UNIT 3

DOMAIN NAME SERVICE

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1. Name System Issues, Concepts and Techniques

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NAME SYSTEM MOTIVATION

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- Computers work with numbers, while humans like to work with meaningful words.
- Name systems technologies allow computers on a network to be given both a conventional numeric address and also a more “user-friendly” human-readable name
- Name Systems Are Both Essential and Unnecessary. the computers and the network can still work—but it will be much harder for us people to use them!

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NAME SYSTEM FUNCTIONS

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- **It has three main functions**:
  - Name Space
  - Name Registration
  - Name Resolution

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- **Name Space:** The name system defines:
  - The rules for how names are structured and used.
  - How the name of one device is related to the names of other devices in the system,
  - How to ensure that no invalid names are given that would cause problems with the system as a whole.

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- **Name Registration**: **every name** on the system **must be unique**. We need some way of managing how the names are assigned The process of linking specific names to particular devices is usually called name registration.
- **Name Resolution**: It is necessary to define a mechanism by which a device's **symbolic name** can be **translated** into its **numeric address**. This process is usually called name resolution.

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Flat and Hierarchical Name Spaces

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- Flat Name Space
  - Names are assigned as a sequence of symbols without any internal structure. There is no clear relationship between any name and any other name.
  - Examples: Jose's pc, Sales 1, Judith ...

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- Hierarchical Name Space
  - Names consist of a sequence of symbols, these symbols are assigned using a specific and clear structure.
  - The name consists of discrete elements that are related to each other usually using hierarchical “parent/child” semantics.
  - Ej:

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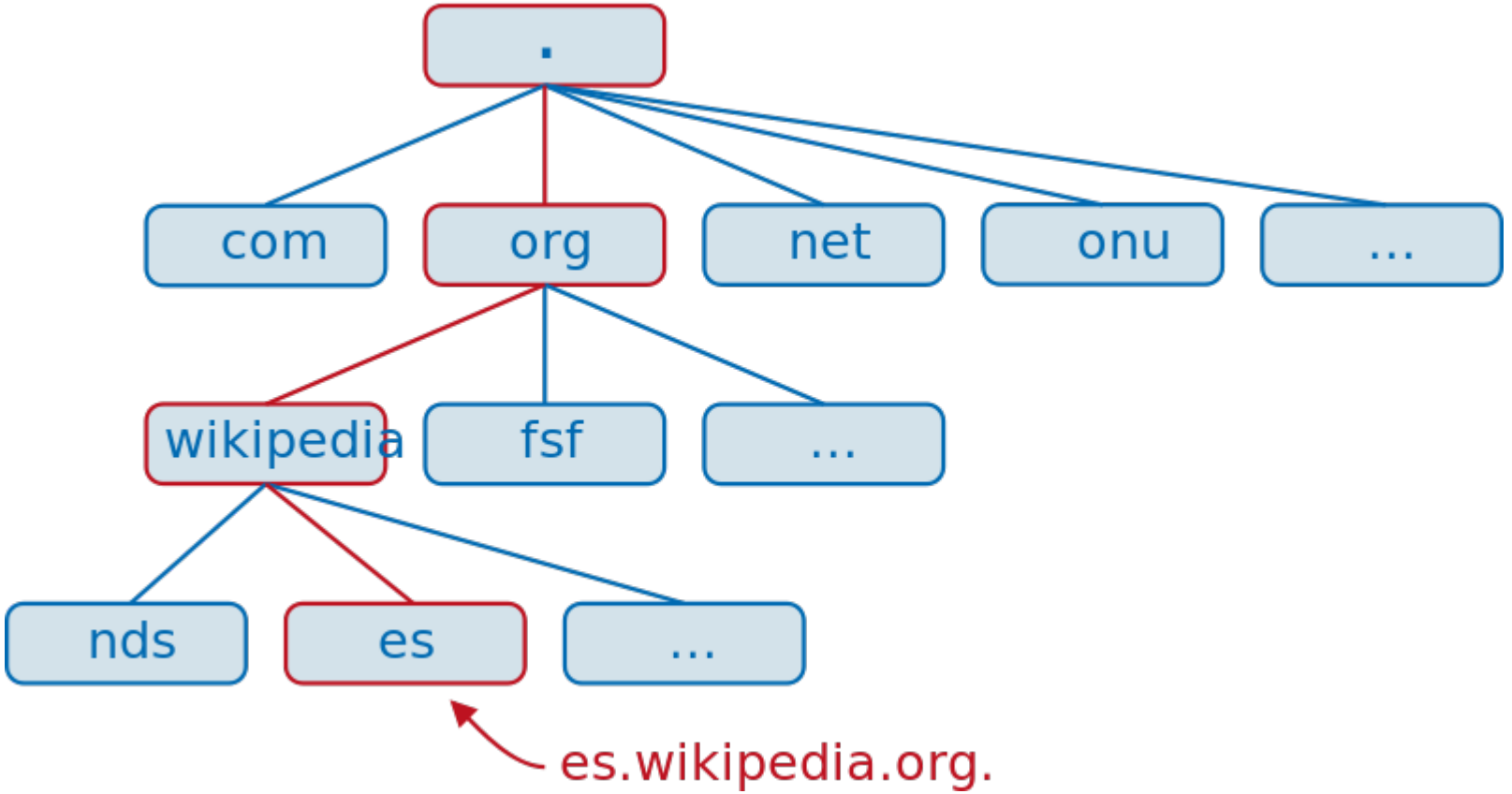

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Name Registration Methods. Administration and Authorities

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- **Name Registration Functions**
  - It must be guarantee uniqueness (each name is unique)
  - To ensure uniqueness of names requires that there be someone “in charge” of the name assignment process.
    - In smaller name systems, the central registration authority may be responsible for the actual registration process for all devices.
    - In larger, hierarchical name systems, the central registration authority will divide the name space and delegate authority for registering names in different parts of it to subordinate organizations.

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- **Name Registration Methods**
  - Table Name Registration
  - Broadcast Name Registration
  - Database Registration

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Table Name Registration:

- name assignments are maintained in a table by an administrator.
- usually associated with small, flat name space name systems

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Broadcast Name Registration

- This is a “trial and error” technique; a device that wants to use a particular name sends out a message to all other devices on the network asking to see if anyone else is already using it. If so, it chooses a different name. If not, the name is considered registered and can then be used.
- It is not practical to attempt to broadcast to thousands of systems, and this method could not be used over the Internet, since there is no way to broadcast to every device on an internetwork.

