

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Y.2221

(01/2010)

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

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

Requirements for support of ubiquitous sensor network (USN) applications and services in the NGN environment

Recommendation ITU-T Y.2221



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GENERATION NETWORKS**

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Recommendation ITU-T Y.2221

Requirements for support of ubiquitous sensor network (USN) applications and services in the NGN environment

Summary

Recommendation ITU-T Y.2221 provides a description and general characteristics of ubiquitous sensor network (USN) and USN applications and services. It also analyses the service requirements of USN applications and services, and specifies the extended or new NGN capability requirements based on the service requirements.

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T Y.2221	2010-01-13	13

Keywords

NGN, sensor networks, ubiquitous sensor network (USN), USN applications and services, wireless sensor networks (WSNs).

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FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

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Recommendation ITU-T Y.2221

Requirements for support of ubiquitous sensor network (USN) applications and services in the NGN environment

1 Scope

This Recommendation, based on [ITU-T Y.2201], covers extensions and additions to NGN capabilities in order to support ubiquitous sensor network (USN) applications and services [b-ITU-T Y.Sup.7] in the NGN environment.

The scope of this Recommendation includes:

- Description and general characteristics of USN and USN applications and services;
- Service requirements to support USN applications and services;
- Requirements of extended or new NGN capabilities based on the service requirements.

The NGN functional architecture extensions for support of the identified extended or new NGN capabilities 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 Q.1703] Recommendation ITU-T Q.1703 (2004), *Service and network capabilities framework of network aspects for systems beyond IMT-2000*.
- [ITU-T Q.1706] Recommendation ITU-T Q.1706/Y.2801 (2006), *Mobility management requirements for NGN*.
- [ITU-T Y.2012] Recommendation ITU-T Y.2012 (2006), *Functional requirements and architecture of the NGN release 1*.
- [ITU-T Y.2201] Recommendation ITU-T Y.2201 (2009), *Requirements and capabilities for ITU-T NGN*.
- [ITU-T Y.2233] Recommendation ITU-T Y.2233 (2008), *Requirements and framework allowing accounting and charging capabilities in NGN*.
- [ITU-T Y.2234] Recommendation ITU-T Y.2234 (2008), *Open service environment capabilities for NGN*.
- [ITU-T Y.2701] Recommendation ITU-T Y.2701 (2007), *Security requirements for NGN release 1*.
- [ITU-T Y.2702] Recommendation ITU-T Y.2702 (2008), *Authentication and authorization requirements for NGN release 1*.
- [ITU-T Z.100] Recommendation ITU-T Z.100 (1999), *Specification and Description Language (SDL)*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 context awareness [ITU-T Y.2201]: A capability to determine or influence a next action in telecommunication or process by referring to the status of relevant entities, which form a coherent environment as a context.

3.1.2 network mobility [ITU-T Q.1703]: The ability of a network, where a set of fixed or mobile nodes are networked to each other, to change, as a unit, its point of attachment to the corresponding network upon the network's movement itself.

3.1.3 open service environment capabilities [ITU-T Y.2234]: Capabilities provided by open service environment to enable enhanced and flexible service creation and provisioning based on the use of standards interfaces.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

3.2.1 sensor: An electronic device that senses a physical condition or chemical compound and delivers an electronic signal proportional to the observed characteristic.

3.2.2 sensor network: A network comprised of interconnected sensor nodes exchanging sensed data by wired or wireless communication.

3.2.3 sensor node: A device consisting of sensor(s) and optional actuator(s) with capabilities of sensed data processing and networking.

3.2.4 service: A set of functions and facilities offered to a user by a provider.

3.2.5 service description language: A language for the specification of event-driven systems, in particular telecommunication systems, and an object-oriented formal language intended for the specification of complex, event-driven, real-time, and interactive applications involving many concurrent activities that communicate using discrete signals.

3.2.6 ubiquitous sensor network (USN): A conceptual network built over existing physical networks which makes use of sensed data and provides knowledge services to anyone, anywhere and at anytime, and where the information is generated by using context awareness.

3.2.7 USN end-user: An entity that uses the sensed data provided by USN applications and services. This end-user may be a system or a human.

3.2.8 USN gateway: A node which interconnects sensor networks with other networks.

3.2.9 USN middleware: A set of logical functions to support USN applications and services.

NOTE 1 – The functionalities of USN middleware include sensor network management and connectivity, event processing, sensor data mining, etc.

NOTE 2 – In the NGN environment, functions of the USN middleware may be provided by the NGN open service environment (OSE) capabilities [ITU-T Y.2234] and/or by other NGN capabilities. However, some of the USN middleware functions (e.g., those for supporting interface to sensor networks) may not be provided by the NGN OSE capabilities or other NGN capabilities.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CDMA Code Division Multiple Access

IP Internet Protocol

ITS	Intelligent Transportation System
MAC	Media Access Control
MAN	Metropolitan Area Network
NGN	Next Generation Network
OSE	Open Service Environment
PHY	PHYsical layer
QoS	Quality of Service
USN	Ubiquitous Sensor Network
WCDMA	Wideband CDMA
WiMAX	Worldwide Interoperability for Microwave Access
WMN	Wireless Mesh Network
WPAN	Wireless Personal Area Network
WSN	Wireless Sensor Network

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 Recommendation 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.

6 USN description and characteristics

Ubiquitous sensor network (USN), as defined in clause 3.2.6, is a conceptual network built over existing physical networks which makes use of sensed data and provides knowledge services to anyone, anywhere and at anytime, and where the information is generated by using context awareness.

