Network programming (IT423+IT432)
Spring 2017
Dr. Islam Taj-Eddin
IT Dept., FCI, Assiut Univ.

Basic Network Concepts

Hosts

- Devices connected to the Internet are called *Nodes*; it includes routers, printers, fax machines, soda machines, bat houses, etc.

- *Hosts* are node which is a general purpose computers,
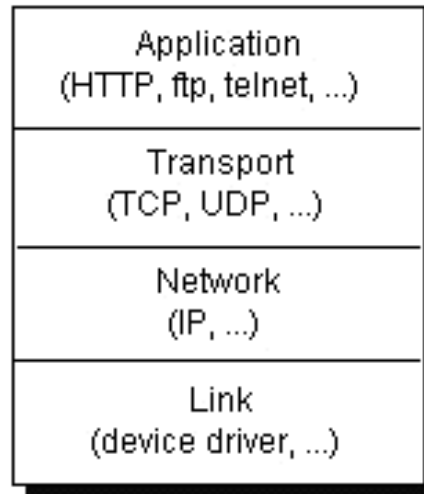
Internet addresses

- Every host on the Internet is identified by a unique, four-byte Internet Protocol (IP) address.

- This is written in *dotted quad* format like 199.1.32.90 where each byte is an unsigned integer between 0 and 255.

- There are about four billion unique IP addresses, but they aren't very efficiently allocated

- IPv4

- IPv6 (eight blocks of four hexadecimal digits separated by colons)

Protocols

- A protocol defines how two hosts talk to each other.
- The daytime protocol, RFC 867, specifies an ASCII representation for the time that's legible to humans.
- The time protocol, RFC 868, specifies a binary representation, for the time that's legible to computers.
- There are thousands of protocols, standard and non-standard

The layers of networks

Usually computers running on the Internet communicate to each other using either the Transmission Control Protocol **(TCP)** or the User Datagram Protocol **(UDP):**

```
Application
(HTTP, ftp, telnet, ...)

Transport
(TCP, UDP, ...)

Network
(IP, ...)

Link
(device driver, ...)
```

When you write Java programs that communicate over the network, you are programming at the application layer or Transport layer.

TCP (Segments packets)

•When two applications want to communicate to each other reliably, they establish a connection and send data back and forth over that connection.

•TCP guarantees that data sent from one end of the connection actually gets to the other end and in the same order it was sent. Otherwise, an error is reported.

•TCP provides a point-to-point channel for applications that require reliable communications.

•*TCP* (*Transmission Control Protocol*) **is a connection-based protocol that provides a reliable flow of data between two computers.**

UDP (Segments packets)

- The UDP (User Datagram Protocol) protocol provides for communication that is not guaranteed between two applications on the network.

- UDP sends independent packets of data, called **segments packets**, from one application to another.

- Many firewalls and routers have been configured not to allow UDP packets.

- Sometimes reliability provided by TCP is not necessary (eg. Time Server) and you can use UDP which doesn't have overhead related to establishing connection.

IP (Datagram packets)

- Transport layer (TCP, UDP) is responsible for:

  - Receiving packets in order

  - No loss or corrupted data

- Network/Internet layer (IP) is responsible for:

  - Routing datagram packets

  - Addressing

- IP is the only network layer protocol java understand

- TCP, UDP are the only protocols java supports

Ports

Generally a computer has a single physical connection to the network. All data destined for a particular computer arrives through that connection.

Data transmitted over the Internet is accompanied by addressing information that identifies the computer and the port for which it is destined.

Ports are identified by a 16-bit number, which TCP and UDP use to deliver the data to the right application.
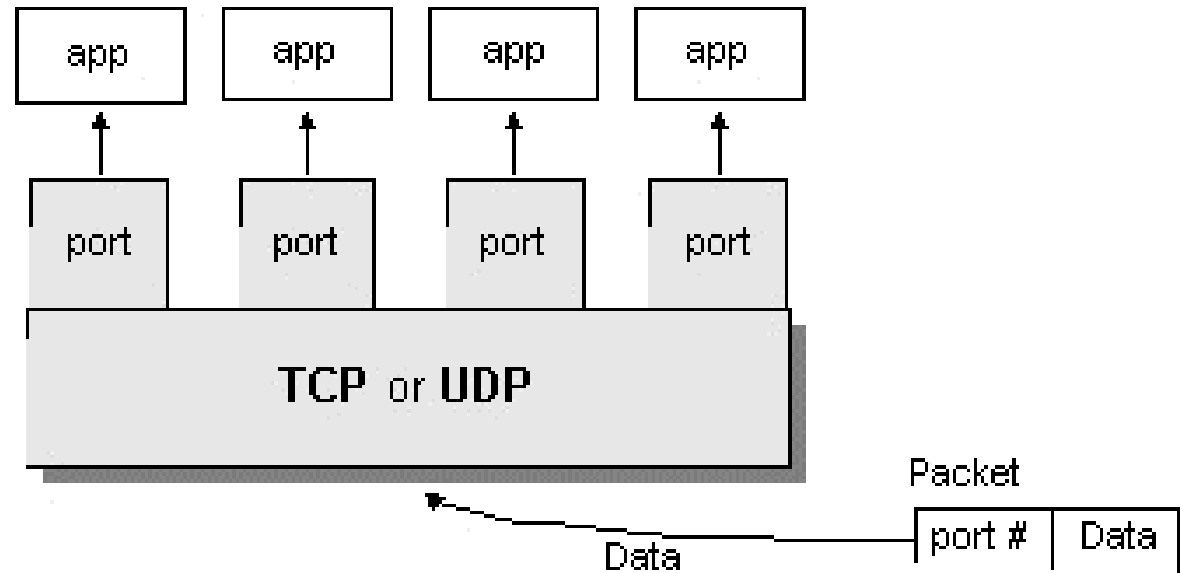
Domain Name System (DNS)

- Numeric addresses are mapped to names like *www.blackstar.com* or *star.blackstar.com* by DNS.

