

International Telecommunication Union

ITU-T

Technical Paper

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(30 July 2010)

SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS
Infrastructure of audiovisual services - Communication
procedures

HSTP.IPTV-ISPF
IPTV retail service provider model

ITU-T

Summary

This document describes an IPTV retail service provider model that is an implementation example of IPTV service provider domain. Herein, we also describe IPTV service platform as a sub-layer between eclectic mixes of service providers and network providers. This sub-layer provides an interface for emerging service providers and mobility service providers including mobile TV to have access to IPTV terminal devices via one or multiple network providers.

Keywords

IPTV, retail service provider, service platform, service provider discovery

Change Log

This document contains Version 1 of the ITU-T Technical Paper on "*IPTV retail service provider model*" approved at the ITU-T Study Group 16 meeting held in Geneva, 19-30 July 2010.

Editor: Teck Kiong LEE
Institute for Infocomm Research (I2R)
Singapore
Tel: +65 64082269
Email: tklee@i2r.a-star.edu.sg

Editor: Kazunori TANIKAWA
NEC Corporation
Japan
Tel: +81-3-3798-2924
Email: k-tanikawa@cq.jp.nec.com

Table of Contents

	Page
1 SCOPE	1
2 REFERENCES.....	1
3 DEFINITIONS	1
3.1 TERMS DEFINED ELSEWHERE.....	1
3.2 TERMS DEFINED IN THIS DOCUMENT	2
4 ABBREVIATIONS AND ACRONYMS	2
5 GENERIC IPTV DOMAINS	2
6 CONCEPT OF RETAIL SERVICE PROVIDER MODEL	5
6.1 BASIC MODEL.....	5
6.2 IPTV RETAIL SERVICE PROVIDER (IRSP) MODEL	5
6.3 VARIATIONS OF USAGE OF AN IPTV SERVICE PLATFORM.....	6
7 FUNCTIONALITIES AND INTERFACES.....	7
7.1 RETAIL SERVICE PROVIDER AND SERVICE PLATFORM.....	7
7.1.1 <i>IPTV service platform in ITU-T IPTV functional architecture context</i>	7
7.1.2 <i>IPTV service API</i>	8
7.2 NETWORK PROVIDER.....	9
8 SERVICE DISCOVERY OF RETAIL SERVICE PROVIDERS	10
9 AN IPTV IMPLEMENTATION EXAMPLE - THREE-LAYER NEXT GENERATION ULTRA HIGH-SPEED BROADBAND NETWORK	11
9.1 OVERVIEW	11
9.2 IPTV SERVICE PLATFORM OPERATOR SCENARIOS	13
9.3 IPTV SERVICE PLATFORM OPERATOR SUPPORT SERVICES	13
9.3.1 <i>Content Services</i>	13
9.3.2 <i>Interactive Services</i>	13
APPENDIX I: ENTERPRISE MODEL FOR NGN.....	14
I.1 BASIC SERVICE ROLE MODEL.....	14
I.2 DETAILED NGN SERVICE ROLE MODEL.....	15
BIBLIOGRAPHY.....	16

IPTV retail service provider model

1 Scope

This document describes an IPTV retail service provider model that is an implementation example of IPTV service provider domain. Herein, we also describe IPTV service platform as a sub-layer between eclectic mixes of service providers and network providers. This sub-layer provides an interface for emerging service providers and mobility service providers including mobile TV to have access to IPTV terminal devices via one or multiple network providers.

2 References

- [ITU-T Y.1901] ITU-T Recommendation Y.1901 (2008), *Requirements for the support of IPTV services*
- [ITU-T Y.1910] ITU-T Recommendation Y.1910 (2008), *IPTV functional architecture*
- [ITU-T H.770] ITU-T Recommendation H.770 (2009), *Mechanisms for service discovery up to consumption for IPTV*
- [ITU-T X.1191] ITU-T Recommendation X.1191 (2008), *Functional requirements and architecture for IPTV security aspects*

3 Definitions

3.1 Terms defined elsewhere

This document uses the following terms defined elsewhere:

3.1.1 Application programming interface (API) [ITU-T Y.101]: This is an implementation interface between equipment and a software module and does not have any physical realization as it is internal to the equipment.

3.1.2 Content provider [ITU-T Y.1910]: The entity that owns or is licensed to sell content or content asset.

3.1.3 End-user [ITU-T Y.1910]: The actual user of the products or services.

NOTE: The end-user consumes the product or service. An end-user can optionally be a subscriber (contractor).

3.1.4 Middleware [ITU-T Y.1901]: A layer of software between applications and resources, which consists of a set of service enablers that allow multiple functionalities running on one or more devices in an IPTV system to interact across a network.

3.1.5 Network provider [ITU-T Y.1910]: The organization that maintains and operates the network components required for IPTV functionality.

3.1.6 Operator [ITU-T M.1400]: An organization responsible for identification and management of telecommunication resources. An operator must be legally recognized by the telecommunication administration of the Country, or delegation thereof. An Operator may or may not correspond to a trading partner

3.1.7 SCP [ITU Y.1901]: A combination of service protection and content protection

3.1.8 Service platform [ITU-T H.770]: A set of functions that facilitate telecommunication services provided by service providers.

NOTE: In context of IPTV services, examples of service platform's functions are service authentication, content aggregation and content delivery

3.1.9 Service provider [ITU-T M.1400]: A general reference to an operator that provides telecommunication services to customers and other users either on a tariff or contract basis. A service provider can optionally operate a network. A service provider can optionally be a customer of another service provider.

3.2 Terms defined in this document

This document defines the following terms:

3.2.1 IPTV retail service provider (IRSP): The role that has mainly responsibility for the provision of a service or set of services to users. IPTV retail service providers do not provide a complete service on its own functionalities.

NOTE 1: IRSPs fall under the 'Service Provider [ITU-T M.1400]' as IPTV domain definition.

4 Abbreviations and acronyms

This document uses the following abbreviations and acronyms.

API	Application Programming Interface
IPTV	Internet Protocol TV
NetCo	Network Company
NGN	Next Generation Network
OpCo	Operating Company
IRSP	IPTV Retail Service Provider
SCP	Service Protection and Content Protection

5 Generic IPTV Domains

The main domains involved in the provisioning of IPTV services are: 'end-user', 'network provider', 'service provider' and 'content provider'.

Figure 5.1 revisits the main domains that are involved in the provision of IPTV services [ITU-T Y.1910]. Content providers own or are licensed to sell content or content asserts. Service providers are operators that provide telecommunication services to customers or other users. Network providers maintain and operate network components necessary for the respective delivery modes supported by the various service providers. End users are those who utilize available services via one or multiple networks.

[ITU-T Y.1901] provides the following requirement for selection of entities relating IPTV services. This document points out the diversity of the structure of entities concerning IPTV service providers.

RR 6.7.3-01: *The IPTV architecture is recommended to support a mechanism for end-users to select IPTV network providers, IPTV services providers, and IPTV content providers according to their preferences.*

Relationships between the main domains range from 1:1, 1:n, n:1 to m:n. In order to better capture this complexity, various sub-domains are introduced.

The generic IPTV domains in Figure 5.2 depicts a standards-based open access IPTV landscape with a multitude of network providers, IPTV service platform operators and IRSPs that are operated through several distinct organizational units. Presented within Figure 5.2 are three plausible configurations:

- One network provider to one IPTV service platform operator to one IRSP.