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Database Registration

- A database of name assignments is maintained.
- To register a name, a request must be made to have the name assignment added to the database.
  - If the authority for the name system is entirely centralized, the database will be centralized and maintained by that authority.
  - If authority for parts of the hierarchy is delegated, then a distributed database is used for registration, with each authority maintaining the part of the database describing their section of the hierarchy.

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Database Registration(cont)

- This is the technique, associated with DNS.
- It has several benefits, including flexibility, reliability and distribution of maintenance effort
- Its main drawback is complexity.

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NAME RESOLUTION TECHNIQUES AND FUNCTIONAL ELEMENTS OF A NAME RESOLUTION SYSTEM

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Name resolution(translation, mapping or binding):

- Table Name Resolution
- Broadcast Name Resolution
- Client/Server Name Resolution

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- **Table name resolution**
  - The table used for table-based name registration is consulted by a device when resolution needs to be performed. The table tells the device how to transform the name of the machine it needs to contact into an address.
  - This technique obviously corresponds to table name registration
  - Table name resolution is suitable for standalone use only in very small name systems

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- **Broadcast Name Resolution**
  - When a device needs to resolve a name, it broadcasts a query that says something to this effect: “I need to send to the device named 'X', who is that?” The device whose name is 'X' responds back saying “I'm 'X' and my numeric address is 'N'”.
  - It can only be used in simple systems where every device can hear a broadcast. The use of broadcasts also makes it wasteful of network bandwidth.

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Client/Server Name Resolution

- Servers are programmed with software that allows them to respond to name resolution requests sent by clients.
- These servers take the name in the request, look up the associated numeric identifier in a database, and send it back in a response.
- This technique is, of course, generally used in conjunction with database name registration.
- It is the most complex of name resolution methods, but is also the most efficient, and the only one that can really work properly on a large, distributed hierarchical name system.

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Client/Server Resolution Functional Elements

- The are two main components
  - **The resolver**: when a name resolution is needed, because of an user request the resolver acts as the client in the name resolution process. It contacts a name server, which responds to the request
  - **The name server:** it responds to the request done by a resolver. In a distributed database for a hierarchical name system, multiple requests may be required, since name servers will contain only information for certain machines and not others. Resolvers follow a special procedure to “travel” the hierarchy until they find the server that has the information they want

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2. DNS Name Space, Architecture and Terminology

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DNS Domains and the DNS Hierarchical Name Architecture

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- **The Essential Concept in the DNS Name Space: Domains**
  - The architecture of the Domain Name System is, based on the concept of an abstraction called a **domain.**
  - The word “domain” generally conveys the notion of a sphere of influence, or area of control or rulership.
  - One sphere of influence may contain smaller ones, which can in turn contain smaller ones still. This means that such domains are naturally arranged in a **hierarchy**.

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- **Example: geopolitical domains in United Nations**

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- The DNS name space is arranged into a hierarchy of domains shaped like an inverted tree. It is structurally similar to the directory structure of a file system, with a root that contains domains, each of which can contain subdomains and so forth.

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Domains, Subdomains, and Nodes; Roots, Leaves and Branches; Parents, Children and Siblings

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- **Domain and subdomains**
  - **Root Domain**: Top of the DNS name structure, this is the root of the tree. By definition, it has no name; it is null.
  - **Top-Level Domains (TLDs):** These are the highest-level domains directly under the root of the tree. They are also sometimes called first-level domains.
  - **Second-Level Domains:** Shockingly enough, these are the domains located directly below the top-level domains.
  - **Subdomains:** In some contexts, this term refers only to domains that are located directly below the second-level domains (but see below).

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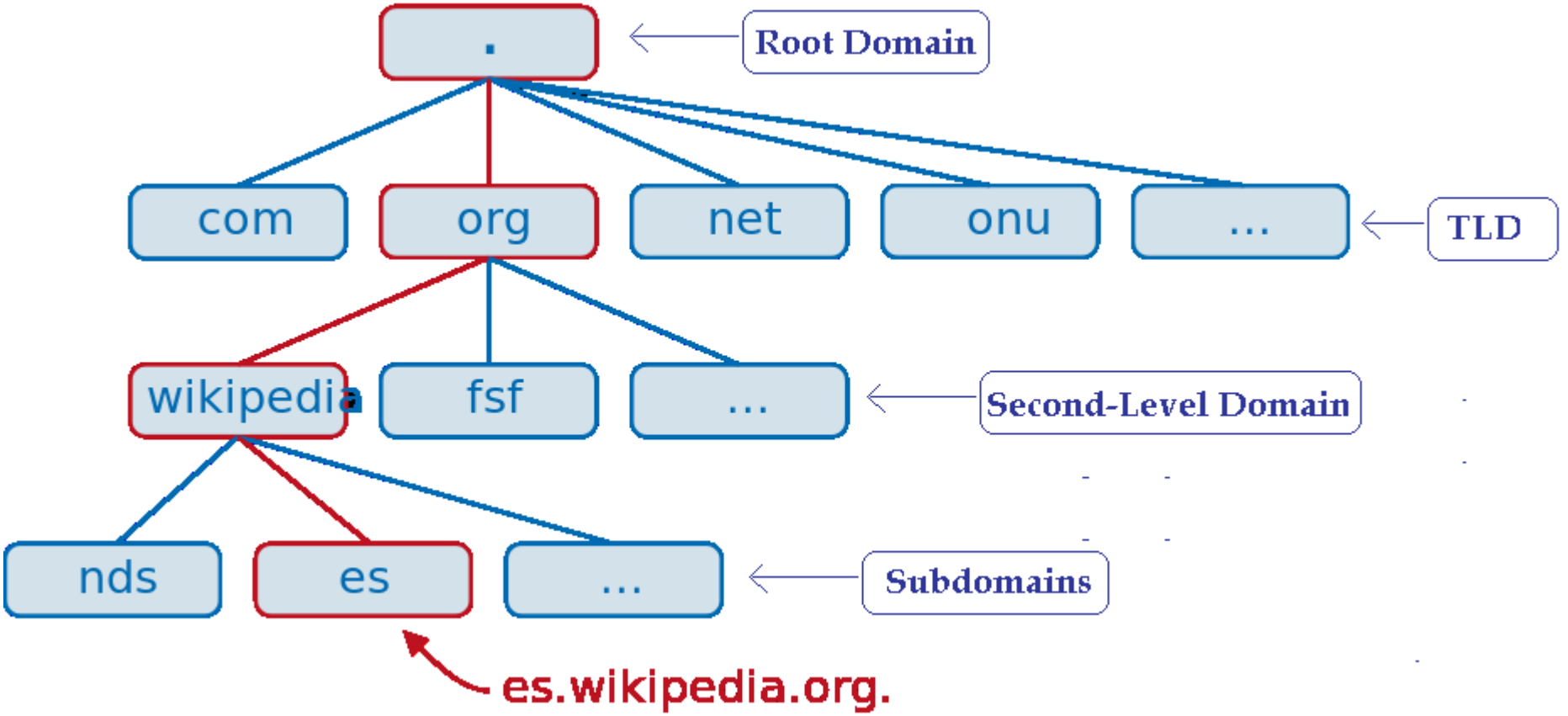

