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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Broadband and triple-play multimedia services –
Advanced multimedia services and applications

Architecture of a system for multimedia information access triggered by tag-based identification

Recommendation ITU-T H.621

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Recommendation ITU-T H.621

Architecture of a system for multimedia information access triggered by tag-based identification

Summary

Recommendation ITU-T H.621 defines the system architecture for the multimedia information access triggered by tag-based identification on the basis of Recommendation ITU-T F.771, and serves as a technical introduction to subsequent definition of detailed system components and protocols. The services treated by this Recommendation provide the users with a new method 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 is one of the major communication services using identification (ID) tags such as radio frequency identifications (RFIDs), smart cards and barcodes. International standardization of these services will give a big impact to international multimedia information services using ID tags. It contains the functional model, its constituent components as well as its workflow. An appendix describes how this architecture realizes typical services.

Source

Recommendation ITU-T H.621 was approved on 6 August 2008 by ITU-T Study Group 16 (2005-2008) under Recommendation ITU-T A.8 procedure.

Keywords

Multimedia information access, tag-based identification.

FOREWORD

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Introduction

This Recommendation defines the system architecture for multimedia information access triggered by tag-based identification and serves as a technical introduction to subsequent specifications of detailed system components and protocols. It contains the functional model, its constituent components as well as its workflow. An appendix describes how this architecture realizes typical services.

Recommendation ITU-T H.621

Architecture of a system for multimedia information access triggered by tag-based identification

1 Scope

This Recommendation defines the following issues to cover multimedia information access services triggered by tag-based identification as defined in [ITU-T F.771]:

– a functional architecture reference model with descriptions of corresponding elements;

– interface protocols between communication elements; and

– a generic work flow to support multimedia information access triggered by tag-based identification.

Moreover, this Recommendation describes implementation examples with work flows.

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.771] Recommendation ITU-T F.771 (2008), *Service description and requirements for multimedia information access triggered by tag-based identification*.
<http://www.itu.int/rec/T-REC-F.771>

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 ID resolution: [ITU-T F.771].

3.1.2 ID tag: [ITU-T F.771].

3.1.3 ID terminal: [ITU-T F.771].

3.1.4 identifier: [ITU-T F.771].

3.1.5 multimedia information: [ITU-T F.771].

3.1.6 multimedia information delivery function: [ITU-T F.771].

3.1.7 real-world entity: [ITU-T F.771].

3.1.8 tag-based identification: [ITU-T F.771].

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

2D Two Dimensional

3D Three Dimensional

3G	Third Generation wireless systems
CD	Compact Disk
DNS	Domain Name Server
DVD	Digital Versatile Disk
GW	GateWay
HTTP	HyperText Transfer Protocol
ID	Identification
IDR	Identification Resolver
IDT	Identification Terminal
IP	Internet Protocol
IR	Infrared
IRS	Identification Resolution Server
MIDF	Multimedia Information Discovery Function
MIDS	Multimedia Information Delivery Server
MIHF	Multimedia Information Handling Function
MIM	Multimedia Information Manager
MMS	Multimedia Messaging Service
NFC	Near Field Communication
NGN	Next Generation Network
P2P	Peer to Peer
PDA	Personal Digital Assistant
RF	Radio Frequency
RFID	Radio Frequency Identification
R/W	Reader/Writer
SB	Service Broker
SIM	Subscriber Identity Module
SMS	Short Message Service
URL	Uniform Resource Locator
WAP	Wireless Application Protocol
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.

– The expression "**can optionally**" indicates an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with the specification.

6 System functional architecture

This clause defines the functional architecture of multimedia information access systems in which the multimedia information access is triggered by tag-based identification. This architecture is based on the system components described in clause 6 of [ITU-T F.771] and shown in Figure 1. Compared with the high-level functional architecture, this system architecture decomposes each component into more detailed functional components.

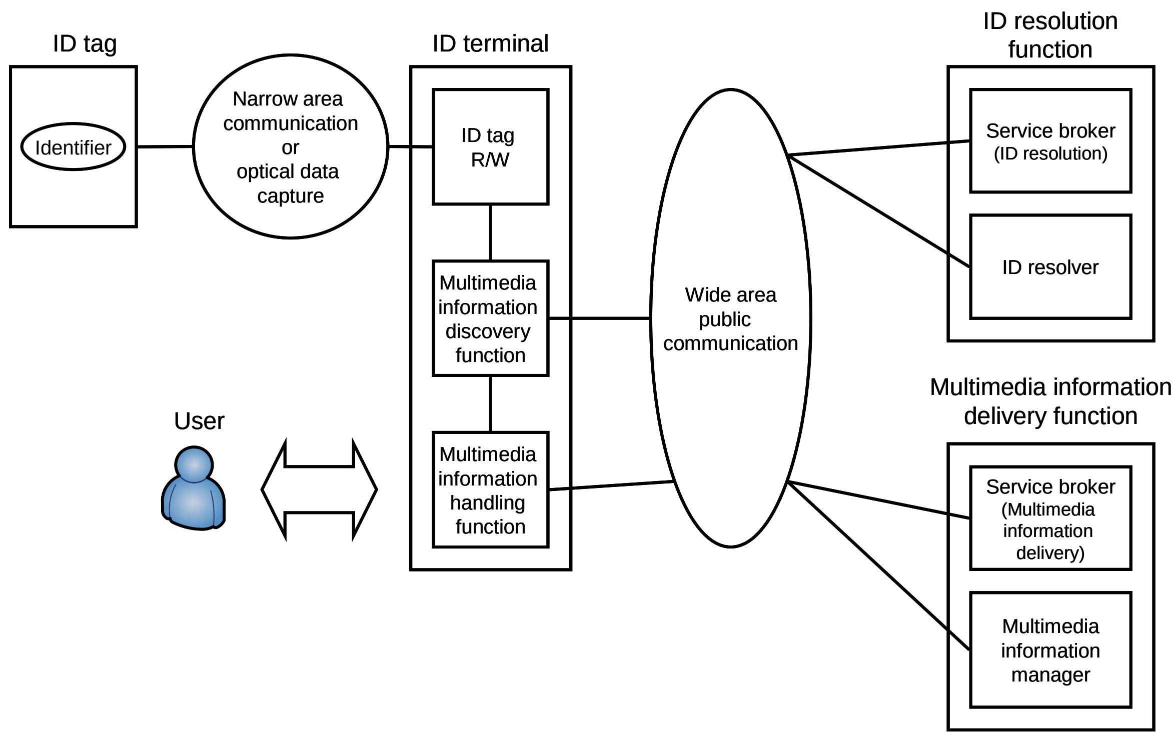


Figure 1 – Functional architecture

Figure 1 shows the logical functional architecture. This does not show the physical implementation of each high-level functional component. Examples of corresponding physical level architecture and their implementation are described in Appendix I.

