

# Networking Overview

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# Introduction

- Who Says?
  - The Standards Bodies
- What is a Network?
  - The Hardware
  - The Topologies
- The OSI Model?
  - The Nitty Gritty Technical Details
- Broadcasting, Multicasting and Gateways?
  - The Communicating



# Standards Bodies

- IEEE ?
- IETF ?
- ISO ?



# Standards Bodies

- IEEE = Institute of Electrical and Electronics Engineers ([www.ieee.org](http://www.ieee.org))
  - Pronounced “Eye-triple-E”
  - Responsible for standards related to:  
“computing, sustainable energy systems, aerospace, communications, robotics, healthcare, and more.”
  - Examples include:
    - IEEE 802.3 - Ethernet
    - IEEE 802.11 - Wi-Fi
    - IEEE 1394 - Firewire



# Standards Bodies

- IETF = Internet Engineering Task Force ([www.ietf.org](http://www.ietf.org))
  - Responsible for standards related to:  
“making the Internet work better by producing high quality, relevant technical documents that influence the way people design, use, and manage the Internet.”
  - Examples include:
    - IPv4 & IPv6
    - SMTP
    - Nearly all other Internet standards.



# Standards Bodies

- ISO = International Organization for Standardization ([www.iso.org](http://www.iso.org))
  - Responsible for standards related to: “developing and publishing International Standards.”
  - Examples include:
    - Manufacturing Certification Standards such as ISO9000
    - Film Standards
    - OSI Networking Model.



# What is a Network?

- Basic Hardware Differences
- Topologies



# Basic Hardware Differences

- Client
- Server
- Router
- Firewall
- Access Point
- Switch/Hub



# Network Topologies

- Wired
- Wireless
- Working together with standards



# Network Topologies

- Wired - IEEE 802.3 Ethernet
  - 10/100/1000 Base
  - Cat 5, 5e, 6 Cabling
  - RJ-45



# Network Topologies

- Wireless - IEEE 802.11 Wi-Fi
  - a - 54 Mbits/s on the 5 GHz
  - b - 11 Mbits/s on the 2.4 GHz
  - g - 54 Mbits/s on the 2.4 GHz
  - n - 270 Mbits/s on the 2.4/5 GHz
  - ac (DRAFT) - ~1 Gbits/s on the 5 GHz



# Network Topologies

- Wired vs. Wireless
  - IPv4/IPv6
  - Difference is mostly Physical
    - Router
    - Access Point



# Network Topologies

- Joining an Access Point
  - Locate access point's SSID
  - Authenticate using appropriate method
    - WEP
    - WPA/WPA Enterprise
    - WPA2/WPA2 Enterprise
  - If necessary verify MAC Address filtering or 802.1x Authentication



# The OSI Model

- Describe the OSI model
- What is it?
- Why does it matter?
- How do I use it?
- Network Layers



# The OSI Model

- OSI Model is:
  - Open Systems Interconnection Model
  - ISO standard
  - 7 layered model developing the framework for standardizing the functions of networking in abstract terms.
  - Evolved from ARPANET, early Internet experiences, NPLNET and others primitive networking protocols.



# OSI Network Model

## Host /Upper Layers

Layer 7	Application Layer	Data	End User Layer (Application or Operating System)	HTTP, FTP, SMTP, DHCP, DNS, POP3, IMAP4, etc.
Layer 6	Presentation Layer	Data	Syntax Layer (encrypt and decrypt)	JPEG, GIF, MPEG, etc.
Layer 5	Session Layer	Data	Interhost Communication	AppleTalk, NetBOIS names
Layer 4	Transport Layer	Segments	End-to-End Connections & Reliability	TCP & UDP

## Media /Lower Layers

Layer 3	Network Layer	Packets	Path Determination, Logical Addressing & Routing	IP
Layer 2	Data Link Layer	Frames	Physical Addressing (MAC Address)	Ethernet
Layer 1	Physical Layer	Bits	Physical Medium, Media Signal & Binary Transmission	Ethernet



