

TECHNICAL REPORT



**Smart television –
Part 2: Framework of integrated service on smart television**

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TECHNICAL REPORT



**Smart television –
Part 2: Framework of integrated service on smart television**

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SMART TELEVISION –

Part 2: Framework of integrated service on smart television

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IEC/TR 63122-2, which is a technical report, has been prepared by subcommittee TA 1: Terminals for audio, video and data services and contents, of IEC technical committee 100: Audio, video and multimedia systems and equipment.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
100/2904/DTR	100/3054/RVDTR

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 63122 series, published under the general title *Smart television*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

This Technical Report is formulated based on the current state of the industrialization of smart television and regards open innovation, vertical integration of chain and in-depth incorporation of technology and service as fundamental principles. The intention of this document is to strengthen the innovation of smart television in terms of technology, service mode and system mechanism, to advance compatibility of smart television products, and to speed up the expansion of the application market, thereby putting forward a relevant conceptual model and standardized demand for smart television. This document applies to guide service operations and service mode implementation of smart television.

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SMART TELEVISION –

Part 2: Framework of integrated service on smart television

1 Scope

This part of IEC 63122 specifies the service pattern conceptual model and standardized demand of smart television, illustrates the terms and related to smart television, and describes service reference model of smart television, the reference model of the service pattern as well as interfaces between various platforms.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

smart television service

general designation of many services provided to users through networks that support live broadcast of interactive television programmes, on-demand multimedia content and various interactive application programs

3.2

smart television service operation platform

platform built, maintained and managed by the service provider in the mode of smart television partnership operations and which is responsible for the electronic programme list service, content distribution, etc.

3.3

operations and maintenance support system

service management platform interacted with service management system is used to complete business service information inquiry and related management.

4 Reference model of smart television service

4.1 Description of general smart television service

4.1.1 General

This document specifies various service industry models, various service descriptions and management system frameworks for smart television services, and offers technical guidance and standard specifications for the development and progress of smart television services. This document also specifies data models and technical definitions of smart television services and puts forward a technical specification for the purpose of further specifying a

reference model of smart television services. A smart television terminal that supports general services needs to meet the following requirements.

- **System:** by installing a smart operating system, such as Android™¹ or iOS™², a user may freely install and uninstall application programs provided by third-party service providers and voluntarily select to accept or expand services, etc.; the user may extend the functions of a traditional television with installed programs, realize somatosensory games, software downloads and installation, multi-screen interaction and voice operation, thereby conducting service for intensive users across regions. The system has a relatively high reliability and availability.
- **Openness:** openness and consistence in terms of service capacity, service size, network size, user access mode, service access mode and device interconnection. An open platform allows infinite extension of content and applications.
- **Mode of delivery:** a smart television service may be delivered through smart interactive means, such as voice control and gesture interaction. Such means are important for service improvement and expansion. It can realize integration and interaction of information, entertainment, application and message on the television screen.

4.1.2 Service industrial chain

General smart television service offers the following features.

- **One-way interactive information flow:** allows the user to search and interact with information, including data flows mainly consisting of audio-video and allows the user to control information mainly containing smart interaction, transformation of traditional one-way viewing into two-way interaction mode, and provide the content along with the appropriate service mode. See Annex B for the typical smart interaction model.
- **Provision of streaming service:** content cache, distribution and storage. Underpinning "content first", smart home entertainment terminals are becoming the new focus of the development trend of smart television. In consideration of the high level of popularization and development of traditional television, consumption of new smart television is aimed at providing users with funded content services. Current smart television terminals are in strict compliance with the principle of high-level integration between hardware and content in terms of interaction mode, multi-screen interaction and application content download. See Annex E for the typical technical application of smart television.
- **Provision of enriched and diversified video/audio resources, entertainment application platforms and content services:** smart television developers are encouraged to actively build a unique ecological system, and launch novel content based on consumption habits and actual demand for smart television, thereby creating an ecological system and profit mode truly exclusive to smart television.

Based on the current development of smart television, the industrial chain of smart television services mainly consists of the following components as shown in Figure 1.

¹ Android is the trademark of a product supplied by Google. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

² iOS is the trademark of a product supplied by Apple. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the product named. Equivalent products may be used if they can be shown to lead to the same results.

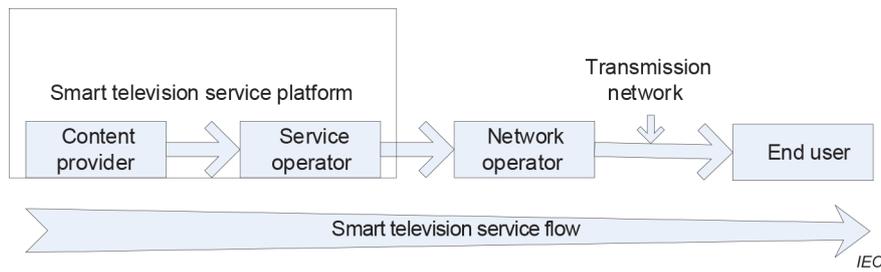


Figure 1 – Model of service industrial chain

- Content provider: the content provider is mainly responsible for the production of content for smart television terminals and the development of various application programs. It provides the content as produced and developed to the service operator. The content provider is the production origin of the entire service industrial chain and integrate the content into a uniform platform of the service operator to allow the content to be used by end user terminals by reaching consumers via smart television terminals. The content provider has the following main responsibilities:
 - 1) to provide new distribution channels for the content provider;
 - 2) to request that the content be protected rather than being illegally disseminated and used;
 - 3) to ensure that the operations of audio/video content are manageable and billable;
 - 4) to ensure that the operations of installable application programs are manageable and billable.
- Service operator: the service operator is mainly responsible for the integration and operations of the content. It also integrates various contents on its own platform and reaches end consumers via the network of the network operator to offer appropriate services and applications to users. The service operator has the responsibilities described below:
 - 1) to ensure normal operations of the service and carry out service management;
 - 2) to guarantee such processes as content review and release and carry out content management;
 - 3) to guarantee user management and carry out account management for users, such as account opening and cancellation;
 - 4) to guarantee a certified authorization and billing mechanism during service use to prevent illegal use of the service;
 - 5) to safeguard the operations of the smart television terminal and carry out terminal management;
 - 6) to provide the user with a uniform service portal navigation;
 - 7) to ensure that the network operator provides a transmission network with QoS guarantee;
 - 8) to ensure that the content provider provides audio/video content that follows the review conducted by the national authority;
 - 9) to ensure that the content provider provides installable application programs that follows the review conducted by the national authority.
- Network operator: the network operator is mainly responsible for using its own network to transmit the content and service provided by the smart television service operator to end user terminals, and obtaining earnings. The network operator understands the operating condition of the network from the point of the network and clarifies the operating condition of the network from the point of service. The network operator includes an infrastructure operator and an access network operator. The former includes telecommunications, radio

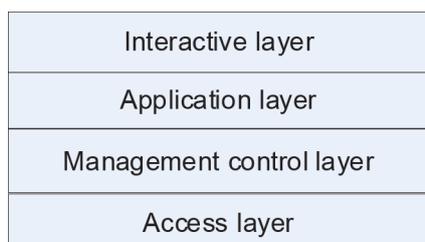
and television, satellite, etc. The latter includes cable, wireless and satellite network access operator. The network operator has main responsibilities described below:

- 1) to satisfy the requirements for high availability, high reliability and quick troubleshooting and restoration;
 - 2) to satisfy the requirements for network manageability;
 - 3) to satisfy the requirements for random distribution and random on-demand for a large number of users;
 - 4) to satisfy the requirements for interconnectivity among various network operators;
 - 5) to provide a sufficient QoS guarantee for user service implementation;
 - 6) to provide a sufficient safety guarantee for user service implementation;
 - 7) to provide the method for monitoring content safety and appropriate network monitoring points.
- End-user terminal: an end-user terminal has access to the network and enjoys smart television service via smart television terminals such as smart televisions, large-screen media systems and large-screen news release systems. The demands of an end-user terminal include:
 - 1) powerful hardware configuration, open operating system and open application program platform;
 - 2) interactive experience of audio/video content and smart television application program;
 - 3) response time of operation equivalent to that of radio and television;
 - 4) long-term consistent, stable QoS;
 - 5) that the system may guarantee the safety of user information;
 - 6) enrichment of application program and film/television content;
 - 7) enriched, smart apps store;
 - 8) simple and easy human-machine interoperability, high-accuracy of smart interaction, response time within acceptable range;
 - 9) simple and clear user interface and inspiring smart human-machine interface;
 - 10) that the system may guarantee the billing accuracy and the diversity of rates and the user may obtain the bill via multiple means.