6.1 Functional components

The system functional architecture for multimedia access triggered by tag-based identification is required to include the following components: ID tag, ID tag reader/writer (ID tag R/W, in short), multimedia information discovery function (MIDF), multimedia information handling function (MIHF), service broker (SB), ID resolver (IDR), and multimedia information manager (MIM). ID tag R/W, MIDF, and MIHF are sub-components included in an ID terminal. The IDR and SB are sub-components included in an ID resolution function. The MIM and SB are sub-components included in a multimedia information delivery function. Refer to clause 6 of [ITU-T F.771] regarding narrow area communication and wide area public communication.

6.1.1 ID tag

An ID tag is required to store identifier(s) which can be read by an ID tag R/W in an ID terminal via narrow area communication. It can optionally store multimedia information and/or other data that is used in ID resolution and/or multimedia information presentation. Typical examples of ID tags are RFID, smartcard, infrared tag, barcode, 2D barcode, NFC listening device, etc.

6.1.2 ID terminal

An ID terminal is required to be composed of three sub-components: 1) ID tag R/W; 2) multimedia information discovery function (MIDF); and 3) multimedia information handling function (MIHF). It can optionally contain multimedia information and/or other data. This data, such as a user's profile, can be used in ID resolution and/or multimedia information presentation.

6.1.2.1 ID tag R/W

An ID tag R/W is required to provide communication interfaces to an ID tag, and read a single or multiple identifier(s) as well as application data from the ID tag. After reading the identifiers, it sends their information to the MIDF. An ID terminal can optionally contain multiple ID tag R/Ws.

6.1.2.2 Multimedia information discovery function (MIDF)

A multimedia information discovery function (MIDF) is required to obtain the identifier from an ID tag R/W, and issues queries to the IDR or optionally the SB, depending on implementations, via wide area public communication. It uses the identifier as a query key in both cases. The ID resolver returns pointer information (e.g., URL) to access the MIM providing the multimedia information delivery services. After obtaining the pointer information, it sends the information to the MIHF.

6.1.2.3 Multimedia information handling function (MIHF)

A multimedia information handling function (MIHF) is required to provide a function to download multimedia information from the MIM, and presents the information to the user. It can optionally upload information to the MIM.

6.1.3 Service broker (SB)

A service broker can optionally provide ID resolution services with the help of an ID resolver. When an ID terminal sends an identifier to the SB, it consults the ID resolver for resolution of the identifier, discovers the multimedia information access information and responds by sending the corresponding resolution result to the ID terminal. That is, the SB works as a proxy for the ID resolver.

A SB can optionally provide multimedia information handling functions as well as the ID resolution proxy functions. That is, the SB can work as a multimedia information delivery proxy as well. Existence of the SB and its features depend on implementations.

6.1.4 ID resolver (IDR)

An ID resolver is required to preserve the relationship between an identifier and its pointer information, such as URL, IP address and phone number, to access the multimedia information delivery function. It is required to provide the MIDF and SB with a translation service from the identifier into the pointer information.

6.1.5 Multimedia information manager (MIM)

A multimedia information manager is required to receive a request from the MIHF in the ID terminal, and delivers multimedia information to it. It can optionally receive uploaded multimedia information from the MIHF.

6.2 Protocols

This architecture is required to be supported by the following standard protocols on the interfaces among the functional components described in clause 6.1. Figure 2 shows those interfaces.

6.2.1 ID tag communication protocol

The ID tag communication protocol is used by the ID terminal and ID tag for their data exchanges and allows the ID terminal to obtain an identifier from the ID tag.

6.2.2 ID resolution protocol

The ID resolution protocol is used by the MIDF and IDR for ID resolution services. The SB is required to use this protocol to interwork with the IDR.

6.2.3 Service broker protocol

The service broker protocol is a communication protocol used between the MIDF and SB, and also between the MIHF and SB.

6.2.4 Multimedia information delivery protocol

The multimedia information delivery protocol is a communication protocol used between the MIHF and MIM.

