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SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

Next Generation Networks – Frameworks and functional architecture models

Functional requirements and architecture of the NGN for applications and services using tag-based identification

Recommendation ITU-T Y.2016

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Recommendation ITU-T Y.2016

Functional requirements and architecture of the NGN for applications and services using tag-based identification

Summary

Recommendation ITU-T Y.2016 includes functional requirements and architecture of the NGN for the support of applications and services using tag-based identification. This Recommendation is based on the capabilities defined in Recommendation ITU-T Y.2213.

Source

Recommendation ITU-T Y.2016 was approved on 22 August 2009 by ITU-T Study Group 13 (2009-2012) under Recommendation ITU-T A.8 procedures.

Keywords

ID tag, ID terminal, frameworks, functional architecture, identifier, RFID, tag-based identification.

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Functional requirements and architecture of the NGN for applications and services using tag-based identification

1 Scope

This Recommendation based on [ITU-T Y.2012] covers extended features in order to support applications and services using tag-based identification in NGN.

This Recommendation describes functional requirements, functional architecture and functional entities in order to support the NGN service requirements and capabilities defined in [ITU-T Y.2213].

This Recommendation covers:

- Support of capabilities defined in [ITU-T Y.2213] from an architectural viewpoint;
- Functional requirements of the NGN architecture to support applications and services using tag-based identification;
- Functional architecture and entities extensions for applications and services using tag-based identification in NGN.

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 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*.

[ITU-T Y.2012] Recommendation ITU-T Y.2012 (2006), *Functional requirements and architecture of the NGN release 1*.

[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*.

[ITU-T Y.2701] Recommendation ITU-T Y.2701 (2007), *Security requirements for NGN release 1*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 associated information [ITU-T Y.2213]: The information which is associated with an identifier.

NOTE – Example associated information instances are URL, URN, IP address, E.164 number, etc.

3.1.2 forward identifier resolution [ITU-T Y.2213]: A function to resolve an identifier into an associated information.

3.1.3 ID tag [ITU-T Y.2213]: A physical object which stores one or more identifiers and optionally application data such as name, title, price, address, etc.

NOTE – It may have a communication capability with an ID terminal depending on implementations.

3.1.4 ID terminal [ITU-T Y.2213]: A device with a data reading and optional writing capability which reads (and optionally writes) identifier(s) and optionally application data from/into an ID tag.

NOTE – The data reading (and optionally writing) capability depends on implementations.

3.1.5 identifier resolution [ITU-T Y.2213]: A function to resolve an identifier into associated information (see "Forward identifier resolution") and vice versa (see "Reverse identifier resolution").

3.1.6 reference point [ITU-T Y.2012]: A conceptual point at the conjunction of two non-overlapping functional entities that can be used to identify the type of information passing between these functional entities.

NOTE – A reference point may or may not correspond to one or more physical interfaces between pieces of equipment.

3.1.7 reverse identifier resolution (or backward identifier resolution) [ITU-T Y.2213]: A function to resolve an associated information into a corresponding identifier. It is the reverse operation of the forward identifier resolution.

3.1.8 tag-based identification [ITU-T Y.2213]: The process of specifically identifying a physical or logical object from other physical or logical objects by using identifiers stored on an ID tag.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 functional architecture: A set of functional entities used to describe the structure of an NGN. These functional entities are separated by reference points, and thus, they define the distribution of functions. The functional entities can be used to describe a set of reference configurations. These reference configurations identify which reference points are visible at the boundaries of equipment implementations and between administrative domains.

3.2.2 functional entity: An entity that comprises a specific set of functions at a given location. Functional entities are logical concepts, while groupings of functional entities are used to describe practical and physical implementations.

3.2.3 identifier: An identifier is a series of digits, characters and symbols or any other form of data used to identify subscriber(s), user(s), network element(s), function(s), network entity(ies) providing services/applications, or other entities (e.g., physical or logical objects). Identifiers can be used for registration or authorization.

NOTE – Identifier can be either public to all networks, shared between a limited number of networks or private to a specific network (private identifiers are normally not disclosed to third parties).

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations:

ABG-FE Access Border Gateway Functional Entity

AN-FE Access Node Functional Entity

ANI Application Network Interface

APL-SCM-FE	Application Service Coordination Manager Functional Entity
AS-FE	Application Support Functional Entity
B2B	Business-to-Business
B2C	Business-to-Customer
DB	Data Base
DNS	Domain Name System
EN-FE	Edge Node Functional Entity
FE	Functional Entity
IBG-FE	Interconnection Border Gateway Functional Entity
ID	Identification
IP	Internet Protocol
IRI	Internationalized Resource Identifier
LDAP	Lightweight Directory Access Protocol
NACF	Network Attachment Control Functions
NGN	Next Generation Network
NNI	Network Node Interface
OID	Object Identifier
PD-FE	Policy Decision Functional Entity
PII	Personally Identifiable Information
RACF	Resource and Admission Control Functions
RFID	Radio Frequency Identification
SAA-FE	Service Authentication and Authorization Functional Entity
SUP-FE	Service User Profile Functional Entity
TRC-FE	Transport Resource Control Functional Entity
TTI	Tag to Terminal Interface
UNI	User Network Interface
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
URN	Uniform Resource Name
XNI	Any Network Interface

5 Conventions

None.