4.1.3 Hierarchical architecture

4.1.3.1 General description

The hierarchical architecture for a general smart television service mainly consists of the parts described in 4.1.3.2 to 4.1.3.5. Interconnection between different layers may be realized by the calling mode of functional modules of loose coupling. Intra-layer may also adopt the structure of a functional module. See Figure 2.



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Figure 2 – Model of hierarchical architecture

4.1.3.2 Access layer

The access layer of a general smart television service uses IP as its basic protocol. It includes broadband access network, urban area network and a backbone network, as well as related control management functions. The access layer can be capable of ensuring sufficient bandwidth and a certain transmission quality and be provided with the following capacities:

- access to the end-user terminal and certification of network layer;
- delivery of each service information stream to the destination end as required by the previous layer;
- calling up network resources as per specific attribute requirements of each service to ensure the function and performance of the service;
- satisfying the special requirements of the streaming media service for access layer;
- satisfying the network access requirements for the installation of application programs;
- monitoring of network administration functions and system equipment.

4.1.3.3 Management control layer

Being responsible for the service execution and control, the management control layer may accept the bottom-layer network function of the access layer and provide service to the application layer. It has the following functions:

- distribution and storage management of media content data, and content management of application program data;
- service subscription and service statistics collection;
- realization of hierarchical level networking and internal load balance mechanism of streaming server;
- provision of streaming service capability to the end user and support and service to end-user applications;
- information maintenance of various services, i.e. one or more content combination.
- packaging of service capacity of the access layer, providing interface to the previous application layer;
- provision of interface with such external systems as the billing system, user management system and network management system.

4.1.3.4 Application layer

By calling up various capacities of the management control layer, the application layer provides end-user terminals and content providers with various services. For instance, video on demand applications and video-based broadcast remote education applications need a basic streaming service capacity, although the service package pattern and service processing logic representation between both applications are different. The application layer needs to use the capacity provided by the service layer and execute application customization and service deployment as required by the operator. It may offer the following features:

- providing the user with a uniform interface and carrying out operations such as service ordering and data inquiry;
- acquiring content metadata and content pricing strategy provided by the content provider.

4.1.3.5 Interactive layer

The layer directly connecting the end-user terminal is located at the top end of the hierarchical architecture, mainly providing customer-facing interaction with the user. End-user terminals may have access to the network via such access means as ADSL, LAN and WLAN, realize relevant services and offer the following features:

- processing user entry, identifying user's intention and getting user's feedback;

- processing two-way interactive data services and transmitting data to application level.

4.1.4 Model of service data

4.1.4.1 Service metadata

Smart television service metadata is used to describe the basic data specification in general smart television services, satisfying activities of all stages that the users demand, and describing service subscription and execution with such basic data, allowing a set of common definitions and standards to describe simple and complicated services as well as breadth and depth of a service. Metadata contained in this document consists of various elements, each with unique attributes, i.e.

NAME: Name of service

TYPE: Type of service

CLIENT: Service client

BILLING: Billing for service implementation

IDENTIFIER: Unique identifier of service

VERSION: Data version that generates service

REGISTRATION AUTHORITY: Service authorization agency

CP/SP DESCRIPTION: Content provider (CP) and service provider(SP) of the service

LANGUAGE: Language description

DEFINITION: Description of service concept and implication

OBLIGATION: Type of service obligation

DATATYPE: Data type reflected in service data

COMMENT: Comment of element application

All elements are divided into three groups, shown in Table 1 by the category and scope of the content as described:

- 1) description of service content;
- 2) description of intellectual property; and
- 3) description of external attribute.

Table 1 – Category grouping

Description of service content	Description of intellectual property	Description of external attribute
Title	Creator	Data
Subject	Operator	Type
Description	Contributor	Identifier
Source	Rights	Client
Language		Billing
Coverage		

Description of service element:

- Title
Label: "Title"
Service name given by the service content creator or publisher.
- Creator
Label: "Creator"
Main creation entity of service content, including name of a person, organization or some kind of service.
- Subject and keywords
Label: "Subject"
Subject of service content, usually descriptive subject word or keyword, or classification code.
- Billing strategy
Label: "Billing"
Billing of service implementation, mainly pricing strategy for end-user terminal.
- Description
Label: "Description"
Text description of service content, including brief introduction to audio-video content, description or comment of main functions of application program, etc.
- Client
Label: "Client"
Description of main service implementation object. For specific attributes, see the detailed description below.
- Operator
Label: "Operator"
Operator responsible for service. Generally, the name of an institution.
- Other contributors
Label: "Contributors"
Significant contributing entities not listed in the element Creator while contributing to providing service.
- Date
Label: "Date"
Date having any association with service. The format YYYY-MM-DD specified in ISO 8601 is recommended. For instance, 2013-11-20 represents November 20, 2013.
- Service type
Label: "Type"
Inherent attribute, form or type of service service content, such as live broadcast, video on demand, video chat, online novel, etc. For improved interoperability, a service type value may be chosen from the service type list.
- Identifier
Label: "Identifier"
String or number used to solely identify the service. For instance, generic unique identifier, such as URL, URN or DOI, existing in network resource identifier contained in online audio-video service.
- Language
Label: "Language"

Language of service content. It is recommended that the content of this field comply with the provisions of RFC1766, i.e. en, de, es, fi, fr, ja, th, and zh (ISO 639), etc.

- Coverage

Label: "Coverage"

Time-spatial characteristic of service content. Spatial scope refers to physical area, derived from location name or full name of normative thesaurus. Time range refers to service service type rather than the time when service is generated (represented by Date). Time description (generally a time range) adopts the same format as Date, i.e. date and time format based on ISO 8601 W3C technical specification.

- Rights management

Label: "Rights"

Statement of rights management, or an identifier directing to a statement of rights management, or an identifier directing to the server providing rights management information content of the service.

Description of client elements:

- Title

Label: "Title"

Name of specific client.

- Identifier

Label: "Identifier"

String or number used to solely identify client information.

