What is a Network?

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What is a network?

- A network is a group of computers connected together for the purpose of sharing resources.
- A network can be one computer connected to another to share a printer, or…
- 1000 computers connected together sharing files, directories, printers, plotters, scanners, processor power, and lots of other networks.*

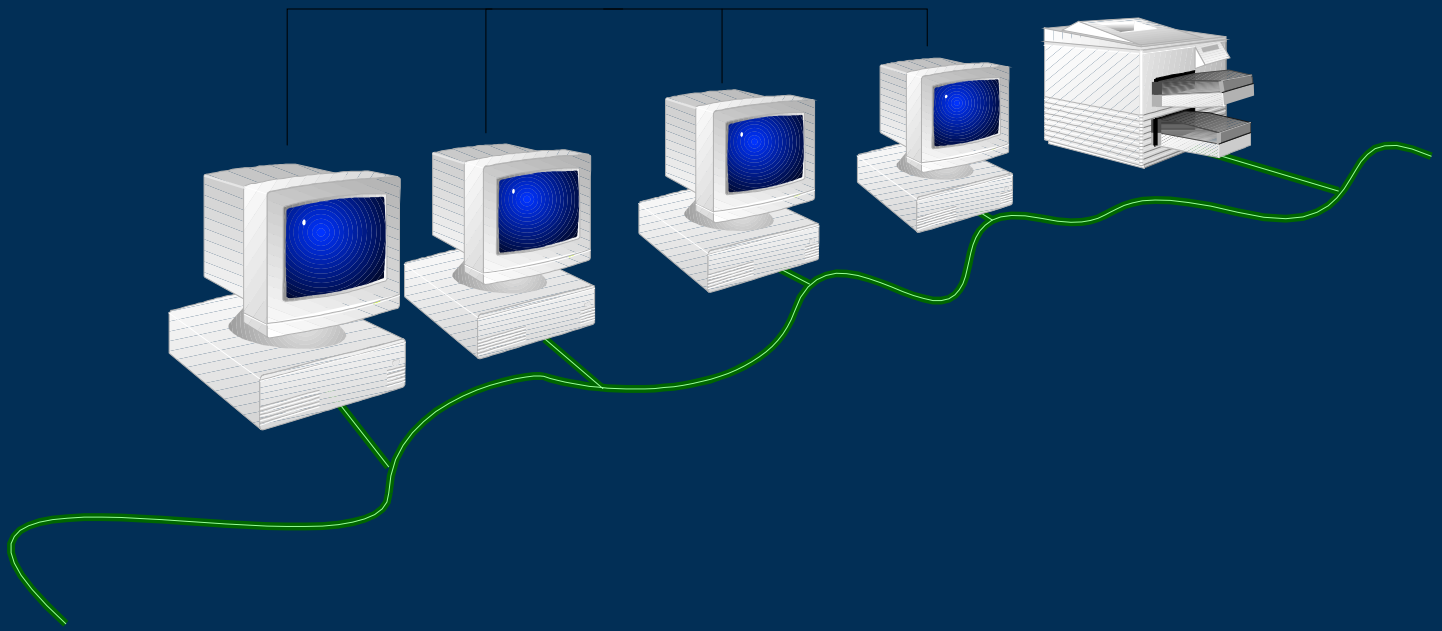
Physical Parts of a Network

- Server
- Clients
- Transmission Media
- Connectivity Devices
- Resources to share
  - Printers and other peripherals
  - Processors/processing power*