6 Functional requirements and functions of the NGN for applications and services using tag-based identification

6.1 NGN functional requirements

[ITU-T Y.2012] describes the NGN architectural functions to support NGN Release 1 services. In order to support applications and services using tag-based identification, NGN functions are required to be extended.

Clause 8.1 of [ITU-T Y.2213] requires that the following capabilities be supported by extension of the existing capabilities of NGN:

- Multi-identifier interpretation;
- Identifier resolution;
- Privacy management;
- Content distribution control;
- Device management;
- Profile management:
  - User profile;
  - Device profile.
- Quality of Service.

In addition, the following capabilities are supported by the existing capabilities of NGN (see clause 8.2 of [ITU-T Y.2213]):

- Service quality control;
- Location management.

Appendix I of [ITU-T Y.2213] also identifies non-NGN high-level service requirements which will not affect the existing functional capabilities of the NGN.

Based upon the analysis of [ITU-T Y.2213] service requirements and network capabilities (see Appendix I for further details), the following list can be supported by NGN functions and end-user functions.

- General requirements for identifiers:
  - Identifiers validation supported by NGN functions during identifier resolution.
- Identification of identifier schemes:
  - Supported by end-user functions in ID terminal.
- Application data encoding:
  - Encoded application data must be decoded in the ID terminal. Therefore, end-user functions in the ID terminal support application data decoding. The definition of this feature is outside the scope of this Recommendation.
- Identification service interworking:
  - Supported by NGN functions.
- Location information management:
  - Supported by NGN functions.
- Management of application mobility:
  - Supported by NGN functions.

- Traceability:
  - Supported by NGN functions. In many applications, traceability will affect PII and therefore these functions are required to be compliant with the legislation and regulation relevant to privacy and protection of PII.
- Identifier filtering:
  - Supported by end-user functions in the ID terminal.

6.2 Functional architecture model

NOTE – High-level reference architecture of ID-based application and services is given in Appendix II.

The capabilities for the support of applications and services using tag-based identification are supported by transport stratum functions, service stratum functions, end-user functions and management functions.

Figure 1 shows the overall functional architecture model of NGN to support applications and services using tag-based identification. More specifically, the figure shows the functions required for the support of applications and services using tag-based identification. Appendix III describes a use-case example based on functional architecture model.