- Description

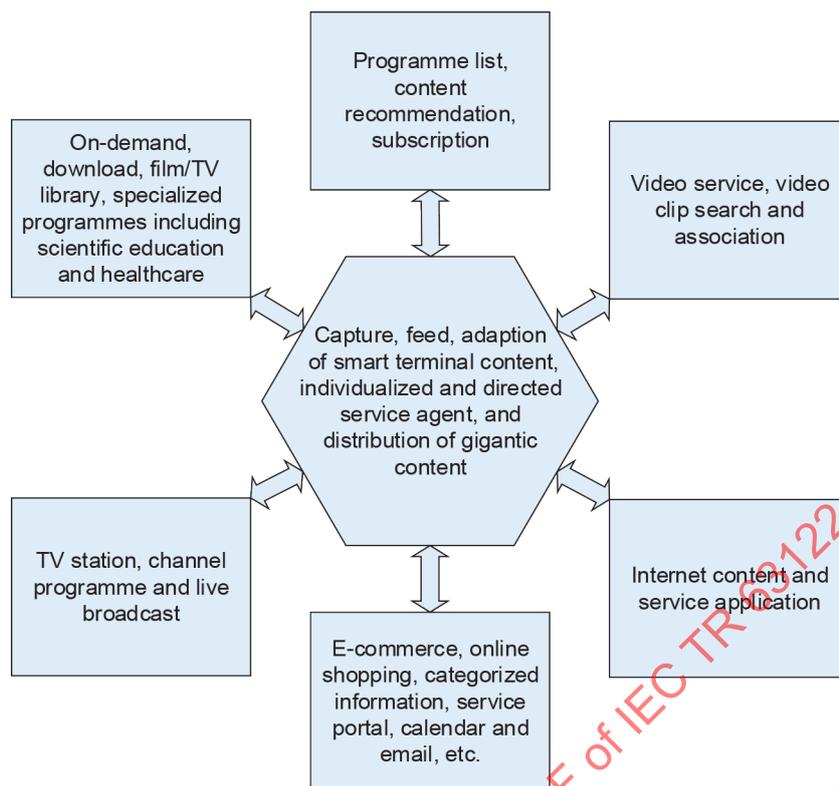
Label: "Description"

Describe information relating to the client and that relating to client account.

4.1.5 General classification of service

4.1.5.1 General description

Classification of a general smart television service is shown in Figure 3. Specifically, a general service may be classified into basic audio/video playing service and application-based service. See Annex C for the model for general service context.



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Figure 3 – Smart television service classification

Figure 3 gives a general clear description of different smart television services; 4.1.5.2 gives a more detailed functional description.

4.1.5.2 Basic audio/video playing service

- **Live broadcast:** similar to ordinary radio and television, it delivers same video/audio stream to multiple users on the smart television platform provided that the user joins a certain broadcast channel before using the broadcast service. External television signal sources include satellite television, cable television, DVB; the content of streaming media is determined by the broadcast service provider. Programmes offered for live broadcast may be of standard definition or high definition. The content is continuous without a clear beginning and ending. Supported by the transmission network, the system can provide users with a live broadcast service through combined broadcasts to improve the usage efficiency of bandwidth as much as possible: without support of combined broadcast in the network, the system may serve the users via a single broadcast.
- **Radio:** radio mainly includes conventional radio and web radio. The former delivers voice information via radio waves or wires to allow end user terminals to receive with a receiver incorporated in smart television. The latter, a web streaming media, establishes a radio server on Internet sites to disseminate the program through specific software to allow end user terminals to install and run the radio-receiving software on smart televisions to connect to these sites and listen to radio programmes.
- **Video on demand:** video on demand, a type of point-to-point play, allows a single user to play video/audio streaming as needed. Video on demand services enable the users to freely allocate their own time and enjoy the programmes that they want to watch. In addition, with various classification and search methods, the user may find the programmes that he/she wants to watch as soon as possible. By access to the terminal for browsing and searching content in stock, a user may play on-demand appropriate programmes as per his/her demand and preferences. Following submitting requests via the smart television terminal, a user may browse various programmes provided by the operator.

4.1.5.3 Application-based service

With application-based smart television services, an end-user terminal may realize a user service through installing a specific application program offered in an app store. Such a service mainly includes the following applications and services.

- Information service application: mainly includes user-requested information, advertising tweeting, video inserts and rolling subtitles, etc. Information service application includes:
 - 1) news information, government announcements;
 - 2) weather forecasts;
 - 3) educational programmes;
 - 4) medical information;
 - 5) film information;
 - 6) stock exchange;
 - 7) tourism information, etc.
- Interactive game application: mainly includes local games for smart television and web-based online games. It focuses on smart interactive experiences, adopts up-to-date interaction technology and is equipped with smart human-machine interface.
 - 1) Local games: games available on smart television terminal without requirements for network transmission. The user may install and run them directly on the terminal.
 - 2) Online games: games that need support from back-end servers. The user may install them on smart television terminal and display complicated game screens on the terminal with network support, thereby conducting an online process with other users on the Internet.
- E-commerce application: mainly includes online shopping application and television shopping application.
 - 1) Online shopping application: the content is provided by the service operator, i.e. similar to online shopping sites as taobao.com and dangdang.com³. The user may complete inquiries, ordering and purchase of the goods via a smart television terminal.
 - 2) Television shopping application: via a smart television terminal, it provides the user with a conventional television commercial shopping guide and plays video advertising in a circular fashion on a smart television terminal to enable the user to order the goods via interactive means.
- Remote education application.
 - 1) Online classroom: through a live broadcast of classroom instructions on smart television terminal, the user may interact with the programme content and programme instructor via a remote control or smart interactive means as well as participate in classroom Q&A interaction.
 - 2) Multimedia teaching on-demand: the user may play on-demand the optional classroom programme via a smart television terminal. The teaching content is pre-produced in advance, so the user may directly choose it.
- Medical application: this kind of application mainly includes online health consulting and health condition examination. Via a smart television terminal, the user may complete consulting regarding health problems, and exchange and interact with experts. Meanwhile, services including home healthcare may be available in collaboration with community medical institutions, famous hospitals and community service agencies.
- Telecommunications application: this kind of application mainly includes distance telecommunications, video conference and other multimedia applications, including:
 - 1) video call: display voice and images of communicating parties via a smart terminal;

³ taobao.com and dangdang.com are examples of online shopping sites. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the products named.

- 2) SMS, instant message: receive text messages via a smart television terminal;
- 3) e-mail: receive and send e-mails via a smart television terminal;
- 4) video conference: multilateral video communications via multiple smart television terminals.
- Application store: the user may download and install various security application software put forward within the document to realize more extended functions.

4.2 Architecture of smart television service management system

4.2.1 General description

A smart television service management system mainly targets smart television service operators. Managed objects include user, content provider/service provider and network resource. In order to adapt to the future development of smart television services and networks, it is necessary that the smart television service system meets the requirements for integration, timing and automation as well as good dynamic capacity. A smart television service system mainly includes strategy management, user management, service customization and content service engine and is used to improve the flexibility of service execution and enhance service operations and management.

4.2.2 Service management objects

4.2.2.1 Overall relation model

A smart television service management system contains a network with complicated and mutual relation. As the relation is getting more and more complicated with network development and service implementation, a clear relation graph is needed to clarify the relation between service management objects, as shown in Figure 4.

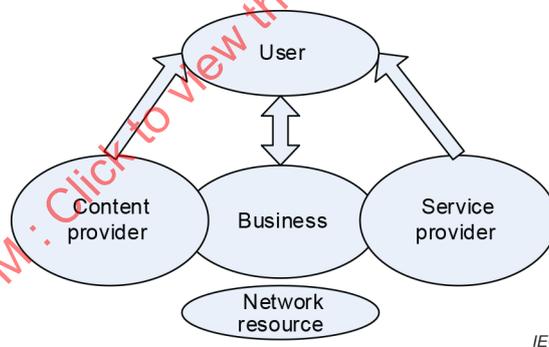


Figure 4 – Relation model of service management objects

4.2.2.2 User

The user is responsible for order, usage and payment of the service. The user may obtain appropriate authority before using the service. Once the user has access to the network, it is necessary to authenticate the network certification to verify whether the user has the authority to access to the network and use the appropriate services. Upon completion of service execution, it is necessary to make billing and settlement.

4.2.2.3 Content provider/service provider

With the help of the network resource, the content provider/service provider provides the user with appropriate service, including audio/video, smart application, advertising and other value-added services. Similarly, content provider/service provider needs to obtain appropriate authority. When content provider/service provider has access to various contents and services offered in the network, it is necessary to conduct certification authentication. When the user

uses the service offered by the content provider/service provider, an appropriate service usage record will be transmitted to the settlement centre for proper processing.

