The Domain Name System

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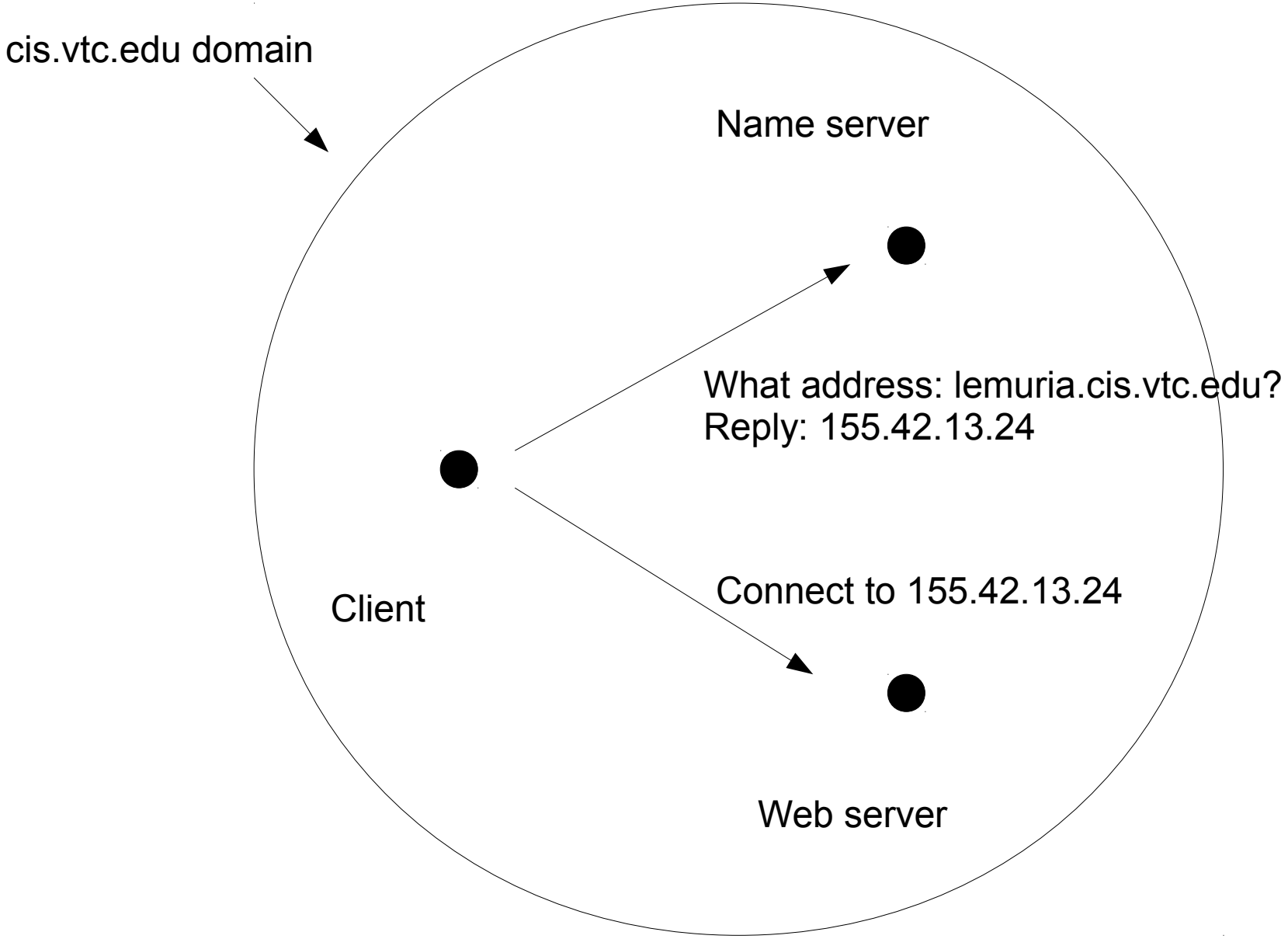
DNS

- The domain name system...
  - Resolves names to IP addresses
    - `lemuria.cis.vtc.edu` to `155.42.13.24`
  - Is a distributed database
    - Each organization maintains its own part.
    - Several fields associated with each domain name.
      - Not just (or not only) IP addresses.
    - Is extensible. New fields can be added.
      - Although this is rarely done.
  - Is described in RFC-1034 and RFC-1035 (plus updates)