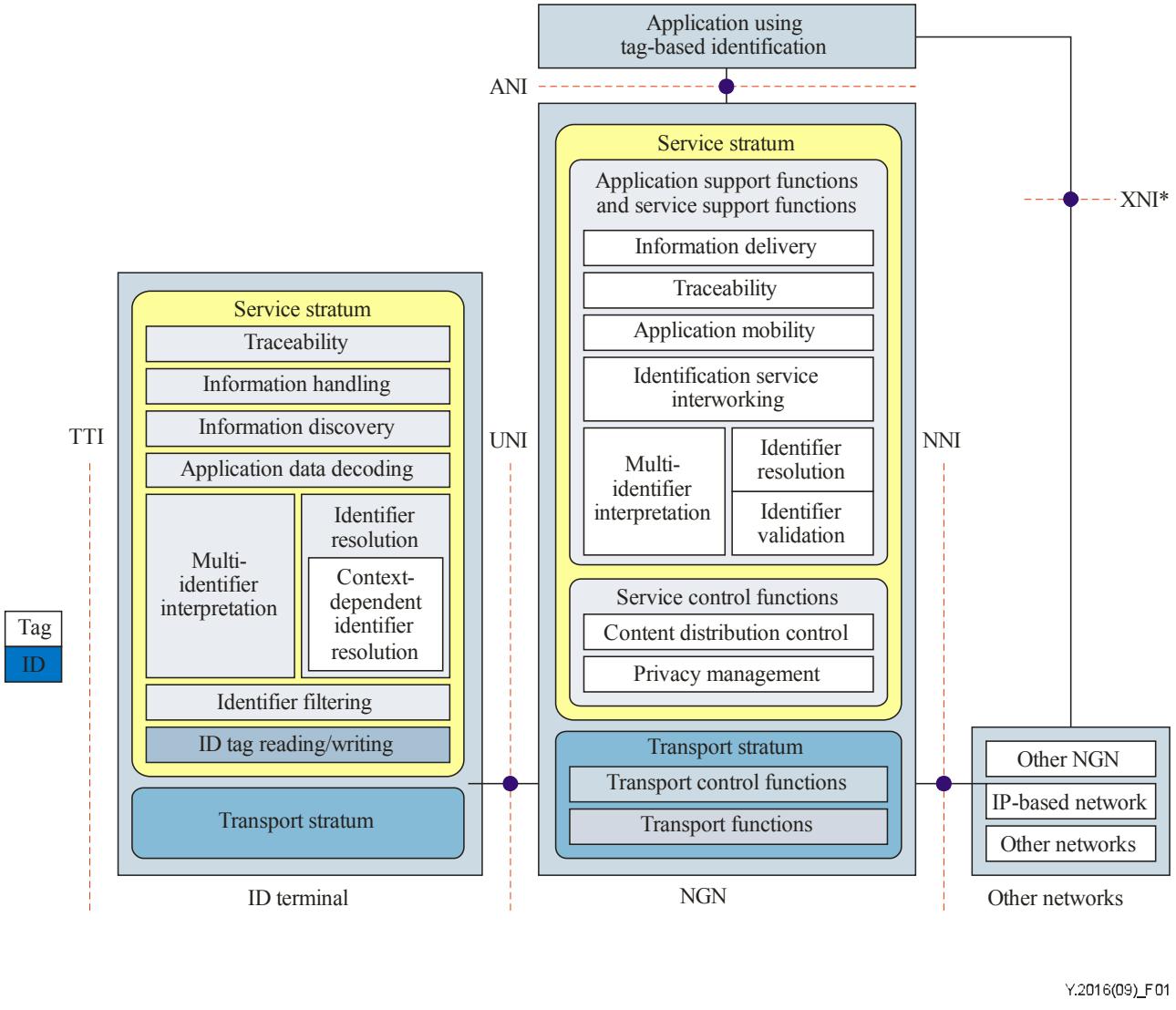

Figure 1 – Overall functional architecture model

6.3 Functions to support applications and services using tag-based identification

This clause describes how functional requirements identified in clause 6.1 are supported in the functional architecture model of clause 6.2. More specifically, this clause identifies how [ITU-T Y.2012] functions need to be extended to support applications and services using tag-based identification.

6.3.1 Transport stratum functions

Transport stratum functions are required to be extended to sustain the transaction volume caused by tag-based identification applications and services.

6.3.1.1 Transport functions

There are no extended capabilities on transport functions to support applications and services using tag-based identification. Access network functions, edge functions and core transport functions [ITU-T Y.2012] support different QoSs, according to the service quality requirements.

6.3.1.2 Transport control functions

The following functional requirements are supported by transport control functions [ITU-T Y.2012]:

- Service quality control:

  Resource and admission control functions (RACF) provide different QoS, according to service quality requirements.

- Location management:

  Network attachment control functions (NACF) support location information management of ID terminal and/or ID tag.

In addition, transport control functions are needed to be extended to support the following capability:

- Quality of Service (Application transaction and traffic requirements):

  Data and signalling traffic caused by tag-based identification applications and services will be increased and access concentration to single resources (e.g., identifier resolution) may happen. Resource and admission control functions (RACF) are required to provide the capability to sustain transaction volume caused by tag-based identification applications and services. In addition, resource and admission control functions (RACF) are recommended to provide traffic distribution using traffic overload control mechanisms.

6.3.2 Service stratum functions

Service stratum functions are required to be extended to support requirements of applications and services using tag-based identification. Extensions of service stratum functions are given in the following subclauses.

6.3.2.1 Service control functions

- Privacy management handling:

  The service user profile is recommended to contain the privacy management profile as a part of the whole profile information. Therefore, service control functions are recommended to provide the capability to handle the privacy management.

- Content distribution control:

  [ITU-T Y.2213] indicates that facilities for control of information content distribution are recommended to be supported (to accommodate possible commercial, regulatory and privacy requirements). Service control functions are recommended to provide content distribution control functions on the basis of the service user profile.

6.3.2.2 Application support functions and service support functions

Application support functions and service support functions are extended with the following functions:

- Multi-identifier interpretation:

  Multi-identifier interpretation is provided by using OID-based identifier interpretation. To support the OID-based identifier interpretation, NGN is required to support OID-based identification scheme, such as [ITU-T X.668], and can optionally provide structure information of identifier schemes based on OID. Application support functions and service support functions are required to support multi-identifier interpretation and can optionally provide structure information of identifier schemes to end-user terminal.

- Identifier resolution:

  Identifier resolution is a procedure that allows finding associated information resources with a given identifier. The application support functions and service support functions are recommended to provide identifier resolution function.

- Identifier validation:

  Lifetime requirement of identifier depends on applications and services. Identifiers are validated according to identifier lifetime. The application support functions and service support functions can optionally provide identifier validation function. This identifier validation capability can be provided during identifier resolution process.

- Identification service interworking:

  The application support functions and service support functions can optionally support identification service interworking which allows interworking of different tag-based identification applications and services.

- Application mobility:

  A communication association can be handed over to other applications by application mobility. A typical example is given for a transportation application. In route from A to C via B, the association of a fare application between A and B has to be handed over to the other fare application between B and C in order to support the single fare association. Application mobility can be optionally provided among different tag-based identification applications and services by the application support functions and service support functions.

- Traceability:

  The application support functions and service support functions support traceability. Traceability provides ID terminal's history of reading an ID tag for an object or tag-based identification applications and services' history of reading an ID tag for an object. Any distribution of information in support of traceability shall meet national legal and regulatory requirements on data privacy and protection.

  NOTE – Traceability mechanism and referential information flows are given in Appendix IV.

- Information delivery:

  The information delivery functions receive content from the application functions, store, process, and deliver it to the end-user functions using the capabilities of the transport functions, under control of the service control functions.

6.3.3 End-user functions

End-user functions are required to support requirements of applications and services using tag-based identification. The following functions are provided by end-user functions:

- Multi-identifier interpretation:

  End-user functions can optionally support multi-identifier interpretation using OID-based identifier interpretation. Application support functions can optionally provide structure information of identifier schemes based on OID to end-user functions. End-user functions use this structure information to support multi-identifier interpretation.