USN utilizes wireline sensor networks and/or wireless sensor networks (WSNs). WSNs are wireless networks consisting of interconnected and spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions (e.g., temperature, sound, vibration, pressure, motion or pollutants) at different locations. Up to now, WSNs were generally implemented as isolated networks. Simple design of applications and services based on isolated sensor networks is made by the capture and transmission of collected sensed data to designated application systems.

Such isolated, simple applications and services have been evolving over the years through deployment of networks, based upon advanced hardware and software technologies that provide network and service integration, data processing schemes enhanced by business logic and by data mining rules, context-awareness schemes, etc. These technical developments enable the ability to build an intelligent information infrastructure of sensor networks connected to the existing network

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infrastructure. This information infrastructure has been called ubiquitous sensor network (USN) opening wide possibilities for applications and services based on sensor networks to various customers such as human consumers, public organizations, enterprises and government.

USN applications and services are created via the integration of sensor network applications and services into the network infrastructure. They are applied to everyday life in an invisible way as everything is virtually linked by pervasive networking between USN end-users (including machines and humans) and sensor networks, relayed through intermediate networking entities such as application servers, middleware entities, access network entities, and USN gateways. USN applications and services can be used in many civilian application areas such as industrial automation, home automation, agricultural monitoring, healthcare, environment, pollution and disaster surveillance, homeland security or military field.

Support of USN applications and services may require some extensions and/or additions to core network architectures in order to cover the functional capability requirements extracted from USN applications and services. USN applications and services are provided through many network assisted functionalities such as context modelling and processing, orchestration of sensed information, data filtering, content management, open interface functions, network and software management, sensor profile management and directory services.

Figure 1 shows an overview of USN with related technical areas including physical sensor networks, NGN, USN middleware and USN applications and services.

NOTE 1 – The details of physical sensor networks and USN middleware are out of scope of this Recommendation.

NOTE 2 – Figure 1 does not represent a functional architecture. The positioning of USN applications and services, USN middleware, NGN and sensor networks in this figure does not correspond to functional layering.

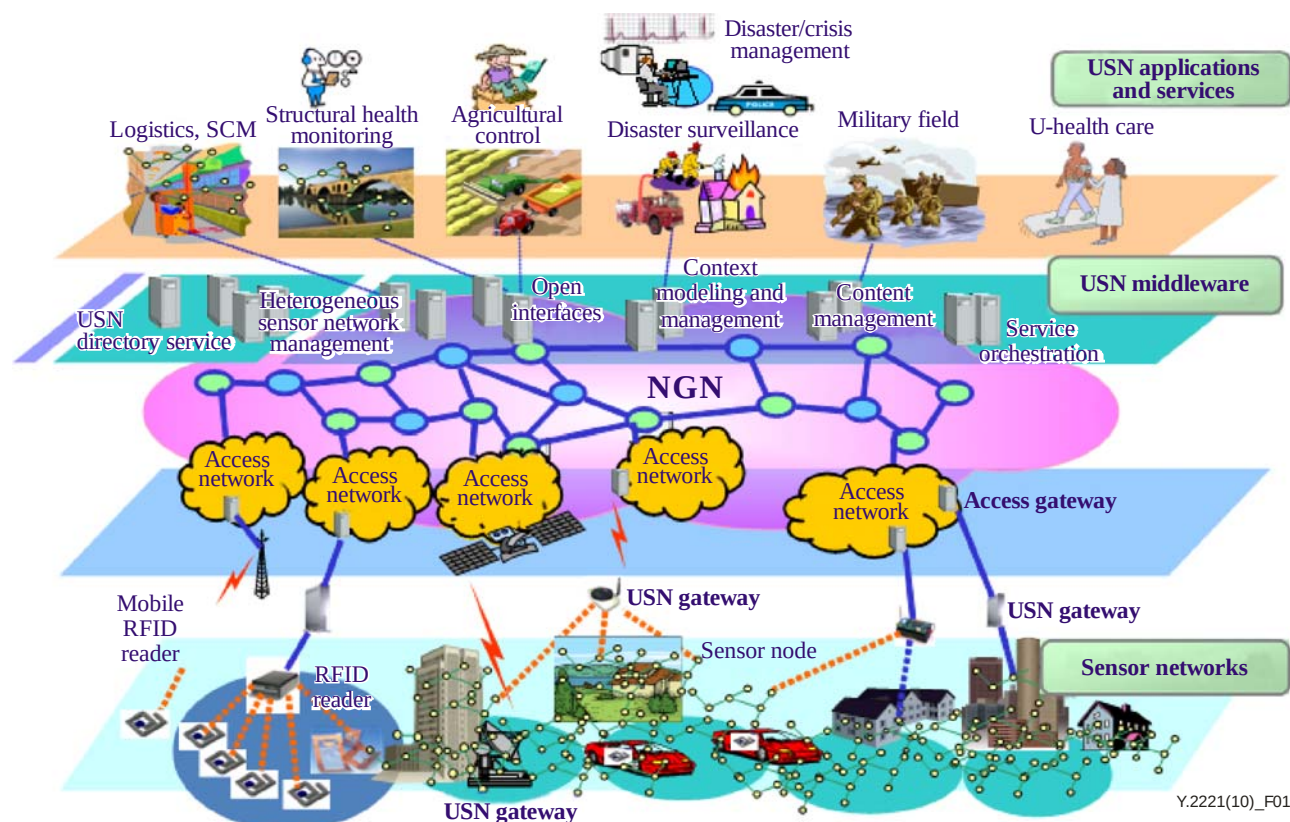


Figure 1 – An overview of USN with related technical areas