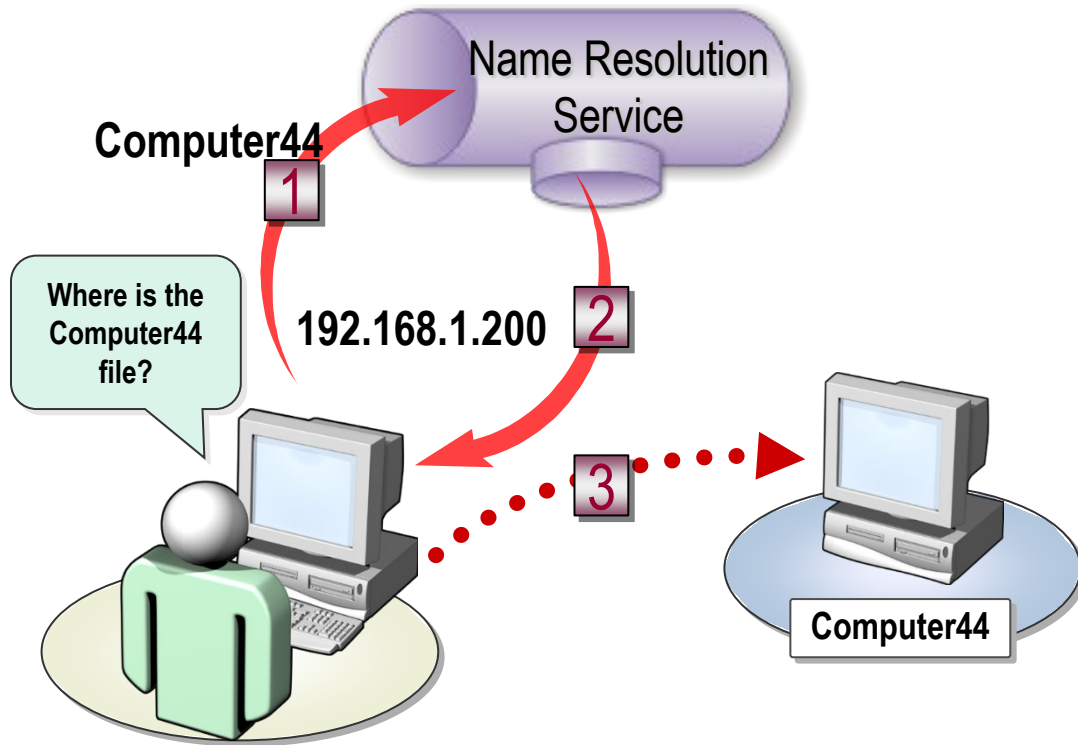
Preferred DNS server: 127 . 0 . 0 . 1

Alternate DNS server: . . .

☐ Validate settings upon exit

Advanced...