# The OSI Model

- Network Layers
  - Lower Level/Media Layers
    - 1 - Physical Layer
    - 2 - Data Link Layer (IP)
    - 3 - Network Layer (TCP/UDP)
  - Upper Level/Host Layers
    - 4, 5, 6, 7 - Transport and Application Layers



# OSI Network Layers

- I - Physical Layer
  - Defines the physical specifications and characteristics
  - Bit level transmission of data
  - Examples include:
    - Copper vs. Fiber
    - Connector pin layouts
    - Voltages
    - Hubs/Switches/network Adapters



# OSI Network Layers

- 2 - Data Link Layer (IP)
  - Provides the method and means to transfer data between network nodes
    - WAN and LAN
    - MAC Addressing used at this layer
  - Organizes bits from the Physical Layer into logical units called Frames
  - Detects and corrects errors introduced in the Physical layer



# OSI Network Layers

- 3 - Network Layer (TCP/UDP)
  - Provides method and means of transferring data packets from a host on one network to a host on another network.
  - Network Layer performs:
    - Network Routing
    - Packet fragmentation and reassembly
    - Routers operate at this layer.



# OSI Network Layers

- 4, 5, 6, 7 - Transport and Application Layers
  - Includes data transfer and between End-user and network layers
  - The establishment, management and termination of communication between local and remote applications
  - Mapping of syntax and semantics between layers.
  - Interacts directly with software.



# Broadcasting, Multicasting, and Gateways

- What are the Broadcast & Gateway addresses?
- Difference between Broadcast & Multicast