- Identifier resolution:

  End-user functions are required to support identifier resolution. End-user functions send identifier resolution request to NGN and application support functions and service support functions in order to perform identifier resolution.

- Context-dependent identifier resolution:

  End-user functions can optionally support usage context of the identifier capability for context-dependent identifier resolution under one-to-many associations between an identifier and associated information instances. End-user application functions can send usage context of the identifier to the appropriate identifier resolution serving function in the NGN.

- Application data decoding:

  Identifier information may be encoded optionally with other application data like title, name, price, etc., into an ID tag in a standardized way. Therefore, end-user functions support application data decoding in a standardized way. The definition of this feature is outside the scope of this Recommendation.

- Traceability:

  When ID terminal reads ID tag, the ID terminal is required to send location information to NGN, with location information and identifier gained from ID tag. End-user functions are required to support the sending of the location information and usage information of identifiers to the NGN. Any distribution of information in support of traceability shall meet national legal and regulatory requirements on data privacy and protection.

  NOTE – Traceability mechanism and referential information flows are given in Appendix IV.

- ID tag reading and writing:

  These functions provide communication interfaces to ID tag. These functions include reading and writing of a single or multiple identifiers as well as application data from and into the ID tag. The information resulting from ID tag reading is sent to the identifier resolution function for further processing. ID terminal can optionally contain multiple ID tag reading and/or writing functions.

- Identifier filtering:

  End-user functions support identifier filtering in order not to process unsolicited ID tags or identifier schemes.

- Information discovery:

  This function obtains identifier from ID tag, and issues queries to identifier resolution functions in NGN. It uses the identifier as a query key in both cases. The identifier resolution function returns pointer information (e.g., URL) for the information delivery services. After obtaining the pointer information, the information discovery function sends the information to the information handling function.

- Information handling:

  This function provides a capability to download relevant information from information delivery services, and to present the downloaded information to the user.

6.3.4 Management functions

Management functions are required to be extended to support requirements of applications and services using tag-based identification. Extensions of management functions are as follows:

- Device management and device profile management (ID terminal and ID tag management):

  Applications using tag-based identification require a number of ID terminals and ID tags to capture identifier and relevant information from ID tags. ID terminals and ID tags consist of a number of technical features in aspects of radio operations, network operations, software upgrade, time synchronization, device identifier, identifier structure information, and filtering rules which need monitoring and maintenance. Management functions are recommended to support ID terminal and ID tag management functions with device profile management.

7 Functional architecture of the NGN for applications and services using tag-based identification

Functional entities defined in [ITU-T Y.2012] need to include additional functions in order to be used for the support of applications and services using tag-based identification.

Based on the functions provided in clause 6.3, this clause identifies potential extensions required to the functional entities of the generalized NGN functional architecture shown in Figure 3 of [ITU-T Y.2012].

NOTE – This Recommendation uses the naming conventions of NGN FEs as defined in [ITU-T Y.2012].

7.1 Transport processing functional entities

7.1.1 T-2 Access node functional entity (AN-FE)

- Service quality control:

  The AN-FE supports different QoSs, according to the service quality requirements.

7.1.2 T-3 Edge node functional entity (EN-FE)

- Service quality control:

  The EN-FE supports different QoSs, according to the service quality requirements.

7.1.3 T-5 Access border gateway functional entity (ABG-FE)

- Service quality control:

  The ABG-FE supports different QoSs, according to the service quality requirements.

7.1.4 T-6 Interconnection border gateway functional entity (IBG-FE)

- Service quality control:

  The IBG-FE supports different QoSs, according to the service quality requirements.

7.2 Transport control functional entities

7.2.1 T-16 Policy decision functional entity (PD-FE)

- Quality of Service (Application transaction and traffic requirements):

  The PD-FE is required to support QoS capabilities to sustain the transaction volume caused by tag-based identification applications and services. Also, the PD-FE is recommended to support QoS capabilities to be able to avoid access concentration to single resources (e.g., identifier resolution).

7.2.2 T-17 Transport resource control functional entity (TRC-FE)

- Quality of Service (Application transaction and traffic requirements):

  The TRC-FE is required to handle transaction volume of applications using tag-based identification and to provide access distribution to single resource.

7.3 Service control functional entities

7.3.1 S-5 Service user profile functional entity (SUP-FE)

- Privacy management:

  The SUP-FE is recommended to support privacy management.

- Content distribution control:

  The SUP-FE is recommended to provide information for content distribution control using the service user profile.

7.3.2 S-6 Service authentication and authorization functional entity (SAA-FE)

- Privacy management:

  The SAA-FE is recommended to provide privacy management when consulting the SUP-FE.

- Content distribution control:

  The SAA-FE is recommended to provide information for content distribution control.

7.4 Application support functions and service support functions

7.4.1 A-1 Application support functional entity (AS-FE)

The following text does not mandate that the same instance of AS-FE has to support the functions listed in this clause but allows for the case where these functions are supported by different instances of the AS-FE (e.g., identifier resolution and traceability can be supported in two different instances of AS-FE).

- Multi-identifier interpretation:

  The AS-FE is required to support the OID-based identification scheme specified by [ITU-T X.668]. Also, the AS-FE can optionally provide structure information of identifier schemes to the end-user terminal.