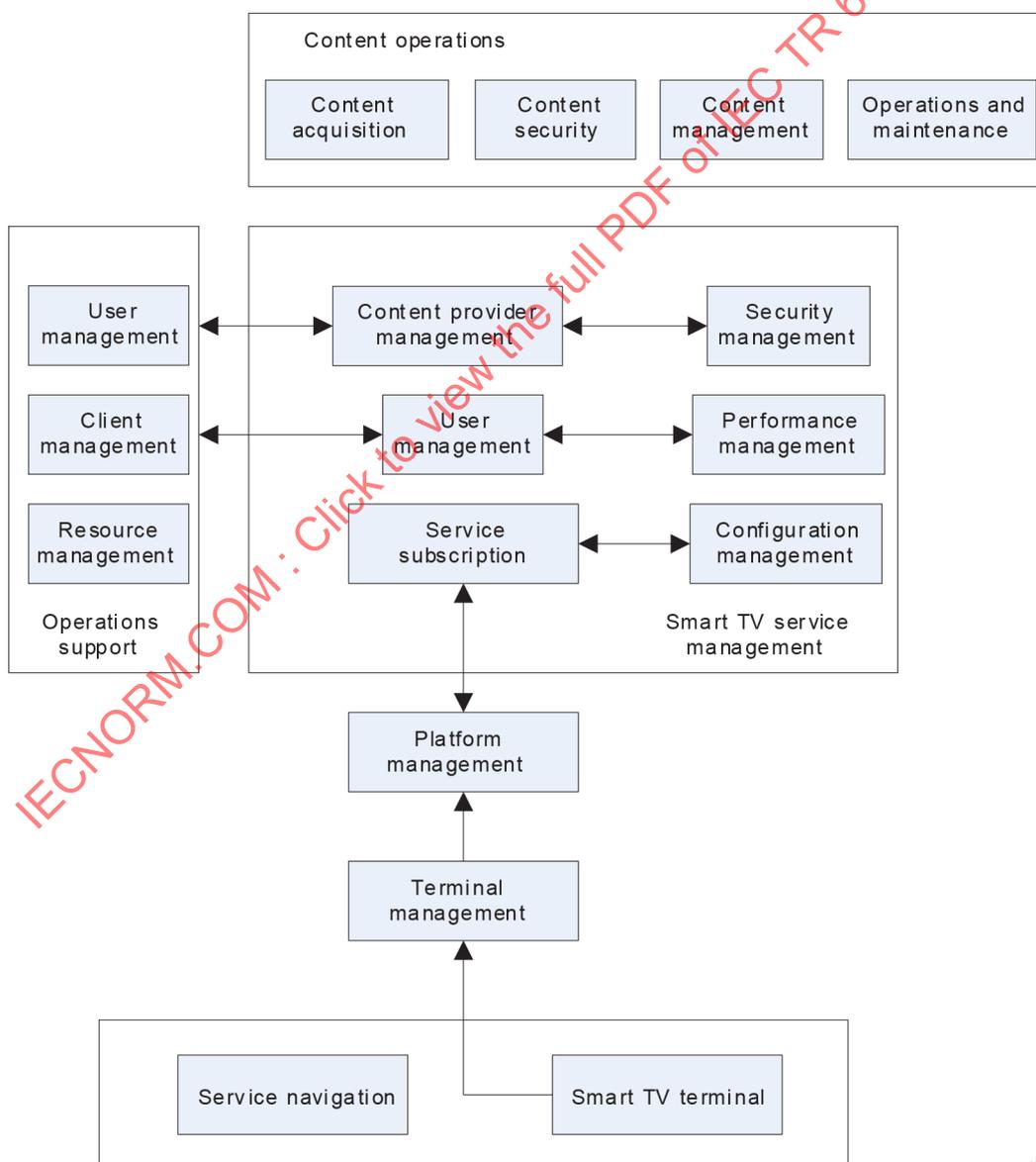
4.2.2.4 Network resource

Network resource refers to various network facilities and related infrastructure that content provider/service provider provides for user. It includes development and delivery of network and IT infrastructure as well as operations & maintenance management, incorporating configuration management, trouble management and performance management.

4.2.3 Service management function framework

4.2.3.1 Architecture of service management system

Figure 5 shows the general architecture of the service management system. Smart television service management is based on a smart television terminal in order to adapt to future service and network development. It is provided with modular structure and specification and properly meets the requirements for integration, timing and automation.



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Figure 5 – Architecture of service management system

Among others, the operations and maintenance support system is mainly used for connection and interaction with service management platforms, completion of service information inquiry and related management, including service configuration, service trouble management and service performance management. The detailed explanations of each parts are as follows.

4.2.3.2 Service management function set

The service management function set mainly includes the function set relating to service management, including:

- User data management: with the support system, a user may conduct operations such as account registration, suspension and cancellation. User attribute maintenance module receives various operations conducted by the user.
- User authentication: user authentication refers to authentication upon the user's entry into smart television while configuring initial information for the user. This function is mainly used to complete the generation and dissemination of various keys, thereby realizing centralized management of user data.
- Service authorization: service authorization includes service authorization during initial activation and service usage of the user and completes the generation and dissemination of the appropriate authorization token. The token available to the user is related to the service attribute of the user. Without appropriate service authority, the user will not obtain the authorization token issued by the authorization server.
- Service customization: with this function, the needed service can be customized for all users or a specific user group and an appropriate system resource and billing strategy can be made available. It includes:
 - 1) management of single content (dispatch control including adding, deletion, moving, lifecycle control): single content refers to one on-demand source or live channel;
 - 2) maintenance of various information: service means a combination of single or multiple contents;
 - 3) information maintenance for various products or services: amongst others, product or service means a service or combined service, and product contains user-oriented billing strategy.
- Application software product management: refers to the combination of content or installable application programs. Product is classified into three kinds, i.e. the product jointly developed by the service content provider and the service operator, the product completely developed by the operator, and the product completely provided by the service content provider. For the product provided by the content provider, the operator has the right to review, inquire, suspend, restore, update or delete the product. Function set of the system includes making available the management authority to the content provider so as to conduct an automatic update on the product. For the product completely developed by the operator, the system releases to the content provider the content and related information change request authority and the operator conducts uniform maintenance and update to complete various functions, such as product review, loading, suspension, restoration, update and deletion.
- Content provider management: content provider management includes attribute management, lifecycle management, service authority management, manipulator management, resource limitation management, etc.

Attribute maintenance management allows the content provider to execute such functions as creation, review, suspension, restoration and cancellation, and maintain the attribute information of the content provider.

In authority management, the operator may allocate and assign appropriate authority to the content provider which may conduct management over itself, such as account adding, deletion and modification, etc.

- Content service engine: the content service engine is mainly used to acquire content metadata from the content provider and manage such metadata, including upload, review,

modification, inquiry and deletion of content source data. Content service engine manages the content metadata and application programs as a whole.

4.3 Smart television service operations platform

A smart television service operations platform is a platform built, maintained and managed by the service operator in the mode of smart television partnership operations, which provides an electronic programme list service, content distribution, service management, operations and maintenance support and value-added service management, etc., as shown in Figure 6.