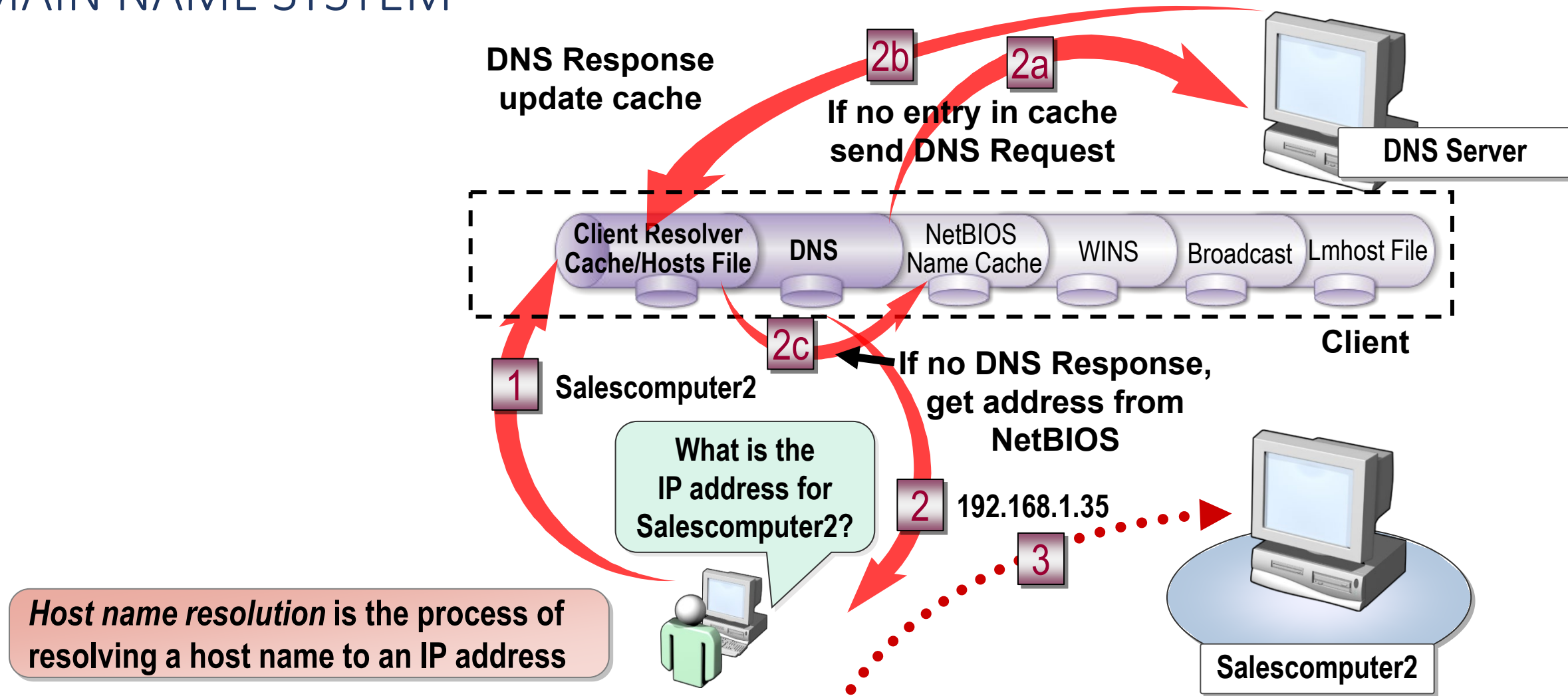
DOMAIN NAME SYSTEM



- Network Basic Input/Output System (NETBIOS)
 - Windows puts the NETBIOS information within a TCP/IP Packet. But Why?
 - ✓ To communicate outside my subnetwork.
 - ✓ That's OK. But How?
 - ✓ Using various protocols. Which?
 - ✓ Name Service – TCP 137, UDP 137
 - ✓ Session Service (Connection oriented) TCP 139