Internal Network Components

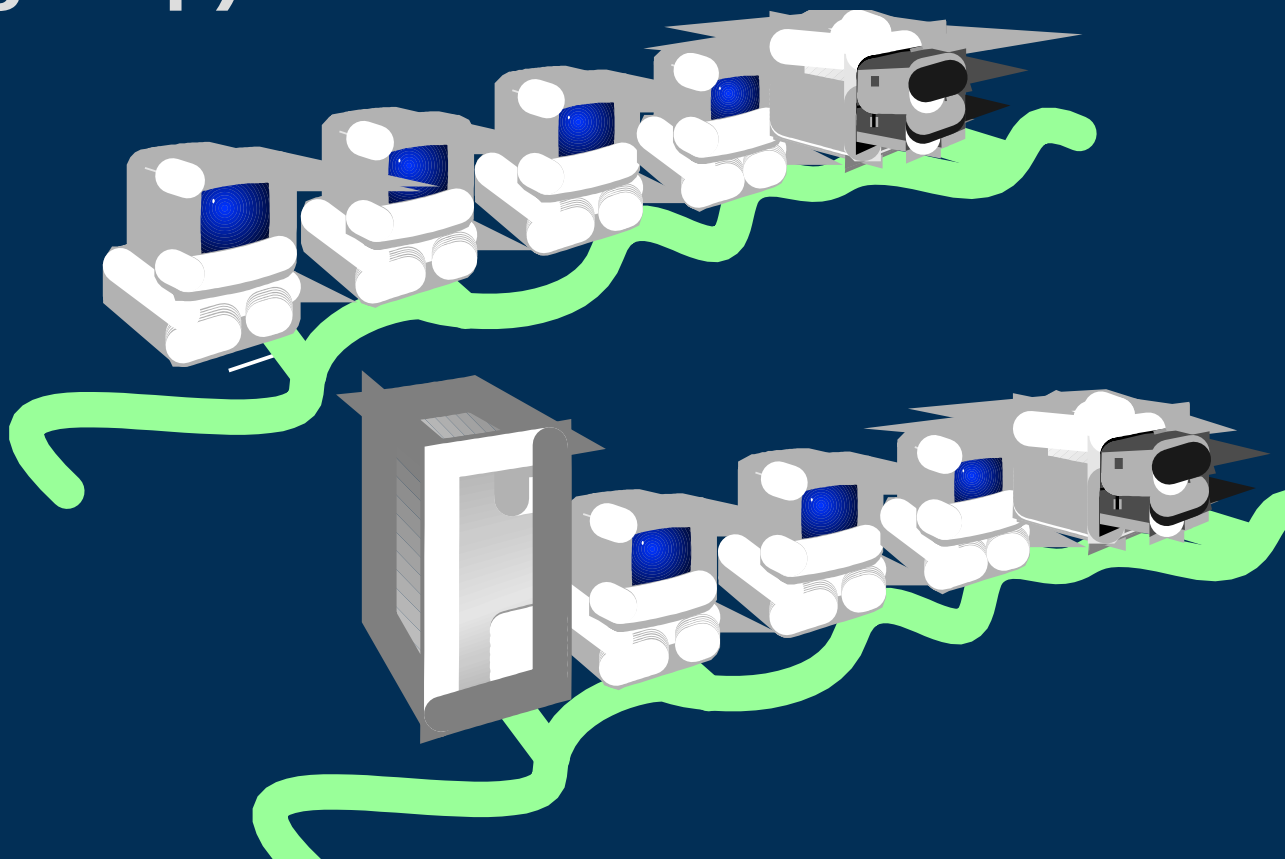
- Network Operating Systems
- Protocols
- Resources to share
  - Files
  - Directories
  - Programs*

