Draft new Recommendation ITU-T Y.ISAC-req-fra

Requirements and framework of integrated sensing and communication in IMT-2020 networks and beyond

Summary

This Recommendation aims to specify the requirements and framework of integrated sensing and communication in IMT-2020 networks and beyond. It addresses the following aspects:

– Overview of integrated sensing and communication;

– Requirements of integrated sensing and communication;

– Framework on integrated sensing and communication;

– Use cases of integrated sensing and communication.

Keywords

IMT-2020 networks and beyond, integrated sensing and communication, network sensing function

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Requirements and framework of integrated sensing and communication in IMT-2020 networks and beyond

1 Scope

This Recommendation aims to specify the requirements and framework of integrated sensing and communication in IMT-2020 networks and beyond. The scope of this Recommendation includes:

– Overview of integrated sensing and communication.

– Requirements of integrated sensing and communication.

– Framework of integrated sensing and communication.

Use cases of integrated sensing and communication are provided in Appendix. .

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.3100] Recommendation ITU-T Y.3100 (2017), *Terms and definitions for IMT-2020 network.*

[ITU-T Y.3101] Recommendation ITU-T Y.3101 (2018), *Requirements of the IMT-2020 network.*

[ITU-T Y.3102] Recommendation ITU-T Y.3102 (2018), *Framework of the IMT-2020 network.*

[ITU-T Y.3104] Recommendation ITU-T Y.3104 (2018), *Architecture of the IMT-2020 network*

[ITU-R M.2160] Recommendation ITU-R M.2160 (2023), *Framework and overall objectives of the future development of IMT for 2030 and beyond.*

[3GPP 22.137] 3GPP TS22.137 (2024), *Service requirements for Integrated Sensing and Communication.*

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 device [b-ITU-T Y.4000]: With regard to the Internet of things, this is a piece of equipment with the mandatory capabilities of communication and the optional capabilities of sensing, actuation, data capture, data storage and data processing.

3.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

TBD

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

AF	Application Function
AI	Artificial Intelligence
AN	Access Network
ASF	Authentication Server Function
CEF	Capability Exposure Function
CN	Core Network
ISAC	Integrated Sensing and Communication
KPI	Key Performance Indicator
NACF	Network Access Control Function
NFR	Network Function Repository
NSSF	Network Slice Selection Function
PCF	Policy Control Function
QoS	Quality of Service
SF	Sensing Function
SMF	Session Management Function
UAV	Unmanned Aerial Vehicle
UE	User Equipment
UPF	User Plane Function
USM	Unified Subscription Management

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

6 Overview of integrated sensing and communication

Integrated sensing and communication (ISAC) is regarded as one of the six important usage scenarios of IMT-2030 [b-ITU-R M.2160]. The technologies supporting this scenario enable the IMT-2020 networks and beyond with the capability to sense the physical world [3GPP TS 22.137]. At the same time, the information about the physical word can also enhance the capability of the network. Via ISAC, both communication-assisted sensing and sensing-assisted communication are enabled [b-ITU-T YSTR.ISAC-fra].

6.1 Communication-assisted sensing

[Editor's Note] This subclause will provide an introduction of communication-assisted sensing.

In communication-assisted sensing, the IMT-2020 networks and beyond utilize the existing infrastructure and devices to sense the characteristics of surrounding objects and environments. The collected sensing information can then be transmitted to the core network (CN) for further processing and service delivery.

The overall sensing process is shown in Figure 6-1. It illustrates the relationships among the key components and the chaining of concepts involved in communication-assisted sensing. First, the service requesters initiate a sensing service request through an application user. The network then selects appropriate sensing nodes to perform the required sensing tasks based on the sensing capabilities to support the sensing service. The generated sensing data will be provided by the selected sensing nodes through the sensing service to the sensing requesters directly, or to applications. These steps together constitute the end-to-end sensing process in communication-assisted sensing systems.

NOTE 1 - The sensing services are the services by which the networks provide sensing data and sensing information to the service requesters.