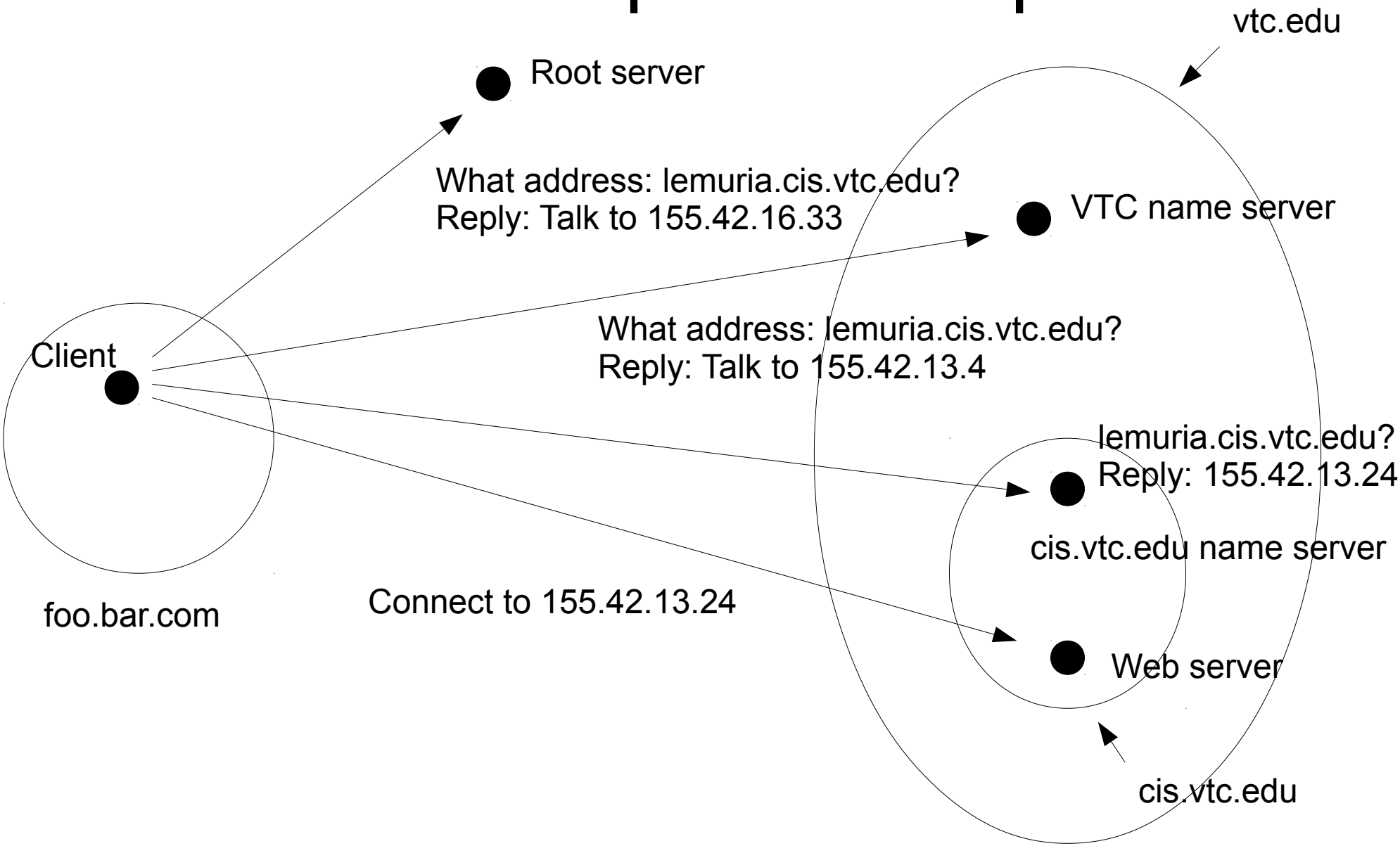
Basic Idea


cis.vtc.edu domain
Name server
What address: lemuria.cis.vtc.edu?
Reply: 155.42.13.24
Client
Connect to 155.42.13.24
Web server

DNS Resolution

- Client needs to know IP address of name server
  - This is a configuration detail
  - Typically handled with DHCP at client boot time
  - Can be hand specified by user if necessary
- Client sends DNS query
  - Asks for address resolution.
  - Sends name to resolve.
- Name server sends answer
  - Requested IP address or error code.

More Complex Example



Remote Resolution

- Client in another domain...
  - First contacts the “root” name server and asks.
    - Is told the IP address of a name server that might know
    - Root servers know IP addresses of all the “top level” domain servers (e.g. vtc.edu).
  - Contacts next name server and asks again.
    - Is told the answer or referred to a lower level name server.
  - Must have built in knowledge of root server's IP.
    - Actually there are several root servers spread over the world. IP addresses are published regularly.