- Identifier resolution:

  The AS-FE is recommended to provide identifier resolution function. Identifier resolution function may be a part of AS-FE or an external entity of the NGN. In case of external entity, the AS-FE interacts with the external entity, via the ANI, to perform the identifier resolution process.

- Context-dependent identifier resolution:

  The AS-FE can optionally support context-dependent identifier resolution under one-to-many associations between an identifier and associated information instances using usage context of the identifier received from the end-user application.

- Identifier validation:

  The AS-FE can optionally provide identifier validation capability that can be performed during the identifier resolution process.

- Traceability:

  The AS-FE can optionally support traceability. In applications and services using tag-based identification, service providers maintain specific systems for traceability like database system. The AS-FE can optionally support traceability functions in cooperation with these specific systems. In case that this database system is maintained in NGN, AS-FE is required to support intercommunicating with end-user functions and receive location information and usage information about the identifier.

- Information delivery:

  The AS-FE supports information delivery. The AS-FE delivers contents to the end-user functions using the capabilities of the transport functions.

7.4.2 A-3 Application service coordination manager functional entity (APL-SCM-FE)

- Identification service interworking:

  The APL-SCM-FE can optionally support identification service interworking between B2C and B2B or some other cooperative business relationships as well as different application and service infrastructures using tag-based identification.

- Application mobility:

  The APL-SCM-FE can optionally support application mobility among different tag-based identification applications and services.

8 Security

Security considerations regarding the functional requirements and architecture of the NGN are addressed in [ITU-T Y.2701].

Appendix I

Analysis of service requirements and network capabilities defined in [ITU-T Y.2213]

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

I.1 NGN service requirements of tag-based identification applications and services

[ITU-T Y.2213] defines the following NGN service requirements for applications and services using tag-based identification.

Requirement	Explanation
Multi-identifier interpretation requirements	An identifier constituted by sub-identifier elements is required to be interpreted into sub-identifiers by its structure information. To interpret multi-identifier, identifier structure information may be provided to ID terminal.
Identifier resolution	Identifier resolution is a procedure to find information resources associated with the identifier. Association between identifier and information can be one-to-one or one-to-many. Different associated information for an identifier may be resolved according to usage context of the identifier, for example, who/when/where/why, which is called context-dependent identifier resolution.
ID terminal and ID tag management	The NGN may monitor and manage ID terminal and ID tag in aspects of radio operations, network operations, software upgrade, time synchronization, device identifier, identifier structure information, filtering rules update and location registration and management.
Content distribution control	It is recommended that facilities for control of information content distribution should be supported (to accommodate possible commercial, regulatory and privacy requirements).
Privacy management	There are many privacy threats in applications and services using tag-based identification. Therefore privacy protection must be prepared.
Location-based services support	Location information of ID terminal and/or ID tag is recommended to be registered (either statically or dynamically) and may be provided if requested by tag-based applications and services.
Service quality control	Some tag-based identification applications and services may have different service quality requirements. It is recommended to provide different service qualities according to service quality requirements.
Application transaction and traffic requirements	It is required to manage the transaction volume generated by tag-based identification applications and services, and to be able to avoid access concentration to single resources.

I.2 Non-NGN high level service requirements of tag-based identification applications and services

[ITU-T Y.2213] defines the following non-NGN high level service requirements of applications and services using tag-based identification.

Requirement	Explanation
General requirements for identifiers	Identifier satisfies the requirements such as uniqueness of identifier, lifetime, Identifier validation, registration or authorization of identifier, and sharing identifier between several applications/services.
Identification of identifier schemes	Identifiers assigned by a certain identifier scheme are required to be distinguishable from identifiers assigned by other identifier schemes, because NGN may handle various identifier schemes.
Application data encoding	Identifier information may be encoded optionally with other application data like title, name, price, etc., into an ID tag. Therefore, application data is required to be encoded in a standardized way on ID tags that are used by tag-based identification applications and services.
Identification service interworking	Various ID-based services and applications are required to be interworked. For example, B2C tag-based identification applications and services can be combined with B2B into B2B2C service model and barcode-based services and RFID-based services should be integrated.
Location information management	Applications may require ID terminal location information or ID tag location information, and will know who is to use this location information. User location, that is an ID terminal location, can be provided using GPS or cell information from cellular networks and so on. ID tag location may be included in the ID tag itself, or retrieved from a service provider via an identifier.
Management of application mobility	Application mobility is recommended to be provided among different tag-based identification applications and services, because an ID tag might be moved among them with a requirement that their communication associations should be retained.
Traceability	Traceability relates to object traceability and usage traceability. For some use cases, it is recommended to provide the information on what an ID terminal has read an ID tag for an object and to provide the information on what tag-based identification applications and services have read an ID tag for an object.
Identifier filtering	Users, applications modules, middleware functions, or lower-layer read functions do not have to process unsolicited ID tags or identifier schemes. Proper filtering is recommended to be provided.

I.3 NGN requirements supported by extensions or additions of NGN Release 1 capabilities

[ITU-T Y.2213] suggests that the following NGN capabilities are required to be extended or added. This clause allocates proper functions of NGN to satisfy the capabilities.