The sensing services can support various sensing related applications. Typical sensing service examples include ranging, speed and angle measurement, positioning, tracking, imaging, detection, and recognition, which can be provided to applications (sensing-related applications), such as intelligent transportation, smart home, health monitoring, and environment detection Depending on the business scenarios, diverse sensing services can be selected.

NOTE 2 - The sensing nodes in IMT-2020 networks and beyond are hardware and/or software that provide the sensing capability to applications.

The sensing nodes may be located in the core network and be supported by the core network elements. The sensing nodes may be also located in the access network and be supported by the sensing devices such as the base station devices and the terminal devices. Specific network functions and devices related to sensing are enhanced to support the sensing capability.

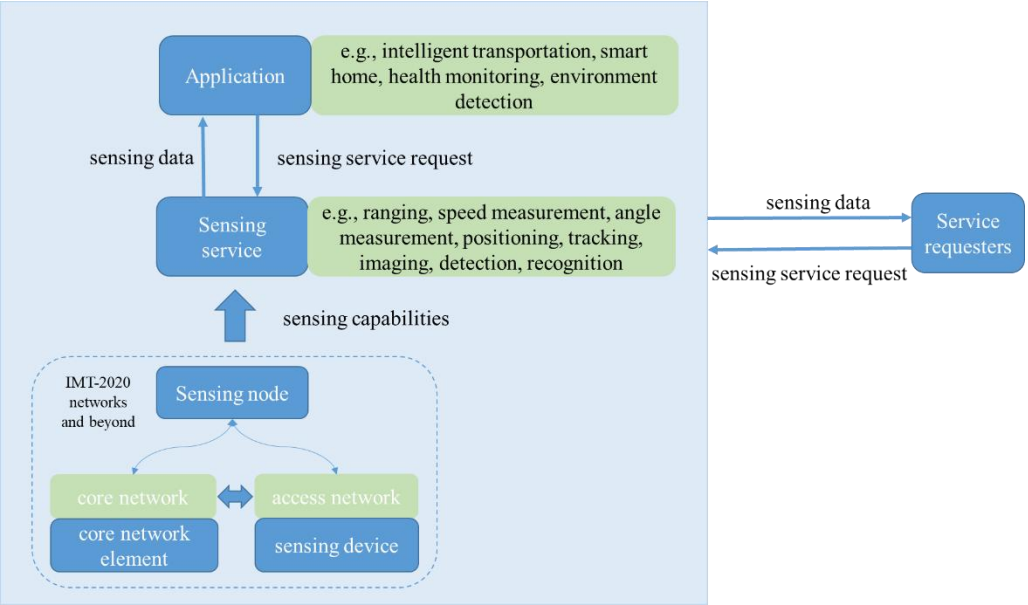

Figure 6-1 An overview of the sensing process in communication-assisted sensing.

6.2 Sensing-assisted communication

[Editor's Note] This subclause will provide an introduction of sensing-assisted communication.

In sensing-assisted communication, through further analysis of the sensing measurement data, a network optimization scheme can be designed to enhance communication capabilities.

In the context of sensing-assisted communication, in terms of intelligent network optimization, the ISAC technology enables real-time network monitoring, user demand analysis, and device status perception. Through data analysis, the network can automatically optimize resource allocation to provide more efficient and stable network connections and service quality, thus meeting the growing communication demands.

In the context of sensing-assisted communication, the ISAC technology also allows the network to dynamically adjust communication parameters based on different environments and usage scenarios, thus enabling energy conservation in the network.

7 Requirements of integrated sensing and communication

[Editor's Note] This subclause will describe the requirements of integrated sensing and communication, including common requirements, requirements of collaborative sensing, requirements of communication-assisted sensing, and requirements of sensing-assisted communication.

NOTE – The requirements will address user protection and privacy aspects, including preventing the leakage of user privacy information.

7.1 Common requirements of integrated sensing and communication

Editor's note: it will consider [b-ITU-T YSTR.ISAC-fra] and other studies (including 3GPP).