A Simple Network



Types of Networks

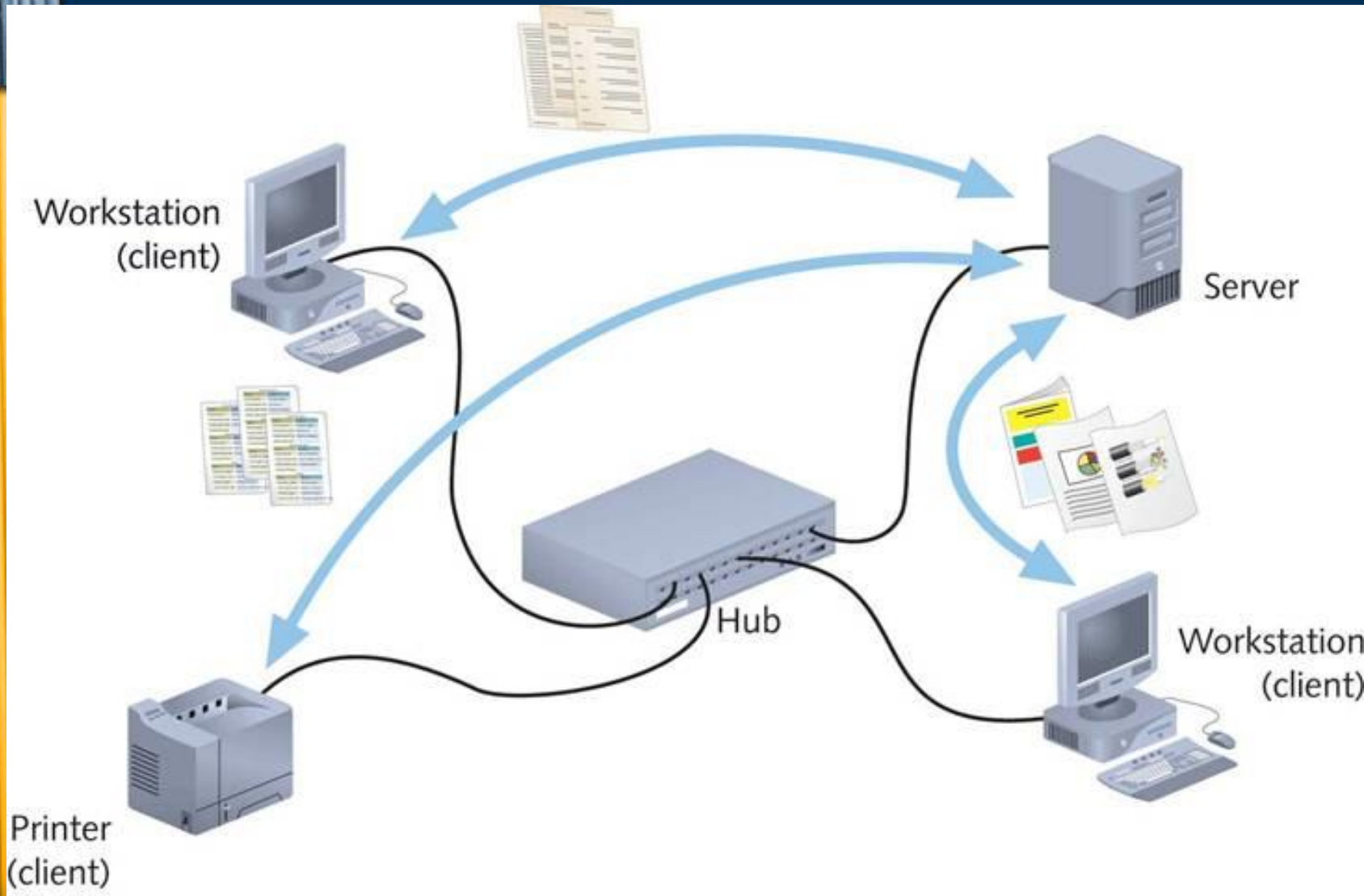
- Client/Server
- Peer to Peer (also known as Workgroup).



Client Server Network

- One or more servers running a network operating system.
- Clients connected to the server via connectivity hardware.
- Required if security is a major issue.
- Required if the network is larger than 11 computers.
- Allows for centralized management.
- Scalable…can grow as a company grows
- Requires less training for users.*