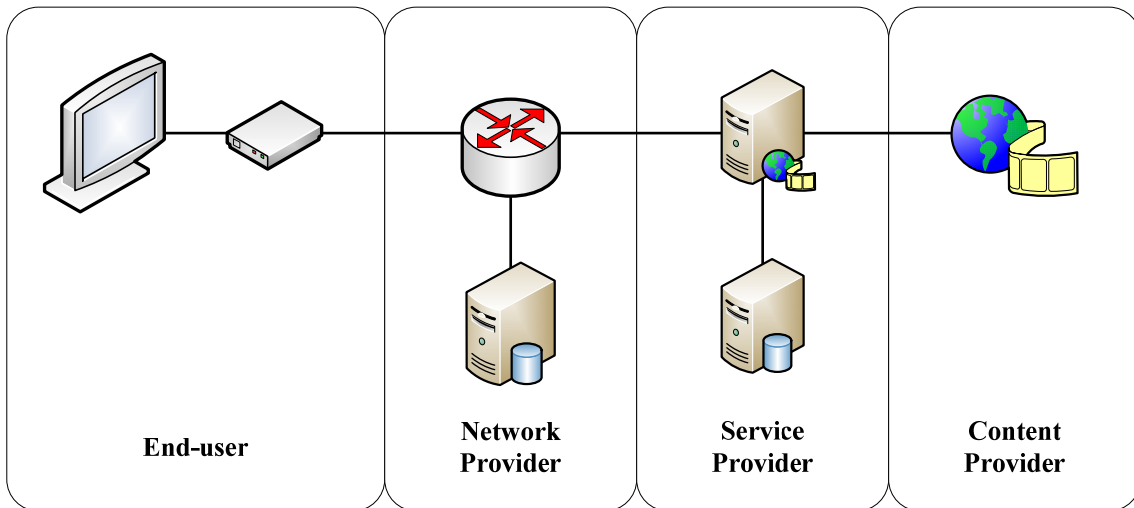


Figure 5.1: IPTV Domains [ITU-T Y.1910])

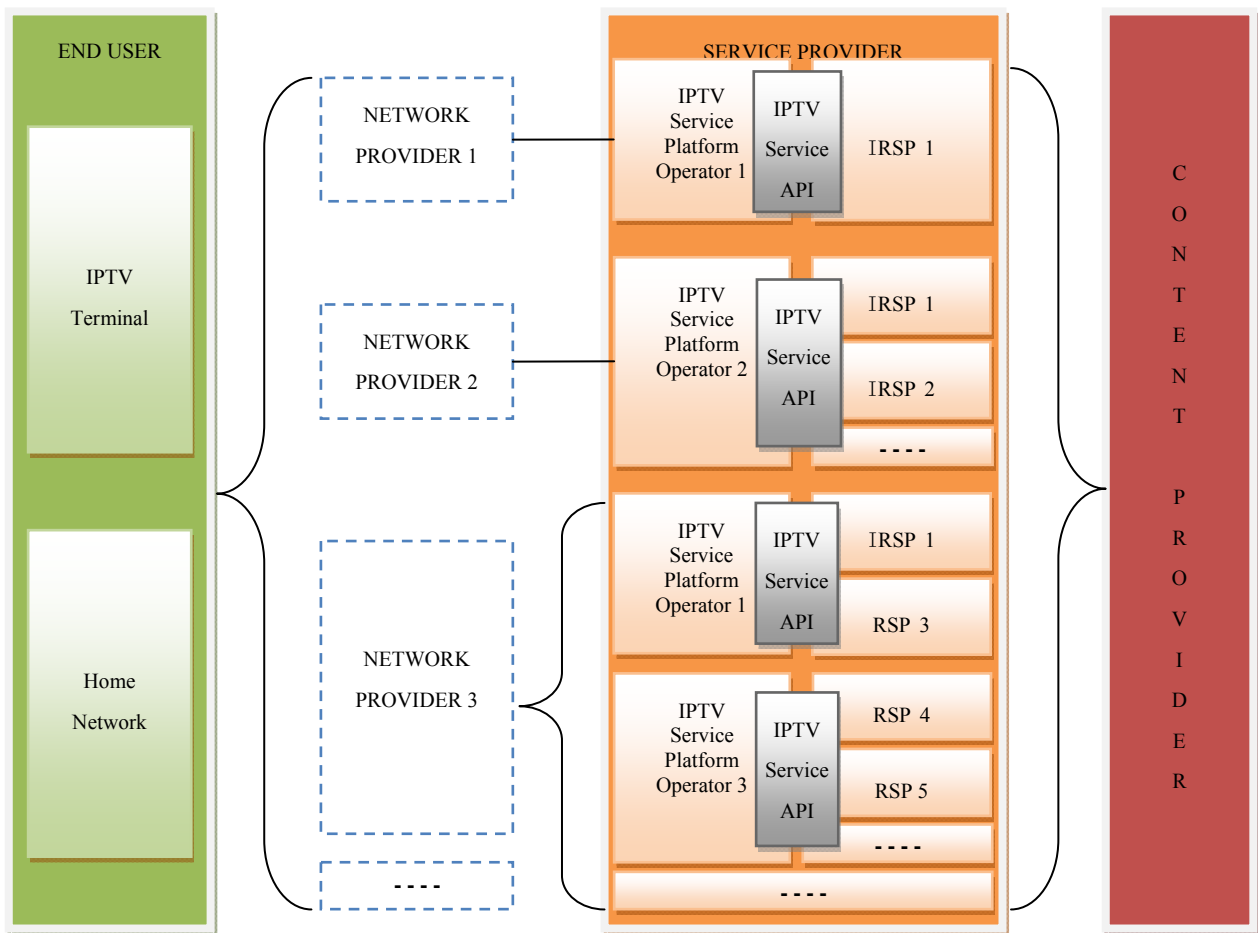


Figure 5.2: Generic IPTV Domains

- One network provider to one IPTV service platform operator to multiple IRSPs.
- One network provider to multiple IPTV service platform operators to multiple IRSPs.

The configuration mixes illustrated in Figure 5.2 are:

- IRSP 1 uses either IPTV service platform operator 1 or IPTV service platform operator 2 to provide services to the end-user.
- IPTV service platform operator 1 uses either network provider 1 or network provider 3 to connect to the end-user.
- End-user terminal devices may be connected to one or multiple network providers.

Here, we describe an implementation scenario using IRSP 1 as an example. In a large geographical landscape, there may be more than one network providers, e.g., a network provider 1 to serve only north region end-user terminal devices and a network provider 2 for south region end-user terminal devices. For the simple case of one IPTV service platform operator per network provider, then a north region terminal will use network provider 1 to connect to IPTV service platform operator 1, while a south region terminal uses network provider 2 and IPTV service platform operator 2. For this implementation scenario, IRSP 1's services can be consumed by both north and south region end-user terminal devices.

Figure 5.3 shows the scope of functionalities of IPTV service platform according to the requirements. These are application functions, service control functions, content delivery functions and management functions.

Certain providers may provide one or more functions simultaneously as IPTV service platform provider.