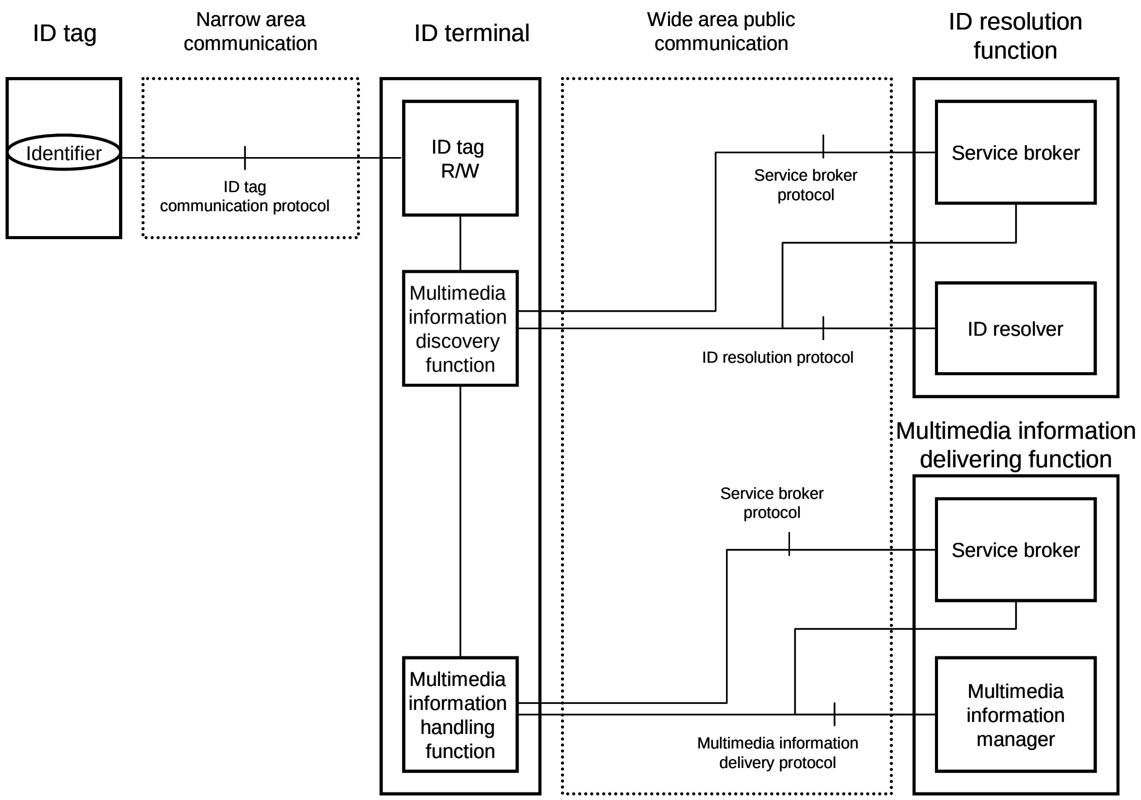


Figure 2 – Interfaces between components in functional architecture

6.3 General workflow

This clause describes the high-level workflow that realizes multimedia access triggered by tag-based identification. This architecture is recommended to work according to the following workflow (see Figure 3).

1) Identifier in the ID tag is obtained by the ID tag R/W in the ID terminal.

2) ID tag R/W sends the identifier to the MIDF.

3) MIDF sends the identifier to the IDR to discover pointer information of the multimedia information delivery function related to the identifier.

This communication can optionally be mediated by the SB. In this case, the MIDF requests the SB to make ID resolution (3-1), then the SB consults the IDR and retrieves the pointer information of the multimedia information delivery function (3-2).

4) IDR resolves the identifier, finds the pointer information of the multimedia information delivery function related to the identifier, and then returns it to the MIDF.

This communication can also optionally be mediated by the SB. In this case, the IDR first sends a reply, including the pointer information to the SB (4-1), and then the SB forwards the reply to the MIDF (4-2).

5) MIDF invokes the MIHF by forwarding the pointer information.

6) MIHF sends the request of retrieving the multimedia information service to the MIM in the multimedia information delivery function.

This communication can optionally be mediated by SB. In this case, the MIHF requests to the SB (6-1), then the SB forwards the request to the MIM (6-2).

7) MIM provides the multimedia information service to the MIHF.

This communication can also optionally be mediated by the SB. In this case, the MIM first provides the service to the SB (7-1), and then the SB mediates the service to the MIHF (7-2).

8) MIHF plays the information and shows it to the user, or it uploads multimedia information to the MIM.

Examples of this workflow are described in Appendix II.

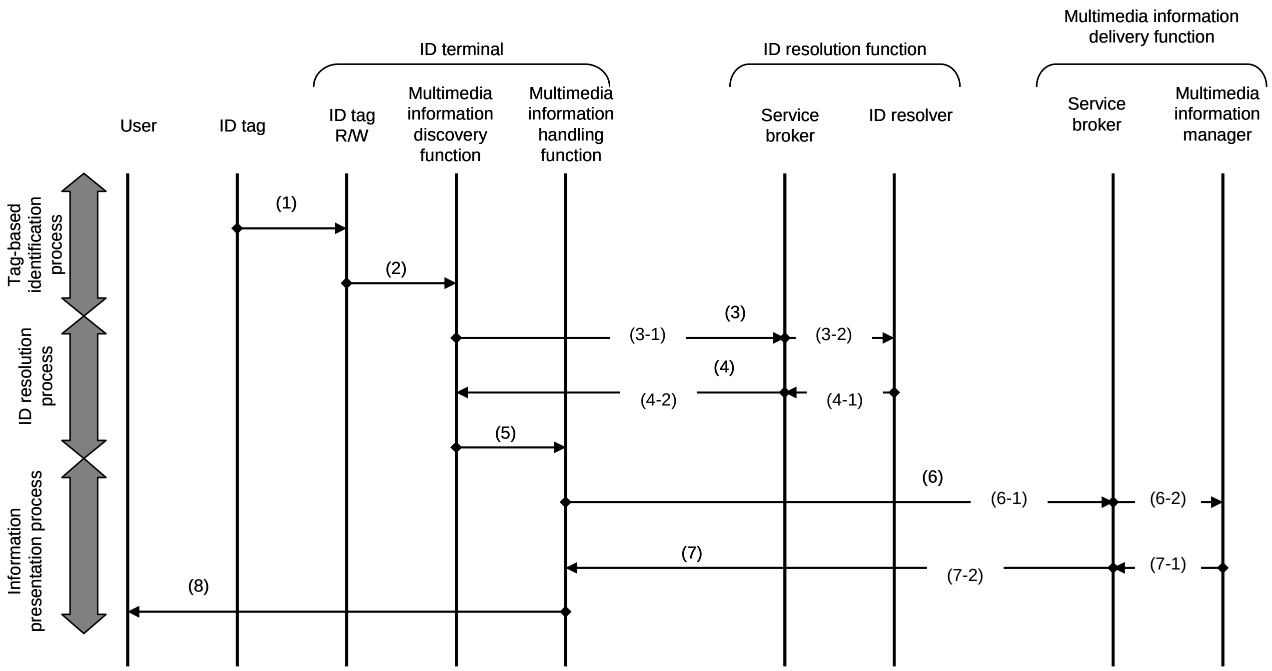


Figure 3 – General workflow of tag-based identification triggered multimedia information access

Appendix I

Examples of physical level architecture

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

I.1 Configuration example of physical level architecture

This appendix describes examples of physical level architecture based on the functional system architecture defined in this Recommendation. In the example shown in Figure I.1, the architecture consists of five types of physical components: 1) ID tags; 2) ID terminals (IDTs); 3) service broker (SB); 4) ID resolution servers (IRSs); and 5) multimedia information delivery servers (MIDSs). A wide area public network provides only end-to-end connection among IDTs, SBs, IRSs, and MIDSs, and it is divided into an IP network and other networks, such as mobile networks, which are interconnected by gateways. IDTs can be connected to other networks, and use the multimedia access triggered by tag-based identification (non-IP IDT).