Client/Server Network



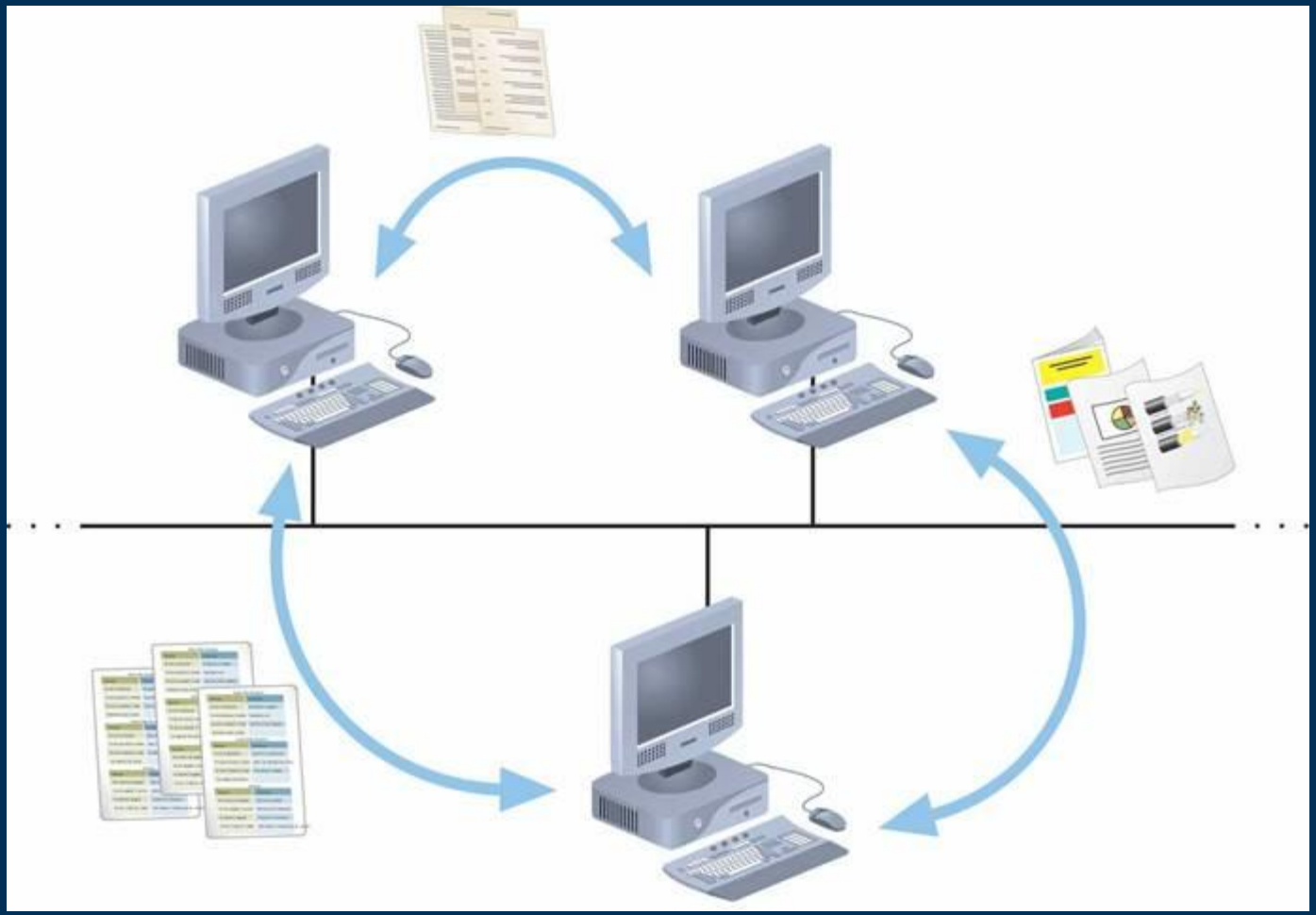
Advantages of using client/server networks

- User logon accounts and passwords can be assigned in one place
- Access to multiple shared resources can be centrally granted to a single user or groups of users
- Problems can be tracked, diagnosed, and often fixed from one location
- Security!*

Peer to Peer Network (workgroup)

- A group of client computers that act as equals. They can work like a client or a server.
- Good for up to 10 computers.
- Provides no real network security.
- Requires training for users.
- No centralized management of resources.
- Difficult to manage as network grows.*

Sharing on a Simple Peer to Peer Network



Centralized vs Distributed Networks

- Describe where processing takes place
- Centralized
  - One system provides both data storage and processing power
  - Mainframes and dumb terminals
  - No processing or storage capabilities at the workstation
- Distributed
  - Processing power shared between servers and workstations*

LANs, WANs, CANs, and MANs

- Large networks are defined by their size and their implementation.
- The most common network is a LAN: Local Area Network.*

LAN-Local Area Network

- Transfer data at high speeds
- Exist in a limited geographical area (office, building, classroom)
- Connectivity and resources are usually managed by the company running the LAN.*

WAN-Wide Area Network

- Exist in a large geographical area
- Usually connect a number of LANs
- Often transmit data at lower speeds
- Connectivity and resources are usually managed by a third party such a phone company or cable company.*

CAN-Campus Area Network

- Exist in a limited geographical area, but encompass a number of buildings such as on a school campus or company campus.
- Connect individual LANs
- Owned by company.
- Basically a WAN*

MAN-Metropolitan Area Network

- Exist in a limited geographical area, but encompass a number of building/offices in a city.
- Connect individual LANs
- Run by a city government.
- Basically a WAN*

Internet vs Intranet

- The Internet is a collection of computers and LANs connected throughout the world.
- An intranet is a collection of computers within a company. There is generally no access to an intranet from outside the company.*

Review

- What is a network?
- What are the physical components required for a network?
- What are the internal components required for a network?
- What is a server?
- What is a network operating system?

Review 2

- Purple McGee has a business office with 8 computers. He wants to set up a small network. His users are pretty bright and security is not an issue.
- Green LaMean has a business office with 8 computers. The business is growing. He works with sensitive data, so security is an issue.*
- What defines a LAN?