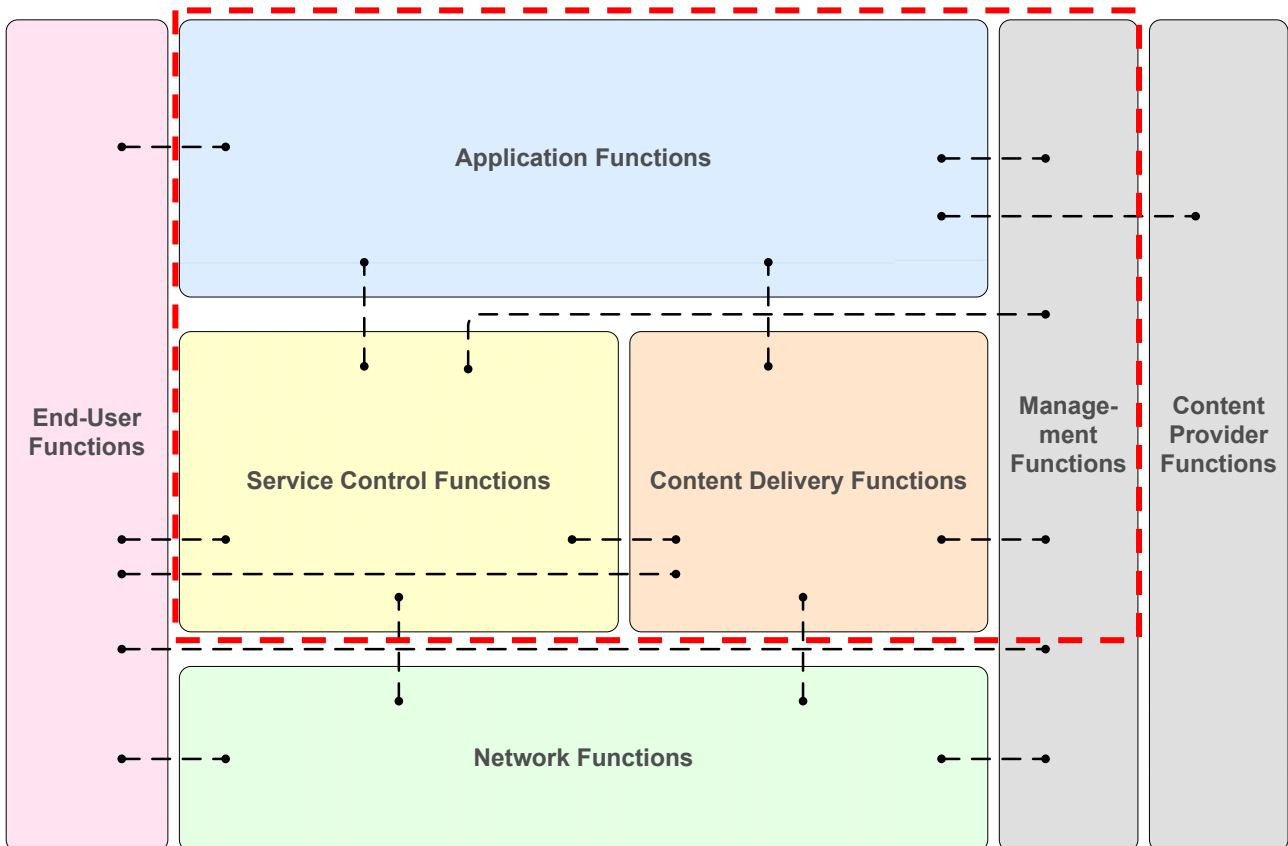


Figure 5.3: The scope of functions of an IPTV service platform

6 Concept of retail service provider model

6.1 Basic model

Let us start with the commonly deployed basic IPTV Platform architecture illustrated in Figure 6.1. The IPTV service providers negotiate with content provider the rights for redistribution of their AV contents. Content providers are broadcasters (i.e. they produce TV channels) or AV content producers such as studios.

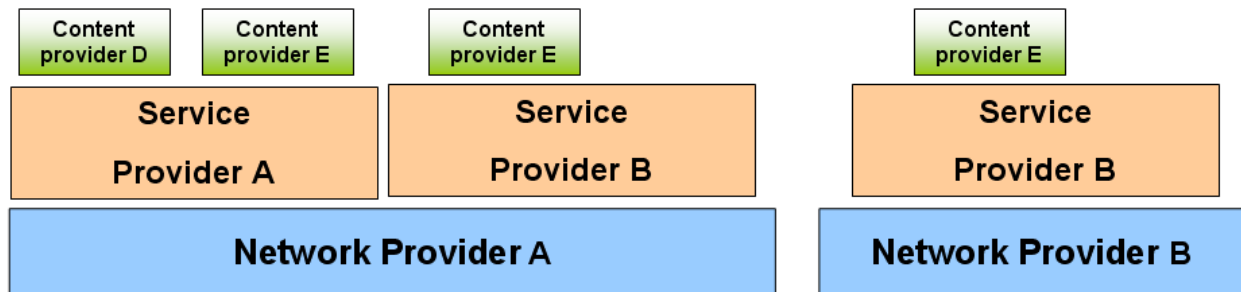


Figure 6.1: Basic IPTV model

The IPTV service providers aggregate a number of TV channels and AV contents which can be subscribed or purchased by end-users.

The interface between service provider and content provider is mainly a contractual interface. However there is an interest to standardise the interface to exchange content metadata to facilitate the relations between the content providers and the different IPTV service providers.

This is the model deployed by many IPTV service operators.

When the service providers have put this basic model in operation, they are looking at how they could make use of the deployed architecture to offer more services or to open it to other providers to get a better return on investment.

This is one of the reasons to consider other models building on the basic one or proposed as alternatives to the basic one.

6.2 IPTV retail service provider (IRSP) Model

The idea with this model is to set up a platform to implement the functions common to all IPTV service providers, making easier and cheaper the deployment of competing IPTV service providers.

Example of functions common to IPTV service providers which could be handled by the IPTV platform operator are content protection, content storage, subscription and charging.

This model is illustrated in Figure 6.2.

In some cases, it makes sense to have several IPTV platform operators, as indicated in Figure 6.3:

If the IPTV platform operator is also an IPTV service provider, the IPTV architecture presented above is still valid.