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DNS Family-Related Terminology

- **Parent Domain**: The domain that is above this one in the hierarchy. For example, the root domain is the parent of all top-level domains.
- **Child:** A domain at the next level down from this one in the hierarchy. Thus, the top-level domains are children of the root.
- **Sibling**: A peer at the same level as this one in the hierarchy, with the same parent. Thus, all top-level domains are siblings with the root as a parent; all second-level domains within a particular TLD are siblings and so on.

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DNS Labels, Names and Syntax Rules

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- **DNS Labels and Label Syntax Rules**
  - The label identifies the domain within the structure, and must follow these syntax rules:
    - Length: Each label can be from 0 to 63 characters in length.
    - Symbols: Letters, numbers are allowed, as well as the dash symbol (“-”). No other punctuation is permitted, including the underscore (“_”).
    - Case: Labels are not case-sensitive. This means that “Jabberwocky” and “jabberwocky” are both permissible domain name labels, but they are equivalent.
    - Each label must be unique within a parent domain, but need not be unique across domains.

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- **Constructing Domain Names From Domain Labels**
  - The labels at each level in the hierarchy are listed in sequence, starting with the highest level, from right to left, separated by dots. The result is the formal definition of a domain name
  - The label for the root exists, it's just empty

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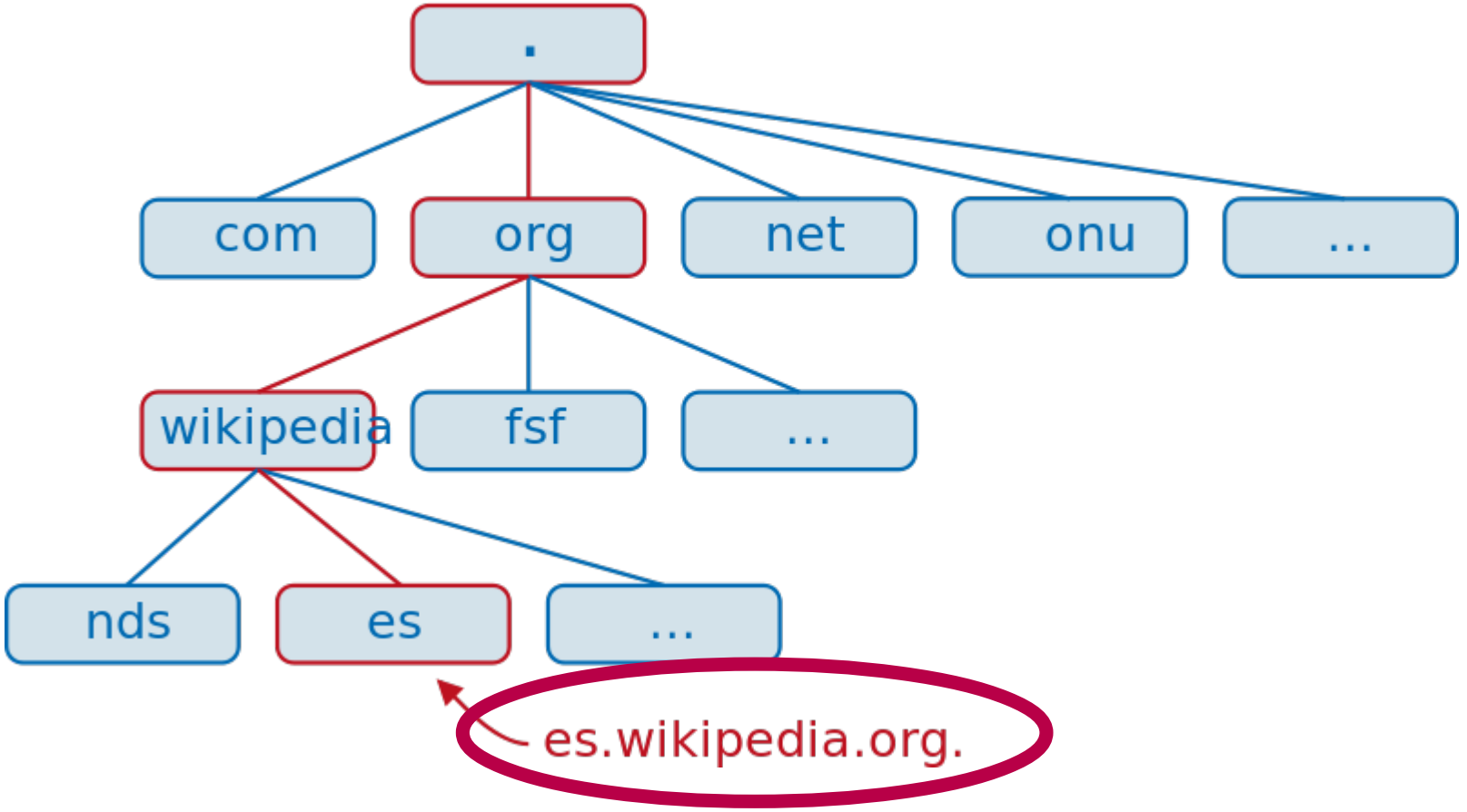

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- **DNS Name Length Limit**
  - There is a maximum limit of 255 characters for a complete domain name
- **Resource Specification**
  - In many protocols, it is possible to specify a particular resource within a domain name by providing a directory structure after a name. A path is indicated using slashes to separate subdirectories.
  - Caution!: the labels in a URL path are case-sensitive

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Fully-Qualified and Relative Domain Name Specifications

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- **Fully-Qualified Domain Names (FQDNs)**
  - Technically, if a top-level domain “A” contains a subdomain “B” that in turn contains subdomain “C”, the full domain name for “C” is “C.B.A.”(Caution!. Don't forget the last dot)
  - Fully-qualified domain names are also sometimes called absolute domain names

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- **Partially-Qualified Domain Names (PQDNs)**
  - The name only partially specifies the location of the device
  - One can only use a PQDN within the context of a particular parent domain, whose absolute domain name is known. We can then find the FQDN of a partially-specified domain name by appending the partial name to the absolute name of the parent domain. For example, if we have the PQDN “Z” within the context of the FQDN “Y.X.”, we know the FQDN for “Z” is “Z.Y.X.”

