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SERIES F: NON-TELEPHONE TELECOMMUNICATION SERVICES

Audiovisual services

Service description and requirements for multimedia information access triggered by tag-based identification

Recommendation ITU-T F.771

ITU-T F-SERIES RECOMMENDATIONS

NON-TELEPHONE TELECOMMUNICATION SERVICES

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T F.771

Service description and requirements for multimedia information access triggered by tag-based identification

Summary

Recommendation ITU-T F.771 specifies a high-level functional model, a service description and requirements for multimedia information access triggered by tag-based identification. The scope of this Recommendation is limited to those applications and services that have both multimedia and tag-based characteristics.

Keywords

Multimedia information access, requirements, tag-based identification.

FOREWORD

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CONTENTS

Introduction

Multimedia information access triggered by tag-based identification is a class of the generic multimedia services identified in Recommendation ITU-T F.700. Following the methodology given in Recommendation ITU-T F.701, this Recommendation specifies the functional model, service description and requirements for multimedia information access triggered by tag-based identification.

When a user's device obtains an identifier from an identification (ID) tag wherever it is attached, the device tries to find the location of associated multimedia information automatically. Each identifier is stored in an ID tag such as a barcode, a passive/active radio frequency identification (RFID), or a smart card, so as to be recognized automatically by various types of tag readers. This feature enables the user to refer to the multimedia content without typing its address on a keyboard or inputting the name of objects about which relevant information is to be retrieved. This information is stored in databases somewhere in the network and provided by several service providers.

Recommendation ITU-T F.771

Service description and requirements for multimedia information access triggered by tag-based identification

1 Scope

This Recommendation specifies the service description and the requirements for multimedia information access triggered by tag-based identification. This service enables users to access multimedia information through users' electronic devices equipped with ID tag readers and communication functions.

The multimedia information is comprised of voice, sound, text, graphic, video and other media which have various applications such as digital maps for route-finding and interactive three-dimensional panoramic pictures. Users will receive its delivery via communication networks such as fixed and mobile networks according to their network access capabilities.

These applications and services are characterized by the use of the following:

1)   Identifier: An identifier is assigned to each real-world entity such as a physical/logical object, a place, or a person.

2)   ID tag: An ID tag is a tag, such as a barcode, a passive/active RFID, a smartcard, or an infrared tag, used to store the identifier.

3)   ID terminal: An ID terminal is a device equipped with an ID tag reader/writer used to capture the identifier. Capturing the identifier triggers access to multimedia information via a network.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T F.700]   Recommendation ITU-T F.700 (2000), *Framework Recommendation for multimedia services*.

[ITU-T F.701]   Recommendation ITU-T F.701 (2000), *Guideline Recommendation for identifying multimedia service requirements*.

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms.

3.2.1   ID resolution: ID resolution is a function to resolve an identifier into associated information. In this Recommendation, it is specifically a function to resolve an identifier on/in an

ID tag into necessary access information such as uniform resource locator (URL), Internet Protocol (IP) address, and phone number, which may indicate a protocol and/or a pointer to access multimedia information services provided by multimedia information delivery functions.

NOTE – Since the ID resolution function handles mapping relationships between identifier and access information, it may have a database for the efficient management of mapping record.

3.2.2   ID tag: An ID tag is a tiny physical object which stores a small amount of information which is an identifier or includes an identifier with other additional application data such as name, title, price and address. An ID tag is attached to or associated with a real-world entity to carry the information or attributes about the entity. In this Recommendation, an ID tag is used to store an identifier of the real-world entity with optional application data. Examples are radio frequency identification (RFIDs), barcodes, 2D barcodes, infrared tags, active radio frequency (RF) tags, etc.

