Packet Networks *Part II: Wide Area Networks* (Lecture 17.10/ML)

Wide Area Network (WAN) is a geographically dispersed telecommunications network. A wide area network may be privately owned or rented, but the term usually connotes the inclusion of public (shared user) networks. An intermediate form of network in terms of geography is a Metropolitan Area Network (MAN). MAN is a network that interconnects users with computer resources in a geographic area or region larger than that covered by even a large local area network (LAN) but smaller than the area covered by a wide area network (WAN).

LAN networks are not able to scale in size due to disperse address structure (management complexity) and increasing collisions with additional users. Splitting the network into separate LAN interconneted by MANs and WANs require new protocols to handle traffic on larger scale. This is job of OSI layer 3 – Network layer. L3 is responsible of global (network wide) addressing and communication. L3 addressing is based on managed structure, like in PSTN +country code/area code/terminal number. In Internet this address structure is not so clear, but anyhow there is logical assignment of addresses based on the subscription (root –> large service provider –> medium size service provider –> small service provider –> user).

Internet Protocol (IP) is de facto protocol used in all major WAN networks. It provides datagram delivery based on IP–addresses (32 bits represented as four eight bit characters). Address structure is based on separation of host address and network address. This is done today with the network mask, which is a variable length bit mask. Network address is resolved with logical AND–function from host address and network mask. Last address of the network (resolved with logical OR–function from network address and inverse network mask) is so called broadcast address, which is used to send information to each and every user in network. It maps into MAC broadcast address FF:FF:FF:FF:FF:FF.

Communication to the hosts in same network (both endpoints produce same network address when added with netmask) is done directly with the L2 protocol. In case communication is to other network (both endpoints produce different network address when added with netmask), information is sent to the L2 interface of default router, i.e. router serving as gateway from particular LAN to the rest of the Internet.

IP is a connectionless protocol, which means that there is no continuing connection between the end points that are communicating. Each packet that travels through the Internet is treated as an independent unit of data without any relation to any other unit of data. This is biggest benefit of IP and also its weakest point. Connectionless structure makes it possible to operate the network in very instabile environment but it also prohibits easy management of delivered service (path is not known and cannot therefore be managed).

MORE INFO
Understanding IP Addressing: http://www.3com.com/nsc/501302.html
(This site provides extensive information address calculation and structure of Internet addresses)

The Network BookChapter 3: The Network Layer
http://www.cs.columbia.edu/netbook/Chapter03/Section01/content.html
(This site provides material describing Internet protocols and operation of Internet)