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SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS

Broadband, triple-play and advanced multimedia services – Ubiquitous sensor network applications and Internet of Things

Multimedia information access triggered by tag-based identification – Identification scheme

Recommendation ITU-T H.642.1

ITU-T H-SERIES RECOMMENDATIONS

AUDIOVISUAL AND MULTIMEDIA SYSTEMS

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Recommendation ITU-T H.642.1

Multimedia information access triggered by tag-based identification – Identification scheme

Summary

Recommendation ITU-T H.642.1 defines an identification scheme for multimedia information access triggered by tag-based identification. Multimedia information associated with such an identifier can be retrieved using a resolution process.

This Recommendation provides a framework for accommodating the legacy existing identification schemes together with the new identification scheme defined here using a pair of object identifiers for the identification scheme and identifier itself.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T H.642.1	2012-06-29	16

Keywords

Identification scheme, identifier.

FOREWORD

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Introduction

The identification scheme defined in this Recommendation provides a new method for accessing multimedia content without typing its address on a keyboard or inputting the name of objects and/or places of relevant information. This is a major communication service that uses an identifier in data carriers such as radio frequency identifications (RFIDs), smart cards and barcodes.

The purpose of this Recommendation is to specify a new identification scheme to be used in applications and services where the existing identification schemes and their combinations cannot be used (see Appendix I for some examples).

From the standpoint of compatibility and reusability of existing identifier schemes, this Recommendation provides a framework to support multiple identification schemes. In this framework, it is possible that multiple existing identification schemes together with the proposed new identification scheme can be used for identification where appropriate. Each identification scheme is identified by an object identifier (OID) according to [ITU-T X.660].

Clause 6 introduces the concept of multiple identification schemes for multimedia information access triggered by tag-based identification.

Clause 7 specifies a new generic identification scheme for multimedia information access triggered by tag-based identification.

Appendix I provides additional information which explains why a new generic identification scheme is needed.

Recommendation ITU-T H.642.1

Multimedia information access triggered by tag-based identification – Identification scheme

1 Scope

This Recommendation defines an identification scheme for multimedia information access triggered by tag-based identification. This identification scheme is mainly used in the multimedia information system architecture defined in [ITU-T H.621]. It also satisfies the requirements defined in [ITU-T F.771].

This Recommendation does not define encoding rules to store the identifier value into data carriers such as barcode tags and RFID tags. When stored in a data carrier, the OID and identifier value shall be encoded according to the relevant international standards if such standards exist for the type of data carrier.

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.*

[ITU-T H.621]   Recommendation ITU-T H.621 (2008), *Architecture of a system for multimedia information access triggered by tag-based identification.*

[ITU-T H.642.2]   Recommendation ITU-T H.642.2 (2012), *Multimedia information access triggered by tag-based identification – Registration procedures for identifiers.*

[ITU-T X.660]   Recommendation ITU-T X.660 (2011) | ISO/IEC 9834-1:2012, *Information technology – Procedures for the operation of object identifier registration authorities: General procedures and top arcs of the international object identifier tree.*

[ITU-T X.668]   Recommendation ITU-T X.668 (2008) | ISO/IEC 9834-9:2008, *Information technology – Open Systems Interconnection – Procedures for the operation of OSI Registration Authorities: Registration of object identifier arcs for applications and services using tag-based identification.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 ID resolution [ITU-T F.771]: A function to resolve an identifier into associated information.

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

3.1.3   object identifier [b-ITU-T X.680]: A globally unique value associated with an object to unambiguously identify it.

3.2   Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1   class: Part of an identifier that defines the layout and interpretation of the following bit string inside the identifier, especially the length of the third level code (3LC) and fourth level code (4LC).

3.2.2   first level code (1LC): Part of the identifier that represents the identifier sub-blocks.

3.2.3   fourth level code (4LC): Part of the identifier which serializes individual multimedia information and services.

3.2.4   ITU-T H.642 identification scheme: Name given to the identification scheme defined in this Recommendation.

3.2.5   identification scheme: Definition and description of the structure of identifiers.

3.2.6   identifier value: String of characters that represents the value of the identifier.

3.2.7   second level code (2LC): Part of the identifier assigned to ITU Member States.

3.2.8   third level code (3LC): Part of the identifier assigned to an RA that handles the allocation of the subspace to other organizations.