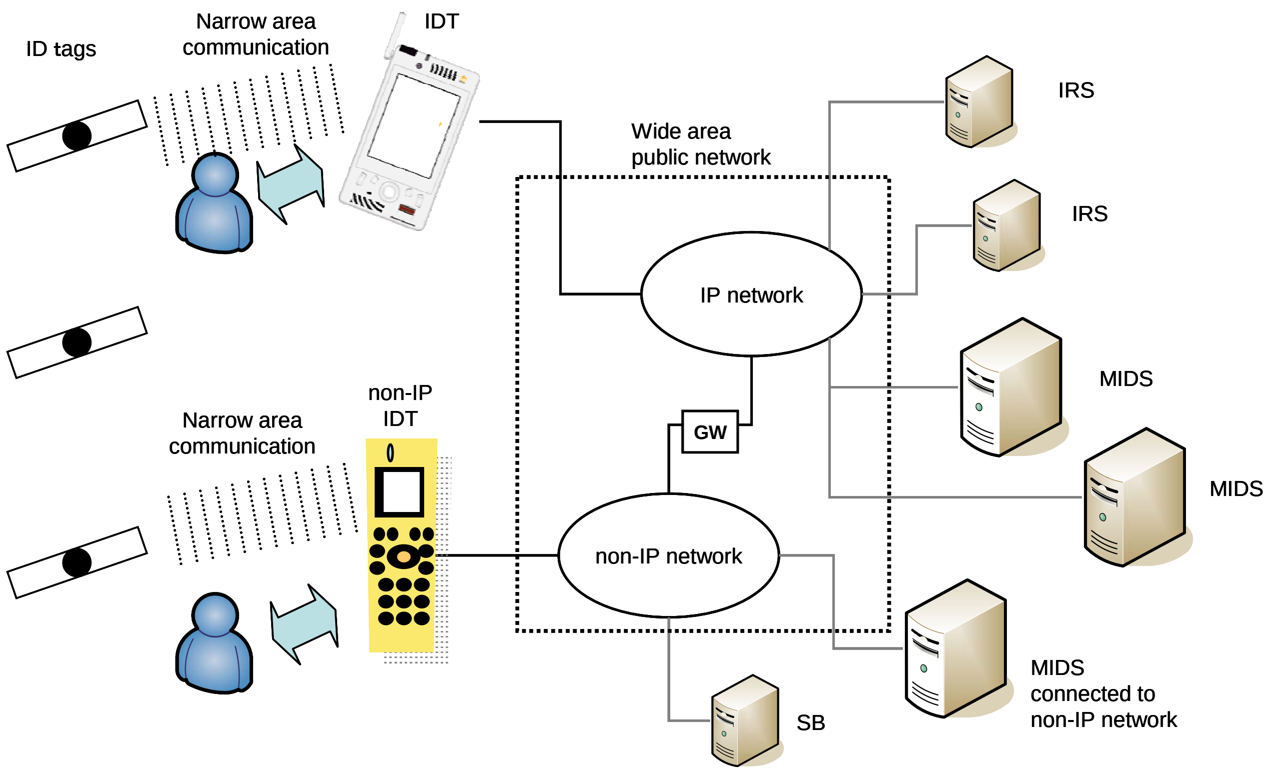


Figure I.1 – An example of physical level architecture

I.2 Components

ID tag

The ID tag contains identifier(s) of object, person and location. It may be RFID, RF/IR tag, barcode or 2D barcode. In usual cases, a single ID tag contains an identifier. However, a single ID tag may contain multiple identifiers. Alternatively, some ID tags are equipped with anti-collision communication or multiplexed communication mechanisms, which enable the tag reader/writer to communicate with multiple ID tags simultaneously.

ID terminal (IDT)

The ID terminal (IDT) implements the three functional components: ID tag reader/writer, multimedia information discovery function (MIDF), and multimedia information handling function

(MIHF). Some IDTs, such as a PDA with a Wi-Fi facility and IP protocol stacks, may connect to an IP network directly, and also some other IDTs may connect to a non-IP network such as a mobile network which is interconnected to the IP network by a gateway. Additionally, Internet browsers are a popular implementation of an MIHF.

Service broker (SB)

The service broker (SB) works as a gateway or proxy of the ID terminal. It also works as a proxy of the MIDF.

ID resolution server (IRS)

The ID resolution server (IRS) realizes the function of ID resolver (IDR). The number space of identifiers is managed by multiple distributed ID resolution servers, which are connected to the IP network and cooperate with each other. To resolve an identifier into the pointer for the multimedia information delivery server, the resolution query is sent to multiple ID resolution servers (Figure I.4).

Multimedia information delivery server (MIDS)

The multimedia information delivery server (MIDS) realizes the function of multimedia information manager (MIM). Generally speaking, a single MIDS can provide multiple services. In this architecture, there may be a huge number of MIDSs, which are connected to an IP network or non-IP networks as peer nodes. Typical examples of the MIDSs are web servers, video/audio streaming servers, etc.

Narrow area communication

The narrow area communication connects ID tags and the ID tag R/W in the ID terminal. It has various types depending on the kinds of ID tag (see clause I.3 for examples). In most cases, the communication range of this network is less than a few metres.

Wide area public network

The wide area public network connects IDTs, IRSs, SBs and MIDSs. This architecture requires only end-to-end reliable connections among these components to the underlying wide area public network. In this architecture, the IP network is supposed to be the primary network, and other networks, such as mobile networks, will be interconnected by gateways. Some IDTs may be connected to the IP network directly, and some IDTs (for example, cellular phones) may be connected to other networks. In the same way, MIDSs may be connected to either IP or non-IP networks.

I.3 Implementation examples of narrow area communication between ID tag and ID terminal