Requirement	Functions supporting requirement
Multi-identifier interpretation requirements	• End-user functions • Application support functions and service support functions
Identifier resolution	• Application support functions and service support functions • End-user functions
Device management (ID terminal and ID tag management in Appendix III)	• Management functions
Content distribution control	• Service control functions with service user profile
Privacy management	• Service control functions with service user profile
User profile (To satisfy privacy management)	• Service control functions
Device profile (To satisfy device management)	• Management functions
Quality of Service (Application transaction and traffic requirements in Appendix III)	• Resource and admission control functions (RACF)

I.4 NGN requirements supported by existing NGN Release 1 capabilities

[ITU-T Y.2213] suggests that the following NGN capabilities are supported by existing NGN Release 1 capabilities.

Requirement	Functions supporting requirement
Service quality control	• Access network functions • Edge functions • Core transport functions • Resource and admission control functions (RACF)
Location management	• Network attachment control functions (NACF)

I.5 Non-NGN high level service requirements supported by NGN Release 1 capabilities

[ITU-T Y.2213] defines the following non-NGN high level service requirements, but some requirements are needed to be supported by NGN functions.

Requirement	Functions supporting requirement
General requirements for identifiers – Identifier validation	• Application support functions and service support functions through identifier resolution
Identification of identifier schemes	• Not applicable
Application data encoding	• End-user functions – End-user functions shall support application data decoding, but this is not in the scope of this Recommendation.
Identification service interworking	• Application support functions and service support functions
Location information management	• Network attachment control functions (NACF)
Management of application mobility	• Application support functions and service support functions
Traceability	• Application support functions and service support functions • End-user functions
Identifier filtering	• End-user functions support identifier filtering

Appendix II

High-level reference architecture of ID-based applications and services in the NGN

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

Figure II.1 depicts high-level reference architecture for the support of ID-based applications in the NGN.

User terminal (ID terminal equipment), service providers and the NGN domains are major components. ID terminal is a device that reads the ID tag and/or writes data to the ID tag. An ID terminal can be connected to the NGN via different types of access networks. ID-based services which are related to the identifier(s) stored in the ID tag are provided to end-users by service providers.

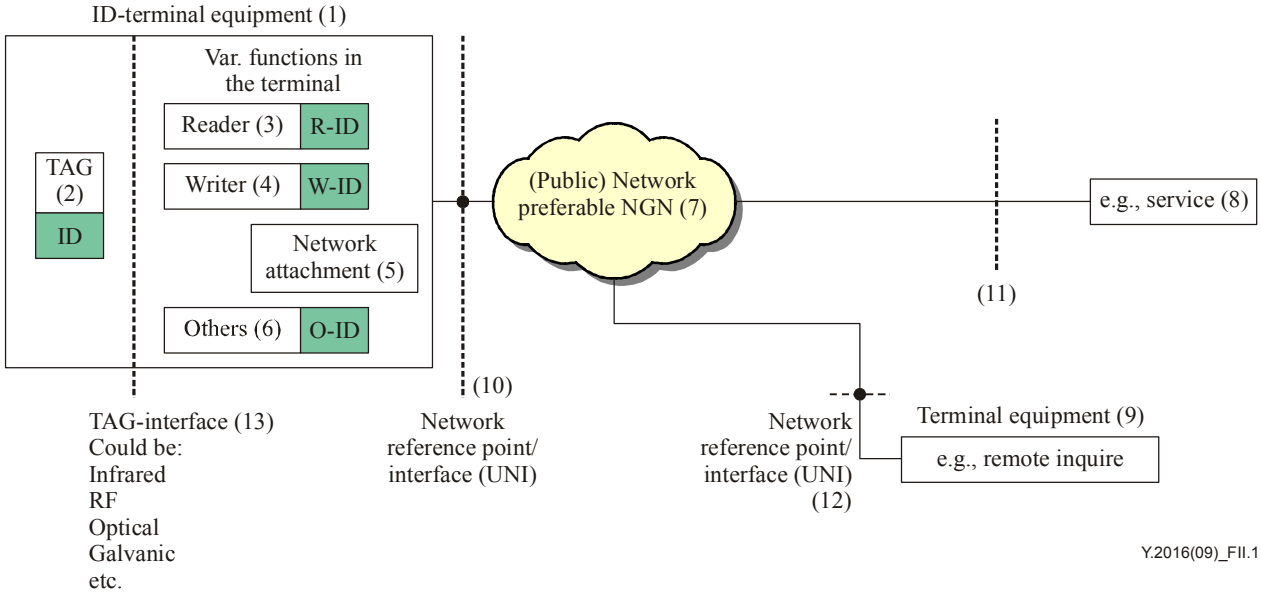

Figure II.1 – High-level reference architecture

Figure II.1 shows very generic and simplified high-level reference architecture. It illustrates the main objects, reference points as well as functional blocks for the support of ID-based applications and services in the NGN. In this figure, the "public network" corresponds to the NGN. Reference point (11) relates to service support and control functions for ID-based applications and services.

Refer to Appendix III of [ITU-T Y.2213] for example scenarios of tag-based identification applications and services, and more specifically to typical B2B and B2C network configuration models.

Appendix III

Use-case example of applications using tag-based identification in the NGN

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

Typical ID-based applications and services can generally be provided with four steps as follows:

1) Reading identifier from ID tags: End-user reads identifier from ID tag with ID terminal (ID tag reading/writing functions).