3.2.3   ID terminal: An ID terminal is a device with a capability to capture data from ID tags, and other capabilities such as communication capability and multimedia information presentation capability. The data capture capability may include a function to obtain an identifier from ID tags even with no communication capability such as barcodes and two-dimensional barcodes. Examples of equipment that use data capture techniques are digital cameras, optical scanners, radio frequency (RF) transponders, infrared data association (IrDA), galvanic wire-line, etc. Sometimes, an ID terminal is called a user terminal.

3.2.4   identifier: An identifier is a series of digits, characters and symbols or any other form of data used to identify a real-world entity. It is used to represent the relationship between the real-world entity and its information/attributes in computers. This relationship enables users to access the information/attributes of the entity stored in computers via users' ID terminals.

3.2.5   multimedia information: Multimedia information is digital information that uses multiple forms of information content and information processing, such as text, pictures, audio, video, three-dimensional panoramic pictures and digital maps, which informs or entertains users.

3.2.6   multimedia information delivery function: A multimedia information delivery function is a function to deliver multimedia information to an ID terminal which is triggered by the tag-based identification.

3.2.7   real-world entity: A real-world entity is a physical and logical entity which mainly acts or is used in the real world, such as a physical object, logical object, place and person. Examples of *physical objects* include water bottle, book, desk, wall, chair, tree, animal, cloth, food, television, light and so on. Examples of *logical objects* include digital content such as video, movie, music and story. Examples of *places* include room, corridor, road, gate, garden and so on. The real-world entity concept includes both networked entities and non-networked entities.

3.2.8   tag-based identification: Tag-based identification is the process of specifically identifying a real-world entity by capturing its identifier from an ID tag storing the identifier. This identification process consists of two steps. The first step is to read an identifier from an ID tag. The second step is to resolve the identifier into associated information such as a uniform resource locator (URL), an Internet Protocol (IP) address, a telephone number, an e-mail address, and/or a content address for audio/video data. For tag-based identification, the identifier, ID tag and ID terminal are mandatory elements.

NOTE – Resolved results indicate the identification of a real-world entity. Thus, the identification process selects proper information from multiple associated information with the identifier according to the condition of applications, services and system implementations. For example, in the identification for telephone applications, a person's identifier may be resolved into a telephone number. On the other hand, in the identification for multimedia messaging applications, the identifier may be resolved into an e-mail address.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

2D	Two Dimensional
3D	Three Dimensional
B2B	Business to Business
B2C	Business to Consumer
DVD	Digital Versatile Disk
G2C	Government to Consumer
ID	Identification
IP	Internet Protocol
IR	Infrared
IrDA	Infrared Data Association
MAC	Media Access Control
NGN	Next Generation Network
PDA	Personal Digital Assistant
QoS	Quality of Service
RF	Radio Frequency
RFID	Radio Frequency Identification
URL	Uniform Resource Locator
Wi-Fi	Wireless Fidelity

5 Conventions

In this Recommendation:

– The expression "**is required to**" indicates a requirement which must be strictly followed and from which no deviation is permitted if conformance to this Recommendation is to be claimed.

– The expression "**is recommended**" indicates a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.

6 High-level functional model and generic service description

The objective of this clause is to describe the high-level functional model of the multimedia information access triggered by tag-based identification. First, this clause describes the high-level functional model consisting of multiple elementary functional components and the relationships between them. Next, a generic service is described with the work process of this model.

6.1 High-level functional model

Figure 1 shows the high-level functional model consisting of high-level functional components and the relationships between them.
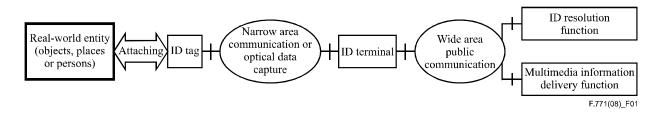
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**Figure 1 – High-level functional model of the multimedia information access
triggered by tag-based identification**

6.1.1   ID tag

ID tag is defined in clause 3.2.2.

6.1.2   ID terminal

ID terminal is defined in clause 3.2.3.

6.1.3   ID resolution function

ID resolution function provides the function of ID resolution defined in clause 3.2.1.