 - ✓ Datagram Service (Connection less) UDP 138
- DNS is also used to resolve names but, on an Internet wide basis

Machine must check DNS name resolution before NetBIOS name resolution

DOMAIN NAME SYSTEM



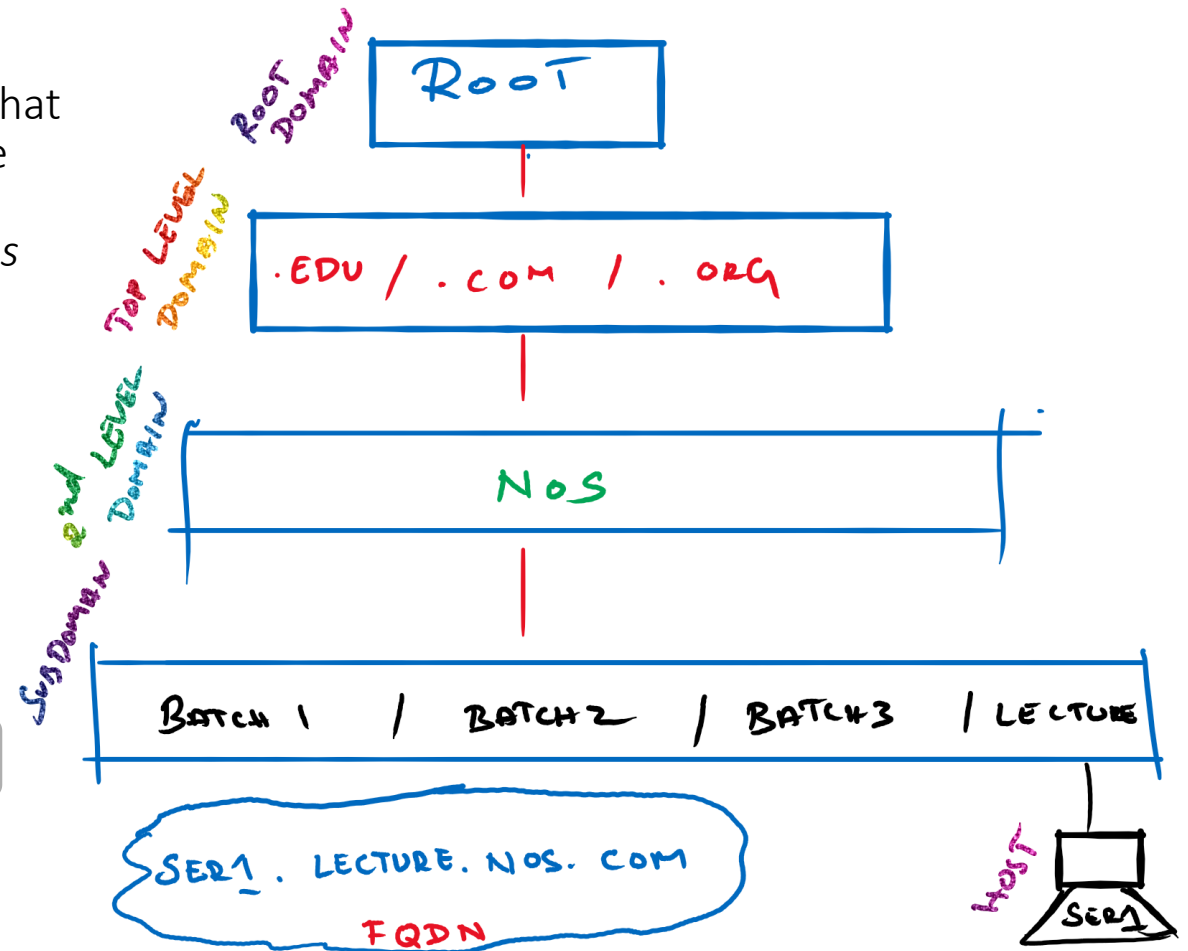
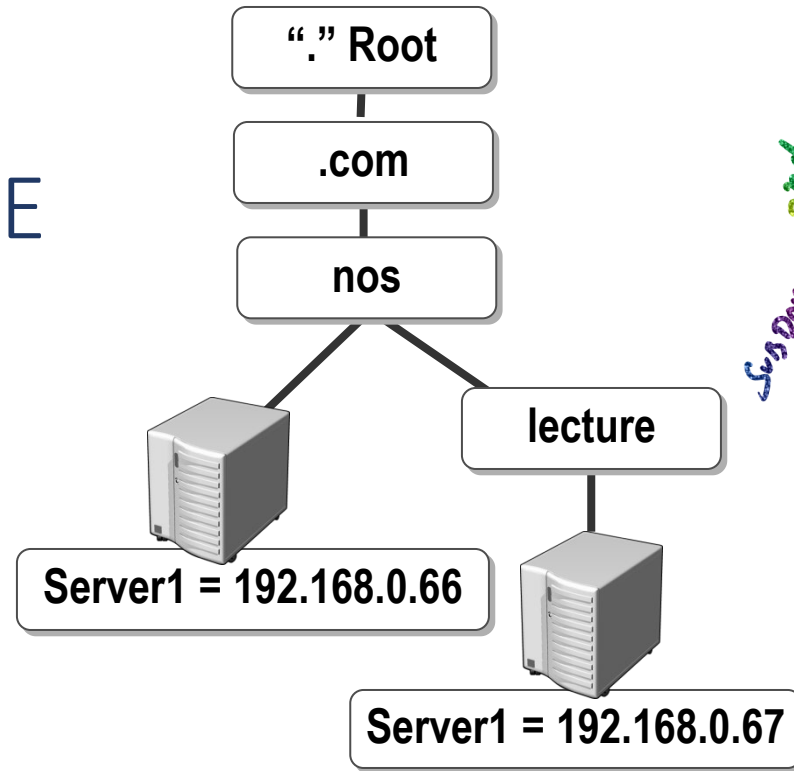
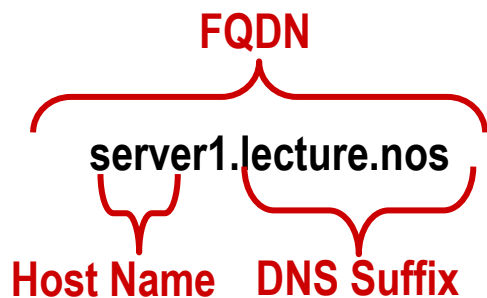
DOMAIN NAME SYSTEM: namespace