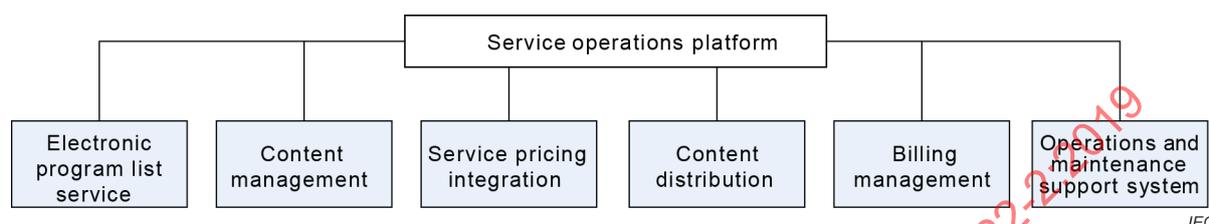


Figure 6 – Service operations platform

The service operation platform contains the electronic programme list service, content management, service pricing integration, content distribution, billing management and O&M support system.

Each part plays the following functions and features:

- transmitting the video/audio programme and electronic programme list released on the content operator platform to the smart television terminal (see Annex F for classified identify of smart television programme list);
- lifecycle management of smart television users, including account creation, authentication, service authorization, suspension, restoration and account cancellation;
- user billing and payment collection support for smart television service, release of billing data and user information to the content operations platform, and regular service reconciliation;
- integration, service pricing and service packaging of non-video/audio service, bundling and marketing of video/audio service and non-video/audio programme, and bundling sales of smart television services and other service operators;
- distribution of live and on-demand content released on the content operations platform, and acquisition, storage and management of useful information relating to live, on-demand and other services.

4.4 Smart television content operations platform

A smart television content operations platform is a platform built, maintained and managed by the content operator in the mode of smart television partnership operations and which is used for service metadata management and content management, as shown in Figure 7.

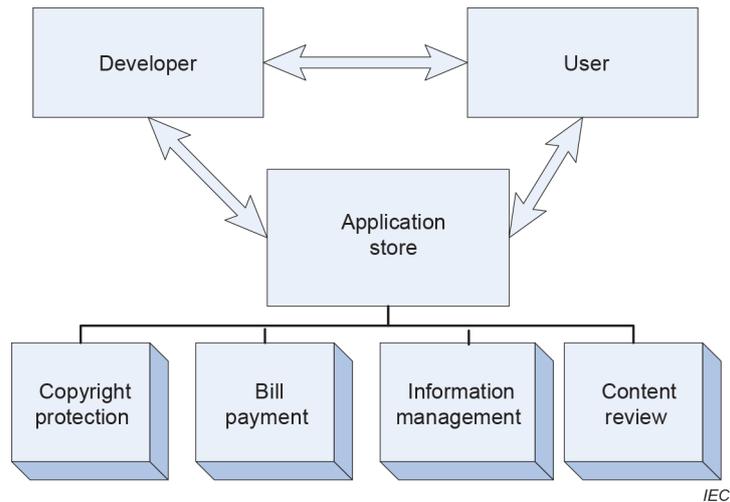


Figure 7 – Content operations platform

It has the following features:

- electronic programme list management: management of electronic programme list template and metadata;
- content management, including content release, pricing, deletion and pause;
- user management, including synchronizing user information and service ordering information with service operations platform; status information includes:
 - 1) normal: indicates that the user is using the service as normal;
 - 2) active suspension: indicates that the user request to suspend the service actively;
 - 3) suspension due to bill unpaid: indicates that the service is suspended due to bill unpaid;
 - 4) account cancellation: indicates that the user account is cancelled;
 - 5) testing status: indicates the status indication when the user is in testing state.
- video/audio programme billing management, including service packaging of video/audio programme, service pricing and billing data synchronization with service operations platform, etc.

5 Reference model of smart television service pattern

5.1 General framework of service pattern

General architecture of smart television service pattern is shown in Figure 8.

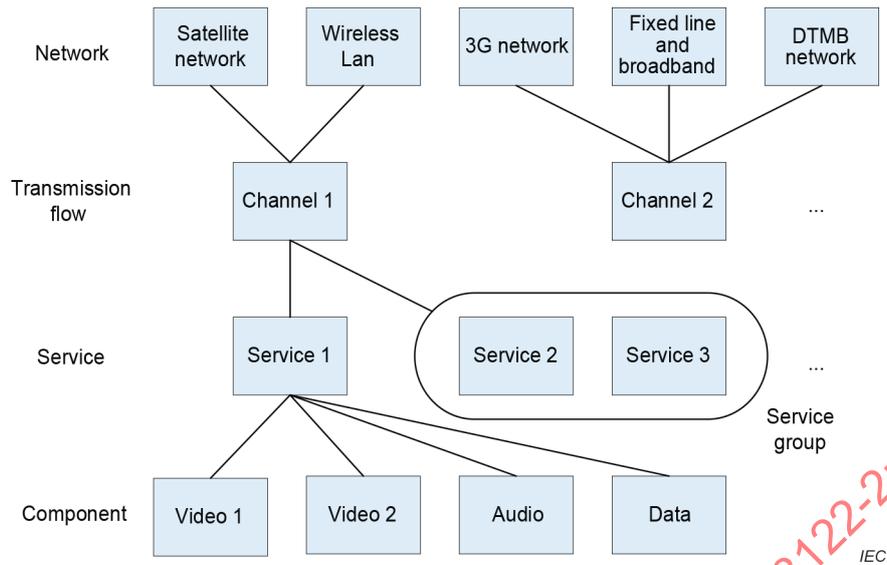


Figure 8 – Framework of service pattern

Smart television service pattern relies on different networks (satellite network, DTMB network, 3G network, fixed line and broadband, wireless LAN, etc). Each component is divided into three levels, i.e. video, audio and data.

5.2 Logic layers of smart television service pattern

5.2.1 Overview

The smart television service pattern defines standards regarding content storage, user centre, and content acquisition from different broadcast platforms. The entire framework is divided into three parts: front-end user layer, central service layer and data layer, as shown in Figure 9.

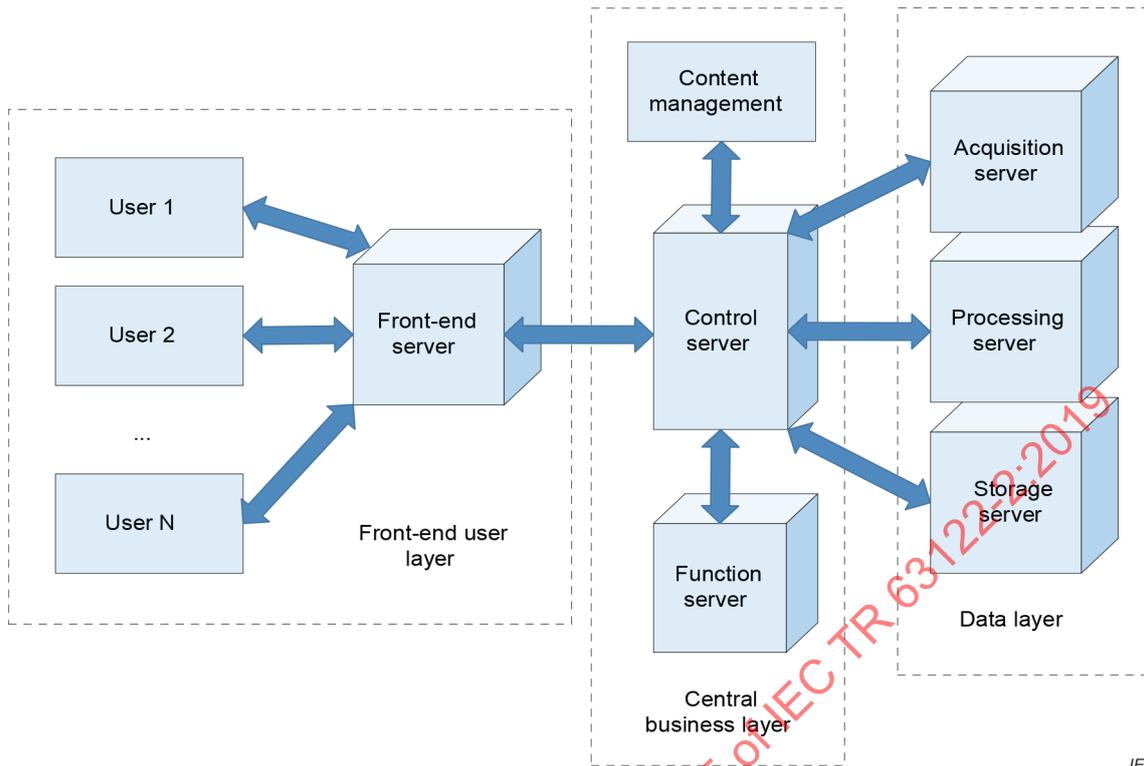


Figure 9 – Service pattern framework

5.2.2 Front-end user layer

The server in the front-end user layer is used to receive the user's requests, analyze them, and forward them to the control server for processing while providing functions of content display and content control to the user.