6.1.4   Multimedia information delivery function

Multimedia information delivery function provides the function of multimedia information delivery defined in clause 3.2.6.

6.1.5   Narrow area communication

Narrow area communication means that an ID terminal and an ID tag have to be located close together, within a few metres, and the ID terminal captures an identifier written in the ID tag in a wireless manner. In case of RFID, this is the contactless communication between the RFID tag and a reader/writer in the ID terminal. In case of infrared tag, it is infrared communication between the infrared tag and the ID terminal.

6.1.6   Optical data capture

When the ID tag is a printed tag, such as barcode or two-dimensional barcode, optical data capture is used to obtain an identifier from the ID tag.

6.1.7   Wide area public communication

Wide area public communication means public communication to support data exchanges among the ID terminal, multimedia information delivery function and ID resolution function. Examples are the Internet, a mobile telephone network and NGN.

6.2   Generic service description

The service defined in this Recommendation is to enable users to access multimedia information relating to real-world entities such as objects, places and persons. Appendix I describes eight examples of the multimedia information access service triggered by tag-based identification. This service is realized by the following three operations:

1)   tag-based identifier-reading process;

2)   ID resolution process; and

3)   information presentation process.

6.2.1 Tag-based identifier-reading process

The tag-based identifier-reading process enables the ID terminal to start identifying real-world entities by using the identifier stored in the ID tag. When this identifier is read, it is transferred to the ID terminal via narrow area communication. Hence, this identifier-reading process works only when the ID tag and ID terminal are in a narrow area together.

6.2.2 ID resolution process

In an ID resolution process, an ID terminal asks an ID resolution function (see clause 3.2.1) to resolve an identifier and receives a result from the ID resolution function. This process enables the ID terminal to find necessary information for accessing the multimedia information delivery service via wide area public communications. Examples of this information are URLs for a web-based information service, a content ID for a digital multimedia retrieval service, a phone number for a voice service, etc.

The simplest relationship between the identifier and multimedia information access may be a static "one-to-one" relationship. However, this relationship may generally be a "one-to-many" type, and a proper service is selected according to the context of users and environments.

For example, an RFID tag is attached to a signboard of a restaurant, and then a user puts the ID terminal on the RFID tag. The menu of the restaurant is shown in the user's preferred language, which is pre-registered in the user profile in the ID terminal. In this example, multiple information content is associated with a single identifier, and the ID resolution function selects the most suitable content among them according to the user's profile.

6.2.3 Information presentation process

The information presentation process enables the ID terminal to access a multimedia information function via wide area public communications, such as voice guidance at a museum, video clip delivery for advertisement, pedestrian navigation using a digital map, restaurant menu, and pedestrian navigation for persons with visual disability. This information presentation process is classified into the following three process types.

6.2.3.1 Information download process

The information download process enables the ID terminal to retrieve multimedia information from multimedia information delivery functions. In this process type, the information may be stored in a server as: fixed data such as in video-on-demand systems; dynamically generated data from elements in the server; or real-time streaming data such as from broadcasting or a networked camera.

6.2.3.2 Information upload process

The information upload process enables the ID terminal to upload information into multimedia information delivery functions. In this process type, information uploaded may be temporarily stored in the ID terminal, manually input by the user, or generated in real-time, such as live data from a video camera in the ID terminal.

6.2.3.3 Bidirectional information process (both download and upload)

The bidirectional information process is a combination of the above two types of multimedia information presentation processes. The ID terminal and the multimedia information delivery function exchange multimedia information with each other. A simple example is a video-conference system. In this case, the ID terminal and the video-conference server exchange audio/video information with each other, after the ID terminal has read all participants' identifiers and resolved the video conference service.

7 Requirements

This clause provides a list of basic requirements for multimedia information access triggered by tag-based identification. The multimedia information access service triggered by tag-based identification has the following requirements in terms of user, service, identifier, ID tag, ID terminal, ID resolution, multimedia information delivery, wide area public communication, security and quality of services (QoS).