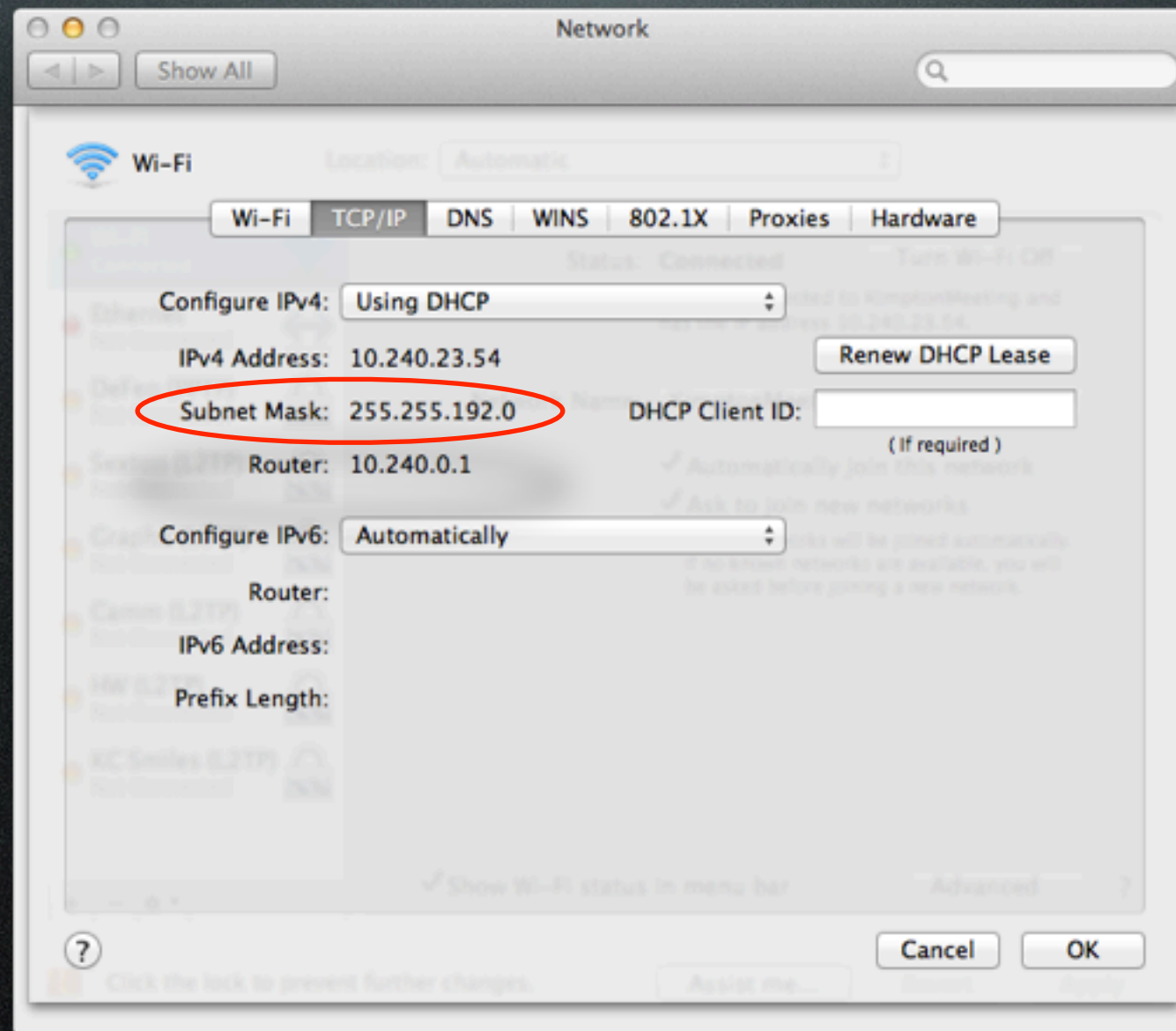


# Broadcast vs. Gateway Addresses

- Broadcast Address
  - Also referred to by Subnet Mask
  - Defines the scope and range of local nodes
  - An example as seen in IPv4 would be:  
255.255.255.0
- Gateway Address
  - Often referred to as the Router
  - Is the addr of the node for routing the network traffic to another network or the Internet.
  - Gateway address/node must be within the Broadcast Address