5.2.3 Service layer

The service layer is used to receive the requests from front-end server and control completion of the user's requests on different servers. It is used to control the working process of back-end acquisition, processing and storage servers. The control server may be provided with an administrator entrance for making appropriate configurations regarding content acquisition, processing and storage.

5.2.4 Data layer

This layer contains data acquisition and processing servers. An acquisition server is used to acquire resources from different networks, usually accompanied with the collection of a great deal of data, while interface and format conversion with a third-party data server and informing of the state of the control server. A processing server is used to process, integrate and compile the content as acquired to make it a content form that meets its own demands.

Finally, the storage server is used to store the content as processed.

6 Content interface of smart television service pattern

6.1 Interface specification of smart television platform

6.1.1 General architecture of platform interface

The architecture of the interface between smart television content operations platform and service operations platform is shown in Figure 10.

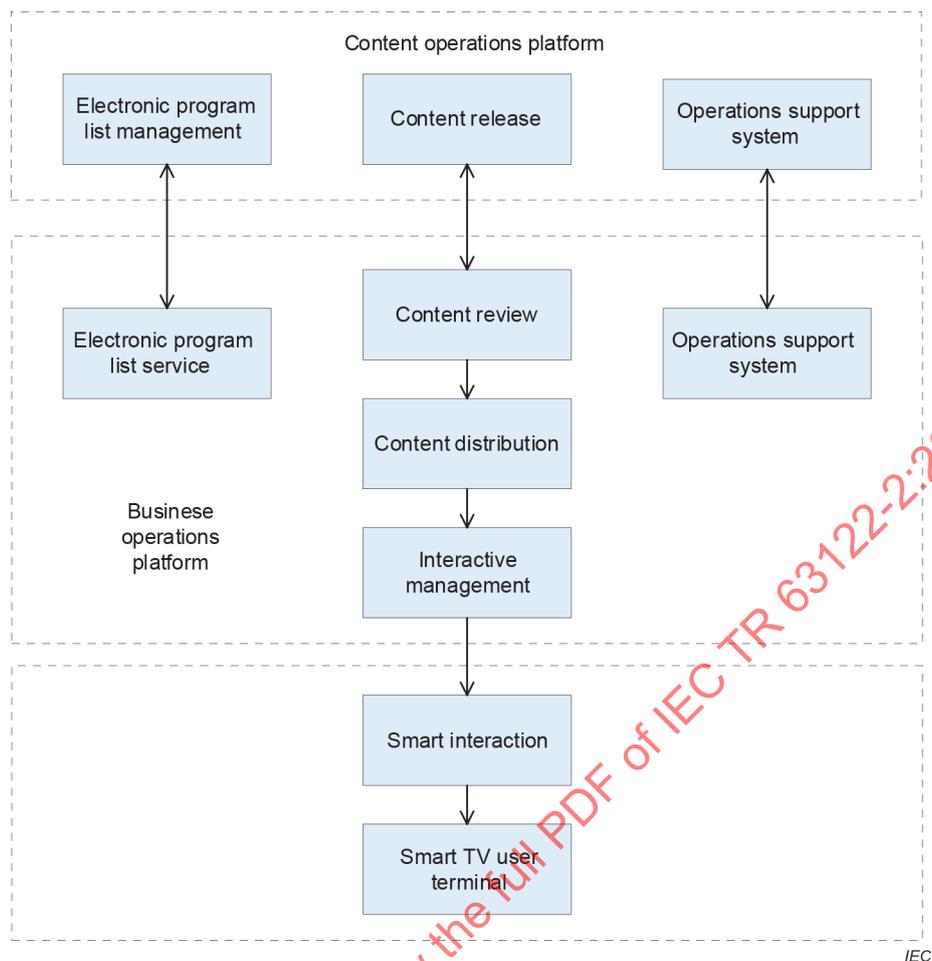


Figure 10 – General architecture of platform interface

- Distribution and management interface of the EPG template: refers to the interface between the content operations platform EPG management system and service operations platform EPG service system. The content operations platform may provide the service operations platform EPG service system with template document or page effect view and the service operator may generate or produce EPG as required by the content provider so as to offer service to users.
- Content distribution and management interface: refers to the interface via which the content operations platform releases the video/audio content to the service operations platform, mainly functioning transmission of live broadcast content, distribution of on-demand content and management of related EPG metadata information.
- Service and information interaction interface: refers to the interface between the application management module and the service management platform, mainly a functioning distribution of the billing strategy, synchronized checking of user data, and synchronization of billing and reconciliation data.

6.1.2 Electronic program list data

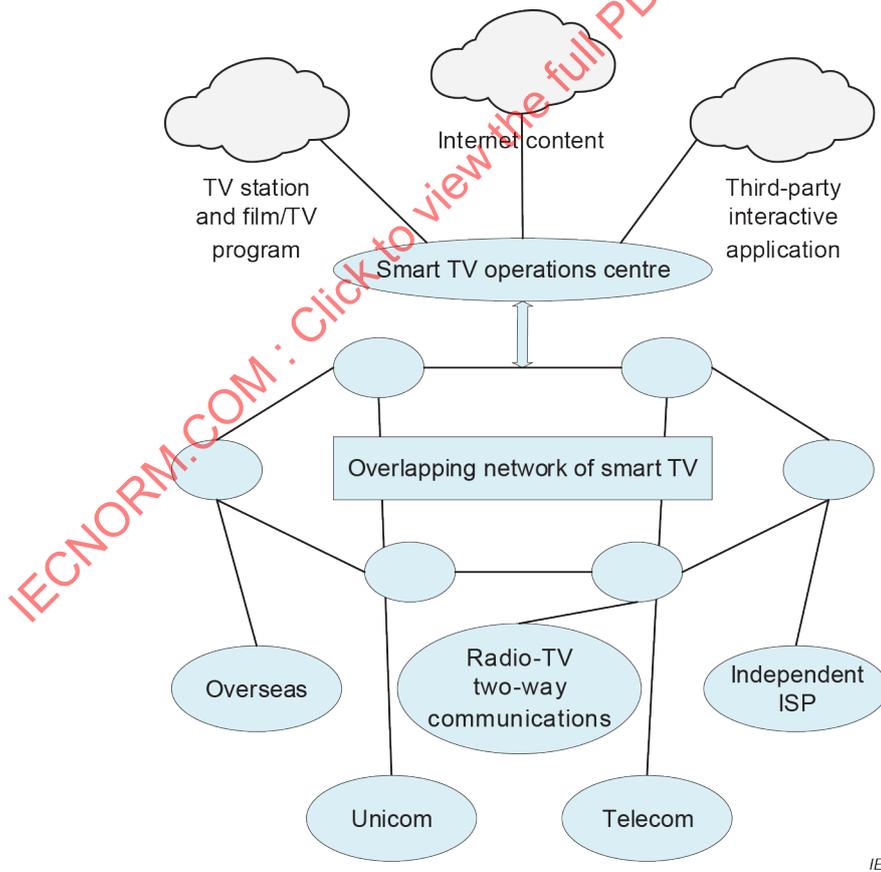
Data model of smart television electronic programme list is listed in Table 2.