I.3.1 Variations of narrow area communication between ID tag and ID tag R/W

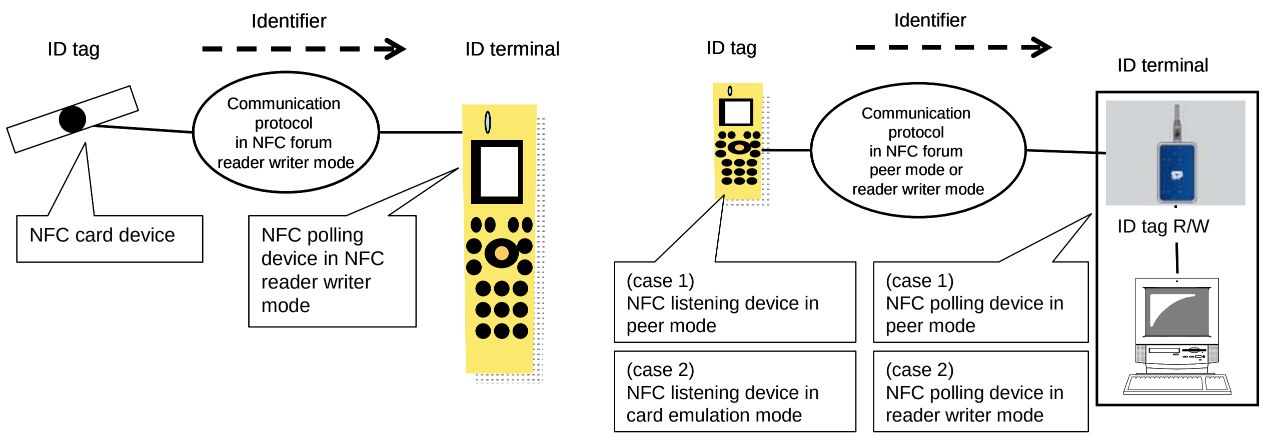
Narrow area communication between ID tag and ID terminal is implemented by various communication technologies, mainly depending on the kinds of ID tag (Table I.1).

Table I.1 – Variations of narrow area communication between ID tag and ID tag R/W

ID tag	ID tag R/W in ID terminal	Narrow area communication
Passive RFID	RFID R/W	Contactless communication of RFID such as [b-ISO/IEC 18000-x]
Contactless smart card	Smart card R/W	Contactless communication of smart card such as [b-ISO/IEC 14443-x], and NFC reader/writer mode
Contact smart card	Smart card R/W or smart card socket	Contact communication of smart card such as [b-ISO/IEC 7816-x]
Barcode, 2D barcode	Camera with image recognition or laser scanner	Image acquisition
Infrared tag	Infrared transceiver	Infrared communication
Active RFID	Base station	Narrow area wireless communication such as Bluetooth, ZigBee, Wi-Fi and [b-ISO/IEC 18000-4]
NFC listening device	NFC polling device	NFC reader/writer mode, NFC peer mode

I.3.2 Narrow area communication implementation using NFC

For example, if we adopt near field communication (NFC) for the narrow area wireless communication network, the ID tag and ID terminal can take several novel forms. Figure I.2a takes the normal form of ID tag and ID terminal in a mobile phone. In Figure I.2b, the ID tag function is implemented by the reader/writer device in a mobile phone, and the identifier is read by an ID terminal implemented as a desktop PC. It is also possible to implement an ID tag and ID terminal in one device together.

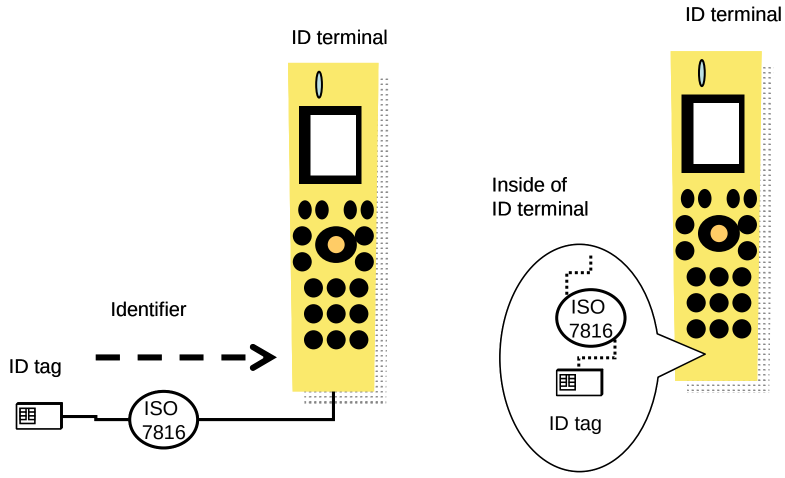


a) Reader-based configuration **b) P2P-based configuration**

Figure I.2 – Examples of narrow area communication using NFC

I.3.3 Wired narrow area communication

Narrow area communication includes wired or contact communication of smart card tags such as those described in [b-ISO/IEC 7816-x]. For example, if the [b-ISO/IEC 7816-x] reader/writer is implemented as an external device for an ID terminal, it takes the form illustrated in Figure I.3a. It is also possible to implement the reader/writer as an internal device for an ID terminal. Figure I.3b illustrates this configuration. Many 3G mobile terminals include a SIM socket and a small smart card is embedded into the socket. The system architecture in this Recommendation covers this type of system configurations. In this configuration, an ID terminal can obtain the identifier and use the multimedia information access at any time because it always carries ID tag(s) within it. On the other hand, it cannot change the identifier for the multimedia information access because it is fixed inside the ID terminal. If the user wants to change the identifier, he/she has to exchange the smart card manually.



a) External R/W b) Internal R/W

Figure I.3 – Examples of wired narrow area communication

I.4 Distributed implementation of ID resolution server

The total number of identifiers used in multimedia information access is expected to be very large. From the point of view of ID resolution query performance, and from the point of view of identifier space management, distributed implementation of IRSs is necessary. Figure I.4 illustrates the configuration of distributed IRSs in a tree structure and the ID resolution process on the basis of this configuration. In this example, identifiers are managed by multiple distributed IRSs, which are connected to the IP network and cooperate with each other. To resolve an identifier into a pointer to MIDS, the resolution query is sent to multiple IRSs. In this example, a query is processed as for domain name servers (DNSs) on the Internet. IRSs near to the root are responsible for resolving upper bits of identifiers, and IRSs near to leaf are responsible for resolving the lower bits. In Figure I.4, the grey part of identifier represents the bits managed by each IRS.