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3. DNS Name Registration, Public Administration, Zones and Authorities

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DNS Hierarchical Authority Structure and the Distributed Name Database

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- **The DNS Root Domain Central Authority**
  - We have a need for uniqueness, this means we must have some sort of authority or process that ensures that each subdomain or object picks a different name within that domain. This is in fact what name registration is all about.
  - We will want to start at the top of the name hierarchy, with the root domain, “null”. To start off the name space we must create top-level domains (TLDs) within the root. Now, each of these must be unique, so one authority must manage the creation of all TLDs. This in turn means that the authority that controls the root domain controls the entire name space.

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- The central DNS authority for the Internet, which controls the creation of TLDs, was initially called the Network Information Center. It was later the Internet Assigned Numbers Authority (IANA), which is also responsible for protocol numbers, IP addresses and more.
- These functions are now shared by IANA and the Internet Corporation for Assigned Names and Numbers (ICANN).

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- **Top Level Domain Authorities**
  - Each TLD must itself be managed using a coordinating authority, however, this is not necessarily the organization that runs the root (IANA).
  - IANA delegates authority for some of the TLDs to other organizations. They may delegate control for each TLD to a different authority at this level of the hierarchy. In fact, there can be completely different rules for managing the creation of second-level domains in one TLD than there are in another.

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- **Lower-Level Authority Delegation**
  - . At each level the name space becomes more specific; if we use an organizational hierarchy, like the ".COM" top-level domain, we generally delegate authority for each second-level domain to the organization whose name it represents.
  - It is not necessary that there be a different authority for every level of the hierarchy. In many cases a single authority may manage a section of the name space that spans more than one level of the structure.

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The DNS Distributed Name Database

- When a name is registered, a set of data is created for it, which can then be used by internetwork devices to resolve the name into an address, or perform other functions.
- The set of all the data describing all DNS domains constitutes the DNS name database. Just as registration authority is distributed and hierarchical, this **database** too is **distributed** and **hierarchical**.
- There is no single place where all DNS name information is stored. Instead, DNS servers carry resource records that describe the domains for which they have authority.

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DNS Organizational (Generic) Top Level Domains and Authorities

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- There are two ways in which the Internet's DNS name space is divided:
  - **Generic Top Level Domains**
  - **Country Code Top Level Domains**

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- Generic Top Level Domains
  - These TLDs are intended to provide a place for all companies and organizations to be named based on their organization type
  - Examples
    - .COM: Corporations and businesses.
    - .EDU: Universities and other educational organizations.
    - .GOV: Government agencies.
    - .MIL: Military organizations.
    - .NET: Organizations that implement, deal with or manage networking technologies and/or the Internet.

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DNS Geopolitical (Country Code) Top Level Domains and Authorities

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- A set of country-code top-level domains paralleling the generic ones
- In this hierarchy, every country of the world is assigned a particular two-letter code as a top-level domain, with a specific authority put in charge of administering the domain.
- To remain neutral, IANA's ccTLD codes are taken directly from the standard country abbreviations maintained by the International Organization for Standardization (ISO) in ISO standard 3166-1. When a country is recognized by the ISO and a code assigned to it on this list, IANA creates it as a top-level domain

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DNS Second-Level and Lower Domains, Delegation of Registration Authority and Public Registration

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- Just as IANA had the choice of how to delegate authority to the subdomains of the “root” domain, the organization in charge of each TLD gets to make the same decision about how second-level domains are to be created under the TLD
- In many of the TLDs, especially the generic ones, second-level domains are assigned directly to individuals or organizations.
- A process of public registration had to be established to allow such name assignment to occur in a consistent and manageable way.

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- There have been some authorities in charge of registration second level domains (in generic TLD's): **INTERNIC, NSI,ICANN...**
- Today, Network Solutions is still the authority running .COM and .NET. However, they aren't the only ones that register names within these TLDs. They further delegate registration authority to a multitude of other companies, called accredited registrars. Any registrar can register names within the TLD(s) for which they are accredited.
- Naturally, coordination becomes much more of a concern when you have multiple companies registering names in a TLD compared to just one

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- As we can choose from a variety of registering companies the cost of registering a domain name in the deregulated generic TLDs is usually much lower than the fees originally charged by the InterNIC.
- Once a company, individual or organization has a registered lower-level domain, he/she/it becomes the authority for that domain. Use of the domain then becomes private,

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DNS Zones of Authority

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- DNS is specifically designed to allow these divisions between the name hierarchy and the authority structure to be created.
- The complete DNS name structure is divided by making cuts between adjacent nodes to create groups of contiguous nodes in the structure.
- Each group is called a zone of authority, or more commonly, just a zone.
- Each zone is usually identified by the domain name of the highest-level node in the zone, that is, the one closest to the root. The zones in DNS are by definition non-overlapping—every domain or subdomain is in exactly one zone.

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- **Methods of Dividing the Name Space Into Zones**
  - Arbitrary way
  - Each domain or subdomain is a separate zone
  - **Divide the name structure in a variety of places depending on the needs of different parts of the name space--> Each zone represents an area that is administered independently, and consists of a contiguous segment of the DNS name tree.**