Review 3

- This network is on a school or company campus.
- This network connects LANs.
- This type of network is usually run by a city government.
- Which generally runs slower, a LAN or a WAN?
- Which is larger, a LAN or a CAN?*

Review 4

- What type of network is internal to a company and cannot be accessed from outside?
- What is a protocol?
- What is transmission media?
- How much wood would a woodchuck chuck if a woodchuck could chuck wood?

Standardization and the OSI Model

Standardization and Reference Models

- There is a purpose to learning about reference models and standardization, even though at first it might seem obscure. Reference models allow different vendors to create hardware and software that will work with other technology that use the same model and standards.
- The OSI model is the main reference model used in networking.*

The OSI Model

- The OSI model is a conceptual model that defines the way network communications take place between two computers.
- There are seven layers on the OSI model*

The OSI Model

- To understand the OSI model is to understand how computers communicate.
- Is mainly used for troubleshooting protocol issues (different protocols work at different levels).*

The OSI Model

- Application
- Presentation
- Session
- Transport
- Network
- Data Link
- Physical

An easy way to remember the OSI model layers:

All people seem to need Dr. Pepper

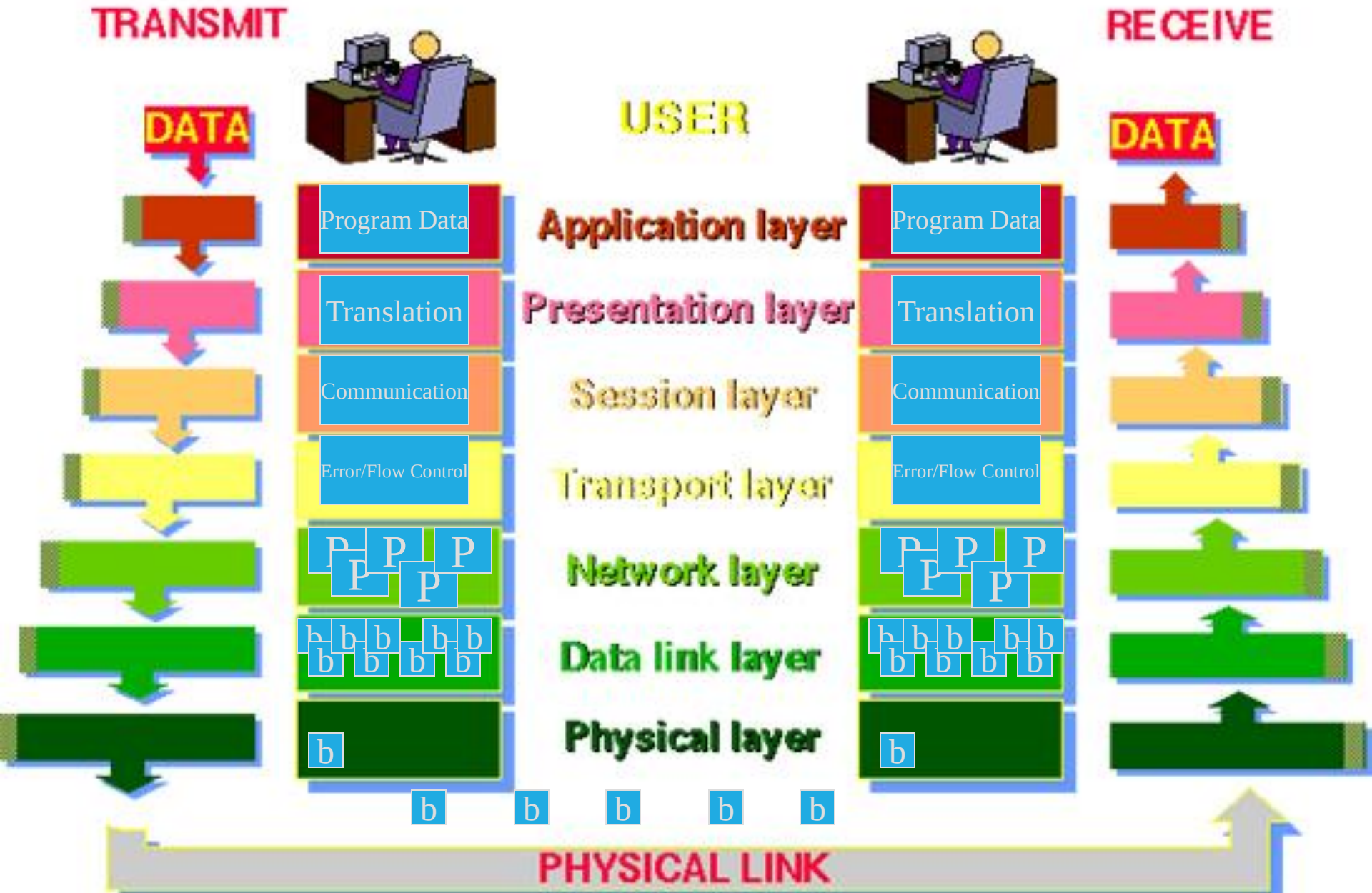
or

Please do not throw sausage pizza away!

How the layers of the OSI Model Work Together

- As a piece of information is sent from computer A it works down the layers of the OSI model.
- Each layer (except the physical) adds information to the packet headers that can be read by the corresponding layer on the other computer.
- On the receiving computer the data goes from the bottom up.
- Each layer then strips off and uses the header information from the corresponding layer.*

THE 7 LAYERS OF OSI



So what does each layer do?

- Each layer works with different protocols kind of like an assembly line.
- Different pieces of connectivity hardware work with different protocols at different layers.
- On a certification test you might be asked about either of these things.*

OSI Model Assignment

- Get together as a team and split up the seven layers of the OSI model.
- Look online for websites related to the OSI model.
- Learn your level of the OSI model be prepared to share:
  - What happens at that level.
  - What protocols work at that level.
  - What hardware works at that level.*

Application Layer

- This is where the users actually “talk” to the network and computer through programs.
- Users interface with the network when they:
  - Read email
