

# Network Technologies for Accessing e-Resources

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# Introduction

- Fantastic increase in the number of hosts on the Internet over the years.
  - Variety of new on-line applications and services.
  - Security and privacy becomes a big issue.
- One of the main applications for the academic community is accessing e-resources.
  - Information available electronically on the web.
  - Should have safe and efficient mechanisms to share and access such information.

# Technologies Involved

- Computer networks
  - Basic infrastructure for any e-application.
  - Should understand the concept of packets and data flow through the network.
- Access control
  - Only authorized persons can access.
  - Use of proxy servers help in the enforcement.

# World Wide Web (WWW)

- Latest revolution in the internet scenario.
- Allows multimedia documents to be shared between machines.
  - Containing text, image, audio, video, animation.
- Basically a huge collection of inter-linked documents.
  - Billions of documents.
  - Inter-linked in any possible way.
  - Resembles a cob-web.

# WWW (contd.)

- Where do the documents reside?
  - On web servers.
  - Also called Hyper Text Transfer Protocol (HTTP) servers.
- They are typically written in
  - Hyper Text Markup Language (HTML).
- Documents get formatted/displayed using
  - Web browsers
    - Internet Explorer
    - Mozilla

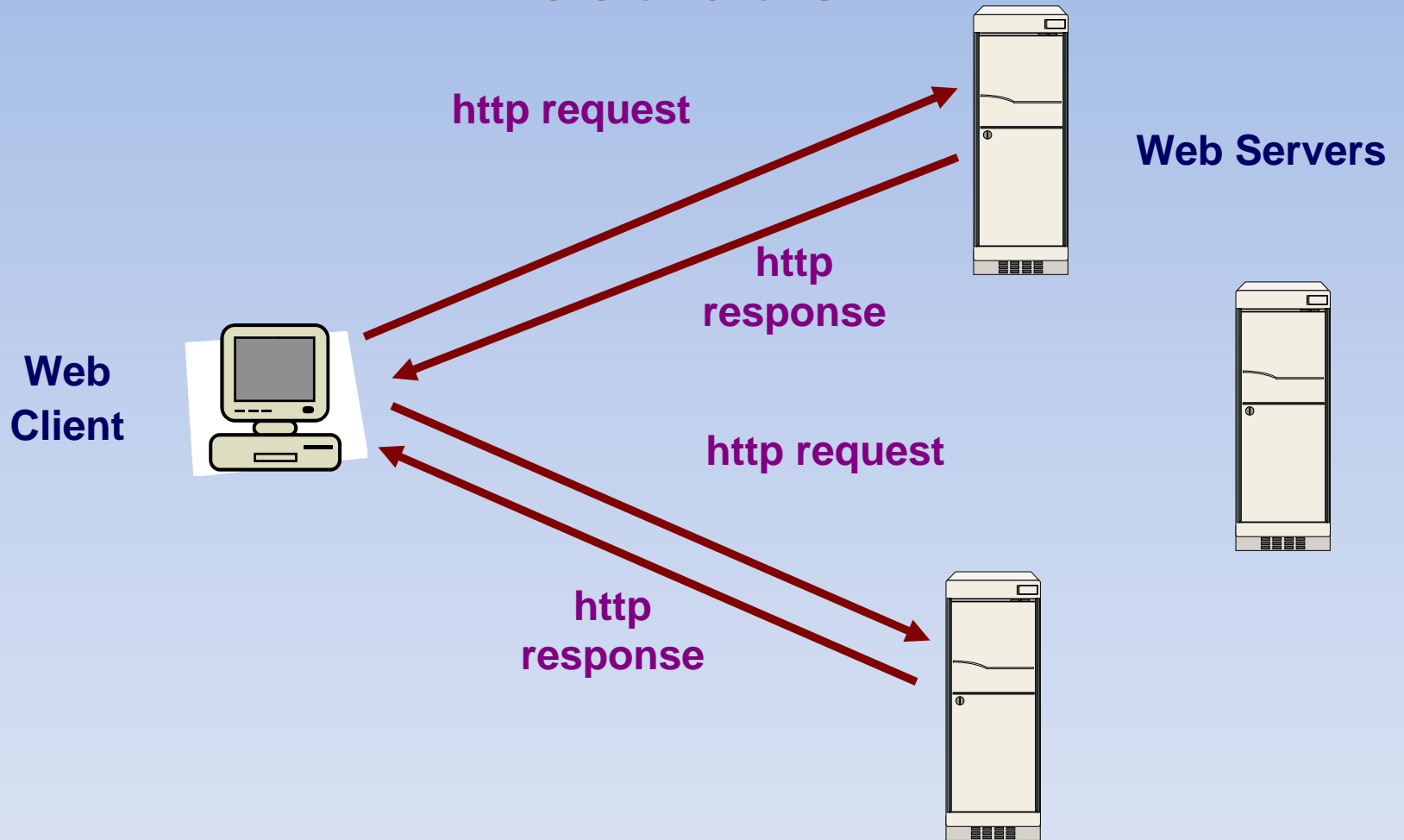
# What is HTTP?

