

- Timing information, passing to the decoder the current time and date,
- Information on services not provided by MPEG-2, such as closed captioning/subtitling, teletext, and data services

OMT (Optical Media Terminal) is a core equipment of RF/PON transmission system, and has wavelength-division multiplexer for separating RF downstream and PON downstream transmitted through different wavelength. OMT also has a RF video converter, RF tuners and demodulators to extract RF broadcast stream while a RF-STB for traditional CATV services has them. Figure 2 shows an architecture of OMT [5].

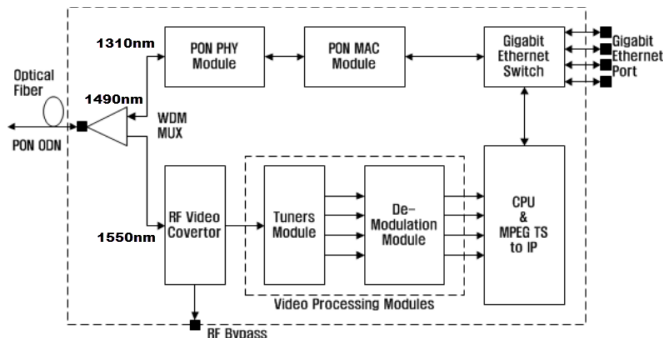
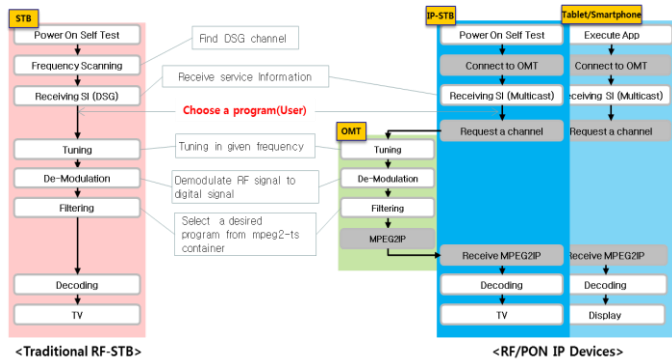


Figure 2. Optical Media Terminal Architecture

In RF/PON transmission system, subscribers can use various their IP devices such as PC, tablet and smartphone as well as IP-STB to view broadcast programs. To do that, IP devices should make connection to and communicate with OMT by TCP/IP [6]. Figure 3 shows difference in behaviour between traditional RF-STB and RF/PON IP devices.



Behaviour comparison between traditional RF-STB and RF/PON IP Devices

III. SERVICE INFORMATION DELIVERY

Service information provides all the information necessary for broadcast services, such as frequency and modulation schemes. SI is composed of eight kinds of table: MGT, STT, RRT, AEIT, AETT, CVCT, NIT and NTT. Each table is transmitted repeatedly for each set period [7].

Table 1 describes briefly about service information tables.

TABLE 1. SI TABLES

Name	Description
MGT	- Master Guide Table - Data pointers to other SI tables except for STT - Max. Cycle Times : 500 msec
STT	- System Time Table - Current time with an accuracy of new time values within 1 second or better - Max. Cycle Time : 1 min
RRT	- Rating Region Table - Content ratings for each country (region) covered by the station - Max. Cycle Time : 1 min
AEIT	- Aggregate Event Information Table - Titles and program guide data
AETT	- Aggregate Extended Text Table - Detailed description of channels and aired events
CVCT	- Cable Virtual Channel Table - Assigns numbers to each virtual channel and enables EITs to be associated with the channel - Max. Cycle Time : 2 min
NIT	- Network Information Table - Physical channel Information: Frequency, modulation scheme, channel name, channel number, and so on
NTT	- Network Text Table - All the name of service channels

Figure 4 shows procedure for an IP device to get service information. When an IP device connects to OMT, IP multicast address is given to which service information is transmitted. Then the device should join the SI multicast group, and gather service information so as to receive broadcast stream.

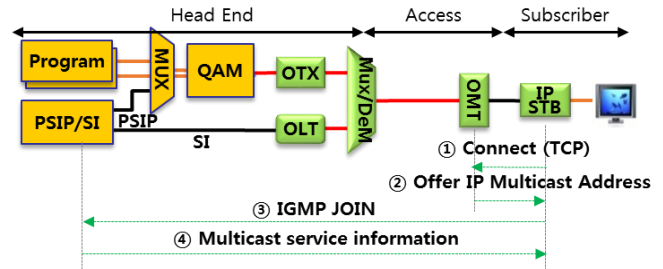


Figure 3. Procedure of SI delivery in RF/PON network

As shown in Table1, CVCT has the longest maximum cycle time, 2 minutes, among the SI tables [2]. This means that subscribers may wait up to 2 minutes at worst to see information about broadcast programs and choose one of them. To solve this problem, we invent a fast and simple SI delivery method that OMT gathers and caches service information, and offers the cached information to IP devices directly. Figure 5 shows the proposed procedure to deliver service information.

During the boot process, OMT joins the multicast group by sending IGMP JOIN message, receives service information from SI server, and saves it at internal storage. There is still the same problem of time delay in this process. But it has little influence since OMT serves internet service and broadcast

service simultaneously, and would not be turned on and off frequently.

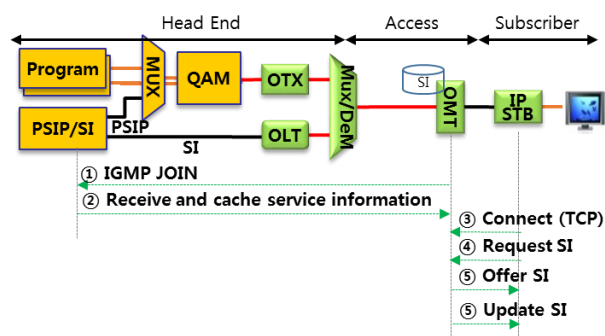


Figure 4. Fast SI delivery procedure

An IP device should connect to OMT and keep the connection. Using the connection, it should request service information, then OMT offers service information right away. Eight kinds of table making up of service the information are transmitted individually. Since the IP device is located in the network segment managed by OMT, network propagation time of a data packet between them is just a few milliseconds. But it takes a couple of hundreds milliseconds to send all the tables since internal processing time of OMT.

As described above, each table is repeatedly transmitted periodically. OMT should look at version information of tables in order to check whether it is updated or not. If updated, OMT sends it immediately to devices which requested service information before.

IV. CONCLUSIONS

Although TV is still the primary means to watch broadcast programs, consuming videos through internet has been being increased significantly and viewing pattern of user has been changed as well after emergence of connected devices such as smartphone and tablet. But it is not easy for commercial providers to accommodate a new type of device while maintaining the existing services without changes of existing facilities.

In this paper, we introduce RF/PON transmission system with which service operators can accommodate various IP devices as a gate to serve broadcast services, and propose a method that OMT rather than PSIP/SI server transmits service information so as to significantly reduce the service information transmit time from 2 minutes at worst to a couple of hundreds milliseconds.

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