Name of discipline:

Transmission systems of access networks (TSAN)

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Lecture 2

CLASSIFICATION OF ACCESS SYSTEMS AND NETWORKS (continuation)

last lecture we have considered:

The classification of AN can be done by the following features:

- by the type of used guiding medium ;
- by the number of used for the connection wires pairs ;
- by way of linking - simplex, half duplex, duplex;
- by type of traffic - symmetric and asymmetric.

last lecture we have considered:

Classification by GM type

Guiding medium for AN can be:

- paired or quartile (star) twist symmetrical cable (SC);
- a wires pair of broadcasting network;
- a wires pair for power network;
- coaxial cable (CC);
- optical fiber (OF) of optical cable (OC);
- radio channel (requires a license for the radio frequency);
- atmospheric optical channel (does not require licensing).

and now

Fig. 2.1 shows the classification of AN by type of used wired network of AS and the number of wires pairs (optical fibers).

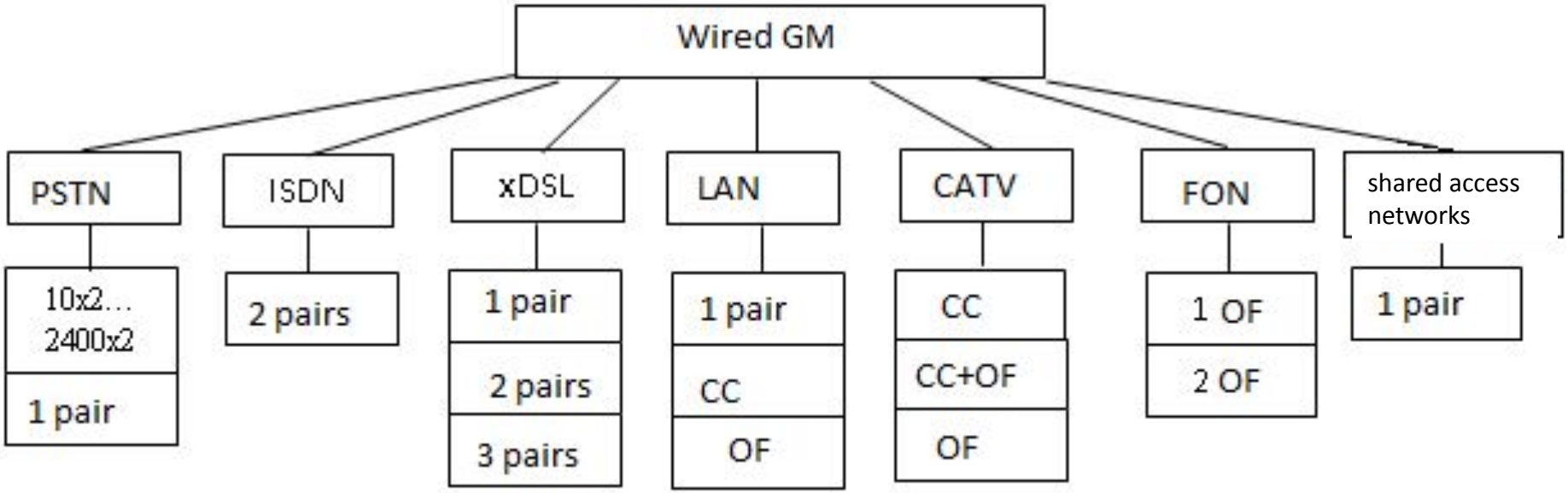

Fig. 2.1 - Access technologies classification

Notes to Fig. 2.1:

1. In PSTN (Public Switched Telephone Network) cables with twisted pair conductors type ТПП with the number of pairs from 10 to 2400 are used, but for the organization of one DSL a single pair is used (regenerators are not used);

2. In the ISDN standard - Integrated Services Digital Network two pairs of conductors is required;

3. In xDSL technology - Digital Subscriber Line / Loop one or two pairs of conductors (rarely – three) are more commonly used;

4. LAN - Local Area Network may be constructed on the basis of the special symmetrical HF cable type "twisted pair", coaxial cable or optical fibers (depending on the transmission rate and standard of LAN);

5. In systems of cable TV (CATV) CC is traditionally used. Large systems CATV in big cities are built on a hybrid "fiber-coaxial technology." In future systems CATV OF will come into the room the user;

6. In fiber optic networks optical fiber is used;

7. To shared access networks except the PSTN refer radio broadcasting network (now it is an anachronism) and power network (perspective technology).