7.1 User requirement

USR-001: This service is required to be usable by a wide range of people including children, the elderly and the physically challenged.

7.2 Service requirements

SVC-001: This service is required to deliver multimedia information to the ID terminal, and is recommended to collect multimedia information from the ID terminal such as user profiles and operation logs.

SVC-002: This service is required to deliver multimedia information stored in prepared multimedia data files, and is recommended to deliver multimedia information encoded in real-time (real-time streaming option).

SVC-003: It is required that both push- and pull-type delivery services be supported.

Push-type delivery is useful for advertisement services, warning message delivery, etc. Pull-type delivery is useful for services where the user initiates the exchange of information. The former service will be realized by IR tags and RF tags, and the latter by passive RFIDs, barcodes, etc.

7.3 Identifier requirements

ID-001: Identifier is recommended to be used by different applications.

If an identifier is assigned to a product, the identifier could be used for production management in a factory, supply chain management, and customer service for end users of the product. If a location identifier is assigned to a room in a building, the identifier could be used for a room reservation system, maintenance activity for the room, or a guidance system in case of emergencies. As described in these examples, an identifier, if required, could be used by different applications.

ID-002: Identifier is required to be assigned for real-world entities such as physical/logical objects, persons and places.

Identifier is required to identify products, foods, drugs, digital content, locations, persons, etc. This requirement has an impact on the design of the identifier scheme because the total number of these entities is estimated to be very large. Hence, the total number of identifiers used by the multimedia information access triggered by tag-based identification is also estimated to be much larger than the number of identifiers for communication entities such as IP addresses, phone numbers and MAC addresses. However, today, it is difficult to estimate accurately the total number of identifiers used in multimedia information access triggered by tag-based identification.

ID-003: Identifier is required to be issuable by any organization, such as businesses, non-profit organizations, governments and individual users.

ID-004: Identifier is required to be globally unique so that the multimedia information access triggered by the identifier is to be globally available.

ID-005: Multiple identifier schemes are required to be supported. It is important to provide a function to use multiple identifier schemes in this service because there are already many existing identifier schemes and new identifier schemes for this service could be designed in the future.

7.4 ID tag requirement

TAG-001: Several types of ID tags are required to be used.

ID tags should involve several kinds of tags such as RFIDs, smart contact-less cards, active tags, IR tags, RF tags, printed tags such as barcodes and two-dimensional barcodes. This is because, technically, there is no tag today that satisfies all uses. For example, RFIDs are of high performance for reading identifiers but are rather expensive. Barcodes are of very low-cost, but are very easy to forge. Therefore, the best tag differs according to the condition of applications and users.

7.5 ID terminal requirements

TRM-001: ID terminal is required to be equipped with a reader of ID tags, such as an RFID reader, IrDA receiver, or high resolution camera for barcode and two-dimensional barcode recognition. An ID terminal is recommended to be equipped with a writer of ID tags.

TRM-002: ID terminal is required to be equipped with a wide area public communication interface such as a mobile communication interface or an IP network interface over a Wi-Fi connection.

TRM-003: ID terminal is required to be equipped with a multimedia information input/output function such as multimedia information browsing and web input function.

7.6 ID resolution function requirements

RSL-001: ID resolution function is required to be able to resolve an identifier into the necessary address information to access the multimedia information related to the identifier, such as URL, IP address and telephone number.

RSL-002: ID resolution functions are recommended to be managed by different organizations such as businesses, non-profit organizations, governments and individual users. They may be distributed among multiple different servers.

7.7 Multimedia information delivery function requirements

MID-001: Multimedia information delivery function is required to reliably request and receive information.

MID-002: Multimedia information delivery function is required to be able to deliver the multimedia information according to the address information, such as the URL returned by the ID resolution function to the ID terminal.