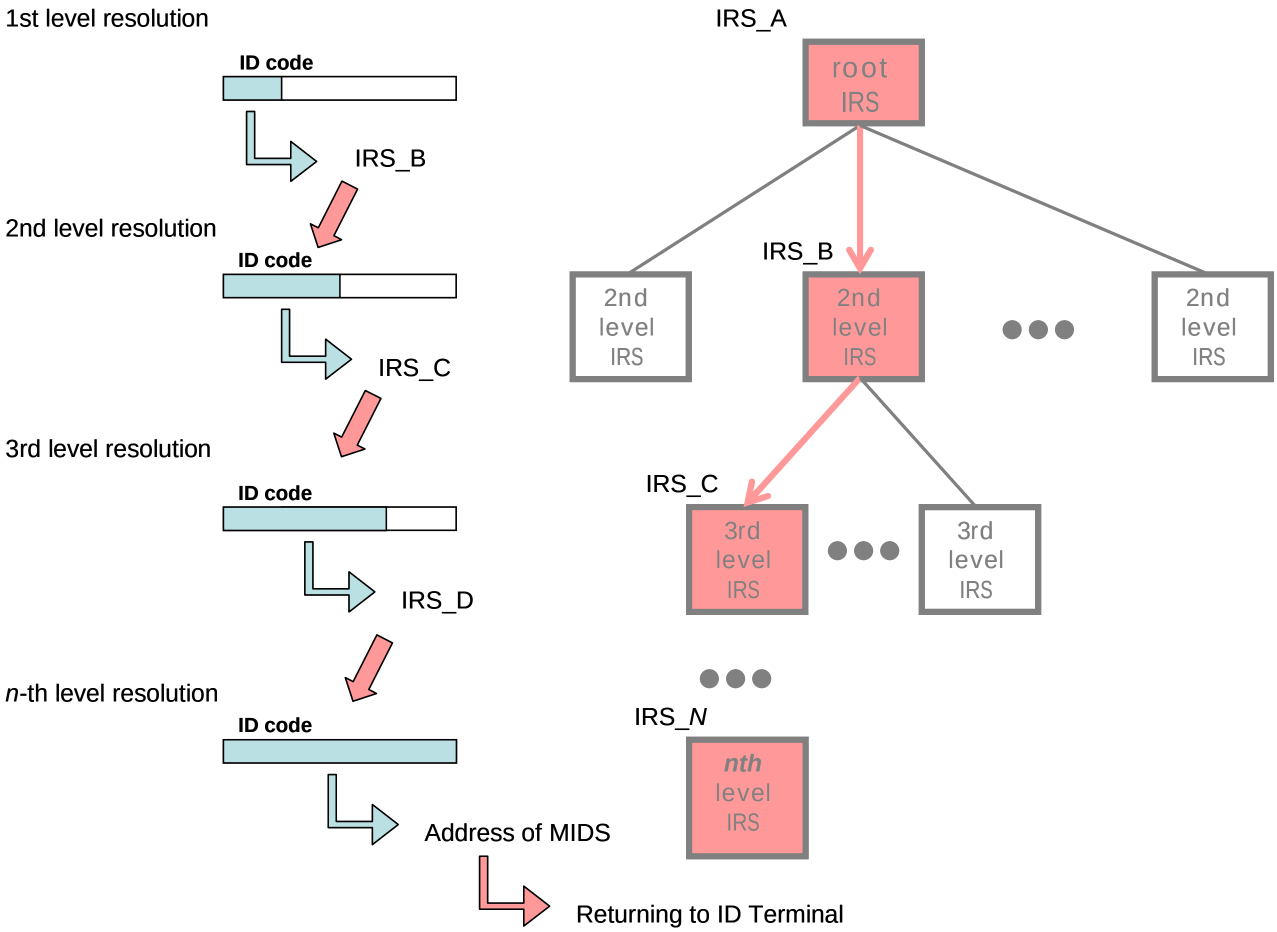


Figure I.4 – Cascade search for ID resolution

Appendix II

Workflow examples for multimedia information access triggered by tag-based identification

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

This appendix presents five typical examples of multimedia information access triggered by tag-based identification included in [ITU-T F.771]. For each example, its application scenario is described, and then the functional architecture and associated workflow are presented. Here, to make the description simple, the service broker is not used in the architecture and workflow.

II.1 Location-aware multimedia information service

II.1.1 Application scenario

Location-aware information services are among the most important applications of RFID. They provide location-aware information once the RFID and the active tag (beacon), which are attached and installed to the physical infrastructure (e.g., road), are read by passers-by and vehicles that try to access location-specific information.

An identifier is assigned to the business information of a shop. The same content may be accessed by many methods, such as short message service (SMS), multimedia messaging service (MMS), wireless application protocol (WAP) and hypertext transfer protocol (HTTP), in several media types, such as text, image and video. The most appropriate method can be selected according to the capabilities of the ID terminal.

II.1.2 System architecture

The architecture in Figure II.1 implements the above scenario.

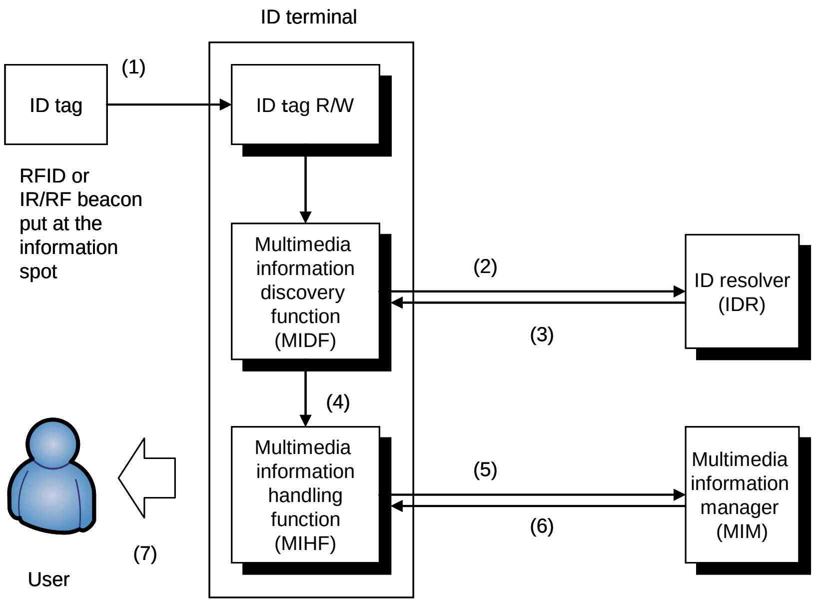


Figure II.1 – Implementation architecture of location-aware information delivery services

II.1.3 Workflow

1) ID tag R/W obtains the identifier of the physical location (location identifier) from RFID or IR/RF beacon.
2) Multimedia information discovery function (MIDF) sends the location identifier to ID resolver (IDR) to find the pointer and transfer protocol information of the associated multimedia information managers (MIMs).
3) The pointer and transfer protocol of the MIMs are provided to the MIDF.
4) MIDF sends the information of pointer and transfer protocol to the multimedia information handling function (MIHF).
5) MIHF sends a multimedia information delivery service request to the MIMs which contain detailed information associated with the location identifier.
6) The multimedia information associated with the location identifier in the tag is delivered to the MIHF in the ID terminal.
7) User watches the multimedia information displayed by the ID terminal.