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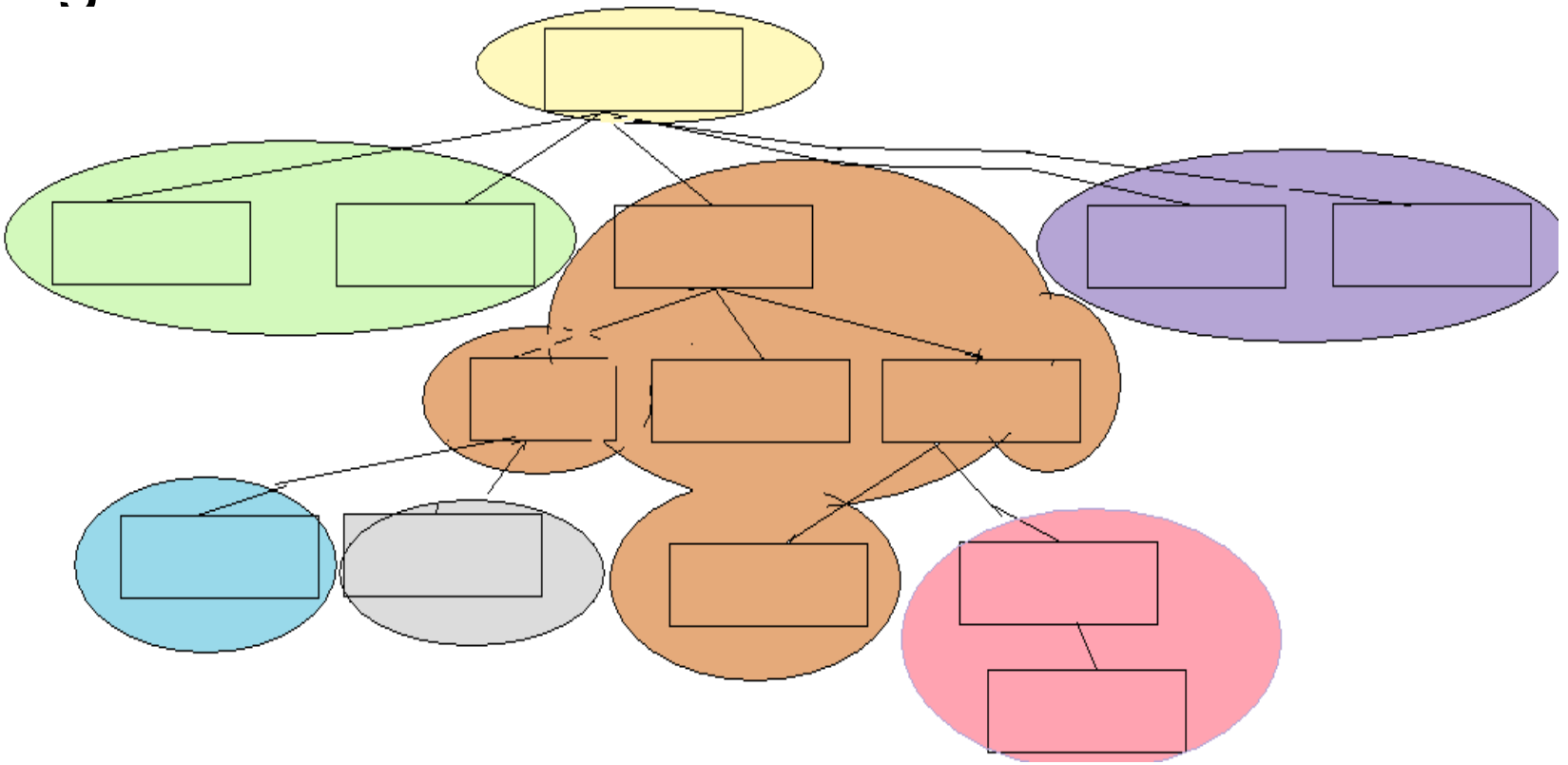
- Example: Each zone indicated using a different background color



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DNS Private Name Registration

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- When a company wants names within its domain to be part of the global DNS name structure, it is required to perform the work necessary to properly set up and manage these names so they fit into the Domain Name System.
- They may do this themselves, if they run their own DNS servers, or may have an ISP or other third party do it for them

4. DNS Name Servers and Name Resolution

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DNS Name Server Architecture and the Storage of the Distributed Name Database

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- In a large DNS implementation, information about domains is not centralized in a single database run by one authority. Instead, it is distributed across many different authorities that manage particular top-level domains (TLDs), second-level domains or lower-level subdomains.
- In the case of the global Internet, literally millions of different “authorities”, many of them responsible only for their own local domain space, participate cooperatively in running the DNS system.
- A key concept in DNS name resolution is that each entity that maintains responsibility for a part of the name space must also arrange to have that information stored on a DNS server

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- Each DNS zone of authority is required to have one or more DNS servers that are “in charge” of managing information about that zone
- At the top of the DNS hierarchy is the root domain, and so we also see there the root name servers. These are the most important servers, because they maintain information about the top-level domains within the root. They also have knowledge of the servers that can be used to resolve domains one level below them. Those servers in turn are responsible for the TLDs and can reference servers that are responsible for second-level domains. Thus, a DNS resolution may require that requests be sent to more than one server.

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DNS Server Support Functions

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- **DNS Server Support Functions**
  - **Interacting With Other Servers**: the DNS resolution process often requires that multiple servers be involved. Servers must thus maintain not just name information, but information about the existence of other servers. Depending on the type of DNS request, servers may themselves become clients and generate requests to other servers.
  - **Zone Management and Transfers**: The server must provide a way for DNS information within the zone to be managed. A facility also exists to allow a zone transfer to be performed between the master (primary) server for a zone and slave (secondary) servers

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- Performance Enhancement Functions: In order to reduce the time required to respond to queries we can cache o name information.
- Administration: Various other administrative details are required of name servers, such as storing information about the different types of “contacts” (humans) who are responsible for certain tasks related to management of a domain or zone.

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DNS Name Server Data Storage: Resource Records and Classes

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- An authoritative server is responsible for storing and managing all the information for the zones of authority it is assigned.
- The database contains many kinds of information about the subdomains and individual devices within the domain or zone for which the server is responsible.
- In DNS, the database entries that contain this name information are called resource records (RRs).
- A specific set of RRs is associated with each node within the zone
- Each RR contains a particular type of information about a node in the DNS tree.

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Common Resource Records Types

Type	Description	Function
A	Address record	Returns a 32-bit IPv4 address, most commonly used to map hostnames to an IP address of the host, but also used for DNSBLs, storing subnet masks in RFC 1101, etc.
AAAA	IPv6 address record	Returns a 128-bit IPv6 address, most commonly used to map hostnames to an IP address of the host.
CNAME	Canonical name record	Alias of one name to another: the DNS lookup will continue by retrying the lookup with the new name.
MX	Mail exchange record	Maps a domain name to a list of message transfer agents for that domain
NS	Name server record	Delegates a DNS zone to use the given authoritative name servers
PTR	Pointer record	Pointer to a canonical name. Unlike a CNAME, DNS processing does *NOT* proceed, just the name is returned. The most common use is for implementing reverse DNS lookups, but other uses include such things as DNS-SD.
SOA	Start of [a zone of] authority record	Specifies *authoritative* information about a DNS zone, including the primary name server, the email of the domain administrator, the domain serial number, and several timers relating to refreshing the zone.