- Logical Tree called the ***domain namespace***
- ***Domain is a tree or subtree*** within the overall domain namespace
 - Root domain - *root node, unnamed(null) sometimes represented as a trailing period* e.g. www.nos.com
 - Top-level domain - *indicates type of organization or geographical region*
 - .com is company | .edu is educational | .org is organisation
 - Second-level domain - *Assigned and registered by InterNIC* e.g. nos, uwtsd etc
- ***Subdomain is an additional domain*** registered with InterNIC
 - Large companies can request multiple domains to represent different departments e.g. .batch1.nos.com
- ***Fully Qualified Domain Name (FQDN)*** is a name which states with absolute certainty the location in the domain name space → maps to an IP address

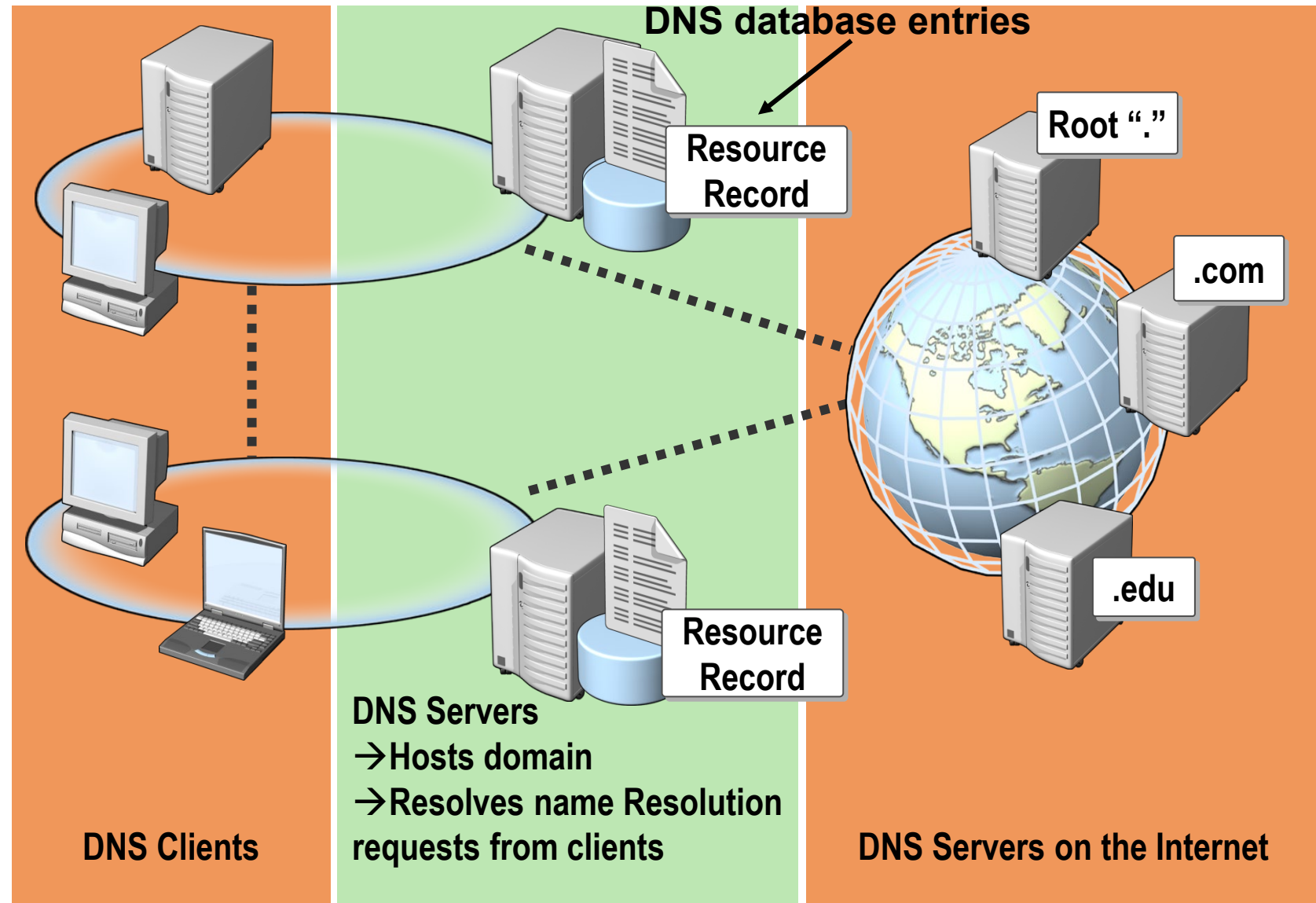
- A *host name* is the DNS name of a device on a network
- A *fully qualified domain name (FQDN)* is a domain name that uniquely identifies a machine in the domain namespace tree
- Machines can have the same names within different domains