Table 2 – Electronic programme list

Field	Attribute	Label value
Basic field	Programme number	
	Programme type	Type number
	Programme name	
	Programme description	
	Programme provider	Provider's label
	Programme status	Available or not
Extension field	Primary classification of programme	See Annex D
	Secondary classification of programme	See Annex D
	Creation date	See ISO8601 W3C technical specification
	Last revision date	See ISO8601 W3C technical specification

6.1.3 Framework of content broadcast

Smart television broadcast framework is shown in Figure 11.



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Figure 11 – Content broadcast of smart television

Includes:

- Content source: television station, film/television production agency, Internet site, other media.
- Smart television operations: radio and television communications group with nationwide operations capacity, such as CCTV and SMG.
- Network support: telecommunications operator, radio-television two-way, and network access service provided by access service providers
- Terminal service: home appliance and television manufacturers, etc.

7 Technical requirements for smart television terminal performance

7.1 Service technical requirements

7.1.1 Communications service capacity

- Voice communications.
 - 1) With the terminal, the user can complete basic voice communications.
 - 2) In establishing a call, when the terminal is the called party, the user may be provided with a function to respond or reject the call.
 - 3) Once the call is established, the caller and the called may hold on or hang up the call as per service demand.
- Video communications.
 - 1) Provision of USB-supported video input via camera; or built-in camera in smart television.
 - 2) Remote control supports voice input and output functions; or have wireless voice input and output devices; or camera with voice input function and television with voice output.
 - 3) Capacity to acquire, code and multiplex the images and other related signals from the end and send to transmission channel.
 - 4) Capacity to de-multiplex, decode and reduce the signals as received to the image, voice and data signals.
 - 5) Capacity to open and close its own video function during communication (optional).

7.1.2 Information service capacity

Mainly includes the requirements for use of information service and download function.

- Capacity to download content from a given server and present to the user, i.e. download of video advertising and image, etc.
- Capacity to download content for local storage and support two modes, i.e. manual playing and automatic playing. Automatic playing strategy is designated by the platform side. For example, play a soundless video advertisement during communication and ringing.
- The user may manually stop the playing of downloaded content. For example, the user may manually switch between video advertising and video communication when playing video advertising.
- Capacity to receive information tweeted by specific server and present it to the user.
- Capacity to store information by category.
- Information tweeted includes text and/or link. When information contains a link, the terminal may execute information, browse and/or stream media (optional) through the link contained in the information.

7.1.3 Language input capacity

Mainly defines content input method of smart televisions.

- Text input: with the terminal's input method, input the content as input in the text area on smart television. At least displays all Chinese characters in GB2312. Supports input by virtual keyboard.
- Voice input: with mobile phone mic, transmit the voice content to television for processing, or convert into text or directly use pinyin to input.
- Video and image input: using a camera of a mobile phone as input media, transmit the video or image content as acquired to television for presentation.
- For touchscreens, a stylus pen is provided for the user to click and input (optional).

7.1.4 System setting capacity

Network television device is equipped with related system setting functions, including setting of time and display, etc.

- All parameters have default value and support restoration to factory settings.
- Support setting of system date, time and time zone.
- Support language selection: Chinese and English.
- Support setting of related parameters of LCD screens: brightness, resolution, screensaver period, screensaver content.
- Support viewing of system information.

7.2 Requirements for media processing

7.2.1 Audio and video

Smart television device is capable of coding, decoding, packing and unpacking of audio and video and supporting multiple audio and video coding formats. Audio and video formats supported are listed in Table 3.

Table 3 – Format of audio and video media

Video	Audio
AVS (optional), MPEG1, MPEG2, MPEG4 (optional), H.264 (optional), RM/RMVB (optional), MOV (optional), MJPEG (optional), FLV (optional), VC1 (optional), WMV (optional)	MPEG1, DRA (optional), MP2/MP3 (optional), AC-3/EAC-3 (optional), WMA (optional), M4A(AAC) (optional)

Main audio and video parameters and indices are shown in Table 4.

Table 4 – Audio parameters and indices

File type	Related parameters		
	Sampling rate	Bitrate	Sound channel setting
DRA	8 kHz to 48 kHz	32 kbps to 320kbps	Mono, stereo 5.1
MP2/MP3	8 kHz to 48 kHz	32 kbps to 320 kbps	Mono, stereo 5.1
AC-3/EAC-3	32 kHz, 44,1 kHz, 48 kHz	32 kbps to 1560 kbps	Mono, stereo 5.1, 7.1
WMA	8 kHz to 48 kHz	32 kbps to 320 kbps	Mono, stereo 5.1
M4A(AAC)	16 kHz to 48 kHz	32 kbps to 192 kbps	Mono, stereo 5.1

The main video parameters and indices (playing of downloaded video) are shown in Table 5.

Table 5 – Video file parameters (played locally)

File type	Related parameters			
	Supported suffix	Internal code	Supported resolution	Supported bitrate
AVS	.AVS	AVS	1920×1080@30P 1920×1080@50i	20 Mbps
MPEG1	DAT\MPEG\MPEG	MPEG1	1920×1080@30P 1920×1080@50i	20 Mbps
MPEG2	.MPG\TS	MPEG2	1920×1080@30P 1920×1080@50i	20 Mbps
MPEG4	.AVI\MP4	DIVX,XVID	1920×1080@30P 1920×1080@50i	20 Mbps
H.264	.MKV\MOV\TS	H.264	1920×1080@30P 1920×1080@50i	20 Mbps
RM\RMVB	.RM\RMVB	RV8,RV9,RV10	1280×720@30P 1280×720@50i	10 Mbps
MJPEG	.AVI	MJPEG	640×480@30P 640×480@50i	10 Mbps
FLV	.FLV	VP6	1280×720@30P 1280×720@50i	10 Mbps
WMV	.AVI	VC1	1920×1080@30P 1920×1080@50i	20 Mbps

The main video parameters and indices (online video play) are shown in Table 6.

Table 6 – Video file parameters (played online)

File type	Related parameters			
	Supported suffix	Internal code	Supported resolution	Supported bitrate
MPEG4	.AVI\MP4	DIVX,XVID	720×576@50i	1 Mbps
H.264	.MKV\MOV\TS	H.264	720×576@50i	1 Mbps
RM\RMVB	.RM\RMVB	RV8,RV9,RV10	720×576@50i	1 Mbps
FLV	.FLV	VP6, H.264	720×576@50i	1 Mbps

7.2.2 Picture

Smart television terminal supports the picture formats shown in Table 7.

Table 7 – Picture format

Picture	JPEG, BMP, PNG (optional), GIF (optional)
---------	---

Parameters of picture files are shown in Table 8.

Table 8 – Type of picture files and parameters

File type	Related parameters	
	Compression option	Supported resolution in pixels
JPEG	Progressive JPEG	1 024 × 768
	Baseline (standard)	4 000 × 3 000
	Baseline optimized	4 000 × 3 000
BMP	Mono-colour	4 000 × 3 000
	16	4 000 × 3 000
	256	4 000 × 3 000
	16 bit	4 000 × 3 000
	24 bit	4 000 × 3 000
	32 bit	4 000 × 3 000
PNG	Non-interlaced	4 000 × 3 000
	Interlaced	1 600 × 1 200

7.3 Network requirements

7.3.1 Network interface and network configuration

A smart television terminal may have one of the following access modes:

- Ethernet interface;
- access to wireless network.