- Hyper Text Transfer Protocol
  - A protocol using which web clients (browsers) interact with web servers.
- It is a stateless protocol.
  - Fresh connection for every item to be downloaded.
- Transfers hypertext across the Internet.
  - A text with links to other text documents.
  - Resembles a cob-web, and hence the name World Wide Web (WWW).

# HTTP Protocol

- Web clients (browsers) and web servers communicate via HTTP protocol.
- Basic steps:
  - Client opens connection to the HTTP server.
  - Client sends HTTP requests to server.
  - Server sends back response.
  - Server closes connection.

# Illustration





# How to Address Hosts Uniquely?

- By using Internet Protocol (IP) addresses.
  - IPv4 :: 32-bits address
  - IPv6 :: 128-bits address
- All data flows through the network in terms of packets.
  - Every packet contains source and destination IP addresses.
  - The routers inspect the addresses and forward the packets in the right direction.

# IP Addresses

# Basic IP Addressing

- Each host connected to the Internet is identified by a unique IP address.
- An IP address is a 32-bit quantity.
  - Expressed as a dotted-decimal notation W.X.Y.Z.
  - Consists of two logical parts:
    - A network number
    - A host number
  - This partition defines the *IP address classes*.

# IP Address Classes

- There are five defined IP address classes.
  - Class A            UNICAST
  - Class B            UNICAST
  - Class C            UNICAST
  - Class D            MULTICAST
  - Class E            RESERVED

<b>Class</b>	<b>Address Range</b>	<b>High-order bits</b>	<b>Network bits</b>	<b>Host bits</b>
<b>A</b>	<b>0.0.0.0 – 127.255.255.255</b>	<b>0</b>	<b>7</b>	<b>24</b>
<b>B</b>	<b>128.0.0.0 – 191.255.255.255</b>	<b>10</b>	<b>14</b>	<b>16</b>
<b>C</b>	<b>192.0.0.0 – 223.255.255.255</b>	<b>110</b>	<b>21</b>	<b>8</b>
<b>D</b>	<b>224.0.0.0 – 239.255.255.255</b>	<b>1110</b>		
<b>E</b>	<b>240.0.0.0 – 255.255.255.255</b>	<b>1111</b>		

- The class-based addressing is also known as the *classful model*.
  - Different network classes lend themselves to different network configurations.
  - Different network-to-hosts ratio.

# Some Conventions

- Within a particular network (Class A, B or C), the first and last addresses serve special functions.
  - The first address represents the network number (for example, 118.0.0.0).
  - The last address represents the directed broadcast address of the network (for example, 118.255.255.255).

# IP Subnetting



# IP Subnet

- Basic concept:
  - A subset of a class A, B or C network.
- IP addresses that do not use subnets consists of
  - a network portion, and
  - a host portion.
  - Represents a static two-level hierarchical addressing model.

# IP Subnet (contd.)

- IP subnets introduces a third level of hierarchy.
  - a network portion
  - a subnet portion
  - a host portion
- Allow more efficient (and structured) utilization of the addresses.
- Uses network masks.

# Natural Masks

- Network mask 255.0.0.0 is applied to a class A network 10.0.0.0.
  - In binary, the mask is a series of contiguous 1's followed by a series of contiguous 0's.

11111111 00000000 00000000 00000000



# Natural Masks (contd.)

- Provide a mechanism to split the IP address 10.0.0.20 into
  - a network portion of 10, and
  - a host portion of 20.