server1.lecture.nos
server1.batch1.nos

DOMAIN NAME SYSTEM



DOMAIN NAME SYSTEM



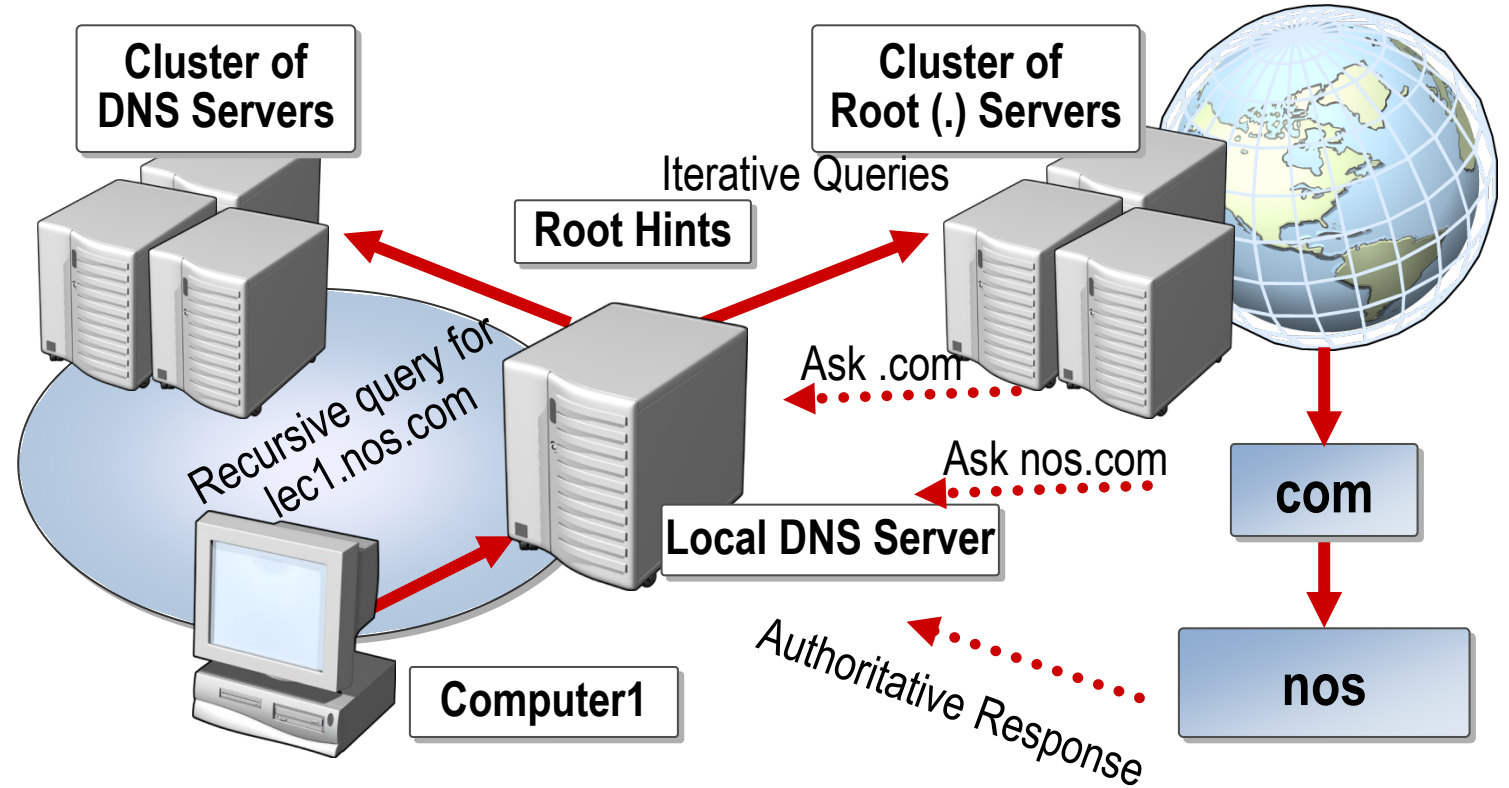
DOMAIN NAME SYSTEM: query

- A *query* is a request for name resolution to a DNS server. Two types of queries: recursive and Iterative
- *DNS clients and DNS servers both initiate queries* for name resolution
- An **authoritative DNS** server for the namespace (i.e. responsible for the domain):
 - ✓ Check the cache, check the zone, and return the requested IP address
 - ✓ Return an authoritative, “No”
 - ✓ Can have more than one authoritative DNS server for a domain
 - ✓ The client/server picks one from the list
 - ✓ Recorded in the parent domain DNS Servers database as NS records
- A **non-authoritative DNS** server for the namespace (i.e. some other DNS server is responsible for the domain that the host is on):
 - Forward the unresolvable query to a specific query server called a Forwarder
 - Use root hints to locate an answer for the query

DOMAIN NAME SYSTEM: query

- *Root hints* are DNS resource records stored on a DNS server that list the IP addresses for the DNS root servers that InterNIC maintains on the Internet
- System32\Dns\Cache.dns

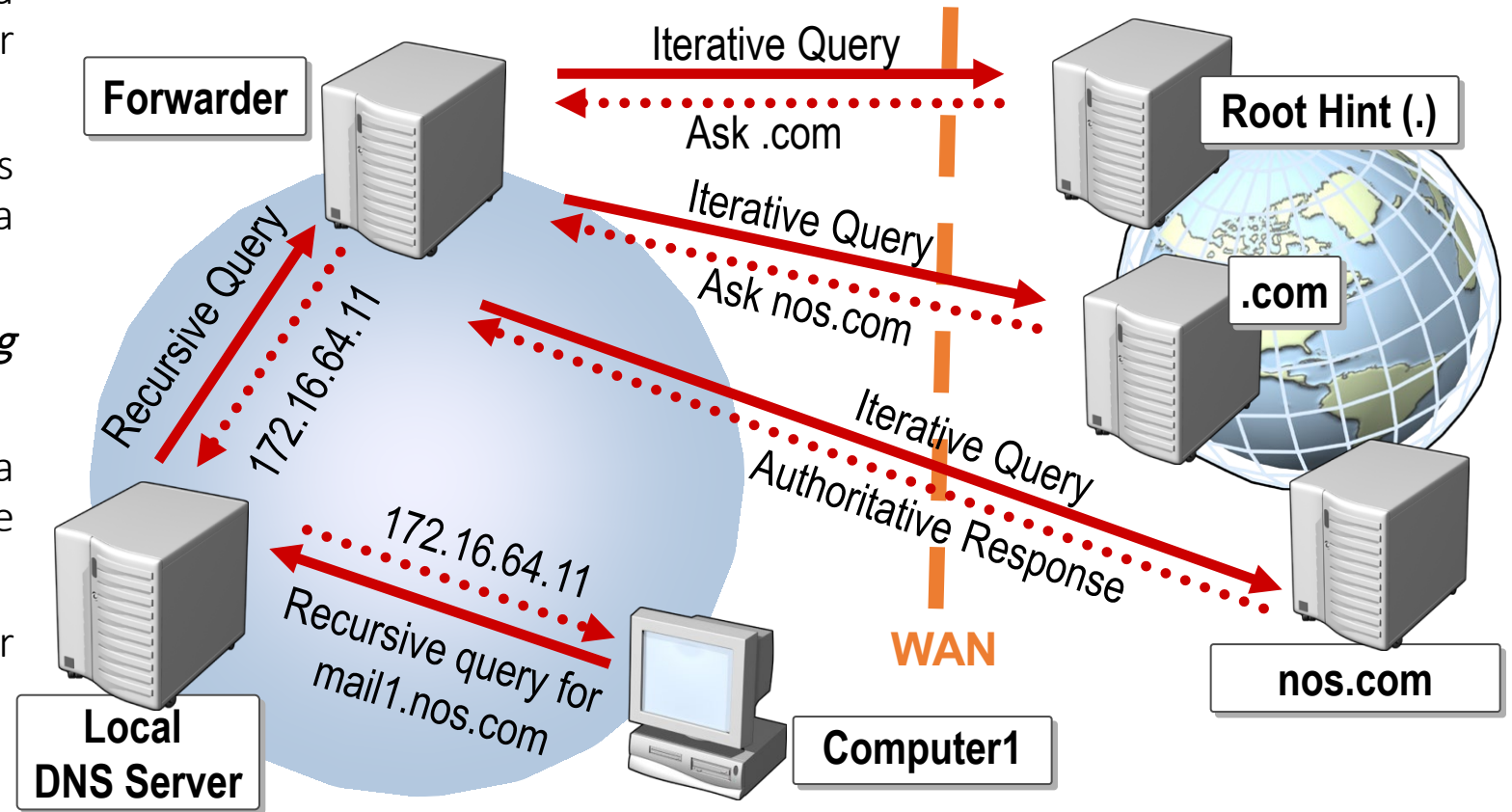
- An *iterative* query is a query made to a DNS server in which the DNS client requests the best answer that the DNS server can provide without seeking further help from other DNS servers.
- The result of an iterative query is often a referral to another DNS server lower in the DNS tree.
- Typically, an iterative query is made by a DNS server to another DNS server when a DNS client makes a recursive query.