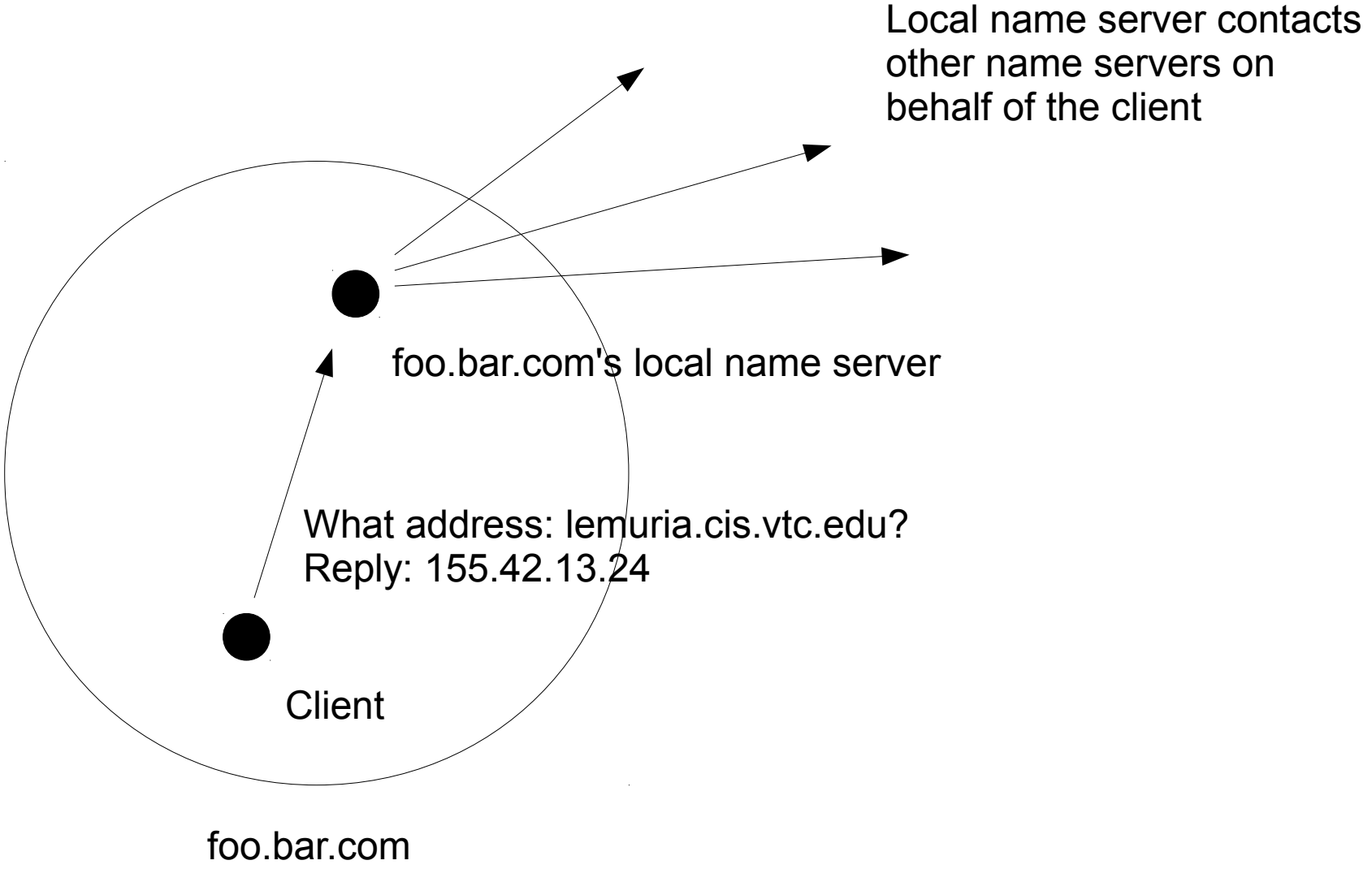
Hierarchy

- This allows a hierarchy of names
  - Name server only needs to know about the names in its domain or... the name servers controlling the subdomains.
  - An organization must register its top level name server(s) with the root servers.
    - “Domain registration”... costs some money.
  - The root servers are incredibly busy
    - Thousands of queries per second!
    - Managed very carefully.
    - Without them, the Internet would fail.

Iterative vs Recursive

- Previous example showed an *iterative* query.
  - Client took responsibility for contacting all necessary name servers.
    - Significant burden to the client.
    - Other clients can't benefit from the results.
- Recursive queries are better.
  - Client asks the local name server to do all the work.
    - Easier for the client.
    - Local name server caches results for other clients.

“Recursive”


Local name server contacts other name servers on behalf of the client
foo.bar.com's local name server
What address: lemuria.cis.vtc.edu?
Reply: 155.42.13.24
Client
foo.bar.com

UDP and the DNS

- UDP is an excellent protocol for DNS transport
  - Request and reply fit into a single datagram.
    - Request is just a name (+ additional bits)
    - Reply is just an address (+ additional bits)
  - Service is idempotent.
    - Resolving the same name twice produces the same result.
      - We assume that IP address assignments change slowly.
  - Service has no side effects.
    - Resolving a name does not change the state of the server.
  - Low overhead of UDP is very desirable.

DNS Details

- [Cover the specifics of the DNS protocol]
  - [See your lab notes]