Networks classification

Technique of transmission

A first manner to classify networks is to consider the technique of transmission:

- broadcast,
- point-to-point (peer-to-peer).

Broadcast networks are characterized the following way: all machines share the same transmission (logical) channel. Therefore when a machine sends a message on such a network, all machines without exception receive it. This is why we speak about broadcast. Machines on such a network are identified using what we call **addresses**. A variant to this kind of network is **multicast network**: only designated machines can receive the sent message. To get the message, machines must subscribe to a multicast group.

On the other hand, **point-to-point (peer-to-peer) networks** are characterized by communication channels that link only 2 specific machine, that is to say that a message must jump from one machine to another to reach its destination.

Thus, in a general way, we can consider that networks with limited dimensions (among others local networks, see below) use preferably broadcast, though wide networks preferably use a point-to-point structure.

Classifying using networks dimensions

General classification

We'd rather classify networks and multiprocessing systems according to the interconnection distance of processors. We then establish the following classification:

distance	category
< 1cm	massively parallel machines or data flow machines
< 1m	multiprocessor machines
< 200m	Local Area Networks (LAN)
< 1km	campus networks
< 10km	Metropolitan Area Networks (MAN)
< 1.000km	Wide Area Networks (WAN)
> 1.000km	interconnection of wide networks (Internet)

This classification highlights also a technical classification. Technical solutions involved to make use of them are indeed quite distinct to each other. For instance,

connections on a local network are realized with coaxial cables or twisted pair cables, though connections on a WAN are realized with optical fibres.

Local Area Networks (LAN)

The main characteristics of such networks are:

- restricted geographical expanse (less than 200m),
- high bit rate (commonly between 10 and 100 Mbps, but it can be greater),
- global integration: it is managed by a unique organization.

This kind of networks is usually used to connect computers of a company. Such networks depend on a **private authority**.

Because of the small size of this kind of networks, transmission periods are short, with few errors. All this make it easy to administrate.

Metropolitan Area Networks (MAN)

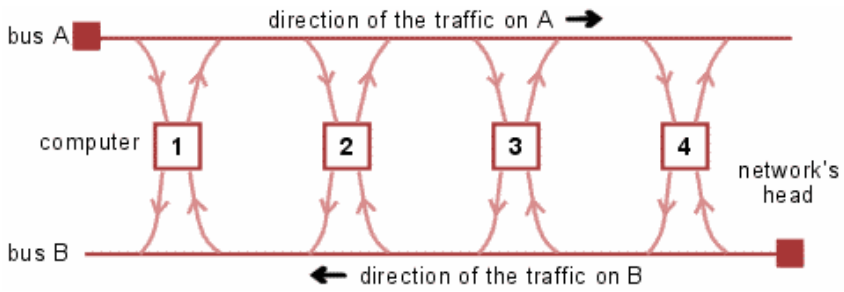
We call them "metropolitan networks" because they are usually used on areas like cities. Main characteristics:

- middle-size geographical expanse (diameter shorter than 10km),
- high bit rate (between 10 and 100 Mbps),
- interconnection capabilities with local networks.

This time, such networks depends on a **public authority**.

We can use this kind of networks to transmit voice and data.

These networks are usually built with 1 or 2 transmission cables (bus) without routing devices. It is a very simple structure, as all computers are indeed directly connected to the bus:



DQDB architecture

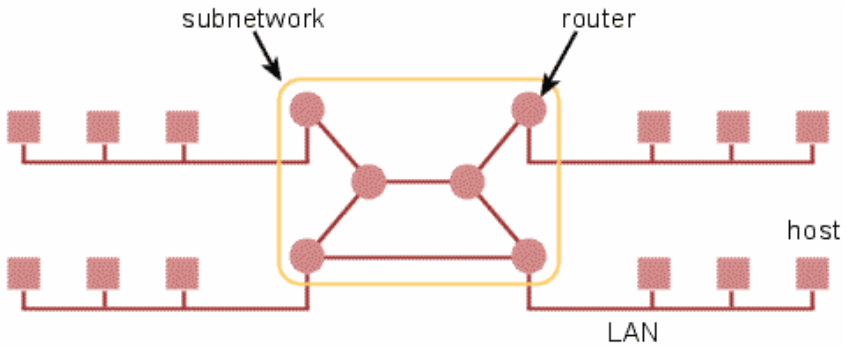
We then use the **DQDB** standard (Distributed Queue Dual Bus) for transmissions.

Wide Area Networks (WAN)

This type of networks covers a wide geographical area, sometimes as large as 1.000 km. Actually, there is no dedicated infrastructures: we directly use those for telecommunications. It is therefore a meeting point for computer science and telecoms. These infrastructure are currently being renewed to complete this convergence and improve the quality of services provided on such networks. The problem is that it is a very expensive operation (see below, performance problems).

In a more technical point of view, these wide area networks are developed around switching nodes (routers or switches) connected to each other by lines. These

nodes form what we call **switching subnetworks** or simply **subnetworks**. The main goal of these subnetworks is to interconnect **hosts** (computers). These hosts are usually connected to a LAN, which is connected to a subnetwork via a router:



WAN: subnetwork/host relation

Routers are often connected to each other with other routers. In this case, a packet received by a router is forwarded to the next router only when it has been xompletely received and the first router is able to reach the second one. This working characterize what we call a **point-to-point**, **packet switching** or **store-and-forward** subnetwork. Apart from satellite networks, all WAN are of this type.

As they are wide, these networks are subjects to some reliability (the background noise grows with the length of lines) and performance (transmission times also grow with the length of lines) constraints and problems. This generate a non negligible increase of costs when we want to improve the quality. Fortunately, the appearance of efficient and cheap synthetic optic fibres can help reducing installation costs.

Examples of WAN: Arpanet (the very first wide network that initiated the Internet), Internet, Transpac...

Other classification

The improvement of technologies, and therefore bit rates, suggests a new classification based on their bit rate (a more "logical" classification). We then have 3 categories:

- low and medium bit rate networks (< 200 kbps),
- high bit rate networks (200 kbps < bit rate < 20 Mbps),
- very high bit rate networks (> 20 Mbps).

Local networks are getting faster and faster, especially with the coming of Fast Ethernet, that has become cheap and very reliable.

 **printable format**

 **LAN topologies**

concepts