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- The DNS standards were originally created to allow them to work with multiple protocols, by specifying the class of each resource record. Today the only class commonly used is that for TCP/IP, which is called “IN” (for “Internet”).

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DNS Name Server Types and Roles: Primary/Master, Secondary/Slave and Caching-Only Servers

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- Authoritative servers:
  - Every zone needs to have at least one DNS name server that is responsible for it.
  - These DNS name servers are called authoritative servers for the zone, because they contain the full set of resource records that describe the zone.
  - When any device on the Internet wants to know something about a zone, it consults one of its authoritative servers.
  - Each zone usually has associated with it at least two name servers

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- Master or primary Server
  - Every zone needs to have at least one primary DNS name server
  - The master name server is obviously the most essential server.
  - It is on this name server that the master files for the zone's resource records are maintained,

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- Secondary or Slave Server
  - Zones may have 0, 1 or more secondary servers
  - Slave name servers act as a backup for the masters they support.
  - Busy zones can use multiple servers to spread the load of name resolution requests to improve performance.
  - Ideally, the primary and secondary servers should be as independent as possible.
  - They normally obtain their resource records not from human-edited master files, but from updates obtained from the master server.
  - Both the master and the slave are considered authoritative for the zone.

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- Caching-Only Name Servers
  - All DNS servers perform caching of DNS information so it can be used again if requested in the near future.
  - There are some servers that are set up only to cache information from other DNS servers. These are called caching-only name servers
  - Caching-only name servers are not authoritative for any zone or domain, and don't maintain any resource records of their own

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- Roles, a server
  - It can be the master name server for more than one zone.
  - It can be a slave name server for more than one zone.
  - It can be a slave name server for certain zones as well as a primary for others.
  - A single physical name server cannot be a primary and a secondary server for the same zone

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DNS Zone Management, Contacts and Zone Transfers

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Domain Contacts

- On the Internet, each DNS domain has associated with it a set of three contacts that are responsible for different facets of managing a domain. These are the:
  - Administrative Contact: The “main” contact, responsible for the domain as a whole.
  - Billing Contact: A contact responsible for handling payment for domain services and other accounting matters.
  - Technical Contact: A contact who handles the technical details of setting up DNS for the domain and making sure it works.

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Zone Transfers

- The resource records on the master name server can be updated at any time, then the information at the slave name servers becomes partially out of date
- The slaves obtain their information from the master name server on a regular basis. The procedure responsible for this is called a zone transfer.
- The SOA register will indicate if there have been some changes in the zone or not
- The zone transfers may be a complete transfer or an incremental transfers
- The master server can notify the slaves whenever a change is made. It sends a notification message to the slaves

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When a slave name server starts up,

- it has no information about the zone at all,and it must immediately perform a full zone transfer, or
- it has a copy of the zone's resource records stored on its local storage, from the last time it was running and it may immediately perform a poll on the master server to see if the data has changed, depending on configuration.

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DNS Root Name Servers

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- Information about the DNS root and its top-level domains is managed by a set of root name servers.
- These servers are essential to the operation of DNS; they are arranged into thirteen groups and physically distributed around the world.

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DNS Name Server Caching, Negative Caching and Data Persistence

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Name Server Caching

- Caching is an essential efficiency feature that reduces DNS message traffic by eliminating unnecessary requests for recently-resolved names.
- Whenever a name is resolved the resulting DNS information is cached so it can be used for subsequent requests that occur shortly thereafter.

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Caching Data Persistence and the Time To Live Interval

- One very important issue that comes up with every caching system, including the one used in DNS, is the matter of the freshness of the cache.
- how do we know the IP address hasn't changed since it is cached?

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- **Two different mechanisms are used to address this issue:**
  - **The first is that when data is cached, the caching server also makes a note of the authoritative server from which it came. The client then has a choice: it can either use the non-authoritative answer, or issue a request for a fresh name resolution from the authoritative server.**

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- **The secondThe second technique for ensuring that caching data doesn't get too old is a procedure for limiting the persistence of DNS cached data. Each resource record has associated with it a time interval, called the Time To Live (TTL). Whenever a resource record is read from a server, the TTL for the record is also read. Any server caching the record is supposed to discard the record after that time interval expires.**

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Negative caching

- **It is also possible for DNS servers to cache the results of unsuccessful name resolution attempts; this is called negative caching**

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DNS Name Server Load Balancing

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- When the number of requests that a particular server or other device needs to handle is relatively small, the function can usually be implemented using a single physical hardware device
- However, some hosts on a large internetwork, especially the Internet, feature servers that must handle tremendous amounts of traffic from many clients. There simply is no single hardware device that can readily handle the traffic of a site like “www.microsoft.com” for example, without becoming unwieldy.

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- **It is possible to create multiple Address resource record for a DNS domain name. This associates several IP addresses with one name, which can be used to spread a large number of access to one domain name over many physical IP devices. This allows DNS to implement load balancing for busy Internet servers.**

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DNS Name Server Enhancements: DNS Notify, Incremental Zone Transfers, and DNS Update (Dynamic DNS)

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Automating Zone Transfers: DNS Notify

- The optional DNS Notify feature allows a master name server to inform slave name servers when changes are made to a zone.
- This has two advantages:
  - it cuts down on unnecessary polling by the slave servers to find out if changes have occurred to DNS information, and
  - it also reduces the amount of time that slave name servers have out-of-date records.

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Improving Zone Transfer Efficiency: Incremental Transfers

- **The DNS incremental zone transfer enhancement uses a special message type that allows a slave name server to determine what changes have occurred since it last synchronized with the master server.**
- **By transferring only the changes, the amount of time and bandwidth used for zone transfers can be significantly reduced.**

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- Dealing With Dynamic IP Addresses: DNS Update / Dynamic DNS
  - An enhancement to DNS, commonly called dynamic DNS, allows DNS information in a server's database to be updated automatically, rather than always requiring hand-editing of master files.
  - This can not only save time and energy on the part of administrators, it allows DNS to better handle dynamic address assignment, such as the type performed by host configuration protocols such as DHCP.

DNS Basic Name Resolution Techniques: Iterative and Recursive Resolution

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- The Difficult Part of Name Resolution: Finding The Correct Server
  - Since DNS name information is stored as a distributed database spread across many servers, name resolution cannot usually be performed using a single request/response communication.
  - It is first necessary to find the correct server that has the information that the resolver requires.
  - This usually requires a sequence of message exchanges, starting from a root name server and proceeding down to the specific server containing the resource records that the client requires.