Let’s discuss these technologies!

Narrowband access using the PSTN (Public Switched Telephone Network)

Here, as the equipment located at the customer premises, telephones, fax machines, modems, VB channels in the frequency band 0.3 ... 3.4 kHz are used.

The maximum speed of information transmission in the forward direction (switching station -user) for enterprise and Internet users is 56.7 kbit / s.

However, users can use either the telephone or modem - simultaneous operation is not possible.

Lines operate in an asymmetric mode, the transmission rate in the reverse direction (user-switching station) is 38.6 kbit/s.

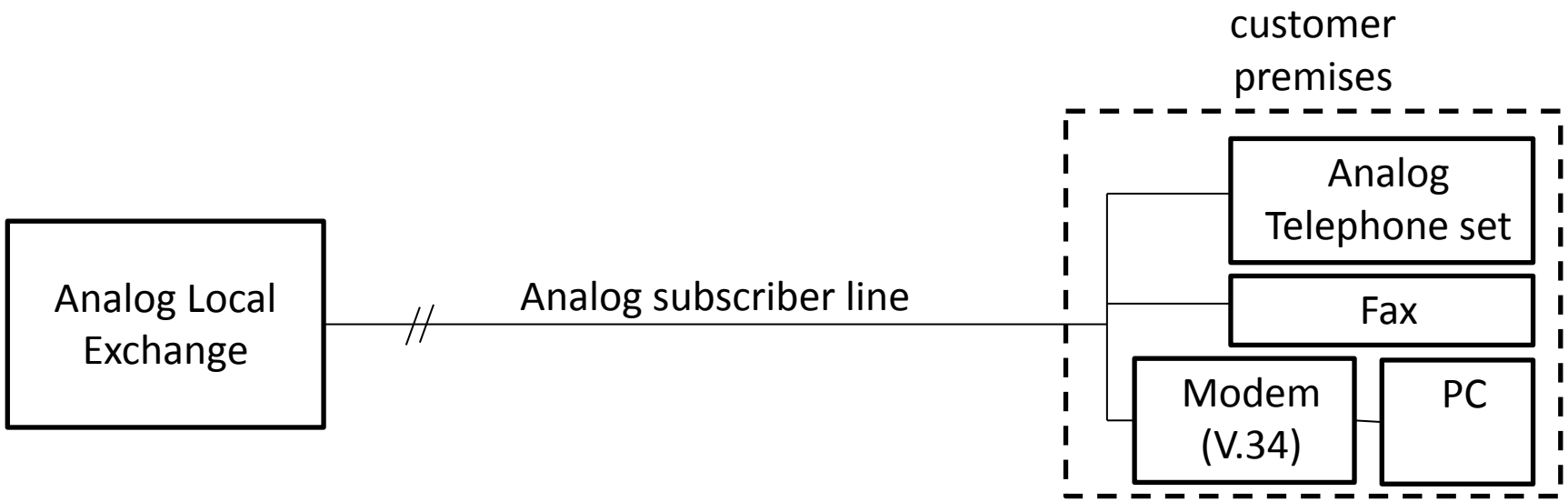

Fig. 2.2 – Block diagram of the subscriber access to the PSTN

ISDN Access Technologies

With such a standard two pairs of conductors are used, so they are not widely used in the PSTN networks.

In the technology of ISDN basic access with speed 144 kbit / s is available on channel 2B+D: two major digital channels 2x64 kbit/s, one service channel 16 kbit/s. Primary access is provided at a speed of 2.048 Mbit / s (E1) and broadband (B-ISDN) access is provided at a speed of 155 Mbit / s (STM-1).

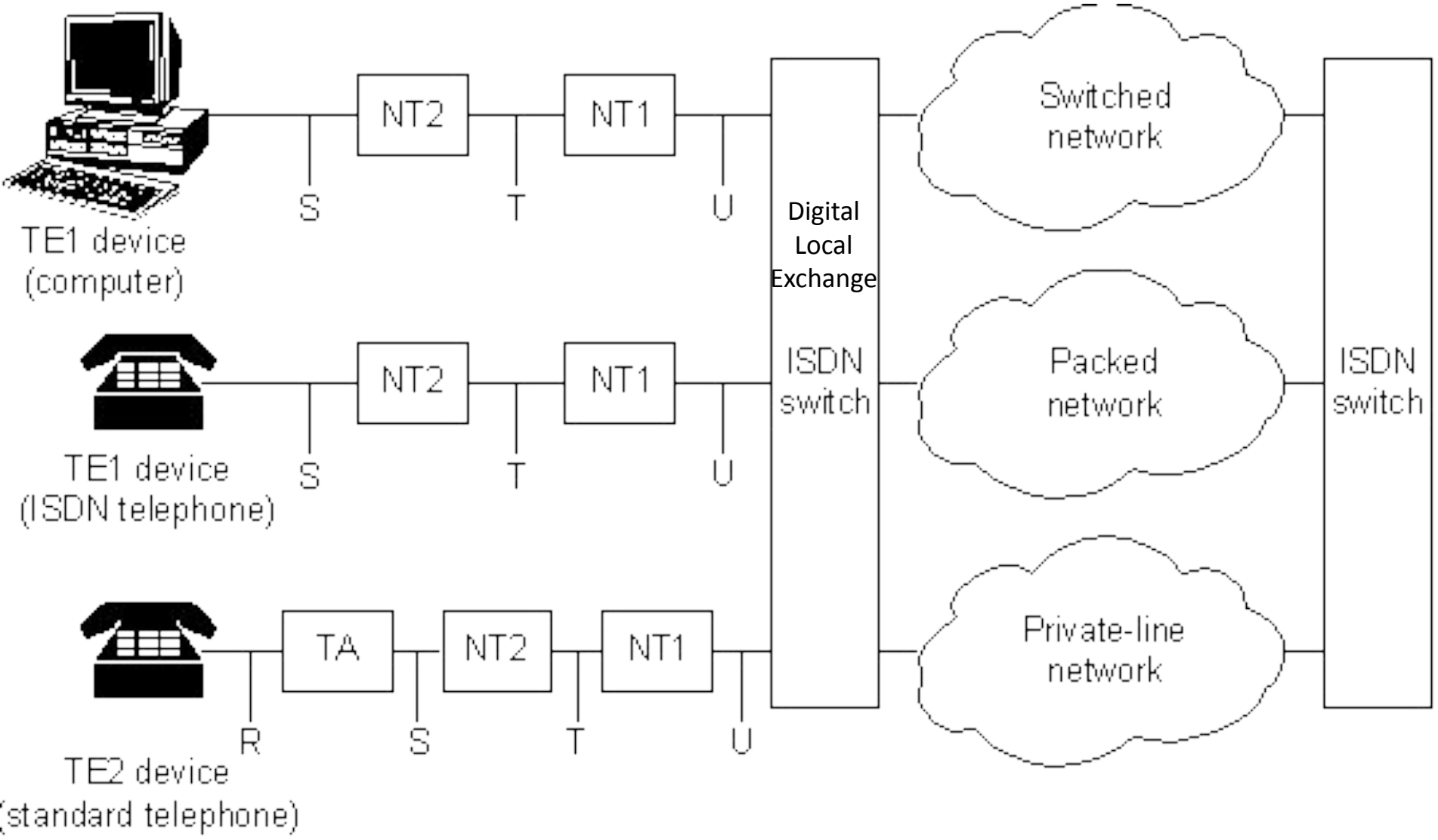

Fig. 2.3 – Block diagram of the subscriber access to the ISDN

Broadband access technologies xDSL

Simplex, half-duplex and full-duplex transmission of xDSL technologies are also different in way of separation of transmitted signals in different directions.

The simple solution - data transmission in forward and reverse directions by different pairs (space division multiplexing), ie for each of two pairs transfer is made in only one direction. Thus the name- Simplex(U - unidirectional DSL).

The majority of xDSL technology is a duplex, ie, transmission takes place in one pair in the forward and reverse directions, wherein the separation is carried out by echo cancellation and / or frequency division (FDM).

During half-duplex transmission occurs in both directions also in one pair, but at different times. Depending on the time required for transmission in both directions is possible to separate at a constant and a variable time grid. The main representatives are the VDSL (Very high DSL) and EtherLoop, Fig. 2.4.

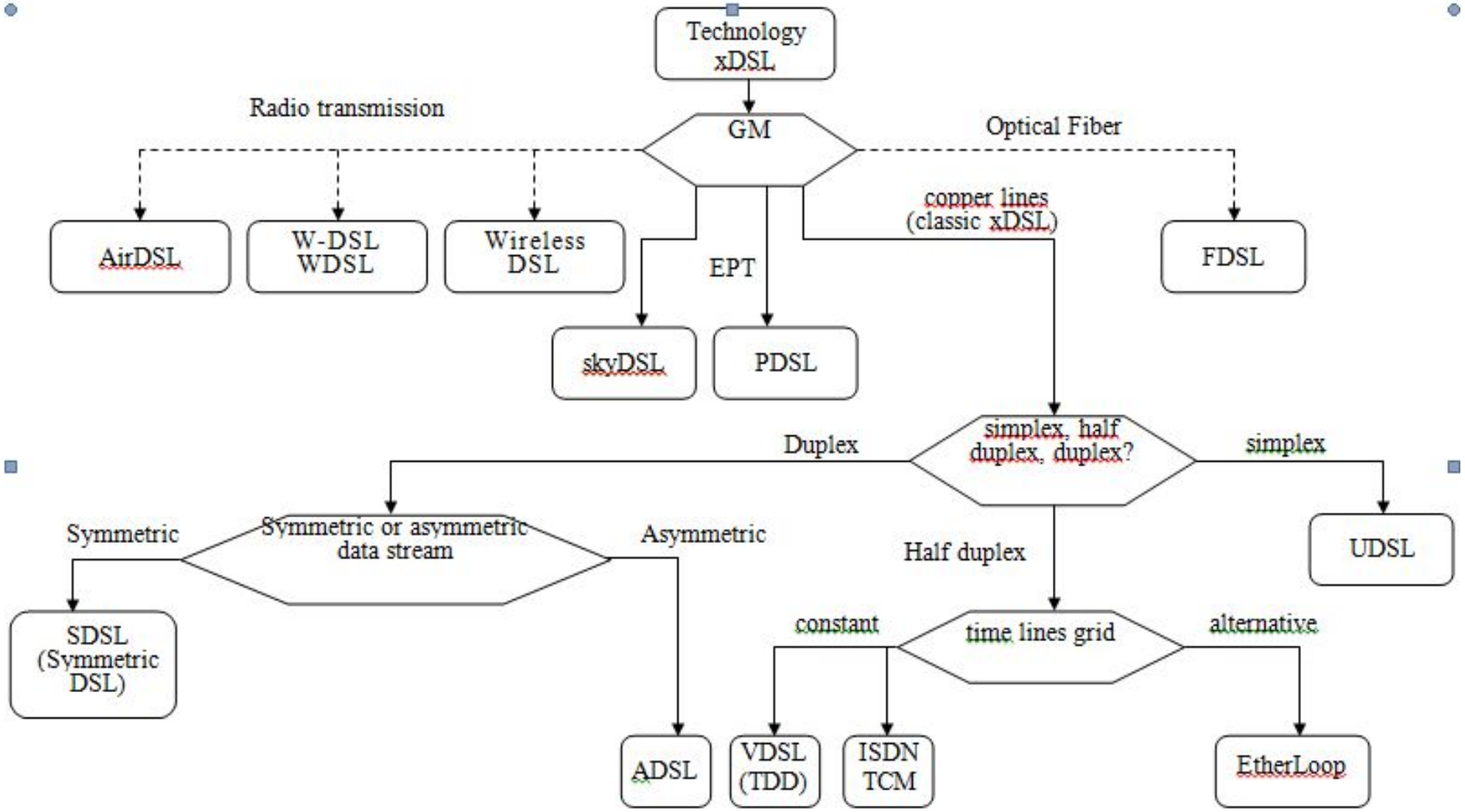

Fig. 2.4 – Part of the xDSL "family tree" of division by means and the direction of transmission: EPT- Electric power transmission

Classification by transmission rate in forward and reverse directions

Duplex xDSL technology can be divided by the ratio of transmission speeds in forward and reverse directions. If the transmission rate in both directions is the same, then we speak about symmetric technologies SDSL - Symmetric DSL.

In asymmetric technology (Asymmetric DSL) transmission speed in the forward direction is higher than in the reverse. In the particular case ADSL can work in a symmetrical mode.

Symmetric Technology - SDSL (Symmetric DSL)

Symmetric xDSL technology is used by enterprise users and differs in the number of pairs of conductors.

HDSL (High bit rate DSL) - one of the most important representatives of symmetric xDSL technologies - is used for transmission of one, two, or three pairs. Part of the "family tree" for symmetric xDSL technology is shown in Fig. 2.5.

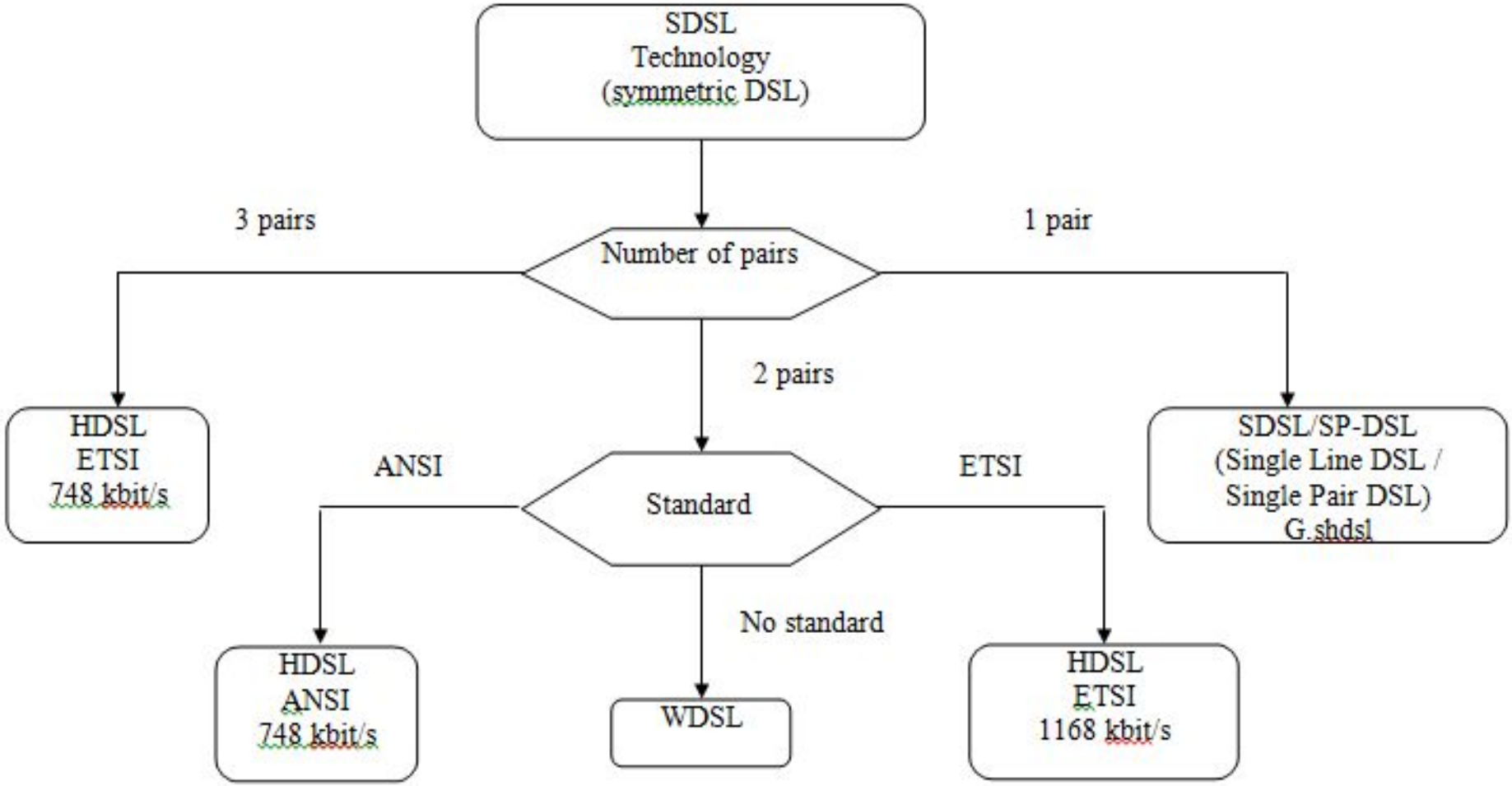

Fig 2.5 – Symmetric DSL technologies
ANSI – American National Standard Institute;
ETSI – European Telecommunications Standards Institute

Asymmetric technologies - ADSL (Asymmetric DSL)

If the initial development of the symmetric xDSL technology was mainly focused on the needs of the business sector, the asymmetric xDSL-technology designed for the private sector.

This approach identifies a noticeable difference in the requirements for them.

In the private sector it was necessary that an existing telephone service (PSTN or BRI-ISDN) continued to work during the transition to ADSL.

In other words, in addition to telephone services was necessary to provide data transfer. In order to separate voice and data signals splitter frequency filters, called splitters are introduced. Fig. 2.6 is a diagram of the network construction with using of asymmetric xDSL technologies

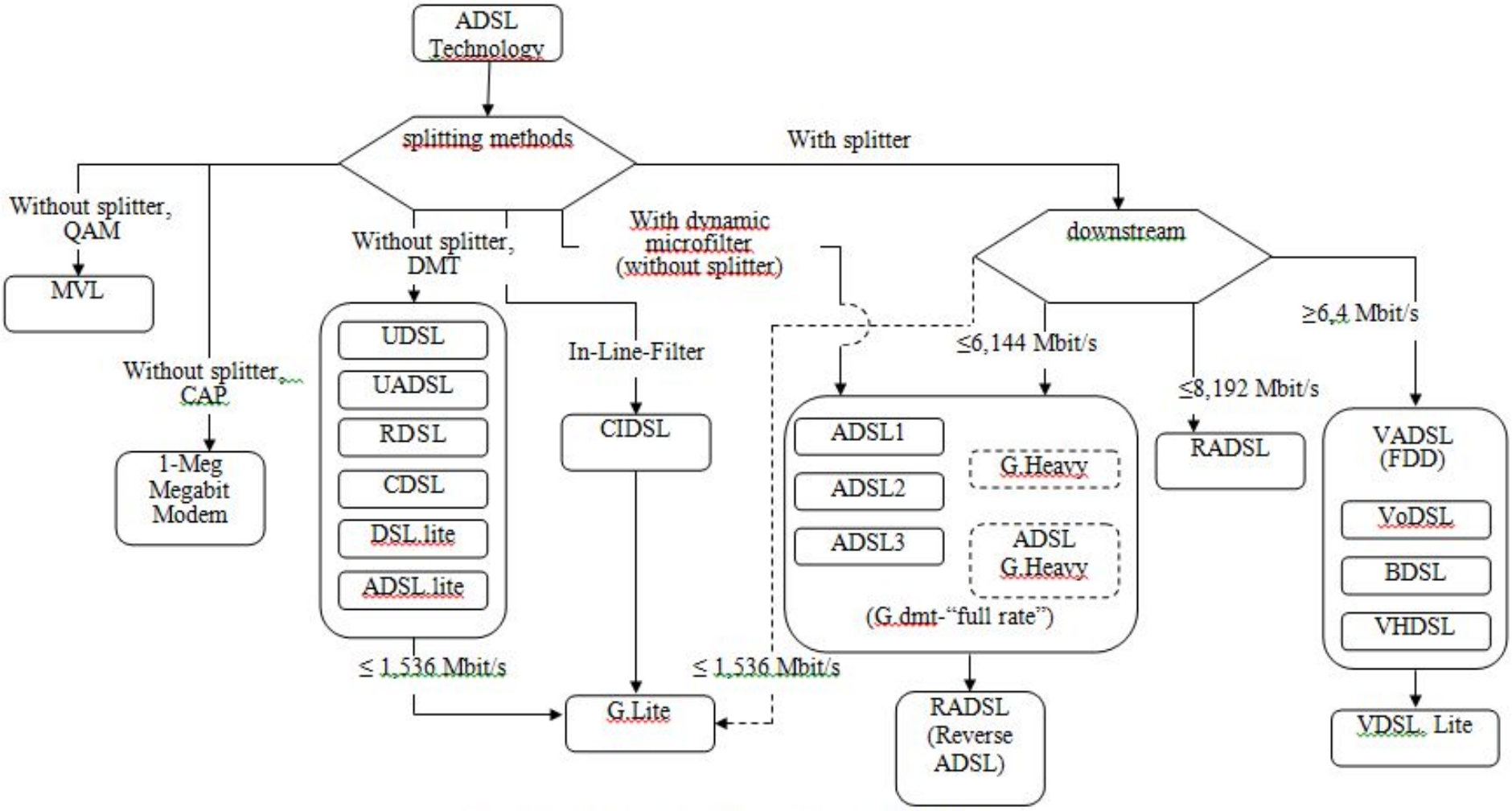

Fig.2.6 – Asymmetric xDSL technology for the PSTN:
QAM - quadrature amplitude modulation; CAP - Carrierless Amplitude and Phase Modulation; DMT - Discrete Multitone Technology, Discrete Multi-Tone