TBD

7.2 Requirements of collaborative sensing*Editor's note: it will consider [b-ITU-T YSTR.ISAC-fra] and other studies (including 3GPP).*

TBD

7.3 Requirements of communication-assisted sensing

Editor's note: it will consider [b-ITU-T YSTR.ISAC-fra] and other studies (including 3GPP).

TBD

7.4 Requirements of sensing-assisted communication

Editor's note: it will consider [b-ITU-T YSTR.ISAC-fra] and other studies (including 3GPP).

TBD

8 Framework of integrated sensing and communication

NOTE – The framework will address user protection and privacy aspects, including preventing the leakage of user privacy information.

Figure 8-1 illustrates the framework of integrated sensing and communication which is based on the IMT-2020 framework specified in [ITU-T Y.3104]. The framework is enhanced with the Network Sensing Function for enabling integrated sensing and communication in IMT-2020 networks and beyond [b-ITU-T YSTR.ISAC-fra].

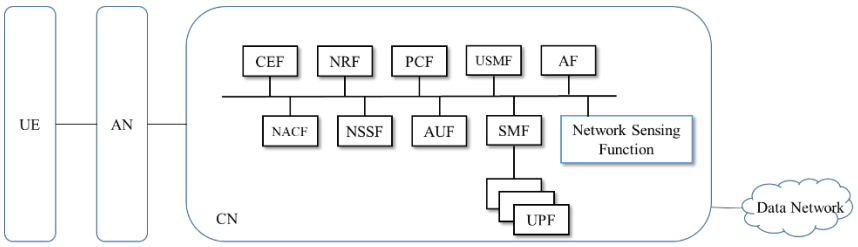

Figure 8-1 Framework of integrated sensing and communication

The IMT-2020 network receives sensing information from UE or AN, and provides the sensing information possessing capabilities. When the CN receives a sensing service request, the CN schedules the sensing resources and conducts the sensing process, which is executed by Network Sensing Function in cooperation with other core network functions.

Specifically, according to the requirements specified in clause 7, Network Sensing Function interacts with other entities to provide the capabilities which are described in clauses 8.1 to 8.6.

8.1 Authentication capability

[Editor's Note] This subclause will describe the authentication capability.

8.2 Sensing service requests processing capability

[Editor's Note] This subclause will describe the sensing service requests processing capability.

8.3 Sensing capability acquisition capability

[Editor's Note] This subclause will describe the sensing service requests processing capability.

8.4 Sensing nodes selection capability

[Editor's Note] This subclause will describe the sensing nodes selection capability.

8.5 Sensing measurement data processing capability

[Editor's Note] This subclause will describe the measurement data processing capability.

8.6 Sensing results exposure capability

[Editor's Note] This subclause will describe the sensing results exposure capability.

Appendix I Typical use cases of integrated sensing and communication

Editor's note: it will consider [b-ITU-T YSTR.ISAC-fra] and other studies (including 3GPP).

I.1 ISAC use case in smart home

Figure I.1 illustrates the use case of ISAC in smart home.

Smart home serves as a crucial scenario for indoor sensing. Given that people spend a significant portion of their daily activities indoors, the implementation of safety monitoring and environmental sensing for indoor environments is of great importance.

In smart home scenarios, ISAC technology enables the convergence of communication and sensing within a unified system. Communication signals and network infrastructures at home can be reused for sensing purposes, enabling communication-assisted sensing. Specifically, due to the activities of indoor object or human, the communication signal measured by UE or network would be influenced. By analyzing and collecting the sensing information such as amplitude change and phase change, the behaviour of object or human could be detected.