## Decimal

## Binary

IP address: 10.0.0.20    00001010 00000000 00000000 00010100

Mask:            255.0.0.0    11111111 00000000 00000000 00000000

Network

Host

# Natural Masks (contd.)

- Class A, B and C addresses
  - Have fixed division of network and host portions.
  - Can be expressed as masks.
    - Called *natural masks*.
- Natural Masks
  - Class A :: 255.0.0.0
  - Class B :: 255.255.0.0
  - Class C :: 255.255.255.0

# Creating Subnets using Masks

- Masks are very flexible.
  - Using masks, networks can be divided into smaller subnets.
- How?
  - By extending the network portion of the address into the host portion.
- Advantage gained:
  - We can create a large number of subnets from one network.
  - Can have less number of hosts per network.

# Example: Subnets

- Network mask 255.255.0.0 is applied to a class A network 10.0.0.0.
  - This divides the IP address 10.5.0.20 into
    - a network portion of 10,
    - a subnet portion of 5, and
    - a host portion of 20.
  - The 255.255.0.0 mask borrows a portion of the host space, and applies it to network space.

# Subnets (contd.)

- What happens?
  - Initially it was a single large Class A network ( $2^{24} - 2$  hosts).
  - We have now split the network into 256 subnets.
    - From 10.0.0.0 to 10.255.0.0.
    - The hosts per subnet decreases to 65,534.