II.2 Multimedia information download via posters service

II.2.1 Application scenario

An RFID tag containing a movie identifier is attached to an advertisement poster for the movie. Multimedia information may be associated with this identifier, such as images, audio/music, movie segments, news or a portal web page 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.

II.2.2 System architecture

The architecture in Figure II.2 implements this scenario.

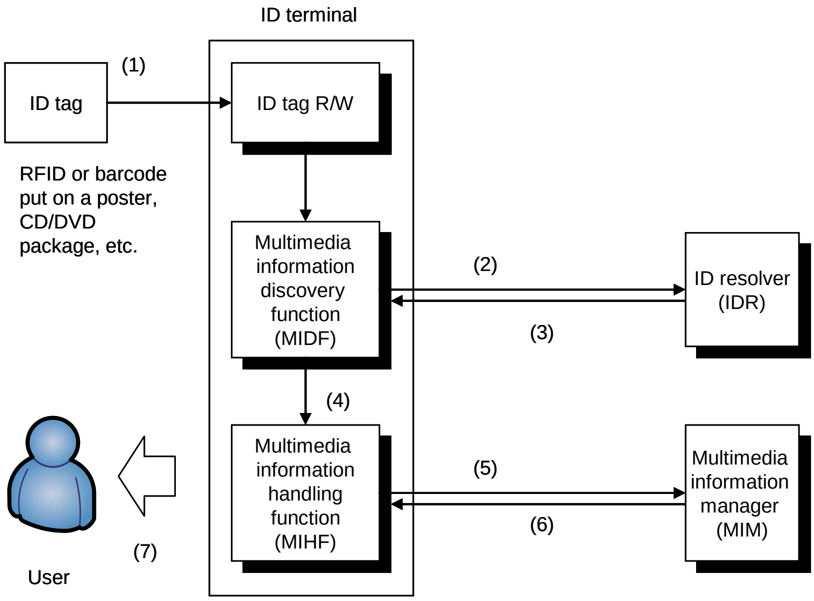


Figure II.2 – Implementation architecture and workflow of digital content delivery services using posters

II.2.3 Workflow

1) ID tag R/W obtains the identifier in the poster or CD/DVD package from RFID or barcode.
2) MIDF sends the identifier to the IDR to find the pointer and transfer protocol information of the associated MIMs.
3) The pointer and transfer protocol information on MIMs is provided to the MIDF.
4) MIDF sends the information, which includes the service identifier and the protocol of the MIM-*i* to the MIHF.
5) The MIHF calls the multimedia information delivery service of the MIM-*i* containing the detailed information associated with the ID code.
6) The multimedia information associated with the ID code is delivered to the MIHF in the ID terminal.
7) User watches the multimedia information via the ID terminal.

II.3 u-Museum

II.3.1 Application scenario

u-Museum (ubiquitous museum) provides a multimedia information service for visitors, such as guidance for 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 ID terminal receive an unexpected location identifier from an infrared tag. Then the ID terminal gives a warning to the visitor.

II.3.2 System architecture

The architecture in Figure II.3 implements this scenario.

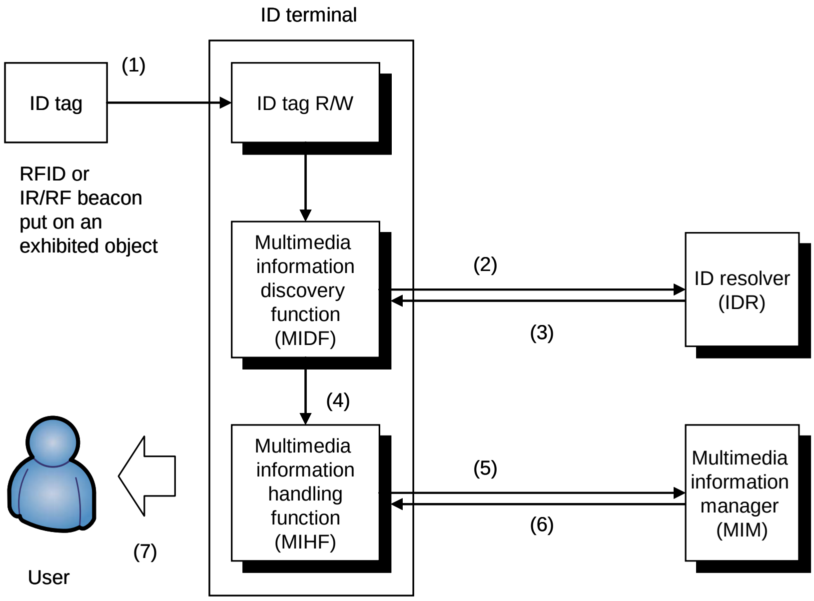


Figure II.3 – Implementation architecture and workflow of u-Museum services

II.3.3 Workflow

1) ID tag R/W obtains the identifier of the exhibited item in a gallery of u-Museum from the RFID or IR/RF beacon.

2) MIDF sends the identifier to the IDR to find the pointer and transfer protocol information of the associated MIMs.

3) The pointer and transfer protocol information of the MIMs is provided to the MIDF.

4) MIDF sends the information to the MIHF.

5) MIHF sends a multimedia information delivery service request to the MIMs.

6) Multimedia information associated with the identifier is delivered to the MIHF in the ID terminal.

7) User watches the multimedia information displayed by ID terminal.

II.4 Business card with personal identifier

II.4.1 Application scenario

Suppose that an identifier of a businessman is written on a business card. The identifier is associated to 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.

II.4.2 System architecture

The architecture in Figure II.4 implements this scenario.

