# Ipt communications notes

Technology, Internet

Communication Systems Overview: * Characteristics of communication systems * Examples of communication systems * Transmitting and receiving in communication systems * Other information processes in communication systems * Issues related to communication systems Characteristics of a Communication System * Enables people to send and receive data and information * We use communication systems every day * Facebook chat: Words/Characters; Wireless Internet; Various friends Text message: Words/Characters; Mobile Network Carrier; Single receiver Mailbox: Physical medium/Paper; Post office; I received the letter PSN: Words/Characters; Wireless Internet/Playstation Network; Single receiver * Must be a sender and receiver * A protocol is a set of rules which governs the transfer of data between computers. Protocols allow communication between computers and networks * Handshaking is used to establish which protocols to use. Handshaking controls the flow of data between computers * Protocols will determine the speed of transmission, error checking method, size of bytes and whether synchronous or asynchronous * Examples of protocols are: TCP/IP, token ring, CSMA/CD * Every communication system has 5 basic requirements: * Data Source: where the data originated * Transmitter: device used to transmit data * Transmission Medium: Cable or non-cable * Receiver: Device used to receive data * Destination: where the data will be placed * A protocol is a set of ruled that governs the transmission of data * Different rules are used for different purposes * Whenever a communication system transfers data, the rules must first be checked * Both sender and receiver must use the same set of rules * Most communication protocols follow internationally accepted standards * One set of standards is the OSI

(Open Standards interconnection) reference model * When using the OSI reference model are considered at different levels related to the structure * Modern computer network architecture is highly organised and structured into layers * Each layer has a particular role in the communication system for which it is responsible * The OSI reference model has different layers. They are: * Physical layer — refers to the electrical and physical aspects of devices * Data link layer — the method in which information from then network is broken down and transmitted over the physical layer * Network layer — ensures large files are transferred * Transport layer — ensures system reliability and quality * Session layer — creates and controls sessions between two computers * Presentation layer — programming languages are translated into machine language * Application layer- the user interaction layer where data turns into an application Handshaking * The exchange in data communication of prearranged signals that defines a protocol between two computers. * Handshaking is used to establish the protocols for the transfer of data. * They must agree on the rules (hence the term ‘ handshaking’) * The transmitter and receiver must ‘ talk the same language’ * Handshaking occurs on 2 levels of the OSI reference model * Session level * Opens the handshaking with a query about the readiness of the receiver. The receiver then responds with a query about what the transmitter wants to do. * Application level * The software goes through the process of verifying the ID and password of the transmitter. * Handshaking is often referred to as flow control as it controls the flow of data. * Handshaking is usually controlled by software over long distance * There are two methods of handshaking used to control the flow of data * Hardware flow control * Uses

a dedicated connection * Only practical when devices are close enough to be linked with a cable * RTS/CTS * Software Flow Control * Uses a special code sent with the data * A common software protocol is XON/XOFF. Protocol | What is it? | Definition | TCP/IP | Transmission Control Protocol/Internet Protocol | Routable seat of rules that splits data into packets for transfer of data across the internet | FTP | File Transfer Protocol | A standard for the exchange of program and data files across a network. | X modem | Simple File Transfer Protocol | XMODEM is a simple file transfer protocol developed as a quick hack by Ward Christensen for use in his 1977 MODEM. ASM | Z modem | Simple File Transfer Protocol | ZMODEM is a file transfer protocol developed by Chuck Forsberg in 1986, in a project funded by Telenet in order to improve file transfers on their X. 25 network. In addition to dramatically improved performance compared to older protocols, ZMODEM also offered restartable transfers, auto-start by the sender, an expanded 32-bit CRC, and control character quoting, allowing it to be used on networks that might " eat" control characters. ZMODEM became extremely popular on bulletin board systems (BBS) in the early 1990s, displacing earlier protocols such as XMODEM and YMODEM. | PPP | Point-to-Point Protocol | data link protocol commonly used in establishing a direct connection between two networking nodes. It can provide connection authentication, transmission encryption, and compression. | POP | Post-Office Protocol | application-layer Internet standard protocol used by local e-mail clients to retrieve e-mail from a remote server over a TCP/IP connection | HTTP | Hypertext Transfer Protocol | application protocol for distributed, collaborative, hypermedia information systems. HTTP is the foundation of data communication for the

World Wide Web. | Transmission Speed * Transmission speed is the time taken to transfer data from the source to the destination * The speed of transmission depends on the hardware being used and the transmission medium * Transmission speed is described in terms of bandwidth, bits per second (bps) and baud rate. * Measuring speed in a communication link — * Baud rate — the number of distinct signal events or timing intervals in a second * Bits per second — the number of bits that are transmitted in a second. This measures the speed of communication bps is the number of 0s and 1s which are transmitted through the communication link in one second. This includes special bits described in protocol, including start and stop bits and various error checking bits. Bps is more useful than baud rate as it shows how much data is sent and how fast it is sent. Bandwidth * Bandwidth refers to the ability of the transmission medium to handle a particular amount of data in a given time * The higher the bandwidth the more data that can be transmitted Examples of Communication Systems * Communication systems of many different kinds are now very common * There are 3 main types of communication systems that we will look at. They are: * Teleconferencing * Messaging systems * Electronic commerce Teleconferencing * Teleconferencing is a meeting in which some participants are physically together in a home, office or conference room and other can participate on their telephones * Teleconferencing is mainly used by businesses and for distance education * Examples for Business: A TNC such as McDonalds has a meeting to discuss long term goals for operations in different countries across its firms. A finance organisation in NSW conferences amongst its firms within the state to discuss its current

projections over the next financial year. * Examples for Distance Education: Software design course taught by Greg Donaldson from Port Macquarie to students from all over the state of NSW. A year 12 Australian student learning economics from other students over the Pacific/Asian countries. * Developments in teleconferencing: * Audio Conferencing: allows for communications between groups of people in different locations using sound only * Video Conferencing: allows ‘ face-to-face’ communication between people in different locations. Achieved using digital video cameras. Audio and Video Hardware | Audio and Video Software | * Polycom® Communicator C100S * Logitech® HD Pro C920 * Sony EVI-HD1 High Definition Camera * Plantronics Audio . 470 USB * Polycom® SoundStation® IP 7000 — VoIP Conference Phone | * Skype * AT-T client * Blackboard Collaborative * Google+ Hangout * Windows Live Messenger Video Call * Chat Roulette | Messaging Systems * Messaging systems are traditional means of communications * Fax systems: * Handles data in a graphical form * Uses a scan process to convert documents to data, which is then compressed so that it can be transmitted and received across the telephone system * The receiver recreates the original document and prints a hardcopy * Fax machines; A History: * The first fax machine was invented by Scottish mechanic and inventor Alexander Bain. In 1843, Alexander Bain received a British patent for “ improvements in producing and regulating electric currents and improvements in timepieces and in electric printing and signal telegraphs", in laymen's terms a fax machine. * In 1850, a London inventor named F. C. Blakewell received a patent what he called a " copying telegraph". * In 1860, a fax machine called the Pantelegraph sent the first

fax between Paris and Lyon. The Pantelegraph was invented Giovanni Caselli. * In 1895, Ernest Hummel a watchmaker from St. Paul, Minnesota invented his competing device called the Telediagraph. * In 1902, Dr Arthur Korn invented an improved and practical fax, the photoelectric system. * In 1914, Edouard Belin established the concept of the remote fax for photo and news reporting. * In 1924, the telephotography machine (a type of fax machine) was used to send political convention photos long distance for newspaper publication. It was developed by the American Telephone & Telegraph Company (AT&T) worked to improve telephone fax technology. * By 1926, RCA invented the Radiophoto that faxed by using radio broadcasting technology. * In 1947, Alexander Muirhead invented a very successful fax machine. * On March 4, 1955, the first radio fax transmission was sent across the continent. Technology today has advanced to the point where thousands of people can get messages from various sources instantly. What are some of the current ways for people to send and receive messages. List and describe how these work. * Facebook message, the user establishes who they wish to send the message, they then compose it and hit enter or send for it to be sent over the internet to the corresponding facebook account * SMS, using the telephone network, a message is composed and sent to the user chosen. Composed of by text * Voicemail, normally associated with a missed call, the user leaves a voice message on an answering machine or message bank on a phone * Pager, a small telecommunications device, this sends messages over a network, normally over a short distance * video/picture message, sending photos or videos as messages over a pure text-based message * skype, voice/video/text based communication

application between 2 or more people over a wifi connection * email, sending a message with possible attachments to the receiver(s) inbox * gmail chat, instant text chat system Email * Email is the most widely used form of communication on the internet * Text book pg 82-84. Trace history of email. * Davis pg 284-288. Technical description for this * What protocols are used with email? * Describe all the parts of an email message * How can email be abused? Research examples. What are the motives? * Sending text messages electronically could be said to date back to the Morse code telegraph of the mid 1800s; and the 1939 New York World's Fair, where IBM sent a letter of congratulations from San Francisco to New York on an IBM radio-type, calling it a high-speed substitute for mail service in the world of tomorrow. Teleprinters were used in Germany during World War II, and use spread until the late 1960s when there was a worldwide Telex network. Additionally, there was the similar but incompatible American TWX, which remained important until the late 1980s. An e-mail when it is commanded to send, will contact the domain that is located after the ‘@’ symbol and inquire about the email name that is located before the ‘@’ symbol, the text section of the message (including the metadata) is broken down into ASCII code and sent, other sections of the email that may be an image or an attachment are handled by their appropriate protocols. IMAP, POP3, SMTP, UUCP, X400 * Email contents component, destination address fields, originator fields, identification fields, informational fields, resent, trace and optional fields. E-mail can be abused by people that send out spam to other people, this could be either phishing links or e-mails that contain virus’ * EFTPOS * Electronic Funds Transfer at Point Of Sale * NFC; Near Field Communication. In the

context of commerce, this technology can be used for contactless payment, similar to the use of credit cards and e-ticket smartcards. It allows mobile payment to replace or supplement these systems. It is being implemented by such companies as Google, who have developed a solution called “ Google Wallet" where funds can be placed in a virtual wallet held by Google and works by synchronizing the phone with an identifier by tapping the two together, transferring the consumer’s information to the hardware as well as the funds required to purchase the good/service. This changes the way we purchase goods as it eliminates the need to carry extra credit cards and money but it also raises security concerns. If one were to misplace their phone with given information on it, then the potential for stolen funds increases drastically, pondering the question as to how this is to be prevented or controlled. Packets * Transmissions are broken up into smaller units or data transmissions called packets. Error Checking Methods * Parity Bit Check * Checksum (data transmitted in blocks, each block added to give a total — checksum) — used for copying files etc * Cyclic redundancy check Parity Check * Early modems transmitted and received each character separately as its 7-bit ASCII code. In essence each packet of data contained just 7-bits, for such small packets a simple error checking known as parity was all that was used * Furthermore much of the data was text, so the occasional incorrect character was not a significant problem. Today data is transmitted by all modems in much larger packets that utilise more sophisticated error check techniques such as checksums and CRCs * The parity check adds an extra bit (8th bit) to every character of bit transmitted. But the sending and receiving devices must agree on which parity checking

method will be used. There are three agreed Parity Check Methods. * Odd, Even or None. * Odd parity: if the devices agree on Odd Parity, than the total number of 1’s in a byte must total an Odd number, including the parity bit. * Even parity: if the devices agree on Even Parity, then the total number of 1’s in the byte must total an even number, including the parity bit * Parity is unreliable, only detects 50% of transmission errors. * Bit swapping: one of the 1s in the data byte is swapped with one of the 0s then the parity wouldn’t change and error is not detected. * Any byte with an even number of will be undetected * Rarely used in modern communications protocols * During transmission there is often interference called noise Checksum * Checks for errors in data transmission by counting the number of bits in a data packet. The count of bits is attached to the data packet * During transmission, the receiving computer add the received data bits, obtaining its own checksum * If the two checksums don’t match then an error is detected * Data is sent in blocks with the total or sum of the ones being sent at the end of the block. Known as checksum * The receiving computer will add the 1s in the received data and compare it to the sum it was sent * If numbers are identical then the message is cleared of errors. Otherwise the receiver will assume there is a mistake and ask the sender to resend the message * Problem may occur in this method when the order of the 1s and 0s maybe incorrect but the checksum will still be correct allowing the error to go undetected. * Example for checksum error detection: * 111111111000011 Checksum = 11 * 101111111100011 Checksum = 11 (message to be sent; error in message due to the change of a 1 to a 0) Cyclic Redundancy Check (CRC) * Checks for errors in data using a division process * The sum is the

divided by a constant and the remainder after this division is sent to the receiver * The receiver then works out the sum of the transmitted data, divides it by the same constant and compares the remainder with the data transmitted * Advantages: * Data is treated as one large block rather than individual packets * Higher probability of error detection * The constant used for division of the checksum is known by both sender and receiver. It is established during protocols and agreed upon in handshaking * 111001100011001 Checksum = 8 Number sent = 4 constant = 2 * Checksum = 8... 8 1s are present. Number sent = 4. Why? Checksum divided by constant = 4. 4 is sent as well as the constant, which is 2. * If a 0 is swapped with a 1, no error is detected. Methods of Data Transmission * Parallel transmission * A transmission process in which a number of data bits are transmitted at the same time. Each bit travels along a separate channel or wire. * The speed depends on the number of channels available. The more channels, the faster the transmission * This form of transmission is suitable over short distances. The data bits can get out of alignment (data skew) when the distance increases. * Serial transmission * A transmission process in which the bits of each character are transmitted sequentially, one at a time, over a single channel or wire. * Serial transmission is slower but there are fewer problems with data. Because of this, it is more suited to a long distance transmission * Why not use Parallel instead of Serial? * Inconsistencies on channels data arrives at different time * Because of the way it is transmitted packet switching cannot be used * The above 2 points make parallel slower than serial requires higher bandwidth * Parallel transmissions are rarely used anymore What is Packet Switching? * Packet

switching refers to protocols in which messages are broken up into small packets before they are sent * Each packet is transmitted individually across the net. The packets may even follow different routes to the destination, depends on the type of packet switching * Each packet has header information in which enable to route the packet to its destination. At the destination, the packets are reassembled into the original message * To prevent delays and ensure the network has a reliably fast transit time, a max length is allowed for each packet. A message submitted to the transport layer may first have to be divided by the transport protocol entity into a number of smaller packet units before transmission. They are reassembled into a single message at the destination. Synchronous and Asynchronous Transmission * Synchronous Transmission * All data sent at once and no packet switching * Asynchronous Transmission * Uses stop/start bits * Most common type of serial data transfer * Allows packet switching * Allows sharing bandwidth ( i. e. talk on phone while another person is using the internet) Transmission Direction * Simplex: One Direction Only (TV, Radio, PA, Megaphone) * Half Duplex: Both directions but only one direction at a time (Fax Machine, Walkie Talkie). * Full Duplex: Send and receive both directions at once (Telephone, Skype) Networks * A communication system that allows two or more computers and their peripheral devices to be connected * Node * Any device attached to a network, such as workstations, terminals, scanners and printers * Terminals send receive data * A smart terminal is capable of processing data * A dumb terminal relies on another node of the network to do the processing * Workstations are intelligent * Local Area Network (LAN) * A network of computers designed to provide

facilities for communication within a single building or site * Nodes are usually linked with some form of cable * Wide Area Network (WAN) * A network of computers designed to provide facilities for communication beyond a single building or site * A WAN usually uses telephone lines, satellites and microwave links to transmit data Protocols * Ethernet (Ethernet network) * Developed at Xerox, 1976 * Approved as an industry standard protocol 1983 * LAN protocol used on bus and star topologies * Most popular LAN protocol * Inexpensive * Carrier Sense Multiple Access/Collision Detection (CSMA/CD) * A protocol used in Ethernet networks to ensure that only one network node is transmitting on the network at any one time * Carrier Sense means that every Ethernet device listens to the Ethernet wire before it attempts to transmit. If the Ethernet device senses that another device is transmitting, it will wait to transmit * Multiple Access means that more than one Ethernet device can be sensing (listening and waiting) at a time * Collision Detection means that when multiple Ethernet devices accidentally transmit at the same time, they are able to detect this error * Ethernet network with two nodes (simple example) * Each node, independently, decides to send an Ethernet frame to the other node * Both nodes listen to the Ethernet wire and sense that no carrier is present, this causes a collision * Both nodes detect the collision; they then wait a random amount of time before transmitting again * Collisions are normal. A small amount of collisions are expected * If too many nodes transmit at once and collide at an abnormal level, the bandwidth may be restricted on the network, causing loss in retransmission * Switches greatly reduce the already minor difficulties experienced with this protocol * TCP/IP * The most

popular and important protocol implemented on corporate and public internet works * Developed in 1973 for ARPANET, a defence force network * Internet communication is basically based on TCP/IP. It was designed fr government and military networks * Allows transfer of data using packet switching * Network Topologies * Star network: * A communication network in which there is one central node and distant nodes are connected along communication lines that radiate as spokes from the central node * Messages from any node must pass through the central computer * A star network can be fast if the central computer is fast * Often used in a large network where speed is important * Bus Network: * A communications network in which several devices are connected to a single communication channel * A straight line topology * Nodes are represented as points off the straight line * As data travels along the main line, each nodes checks and retrieves data as appropriate * Only on computer can transmit messages at a time to avoid data collisions * Reliable but slow * A form of Ethernet. Uses CSMA/CD protocol. * Ring Network: * A communication network in which the topology is in a continuous circle with nodes represented as points on the circumference * Messages between nodes must pass through all intervening nodes on the ring * Messages are sent one way around the ring * If one node breaks the chain is cut and the network will not work Network Topologies pg 307-310 Network Topologies * Describes the way in which the devices ( nodes) are connected. * A Node is any device that is connected to a network, computers, printers, hubs, switches and routers * Topology describes these connections in terms of their physical layout and also in terms of how data is logically transferred * Three basic topologies Bus, Star

and Ring * Physical Bus topology * All nodes are connected to a single backbone (a trunk or bus) * Single cable carrier of data packets to all nodes * Each node attaches and listened for data via a T-connector or vampire connector. * Function of a terminator is to prevent reflection of the data signal back down the cable * Bus topologies were used for most LANs- in particular Thicknet and Thinnet Ethernet LANs that use coaxial cable as the transmission media. * Today bus topologies are used for some high-speed backbones and other long distance connections within commercial and government WANs * It is common to install a secondary backbone to provide a redundant connection * Physical Star Topology * All nodes connect to a central node via their own dedicated cable. * Star topology is used on almost all LANs, including wireless LANs * Central node is a switch that includes multiple ports. * Multistation Access Unit (MAU) or even a central computer. * MAUs are used in token ring networks so that a physical start topology can be used with token ring’s logical ring topology * For a wireless LANs a WAP ( wireless access point) is used as a central node. * They have a number of advantages over bus * Each node has its own cable and hence can be connected and disconnected without affecting any other nodes * New nodes can easily be added without first disabling the network * Identifying faults is simplified as single nodes can simple be disconnected from the central node until the problem is solved * Also Disadvantages * More cabling is required, however this cable is generally less expensive as it must only support transmission speeds for a single node * If a fault occurs in the central node, all connected nodes are disabled * Physical Ring Topology * Each node connects to exactly two other nodes. Completing a ring formation * Each

node receives data from one node and transmits to the other node in a continuous loop. * If a cable is broken at any point, the entire network is down * Removing a node or adding a new node requires the network to be stopped. * Seldom used for LANs today * FDDI (Fibre Distributed Data interface) and SONET (Synchronous Optical Network) are usually configured as physical rings and always operate as logical rings * Physical Hybrid Topology * Hybrid or tree topologies use a combination of connected bus, star and ring topologies * Commonly a physical bus or topology forms the backbone with multiple physical start topologies * The backbone is installed through each building with a star topology used to branch out to the final workstations- the topology resembles the trunk and branches of a treetrunk * Hybrid topologies have a single transmission path between any two nodes * Primary topology of most organisation’ networks. Difference between a LAN and a WAN network * Difference on the basis of scope: WAN is considered to be more vast and widespread. LAN is mainly used for private connectivity among residential offices or a single edifice. * LAN, Ethernet is the main device which is used for connecting the workstations or the computers. * WAN, common carriers are usually used and most people opt in for service providers. When it comes to the speed of both the network technologies, * A LAN is usually faster as it is confined to a small space with servers in a nearby location. * LAN is based on peer to peer communication where each node is connected to the other node and can share the data and other applications with each other. * LAN is mainly used for data and peripheral sharability like the accessing of scanners printers and other peripherals, and the main feature of a LAN is that usage is restricted and controlled among a

limited number of people. In the case of WAN, however, it maybe used to conduct business, connect with people on a social level, share files and data, etc. How does the Internet work The Internet is a global network of computers which allows people to exchange data worldwide instantaneously. The Internet spreads across all seven continents and includes computers that range from 35 year-old mainframes to modern home PCs to handheld devices. These computers connect to the Internet via a tremendous array of communications mediums including phone lines, coaxial television cable, fiber optic cable, serial lines, short-range (in-building) wireless signals and long-range (cellular) wireless signals. Even with all this variance, the technology of the Internet allows a 10-ounce handheld computer to exchange data with a room-sized mainframe from the 1970's. Definitions Server Type | Definition | File Server | file server is a computer attached to a network that has the primary purpose of providing a location for shared disk access, i. e. shared storage of computer files (such as documents, sound files, photographs, movies, images, databases, etc.) that can be accessed by the workstations that are attached to the computer network. | Mail Server | software that transfers electronic mail messages from one computer to another using a client—server application architecture. An MTA implements both the client (sending) and server (receiving) portions of the. Simple Mail Transfer Protocol. | Web Server |  can refer to either the hardware (the computer) or the software (the computer application) that helps to deliver content that can be accessed through the Internet | Print Server | a device that connects printers to client computers over a network. It can accept print jobs from the computers and send the jobs to the appropriate

printers. | Role of a network administrator Person responsible for the maintenance of computer hardware and software that comprises a computer network. This normally includes deploying, configuring, maintaining and monitoring active network equipment. * Adding/removing users * Assigning users to printers * Giving users file access rights * Installation of software and sharing with users * Client installation and protocol assignment * Logon and logoff procedures * Network based appliactions Jobs on offer at Mycareer. com Basically all the jobs are Network or systems administrator, with very slight alterations of the two The qualifications for the job at iQmultimedia * Outstanding communication skills. We have great pride in our company and our work and so hold all employees to a high standard, both in our communication with our clients and our personal presentation. It is essential that the successful candidate demonstrates good written and verbal English skills and is willing to speak his or her mind. * An ability to adapt to changing requirements easily and creatively and an open mind when it comes to experimenting with new tools, technologies, languages and infrastructure. * An understanding of programming methodologies and the capacity to work within them. * A solid understanding of source control and its place in the software development cycle. * Strong networking knowledge (working with network infrastructure: servers, switches, VPN setup, etc.) * Mac OS X (Snow Leopard, Lion) & Windows desktop support (XP, Vista and 7) * Australian citizen, permanent resident or have the legal right to work in Australia. * Available to work full-time from our Wollongong office (due to the nature of the work this is not currently a telecommuting position). The description of the job Software Dev

and Network Admin * Interesting, varied work * Wollongong-based company with international customers * Creative work environment iQmultimedia is a leader in the software development industry, working with several global companies. We've grown extensively in the last few years, so we're looking for an eager individual to work in this combined development and network administration role. As we continue to expand, we expect the successful applicant will eventually be able to specialise in either development or system administration. If you're sick of the everyday commute to Sydney this position could be an ideal fit for you to help with work/life balance. The salary for this job is between $55, 000 - $70, 000 neg. Others are between $50, 000 - $60, 000. But a large majority have no specified salaries Networks * Token Ring Network * Token passing is a method that ensures there are no collisions * A token is a unique string of bits and there is only one in the network * The token moves continuously around the network when no transmissions are occurring * When a node needs to transmit data, it must wait for the token and when it appears; it is captured by the device and changed such that it contains sender's address, the data as well as the destination address. * Each node checks the token as it passes on the ring and may either put a message on if it is empty, or take a message off. If a node identifies a message that it had sent, it removes the message from the token. The assumption is that if a message returns, then the destination node must have been inactive * Once transmission is complete the token is released back to the network * In most token based systems there is a limit on the amount of transmission time available to any one node. If the time runs out while the node is transmitting a signal,

transmission will be suspended until the token becomes available again. The message is then resumed from the point where it was interrupted * The token signal must be kept at high strength so each node acts as a repeater to boost the signal. * This topology is very efficient because it uses less cabling. Also, there are no problems with queuing to use the central host. * One disadvantage is that if any computer breaks down then the whole ring stops functioning Network Interface Card (NIC) * A device that links the computer processor to the network * NICs are often expansion cards that slot into the motherboard and connect to the network using a cable Router * A device that maintains knowledge of the nodes and routes on the network * It determines the best possible time and logic path for the data * A router is protocol independent such that it can connect networks of different topology * Routers can be used instead of a switch or bridge. Switch * A device that directs data packets along the determined path * It allows the full bandwidth of the medium to be used by a single port so that data can be transmitted much faster. Usually the bandwidth is even divided between the ports using the medium. In this way the device ‘ switches’ the medium to the port needing to transmit data * A switch is not always required in a network as the nodes as part of the network card inspect the data and directs the data. Bridge * A combination of hardware and software to link networks of the same protocol * A bridge itself is protocol independent Gateway * A combination of hardware and software to link networks of different protocol and topology * More complex than bridges and will translate data into one protocol to another protocol for transmission Network Hub * A central connecting device used to connect network cables * Repeats the signal (a

necessary operation as the signal fades over distance) * Simple hubs just accept a transmission through one cable and pass the transmission to any devices connected to the hub through other cables * Repeater hubs amplify the received signal directly to the destination path and do not broadcast it to other connections * Intelligent hubs carry out their own processing Connecting LANs with same topology/protocol * A hub or switch is needed to examine the data packet and forward any data packets addressed to the connected LAN * Hubs provide a central point of connectivity for network devices * A switch is preferred because it isolates the data traffic to the destination path rather than being broadcast over the entire network Connecting LANs with different topology/protocol same operating system * This known as hybrid topology. * Router or bridge is needed that has the properties of both LANs, for example, a router linking a bus and ring network must have the ability to recognise a token and the ability to recognise data on a bus Connecting LANs with different topology/ protocol different operating systems * A gateway is needed * The gateway converts all protocols and parameters for messages passing between the LANs Connecting a LAN with a WAN * Typically the protocols used in a LAN (such as Ethernet) and a WAN (such as the internet, TCP/IP) are different therefore a router must be used to transfer signals between the networks Communication Channels * A communication medium is the medium, or pathway, through which data is transmitted between devices * A medium can be bounded (through a cable) or unbounded (through the air) * Bounded communication channels fall into 2 basic categories: * Copper wire * Fibre optic * Unbounded communication channels: * Microwave * Satellite *

Bounded Media 1 — Copper Twisted pair * Bandwidth 60 kbps * Twisted pair is a baseband media which uses the full bandwidth of the cable to transmit a single signal at a time * The cable are twisted to minimize electromagnetic interference generated by the flow of electricity in the individual cables (cancelling effect) * Bounded Media 2 — Copper Coaxial * Bandwidth 10 Mbps * Coaxial is a broadband media which allows the channel to be divided such that multiple signals can be send over a single cable at the same time * Bounded Media 3 — Fibre Optic * Uses pulses of laser light to transmit data at the speed of light which exceeds the speed of electrons in copper (electricity) * Not effected by electromagnetic radiation or interference * Bandwidth 400 Mbps * Unbounded Media 1 — Microwave * High frequency radio waves (3 GHz — 10 GHz) are used to transmit data * These signals are ‘ line of sight’ in what they cannot bend * Bandwidth at least 400 Mbps * The curvature of the Earth and atmospheric impedance demands a repeater station every 50km Internet, Intranet, Extranet * Internet * Public/international network which is used to access information, e-shopping, e-banking, email * Intranet * Private network (LAN or WAN) used to share resources in secure environment * Uses web pages (HTML to view) and TCP/IP protocol (To make connection) * Extranet * Intranet that has been extended to include access to or from selected external organizations such as customers, but not general public * Note: Connections via leased lines, or network interconnections Issues Related to Communication systems Messaging Systems — (Social context, Danger of misinterpretation, power relationships, privacy and confidentiality, junk mail, information overload Internet — (Internet trading, taxation, employment, nature of business, trade

barriers, censorship, child protection, internet banking, security, changing nature of work, branch closures and job losses, radio and video) Telecommuting (work from home, blurring between work and home, more stress, advantages and disadvantages) Issues Relating to Messaging Systems * ‘ netiquette’ is etiquette/manners on net * Many people rely on messaging systems more than spoken or face to face communication * Written word only recipient miss out on * Privacy * Spam is overloading mailboxes * Work/information overload from ever growing number of emails Client — Server Architecture * Machines on a network can be categorised as two types: * Servers * Clients * Servers * Machines that provide services to other machines are servers * File server * Print server * Mail server * Web server * Media server * Clients * Machines that are used to connect to those services * When you connect to a search engine on the internet, a web server may be used to service your request * Your machine is the client * It is possible for a machine to be both server and client * Fat Client (aka Thick Client) * A machine that typically provides rich functionality independent of the central server * A networked computer with most resources installed locally * Most PCs are fat clients * Thin Client * A computer or computer program that relies heavily on the resources of other computers on the network * Has limited capabilities and processing power