DOMAIN NAME SYSTEM: cache

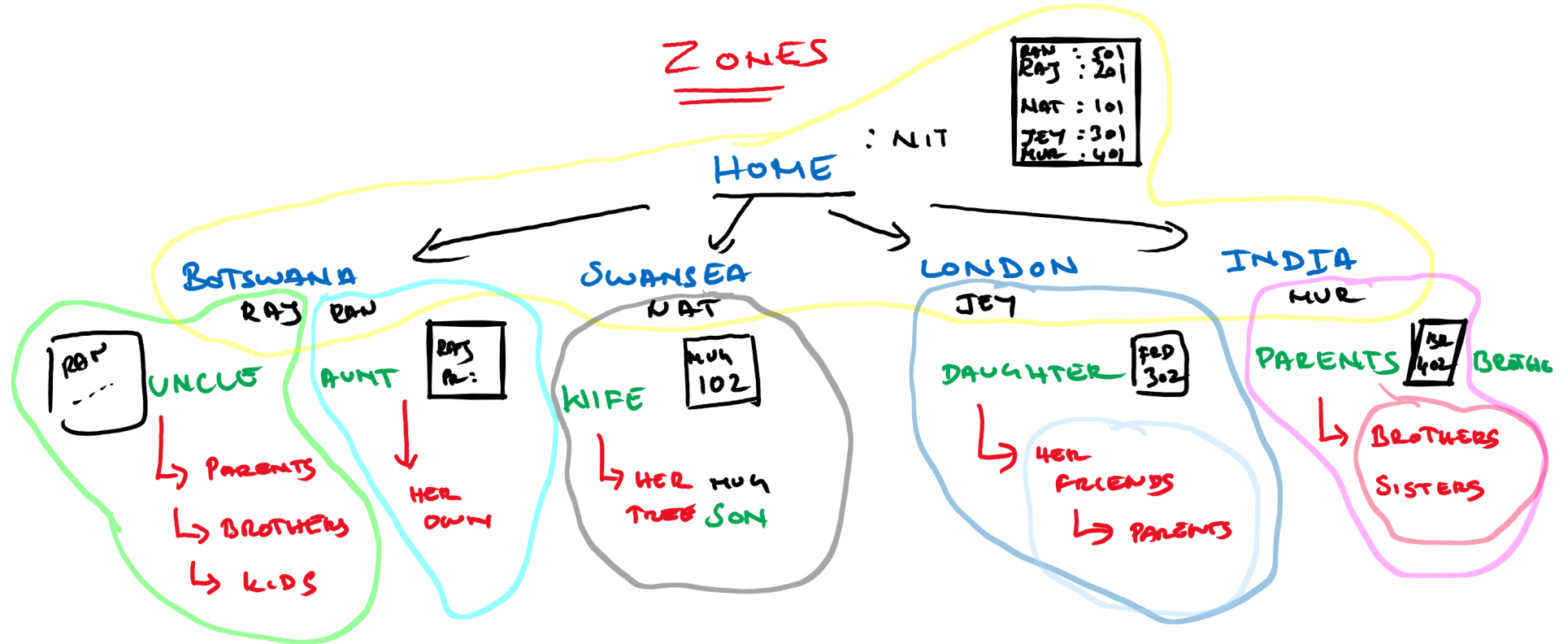
- *Caching* is the process of temporarily storing recently accessed information in a special memory subsystem for quicker access
- Server caches answers to all queries (including top-level, second-level, etc) for a given time (TTL)
- *Can set a DNS domain when configuring forwarding*
- Like, If you ever need to need to resolve a name for nos domain, then don't go to the Internet – ask this server (forwarder)
- you can define your own domain for your local network using this process
- may even override an existing domain
- e.g. google.com, for your local network