  - Send/receive packets
  - Surf the net
  - Other network related activities

Application Layer

- **Hardware:**
  - **Gateway**
- **Protocols**
  - **DNS**
  - **FTP**
  - **TFTP**
  - **BOOTP**
  - **SNMP**
  - **SMTP**
  - **MIME**
  - **NFS**
  - **TELNET**
  - **NCP**
  - **SMB**
  - **ETC.**

Presentation Layer

- Something has to take our chicken scratchings and turn them into something the computer and network can understand.
- This layer is essentially a translator providing coding and conversion to formats that can be read by all computers.*

Presentation Layer

- Responsible for
  - Protocol conversion
  - Data encryption/decryption
  - Expanding graphics commands (so jpegs look like pictures)
  - Data compression
- Hardware
  - Gateway
  - Redirector
- Protocols
  - Application protocols usually work here too.*

Session Layer

- Sets up, maintains, manages, and closes a session between two network nodes.
- Manages who can transmit data and for how long
- Makes sure that if a session drops, and then picks up again, old stuff isn't resent.
- Hardware:
  - Gateway
- Protocols:
  - NetBIOS
  - Named Pipes
  - Mail slots
  - RPC*

Transport Layer

- Segments and reassembles data into a data stream. (Breaks stuff into packets/frames.)
- Transport layer services take data from upper layers and break it into packets, and take packets from lower layers and assemble it into data.
- Works with session layer to maintain flow control

Transport Layer

- Makes sure everything gets there
- Hardware:
  - Gateway
  - Advanced cable tester
  - Brouter
- Protocols
  - TCP
  - ARP
  - RARP
  - SPX
  - ATP
  - NWLink*

Transport Layer Reliable Networking

- Flow Control—by ensuring sending and receiving computers are going at a speed that both can handle, packets don’t get lost.

Transport Layer Reliable Networking

- Connection-oriented communication—One device pokes the other device and makes sure it's ready, the other device says "Yeah, I'm ready…quit poking me", the sending device sends, the receiving device says "Yeah, got it."
  - Synchronize
  - Negative connection
  - Synchronize
  - Acknowledge
  - Communication established
  - Data transfer
- Connectionless communication
  - Data is sent but receiving computer doesn't acknowledge receipt and sending computer couldn't give a rip*

Network Layer

- Manages device addressing, specifically IP addresses
- Tracks location of devices on a network
- Determines the best way to move something from one computer to another*

Network Layer

- Responsible for
  - Addressing
  - Determining routes for sending
  - Managing network problems such as packet switching, data congestion, and routing
- Breaks frames into packets that can be handled by router