ISAC-based smart home systems can support functions such as intruder detection, activity recognition, sleep monitoring, and health monitoring. Users can submit the sensing service request through an app in the phone. Under the condition that the user has given authorization and consent, the network then selects appropriate sensing devices deployed at home to perform the required sensing tasks. The sensing data will be securely transmitted over the network for further processing. After positioning, tracking, detection, and recognition, the network can infer room-level occupancy and user activity states to enable adaptive lighting, heating, ventilation, and appliance control. In healthcare-oriented applications, ISAC sensing capabilities can be used to detect abnormal behaviors such as falls or prolonged inactivity. The sensing results will be exposed to users to ensure the safety of family members and assisted living services.

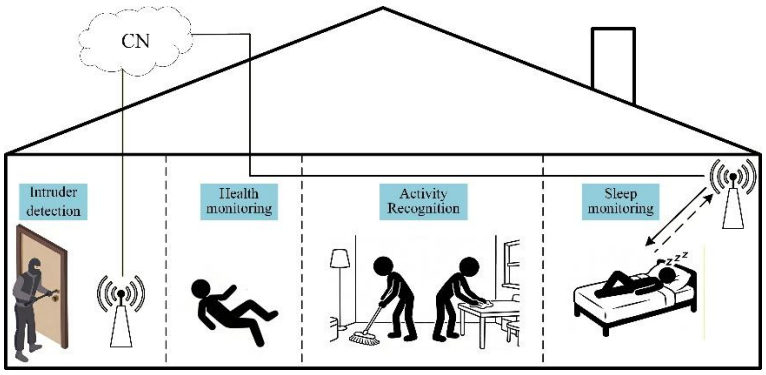

Figure I.1 – ISAC use case in smart home

I.2 ISAC use case in smart transportation

Figure I.2 illustrates the use case of ISAC in smart transportation.

In smart transportation scenarios, ISAC enhances the capability of communication networks to perceive dynamic traffic environments while supporting high-reliability, low-latency data exchange among vehicles, roadside infrastructure, and traffic management systems. The network can detect and track vehicles, pedestrians, and obstacles, as well as estimate their positions, velocities, and trajectories by analyzing and collecting the sensing information such as amplitude change and phase change.

ISAC-enabled transportation systems can support advanced applications such as traffic flow monitoring, collision risk assessment, and adaptive traffic control. For instance, roadside ISAC

nodes can provide real-time sensing information to complement onboard vehicle sensors, improving sensing accuracy in adverse weather conditions. The network selects appropriate and authorized sensing devices deployed on the road to perform the sensing tasks. The sensing data will be securely transmitted over the network for further processing. The sensing results will be exposed to users to ensure the traffic safety of drivers and pedestrians.

On the other hand, these sensing information about road condition and pedestrians can be exploited to enhance communication performance through adaptive network optimization and resource allocation, thereby realizing sensing-assisted communication.

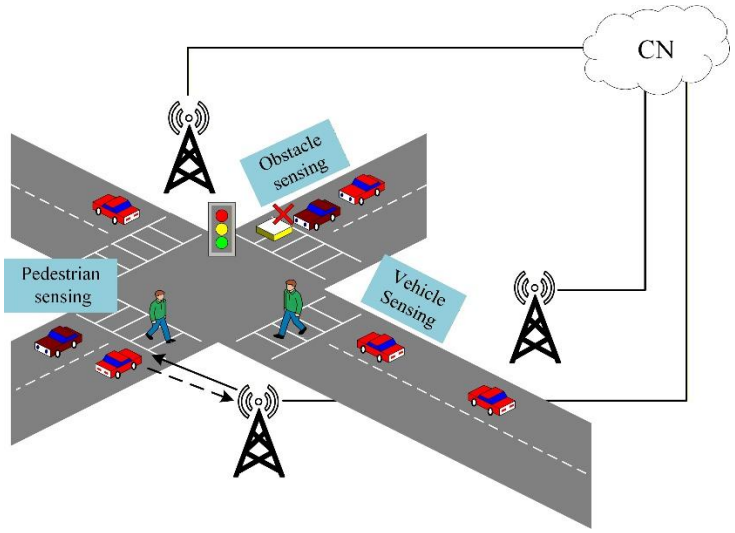

Figure I.2 – ISAC use case in smart transportation

Bibliography

[b-ITU-T Y.4000] Recommendation ITU-T Y.4000/Y.2060 (2012), *Overview of the Internet of things*

