CATV NETWORK EVOLUTION

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Summary Cable television (CATV) distributions are transmissions systems assigned for received and distribution televisions (TV) and radios (R) signals. This paragraph is about individual stages of evolution of this distribution. It begins by classic CATV network by using coaxial cable then it continues by modernization of optical fibre. It describes structure and two-way communication of interactive TV cable distribution frame and it describes intelligence of this network. By implementation interactivity we can not understand it as the CATV network as only distributions system which transfers only TV and R signals but like multifunctional system which can transfer information by both directions.

1. INTRODUCTION

Television cable distribution CATV was suggested as distribution system which should transfer analog televisions canals to maximum counts of customers in lowest possible costs. In ninetieth with coming DBS (Direct Broadcast Satellite) and DSL (Digital Subscriber Line) operators provided cable TV must fight with this competing technologies for position on the market. DBS operators offered more options and better vision quality via digital technology, while DSL technology suggested voice, video and data transfer through DSL. Worries of loss participation on the market forced operators CATV to offer bigger options of services. At the present time the ambition of CATV is to distribute not only television TV and radio R signal but also offer users interactive access to their services as e.g. are electrical mail, videophone, video-conference, interactive informations searching, video on demand (VoD) etc. The ambition is also to implement software and hardware equipment to the network, which guarantee specific intelligence of this networks.

2. TELEVISION CABLE NETWORK WITH COAXIAL CABLES - CATV

Coaxial cable technology is used from the beginning of cable distribution. Its big advantage is financial unpretentiousness concerning network building-up. TV and R signals assigned for transfer to CATV members are feed into main station through head-end from individual antennas, eventually by cable splice, radio relay splice etc. In main station are this signals processed, amplified and changed into another frequency position according the need. On exit main station are this signals set into the channel according respective standard and are transmitted through direct broadcast channel. This broadcast channel is on this exit main station connected on one eventually on more coaxial cables, which are part of distribution network (Fig. 1).

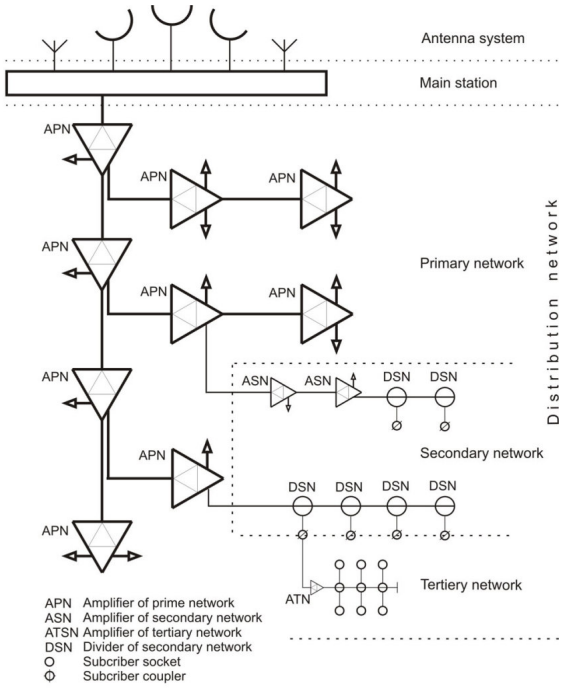

Fig. 1 Block scheme of CATV network with coaxial cable

Distribution network is usually realized in hierarchal order in tree structure, with gradual branching from main station.

Its levels are:

1. *Prime network* - safeguards transfer of signals on bigger distances.
2. *Secondary network* - safeguards transfer of signals on smaller distances, usually directly to individual objects or to groups of objects (house).
3. *Tertiary network* - safeguards transfer of signals on participants sockets, which are input spots

of cable TV and through which are signals feeding directly on TV and R receiver.

3. HYBRID TELEVISION CABLE NETWORK - HFC

By influence of customer rising, by incoming of data services and by distribution satelits TV chanells have coaxial cables insufficient wave-lenghts and big signal damping, which must be stronger. This problem can be removed by using optical fiber which have broadband, small absorbing signals, no spurious radiation, small parameters, etc. HFC network is created by optical fiber from the main station to the optical node (optical-electric converter) and by coaxial cable from the optical node to the participant. Optical part of network consists of optical transmitters, optical fiber and from optical acceptors. It can contain another components too, e.g. optical amplifiers, optical couplers, etc.

We know 3 types of optical system configurations (OS):

1. *Simple OS* – can replace coaxial cable in maximum level of distribution network (Fig. 2).
   Can be configuration:
   - point to point
   - point-to multipoint
2. *OS with repeating* – allows to realize bigger network configurations on shorter distance (Fig. 3).
3. *OS with optical amplifier* – is possible class also several amplifier to cascade and so realize large CATV networks (Fig. 4). [2]

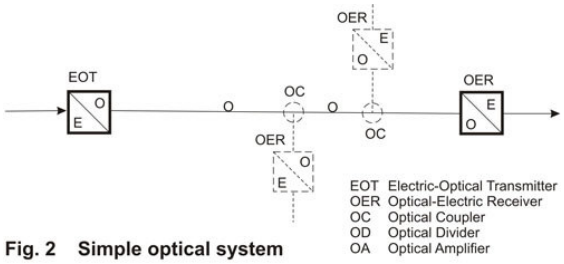

Fig. 2 Simple optical system

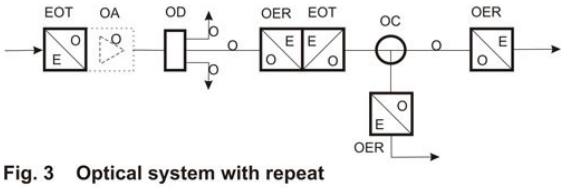

Fig. 3 Optical system with repeat

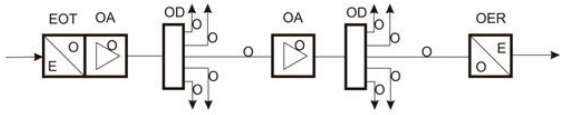

Fig. 4 Optical system with optical amplifier

On Fig. 5 is one from possible realizations of hybrid network, where prime network is solving by optical ring structure with 1550 nm of wave-length. Optical systems in distributive nodes continue by 1310 nm of wave-length. These can be solving by ring or star structure. On optical node are attached short coaxial networks up to the customer.

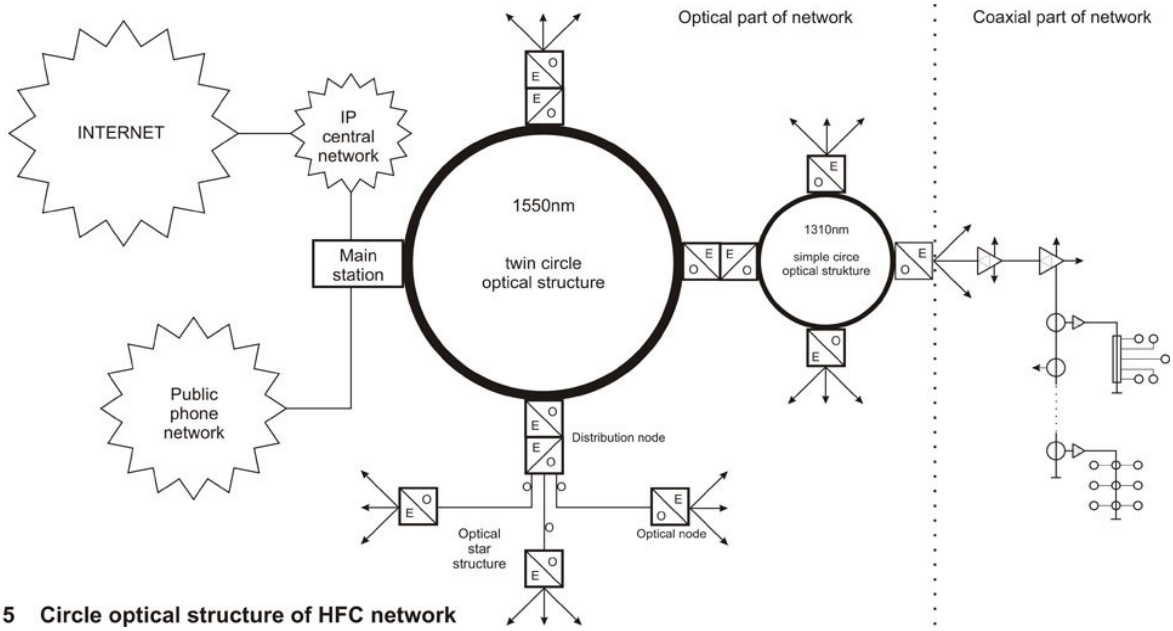

Fig. 5 Circle optical structure of HFC network

4. INTERACTIVE TELEVISION CABLE NETWORK - ICATV

Interactive television cable distributions are systems, which offer to participant an interactive access to informations. Interactive access to services is realized on the basis of requisitions from participants to main station. If participant want to have an access to informations must be ICATV network equipped by back-channel and by technical facilities, which minimally provide:

- Manage information transfer in straight and back direction
- Selective access to information searching and its heading to participant
- Protect the information against abuse by illegal access

For provision of interactive services are necessary two types of transmission channel:

1. *Downstream* - is headed from main station to participant.
2. *Upstream* – is headed from participant to main station. By it are transferred requests of customers about services. [3]

Structure ICATV network which provides interactive access of participants to informations is on the Fig. 6.

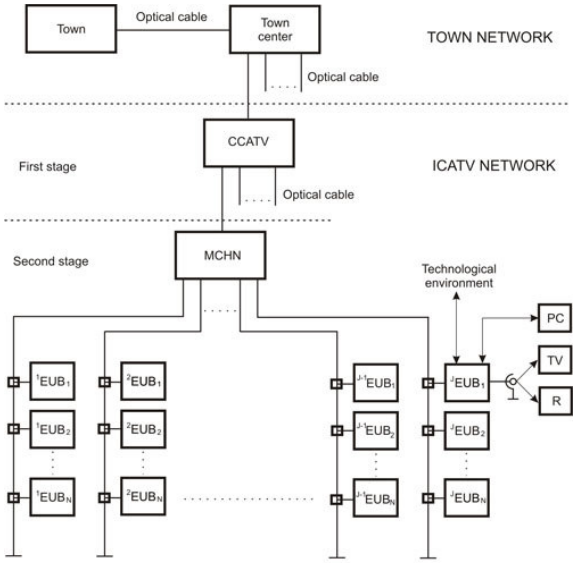

Fig. 6 ICATV network

Conception of this ICATV network is defined as open two-stage system.

- *First stage* is characterized as the centre of TV cable distribution CCATV, which is "concentrator of services". It allows access to upper level of network, manage transmission between CCATV and managing centre of home network MCHN.
- *Second stage* is characterized as group of final participants border lines EUB (End user box) connected to MCHN. Managing centre of home network from information aspect contains subset of services concentrated in CCATV and complete set of services connect to database of participants, who are individual EUB. Managing centre of home network manages communication within second stage, where EUB allows selective access of participants to services and data in MCHN.

Two-directional communication in ICATV networks

Two-directional is secured by frequency multiplex of backward and straight transmission. Switches are solving by parallel combination of high pass H (in straight direction) and low pass filter D (in back direction).

Structure of two-directional communication in ICATV network

1. Sharing of one retrace zone by all participants connected to one main station. Typical for older or smaller CATV network with small request for transmission in retrace and for two-directional communication (Fig. 7.a).
2. Hybrid structure with selective transmission of individual zone of retrace (Fig. 7.b).
3. Hybrid structure with network partition into the segments in which can by transfer signals of two-directional communication (Fig. 7.c).

To solve two-directional communication are available different solutions from simple for small traffic till to more complicated and strong traffic with big number of participants with high requirements for information content. [2]

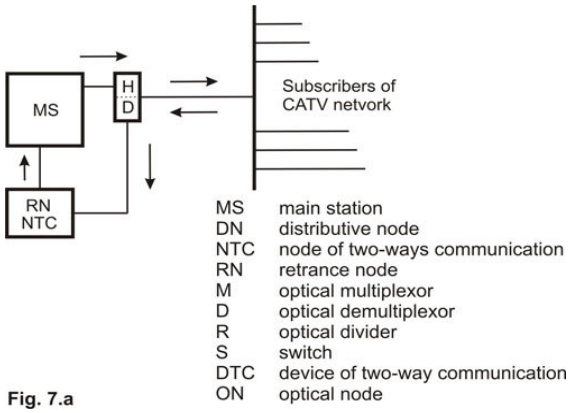

Fig. 7.a

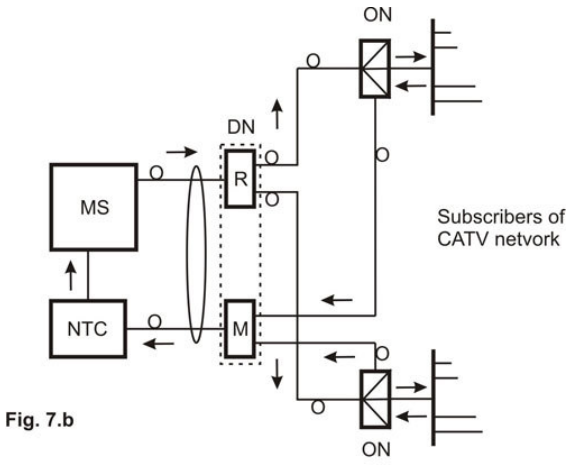

Fig. 7.b

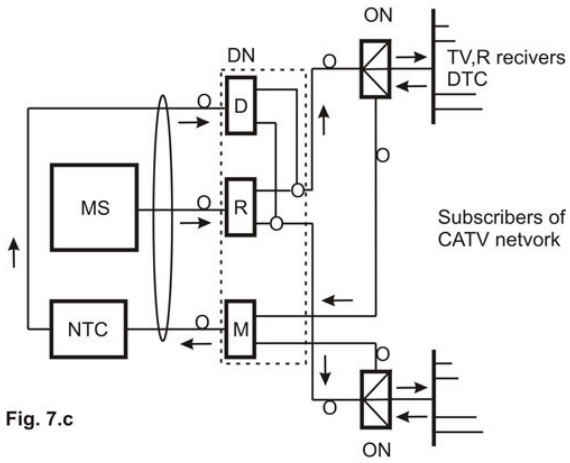

Fig. 7.c

Structure of communication through straight and back channel in the CATV network

5. INTELLIGENT ICATV NETWORK

Intelligence is facts recognition and research, it is analyse and eduction of logical results. Term intelligent ICATV network is not new network, which is separate from already existing ICATV network, but is conception, which will fill existing ICATV network about new functions for customers. By application of other services will be create conditions for more extensive using of network by customers and also rise in earnings for participants of cable distribution. [4] Construction and service of intelligent ICATV network requires relatively not much new technical devices toward construction ICATV where we must expressively intervene in to the structure of network by building backward channel and also by plan and building CCATV and MCHN. New functions of network are realized mostly by program devices implement into the already existing devices. To be conception of intelligent ICATV able to change fast according the customers, it must have efficient flexible management devices. Block of services management realizes control of service progress, and also management of service. As example of concrete functions is possible present database administration, data requests about network, and also controlling and testing the network. Intelligent communication network must be at least able to provide and communicate with surroundings, make decision, use and effectively manage the network devices.

6. CONCLUSION

Network intelligence will evolve through growth in computational power and through the accumulation of knowledge about the types of input data needed for making decisions concerning expected response, and about the algorithmic processing required in a complex and changing communications environment. Increasingly sophisticated network intelligence makes possible lookahead planning, management before responding and reasoning about the probable results of alternative actions. These intelligent network capabilities can provide service providers with competitive and operational advantages over traditional networks. [5] Network intelligence will be develop with increased power of computer technique, with capacity data increase of incoming statements, which are nessecery to creation solution about expected result and required algorithm which reacts to change of communication surroundings.

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