MID-003: Multimedia information delivery function is recommended to be established and maintained by various types of organization, such as businesses, non-profit organizations, governments and individual users. It is recommended to be open for every organization and individual.

7.8 Wide area public communication requirement

WAN-001: Wide area public communication is required to mediate the communication among information terminals, multimedia information delivery functions and ID resolution functions. For example, the Internet, mobile network or NGN can satisfy this requirement.

7.9 Security requirements

SEC-001: Tag-based identification is required to protect privacy.

Some consumers are concerned about privacy threats incurred by ID tags. Especially RFID reader-equipped mobile phones or secret RFID reader/writers may threaten privacy because consumers cannot be aware of exposing their private information to RFIDs. The exposed

information may include brand names, manufacturer, price, etc., of goods that the consumer possesses.

SEC-002: ID resolution functions and multimedia information delivery functions are required to be aware of validation.

Some information associated with objects, places and persons may be available only to a limited number of valid users. In this case, some access control mechanism with a validation check is necessary at the ID resolution function or the multimedia information delivery function.

7.10   Quality of service (QoS) requirement

QOS-001: Proper QoS function is required to be provided by each functional component and communication function for each service and application triggered by tag-based identification.

Tag-based identification triggers several types of multimedia service such as web page reference services, video delivery services and video conference services. These services have their own different QoS requirements. So, each functional component and communication function should provide satisfactory QoS for each service.

Appendix I

Service description in applications

(This appendix does not form an integral part of this Recommendation)

The multimedia information access triggered by tag-based identification is useful in various fields such as medical applications in hospitals and drug stores, manufacture, agriculture, library management, personal safety, welfare, shopping, leisure (such as sight-seeing), logistics and supply chain management. Table I.1 summarizes these application fields. This appendix describes multimedia information access services triggered by tag-based identification in eight typical example applications; however, application is not restricted to these services. It is also noted that some other scenarios of tag-based identification applications and services are given in Appendix III to [b-ITU-T Y.2213].

I.1 u-Museum

u-Museum (ubiquitous museum) provides a multimedia information retrieval service for visitors, such as guidance of exhibited art pieces, navigation in the gallery, and advertisement information for museum shops. This service is implemented by RFID tags, active infrared tags, mobile terminals with an RFID reader and infrared receiver, multimedia database of exhibits, wired/wireless networks, and so on. In the u-Museum, an active infrared tag is put at the entrance gate of an exhibition room, and sends the identifier of the room. When a visitor with a mobile terminal walks through the gate, the terminal receives the identifier, retrieves the information of the exhibition in this room, and shows the information to the visitor. The exhibition room shows several pieces of fine art and a tiny RFID tag is embedded in the explanation plate of each exhibit. The user can get precise information on the exhibits by touching the mobile terminal on the plate. When the visitor wants to go to the next exhibit, the system navigates the route according to the art tour route. If the visitor takes a wrong turn, the mobile terminal receives an unexpected location identifier from an infrared tag. Then the mobile terminal gives a warning to the visitor.

I.2 Multimedia information download via posters

Multimedia information may be assigned to an RFID tag attached to a movie advertisement poster; this information could include images, audio/music, movie segments, news information, or the portal site for booking a ticket. If the user touches his/her mobile phone with an RFID reader on the RFID in the poster, he/she receives a list of the candidate services from the network. Then the user can pick up the desired information service by operating the mobile phone.

I.3 Operating manual for a product

Recently, several classes of electronic equipment have been released that have very complicated operation sequences. Typical examples of such equipment are DVD players, hard-disk video recorders, video cameras, digital televisions, facsimile machines, etc. These machines are often used for a long time, and the user sometimes loses the operating manuals. To assist in this situation, each of these machines can bear an RFID or 2D barcode which contains an identifier of the machine. This identifier is associated with the details of the version and options of the product. Using this identifier, the user can select a proper operating manual from a large manual database, and refer to it via a network with his/her hand-held terminal.

I.4   Food traceability

The confidence in food wavers due to problems such as bovine spongiform encephalopathy (BSE) and pesticide residue found in vegetables. Consequently, food safety has become a global issue with a central focus of the consumer.

Traceability of the food chain enables tracing and tracking of food and the information at each stage of the food chain, including production, processing, distribution and sales. When a food accident occurs, consumers can search for information and confirm the safety of the food in their refrigerators.

An identifier of the food is attached to the product using RFID or a small barcode. Food chain information is associated with the identifier so that the consumer can retrieve the food information from multimedia information delivery functions via available networks.

I.5   Business card with personal identifier

Suppose that an identifier of a businessman is written on a business card. The identifier is associated with the latest contact address data record, including telephone number, fax number and e-mail address. His/her business client could get all the latest information from this identifier even after he/she has moved to another office or company.

I.6   Presence service with multimedia information

Imagine a theatre in which every visitor had a ticket with RFID, and every seat in the theatre contained an RFID reader. When the visitor enters the theatre and takes a seat, he/she puts the ticket on the RFID reader located in the arm of the seat. The reader reads the ticker identifier and automatically notifies the theatre office of the visitor status through the theatre management application.

I.7   Location-aware information delivery for commercial advertisement

Suppose that an ID tag is embedded in front of the doors of a department store or shop. In this case, if the ID tag is an active RFID or an infrared tag so as to be able to send an identifier to ID terminals, users can obtain the identifier automatically without explicit operations. An advertisement movie clip or speech message is associated to the location identifier. In this scenario, when a visitor walks in front of the entrance of the store or shop, he/she is automatically notified of the advertisement message.

I.8   Sightseeing information delivery

Suppose that each sightseeing spot is equipped with RFIDs, infrared tags, active RF tags, or barcodes including the identifier of the location. At the sightseeing spot, a visitor with a handheld terminal automatically reads the location identifier and receives sight-seeing video clips or speech explanation with pictures retrieved via available networks.

Table I.1 – Applications sorted by fields

Field	Application	Business types	Function	Purpose	Tag mobility (Note)
Supply chain	Food traceability (see clause I.4)	B2B, B2C	Information retrieval, information monitoring	Increasing food safety, increasing total visibility of food chain	Mobile tag
Medical	Confirmation of drugs	B2B, B2C	Information retrieval, information monitoring	Reducing human error, anti-counterfeit	Mobile tag
Museum	u-Museum (see clause I.1)	B2C	Information retrieval	Value-added service	Mobile tag
Office	Business card with personal identifier (see clause I.5)	B2B	Information retrieval	Value-added service	Mobile tag
	Automatic telephone calling using business card with personal identifier	B2B	Bidirectional information exchange	Value-added service	Mobile tag
Family safety	Child monitoring	B2C	Information monitoring	Increasing safety	Mobile tag
Shopping	Advertisement, shopping guidance (see clause I.7)	B2C	Information retrieval	Value-added service	Fixed tag
Advertisement	Music information download from advertisement poster (see clause I.2)	B2C	Information retrieval	Effective advertisement	Fixed tag
Customer support	Operating manual download (see clause I.3)	B2C	Information retrieval	Value-added service	Mobile tag
Leisure	Sight-seeing information, navigation (see clause I.8)	B2C G2C	Information retrieval	Value-added service	Fixed tag
	Presence service of audience (see clause I.6)	B2B	Information monitoring	Saving cost for audience management	Fixed tag
Welfare	Location-aware information	G2C, B2C	Information retrieval	Value-added service, increasing safety	Fixed tag
NOTE – If the tag is attached to an object that is fixed in location, it is called a "fixed tag", otherwise it is called a "mobile tag".					

Bibliography

[b-ITU-T Y.2213]   Recommendation ITU-T Y.2213 (2008), *NGN service requirements and capabilities for network aspects of applications and services using tag-based identification.*

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