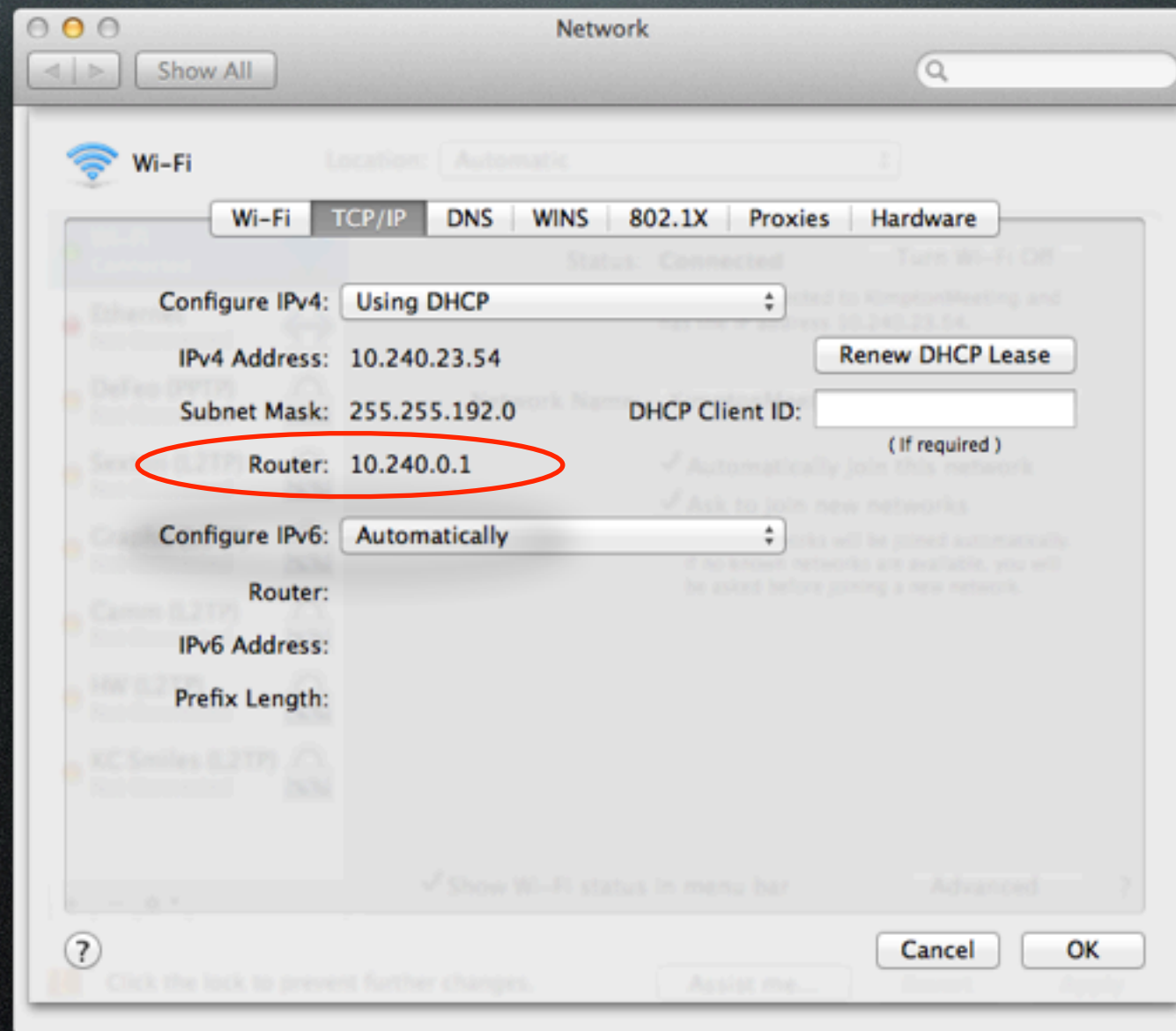


# Broadcast vs. Gateway Addresses





# Broadcast vs. Gateway Addresses

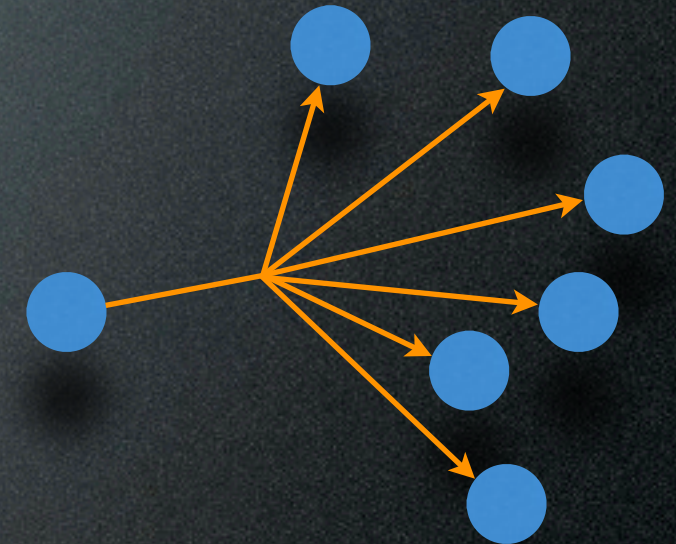




# Broadcast vs. Multicast

- Broadcast

- One-to-All - A method of transferring a message or packets to all recipients simultaneously in a single transmission
- “All” recipients is defined by Broadcast Address



- Multicast

- One-to-Multiple - A method of transferring a message or packets to a group of recipients simultaneously in a single transmission.
- Common use of multicast is streaming media, conferencing.