Smart television can provide the following network configuration modes:

- dynamic acquisition of IP address;
- manual configuration;
- dial-up (optional).

7.3.2 QoS strategy

Smart television may have the following QoS strategies:

- self-adaption of frame rate;
- through real-time detection of error rate and packet loss rate, automatically adjust data rate and image frame rate to adapt to changing network conditions and ensure the quality of image and voice;
- TOS marking;
- for data rate of media such as voice or image, add the desired service type mark through the TOS field in the IP packet as sent to allow the network-side device to offer differentiated service based on the service type mark.

7.3.3 Performance indices

Requirements of the smart television device for network performance include the following network performance parameters: network latency, jitter, packet loss rate and error rate. Because of instability of the network environment, audio/video communication time-delay for smart television may be less than 1 s at a bandwidth of 2 Mbps.

If the end-to-end performance of the IP network meets the following criteria, network television device may have good quality of image and voice:

- network latency: less than 200 ms;
- jitter: less than 50 ms;
- packet loss rate: less than 5 %;
- error rate: less than 1×10^{-4} .

If the end-to-end performance of the IP network meets the following criteria, the network television device could offer at least an acceptable quality of image and voice:

- network latency: less than 400 ms;
- jitter: less than 100 ms;
- packet loss rate: less than 10 %;
- error rate: less than 5 %.

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Annex A (informative)

Typical application scenarios of smart television

A.1 Overview

Interaction can be realized in a range of real scenarios, including but not limited to: home scenario, office scenario, public media scenario, education scenario, entertainment scenario, social scenario, game scenario.

A.2 Scenario description

A.2.1 Home office scenario

The home multimedia centre is the most common application scenario of smart television (see Table A.1).

Table A.1 – Home office scenario

Number of users	Smart interactive distance	Smart interactive mode	Sense of space
Less	Closer	More	Low

A.2.2 Public media scenario

Mainly includes large-screen smart terminal applications such as screen-media system (see Table A.2).

Table A.2 – Public media scenario

Number of users	Smart interactive distance	Smart interactive mode	Sense of space
More	Farther	Less	High

A.2.3 Game entertainment scenario

Mainly includes terminal application scenarios carrying smart application services (see Table A.3).

Table A.3 – Game entertainment scenario

Number of users	Smart interactive distance	Smart interactive mode	Sense of space
More	Close	More	Low

A.3 Interactive mode

Interactive mode mainly includes the following:

- interaction between standalone user and large screen;
- interaction between multiple users and large screen; and
- content sharing between large screens and between users.

A.4 Discovery mode

Discovery mode mainly includes automatic discovery and active searching.

- Automatic discovery: when a user reaches a certain area, the handheld device will automatically discover the smart television terminal and give a prompt.
- Active searching: the user may use a large-screen function to find the nearest smart television distribution.

A.5 Connection mode

Connection mode mainly includes the following:

- LAN WiFi connection: devices within LAN connected via WiFi.
- 3G connection: handheld device and content server, and smart television and server connected via a 3G signal.

Operating interaction adopts the 1st connection mode while content interaction adopts the 2nd interaction mode along with the 1st one.

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Annex B (informative)

Typical smart interaction mode of smart television

B.1 Overview

With increasingly enriched and powerful functions, smart television also has changing manipulation modes. Much natural and convenient human-machine interaction is gradually accepted by more and more people, such as voice control, action recognition, touch control and multi-screen interaction.

B.2 Description of interaction mode

B.2.1 Interaction via remote control

Being less difficult, input through a remote-control keyboard is the most widely used interaction mode. However, the remote control may be produced with an appearance different from that of a traditional one, and provided with buttons located on sides similar to a mobile phone, offering convenience to people in getting accustomed to appearance design and remote-control manipulation.

B.2.2 Interaction via voice

Voice recognition is a technology that allows the machine to transform a voice signal into appropriate text or command through a recognition and understanding process. Voice recognition mainly includes characteristic retrieval, pattern matching criteria and model training. Voice control allows a vivid, fun and emotional communication with consumers, and offers specific service and assistance. However, at present, voice control is only limited to some basic operations rather than completely replacing key operation. So, voice control needs to develop towards a higher level. For example, when we need to start a television, we can control the power on through voice without needing a remote control; moreover, when we forget which channel we are currently watching, we may directly speak out to change channels. In addition, non-Mandarin support is another important goal for smart interaction of smart television, thereby allowing smart television to recognize various dialects and consumers to input via voice freely.

B.2.3 Interaction via smart touch

B.2.3.1 General

With advanced multi-point touch functions, a user may directly write on the screen. A stylus pen, wireless mouse and keyboard may be also provided for completely satisfying the diversified demands of users.

B.2.3.2 Interaction via action

Action recognition is a technology consists of human body movement capturing and image recognition. Through action recognition, television may completely get rid of remote controls, thereby creating a whole new experience of smart virtual touching. Since the human body has a complicated structure, it is still difficult for action recognition to achieve precise tracking of 3D movement of the human body. Action recognition technology has a promising future in the television field, and may basically fulfil all television operations if combined with a voice control system.

B.2.3.3 Interaction via gesture

As a special form of action manipulation, gesture manipulation is the smart interaction mode that is first used. For now, one of the hottest technologies is gesture command mapping, i.e. how to define gesture action for television remote controls, including such simple gestures as grabbing and holding. Some of the main gesture manipulations are described as below:

- static gesture recognition;
- cursor input based on hand position;
- 3D depth perception:
- spatial positioning sensor;
- gesture input prompt and confirmation;
- dynamic gesture tracking;
- hand image overlay;
- gesture command mapping.

B.2.3.4 Human body recognition

Human body recognition includes face recognition and body detection, etc. Face recognition technology may create an individualized television experience. If a smart television is added with face detection and face recognition functions, we may make estimates of number, age and sex, and realize user identification verification based on a local database. After recognizing the person in front of the television, this technology will allow for such applications as programme recommendation, individualized customized user interface, parent management, and logging into social networks, etc.

Annex C (informative)

Model for general service context of smart television

C.1 Overview

Since smart television is a smart terminal, the service it receives in a general service scenario may be of smart nature. As the carrier for the service used by users, a smart television terminal is not limited to smart television in a home environment. New types of smart television terminals are emerging so that a user may enjoy ubiquitous service through various types of terminal devices. The network allows a user to participate in the customization process of a service so that the user may enjoy a ubiquitous smart service and set characteristic parameters of service quality and presentation mode based on his/her own demands and preference. The model of general service context allows for laying a foundation of smart and individualized smart television service and reflecting the user-oriented feature of smart television. In addition, it may also collect characteristic information relating to the service in the cross-network to change the situation where traditional service is fully bundled with the terminal device.

C.2 Definition of model

The definition of the model is given based on a four-layer structure, as shown in Figure C.1.

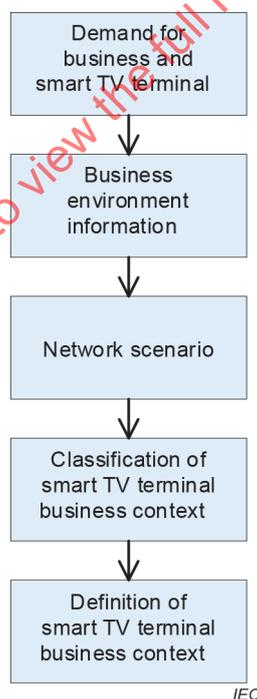


Figure C.1 – Definition of context model

Service environment information mainly includes the following:

- Scenario information, see Annex A.
 - 1) Service user scenario identity.
- Network environment. There is currently no other connected network and overall network condition, including:
 - 1) terminal networking;