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

Next Generation Networks – Service aspects: Service capabilities and service architecture

Requirements for information control networks and related applications

Recommendation ITU-T Y.2239

International Telecommunication Union

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Recommendation ITU-T Y.2239

Requirements for information control networks and related applications

Summary

An information control network (ICN) is a logical network providing services over digital television infrastructure characterized by high-reliable data transfer, service management and traffic control.

ICN allows the organization of a trusted environment for the provisioning of mission-critical services, such as emergency management, e-government, e-commerce and e-health, by introducing the ICN operator as a single point of service management.

The usage of the digital television infrastructure is effective in terms of large geographical area coverage.

Where next generation network (NGN) is available, ICN typical deployments combine the usage of digital television infrastructure with NGN for an increased service offer while reducing NGN bandwidth requirements for service users (this is extremely relevant for areas not covered by broadband access).

Recommendation ITU-T Y.2239 provides a description of ICN and general characteristics of ICN applications. It then describes requirements of ICN applications and specifies extended or new NGN capability requirements based on the identified requirements.

History

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* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

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Recommendation ITU-T Y.2239

Requirements for information control networks and related applications

1 Scope

This Recommendation deals with information control networks (ICN) that provide services utilizing digital television (TV) infrastructure, focused on high-reliable data transfer, service management and traffic control.

ICN allows the organization of a trusted environment for the provisioning of mission-critical services, such as emergency management, e-government, e-commerce, e-health, by introducing the ICN operator as a single point of service management.

This Recommendation provides a description and general characteristics of ICN applications, i.e., applications which use the capabilities of ICN. It also describes requirements of ICN applications and, based on the identified requirements, specifies extended or new next generation network (NGN) capability requirements with respect to the NGN capabilities as described in [ITU-T Y.2201].

The scope of this Recommendation includes:

- an overview of ICN including business roles for the provisioning of ICN applications;
- general characteristics of ICN applications;
- requirements of ICN applications;
- requirements of extended or new NGN capabilities based on the requirements of ICN applications.

NOTE – This Recommendation covers the requirements of NGN capabilities for support of ICN applications (typical deployment of ICN with NGN). The capability requirements of the whole ICN infrastructure (the digital television infrastructure is also used in a typical deployment of ICN) are out of scope of this Recommendation.

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 Y.2201] Recommendation ITU-T Y.2201 (2009), *Requirements and capabilities for ITU-T NGN*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following term defined elsewhere:

3.1.1 next generation network (NGN) [b-ITU-T Y.2001]: A packet-based network able to provide telecommunication services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service-related functions are independent from underlying transport-related technologies. It enables unfettered access for users to networks and to competing

service providers and/or services of their choice. It supports generalized mobility which will allow consistent and ubiquitous provision of services to users.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 information control network (ICN): A logical network providing services over digital television infrastructure characterized by high-reliable data transfer, service management and traffic control.

NOTE – Where next generation network (NGN) is available, ICN typical deployments combine the usage of digital television infrastructure with NGN for an increased service offer. In some technically justified cases, NGN may fully replace the digital television infrastructure.

3.2.2 ICN operator: The operator of ICN that provides and manages the ICN services and controls their service provisioning.

3.2.3 ICN service: A service provided to the ICN users via ICN.

3.2.4 ICN user: A person or organization which obtains ICN services from the ICN operator.

3.2.5 mission-critical service: A service whose failure or disruption will result in serious damage to the users of the service.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

HbbTV Hybrid Broadcast Broadband Television

ICN Information Control Network

NGN Next Generation Network

QoS Quality of Service

TV Television

5 Conventions

In this Recommendation:

The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted if conformance to this document is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus this requirement need not be present to claim conformance.

The keywords "can optionally" and "may" indicate an optional requirement which is permissible, without implying any sense of being recommended. These terms are 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.

The terms "ICN application" and "ICN service" are used interchangeably.