2) Identifier resolution process: Identifier itself has no meaning for an end-user. Identifier resolution is a procedure to find the location of the information resources (service/content) which are associated with the identifier. The location of the information can be presented as URI, URL, IRI, etc. that provide how to access to and where to locate the final target content. Identifier resolution process is performed in the NGN. This means that some functional entities (FEs) are required to support identifier resolution capability. An NGN FE can perform identifier resolution process by itself or commit identifier resolution to external identifier resolution server. Identifier resolution protocol can be implemented with a directory service protocol such as X.500, LDAP or DNS.

3) Selection of content/service: The end-user obtains the result of identifier resolution request. The result will be in a form of a content/service list. Then the end-user chooses the preferred content/service from the list. Choosing the service in the ID terminal leads to finding the service provider for the service with its locator such as URI, URL or IRI.

4) Service delivery: After the end-user has chosen the service, the end-user is connected to the corresponding service provider through the NGN. The chosen service is delivered to the end-user by the service provider via the NGN.

Figure III.1 illustrates an example use-case where the end-user reads the identifier stored in ID tags attached to a movie poster. The end-user reads the identifier with his/her ID terminal, then the ID terminal sends an identifier resolution request to the NGN. The identifier resolution is processed by the NGN itself or with the aid of the NGN. The end-user obtains a service list including a trailer service as a result of the identifier resolution request. A trailer service is provided by a service provider. This example assumes the following:

- A movie poster has media for storing an identifier.
- A service provider creates a trailer service for that movie and associates that service with the identifier.
- The end user is provided an ID terminal (e.g., containing a RFID reading function, ID tag reading/writing functions).
- The reading identifier by the ID terminal involves an identifier resolution with which a user can acquire a service list associated with the identifier.

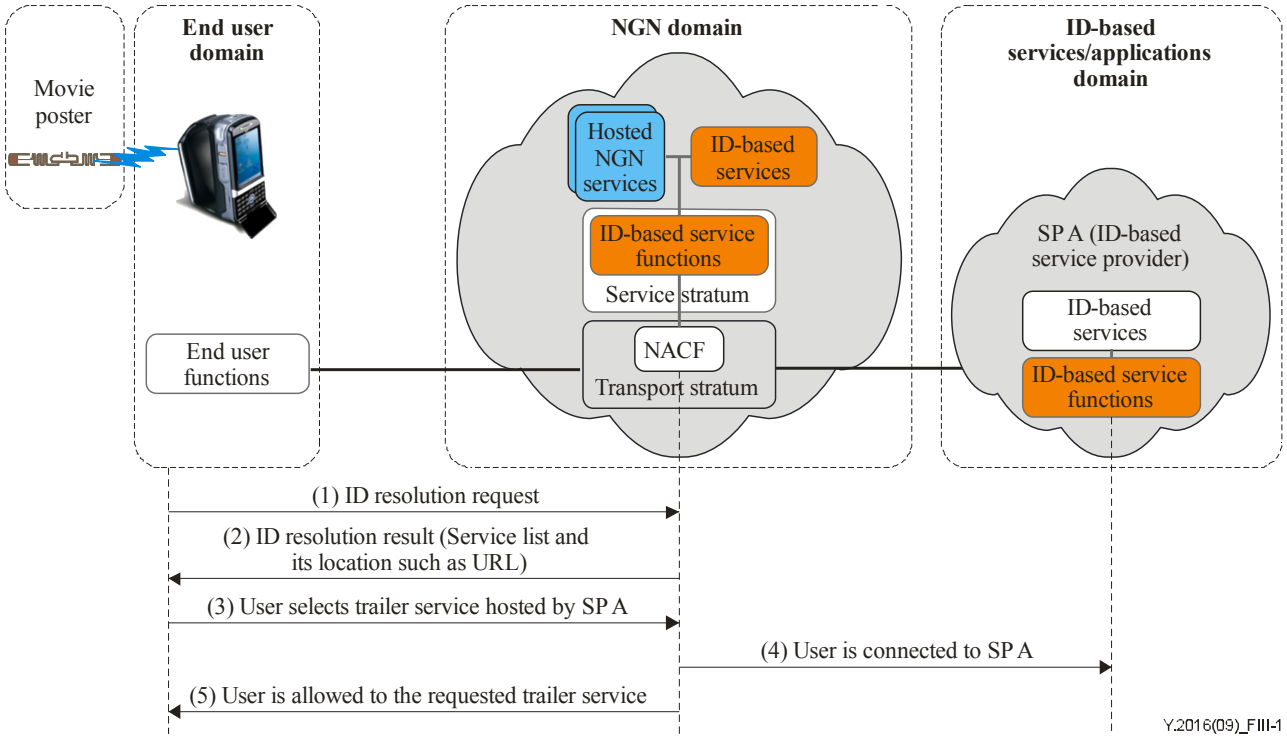

Figure III.1 – Typical ID-based application and services information flow

The information flows are summarized as follows:

(1) The end-user device reads the identifier from the movie poster. For the identifier resolution, the end-user device attaches to the NGN service provider and requests identifier resolution.

(2) The NGN service provider performs identifier resolution using the identifier resolution protocol such as DNS, X.500 or specific protocols. The result of the identifier resolution process includes a service list and its location.