- Each site runs domain name server software that translates names to IP addresses and vice versa

- DNS is a distributed system

Firewalls & Proxy servers

Firewalls operates generally operates on the transport or internet layers to control packets flow

Proxy server operates on application layer as a

go- between the local network and the internet (new protocol and java identification problems)

Servers & Clients

- Two machines must connect

- Server waits around for connection

- Client initiates connection

- Once the connection is made, server & client look identical

- Both ends are turned into InputStream and OutputStream objects, which can then be converted to Reader and Writer objects

The client/server model
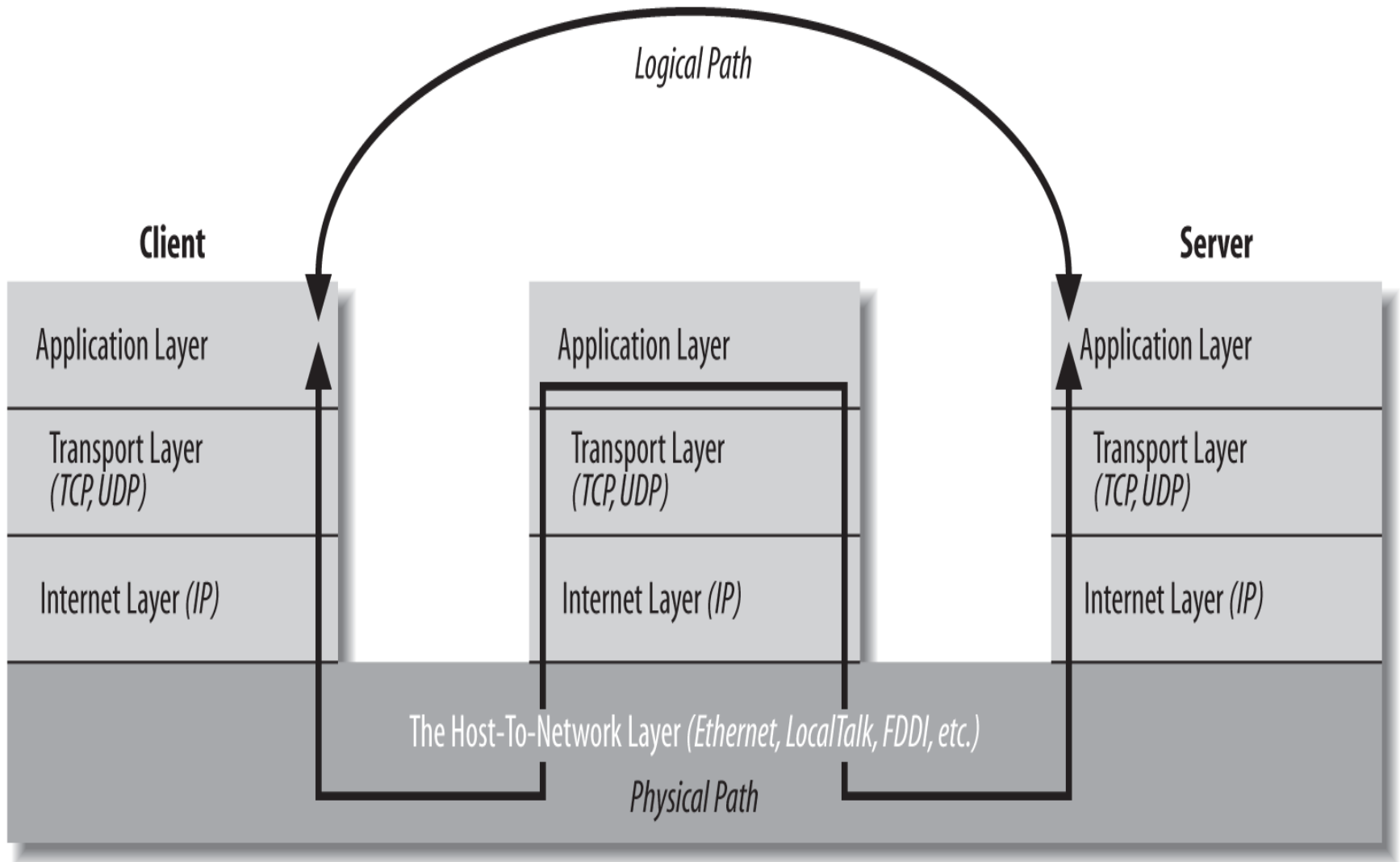
IETF RFCs

- Requests For Comment
- Document how much of the Internet works
- Various status levels from obsolete to required to informational
- TCP/IP, telnet, SMTP, MIME, HTTP, and more
- http://www.faqs.org/rfc/

W3C Standards

- IETF is based on "rough consensus and running code"
- W3C tries to run ahead of implementation
- IETF is an informal organization open to participation by anyone
- W3C is a vendor consortium open only to companies

W3C Standards

- HTTP
- HTML
- XML
- RDF
- MathML
- SMIL
- P3P