4   Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

1LC	First Level Code
2LC	Second Level Code
3LC	Third Level Code
4LC	Fourth Level Code
EPC	Electronic Product Code
GIAI	Global Individual Asset Identifier
GRAI	Global Returnable Asset Identifier
ID	Identifier
IP	Internet Protocol
ISBN	International Standard Book Number
ISSN	International Standard Serial Number
OID	Object Identifier
RA	Registration Authority
RFID	Radio Frequency Identification
SGLN	Serialized Global Location Number
SGTIN	Serialized Global Trade Item Number

SSCC	Serial Shipping Container Code
URL	Uniform Resource Locator
URN	Uniform Resource Name
UUID	Universally Unique Identifier

5 Conventions

In this Recommendation, xx_2 denotes that number xx is expressed as a binary (base-2) number.

6 Concept of an identification scheme for multimedia information access triggered by tag-based identification

6.1 Overview

An identification scheme in this Recommendation is designed to discriminate multimedia information and services associated with "objects" or "places" of the real world in the architecture defined by [ITU-T H.621].

A data carrier such as an RFID tag which triggers access can be placed anywhere and its whereabouts is out of the scope of this Recommendation.

6.2 Uniqueness of ID value

Figure 1 gives an overview of the general approach to accommodate multiple identification schemes. Many different identification schemes can be used for multimedia information access triggered by tag-based identification. Each identification scheme should be identified by an object identifier (OID) under the arc `{joint-iso-itu-t(2) tag-based(27)}` as specified in [ITU-T X.668]. For example, in Figure 1, the top row indicates that Identification scheme 1 is identified by OID arch `{joint-iso-itu-t(2) tag-based(27) `i_1`}`.

Identifier schemes which are widely used and already have an OID allocated to them (not under arc `{joint-iso-itu-t(2) tag-based (27)}`) can continue to use that OID. In Figure 1, "Existing identification scheme 1", that has an OID value not under arc `{joint-iso-itu-t(2) tag-based(27)}` is identified by OID `{`x_1` `y_1` `z_1`}`.

For a given identifier scheme (identified by an OID), the uniqueness of identifier values is required to be managed by the organization which is allocating those values. That is, the uniqueness of identifier values should be managed by the registration authority (RA) for that identifier scheme with the cooperation of those who store identifiers into data carriers.
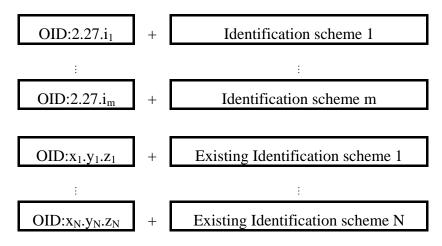

Figure 1 – Multiple identification schemes

7 ITU-T H.642 identification scheme for multimedia information access triggered by tag-based identification

7.1 Structure of an ITU-T H.642 identification scheme

The identification scheme defined in this Recommendation is called the ITU-T H.642 identification scheme. The ITU-T H.642 identification scheme consists of the fields: 'First Level Code' (1LC), 'Second Level Code' (2LC) and 'Class', followed by some of the elements ('Third Level Code' (3LC) and 'Fourth Level Code' (4LC)) as shown in Figure 2.

1LC	2LC	CLASS	3LC / 4LC						
4 bits	16 bits	4 bits	8 bits	16 bits	16	16	16	16	16
0001₂	16 bits	0000₂	Reserved						
		0001₂	Reserved						
		0010₂	Reserved						
		0011₂	Reserved						
		0100₂	Reserved						
		0101₂	Reserved						
		0110₂	Reserved						
		0111₂	Reserved						
		1000₂	Reserved						
		1001₂	3LC	4LC					
		1010₂	3LC		4LC				
		1011₂	3LC			4LC			
		1100₂	3LC				4LC		
		1101₂	3LC					4LC	
		1110₂	3LC						4LC
		1111₂	Reserved						
0000₂	Reserved for backward compatibility (see clause 7.2)								
0010₂ ~ 1111₂	Reserved for future use								

Figure 2 – Structure of an identifier

Table 1 – Field name and length

Field name	Length		
1LC	4 bits		
2LC	16 bits		
CLASS	4 bits		
3LC, 4LC	Variable length, but the sum of these is 104 bits		
	Value of class	**Length of 3LC**	**Length of 4LC**
	9	8 bits	96 bits
	10	24 bits	80 bits
	11	40 bits	64 bits
	12	56 bits	48 bits
	13	72 bits	32 bits
	14	88 bits	16 bits

7.2 First level code

1LC is 4 bits long and represents the identifier of sub-blocks. It serves as version information.