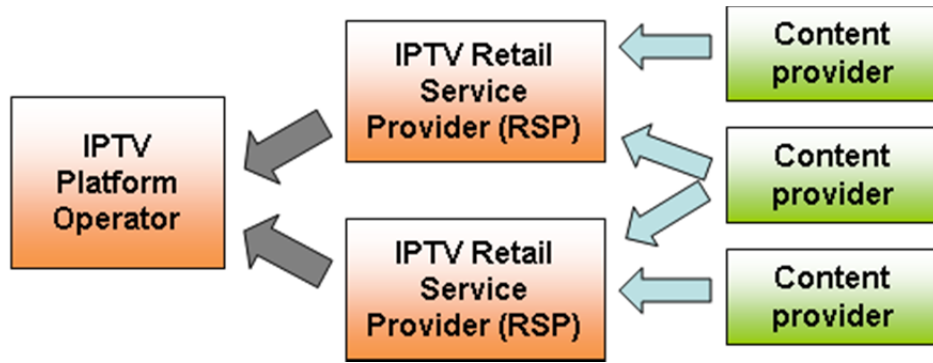


Figure 6.2: Single IPTV platform with IPTV retail service providers

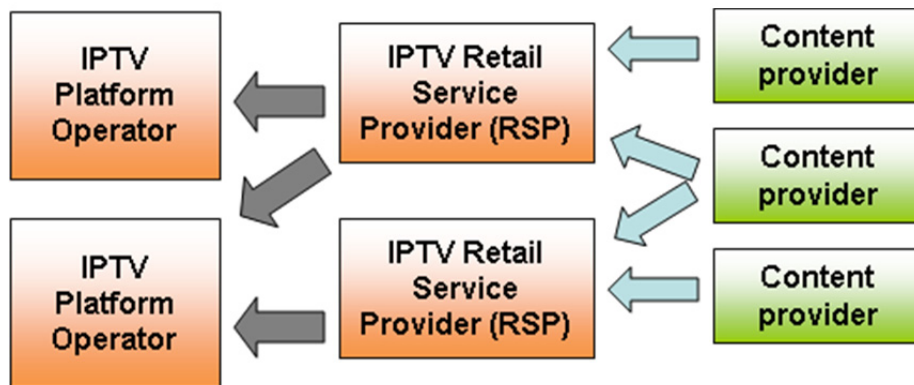
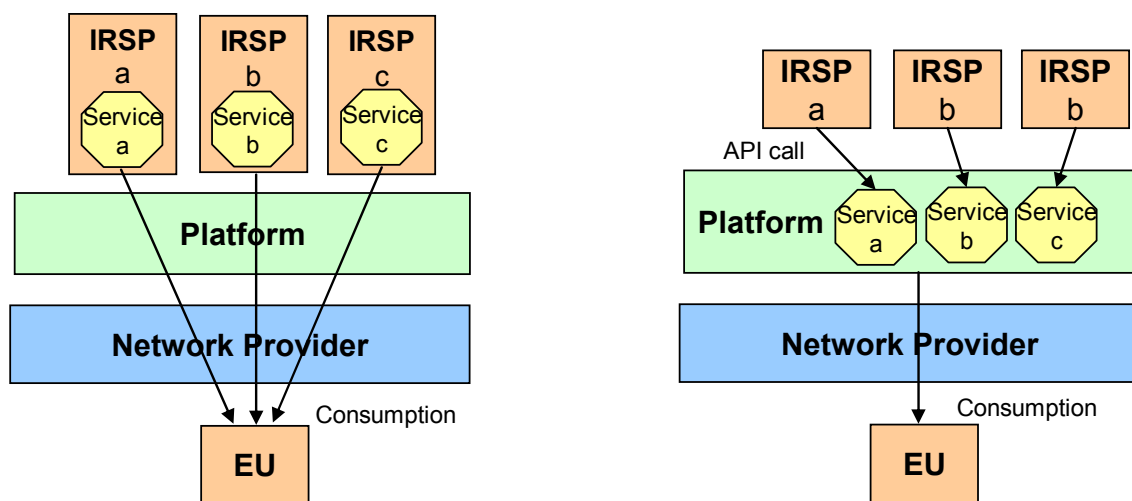


Figure 6.3: Several IPTV platforms with IPTV retail service providers

6.3 Variations of usage of an IPTV service platform

By focusing on the usage of functionalities of IPTV service platforms, two types of the usage can be defined. They are distinguished with the usage of the degree of functionalities of service platforms. In one case, service platform acts as a facilitator for supporting partial retail service providers' capabilities. In another case, service platform acts as a service aggregator for retail service providers.



(a) independent type (partially-usage)

(b) dependent type (fully-usage)

Figure 6.4: Two types of the usage of IPTV service platform

Figure 6.4 shows the relations among an IPTV service platform and two cases of retail service providers. In case (a) that service platform might partially provides IPTV functionalities such as only SCP functionalities. In the contrary, in case (b) that a retail service provider uses almost all IPTV services functionalities in an IPTV service platform. For both cases, the IPTV terminal devices are unaware of these. It will still communicate via network provider layer to the service platform layer. The difference is the location of hosted services. For the former case (a), retail service providers' services are hosted on-site, while for the latter case (b), these services are hosted remotely at the service platform layer.

7 Functionalities and interfaces

7.1 Retail service provider and service platform

7.1.1 IPTV service platform in ITU-T IPTV functional architecture context

The main two functional components, i.e., IRSPs and IPTV service platform operator, are further detailed in Figure 7.1 with input/source and output/destination components as follow:

- Service discovery aggregation server
 - It serves to consolidate program/content information from multiple IPTV metadata service providers. This bundled information will permit the terminal to discover, select and consume services across multiple IRSPs.
- Middleware servers
 - As defined in [b_ITU-T FG-IPTV Proceedings](page 483), middleware is the layer of software between applications and resources, which consists of a set of service enablers that allow multiple functionalities running on one or more devices in an IPTV system to interact across a network.
 - The servers should have presentation component (e.g. browser application) and IPTV service APIs (e.g. functions to support boot-up of set-top boxes, A/V trick mode, and service application management).
- Service and content protection servers
 - As defined in [ITU-T X.1191], service and content protection (SCP) server ensures that a terminal can only receive services (or content) that it is entitled to base on the terminal's end-user profile.

From a functional perspective, the components of IPTV service platform relate to ITU-T IPTV functional architecture [ITU-T Y.1910] as shown in Table 7.1.