# Subnets (contd.)

Decimal

Binary

IP address: 10.5.0.20    00001010 00000101 00000000 00010100

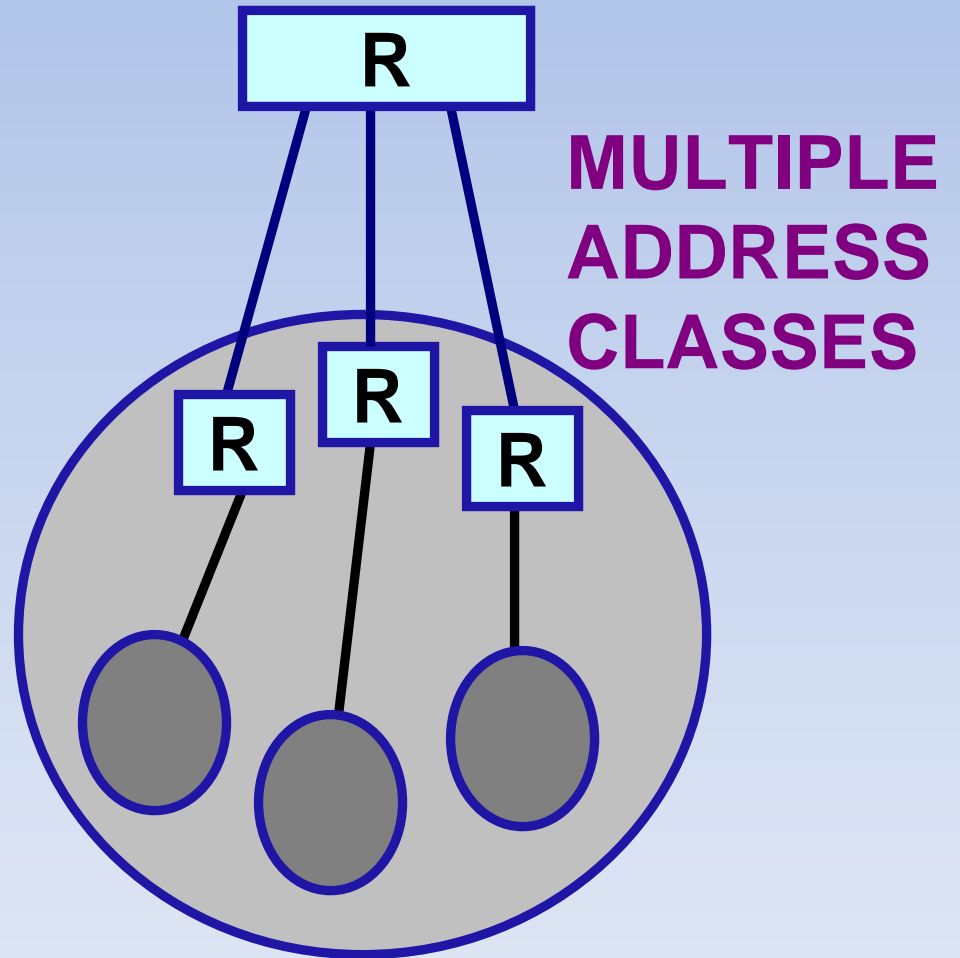
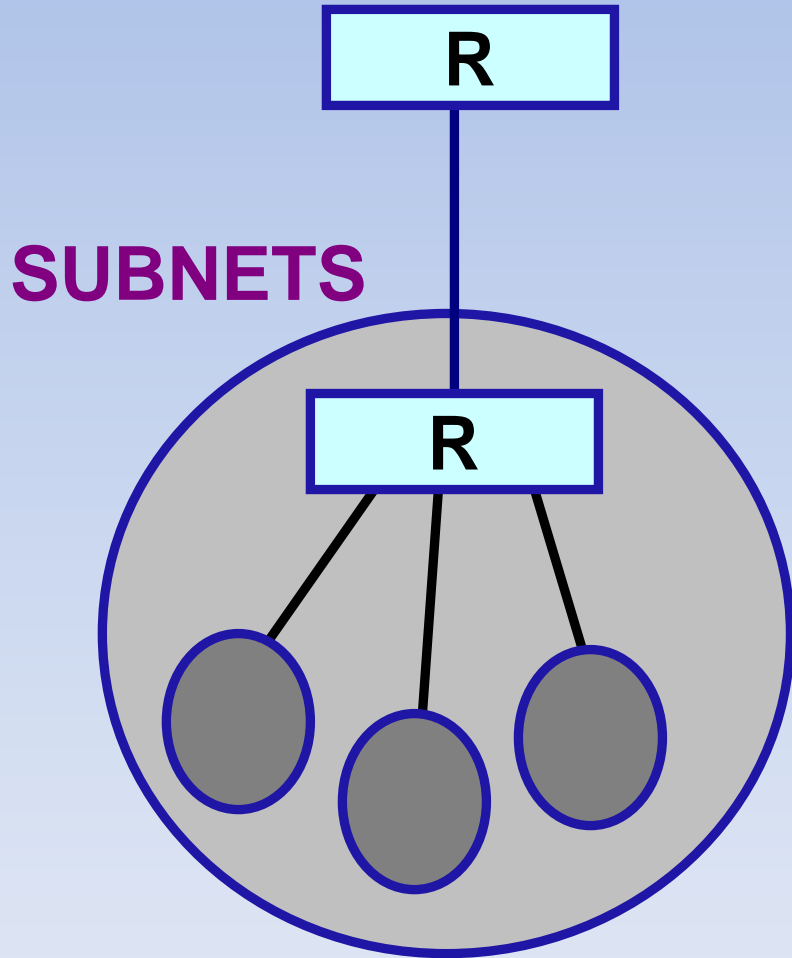
Mask:    255.255.0.0    11111111 11111111 00000000 00000000

Network

Subnet

Host

# Comparison



# Proxy Server

# Introduction

- What is a proxy server?
  - Acts on behalf of other clients, and presents requests from other clients to a server.
  - Acts as a server while talking with a client, and as a client while talking with a server.
- Commonly used HTTP proxy server:
  - Squid
    - available on all platforms.