1LC from 0010_2 to 1111_2 are reserved for future use.

Part of the identifier sub-block with 1LC of 0000_2 shall be reserved to avoid conflict with the 'ucode' identification scheme [b-uID].

7.3 Second level code (2LC)

2LC is 16 bits long and is assigned to ITU Member States as specified in [ITU-T H.642.2].

7.4 Class

Class indicates the layout of a particular identifier format. There are different formats that correspond to Class 9, 10…, 14 as shown on Figure 2 (Class 0, 1, 2…, 8, 15 are reserved for future use).

7.5 Third level code (3LC)

The 3LC assignment is done by an entity that is assigned the 2LC of that subspace (see clause 7.3). A 3LC is assigned to an RA that handles the allocation of the subspace to other organizations. The subspace controlled by this RA is called the 3LC space. It has six different sizes from 16 bits to 96 bits by steps of 16 bits.

3LC spaces are assumed to be managed by entities such as companies, associations, universities, schools, local governments, etc.

7.6 Fourth level code (4LC)

4LC is a serialization number to identify individual multimedia information and services.

Appendix I

Survey on identification schemes

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

I.1   Introduction

The purpose of this appendix is to survey whether existing identification schemes (most of them being internationally standardized) satisfy the requirements found in [ITU-T F.771].

The currently existing schemes may not satisfy all the needs identified by [ITU-T F.771] that came later than the schemes themselves. The ITU-T H.642 identification scheme in this Recommendation is a complementary scheme to existing identification schemes. It is meant to fill the gaps left by existing schemes and identified by [ITU-T F.771] for particular classes of applications. It is complementary to existing schemes in this sense, and is not a competitor. This Recommendation outlines the framework to make these identification schemes co-exist in future applications to take advantage of all the existing schemes including the ITU-T H.642 identification scheme.

I.2   Need for a generic identification scheme for multimedia information access triggered by tag-based identification

A generic identification scheme in this Recommendation is applicable to multimedia information and services associated with any kind of objects and places. Any systems for multimedia information access triggered by tag-based identification should implement the generic identification scheme defined in this Recommendation.

I.3   Requirements on the identifier for multimedia information access triggered by tag-based identification

[ITU-T F.771] defines in clause 7.3 five requirements for identifiers for multimedia information access triggered by tag-based identification. The following gives clarification of each identifier requirement to stress that the identification scheme defined in this Recommendation satisfies these identifier requirements.

–   **ID-001: identifier is recommended to be used by different applications**.

   Multimedia information access triggered by tag-based identification specifies a mechanism of information processing and communication, but no applications. The mechanism is proposed and recommended to be used by any application. In other words, it is for "general purpose" use. Also, the identifiers should be for general purposes too. This means, it is recommended to be used by different applications. Most identification schemes can be used for many applications, so almost every identification scheme satisfies this requirement.

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

   "Tag-based identification" deals with every type of real-world entity e.g. tangible objects (items), persons and places because all of these can be targets of tag-based identification. (Although "people" is mentioned here, this Recommendation does not attempt to define an identifier for persons). In some applications, the information service is triggered by some tangible objects (items), persons or places. Thus, identifiers must be assignable to tangible objects, logical objects, people and places. It is important to note that many application target areas do not have an applicable international standard identification scheme. For example, locations with meanings, vegetables, fish, meat, houses, roads, buildings, bridges, boats, art items, posters and so on, do not have proper identification schemes based on an

international standard. This Recommendation is meant for such wider areas which lack any previous standard ID scheme.

– **ID-003: identifier is required to be issuable by any organization such as companies, non-profit organizations, governments and individual users**.

– ID-003 is a requirement for the governance of identification schemes. To satisfy this requirement, for example, even an individual without any corporate affiliation should be able to obtain identifiers, and identifiers must be allocated at a low enough cost. For example, if an identification scheme has a short company code bit field, and it is too short to be used by all the companies in the country or in the world, it does not satisfy this requirement. If the company code cannot be assigned to non-company organizations such as governments, NPOs, small businesses, schools and individuals, it does not satisfy this requirement. The governance of this Recommendation should satisfy this requirement.