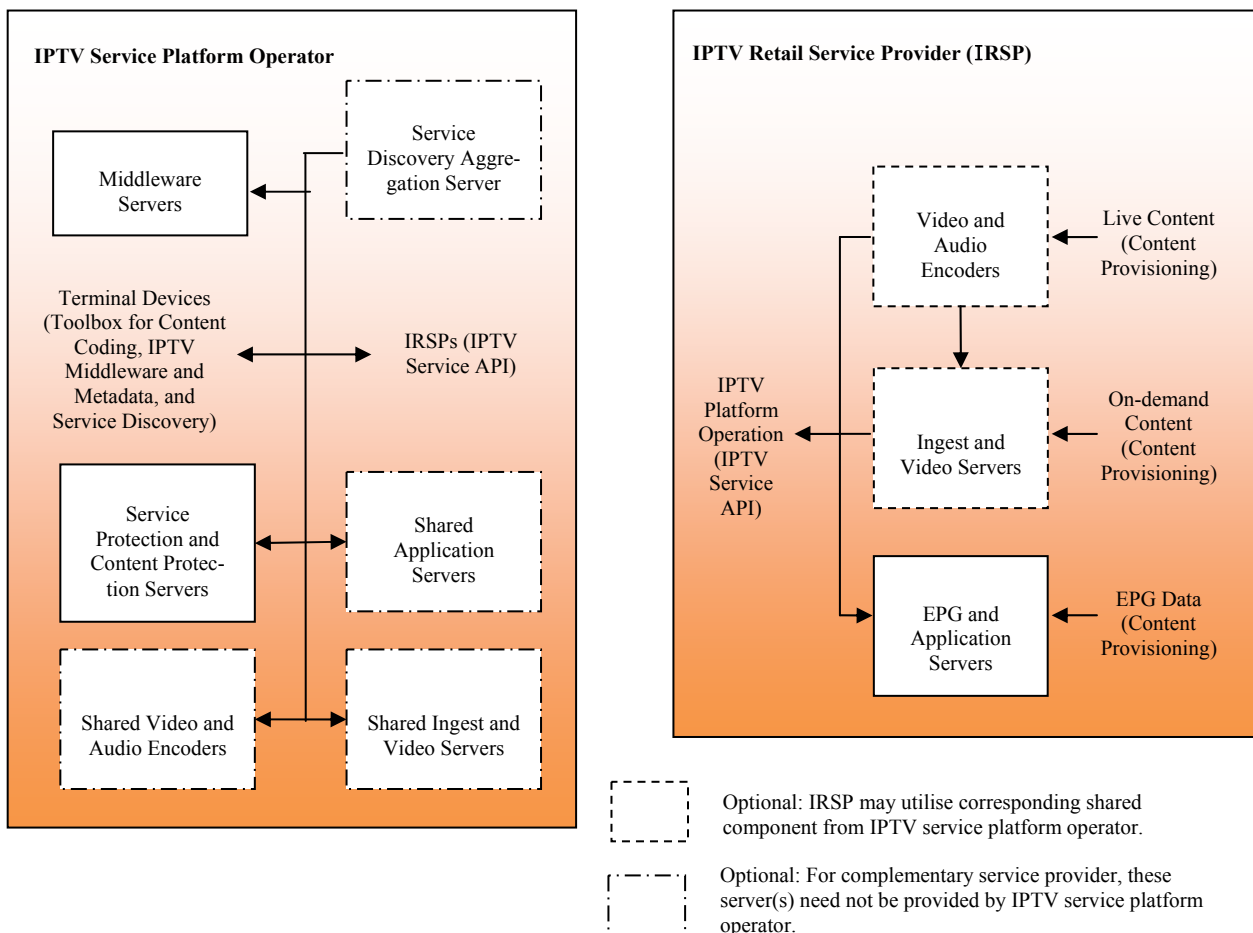


Figure 7.1: Functional components of IRSPs and the IPTV service platform operator

7.1.2 IPTV service API

The following is a set of interfaces [ITU-T Y.1910] between IPTV service platform operator and IRSPs:

- Application management
 - Allows the service platform to manage the application used by IRSPs, e.g., application lifecycle, application status and control information, and application's resource.
- Content distribution and control
 - Control the content delivery based on the IRSP's distribution policy; copy and caches or retrieve the content; bandwidth and congestion control; and manages scheduled or on-demand content distribution.
- Content streaming
 - Manages media streaming, trick mode, and personal PVR storage.
- Service management
 - Allows the service platform to manage the IPTV services offered to end users, e.g., service profile, service package, service pricing policies, and statistics and usage management.
- End user management
 - Manages the end user profile and account, usage statistics, and authentication, authorization and audit of the end user.

Table 7.1: Relationship of IPTV service platform components and ITU-T IPTV functional architecture

IPTV Service Platform	ITU-T IPTV Functional Architecture
<i>Input/source and Output/destination:</i>	
EPG Data (Content Provisioning)	Content Provider Functions
Live Content and On-demand Content (Content Provisioning)	Content Provider Functions
Terminal Devices (Toolbox for Content Coding, IPTV Middleware and Metadata, and Service Discovery)	End User Functions
<i>Service Provider - IPTV retail service providers:</i>	
EPG and Application Servers	Application Function
Ingest and Video Servers	Content Delivery Functions
Video and Audio Encoders	Content Delivery Functions and Toolbox for Content Coding from End-User Functions
<i>Service Provider - IPTV Service Platform Operator:</i>	
Shared Application Servers	Application Functions
Shared Ingest and Video Servers	Content Delivery Functions
Shared Video and Audio Encoders	Content Delivery Functions and Toolbox for Content Coding from End-User Functions
Middleware Servers	Service Control Functions and IPTV Middleware & Metadata from End-User Functions
Service Protection and Content Protection Servers	Application Functions
Service Discovery Aggregation Server	Application Functions

7.2 Network provider

Figure 7.2 illustrates the components within a network provider.

- Middleware abstraction layer
 - Enables the middleware to be software and hardware (lower layers) resource independent, e.g., drivers, firmware, computing devices.
- Service / content / end user / context metadata wrapper
 - It encapsulates the service discovery information like service providers and contents/services data for error-free/-correction delivery across the network between end user and IPTV service platform.
- Video and audio stream wrapper
 - It encapsulates the video and audio streams for error-free/-correction delivery across the network between end user and IPTV service platform.

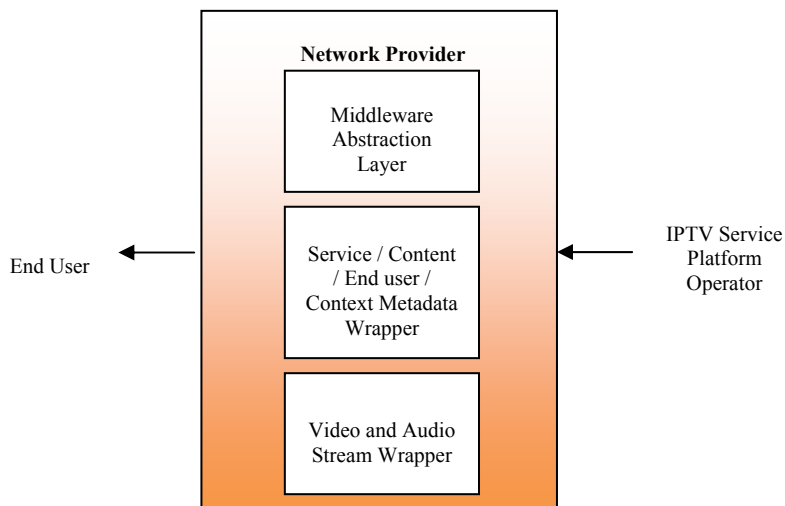


Figure 7.2: Functional components of network provider

8 Service discovery of retail service providers

In the case of retail service provider model described in clause 6.2, IPTV terminal devices can consume the IPTV through services service discovery processes according to H.770.

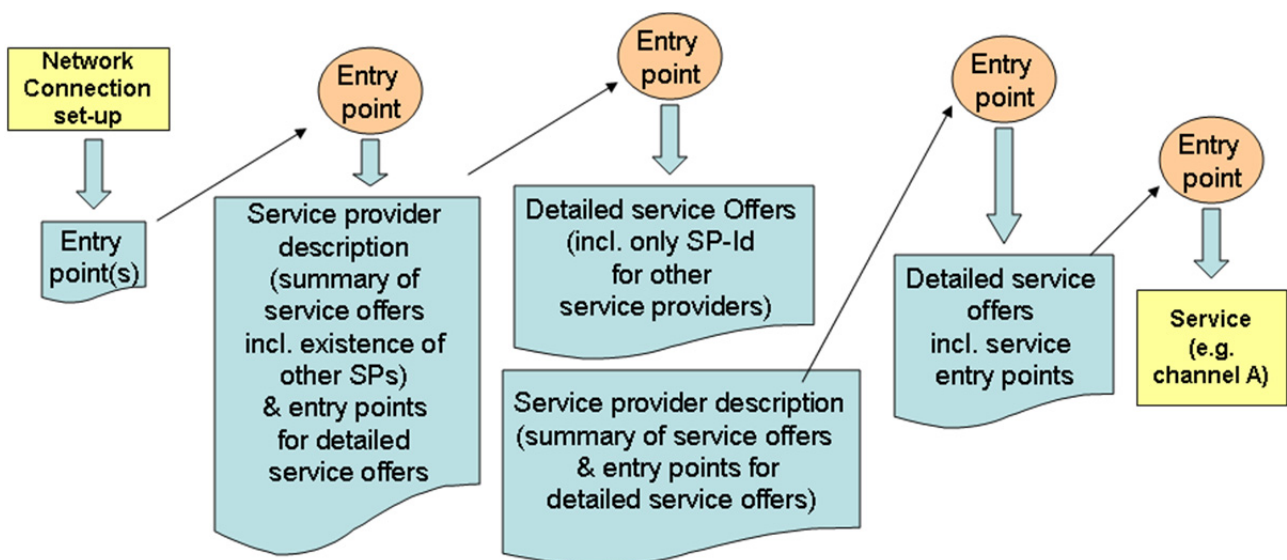


Figure 8-1: H.770 service discovery process for services provided by retail service providers

Details of respective in Figure 8-1 are as follows:

- 1) The terminal device at network connection set-up on one of the network providers (A or B) gets one or more entry points from the network provider. There may be one entry point for each IPTV platform operator or an entry point for a common IPTV platform operator description repository for all IPTV platform operators available through each network operator.
- 2) From the entry point(s), the terminal device gets a summary of the services offered by the IPTV platform operators with entry points for detailed service offering and entry points for IRSPs behind each platform.
- 3) From the entry points for detailed service offering, the terminal device gets a detailed description of each service offered by the IPTV platform operator (e.g. channel 4)

- 4) From entry points for IRSP, the terminal device first gets the identifiers of the IRSPs behind the platform and after the summary of the services offered by these IRSPs and after the detailed service offers.

What happens after when the terminal device, connected to network provider B, discovers that the same IRSP services are available through different IPTV platform operators as shown on the figure.

9 An IPTV implementation example - Three-layer next generation ultra high-speed broadband network

9.1 Overview

Figure 9-1 shows a Three-layer next generation ultra high-speed broadband network concept [b_Infocomm-NGNB]. This network concept is demarcated into three main layers, namely, network company (NetCo), operating company (OpCo) and the IPTV retail service providers (IRSPs).

- **Network Company (NetCo):** A company that will design, build and operate the passive infrastructure that will carry traffic payload. NetCo falls under the ‘Network Provider [ITU-T Q.1290]’ IPTV domain definition.
- **Operating Company (OpCo):** A company that deploys active electronics such as switches and routers to manage the flow of traffic on the passive infrastructure. OpCo will lease the passive connectivity from the NetCo, and offers wholesale broadband access to the downstream IPTV retail service providers. Similar to NetCo, OpCo falls under the ‘Network Provider [ITU-T Q.1290]’ IPTV domain definition.

For IPTV services, the three-layer network concept will permit multiple IRSPs to deliver their services in the most cost effective manner, through the use of common network facilities. Presented herein, is one such IPTV service platform ‘service-delivery’ model.

Figure 9-2 shows an articulation of the IPTV service platform mapped to ITU-T IPTV domain figure [ITU-T Y.1910] using IPTV middleware, application and content platforms components ([b_ITU-T FG-IPTV proceedings]clause II.6). For this discussion section, we assume there is a single IPTV service platform operator, which serves different IRSPs and end-user terminals.

For the IPTV service platform profile, the ITU-T IPTV service provider domain is divided into multiple IRSPs and a common IPTV service platform operator. The IRSPs will obtain content from content provider(s) via the content provisioning, and bundle it as a service package. This package is then made known via the IPTV service API to the IPTV service platform operator. The IPTV service API should provide a common interface for IRSPs (which may use different proprietary hardware and software components) to interact with the IPTV service platform operator components.

The services are then discovered, selected and consumed by the end-user terminals via service discovery. The network provider resides between end-user terminals and service provider, providing the platform to carry data and information exchanges.

The IPTV middleware consists of a set of software enablers that reside between the application and resource layers. It enables multiple functionalities running on end-user terminals to interact with the IPTV network via the IPTV service platform operator. The IPTV metadata is common to the ecosystem between (and inclusive) the IRSPs and the end-user terminals. Metadata is a structured set of data that describe characteristics of information-bearing entities. Last but not least, the toolbox for content coding denotes the use of video and audio coding in IPTV services delivered over IP and MPEG-2 Transport Stream.

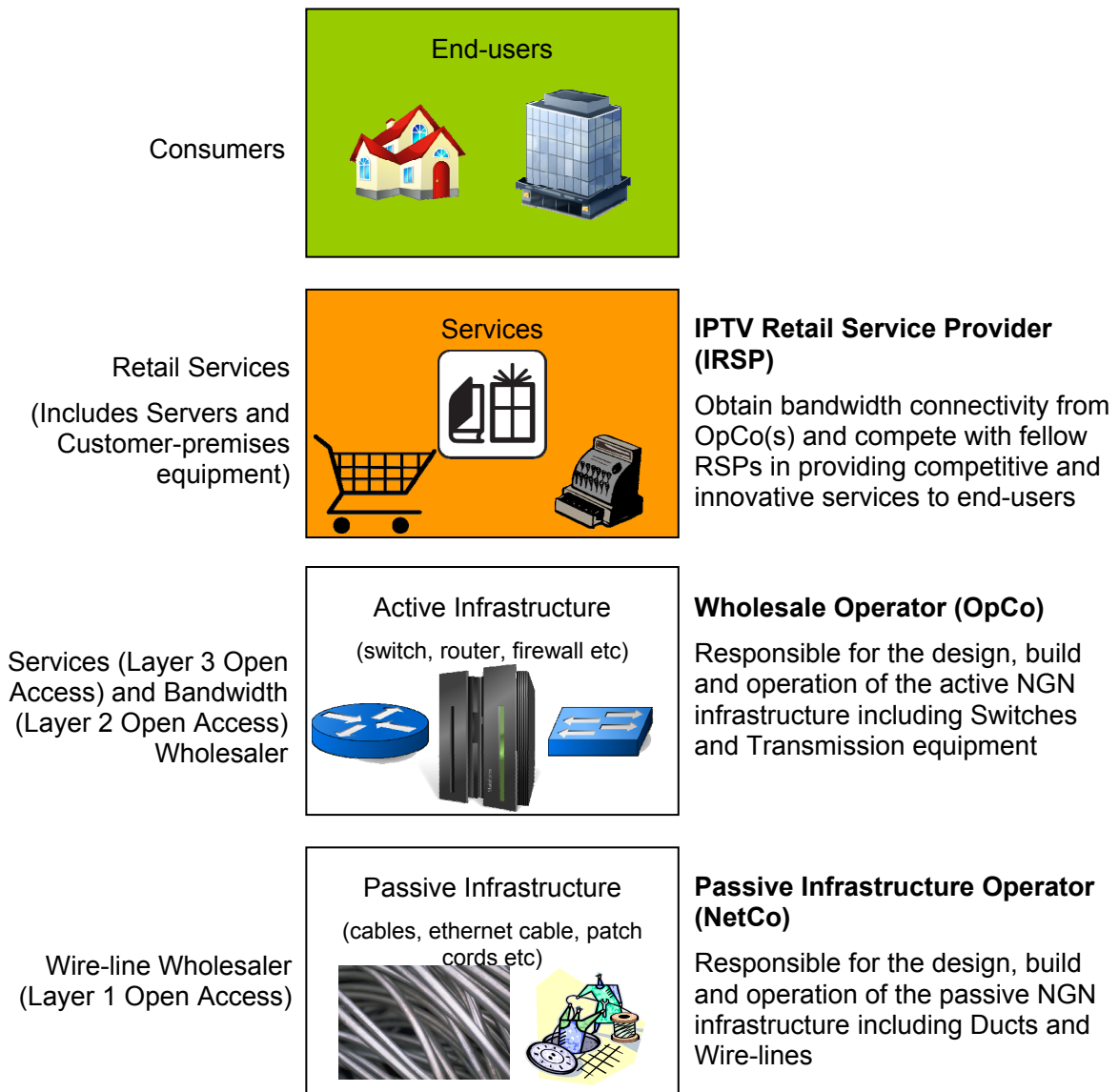


Figure 9-1: Three-layer ultra high-speed broadband network concept

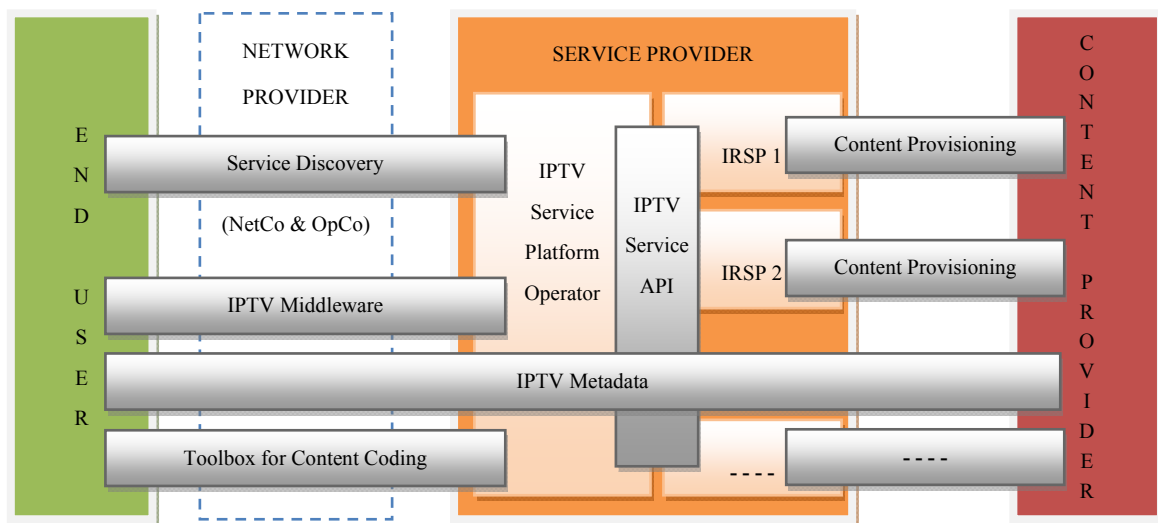


Figure 9-2: IPTV Service Platform with Middleware, Application and Content Platforms

9.2 IPTV service platform operator scenarios

Using the example of the three-layer network profile, the IPTV service platform operator needs to provide an open-access model for all IRSPs so as to level the ‘playing field’. In other words, small- and large-scale IRSPs should have equal access to the services provided by the IPTV service platform operator since it is operated independent of all other IPTV business entities.

With this concept in mind, we briefly mention two plausible IPTV service platform operator locations within the three-layer network architecture.

a) Operated by Three-layer network’s OpCo

The OpCo may also be the IPTV service platform operator. To realise this scenario, the OpCo will have to go beyond being a bandwidth wholesaler and instead provide and manage the additional (common) IPTV platform components shown in Figure 7.1.

b) Operated by Three-layer network’s IRSP

In this scenario, a three-layer network’s IRSP is the IPTV service platform operator. This IRSP should be a non-profit and publicly-funded entity that will provide open-access to other (profit-driven) IRSPs. It will need to negotiate with the OpCo a set of commonly managed network services like bandwidth provisioning, charging facilities, and handle an eclectic-mix of terminals, on behalf of the other IRSPs.

9.3 IPTV service platform operator support services

To ensure non-discriminatory access, the IPTV service platform operator can provide the following support services common to all IRSPs:

9.3.1 Content Services

- Support both standard-definition (SD) and high-definition (HD) contents.
- Provide quality-of-service sessions for carried traffic like video and audio streams.
- The outputs of any encoding and processing shall provide a unicast or multicast stream as stipulated in the [ITU-T H.770].
- Support both free-to-air and subscription-based multicast services.
- Support on-demand unicast services.

9.3.2 Interactive Services

- Support messaging to single user, group of users or all users based on a given criteria. Messages may require a user intervention in order to be removed from the screen.
- Support an interactive services portal. Example services are road traffic condition, transport map and guide, multimedia sites, online purchases, and info-services for government and community.
- Support an interactive EPG with user-friendly graphical interface. Example of interface includes version display, search, theme personalization, and programme information for present and future events.

Appendix I: Enterprise model for NGN

I.1 Basic service role model

This clause provides additional information for consideration of IPTV retail service provider model over NGN.

[b-ITU-T UMTS 22.01].and [b_ITU-T Y.2012] introduce an enterprise model to identify interfaces that are likely to be of general commercial importance. To do this, a number of roles are identified, which describe reasonably well-defined business activities that are unlikely to be subdivided between a numbers of players.

A basic role model for NGN is discussed in [b_ITU-T Y.2012] according to following model in [b-ITU-T UMTS 22.01].

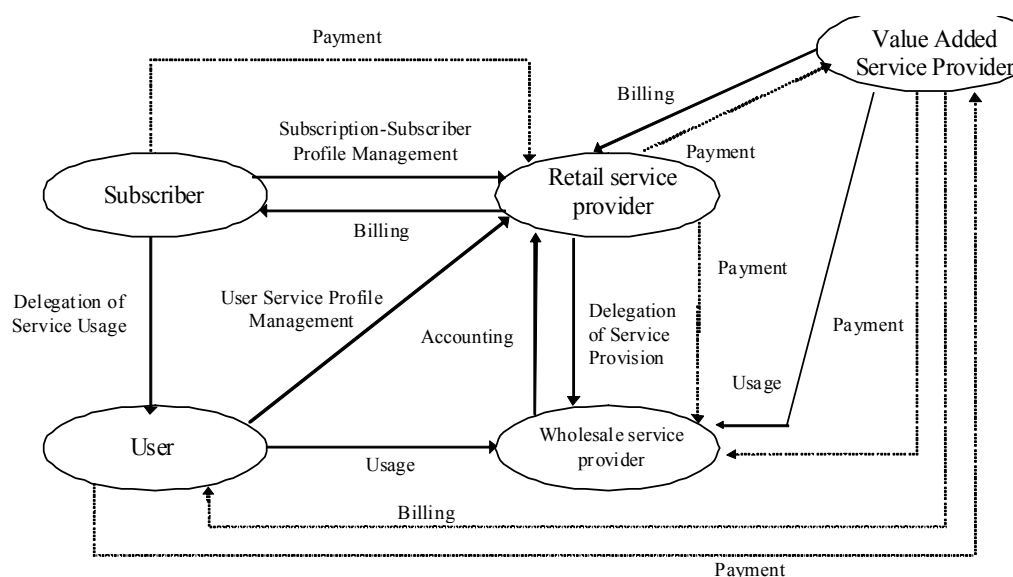


Figure I.1: Basic service role model

NGN relevant service roles identified in [b_ITU-T Y.2012] are as follows:

- *Customer (Subscriber)*: The role denoting a person or other entity that has a contractual relationship with a service provider on behalf of one or more users.
- *User*: The role in which a person or other entity authorized by a customer uses services subscribed to by the customer.
- *Retail service provider*: The role that has overall responsibility for the provision of a service or set of services to users associated with a subscription as a result of commercial agreements established with the users (i.e., subscription relationships). The user profile is maintained by this service provider. Service provision is the result of combining wholesale network services by network operators and service provider service capabilities.

