

## **Draft new Recommendation ITU-T Y.4245 (ex Y.ACC-ASM)**

### **Requirements and capabilities of accessible service management using user accessibility preference profile for IoT services**

#### **Summary**

This Recommendation defines requirements and capabilities for Accessible Service Management (ASM) using User Accessibility Preference Profiles (UAPP) for IoT services. It addresses the difficulty users with disabilities face when identifying, activating, and adjusting accessibility features across different IoT services and interfaces. The Recommendation specifies requirements for UAPP, including user identification, assistive technology information, preferred input/output modes, and UI/UX personalization. It also defines ASM requirements and capabilities to map IoT service accessibility features to user preferences, provide alternative formats for visual and auditory information, maintain settings across interfaces, and allow users to control or delete stored preferences.

#### **Keywords**

Accessible Service Management, assistive technology, Internet of Things, personalization, persons with disabilities, privacy protection, User Accessibility Preference Profile

## Table of contents

1	Scope.....	3
2	References.....	3
3	Definitions .....	3
3.1	Terms defined elsewhere .....	3
3.2	Terms defined in this Recommendation.....	4
4	Abbreviations and acronyms .....	4
5	Conventions .....	4
6	Introduction to accessible service management (ASM) and user accessibility preference profile (UAPP).....	5
7	Requirements of user accessibility preference profiles .....	6
7.1	General requirements.....	6
7.2	Assistive technology and usage environment requirements.....	6
7.3	Personalization and adaptive system integration requirements.....	7
8	Requirements and capabilities of accessible service management.....	7
8.1	Requirements of accessible service management.....	7
8.2	Capabilities of accessible service management.....	7
	Appendix I Use case scenarios of accessible service management using user accessibility preference profiles in the IoT services.....	8
	Bibliography.....	10

## List of figures

Figure 1 – Overview of ASM using UAPP.....	6
Figure I.1. Types of user interface that can be used in smart home services.....	8
Figure I.2. Overview of accessible service management in smart home services .....	9

## Draft new Recommendation ITU-T Y.4245 (ex Y.ACC-ASM)

### Requirements and capabilities of accessible service management using user accessibility preference profile for IoT services

#### 1 Scope

This Recommendation defines the requirements and capabilities of the accessible service function using user accessibility preference profiles for Internet of things (IoT) services.

The scope of this Recommendation includes:

- 1) Requirements for user accessibility preference profiles.
- 2) Requirements and capabilities of accessible service management in IoT.

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

[[ITU-T Y.4204](#)] Recommendation ITU-T Y.4204 (2019), *Accessibility requirements for the Internet of things applications and services*.

#### 3 Definitions

##### 3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

**3.1.1 accessibility** [b-ITU-T F.791]: The degree to which a product, device, service or environment (virtual or real) is available to as many people as possible.

**3.1.2 accessibility feature** [b-ITU-T F.791]: An additional content component that is intended to assist people hindered in their ability to perceive an aspect of the main content.

**3.1.3 Internet of things (IoT)** [ITU-T Y.4000]: A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies.

NOTE 1 – Through the exploitation of identification, data capture, processing and communication capabilities, the IoT makes full use of things to offer services to all kinds of applications, whilst ensuring that security and privacy requirements are fulfilled.

NOTE 2 – From a broader perspective, the IoT can be perceived as a vision with technological and societal implications.

**3.1.4 person with age-related disabilities** [b-ITU-T F.791]: A person with cognitive or physical disabilities caused by the aging process. Examples are impaired eyesight, deafness in varying degrees, reduced mobility or cognitive abilities.

**3.1.5 person with specific needs** [b-ITU-T F.791]: Includes persons with disabilities (PWDs), persons who are not literate, those with learning disabilities, children, indigenous people, older persons with age-related disabilities, and anyone who has a temporary disability.

**3.1.6 platform accessibility feature** [b-ITU-T F.791]: Accessibility functionality provided as standard on a particular hardware or software platform.

**3.1.7 profile setting** [b-ITU-T F.791]: The ability for users to store and retrieve multiple profiles containing sets of user interface preference settings without having to reset them each time, including accessibility settings.

**3.1.8 specific needs** [b-ITU-T F.791]: This replaces the use of the term 'special needs'. This term refers to a wide range of categories including women, children, youth, indigenous people, older persons with age-related disabilities, persons with illiteracy, as well as persons with disabilities (PWDs), see [b-ITU PP Res.175], [b-WTDC Res.58], and [b-WTDC AP] and clause 6.39 (of [b-ITU-T F.791]).

**3.1.9 universal design** [b-ITU-T F.791]: The design of products, environments, programmes and services to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. "Universal design" shall not exclude assistive devices for particular groups of persons with disabilities where this is needed.

NOTE 1 – See [b-UNCRPD]. This term succeeds "design for all" (see clause 3.14) and "inclusive design" (see clause 3.18). See also Appendix I.

NOTE 2 – Paraphrased from [b-UNCRPD].

## **3.2 Terms defined in this Recommendation**

None.

## **4 Abbreviations and acronyms**

This Recommendation uses the following abbreviations and acronyms:

AI	Artificial Intelligence
ASM	Accessible Service Management
IoT	Internet of Things
SLI	Sign Language Interpretation
UAPP	User Accessibility Preference Profile
UI	User Interface
UX	User Experience

## **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 with this Recommendation is to be claimed.
- The keywords "is recommended" indicate a recommendation which is not absolutely required. Thus, this requirement need not be fulfilled to claim conformance.
- The keyword "may" indicates an option 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 the specification.

## **6 Introduction to accessible service management (ASM) and user accessibility preference profile (UAPP)**

The accessibility requirements for Internet of things (IoT) applications and services have been defined in [ITU-T Y. 4204]. IoT applications and services need to meet all requirements specified in [ITU-T Y.4204] to address the accessibility needs of various users. However, from the perspective of individual users with disabilities, not all the requirements specified in [ITU-T Y.4204] are relevant to their use of IoT applications and services. Each user has his or her own requirements, which are a subset of those in [ITU-T Y.4204]. This Recommendation provides requirements and capabilities for an accessible service management (ASM) that supports the initiation and adjustment of specific accessibility features for users with disabilities among various accessibility functions provided by the IoT applications and services [ITU-T Y.4204].

For persons with disabilities, older persons with age-related disabilities and those with specific needs to enable the use the service smoothly in the IoT environment, accessibility features that meet their needs must be activated. For example, users with visual disabilities should activate a screen reader to read visual information, and users with hearing disabilities should set up a function that converts audio into sign language or subtitles. It is not easy for users with disabilities to determine which accessibility features can meet their accessibility needs. Also, it is difficult to adjust the accessibility feature's detailed settings to suit their needs.

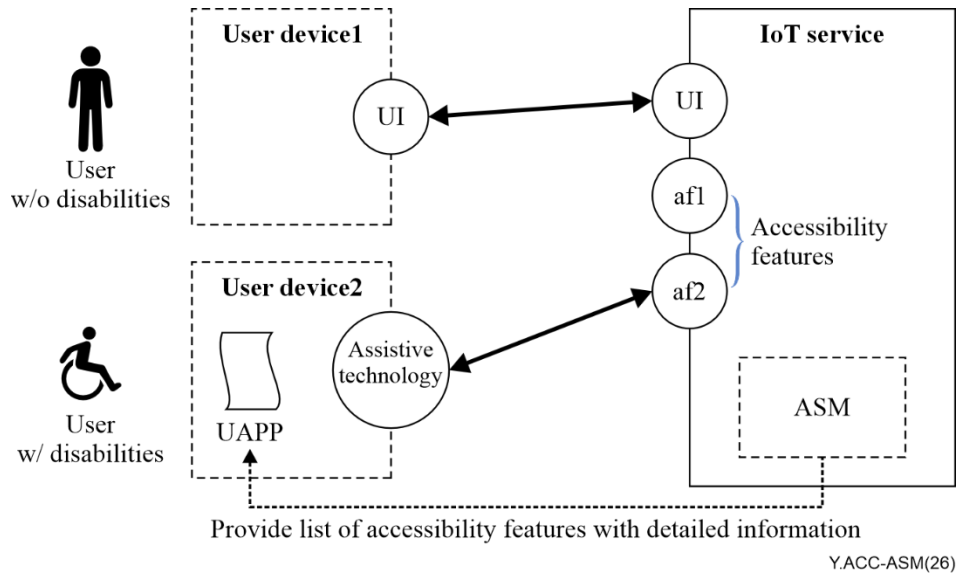
For persons with disabilities to use the service, they must spend a lot of time and go through trial and error to activate accessibility features that meet their needs every time they want to use a new service. Users with limited technical understanding cannot understand a specific accessibility feature solely from its name.

From the user's point of view, it is not easy to investigate individually what accessibility features an IoT service provides, select the functions he or she needs, and check whether the functions meet the user's needs. For example, even if IoT services provide an enlargement function, it is necessary to ensure that information can be sufficiently expanded to a recognisable level in response to the user's vision. In particular, when providing a new accessibility feature that other services do not provide, it is not easy to confirm whether it suits the user.

On the other hand, from the perspective of an IoT service provider, it is challenging to identify the individual needs of all users and provide accessibility features tailored to them. For instance, persons with visual disabilities, blind and low-vision users may have different needs. Even for persons with low vision, some users may prefer a screen magnification feature, some rely on a screen reader, and others may prefer to use both features together. This is a user-selection issue, and the service provider may not be able to identify or provide it in advance.

To solve this problem, it is necessary to introduce a method that can pre-define users' needs and preferred accessibility features using standardised user accessibility preference profiles (UAPP) and set up IoT services collectively based on them.

This Recommendation defines the requirements and capabilities of accessible service management (ASM) using UAPP to solve these difficulties for users and service providers. Figure 1 describes the use of ASM. The user sets up an accessibility preference profile tailored to their needs, and the IoT service provider presents a list of accessibility features for IoT services, along with specific descriptions provided by the functions. ASM selects and recommends features from the IoT service's accessibility feature list that fit the UAPP. Based on this, users can utilise the service by setting the IoT service's accessibility feature to suit them.



**Figure 1 – Overview of ASM using UAPP**

ASM using the UAPP reduces the need for users with disabilities to be familiar with accessibility features to set up a new IoT service each time, and helps to systematically present accessibility features that IoT service providers must provide to persons with disabilities.

## **7 Requirements of user accessibility preference profiles**

This Recommendation does not aim to standardize the structure of the profile itself. User requirements among persons with disabilities are highly diverse and complex, and new accessibility features continue to emerge. Accordingly, user accessibility preference profiles may vary significantly depending on the type of service and the range of accessibility features provided, and the profile structure may be defined in different ways depending on the service objectives.

### **7.1 General requirements**

1. UAPP is required to enable unique user identification, with options for anonymisation to protect privacy.
2. UAPP is required to accommodate various types of disabilities, including visual, hearing, mobility, speech, and cognitive disabilities.
3. UAPP is required to allow representation of multiple co-existing disabilities in a single profile.
4. Disability-related information is considered sensitive personal data, and therefore UAPP is required to be encrypted and collected under data minimisation principles.
5. UAPP is required to give users full control over editing, deleting, and sharing their profile data, including consent for third-party access.
6. All data usage within the UAPP is required to be based on explicit user consent and strictly limited to the specified purposes.

### **7.2 Assistive technology and usage environment requirements**

1. UAPP is required to include information on assistive technologies used by the user (e.g., screen readers, hearing aids, wheelchairs).
2. UAPP is required to specify the user's preferred or accessible input/output modes, such as voice, text, Braille, or images.
3. UAPP is recommended to record conditions that affect accessibility, such as lighting, noise level, and connectivity.

### **7.3 Personalization and adaptive system integration requirements**

1. UAPP is required to store user interface (UI) / user experience (UX) preferences such as text size, colour contrast, and layout settings.
2. UAPP is required to reflect user preferences for content presentation (e.g., summaries vs. detailed information), notification methods, and interaction style.
3. UAPP is required to adapt learning and feedback history based on the user's learning progress or level of familiarity with features.

## **8 Requirements and capabilities of accessible service management**

This clause defines the requirements and capabilities of accessible service management (ASM). ASM is part of an IoT service that suggests accessibility features of IoT services to users by mapping the service's accessibility features to the UAPP. ASM should provide a list of accessibility features for the IoT service and clearly explain the specific roles these features play and their limitations. In addition, this information should be continuously updated to users whenever the service's accessibility features change. Also, sensitive user information should not be collected.

### **8.1 Requirements of accessible service management**

1. Visual information is required to be selectable in an equivalent audio or tactile format based on the preferences defined in the UAPP.
2. Information presented through colour is required to be either replaced with equivalent alternative information or have its colour scheme modified according to the preferences defined in the UAPP.
3. The size of the presented text is required to be adjustable according to the preferences defined in the UAPP.
4. Temporarily displayed information is required to be presented as persistent guidance in an alternative format, based on the preferences defined in the UAPP.
5. All auditory guidance is required to be accompanied by equivalent alternative information based on the preferences defined in the UAPP.
6. The volume of auditory information is required to be adjustable to an appropriate level according to the preferences defined in the UAPP.
7. All alerts are required to be provided in a way that allows users to recognise them through training, based on the preferences defined in the UAPP.
8. All alerts are required to be presented in a format understandable to the user, not as numerical values, as defined in the UAPP.
9. All presented information is recommended to be summarized in plain and simple language, according to the preferences defined in the UAPP.
10. Text, illustrations, and diagrams are recommended to be rendered in spoken language form, based on the preferences defined in the UAPP.

### **8.2 Capabilities of accessible service management**

1. Provide appropriate accessibility features to the user based on the preferences defined in the UAPP.
2. Allow the user to adjust the accessibility features.
3. Apply user-modified accessibility preferences to other IoT services that utilize the UAPP.
4. Maintain and apply the user's accessibility preferences defined in the UAPP, even when the user interface is changed.
5. Store only the accessibility preference information derived from the UAPP, without storing the full UAPP itself.
6. Delete the stored accessibility preference information immediately upon the user's request.
7. Provide all current settings and any changes to the user in an immediate and intuitive manner.

## