Introduction to networking Section_ 3 E.M.A Medium MediumAccessAccessControlControl(MAC),(MAC),alsoalsoknownknownasasMediaMediaAccessAccess Control,Control,isisaasetsetofofrulesrulesandandproceduresproceduresthatthatgoverngovernhowhowmult iplemultipledevicesdevicesshareshareaasinglesinglesharedsharedtransmissiontransmissionmediummedi umininaanetworknetwork..It'sIt'saacrucialcrucialcomponentcomponentofofthethedatadatalinklinklayerlayer (Layer(Layer22))ofofthetheOSIOSImodelmodel..?Function:Function:Packages data into frames, adds error detection and correction mechanisms (like checksums), Packages data into frames, adds error detection and correction mechanisms (like checksums), and controls access to the physical medium using protocols like Carrier Sense Multiple Access with and controls access to the physical medium using protocols like Carrier Sense Multiple Access with Collision Detection (CSMA/CD).Collision Detection (CSMA/CD).?ProtocolsProtocols::DefinesDefinesthetheelectrical,electrical,mechanical,mechanical,andan doperationaloperationalspecificationsspecificationsforfortransmittingtransmittingdata,data,includingincludi ngvoltagevoltagelevels,levels,cablecablepinouts,pinouts,andandsignalsignalencoding/decodingencoding/ decoding..?CarrierCarrierSenseSenseMultipleMultipleAccessAccesswithwithCollisionCollisionAvoidance Avoidance(CSMA/CA)(CSMA/CA)::UsedUsedininWiWi--FiFiandandotherotherwirelesswirelessnetworks,networks,wherewheredevicesdevicesavoidavoidcollisions collisionsbybysendingsendingaarequestrequesttototransmittransmit(RTS)(RTS)beforebeforesendingsend ingdatadataandandwaitingwaitingforforaaclearcleartotosendsend(CTS)(CTS)responseresponse..?Trans missionTransmissionControlControlProtocolProtocol((TCPTCP)): TCPTCPisisaaconnectionconnection-- orientatedorientatedprotocolprotocolthatthatoffersoffersgreatergreaterreliabilityreliabilitywhenwhenititcom escomestototransportingtransportingdatadatathanthanwhatwhatUDPUDPprovidesprovides..WithWithTC P,TCP,thetheapplicationapplicationwhichwhichsendssendsthethedatadatareceivesreceivesacknowledgm entacknowledgmentororverificationverificationthatthatthethedatadatawaswasactuallyactuallyreceivedrecei ved..ItItisisusedusedforformanymanyprotocols,protocols,includingincludingHTTPHTTPwebwebbrowsingb rowsingandandemailemailtransfertransferwherewherelosslesslosslessdatadatatransfertransferisisimporta ntimportant..IndividualIndividualunitsunitsofofdatadatatransmissiontransmissionininthetheTCPTCPprotoc olprotocolareareferredreferredtotoasassegmentssegments..?Protocols:Protocols:Ethernet, WiEthernet, Wi--Fi (IEEE Fi (IEEE 802.11802.11), Frame Relay, Point), Frame Relay, Point--toto--Point Protocol (PPP).Point Protocol (PPP).?UserUserDatagramDatagramProtocolProtocol((UDPUDP))::UDPUDPisisaaconnectionlessconne ctionlessprotocolprotocolthatthatdoesdoesnotnotprovideprovidereliablereliabledatadatatransporttransport. .NoNoacknowledgmentsacknowledgmentsarearetransmittedtransmitted..ThisThisprotocolprotocolgivesgi vesaahigherhigherthroughputthroughputandandshortershorterlatencylatencyandandisisoftenoftenusedus edforformulticasting,multicasting,broadcastingbroadcastingandandrealreal--timetimemultimediamultimediacommunicationcommunicationwherewhereoccasionaloccasionalpacketpac ketlosslossisisacceptableacceptable..MessagesMessagessentsentwithwithUDPUDPareareferredreferr edtotoasasdatagramsdatagrams..The OSI The OSI 77--layers modellayers model The TheOSIOSImodel,model,alsoalsoknownknownasasthetheOpenOpenSystemsSystemsInterconnectionInte

rconnectionmodel,model,isisaaconceptualconceptualframeworkframeworkusedusedtotodescribedescribe networknetworkcommunicationcommunication..ItItdefinesdefinessevensevendifferentdifferentlayers,layer s,eacheachwithwithspecificspecificfunctionalitiesfunctionalitiesandandresponsibilitiesresponsibilities..?Th eTheSessionSessionLayerLayerprovidesprovidesprocessprocesstotoprocessprocesscommunicationsco mmunicationsbetweenbetweentwotwoormoremorenetworkednetworkedhostshosts..ThisThislayerlayeri sisresponsibleresponsibleforformaintainingmaintainingproperpropercommunicationcommunicationbybyes tablishing,establishing,managingmanagingandandterminatingterminatingsessionssessions(a(apropertypr opertyofofTCP)TCP)betweenbetweentwotwonodesnodes..ItIttakestakescarecareofofgracefullygracefullyc losingclosingsessionssessionsandandforforsessionsessioncheckcheckpointingpointingandandrecoveryre covery..?ConnectionConnection--oriented:oriented:Guarantees inGuarantees in--order delivery of data packets and errororder delivery of data packets and error--free transmission (e.g., free transmission (e.g., TCP).TCP).Uses routing protocols like Open Shortest Path First (OSPF) or Border Gateway Protocol (BGP) to determine the best path for data to travel.(BGP) to determine the best path for data to travel.?Additional functionalities:Additional functionalities:Performs network address translation (NAT) to allow private IP addresses to Performs network address translation (NAT) to allow private IP addresses to communicate on the public internet.communicate on the public internet.?Additional functionalities:Additional functionalities:Provides logical addressing (MAC addresses) for identifying devices on the same Provides logical addressing (MAC addresses) for identifying devices on the same network segment.network segment.?Protocols:Protocols:Transmission Control Protocol (TCP), User Datagram Protocol (UDP), port numbers.Transmission Control Protocol (TCP), User Datagram Protocol (UDP), port numbers.Uses routing protocols like Open Shortest Path First (OSPF) or Border Gateway Protocol addresses).?FunctionFunction::EstablishesEstablishesthethephysicalphysicalconnectionconnectionbetw eenbetweendevicesdevicesandandtransmitstransmitsrawrawdatadatabitsbitsthroughthroughaaphysicalph ysicalmediummediumlikelikecablescables(copper,(copper,fiberfiberoptic)optic)ororwirelesswirelesssignal ssignals(radio(radiowaves)waves)..?UnicastUnicast::oneone--toto--oneonecommunication,communication,wherewheredatadataisistransmittedtransmittedfromfromaasinglesi nglesourcesourcetotoaasinglesingledestinationdestination..?MulticastMulticast::OneOne--toto--manymanycommunication,communication,wherewheredatadataisissentsenttotoaagroupgroupofofdevices devicessimultaneouslysimultaneously..?BroadcastBroadcast::OneOne--toto--allallcommunication,communication,wherewheredatadataisissentsenttotoeveryeverydevicedeviceononthe thenetworknetwork..Transmission Types: Transmission Types: Transmission Transmissiontypestypesreferrefertotothethedifferentdifferentmethodsmethodsusedusedtototransmittrans mitdatadatabetweenbetweendevicesdevicesininaacommunicationcommunicationsystemsystem..TheyThe ydefinedefinehowhowinformationinformationisispackaged,packaged,sent,sent,andandreceived,received,e ??????????????????..nsuringensuringreliablereliableandandefficientefficientdatadataexchangeexchange ???