6 Introduction

6.1 ICN overview

The term "ICN" as defined in clause 3 is used to name logical networks that are emerging in order to meet security, reliability, quality and other requirements of applications.

NOTE 1 – The services provided via ICN to users are termed as "ICN services" and the users as "ICN users".

Typical ICN deployments use digital television infrastructure to deliver data to the ICN users and a reverse asymmetrical ICN channel for the transmission of ICN service requests from ICN users (in cases where the reverse asymmetrical ICN channel has sufficient bandwidth, it may be also used for the exchange of other ICN service data from and to ICN users).

The usage of the digital television infrastructure is effective in terms of large geographical area coverage. On the other hand, such universal coverage might still leave some sparsely populated areas with no convenient access bandwidth, limiting the possibilities of service offer in these areas. While broadband access is generally used for the reverse asymmetrical ICN channel, in such areas the reverse asymmetrical ICN channel can still be implemented and services offered via ICN.

ICN allows the organization of a trusted environment for the provisioning of mission-critical services, such as emergency management, e-government, e-commerce and e-health, by introducing the ICN operator as a single point of service management.

There are major differences in the models of provisioning of mission-critical services in comparison with those of other services, e.g., entertainment services provided by hybrid broadcast broadband television (HbbTV) [b-ETSI TS 102 796]:

- service provisioning for mission-critical services often results in some irrevocable actions in the physical world (e.g., initiation of goods transportation, health equipment activation, etc.), considerable financial transactions and/or legally significant actions (e.g., filling in of an income declaration). Therefore, the cost of error or poor quality of service is much higher for mission-critical services than other services;
- diversity of service providers which is generally a good condition for entertainment services may have no sense or be harmful for some mission-critical services (e.g., e-health services) and may be just impossible for e-government services.

Such peculiarities of mission-critical services make a star network topology of ICN a good choice for mission-critical services. In ICN, a single entity, the ICN operator, is in fact assigned to be in charge for all the aspects of service provisioning. From the user point of view, the ICN operator is at the same time service provider and network operator. However, it may own neither the network infrastructure nor the service provisioning facilities: in order to provide the services, the ICN operator may contract with service providers as well as lease the network infrastructure, e.g., from an NGN provider.

The ICN operator creates a trusted environment controlling the quality of the services from service providers and providing a unified interface to the service users. In this way, ICN users can obtain mission-critical services from the ICN operator in a trusted environment.

Figure 1 depicts the process of service provisioning in ICN in a typical deployment where the part of the network infrastructure complementing the digital television infrastructure is made available by an NGN provider and the ICN operator contracts the service offer with service providers.

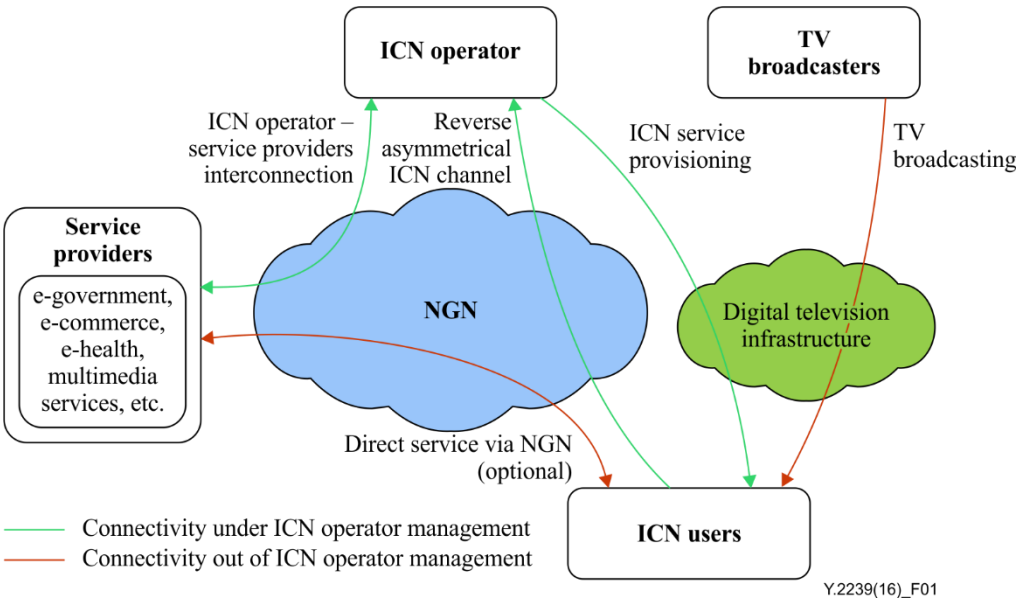

Figure 1 – The process of service provisioning in ICN in typical deployment with NGN

ICN users obtain services from the ICN operator (using the infrastructure over which ICN is deployed). All ICN users have enhanced support by the ICN operator that is responsible for service provisioning and service management.

NOTE 2 – As shown in Figure 1, the ICN users can also obtain services from service providers independently of ICN (in typical deployment with NGN, they may use NGN for this "direct service").

Where next generation network (NGN) is available, ICN typical deployments combine the usage of digital television infrastructure with NGN for an increased service offer.

In such deployments, the reverse asymmetrical ICN channel is implemented via NGN. In addition, utilizing the digital television infrastructure for data delivery to ICN users reduces the traffic load on NGN within the ICN coverage area. As a result, ICN reduces the bandwidth requirements for users' NGN connections and this is extremely relevant for areas not covered by broadband access.

The capabilities of NGN may provide support to the ICN operator for service provisioning.

ICN uses the digital television infrastructure as a network for providing services by the ICN operator to ICN users, in parallel with TV broadcasting services. Both TV broadcasters and the ICN operator are connected to the digital television infrastructure independently.

NOTE 3 – Because of this connectivity independence, the TV broadcasters will usually not require additional licences for the transmission of non-broadcast supplementary data.

6.2 Business roles for the provisioning of ICN applications

Figure 2 depicts business roles for the provisioning of ICN applications and their relationships. Four key roles are identified: NGN provider, ICN operator, service provider and ICN user.

NOTE – In Figure 2, technical relationships are shown via dashed lines, while business relationships are shown via continuous lines.

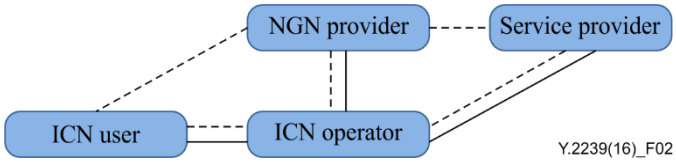

Figure 2 – Business roles in ICN

The following describes the identified roles:

- **NGN provider**: the NGN provider offers NGN capabilities to the ICN operator.
- **ICN operator**: in comparison with usual NGN services where service management as well as responsibility for poor quality of provided services is shared among different parties (e.g., network providers, service retailers and service providers), all ICN applications are provided from the user point of view by a single entity, the ICN operator. The ICN operator performs the following main functions:
  - Access and integration of resources provided by service providers;
  - Customization of services and provisioning of a unified interface to the ICN users;
  - Service management.
- **Service provider**: the service provider offers services which can be provided to the ICN users by the ICN operator.
- **ICN user**: the ICN user interacts with both NGN provider and ICN operator to obtain services from the ICN operator.

7 General characteristics of ICN applications

7.1 Permanent connectivity

In contrast to the usual NGN service provisioning scenarios where a user terminal may not be permanently connected to NGN and may become online whenever it is needed, ICN applications usually require permanent connectivity to the infrastructure over which ICN is deployed and the case of a disconnected user terminal is considered as a fault.

7.2 Data synchronization

The ICN operator provides only a limited amount of services. This allows limitation of both the amount of transmitted data and the load of the digital television infrastructure (which by the way supports in parallel TV programmes broadcasting).

In order to not interfere with the TV programmes traffic, the ICN operator utilizes residual bandwidth capacity of the digital television infrastructure for synchronization of all the necessary data to the ICN users' terminals. Data synchronization is necessary for service provisioning (for example, to update the product database of an e-commerce service in the ICN users' terminals).

NOTE – These data are usually synchronized with the ICN users' terminals independently of their effective timing of usage (data preloading) and stored locally.

7.3 Synchronous software update

In the ICN environment the time required for software update of each ICN user's terminal can be extremely short due to the permanent terminal connectivity and multicasting capabilities. Therefore ICN applications' updates can be basically distributed over ICN in a synchronous way.

7.4 Rule-based multicasting

Data preloading and synchronous software updates are enabled via the usage of the multicasting capabilities of the digital television infrastructure (or of the NGN when it replaces the digital television infrastructure). As not all these data are intended for each ICN user, an agile set of rules may be applied to discriminate the receivers of a given piece of information (rule-based multicasting).

7.5 Service management and security

The ICN applications are protected from external threats by technical and organizational measures taken by the responsible entity, the ICN operator. If the ICN user's terminal is also used for tasks other than ICN service provisioning, damages can be caused to the terminal's ICN related software. Strict service management and security of ICN provide a trusted environment in order to avoid such threats and protect ICN users.

NOTE – In case of an ICN user's terminal used exclusively for ICN service provisioning, the ICN operator ensures the adequate protection of the ICN user.

7.6 Logging

Poor quality of services in an ICN environment may lead to legal liability. So the service provisioning in an ICN environment must be carefully logged. A legally recognized logging framework is usually provided by the utilization of special trusted services.

7.7 Resiliency

The ICN applications need to be unaffected by failures. For this purpose, backup connectivity (i.e., availability of connections through the ICN infrastructure that can be used when primary connections go down), network equipment redundancy and availability of multiple service providers should be foreseen as appropriate. This is extremely important for mission-critical services.

8 Requirements of ICN applications

This clause specifies requirements of ICN applications.

8.1 Information security

For ICN applications there are stringent requirements for information security. This is due to the fact that ICN is designed to provide mission-critical services to a wide range of users, including the socially vulnerable segments of the population. Some of these services may provide critical information, such as emergency alerts, or may use confidential information about users, or may involve financial transactions. All of these types of interactions require measures to ensure information security.

It is required for the ICN operator, as well as the NGN provider where NGN is used, to take all necessary measures to provide information security in accordance with international best practices and local laws.

8.2 Reliability support

The infrastructure over which ICN is deployed is required to provide the ICN operator with capabilities which comply with reliability requirements of mission-critical services.

The ICN operator is required to ensure the compliance of the provided capabilities to the reliability requirements of mission-critical services.

8.3 Service management

There are special requirements for the provider(s) of the infrastructure over which ICN is deployed and for the ICN operator for the correct management of ICN. The ICN operator is responsible for the correct management of the ICN, including the quality of ICN services, provisioning of false information to customers, leakage of confidential information and incorrect processing of financial transactions. Therefore, the ICN operator is expected to conduct a careful selection of the provider(s) of the infrastructure over which ICN is deployed (e.g., NGN provider(s) in cases of

usage of NGN). The same reasoning applies for the selection of service providers before releasing their services into ICN.

The ICN operator is required to provide service management of ICN services (including service planning, organization and control in order to ensure service quality). The purpose of service management is to resolve any disputes in the shortest time possible and ensure continuous quality of service control. In this perspective, in typical deployment scenarios, the ICN operator is required to perform traffic processing and traffic management in order to avoid overloading of the digital television infrastructure due to its simultaneous usage by TV broadcasters and the ICN operator.

In addition, poor quality of services in ICN may lead to legal liability. So the ICN operator is required to carefully log the service provisioning process in the ICN. The ICN operator is also required to support trusted identity services, documentation and authentication of communications services which provide legally significant interaction within the ICN.

The provider(s) of the infrastructure over which an ICN is deployed is required to provide the appropriate capabilities for support of end-to-end quality of service (QoS) across the whole infrastructure.

8.4 Multicasting

ICN is designed as a tool for centralized service provisioning of huge geographical areas. An important requirement for ICN deployment is the support of multicasting capabilities.

The infrastructure over which ICN is deployed is required to support multicasting data delivery capabilities and rule-based multicasting.

In the case of ICN deployment for mission-critical services, the infrastructure is required to support reliability for multicasting capabilities based on the requirements described in clause 8.2.

8.5 Context awareness

An ICN application may use context information about ICN users in order to customize services for them. Context information may include user location information, user equipment information and personal user information stored in individual user equipment.

9 NGN capability requirements for support of ICN applications

NOTE – This clause deals with the NGN capability requirements for support of ICN applications (typical deployment of ICN with NGN). The capability requirements of the whole ICN infrastructure (the digital television infrastructure is also used in a typical deployment of ICN) are out of scope of this Recommendation.

9.1 Requirements for extensions or additions to NGN capabilities

One of the main characteristics of ICN is the strict management of ICN services. This implies that ICN users are provided with special capabilities for the settlement of disputes in the case of incomplete or poor quality service delivery. It also implies that the cost sustained by the ICN users will be refunded to the ICN users as soon as possible in the case of poor quality of service provisioning. The method and timing parameters of reimbursement are often critical for vulnerable groups of users. Therefore, the ICN operator guarantees a high service management level in order to attract these groups of users to use the ICN services.

It is not efficient from a resource usage point of view to ensure, simultaneously, prompt service management at the same level for each of the ICN services. Efficiency can be achieved by the introduction of several levels of priorities for the various services, for instance socially oriented services and services related to emergencies may have a higher priority than entertainment services. It is sufficient to introduce service groups, with different service management parameters within

ICN. An ICN user can define the affiliation of the selected services to one or another service group when ordering these services.

The identified requirements for extensions or additions to the NGN capabilities are as follows:

- NGN is required to support priority enabling mechanisms to ensure the prioritization of data delivery in accordance with the priority of the affiliated service group;
- NGN is required to support trusted services in order to provide legally significant interaction within ICN.

NOTE – Except for the above requirements, the whole set of service management requirements of ICN applications can be satisfied based on existing NGN capabilities, see clause 9.1 (General QoS requirements), clause 9.3 (Service/application priority) and clause 9.4 (QoS control) of [ITU-T Y.2201].

9.2 Requirements supported by existing NGN capabilities

Information security, reliability, as well as multicasting and context awareness requirements of ICN applications can be satisfied based on existing NGN capabilities described in [ITU-T Y.2201] as shown in Table 1.

Table 1 – Mapping analysis between ICN application requirements and NGN capabilities

ICN application requirements	NGN capabilities [ITU-T Y.2201]
Information security	Identification and security clause 10 of [ITU-T Y.2201] ○ General requirements for identification, authentication and authorization ○ Requirements for identification; ○ Requirements for authentication; ○ Requirements for authorization; ○ Identity management; ○ Security requirements; ○ Critical infrastructure protection.
Reliability	Quality of service clause 9 of [ITU-T Y.2201] ○ General QoS requirements; ○ QoS control. Identification and security clause 10 of [ITU-T Y.2201] ○ Security requirements; ○ Critical infrastructure protection.
Multicasting	Multicast support clause 6 of [ITU-T Y.2201]
Context awareness	Service and application support clause 7 of [ITU-T Y.2201] ○ Open service environment; ○ Service enablers; ○ Context awareness. Users with disabilities clause 20 [ITU-T Y.2201]

Bibliography

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

[b-ITU-T Y.2012] Recommendation ITU-T Y.2012 (2010), *Functional requirements and architecture of next generation networks*.

[b-ETSI TS 102 796] ETSI Technical Specification vol. 1.1.1 (2010), *Hybrid Broadcast Broadband TV*.

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