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- DNS Name Resolution Techniques
  - Iterative Resolution
  - Recursive Resolution

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Iterative Resolution

- When a client sends an iterative request to a name server, the server responds back with either:
  - the answer to the request (for a regular resolution, the IP address we want)
  - or the name of another server that has the information or is closer to it
- . The original client must then iterate by sending a new request to this referred server, which again may either answer it or provide another server name. The process continues until the right server is found

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Recursive Resolution

- When a client sends a recursive request to a name server, the server responds back with the answer if it has the information sought.
- If it doesn't, the server takes responsibility for finding the answer by becoming a client on behalf of the original client and sending new requests to other servers.
- The original client only sends one request, and eventually gets the information it wants (or an error message if it is not available).

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Contrasting Iterative and Recursive Resolution

- In iterative resolution, if a client sends a request to a name server that does not have the information the client needs, the server returns a pointer to a different name server and the client sends a new request to that server.
- In recursive resolution, if a client sends a request to a server that doesn't have the requested information, that server takes on the responsibility for sending requests to other servers to find the necessary records, then returns them to the client. A server doing this takes on the role of client for its requests to other servers.

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DNS Name Resolution Efficiency Improvements: Caching and Local Resolution

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- In addition to the caching performed by DNS name servers, many (but not all) DNS resolvers also cache the results of recent resolution requests.
- This cache is checked prior to beginning a name resolution, to save time when multiple requests are made for the same name.
- You can check your ouwn dns cache with the following command:
  - ipconfig /displaydns

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DNS Name Resolution Process

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- As usual, the best way to do this is by example.
  - Let's say that iesabastos runs its own DNS servers for the “iesabastos.edu” zone. The master name server is called “ns1.iesabastos.edu”, and the slave is “ns2.iesabastos.edu”.
  - These are also used as local DNS servers for resolvers on our client machines.
  - We'll assume that our DNS servers will accept recursive requests from machines within our high school.
  - Let's also assume that both the server and resolver perform caching, and that the caches are empty.
  - Suposse You type into your Web browser the address of www.ict.e-books.editorial1.com.

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- The resolution process would involve the following set of steps
  1. The Web browser invokes the local resolver, passing to it the name “www.ict.e-books.editorial1.com”.
  2. The resolver checks its cache to see if it already has the address for this name:
     - If it does, it returns it immediately to the Web browser,
     - In this case we are assuming that it does not. The resolver also checks to see if it has a local host table file. If so, it scans the file to see if this name has a static mapping. Again, let's assume it does not,

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3. The resolver generates a recursive query and sends it to “ns1.iesabastos.edu” (using that server's IP address, of course, which the resolver knows).
4. The local DNS server receives the request and checks its cache. Again, let's assume it doesn't have the information needed. If it did, it would return the information, marked “non-authoritative”, to the resolver. The server also checks to see if it has in its zone resource records that can resolve “www.ict.e-books.editorial1.com”. Of course it does not.
5. “ns1.iesabastos.edu” generates an iterative request for the name and sends it to a root name server.

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6. The root name server does not resolve the name. It returns the name and address of the name server for the ".com" domain.
7. "ns1.iesabastos.edu" generates an iterative request and sends it to the name server for ".com".
8. The name server for ".com" returns the name and address of the name server for the "editorial1.com" domain.
9. "ns1.iesabastos.edu" generates an iterative request and sends it to the name server for "editorial.com"".
10. The name server for "editorial1.com" is authoritative for "www.itc.e-books.editorial1.com". It returns the IP address for that host to "ns1.iesabastos.edu".

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11. “ns1.iesabastos.edu” caches this resolution. The local name server returns the resolution to the resolver on your local machine.
12. Your local resolver also caches the information.
13. The local resolver gives the address to your browser.
14. Your browser commences an HTTP request to the ict.e-books.editorial1.com machine's IP address.

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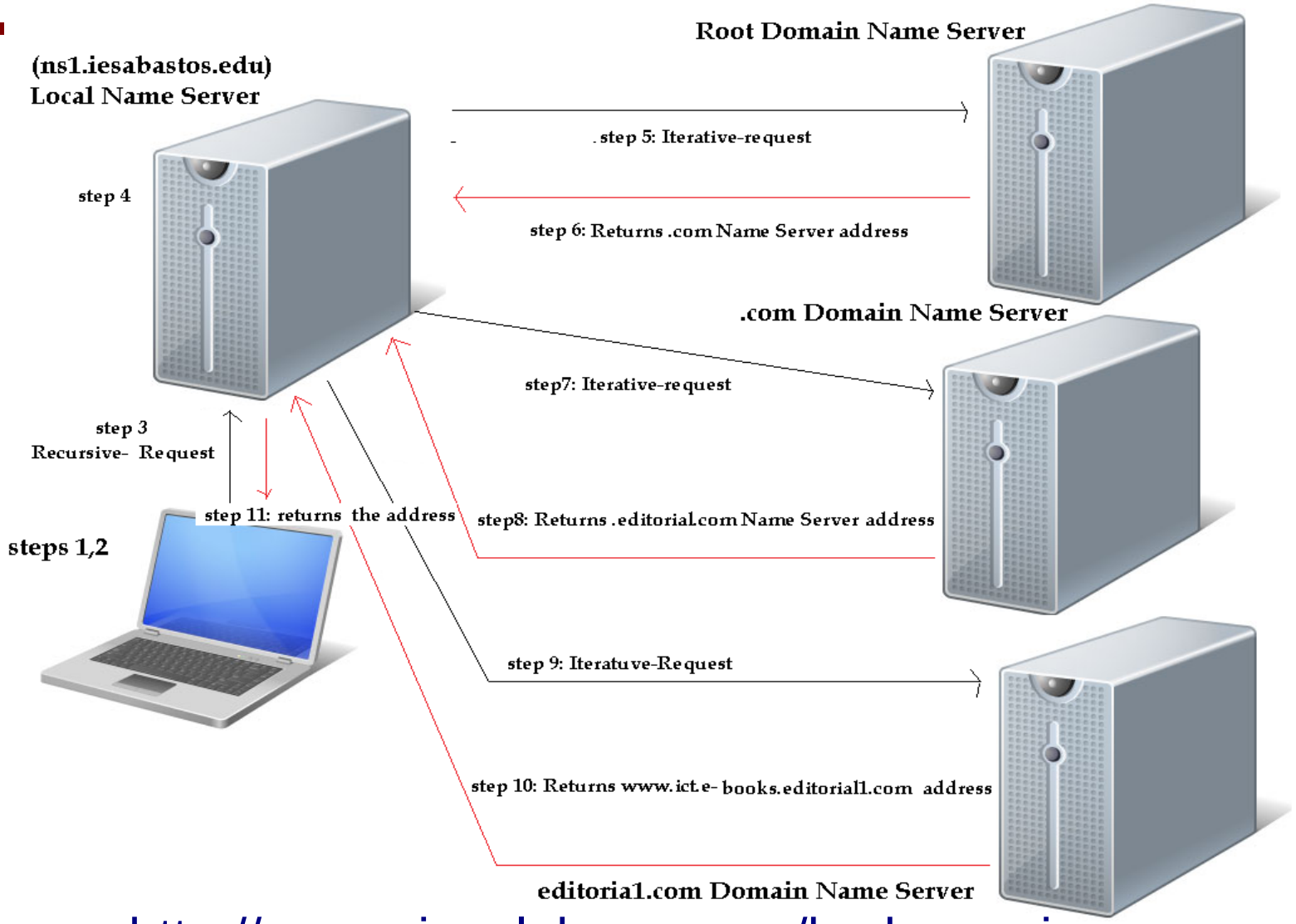

http://www.visualpharm.com/hadware_icon_set/

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- Another possibility is to have one more DNS server (**I**nternet **S**ervice **P**rovider name server) between our local server and the other authorized servers.

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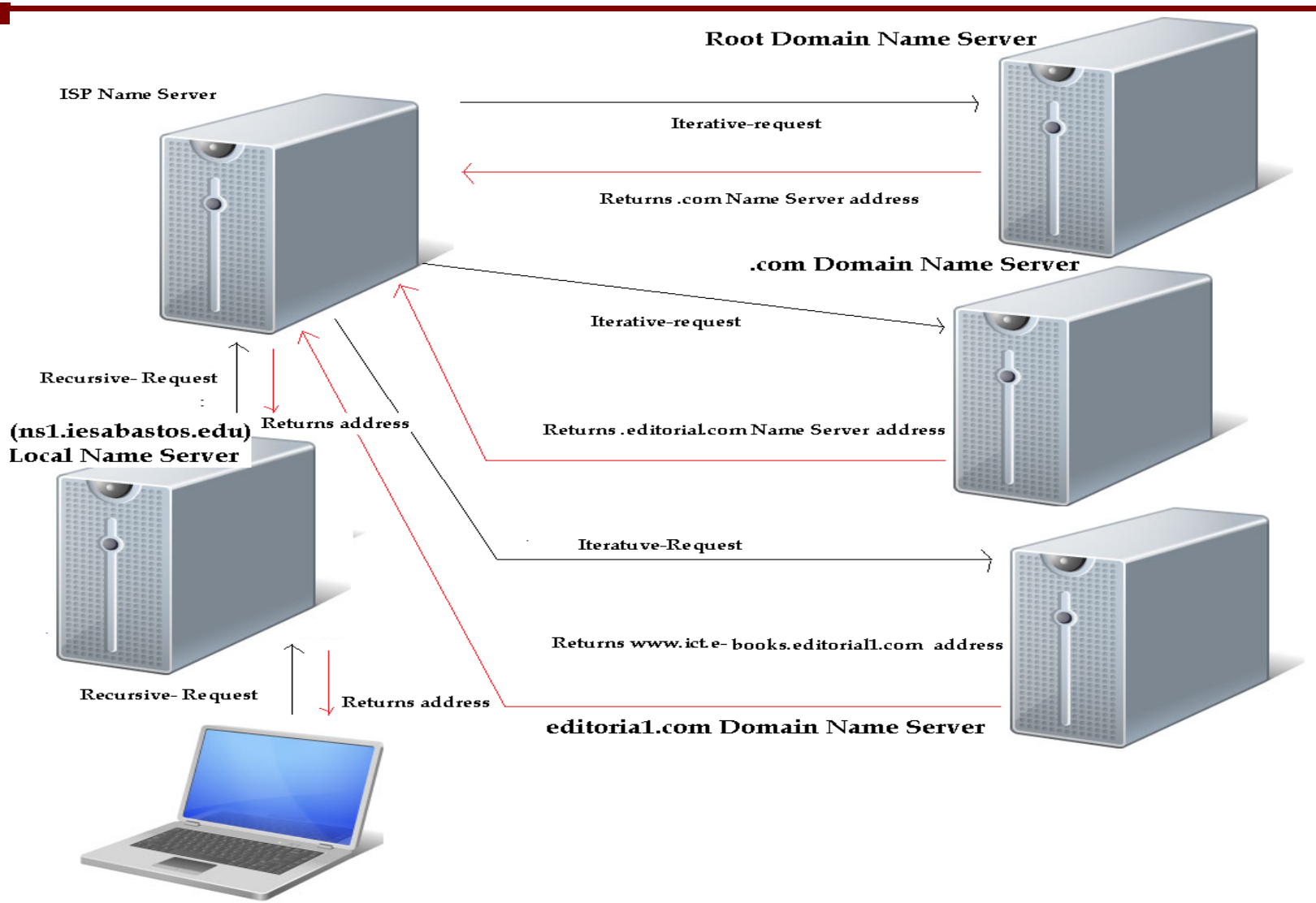

DNS Reverse Name Resolution Using the IN-ADDR.ARPA Domain

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The Need for Reverse Name Resolution

- A World Wide Web server records the IP address of each device that connects to it in its server logs, but these numbers are generally meaningless to humans, who prefer to see the names that go with them.
- A hacker trying to break into your computer; by converting the IP address into a name you might be able to find out what part of the world he is from, what ISP he is using, and so forth. There are also many reasons why a network administrator might want to find out the name that goes with an address, for setup or troubleshooting purposes.

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- **The IN-ADDR.ARPA Name Structure for Reverse Resolution**
  - We create an additional, numerical hierarchy that coexists with the name hierarchy. We then use this to find names from numbers, using a process commonly called reverse name resolution.A special numerical hierarchy is created within “IN-ADDR.ARPA” that covers the entire IP address space:
  - The name hierarchy for the Internet is implemented using a special domain called “IN-ADDR.ARPA”
  - A special numerical hierarchy is created within “IN-ADDR.ARPA” that covers the entire IP address space

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