Caching Table		
Host Name	IP Address	TTL
Lect.nos.com	10.1.1.10	28 second

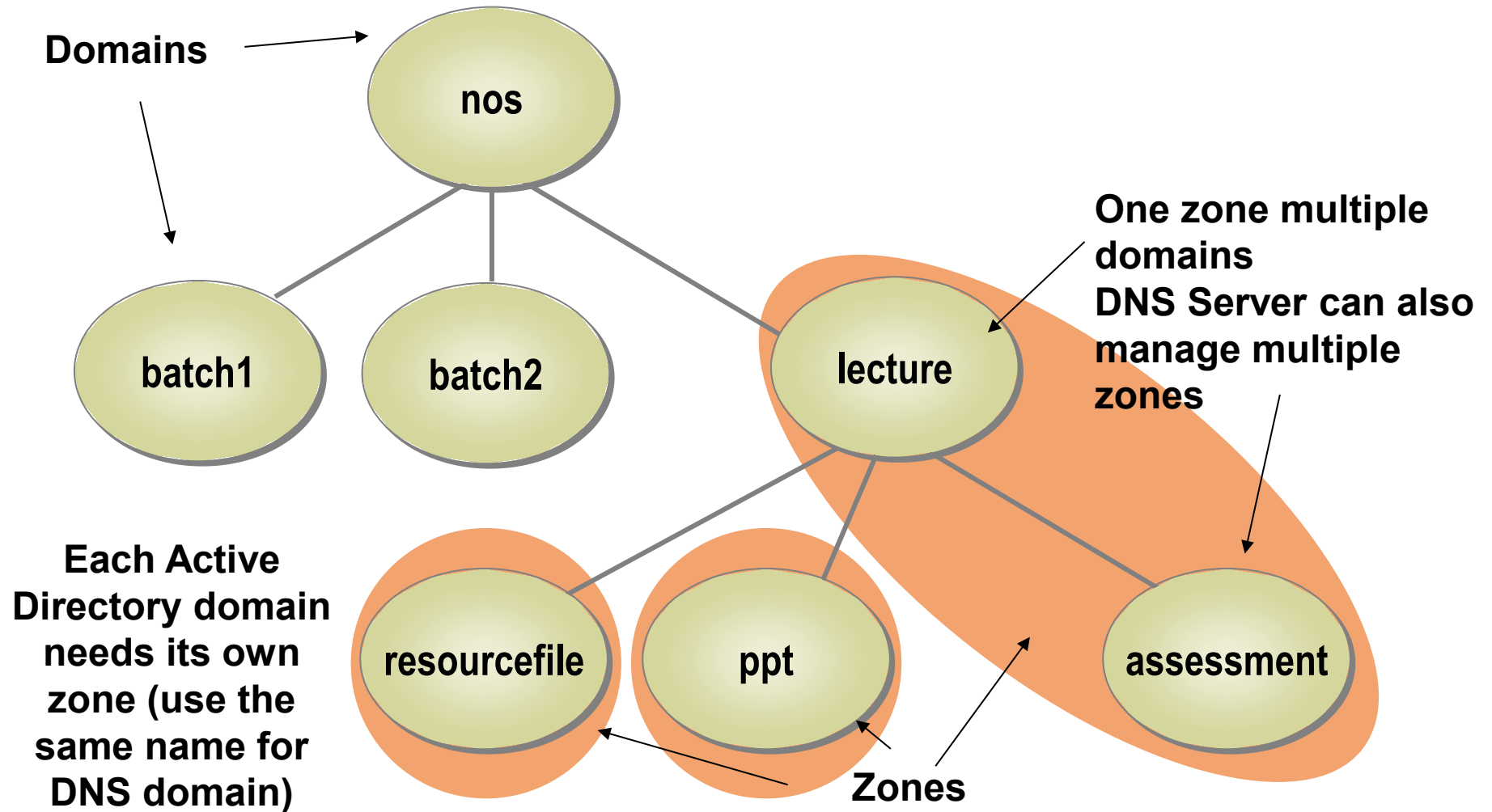


DOMAIN NAME SYSTEM: zones

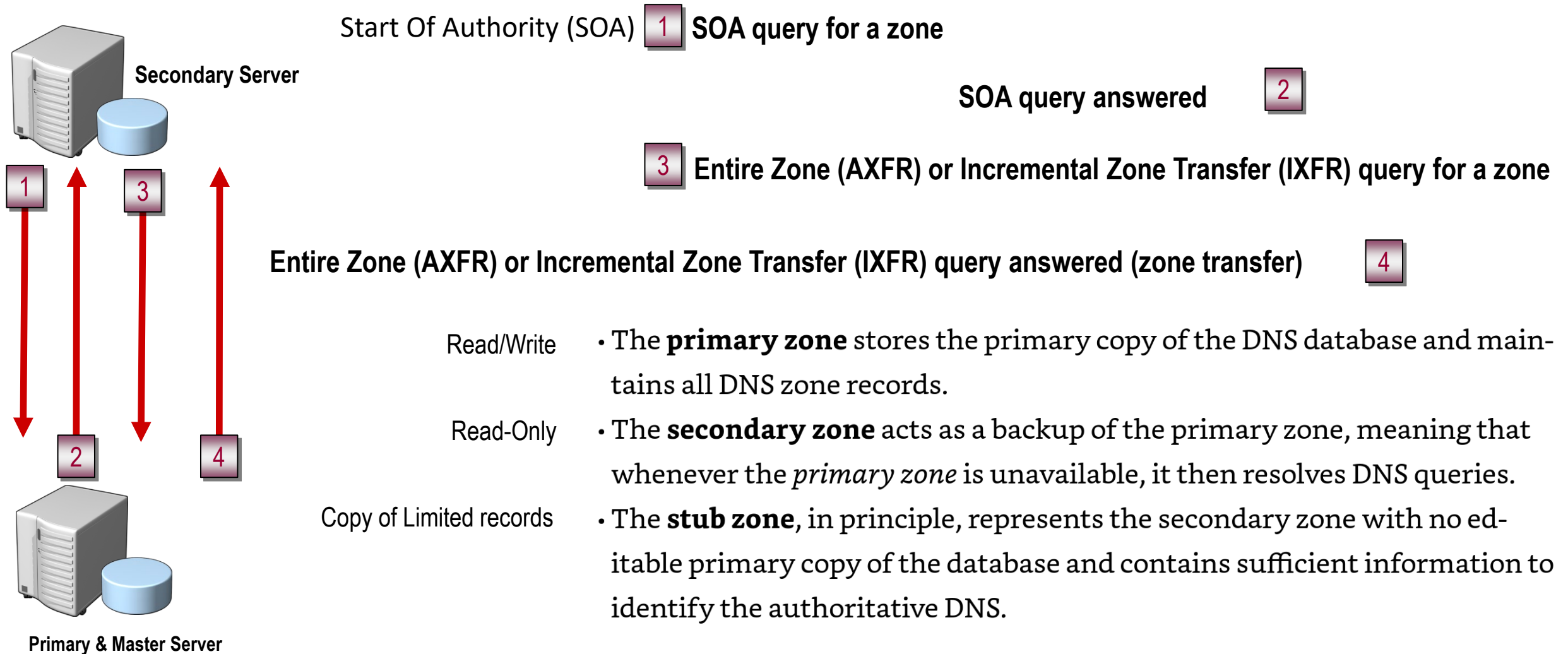
- Zone file is the **file on the DNS servers hard drive** that contains all the information for a zone and the resource records contained therein. It is an ASCII file if not using Active Directory.
- Each zone has its own zone file (when not using Active Directory)



DOMAIN NAME SYSTEM: zones

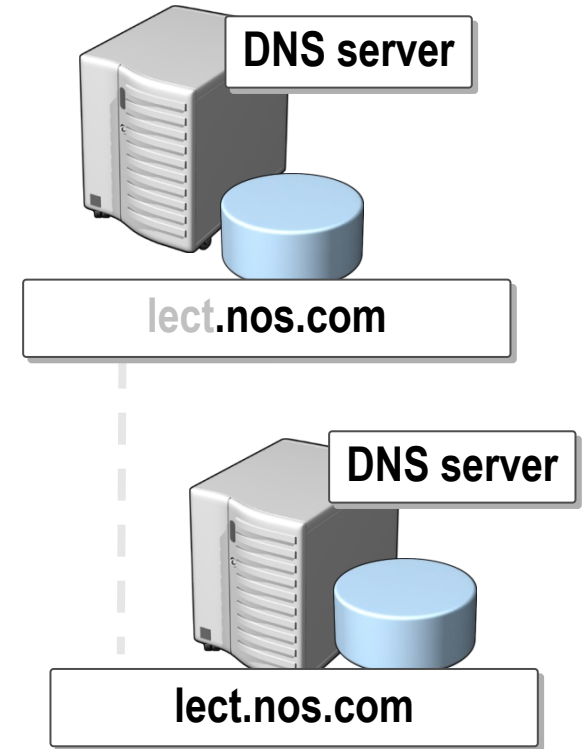


DOMAIN NAME SYSTEM: zones



DOMAIN NAME SYSTEM: DELEGATION

- The administrator, at the nos.com level of the namespace, delegates authority for lect.nos.com and offloads administration of DNS for that part of the namespace.
- **lect.nos.com** now has its own administrator and DNS server to resolve queries in that part of the namespace/organization
- Delegation is the process of assigning authority over child domains in your DNS namespace to another entity by adding records in the DNS database



Summary: So far

- Active Directory
- Active Directory Structure
- Domain Controller
- Functional Levels
- DNS
 - Functions
 - Query
 - Cache
 - Zones
 - Delegations

Diolch/Thank You

Any Questions?

Books Referred: *Dauti, Bekim. Windows Server 2019 Administration Fundamentals: A beginner's guide to managing and administering Windows Server environments, 2nd Edition . Packt Publishing.*

Links referred in this presentation:

- Microsoft Virtual Academy