# What is it really?

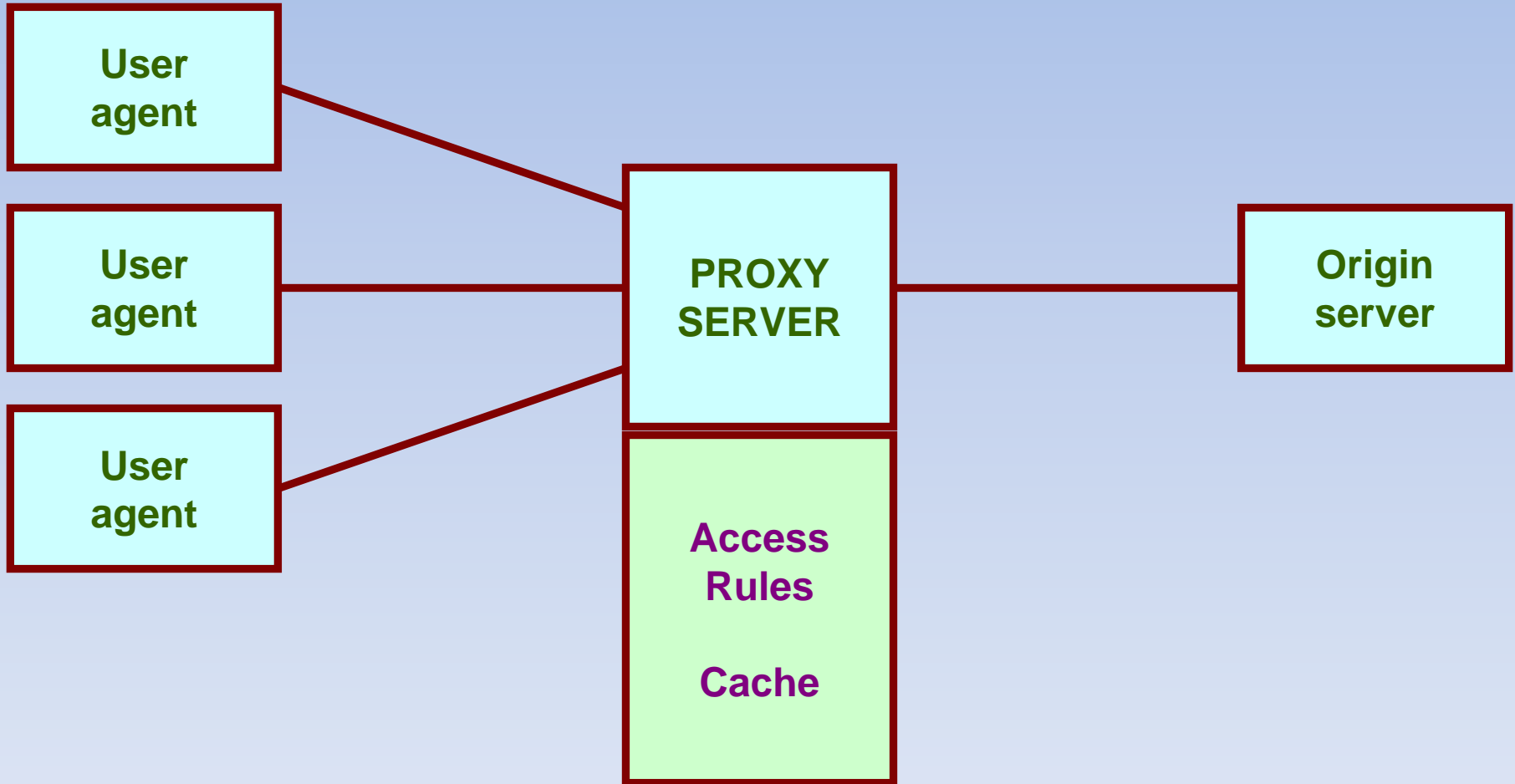
- It is a server that sits between a client application (Web browser), and a real server.
  - It intercepts all requests to the real server to see if it can fulfill the requests itself.
  - If not, it forwards the request to the real server.

- Mainly serves two purposes:
  - Improve performance
    - Can dramatically improve performance for a group of users.
    - It saves all the results of requests in a cache.
    - Can greatly conserve bandwidth.
  - Filter requests
    - Prevent users from accessing a specific set of web sites.
    - Prevent users for accessing pages containing some specified strings.
    - Prevent users from accessing video files (say).

# Anonymous Proxy Servers

- Hide the user's IP address, thereby preventing unauthorized access to user's computer through the Internet.
- All requests to the outside world originate with the IP address of the proxy server.
- Very convenient for group subscription:
  - On-line journals.
  - Digital library.

# Where it is located?





# Accessing e-Resources

- Consider an example of on-line subscription to journals and conference proceedings (say, IEEE).
  - During the registration process, IEEE will ask the applicant to send a small list of authorized IP addresses.
  - We can send the IP addresses of the proxy servers.
    - All packets going out will appear to be coming from the proxy server.

THANK YOU