
CEN 449

**BROADBAND AND HIGH SPEED
NETWORKS**

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NARROWBAND AND BROADBAND ACCESS TECHNOLOGIES

- A variety of technologies are used for Internet access
- They can be divided into two broad categories based on the data rate they provide
 - Narrowband
 - Broadband
- In networking terms, network bandwidth refers to data rate
- Thus, the terms narrowband and broadband reflect industry practice
 - Narrowband Technologies
 - Broadband Technologies

NARROWBAND TECHNOLOGIES

- refers to technologies that deliver data at up to 128 Kbps
- For example, the maximum data rate for dialup noisy phone lines is 56 Kbps and classified as a narrowband technology
- Figure (below) summarizes the main narrowband access technologies

Narrowband

Dialup telephone connections

Leased circuit using modems

Fractional T1 data circuits

ISDN and other telco data services

BROADBAND TECHNOLOGIES

- Generally refers to technologies that offer high data rates, but the exact boundary between broadband and narrowband is blurry
 - The broadband technologies deliver speed higher than dialup
- Figure (below) summarizes the main broadband access technologies

Broadband
DSL technologies
Cable modem technologies
Wireless access technologies
Data circuits at T1 speed or higher

NARROWBAND VS BROADBAND

Features	Narrowband	Broadband
Service area	National, regional, or local	National, regional, or local
Connection	Dial-up	DSL, cable, satellite, wireless
Speed	Painfully slow - under 56K	Really fast download speeds but somewhat slower upload speeds
Features	email, personal webpages, instant messaging, local dial-up number	Same
Equipment	pc, phone line, modem	pc, phone line, cable connection, satellite dish, broadband modem
Security	None	User must check to see if firewall is installed
Time online	Unlimited or set amount number of minutes	Always on
Cost	Flat rate but additional fees if time allotment exceeded	Flat rate for unlimited access or service tiers

LOCAL AND METROPOLITAN AREA NETWORKS

- ❑ Local Area Networks (LAN)- Networks that optimized for a moderate-size geographic area, such as a single office building, a warehouse, or a campus.
 - low bit error rate and delay
- ❑ Metropolitan Area Networks (MAN) - Networks that optimized for a larger geographic area than a LAN, ranging from several blocks of buildings to entire cities.
 - bit error rate and delay higher than LAN
- ❑ Wide Area Networks (WAN) - Networks that optimized for connecting equipment separated by long distances, (hundreds or thousands of miles), typically use telephone lines leased from phone companies.
 - high bit error rate and delay.

BASEBAND VS. BROADBAND

□ Baseband LAN/MANs

- Use digital signaling.
- Signals are inserted on the line as voltage pulses and use the entire frequency spectrum.
- Bi-directional transmission.
- Limited distance, ~1km, (due to attenuation.)

□ FDM Broadband LAN/MANs

- Use Analog signaling.
- Use FDM to divide whole bandwidth into channels.
- Uni-directional transmission
- Use active amplifier.

LOCAL/WIDE AREA NETWORK STANDARDS

Logical Link Control (LLC)	<p style="text-align: center;">IEEE 802.2</p> <ul style="list-style-type: none"> -Unacknowledged connectionless service -acknowledged connectionless service -Connection-mode service 					
Medium Access Control (MAC)	802.3 CSMA/CD	802.4 Token Bus	802.5 Token Ring	802.6 MAN (DQDB)	802.7? ATM BISDN	FDDI Token Ring
Physical Medium	baseband: 10 Mbps (2versions); twisted pair: 1, 10 Mbps; broadband coaxial: 10Mbps	broadband coaxial: 1,5,10Mbps; carrierband: 1,5,10Mbps; Optical fiber: 5,10,20 Mbps	shield twisted pair: 1,4 Mbps	broad- bandco- axial: T1,T3 1.5,44.5 Mbps optical fiber: STS-3C, 155Mbps	optical fiber: 155,622 Mbps	optical fiber: 100 Mbps

Topology:

BUS

Ring

**Dual
Buses**

**2-counter
Rotating
Ring**

INTRODUCTION TO BROADBAND

- × **Broadband definition**
- × **Broadband technologies**
- × **Broadband applications**

BROADBAND DEFINITION

- ✘ A broadband network is defined as a network able to transmit signals with a high bit rate.
- ✘ In opposition to a base band network, which uses only one channel for transmission, a broadband network uses several channels.
- ✘ A transmission channel being equal to 64 Kbps, any network transmitting to 128 Kbps is a broadband network. This is an ITU definition.

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- ✘ Some countries have other definitions, the FCC establishes broadband from 200 Kbps. In Sweden for example, one speaks about 2 Mbps.
 - ✘ In fact the definition of broadband depends on the aims of the decision-makers and the services which are provided to the customers.
 - ✘ In countries of sub-Saharan Africa, one can define broadband as any network transmitting at a bit rate of 256 Kbps.

BROADBAND TECHNOLOGIES

- ✘ Technologies can be in cable, microwave systems or satellite.
- ✘ Technologies in cable include copper pair, electric cable, optical fibre and hybrid technology cable optical fibre.
- ✘ Microwave includes 2,5 and 3G networks. Satellite technology uses VSAT.

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- ✘ **Copper pair.** Many known technologies are used including ADSL (up to 8 Mbps. and 3 Kms.), ADSL2 (12 Mbps.), ADSL2+ (24 Mbps.).
 - ✘ **Broadband on electric cable.** This technology allows a bit rate from 2 to 80 Mbps. It is not yet widespread.

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- ✘ Optical fibre. Up to 100 Mbps with VDSL. In this case, the fibre is extended towards the equipment of the subscriber. Fibre in buildings and Fibre at home (FTTB, FTTH).
 - ✘ Hybrid Fibre Cable (HFC). It is an extension which uses the network of Cable TV through the use of cable modems. This technology is very developed in North America.

BROADBAND APPLICATIONS

- ✘ The development of broadband has involved an integration of technologies (fixed and mobile), of services (voice, data and images) and a change in the business model.
- ✘ This integration is made possible by the transmission capacities offered by broadband.
- ✘ The telecommunication market becomes global, it brings together traditional telecommunication operators, content providers, television operators.

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- × High Speed internet access
 - × Collaborative working
 - × Military and defense
 - × Mobile video conferencing
 - × Remote monitoring of industrial

END-TO-END DELIVERY OF DATA TO APPLICATIONS

- Delay: D end-to-end d per hop
- Bandwidth: B aggregate b per flow

Bandwidth x delay product

number of bits on a high speed path =

$$b \text{ [bits/sec]} \times d \text{ [sec]} = \text{[bits]}$$