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

Essentially, the identification scheme proposed must be a globally unique numbering system. When the same identifier is assigned to two different entities, confusion arises. However, some identification schemes do not follow this principle entirely. For example, an IP address system has a private address subspace in its numbering space, such as "192.168.1.1". Everyone can assign the private address to the network interfaces of his/her own networked machines. Some supply chain management (SCM) identification schemes have an "in-house ID code area", which can be used by shops or factories freely, thus the code area is not globally unique. In [b-ITU-T X.667], identifiers are generated automatically by a standard algorithm and procedure, so each identifier is assured to be almost globally unique. However, in theory, there is a small possibility of collisions when random number generators are used. Additionally, there may be bugs in the identifier generating software, and some unauthorised people may intentionally issue duplicate identifiers. Therefore, [b-ITU-T X.667] does not fully satisfy this requirement. The governance of this Recommendation is meant to satisfy this requirement.

– **ID-005: multiple identifier schemes are required to be supported**.

This is an important requirement to accommodate both the existing and the yet-to-appear future identification schemes.

Among the requirements outlined above, ID-005 is not a requirement for the identification scheme itself, but for the system that utilizes identifiers. Therefore, this requirement is excluded from the use case analysis. ID-001 is also excluded from the use case analysis because all the target identification schemes listed below satisfy this requirement.

I.4 Survey on existing identification schemes

I.4.1 Existing identification schemes

To make this use case analysis comprehensive, widely-used existing identification schemes from a wide range of application areas were studied.

I.4.1.1 EPC

The electronic product code (EPC) is a family of identification schemes proposed by EPCglobal. It is currently one of the most widely used identification schemes in the field of supply chain management, even though it is not a *de jure* international standard. It is designed to be used in a low-cost way for tracking goods using RFID technology, to meet the needs of various industries, to identify each item manufactured (unlike barcode systems), and to guarantee uniqueness for all EPC-compliant tags. This implies that the initial intention of EPC is to identify products manufactured by using RFID-based tags.

It contains a serialized global trade item number (SGTIN), a serial shipping container code (SSCC), a serialized global location number (SGLN), a global returnable asset identifier (GRAI) and a global individual asset identifier (GIAI).

I.4.1.2 ISO/IEC 15459-x

[b-ISO/IEC 15459-x] is an identification scheme designed for supply chain management because the original intended application of this identification scheme is for a supply chain management system.

I.4.1.3 ISO/IEC 6709

[b-ISO/IEC 6709] is an international standard representation of latitude, longitude and altitude for (fixed) geographic point locations. It is used by many GIS applications. But other kinds of ID-based applications such as a supply chain management system, which is intended for the identification of moving objects, cannot use this identification scheme. (It is impractical to replace identifiers whenever objects change their locations. We need a separation of the identifier value and the location information. The multiple identification schemes in [ITU-T H.621] would be effective here).

I.4.1.4 ISO 2108 International standard book number

The international standard book number (ISBN) is a numbering scheme for the identification of books.

I.4.1.5 ISO 3297 International standard serial number

The international standard serial number (ISSN) is a numbering scheme for the identification of serial publications such as newspapers, magazines, journals and annually published books globally.

I.4.1.6 Universally unique identifier

The universally unique identifier (UUID) in [b-ITU-T X.667] is an identification scheme designed for identifying information or components in the distributed systems without the assumption of any management systems of identifiers. One of the most famous implementation of UUID is Microsoft's GUID.

I.4.1.7 ISO/IEC 15963

[b-ISO/IEC 15963] is an identification scheme designed for RFID tags and mainly used for supply chain management. Since this identification scheme is designed only for RFID tags, it cannot be used for applications that require other kinds of ID tags such as a printing code.

I.4.1.8 ISO/IEC 11784

[b-ISO/IEC 11784] is an identification scheme designed for identifying animals.

NOTE – All of the above identification schemes other than EPC are *de jure* international standards, and also note that EPC is widely used.

I.4.2 Analysis

Surveys on existing identification schemes are in Table I.1. For comparison, the ITU-T H.642 identification scheme is also included in this analysis.