Network Layer

- **Hardware:**
  - **Brouter**
  - **Router**
  - **Frame Relay Device**
  - **ATM Switch**
  - **Advanced Cable Tester**
- **Protocols**
  - **IP**
  - **ARP**
  - **RARP**
  - **IGMP**
  - **NWLink***

Network Layer

- Packets used on the network layer
  - Data packets—transport data (duh). Protocols used to support data traffic are called routed protocols.
  - Route update packets—Packets that update neighboring computers of changes in the network. These are called routing protocols:
    - RIP
    - EIGRP
    - OSPF*

Data Link Layer

- Provides physical transmission of data and handles error notification, network topology, and flow control.
- Makes sure the messages are delivered to the proper device on a LAN using hardware addresses
- Translates data into bits to be sent along the physical layer*

Data Link Layer

- Messages are formatted into frames which contain a header (containing hardware destination and source address), data, and (sometimes) a footer saying “all done”
- Once the frames arrive at the destination, the data is extracted and used*

Data Link Layer

- Broken into two sub-layers
  - Media Access
    - Communicates with NIC
    - Controls type of media being used
  - Logical Link Control
    - Simple error correction and flow control
    - Manages link control and defines SAPs
  - Hardware:
  - Switch
  - Bridge
  - Intelligent hub
  - NIC
  - Advanced Cable Tester
  - ISDN Router

Data Link Layer

- Protocols
  - SAP
  - MAC
  - ATM
  - HDLC*

Physical Layer

- Sends and receives bits
- Defines what kinds of cables and connectors are used
- No protocols work here (although sometimes you'll see ODI and NDIS as they are network card protocols)
- Hardware:
  - NIC
  - simple hubs
  - Repeaters
  - TDR
  - Oscilloscope*

Review

- Which layer is responsible for breaking data into bits?
- Which layer is responsible for breaking data into packets?
- What is the purpose of a message header?
- If a sending computer adds information to the header on the transport layer, what does the receiving computer do with that information?
- At what layer does the router work?
- At what layer does a bridge work?

Review

- At what layer does a switch work?
- What kind of addressing does a router use?
- What kind of addressing does a bridge use?
- What is a broadcast message?
- At what layer does a NIC work?
- Which layer is responsible for placing bits on the media?
- Which layer is responsible for opening and maintaining communications between two systems?

IEEE 802 Family

- Institute of Electrical and Electronic Engineering is the standardizing body for many industries.
- The 802 section specifically deals with networking*

IEEE 802 Family

- There are 22 subcommittees in the 802 family.
- Each subcommittee is responsible for a specific part of networking.
- You should be aware of the IEEE because it is where you will go when you need to understand, in depth, the standard for a certain technology.*

IEEE Assignment

- Get online and look up the IEEE 802 information from your reading.
- As a group, split the 802 IEEE committees and find out:
  - What it does
  - If it is still active
- You have ten minutes to do this.

IEEE 802 Family

- 802.1—Defines internetwork communications standards between devices and includes specifications for routing and bridging.
- 802.2—Defines the LLC sublayer of the data link layer of the OSI model.
- 802.3—Defines Ethernet communication standard, including the MAC sublayer use of CSMA/CD
- 802.11 Wireless LAN
- 802.15 Wireless Personal Area Network (WPAN)*

802 Family Continued

- 802.16 Broadband Wireless Access
- 802.17 Resilient Packet Ring
- 802.18 Radio Regulatory
- 802.19 Coexistance TAG
- 802.20 Mobile Broadband Wireless Access (MBWA)
- 802.21 Media Independent Handoff Working Group
- 802.22 Regional Wireless Area Networks

802 Family Inactive

- 802.2 Logical Link Control
- 802.5 Token Ring
- 802.12 Demand Priority
- Disbanded
  - 802.4 Token Bus
  - 802.6 MAN
  - 802.7 Broadband
  - 802.8 Fiber Optic
  - 802.9 Integrated services LAN
  - 802.10 Security
  - 802.14 Cable Modem

Characteristics specified in each standard

- Speed
- Access methods
  - CSMA/CD
  - Token passing
  - CSMA/CA
  - Demand priority
- Topology
- Media
- White papers—contain information on implementation of the technologies, including new patents.*

Know:

- The purpose of the 802s
- Which 802 committee defines Ethernet networking
- Which 802 separates the Data Link layer by defining the LLC layer
- Which layer is responsible for wireless communications
- Who works with token ring networks
- Where security is handled*