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(54) **APPARATUS FOR RECEIVING ADAPTIVE BROADCAST SIGNAL AND METHOD THEREOF**

(76) Inventors: **Jin Pil Kim**, Seoul (KR); **Ho Tack Hong**, Seoul (KR); **Jong Yeul Suh**, Seoul (KR); **Joon Hwi Lee**, Seoul (KR)

Correspondence Address:
MCKENNA LONG & ALDRIDGE LLP
Song K. Jung
1900 K Street, N.W.
Washington DC, DC 20006 (US)

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(52) **U.S. Cl.** **725/110**

(57) **ABSTRACT**

An apparatus for receiving an adaptive broadcast signal and method thereof are disclosed. The present invention includes linking an IP network, sending display status information for a receiver to a service provider via the linked IP network, receiving an available service information list provided by the service provider based on the display status information for the receiver, and if at least one service is selected from the received available service information list by a user, providing the selected service to the receiver.

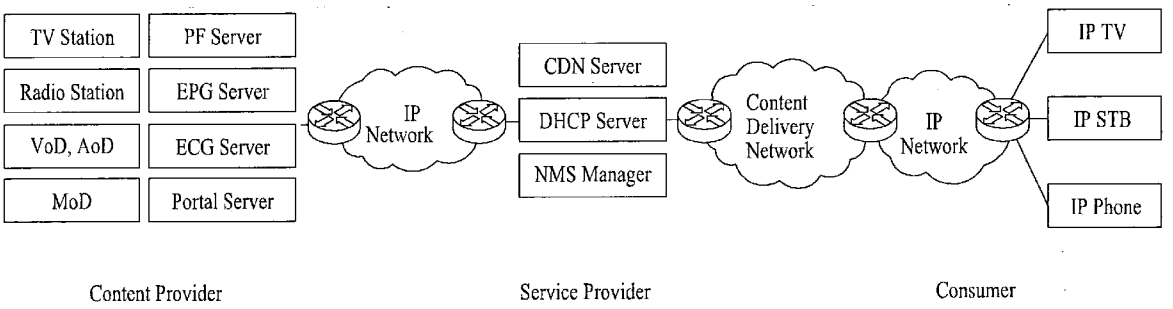


FIG. 1A

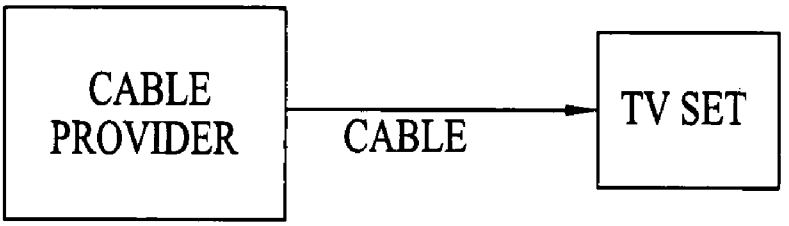


FIG. 1B

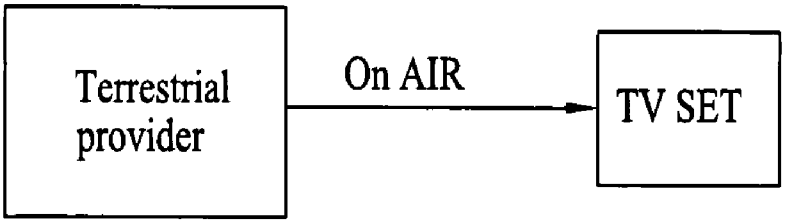


FIG. 1C

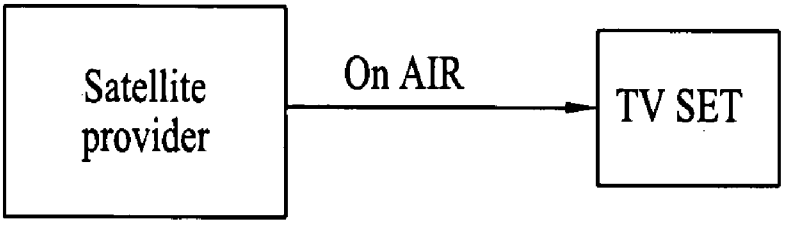


FIG. 2

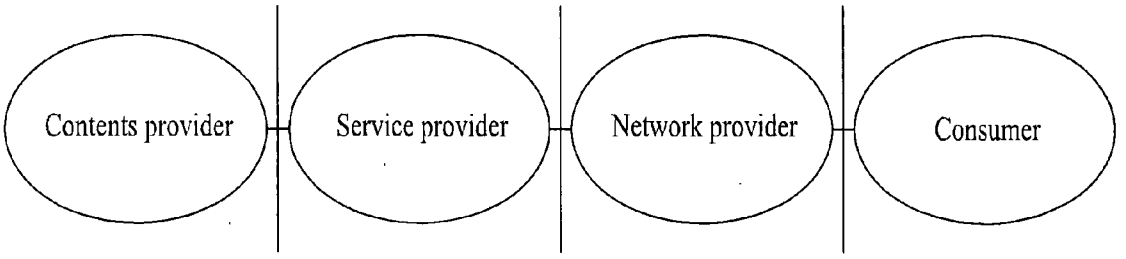

Contents provider
Service provider
Network provider
Consumer

FIG. 3

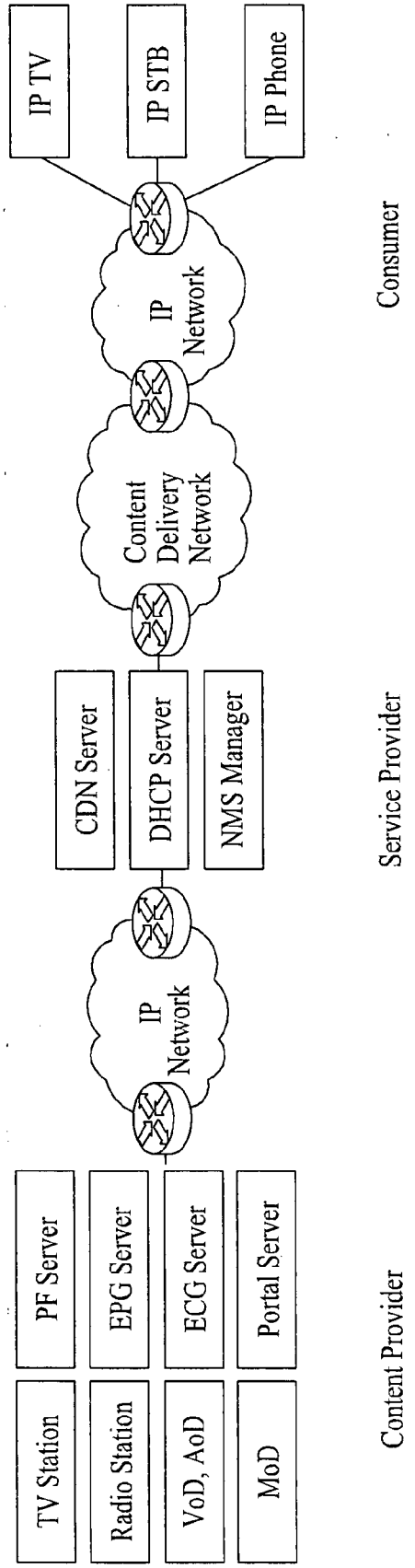

IP TV
IP STB
IP Phone
IP Network
Content Delivery Network
IP Network
CDN Server
DHCP Server
NMS Manager
PF Server
EPG Server
ECG Server
Portal Server
TV Station
Radio Station
VoD, AoD
MoD
Consumer
Service Provider
Content Provider

FIG. 4

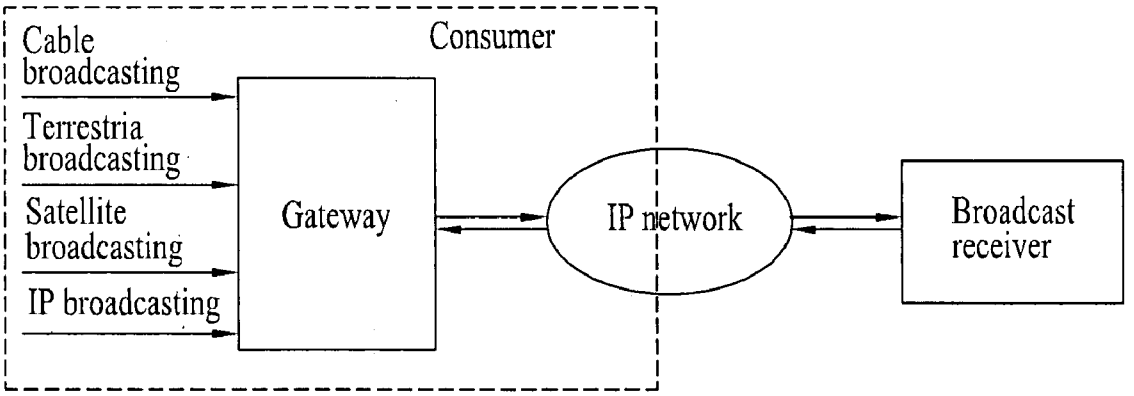

Consumer
Cable broadcasting
Terrestria broadcasting
Satellite broadcasting
IP broadcasting
Gateway
IP network
Broadcast receiver

FIG. 5

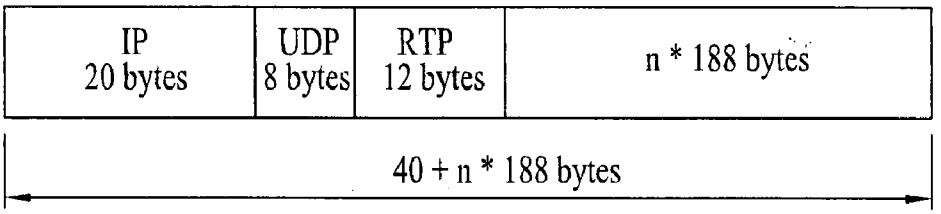

IP
20 bytes
UDP
8 bytes
RTP
12 bytes
n * 188 bytes
40 + n * 188 bytes

FIG. 6

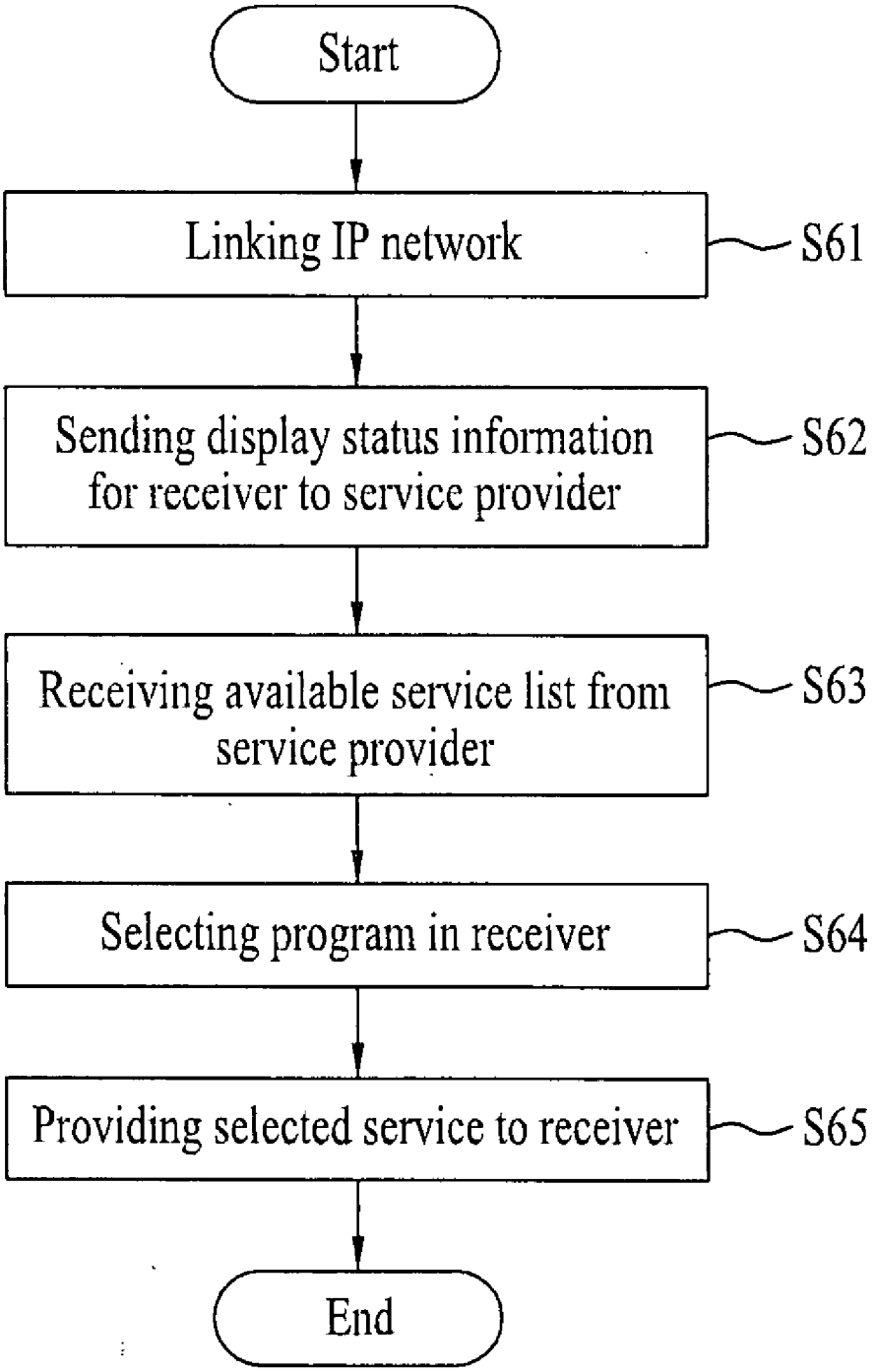

Start
Linking IP network
S61
Sending display status information for receiver to service provider
S62
Receiving available service list from service provider
S63
Selecting program in receiver
S64
Providing selected service to receiver
S65
End

FIG. 7

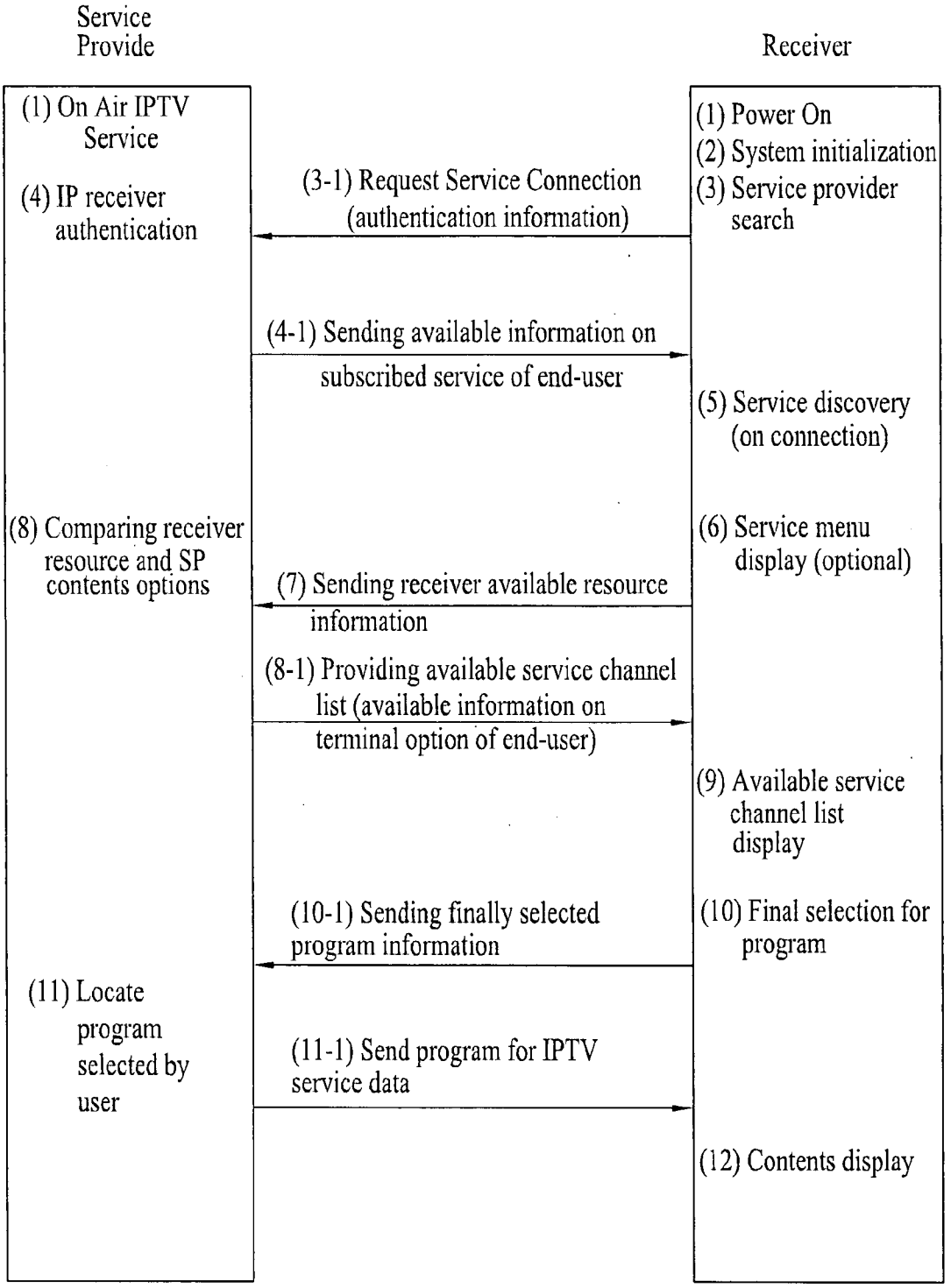

Service Provide
Receiver
(1) On Air IPTV Service
(4) IP receiver authentication
(8) Comparing receiver resource and SP contents options
(11) Locate program selected by user
(1) Power On
(2) System initialization
(3) Service provider search
(5) Service discovery (on connection)
(6) Service menu display (optional)
(9) Available service channel list display
(10) Final selection for program
(12) Contents display
(3-1) Request Service Connection (authentication information)
(4-1) Sending available information on subscribed service of end-user
(7) Sending receiver available resource information
(8-1) Providing available service channel list (available information on terminal option of end-user)
(10-1) Sending finally selected program information
(11-1) Send program for IPTV service data

FIG. 8

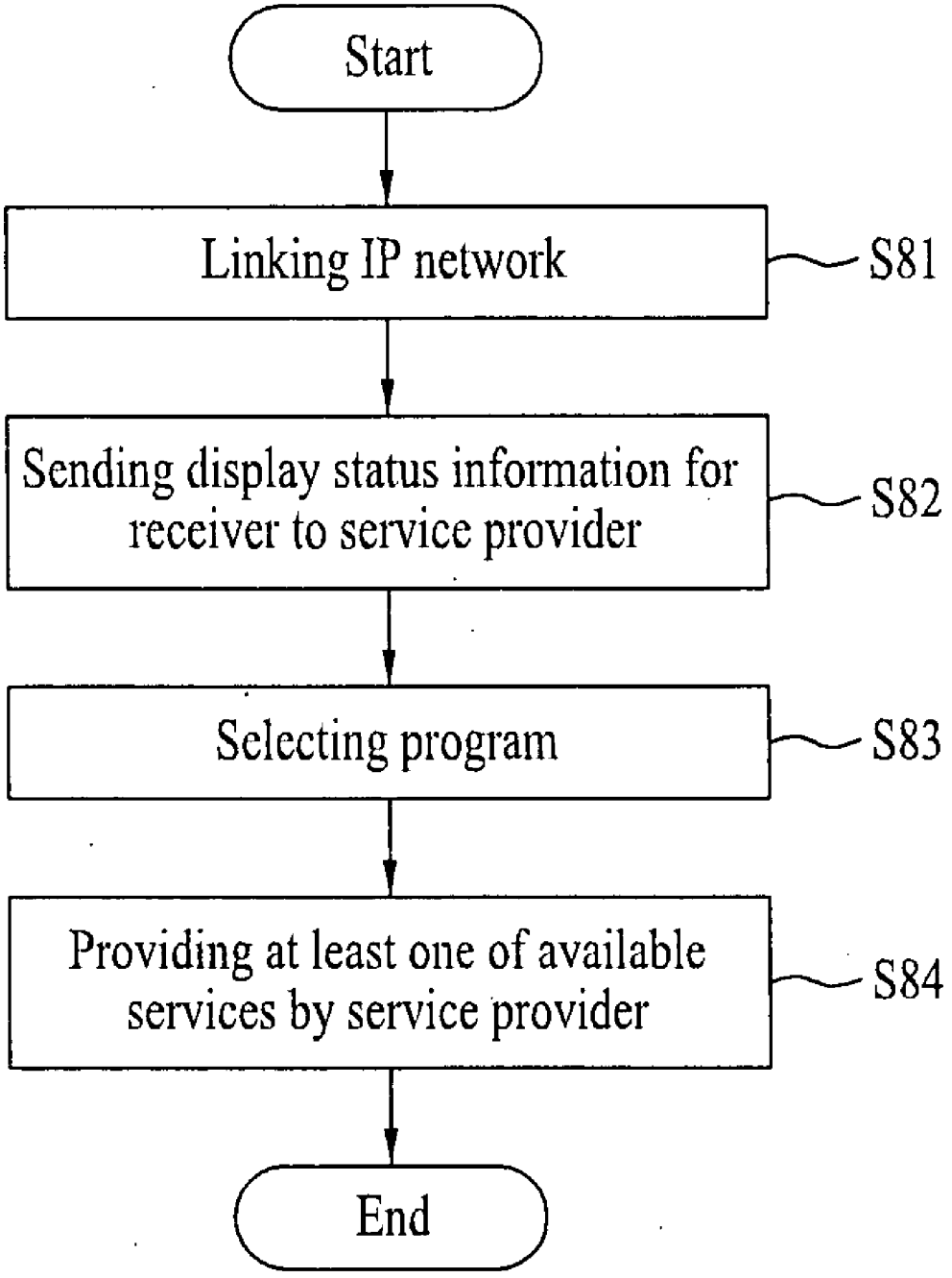

Start
Linking IP network
S81
Sending display status information for receiver to service provider
S82
Selecting program
S83
Providing at least one of available services by service provider
S84
End

FIG. 9

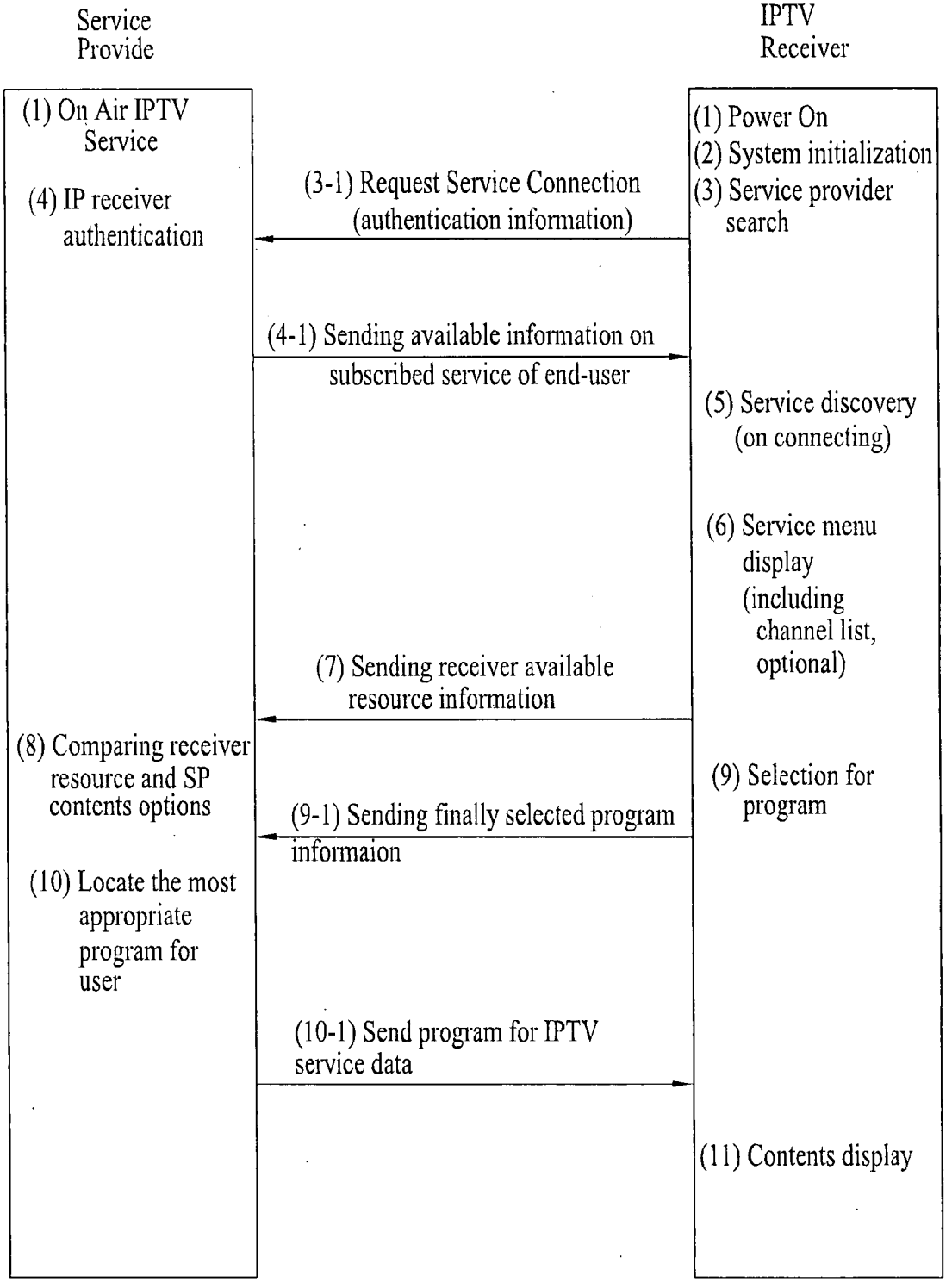
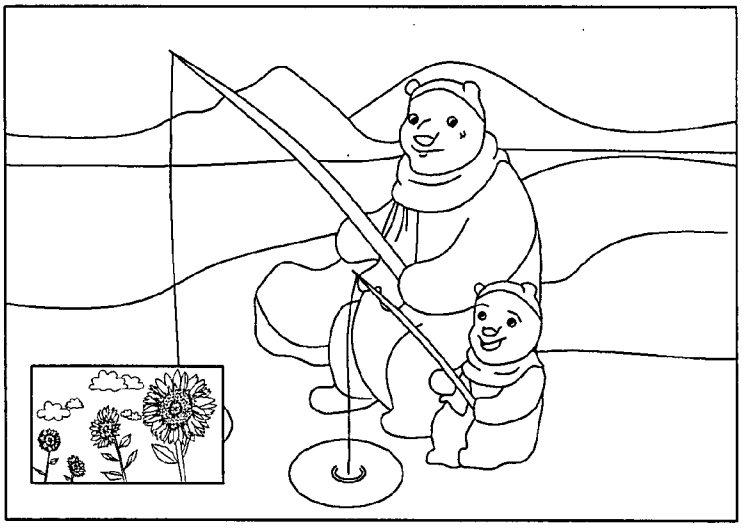

Service Provide
IPTV Receiver
(1) On Air IPTV Service
(4) IP receiver authentication
(1) Power On
(2) System initialization
(3) Service provider search
(3-1) Request Service Connection (authentication information)
(4-1) Sending available information on subscribed service of end-user
(5) Service discovery (on connecting)
(6) Service menu display (including channel list, optional)
(7) Sending receiver available resource information
(8) Comparing receiver resource and SP contents options
(9) Selection for program
(9-1) Sending finally selected program informaion
(10) Locate the most appropriate program for user
(10-1) Send program for IPTV service data
(11) Contents display

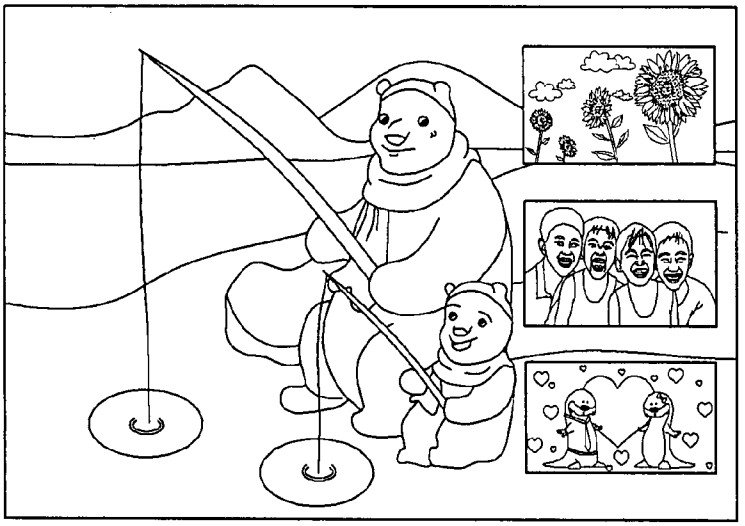
FIG. 10A

Main screen :
Source : 1920 x 1080
Display : 1920 x 1080



Sub-screen :
Source : 352 x 288
Display : 352 x 288

FIG. 10B



Screen 2 :
Source : 352 x 288
Display : 352 x 288

Screen 3 :
Source : 352 x 240
Display : 352 x 288

Screen 4 :
Source : 320 x 240
Display : 352 x 288

Screen 1 :
Source : 1280 x 720
Display : 1280 x 960

FIG. 11

Display Resolution

Field name	bits	description
Command	8	send resource information
Resolution information		RI_structure
Audio CODEC information		AC_structure
Video CODEC information		VC_structure
Network Information		NI_structure
User Level Information		ULI_structure

FIG. 12

RI_Structure

Field name	bits	description
Number_of_available_Resolution_list	4	
For (I = 0; to Number_of_available_Resolution_list; I++)		
{		
code_value	5	
text	var	
format_type	4	
}		

FIG. 13

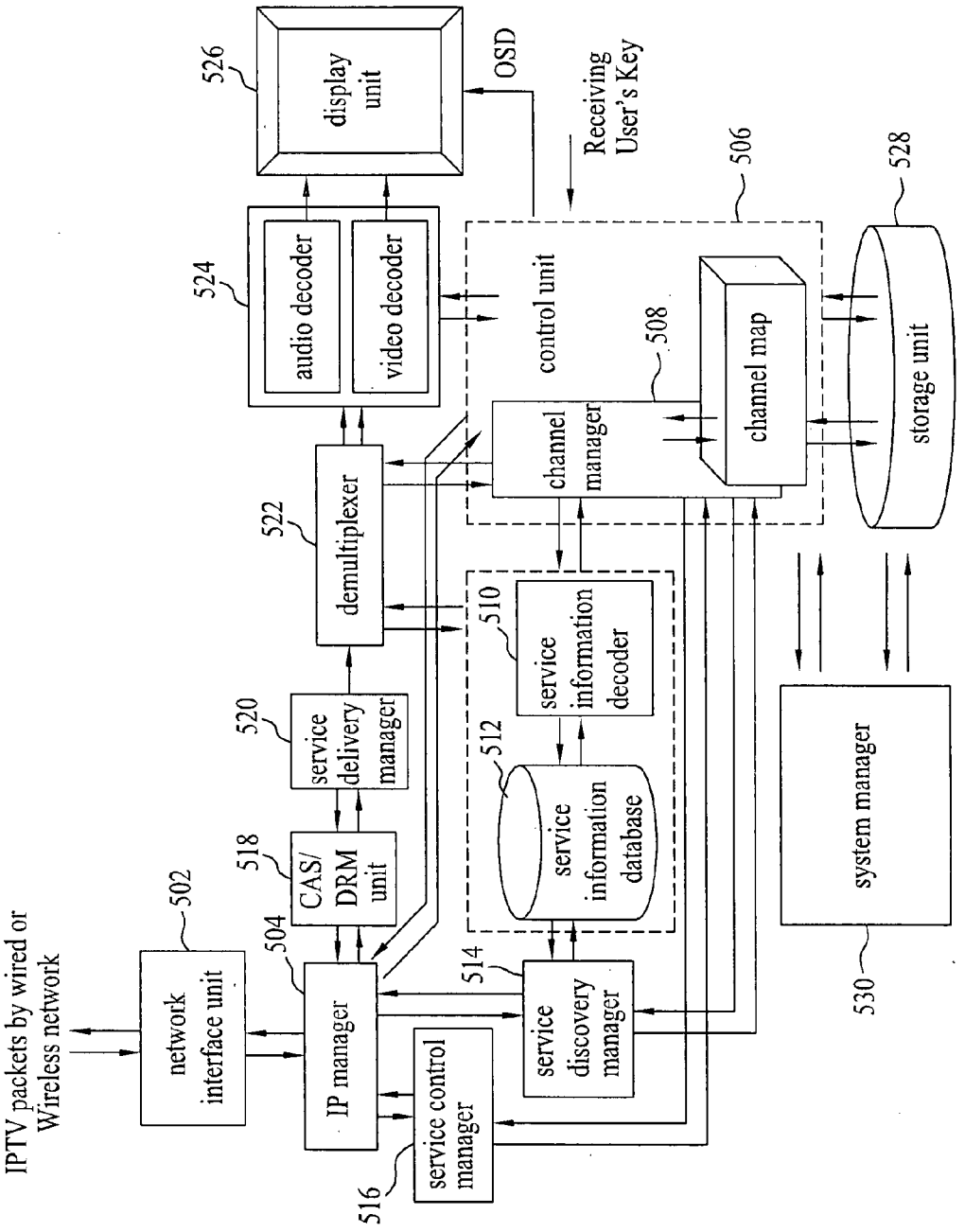
RI_Structure

Field name	bits	description
{		
Command	2	upper / down
code_value	5	
text	var	
format_type	4	
Height	4	
Width	4	
}		

FIG. 14

Format	Width	Height	Code
SQCIF	128	96	00000
QCIF	176	144	00001
QVGA	320	240	00010
525 SIF	352	240	00011
CIF	352	288	00100
525 HHR	352	480	00101
625 HHR	352	576	00110
VGA	640	480	00111
525 4SIF	704	480	01000
525 SD	720	480	01001
4CIF	704	576	01010
625 SD	720	576	01011
SVGA	800	600	01100
XGA	1024	768	01101
720p HD	1280	720	01110
4VGA	1280	960	01111
SXGA	1280	1024	10000
525 16SIF	1408	960	10001
16CIF	1408	1152	10010
4SVGA	1600	1200	10011
1080 HD	1920	1088	10100
2Kx1K	2048	1024	10101
2Kx1080	2048	1088	10110
4XGA	2048	1536	10111
16VGA	2560	1920	11000
3616x1536 (2.35:1)	3616	1536	11001
3672x1536 (2.39:1)	3680	1536	11010
4Kx2K	4096	2048	11011
4096x2304 (16:9)	4096	2304	11100

FIG. 15


IPTV packets by wired or Wireless network
network interface unit
502
IP manager
504
CAS/ DRM unit
518
service delivery manager
520
demultiplexer
522
audio decoder
video decoder
524
display unit
526
OSD
Receiving User's Key
control unit
506
channel manager
channel map
508
storage unit
528
service information decoder
510
service information database
512
service discovery manager
514
service control manager
516
system manager
530

APPARATUS FOR RECEIVING ADAPTIVE BROADCAST SIGNAL AND METHOD THEREOF

[0001] This application claims the benefit of U.S. Provisional Application No. 60/848,366, filed on Oct. 2, 2006, in the name of inventors Jin Pil KIM, Ho Taek HONG, Jong Yeul SUH and Joon Hwi LEE, titled "APPARATUS FOR RECEIVING ADAPTIVE BROADCAST SIGNAL AND METHOD THEREOF", which is hereby incorporated by reference.

BACKGROUND

[0002] 1. Field

[0003] The present disclosure relates to an apparatus for receiving an adaptive broadcast signal and method thereof.

[0004] 2. Discussion of the Related Art

[0005] FIGS. **1**A to **1**C show a broadcast receiving method according to a related art.

[0006] Referring to FIGS. **1**A to **1**C, in a related art TV, contents provided by a broadcasting station are transmitted via a radiowave transferring medium such as a broadcast network and the like by a cable broadcast provider, a terrestrial broadcast provider or a satellite broadcast provider. A viewer receives a corresponding service in a manner of viewing the contents via a TV receiver capable of receiving each of the transfer media.

[0007] As the digital based TV technology has been developed and commercialized from the conventional analog TV broadcasting, various contents including real-time broadcasting, CoD (contents on demand), games, news and the like can be provided to viewers via Internet networks connected to home as well as the conventional radiowave media.

[0008] As an example of the contents providing via the internet network, there is an internet protocol TV (IPTV). The IPTV means a service for providing information services, moving picture contents, broadcasts and the like to a television using high-speed internet networks.

[0009] The IPTV is identical to normal cable broadcasting or satellite broadcasting in providing broadcast contents including video. Yet, the IPTV is characterized in having bi-directionality in addition. Differing from terrestrial broadcasting, cable broadcasting or satellite broadcasting, the IPTV enables a user to view a specific program at a specific time convenient to the user.

[0010] Meanwhile, a broadcast receiver has a supported display status value varying according to performance thereof. And, a requested display status value varies according to a display type as well.

[0011] However, it frequently happens that contents provided by contents providers are uniformly received to increase a service information size unnecessarily.

SUMMARY

[0012] Accordingly, the present invention is directed to an apparatus for receiving an adaptive broadcast signal and method thereof that substantially obviate one or more problems due to limitations and disadvantages of the related art.

[0013] Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0014] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a method of receiving an adaptive broadcast signal according to the present invention includes the steps of linking an IP network, sending display status information for a receiver to a service provider via the linked IP network, receiving an available service information list provided by the service provider based on the display status information for the receiver, and if at least one service is selected from the received available service information list by a user, providing the selected service to the receiver.

[0015] In another aspect of the present invention, a method of receiving an adaptive broadcast signal includes the steps of linking an IP network, sending display status information for a receiver and program selection information to a service provider via the linked IP network, and providing the receiver with at least one service in available service information for a program selected by a user based on the transmitted display status information.

[0016] In another aspect of the present invention, an adaptive broadcast receiver includes a network interface unit transceiving an IP packet by connecting the broadcast receiver to a service provider via a network, a display unit outputting a broadcast signal received by the network interface unit, and a control unit controlling display status information for the display unit to be sent to the service provider, the control unit controlling an adaptive broadcast signal based on the sent display status information to be displayed.

[0017] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] The accompanying drawings, which are included to provide a further understanding of the implementations and are incorporated in and constitute a part of this disclosure, illustrate implementations and together with the description serve to explain the implementations. In the drawings;

[0019] FIGS. **1**A to **1**C are diagrams for a broadcast receiving method according to a related art;

[0020] FIG. **2** is a diagram for system layers of IPTV (IP television);

[0021] FIG. **3** is a characteristic diagram for IPTV system;

[0022] FIG. **4** is a block diagram of a system between a service provider and a broadcast receiver;

[0023] FIG. **5** is a diagram for IP capsulation in case that a service provider provides a service to a broadcast receiver via an IP network;

[0024] FIG. **6** is a flowchart of a method of receiving an adaptive broadcast signal according to a first embodiment of the present invention;

[0025] FIG. **7** is a detailed diagram for a method of receiving an adaptive broadcast signal according to a first embodiment of the present invention;

[0026] FIG. **8** is a flowchart of a method of receiving an adaptive broadcast signal according to a second embodiment of the present invention;

[0027] FIG. **9** is a detailed diagram for a method of receiving an adaptive broadcast signal according to a second embodiment of the present invention;

[0028] FIG. **10**A and FIG. **10**B are diagrams of embodiments for video formats varying according to a multiple channel watching display status;

[0029] FIG. **11** is a diagram of a data structure to send resource information for a broadcast receiver to a service provider from the broadcast receiver according to an embodiment of the present invention;

[0030] FIG. **12** is a diagram of a data structure to send display status information for a broadcast receiver to a service provider from the broadcast receiver according to an embodiment of the present invention;

[0031] FIG. **13** is a diagram of a data structure for indicating available service information sent from a service provider to a broadcast receiver according to an embodiment of the present invention;

[0032] FIG. **14** is a diagram of expressions for transceiving video resolution information for a broadcast receiver according an embodiment of the present invention; and

[0033] FIG. **15** is a block diagram of an adaptive broadcast receiver according to one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0034] Reference will now be made in detail to the implementations, examples of which are illustrated in the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts.

[0035] FIG. **2** is a diagram for system layers of IPTV (IP television).

[0036] Referring to FIG. **2**, an IPTV system includes a contents provider layer, a service provider layer, a network provider layer, and a consumer layer.

[0037] The contents provider plays a role in providing the service provider with contents.

[0038] The service provider plays a role in providing a service to a subscriber. And, the service provider collects various contents, transforms signals to fit an IP environment, and then delivers the transformed signals to the consumer. In this case, the service provider may correspond to a virtual existence and the contents provider can be the service provider.

[0039] The network provider plays a role in connecting the consumer and the service provider together via IP network.

[0040] A transport system can use various networks including an access network, a backbone network, etc. The consumer is the layer for receiving a broadcast by being provided with contents. And, the consumer includes a set-top box, a personal computer (PC), a mobile terminal or the like.

[0041] A concept of the IPTV is explained in detail in the following description.

[0042] FIG. **3** is a characteristic diagram for IPTV system.

[0043] Referring to FIG. **3**, system layers of IPTV can be mainly categorized into a contents provider, a service provider, and a consumer. The contents provider can be called a platform provider as well. The three kinds of groups play different roles, respectively.

[0044] The contents provider can indicate a group that provides overall services and data for broadcast programs.

[0045] The service provider transmits multimedia data. The service provider provides the consumer with maintenance and management to enable stable reception of contents. And, the service provider provides the contents provider with the infrastructure and functions for capability of network transmission.

[0046] And, the consumer group plays a role in playing data inputted using such an infrastructure as xDSL, cable and the like or responding to a user request promptly. The consumer group mostly includes manufacturers for manufacturing IPTVs and its kinds can be categorized into IPTV, IP STB, IP Phone, and the like. The respective groups are explained in detail as follows.

[0047] First of all, the contents provider group may include a TV station that produces a broadcast program. The TV station means a conventional terrestrial broadcasting station or a cable broadcasting station. These broadcasting stations produce and store programs viewable by consumers and are capable of converting the programs digitally to be transmitted. This is to enable various broadcasting types to be transmitted.

[0048] A radio station means a general radio broadcasting station and may have a video channel in some cases. Yet, the radio station is mostly operated without video channel. VoD (video on demand) or AoD (audio on demand) service has characteristics different from those of the TV station or the radio station.

[0049] The contents provider may store and keep a program to be broadcasted. Yet, this program is a live broadcast with continuity. So, this program is characterized in being unable to be rewound or paused to be viewed unless being recorded.

[0050] Yet, in case of VoD or AoD, a specific broadcast program, movie or music can be stored and then played later to be viewed. For instance, if a broadcast program is currently missed to view due to lack of time, a site providing

the broadcast service is accessed to download a corresponding file or play the downloaded file directly.

[0051] Likewise, the AoD provides a function of recording an audio program or playing an audio program by real time. MoD (music on demand) service enables a user to download a specific music to listen to. Targets of the MoD service can be implemented in a manner that a phonograph record manufacturer or distributor expands a conventional web service.

[0052] An embodiment of a service provided by a contents provider group is explained as follows.

[0053] First of all, a PF server can be serviced by a company that manages all broadcast information and location information provided by the contents provider. This service mainly contains location information necessary for a broadcast time or broadcast of a corresponding broadcasting station and information for enabling a customer to access the corresponding broadcasting station. The customer is able to obtain and display this information on a screen. The PF server is one of the services mandatory for each broadcasting station. In the IPTV environment, this service is provided to enable a customer to access a corresponding broadcasting station.

[0054] EPG service is one of convenient services provided to enable a customer to inquire a broadcast program per a time zone and recognize a broadcast program per a channel. The EPG service is configured to be executable in a manner that a corresponding program is automatically installed at a customer side in advance.

[0055] A customer is able to obtain the information for a corresponding broadcasting station only from a PF server. Yet, the EPG service enables a customer to obtain information for real-time broadcast channels of all broadcasting stations at a time. So, the EPG service can be very conveniently usable. For instance, the EPG service is provided with a powerful function of making a reservation for recording CNN news or a reservation for viewing Disney channel. So, the EPG service should provide details of information for broadcast programs in a corresponding area per a time zone. In particular, in case of a prescribed drama, contents of the drama are searched. The broadcast programs can be categorized into SF, drama, animation, and the like for discrimination. Detailed information for a story or characters of a movie or drama of a simple broadcast program can be included.

[0056] One big problem of the EPG service is how to transmit EPG data suitable for a customer due to too many kinds of licenses of customers who view IPTV. To access the EPG service, a customer finds and presses an input key of a remote controller with ease.

[0057] ECG service has all kinds of functions for facilitating a customer to use information for contents possessed by a contents provider, a location of an access server, an access authority and the like. In brief, the functions include a function of facilitating servers having contents to be accessed and an electronic program guide (EPG) indicating details of information for contents.

[0058] In particular, a load in individually accessing a prescribed content service to view or download contents can be reduced in a manner of binding services including AoD, MoD and VoD into one such as EPG except a real-time broadcast.

[0059] Similar to the EPG service, the ECG service enables contents stored in a server to be viewed at any time instead of informing real-time broadcast channel information. And, the ECG service enables contents to be downloaded and stored. If a customer attempts to access a server having corresponding contents, the customer has difficulty in obtaining an address or accessing PF servers. This is a very complicated process and consumes considerable time. A company providing ECG enables an ECG program to be automatically installed in a customer, collects information for all kinds of contents, and provides the corresponding data. In order to access an ECG service, a customer just clicks an input key button on a remote controller as well.

[0060] A portal server is connected to a broadcasting station via a web service provided by each broadcasting station or connected to a web server of a company servicing contents. The portal server plays a role in searching or viewing a program list provided by each broadcasting station or each contents provider providing a contents service. This can be considered as a function of ECG or EPG. Yet, a portal service is equipped with such a function as user authentication or license contract. So, an access is needed to view a specific program. Although ECG or EPG provides a unified broadcast or contents list, the portal service provides broadcast or contents list information for a corresponding program providing company to enable detailed search. In order to access a portal service, a customer just clicks a portal input button on a remote controller.

[0061] Thus, the contents provider side should include a function of providing those services and the like. If it is attempted to normally operate the functions, servers of service companies should be access IP network to transmit a corresponding program by real time or transmit broadcast information.

[0062] And, the respective broadcasting stations or the service companies should be connected to a network of a service provider for errorless transmission without delay. So, they should have a system for transmitting multimedia data using internet real-time protocol such as RTP, RTSP, RSVP, MPLS and the like.

[0063] For instance, in case that a TV studio currently providing news attempts to transmit multimedia by real time, if the multimedia includes MPEG-2 and AC-3 audio specifications, a transcoding work for converting them to fit a format of IPTV should be carried out. After a server for executing this work has been passed, a system is configured in a manner that RTP/UDP protocol including time information for matching caption or lip-sync is attached to pass through IP network provided by a service provider.

[0064] The service provider provides stability and bandwidth of network to enable multimedia data and broadcast data to be well transmitted by a contents provider. Service providers are able to provide IPTV services using a conventional cable network. In this case, equipments of delivery network need to be changed. In particular, network equipments capable of real-time data transmission should be provided for configuration and a customer should configure a network by considering a bandwidth. The equipments

should reduce a bandwidth by processing massive multimedia data using a multicast service as a basic network service of IPTV. If a bandwidth is not secured, a service provider changes an optical cable network configuration or transcodes multimedia data from a contents provider into MPEG-4 or MPEG-7 formatted data with efforts to secure a bandwidth and then transmits the corresponding data. For this, the service provider should provide several kinds of services including NMS (network management system), DHCP (dynamic host control protocol), and CDN services.

[0065] The NMS service enables a service provider to manage a delivery network for a delivery to each customer and an IPTV receiver of the corresponding customer. In particular, in case that a broadcast reception is not available for a customer due to a technical difficulty of a delivery network, a means for emergency processing should be provided.

[0066] The NMS is widely used as a standardized means for controlling and managing machined in a remote transport layer. Using this service, it is able to check how many traffics are generated for a prescribed broadcast or which area is in short of bandwidth. The NMS service should be provided to contents providers to enable the corresponding contents provider to generate and manage groups in multicast. This is because more multicast groups may need to be generated occasionally.

[0067] The DHCP service enables an IP to be automatically allocated to an IPTV receiver of a customer and is used to inform an address of a CDN server. The DHCP service is a useful means for allocating IP to a PC on a general network. By transmitting an accessible address to an authorized IPTV receiver, a user is allowed to make a registration procedure for an initial access. Generally, an IPTV receiver will provide IPv4. Yet, IPv6 is also available. So, an IPTV receiver providing IPv4 is usable as well.

[0068] In the CDN service, when an IPTV receiver is initially operated with data provided by a service provider by receiving a power, CDN information is received from a service provider while IP is received by the DHCP service. This information contains customer registration or authentication of an IPTV provider and the above-explained PF informations. As an IPTV receiver obtains CDN information from a service provider, an IP broadcast signal reception is enabled.

[0069] A customer can have various kinds of IPTV receivers. A customer having a normal TV rents IPTV STB to enjoy an IPTV inexpensively. A service provider pays an additional service charge with a low price and a customer requests an IP phone to use together.

[0070] An IPTV receiver basically includes a network interface capable of accessing a network and has an Internet protocol. The IPTV receiver receives and processes data packets coming from a network and then plays multimedia data on a screen. In case of manipulating the IPTV receiver using a remote controller, the IPTV receiver should make a response by sending data packets quickly via a network to obtain corresponding information from a server. In particular, the IPTV receiver is capable of operating to transmit user requested items bi-directionally while processing multimedia data. And, buttons for IPTV ca be provided to a remote controller to use the corresponding service well. So, a consumer is able to store and view a fine scene of a drama in the above-provided IPTV receiver and enjoy additional services including location information, hotel reservation and the like.

[0071] Meanwhile, the above-mentioned NMS includes the function that a service provider manages a network. And, the NMS helps the service provider control and manage an IPTV receiver of a consumer. If more IPTV receivers are used and if more additional services are provided, the role of the NMS becomes more important. So, SNMP protocol becomes mandatory for an IPTV broadcast receiver. This is intended for a service provider to manage and control an IPTV broadcast receiver. If so, an IPTV broadcast receiver is able to obtain details of statistical data of a currently communicating protocol, information for a currently used processor, information for a TV manufacturer, and the like.

[0072] FIG. **4** is a block diagram of a system between a service provider and a broadcast receiver.

[0073] Referring to FIG. **4**, a terminal o a service provider is capable of bi-direction communication via an IP network. In particular, according to the present system, a broadcast receiver is capable of receiving a broadcast from a service provider and also capable of transmitting information for an environment of the broadcast receiver to the service provider.

[0074] In this case, when the service provider collects to provide broadcast signals to the broadcast receiver, a broadcast stream can include a single or multi program. In case of attempting to transmit a transport stream via an IP network, IP capsulation is required.

[0075] FIG. **5** is a diagram for IP capsulation in case that a service provider provides a service to a broadcast receiver via an IP network.

[0076] Referring to FIG. **5**, an IP capsule can include an IP header, a UDP header, an RTP header, and real data, i.e., a transport stream packet.

[0077] FIG. **6** is a flowchart of a method of receiving an adaptive broadcast signal according to a first embodiment of the present invention.

[0078] Referring to FIG. **6**, a method of receiving an adaptive broadcast signal according to a first embodiment of the present invention includes the steps of linking an IP network, transmitting display status information for a receiver to a service provider via the linked IP network, receiving an available service information list provided by the service provider based on the display status information for the receiver, and if at least one service is selected from the received available service information list by a user, providing the selected service to the receiver.

[0079] In the IP network linking step (S**61**), a terminal is connected to the service provider via the IP network. In this case, a service provider designated as a default can be preferentially connected. In case that subscriptions are made to several service providers, it is able to select a specific service provider to be connected.

[0080] In the step (S**62**) of transmitting the display status information for the receiver to the service provider, the display status information is transmitted to the service provider to be provided with a service suitable for display performance of the receiver.

[0081] In this case, the display status information indicates a value for determining the display performance and corresponds to resolution, color quality or the like. For instance, a broadcast receiver supporting standard definition (hereinafter abbreviated SD) receives high definition (hereinafter abbreviated HD) contents but displays the received contents with SD. The broadcast receiver receives the large-size non-displayable HD contents and increases a service information size unnecessarily. So, the broadcast receiver transmits a maximum displayable resolution value and then receives contents having a version of a suitable resolution value. For this, the service provider should be equipped with various resolution versions for the same program contents.

[0082] Despite a broadcast receiver that provides HD image quality, in case of displaying multiple channels using a PIP (picture in picture) function or a pop-up function, a main screen and a sub-screen are displayed with resolution lower than that of a full screen. So, instead of receiving high-resolution contents and reducing the received contents to display, in aspect of network, it is more efficient to receive contents having a resolution version suitable for a display environment in the contents transceiving step. And, it is unnecessary to receive contents information of a video format different form that of a display type and reformat the received contents information to fit the display type.

[0083] In the step (S**63**) of receiving the available service information list from the service provider, a contents information list of various versions suitable for the display performance of the receiver is sent to the receiver by the service provider based on the display status information having been transmitted to the service provider. For instance, the service provider sends a contents list having at least one version the service provider is equipped with. In this case, if the broadcast receiver is for SD, an HD list and an SD list are sent to enable a user to make a selection or a list of SD corresponding to resolution suitable for an output of the receiver can be sent.

[0084] If the user selects contents from the received available service information list (S**64**), the service provider provides the contents selected by the user (S**65**). If the user selects a contents program of a specific version to be viewed from the received list, the service provider provides the corresponding service based on an inputted selection signal.

[0085] FIG. **7** is a detailed diagram for a method of receiving an adaptive broadcast signal according to a first embodiment of the present invention. A broadcast signal receiving method between a service provider and a broadcast receiver is explained with reference to FIG. **7**. In this case, steps explained in the following description are just exemplary but the claims of the present invention are not restricted by the following steps or temporal sequence thereof.

[0086] Referring to FIG. **7**, while a service provider is providing a broadcast service (**1**), a power of a broadcast receiver is turned on (**1**).

[0087] If the power of the broadcast receiver is turned on, system initialization is carried out (**2**).

[0088] The system-initialized broadcast receiver searches for a connectable service provider (**3**) or makes a connection to a service provider set to a default. In case that there are a plurality of connectable service providers, a user is requested to make a selection. If so, the user is able to make a selection.

[0089] The broadcast receiver transmits its authentication information while making a request for a service connection to the service provider (**3-1**).

[0090] The service provider having received the authentication information for the broadcast receiver performs a receiver authentication (**4**).

[0091] Once a qualification of the broadcast receiver is authenticated in the authenticating step, available information on a subscribed service is transmitted (**4-1**_. The available information on the subscribed service means available service information for a receivable physical channel.

[0092] The broadcast receiver performs service discovery (**5**). This is the step of searching a service and deciding a service characteristic. Through this step, the broadcast receiver is connected to the service provider.

[0093] The broadcast receiver displays a service menu (**6**). Hence, the user is able to see an available service on the subscribed service.

[0094] The broadcast receiver transmits an available resource, i.e., display status information to the service provider (**7**). In particular, the broadcast receiver transmits its display performance value such as resolution, color quality and the like for example.

[0095] Having received the display status information, the service provider compares various versions of retained contents to options of the display status information (**8**). As a result of the comparison, the service provider sends an available service channel list, which can be outputted from the broadcast receiver, to the broadcast receiver (**8-1**). In particular, the service provider sends available information for receiver options.

[0096] Having received the available service list from the service provider, the broadcast receiver displays the available service list (**9**). The user then selects at least one from the available service list (**10**). In this case, the user selects a channel to view from the available service list and also selects a display version to be outputted from contents of the same channel. In this case, channel selection information can be transmitted together in the step (**7**) of transmitting the display status information for the broadcast receiver. If so, the service provider is able to provide an available service version list for the selected channel.

[0097] If the selected program information is sent to the service provider (**10-1**), the service provider searches for a service selected by the user (**11**) and then provides the searched service to the broadcast receiver (**11-1**).

[0098] FIG. **8** is a flowchart of a method of receiving an adaptive broadcast signal according to a second embodiment of the present invention.

[0099] Referring to FIG. **8**, a method of receiving an adaptive broadcast signal according to a second embodiment of the present invention includes the steps of linking an IP network, transmitting display status information for a broadcast receiver and program selection information to a service provider via the linked IP network, and receiving at least one

service in available service information for a program selected by a user based on the transmitted display status information.

[0100] The step of linking the IP network and the step of transmitting the display status information for the broadcast receiver to the service provider are identical to those of the second embodiment of the present invention. Yet, the second embodiment differs from the first embodiment in that the service provider selects to send a suitable service version to the broadcast receiver based on the received display status information for the broadcast receiver instead of selecting a service to be provided to the user from the available service list.

[0101] The step (S82) of transmitting the display status information for the broadcast receiver to the service provider and the step (S83) of selecting the program to be viewed by the user can be executed together or separately.

[0102] In particular, the display status information and the program selection information, i.e., channel information are sent to the service provider. For instance, the user selects channel-10 and the display status information, i.e., resolution information according to a display option or video format information according to a channel display type is provided as well.

[0103] The service provider selects at least one service from available services and then provides the selected service to the broadcast receiver (S84).

[0104] In particular, if resolution of the broadcast receiver corresponds to SD for the channel-10 selected by the user, the service provider provides program contents of the version corresponding to the SD among various versions of the retained contents of the channel-10.

[0105] If the channel-10 selected by the user is outputted in a display type of PIP or POP instead of being outputted as a main screen, the service provider provides program contents of a video format version suitable for the PIP or POP among various versions of the retained contents of the channel-10.

[0106] In this case, if the service provider fails to retain the contents matching a video format of the broadcast receiver, the service provider provides a broadcast signal coded in a format closest to the video format. For instance, when a video format of a displayed PIP screen is 352*288, if the service provider fails to retain a version of the same video format, the service provider can provide a version formatted by 352*240 closest to 352*288.

[0107] FIG. **9** is a detailed diagram for a method of receiving an adaptive broadcast signal according to a second embodiment of the present invention. A broadcast signal receiving method between a service provider and a broadcast receiver is explained with reference to FIG. **9**. In this case, steps explained in the following description are just exemplary but the claims of the present invention are not restricted by the following steps or temporal sequence thereof.

[0108] Referring to FIG. **9**, steps (**1**) to (**6**) are identical to those of the first embodiment of the present invention. N the following description, steps after the step (**6**) are explained.

[0109] First of all, a broadcast receiver sends its available resources, i.e., display status information to the service provider (**7**). In particular, the broadcast receiver sends its display performance values including resolution, color quality and the like for example.

[0110] Having received the display status information, the service provider compares options of various versions of the retained contents to options of the display status information (**8**).

[0111] The broadcast receiver receives a program selection signal of the user (**9**) and then sends finally selected program selection information to the service provider (**9-1**). In this case, the program selection in the broadcast receiver and the selection signal sending to the service provider can be carried out before the option comparing step (**8**) in the service provider. And, they can be executed together with the transmission of the available resource information (**6**).

[0112] Namely, the display status information is sent (**7**), the corresponding options are compared to each other (**8**), and the finally selected program selection information is then sent. Alternatively, after the display status information and the finally selected program information have been sent, option comparison can be carried out on the retained contents for the selected program.

[0113] If the selected program information is sent to the service provider (**9-1**), the service provider searches for a display version closest to a display status corresponding to a result of the option comparison (**10**) and then provides the searched contents to the broadcast receiver, for the selected program (**10-1**).

[0114] The broadcast receiver having received the contents provided by the service provider displays the received contents (**11**).

[0115] In the first embodiment of the present invention, once the display status information for the broadcast receiver is provided to the service provider, the service provider sends the available service information list to the broadcast receiver. If so, the user selects the display version to be finally outputted. Namely, the display version to be finally outputted is selected by the user.

[0116] On the contrary, in the second embodiment of the present invention, if the display status information for the broadcast receiver is provided to the service provider, the service provider directly selects the service closest to the display option and then provides the selected service to the broadcast receiver. Namely, the display version to be finally outputted is selected by the service provider.

[0117] FIG. **10**A and FIG. **10**B are diagrams of embodiments for video formats varying according to a multiple channel watching display status. In this case, a source means an actually coded video format of a broadcasted program and a display means a video format to output a corresponding program to a screen.

[0118] Referring to FIG. **10**A, a video format of a PIP display for outputting a sub-screen in a main screen can be observed.

[0119] It is assumed that an option of a monitor of a user is capable of outputting 1080HD. And, it is also assumed that CIF is set to be outputted in case of a PIP output.

[0120] A format of a program to be outputted on a main screen is determined as 1080HD. And, a corresponding

stream is received and then outputted. In this case, for a program to be outputted to a sub-screen, a stream coded by CIF image quality is requested or a service provider sends a stream coded by CIF image quality.

[0121] Namely, according to the present invention, instead of receiving 1080HD-coded stream uniformly and then changing a corresponding format for a program to be outputted to a sub-screen, a stream coded by CIF image quality suitable for a program to be outputted to a sub-screen is received and then displayed.

[0122] Referring to FIG. **10**B, a video format of a POP display for outputting a pop screen can be observed.

[0123] It is assumed that a size of a video window to be outputted to a screen **1** corresponds to 4VGA. And, it is also assumed that a size of each video window of screens **2** to **4** is set to CIF.

[0124] When a 4VGA-coded stream in a program coded in various video formats is requested for a channel to be outputted to the screen **1**, if a service provider fails to retain a stream coded in a same video format, it is able to select and receive a broadcast signal coded in a format closest to 4VGA. In this case, a broadcast signal encoded by 720pHD is transmitted.

[0125] The same method of the screen **1** is applied to the screens **2** to **4**. In particular, a broadcast signal coded in a format matching a user's display setup is selected and received. If a matched format does not exist, a broadcast signal coded in a closest format is received and outputted.

[0126] A subject to select a video format in the present embodiment can be the user in the first or second embodiment or the service provider.

[0127] FIG. **11** is a diagram of a data structure to send resource information for a broadcast receiver to a service provider from the broadcast receiver according to an embodiment of the present invention.

[0128] Referring to FIG. **11**, resolution information, audio codec information, video codec information, network information, and user level information for a broadcast receiver can be sent.

[0129] FIG. **12** is a diagram of a data structure to send display status information for a broadcast receiver to a service provider from the broadcast receiver according to an embodiment of the present invention, in which a video resolution data structure (RI-structure) in the display status information is shown.

[0130] Referring to FIG. **12**, an RI data structure includes such information for representation to specify a video resolution as a code value, a text, and a format type (format_type). In case of video resolution, at least two resolution informations can be sent to implement a multiple window function.

[0131] In this case, the video resolution information sent by a user can include several kinds. For instance, it can be a maximum video resolution supported by a display unit of a broadcast receiver of a user or display resolution information of each window in case that a multiple video window function such as PIP and POP is activated.

[0132] Besides, a command filed (not shown in FIG. **12**) is usable. For instance, if the command is set to 0, video resolution information means a maximum video resolution supported by a monitor. And, this indicates a video resolution of a main screen. If the command is set to 1, it can be engaged that next video resolution information indicates a video resolution of a sub-screen **1** in case of multiple video window implementation. According to this, the command and the video resolution information can be sent as many as the number of maximum multiple screen windows that can be implemented by a display unit.

[0133] FIG. **13** is a diagram of a data structure for indicating available service information sent from a service provider to a broadcast receiver according to an embodiment of the present invention, in which a video resolution data structure (RI-structure) in display status information is shown.

[0134] Referring to FIG. **13**, an RI data structure is a means for sending video resolution information in sending an available service channel list or an available program list to a broadcast receiver from a service provider. The present data structure represents which video resolution is available for a specific program.

[0135] The corresponding information can connect all available video resolutions or represent all available video resolutions by engagement using a command and the like.

[0136] For instance, if a command is set to 0, it may mean that all resolutions equal to or smaller than a resolution indicated by a code value are available. If the command is set to 1, it may mean that all resolutions equal to or greater than a resolution indicated by a code value are available. Namely, it is able to configure the RI data structure with simplicity using a command engaged between a service provider and a broadcast receiver.

[0137] FIG. **14** is a diagram of expressions for transceiving video resolution information for a broadcast receiver according an embodiment of the present invention.

[0138] Referring to FIG. **14**, video resolution information sent to a service provider from a broadcast receiver can be defined identical to available video resolution information provided to the broadcast receiver by the service provider.

[0139] FIG. **14** exemplarily shows a format type (format_type), a width, a height, and a code value (code_value), which are included in the RI data structure shown in FIG. **12** or FIG. **13**.

[0140] FIG. **15** is a block diagram of an adaptive broadcast receiver according to one embodiment of the present invention.

[0141] Referring to FIG. **15**, an adaptive broadcast receiver according to one embodiment of the present invention includes a network interface unit transceiving an IP packet by connecting the broadcast receiver to a service provider via a network, a display unit outputting a broadcast signal received by the network interface unit, and a control unit controlling display status information for the display unit to be sent to the service provider, the control unit controlling an adaptive broadcast signal based on the sent display status information to be displayed.

[0142] Detailed configuration of the broadcast receiver is explained as follows.

[0143] First of all, the broadcast receiver includes a network interface unit **502**, an IP manager **504**, a control unit **506**, a channel manager **508**, a service information decoder **510**, a service information database **512**, a service discovery manager **514**, a service control manager **516**, a CAS/DRM unit **518**, a service delivery manager **520**, a demultiplexer **522**, an audio/video decoder **524**, a display unit **526**, a storage unit **528**, and a system manager **530**.

[0144] The network interface unit **502** receives packets received from a network and transmits a packet to the network from the broadcast receiver. In particular, the network interface unit **502** receives an adaptive broadcast signal of the present invention from a service provider of the present invention via the network.

[0145] The IP manager **504** manages a packet delivery to a destination from a source for the packets received or transmitted by the broadcast receiver. And, the IP manager **504** sorts the received packets to correspond to a suitable protocol.

[0146] The control unit **506** controls an application and an overall operation of the broadcast receiver according to a user input signal by controlling a user interface (not shown in the drawing). The control unit **506** provides a graphic user interface (GUI) for a user using an OSD (on screen display) or the like. The control unit **506** receives an input signal from the user and then performs a receiver operation according to the corresponding input. For instance, if a key input concerning a channel selection is inputted by a user, the control unit **506** sends a channel selection input signal to the channel manager **508**.

[0147] The control unit **506** controls the display status information for the display unit to be sent to the service provider. And, the control unit **506** controls the adaptive broadcast signal based on the sent display status information to be displayed.

[0148] The channel manager **508** stores received channel information and then generates a channel map. The channel manager **508** selects a channel according to the key input received from the control unit **506** and controls the service discovery manager **514**.

[0149] The channel manager **508** receives service information for a channel from the service information decoder **510** and performs audio/video PID (packet identifier) setting of the selected channel on the demultiplexer **522**.

[0150] The service information decoder **510** decodes such service information as PSI (program specific information). In particular, the service information decoder **510** receives and decodes PSI table, PSIP (program and service information protocol) table, DVB-SI (service information) table or the like demultiplexed by the demultiplexer **522**.

[0151] The service information decoder **510** decodes the received service information tables, generates a database for the service information, and then stores the generated database for the service information in the service information database **512**.

[0152] The service discovery manager **514** provides information necessary to select a service provider which provides a service. If a signal for a channel selection is received from the control unit **506**, the service discovery manager **514** searches for a service provider using the information.

[0153] The service control manager **516** is responsible for a selection and control of a service. For instance, if a user selects a live broadcasting service as good as a conventional broadcasting type, the service control manager **516** performs the selection and control of the service using IGMP or RTSP.

[0154] If a user selects such a service as VOD (video on demand), the service control manager **516** performs the selection and control of the service using RTSP. In this case, the RTSP (real-time streaming protocol) can provide a trick mode for a real-time streaming.

[0155] The packet for the service received via the network interface unit **502** and the IP manager **504** is sent to the CAS/DRM unit **518**. The CAS/DRM unit **518** is responsible for CAS (conditional access system) of service and DRM (digital rights management).

[0156] The service delivery manager **520** is responsible for control of the received service data.

[0157] For instance, in case of controlling real-time streaming data, RTP/RTCP (real-time transport protocol/RTP control protocol) is used. If the real-time streaming data is transported using the RTP, the service delivery manager **520** parses the received data packet according to the RTP and then sends the parsed packet to the demultiplexer **522**. And, the service delivery manager **520** feeds back the network reception information to a server side providing the service using the RTCP. In this case, the real-time streaming data can be capsulated by UDP without RTP and then directly delivered.

[0158] The demultiplexer **522** demultiplexes the received packet into audio data, video data and PSI (program specific information) data and then sends the data to the video/audio decoder **524** and the service information decoder **510**, respectively.

[0159] The video/audio decoder **524** decodes the video and audio data received from the demultiplexer **522**. And, the video/audio data decoded by the video/audio decoder **524** is provided to the user via the display unit **526**.

[0160] The storage unit **528** stores setup data for system and the like. In this case, the storage unit **528** can include a nonvolatile memory such as a nonvolatile RAM (NVRAM), a flash memory, and the like.

[0161] And, the system manager **530** controls overall operations of the broadcast receiver via a power system.

[0162] It will be apparent to those skilled in the art that various modifications and variations can be made in the implementations without departing from the spirit or scope of the above implementations. Thus, other implementations are within the scope of the following claims.

1. A method of receiving an adaptive broadcast signal, comprising the steps of:

validating an IP network;

sending display status information of a receiver to a service provider via the linked validated IP network;

receiving information list about an available media service in the receiver that is transmitted from the service provider based on the display status information of the receiver; and

receiving a selected media service from the service provider, when at least one service is selected according to the received information list about an available media service.

2. The method of claim 1, wherein the display status information comprises resolution information.

3. The method of claim 1, wherein the display status information comprises video format information according to a display type.

4. The method of claim 3, wherein the video format information comprises main watching screen information and sub-watching screen information according to a multiple channel watching type.

5. The method of claim 4, wherein the multiple channel watching type comprises a PIP (picture in picture) type or a POP type.

6. The method of claim 1, wherein in the step of sending the display status information of the receiver to the service provider, a data structure representing the display status information of the receiver as at least one selected from the group comprising a code value (code_value) field, a text field, and a format type (format_type) field is sent to the service provider.

7. The method of claim 1, wherein in the step of sending the display status information of the receiver to the service provider, service selection information is provided to the service provider together with the display status information.

8. The method of claim 1, wherein the information list about an available media service, comprises at least one display version list for a selected service.

9. The method of claim 1, wherein in the step of receiving the information list about an available media service in the receiver, a data structure representing an available media service as a command field is received.

10. The method of claim 1, wherein in the step of receiving the information list about an available media service in the receiver, a data structure representing the information list about an available media service for the receiver as at least one selected from the group comprising of a code value (code_value) field, a text field, a field format type (format_type) field, and a height and weight field is received.

11. The method of claim 1, wherein in the step of selecting the at least one service according to the received information list about an available media service in the receiver, a user selection signal is inputted as OSD.

12. A method of receiving an adaptive broadcast signal comprising the steps of

validating an IP network;

sending display status information of a receiver and service selection information to a service provider via the validated IP network; and

receiving at least one media service among available media services of a selected service that is transmitted from the service provider according to the display status information of the receiver.

13. The method of claim 12, wherein the display status information comprises either resolution information or video format information according to a display type.

14. The method of claim 13, wherein the video format information according to the display type comprises main watching screen information and sub-watching screen information according to a multiple channel watching type.

15. The method of claim 14, wherein the multiple channel watching type comprises a PIP (picture in picture) type or a POP type.

16. The method of claim 12, wherein in the step of sending the display status information of the receiver and the service selection information to the service provider, a data structure representing the display status information of the receiver as at least one selected from the group comprising of a code value (code_value) field, a text field, and a format type (format_type) field is sent to the service provider.

17. The method of claim 12, further comprising the step of deciding a contents version to be transmitted to the receiver by comparing the display status information to contents display information.

18. The method of claim 17, wherein in the step of deciding a contents version to be transmitted to the receiver, at least one contents version is decided for the selected service.

19. An adaptive broadcast receiver comprising:

a network interface unit transceiving an IP packet by connecting the broadcast receiver to a service provider via a network;

a display unit outputting a broadcast signal received by the network interface unit; and

a control unit controlling display status information for the display unit to be sent to the service provider, and controlling an adaptive broadcast signal based on the sent display status information to be displayed.

20. The adaptive broadcast receiver of claim 19, wherein the control unit controls either resolution information or video format information according to a display type to be sent to the service provider.

21. The adaptive broadcast receiver of claim 20, wherein the video format information according to the display type comprises main watching screen information and sub-watching screen information according to a multiple channel watching type.

22. The adaptive broadcast receiver of claim 21, wherein the multiple channel watching type comprises a PIP (picture in picture) type or a POP type.

23. The adaptive broadcast receiver of claim 19, further comprising an IP manager unit managing a packet delivery to a destination from a source for a packet received via the network interface unit and a packet sent by the receiver.

24. The adaptive broadcast receiver of claim 19, further comprising:

a service discovery manager providing information necessary to select the service provider providing a service; and

a service control manager responsible for a selection and control of the service.

25. The adaptive broadcast receiver of claim 19, further comprising a user interface unit receiving a service selection signal for selecting at least one service from an information list about an available media service received from the service provider based on display status information sent to the service provider.

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