Table I.1 – Analysis of existing identification schemes

ID schemes	ID-002	ID-003	ID-004
EPC	Most identifiers are mainly assigned to objects, but not to logical objects. SSCC can be assigned for shipping containers and SGLN can be assigned only for locations.	Registered issuing agencies may issue identifiers and a hierarchical structure of issuing agencies is provided.	Each identifier is assured to be globally unique.
ISO/IEC 15459-x	Identifiers are mainly assigned for objects, but not places. Since this identification scheme is designed for ID tags, it is impossible to assign the identifier to any logical object.	Registered issuing agencies may issue identifiers and a hierarchical structure of issuing agencies is provided.	Each identifier is assured to be globally unique.
ISO 6709	Identifiers are assigned for geographic point locations. This identifier cannot be assigned to any objects that move around.	It is a representation for identifying geographic point locations, thus no one can issue the identifiers.	Each identifier is assured to be globally unique.
ISBN	ISBN numbers are assigned only for books and physical publications. ISBN numbers are not assignable for any logical objects and other physical objects.	Only affiliated organizations (sometimes national organizations) that manage books in the region or country may issue the ISBN numbers.	Identifiers are assured to be globally unique.
ISSN	ISSN numbers are assigned only for serial publications. ISSN numbers are not assignable for any other logical or physical objects.	Only affiliated organizations (sometimes national organizations) that manage serial publications in the region or country may issue the ISSN numbers.	Identifiers are assured to be globally unique.
UUID	Identifiers can be assigned for everything that can be identified.	Individual users or programs may issue identifiers. Since central coordination is difficult in this identification scheme, it is not suitable for organizations that want to control issuance of identifiers from the fixed numbering space that can freely be managed by the organization to hierarchically manage products.	Each identifier is almost assured to be globally unique, but there is small possibility of collisions (except if the UUID is registered as an OID).

Table I.1 – Analysis of existing identification schemes

ID schemes	ID-002	ID-003	ID-004
ISO/IEC 15963	Identifiers are mainly assigned for objects, but not places. Since this identification scheme is designed for RFID tags, it is impossible to assign the identifier to any logical objects.	This identifier is always written into RFID tags when a tag chip manufacturer produces an RFID tag. Only tag chip manufacturers can issues this identifier.	Each identifier is assured to be globally unique.
ISO/IEC 11784	Identifiers are assigned only for animals.	Registered issuing agencies may issue identifiers and a hierarchical structure of issuing agencies is provided.	Each identifier is assured to be globally unique.
ITU-T H.642 identification scheme	An ITU-T H.642 identifier can be assigned for multimedia information and services associated with any object or place.	Registered issuing agencies may issue identifiers and a hierarchical structure of issuing agencies is provided.	Each identifier is assured to be globally unique.

I.4.3 Summarized analysis

Table I.2 summarizes the information given in the preceding clauses. According to this investigation, it is considered that no existing identification scheme other than the ITU-T H.642 identification scheme satisfies all the requirements described in [ITU-T F.771].

Table I.2 – Summary of analysis

	ID-002	ID-003	ID-004
EPC	U	S	S
ISO/IEC 15459-x	U	S	S
ISO 6709	U	U	S
ISBN	U	S	S
ISSN	U	S	S
UUID	S	U	P
ISO/IEC 15963	U	P	S
ISO/IEC 11784	U	S	S
ITU-T H.642 identification scheme	S	S	S
S: satisfied, U: unsatisfied, P: Not strictly satisfied			

Bibliography

[b-ITU-T X.667]   Recommendation ITU-T X.667 (2008) | ISO/IEC 9834-8:2008, *Information technology – Open Systems Interconnection – Procedures for the operation of OSI Registration Authorities: Generation and registration of Universally Unique Identifiers (UUIDs) and their use as ASN.1 object identifier components*.

[b-ITU-T X.680]   Recommendation ITU-T X.680 (2002) | ISO/IEC 8824-1:2002, *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation*.

[b-ISO 2108]   ISO 2108 (2005), *Information and documentation – International standard book number (ISBN)*.

[b-ISO 3297]   ISO 3297 (2007), *Information and documentation – International standard serial number (ISSN)*.

[b-ISO 6709]   ISO 6709 (2008), *Standard representation of geographic point location by coordinates*.

[b-ISO 11784]   ISO/IEC 11784 (1996), *Radio frequency identification of animals – Code structure*.

[b-ISO/IEC 15459-x] ISO/IEC 15459-x, *Information technology – Unique identifiers*.

[b-ISO/IEC 15963]   ISO/IEC 15963 (2009), *Information technology – Radio frequency identification for item management – Unique identification for RF tags*.

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