NOTE 1: [b_ITU-T Y.2012] uses a term “retail service provider” as different meaning in this document. This role is treated as “service platform operator” in this document.

NOTE 2: To enable service provisioning, the request from a value-added service provider may be delegated to the network operator and the services offered by the service provider are then delivered through.

- *Wholesale service provider*: The role that combines a retailing service provider's service capabilities with its own network service capabilities to enable users to obtain services.

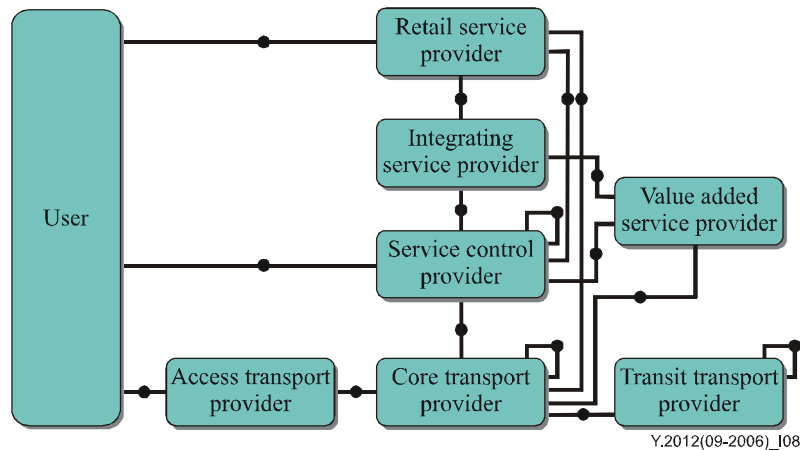
- *Value-added service provider*: The role that provides services other than basic telecommunications service (e.g., content provision or information services) for which additional charges may be incurred. These may be billed via the customer's service provider or directly to the customer.

This basic model provides a kind of super-class for roles and their relations.

NOTE: The role of retail service provider is broader than the role of IPTV retail service provider herein.

I.2 Detailed NGN service role model

The study in [ITU-T Y.2012] moreover focuses on the detail roles of service provider and network operators in Figure I.1 relating to NGN capabilities, and shows following figure as NGN roles:



NOTE: “Service provisioning service provider” in this diagram is equivalent to “retail service provider” in [ITU-T Y.2201]

Figure I.2: NGN roles: Second level of specialization

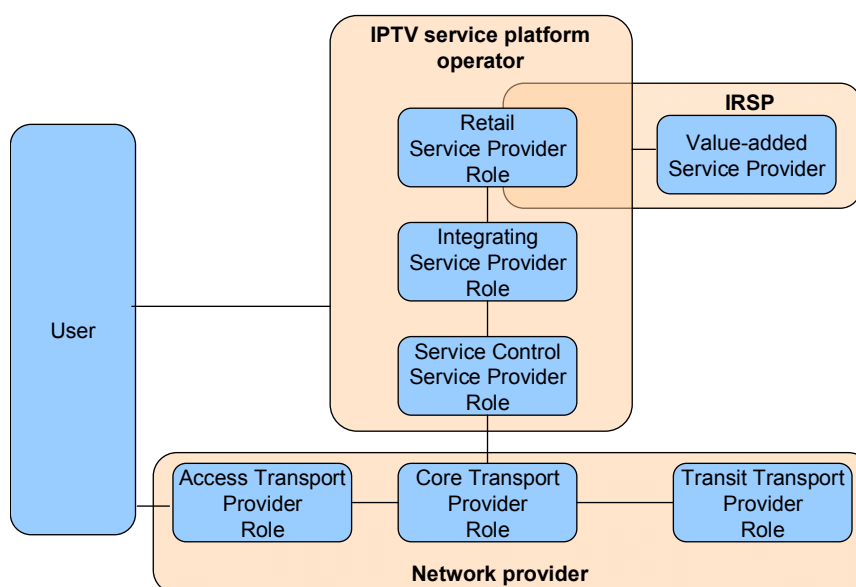
Each of the new decomposed roles has a relationship with the service provisioning service provider role that holds the user profile database. A service provisioning role player may hold the user information for all three roles, or a user may have a relationship with multiple service provisioning role players. This cannot be derived from the figure, because it does not show the cardinality of these relationships.

In summary, the second level of specialization of the NGN enterprise model defines the following roles (parenthetical names are used in [ITU-T Y.2012]):

- *User*: The role in which a person or other entity authorized by a customer uses services subscribed to by the customer.
- *Retailing service provider*: The role that has overall responsibility for the provision of a service or set of services to users. The user profile is maintained by the retailing service provider. Service provision is the result of combining retailing service provider services with wholesale services from at least the access and core transport provider roles and at most from all other provider roles.
- *Integrating service provider*: The role that creates unique new service offerings from the wholesale services provided by other roles.
- *Service control provider*: The role that provides session and call control and related services, such as registration, presence, and location, wholesale to retailing and integrating service providers.

- *Value-added service provider*: The role that provides value-added services (e.g., content provision or information services) on top of the basic telecommunications service provided by the service control provider role. It does not provide a complete service on its own.
- *Core transport provider*: The role that provides connectivity either end-to-end or in part, and related services such as registration for connectivity service, by combining its own services with those of the access transport provider and transit provider roles as necessary.
- *Access transport provider*: The role that provides a wholesale connectivity service between the user and a core transport provider.
- *Transit transport provider*: The role that provides a wholesale connectivity service between core transport providers, in conjunction with other transit transport providers as necessary. It also provides related DNS services.

The main role of “IPTV service platform” seems to consist of multiple roles above-mention such as service provider and service control provider. One possible mapping of the roles on IPTV service platforms is as follows:



NOTE: bold names are the same roles in the IPTV domains in Figure 5.2

Figure I.3: Mapping of NGN roles on IPTV retail service provider model

Bibliography

- [b_ITU-T Y.2012] ITU-T Recommendation Y.2012 (2009), *NGN Functional requirements and architecture*
- [b_ITU-T FG-IPTV Proceedings] ITU-T IPTV Focus Group Proceedings (2008)
- [b-ITU-T UMTS 22.01] ITU-T UMTS 22.01, *Universal Mobile Telecommunications System (UMTS); Service aspects, Service principles.*
- [b_IPTVFJ-STD-0006] IPTV Forum Japan IPTVFJ STD-0006 V1.0 (2008), *CDN Scope Service Approach specification*
- [b_Infocomm-NGNB] Infocomm Development Authority Singapore, *Next Generation National Broadband Network (Next Gen NBN)*, <http://www.ida.gov.sg/infrastructure/20060919190208.aspx>.