For example, service list may have "1. Preview, 2. Ticketing, 3. Review" services and its location may be "1. http://www.xxx.com/preview/themovie.html",
2. http://www.xxx.com/ticket/themovie.html",
3. http://www.xxx.com/review/themovie.html".

(3) The end-user selects "Preview" service hosted by service provider A.

(4) The end-user is connected to service provider A through the NGN service provider.

(5) "Preview" service is delivered to the user through the NGN service provider.

Appendix IV

Traceability mechanism and referential information flows

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

Due to the mobility of the objects that contain an ID tag (called "ID tagged objects"), it is useful to get the current ID tag's position, and to know how the ID tagged object has been treated and what the ID tagged object has been used for. This information can be preserved in a database for traceability, called "track information database" in this appendix.

Because of mobility, it is difficult to configure this traceability information statically, and therefore a dynamic mechanism needs to be considered.

Any distribution of information in support of traceability shall meet national legal and regulatory requirements on data privacy and protection.

IV.1 Traceability mechanism

The traceability mechanism is as follows:

1) ID tagged object traceability

   It is unreasonable for the ID tagged object to transfer its location information to the network, since an ID tagged object has generally limited power. Given that the communication distance between the ID tag reading function and the ID tag is usually very short (i.e., within a few metres), and given that end-user functions containing the ID tag reading function usually have more intelligence, the track information DB stores the location information of the ID tag reading function as the location of ID tag.

   When a given ID tag reading function in the end-user functions identifies a new ID tag, the end-user functions send location information and the identifier of the ID tag to the track information DB.

2) Usage traceability

   The operation of writing/reading (to) ID tag(s), and the handling of identifier(s) stored in ID tag(s) are performed by the end-user functions. In order for the track information DB to get usage-related information, end-user functions can be required to send usage-related information to the track information DB.

IV.2 Information flows

Figure IV.1 provides an example of information flows for object traceability and usage traceability.

Detailed flows are as follows.

(1) End-user functions read an identifier from the ID tag. As a result, the corresponding end-user functions request ID resolution.

(2) ID resolution function provides the result of resolution to the end-user functions, including the URL of the track information DB and other relevant information.

(3) End-user functions notify the location information to the track information DB. The location information can be the location information of the ID reader or more globally of the end-user functions.

(4) As a result, the track information DB provides a confirmation notification.

End-user functions may perform some operations on the ID tag such as writing data or invoking some services. Such operations may be reported to the track information DB as follows:

(5) End-user functions notify the track information DB about the usage description.

(6) As a result, the track information DB returns a confirmation notification.

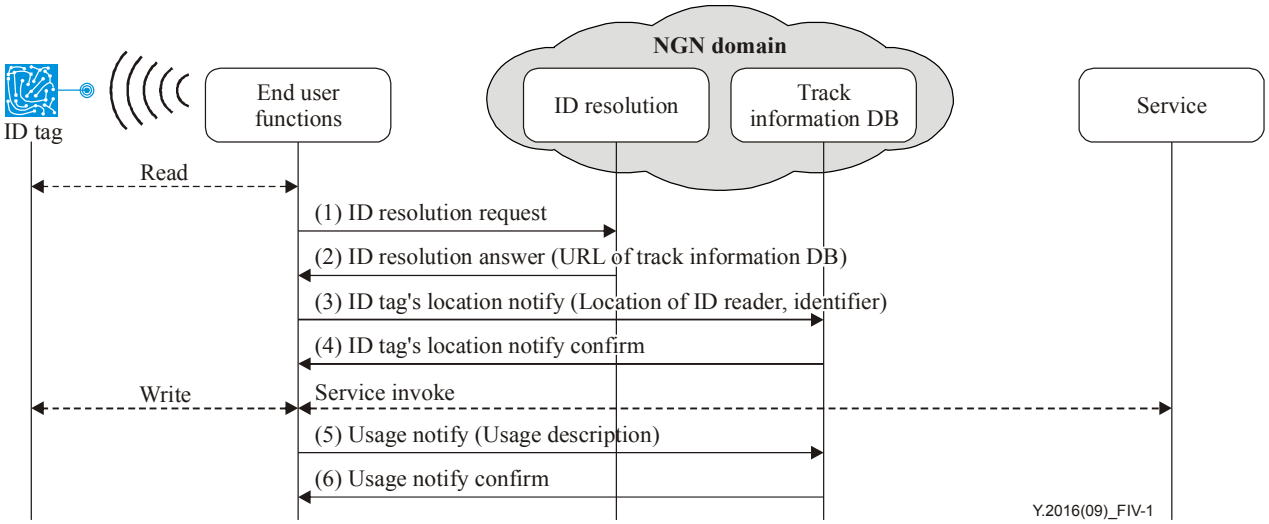

Figure IV.1 – Example of information flows for object traceability and usage traceability

Bibliography

[b-ITU-T Y.2001] Recommendation ITU-T Y.2001 (2004), *General overview of NGN*.

[b-ITU-T Y.2011] Recommendation ITU-T Y.2011 (2004), *General principles and general reference model for Next Generation Networks*.

[b-ITU-T Y.2201] Recommendation ITU-T Y.2201 (2007), *NGN release 1 requirements*.

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