[b-ITU-T YSTR.ISAC-fra] Technical Report ITU-T YSTR.ISAC-fra (2025), *"Considerations on integrated sensing and communication in IMT-2020 networks and beyond". Future technology trends of terrestrial International Mobile Telecommunications systems towards 2030 and beyond.*

[b-ITU-R M.2516] Report ITU-R M.2516 (2022), *Future technology trends of terrestrial International Mobile Telecommunications systems towards 2030 and beyond.*

[b-3GPP TR 23.700-14] 3GPP TR 23.700-14 V2.0.1 (2025-12), *Study on Integrated Sensing and Communication; Stage 2(Release 20).*

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Annex A

A.1 justification for proposed draft new ITU-T Y.ISAC-req-fra "Requirements and framework of integrated sensing and communication in IMT-2020 networks and beyond"

<table>
<tr><td>Question:</td><td>20/13</td><td>Proposed new ITU-T Recommendation</td><td colspan="2">Geneva, 23 February-27 February 2026</td></tr>
<tr><td>Reference and title:</td><td colspan="4">ITU-T Y.ISAC-req-fra "Requirements and framework of integrated sensing and communication in IMT-2020 networks and beyond"</td></tr>
<tr><td>Base text:</td><td colspan="2">SG13-TD426/WP1</td><td>Timing:</td><td>2028-Q1</td></tr>
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<tr><td colspan="5">Scope (defines the intent or object of the Recommendation and the aspects covered, thereby indicating the limits of its applicability):
This Recommendation aims to specify the requirements and framework of integrated sensing and communication in IMT-2020 networks and beyond. The scope of this Recommendation includes:
-Overview of integrated sensing and communication.
-Requirements of integrated sensing and communication.
-Framework of integrated sensing and communication.
Use cases of integrated sensing and communication are provided in Appendix.
NOTE – The requirements and framework will address user protection and privacy aspects, including preventing the leakage of user privacy information.</td></tr>
<tr><td colspan="5">Summary (provides a brief overview of the purpose and contents of the Recommendation, thus permitting readers to judge its usefulness for their work):
Integrated Sensing and Communication (ISAC) technology combines communication and sensing technologies, enhancing communication-assisted sensing performance and sensing-assisted communication performance enhancement. The high integration of information transmission capability and sensing capabilities fosters mutual benefits between communication and sensing, serving as a critical direction and key supporting technology for future networks including IMT-2020 networks and beyond.
Some organizations and working groups have done some related works. Current ISAC projects have involved use cases, service requirements, signalling discussion, quality of services assurance, security, etc. However, the standardization of network requirements and framework of ISAC is lacked. This work item will specify requirements and framework of ISAC, including common requirements, collaborative sensing requirements, requirements of communication-assisted sensing, and requirements of sensing-assisted communication, as well as the ISAC framework in IMT-2020 and beyond. The framework will contribute to enhancements of the IMT-2020 network architecture [ITU-T Y.3104].</td></tr>
<tr><td colspan="5">Relations to ITU-T Recommendations or to other standards (approved or under development):
ITU-T Y.3104, ITU-T YSTR.ISAC-fra, ITU-T TR-SSC, 3GPP TR 22.837, 3GPP TS 22.137, 3GPP TR 23.700</td></tr>
<tr><td colspan="5">Liaisons with other study groups or with other standards bodies:
ITU-T SG11, SG15, SG17, SG20, SG21, 3GPP SA1 and SA2, ITU-R WP5D</td></tr>
<tr><td colspan="5">Supporting members that are committing to contributing actively to the work item:
China Telecom, China Unicom, China Mobile, MIIT China, CAICT China, Huawei, ZTE Corporation, Beijing University of Posts and Telecommunications, Beijing Institute of Technology</td></tr>
</table>