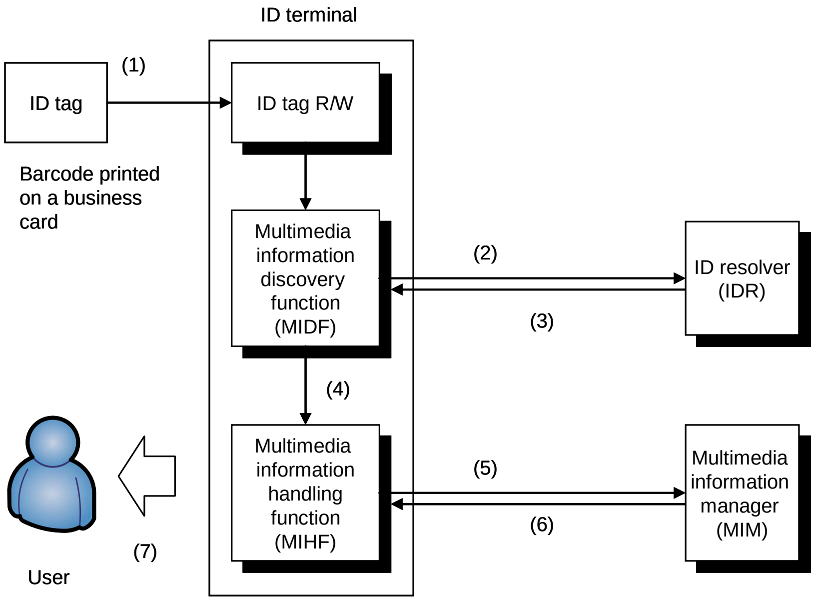


Figure II.4 – Implementation architecture and workflow of business card services

II.4.3 Workflow

1) ID tag R/W obtains the identifier of a person from the barcode printed on a business card (personal identifier).
2) MIDF sends the personal identifier to the IDR to find an associated personal information service.
3) Pointer and transfer protocol information of the MIMs are provided to MIDF.
4) MIDF sends the information to the MIHF.
5) MIHF requests the personal information delivery service of the MIMs with the personal identifier. The MIHF also sends the login name and password information for user authentication.
6) The personal information is delivered to the ID terminal according to the authentication result. If the user is authenticated as a valid business partner, the server will provide full contact information. If not, it will only provide an e-mail address.
7) User receives the personal information displayed by the ID terminal.

II.5 Presence service with multimedia information

II.5.1 Application scenario

Imagine a theatre in which every visitor has a ticket with RFID, and every seat in the theatre contains 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 visitor identifier and automatically notifies the theatre office of the visitor status through the theatre management application.

II.5.2 System architecture

In this scenario, the configuration of the system looks somewhat different from that of the other scenarios (Figure II.5). However, this architecture is a simple variation of the general system architecture in Figure 1. ID terminal consists of two physical components: ID tag R/W and personal computer equipped with a presence management application. In this case, a visitor's ticket is the real-world entity identified by the ID tag, and the theatre manager in the theatre office is the user of the multimedia information access. The theatre management server manages the presence information in the theatre, and delivers, for example, theatre seat status information in 2D map format to the ID terminal.

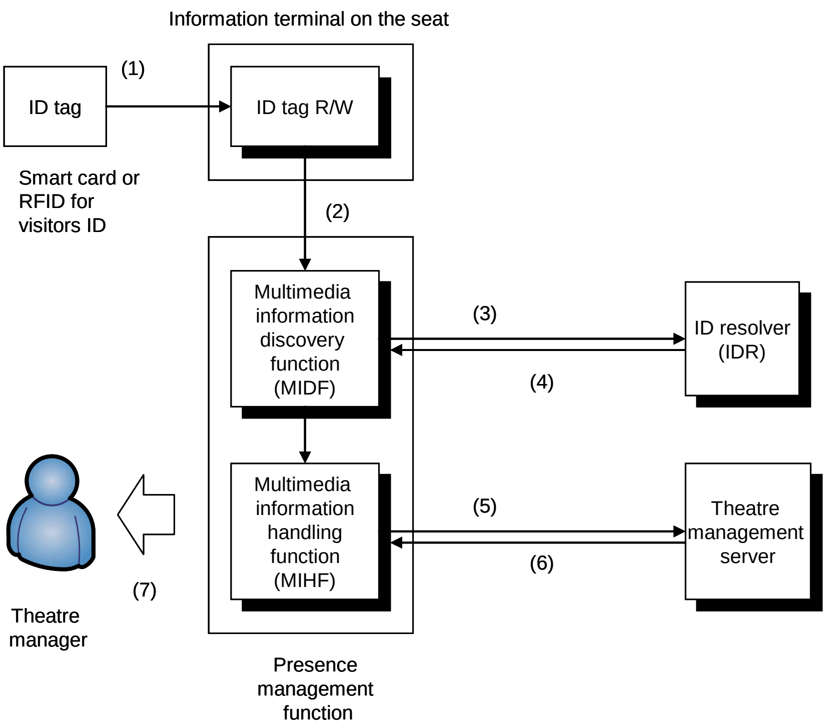


Figure II.5 – Implementation architecture and workflow of the presence service in theatres

II.5.3 Workflow

1) ID tag R/W of the theatre seat obtains the visitor identifier from the visitor's ticket.
2) ID tag R/W sends the visitor identifier to the MIDF in the presence management application.
3) MIDF sends the visitor identifier to the IDR to find the theatre management servers associated with the visitor identifier.
4) IDR informs the pointer and transfer protocol of the theatre management servers to the MIDF.
5) MIDF sends the information to the MIHF, which, in turn, requests the theatre management servers to obtain the presence information.
6) The server replies with the presence information.
7) Multimedia information browser updates the presence information according to the received information, and shows it to the theatre manager.

Bibliography

[b-ISO/IEC 18000-x] ISO/IEC 18000-x-series (2008), *Information technology – Radio frequency identification for item management*.
<http://www.iec.ch/searchpub/cur_fut.htm>

[b-ISO/IEC 18000-4] ISO/IEC 18000-4 (2008), *Information technology – Radio frequency identification for item management – Part 4: Parameters for air interface communications at 2,45 GHz*.
<http://webstore.iec.ch/webstore/webstore.nsf/artnum/041837>

[b-ISO/IEC 14443-x] ISO/IEC 14443-x-series (in force), *Identification cards – Contactless integrated circuit cards – Proximity cards*.
<http://webstore.iec.ch/webstore/webstore.nsf/artnum/039489>
<http://webstore.iec.ch/webstore/webstore.nsf/artnum/040281>
<http://webstore.iec.ch/webstore/webstore.nsf/artnum/040282>
<http://webstore.iec.ch/webstore/webstore.nsf/artnum/041675>

[b-ISO/IEC 7816-x] ISO/IEC 7816-x-series (in force), *Identification cards – Integrated circuit cards*.
<http://www.iec.ch/searchpub/cur_fut.htm>

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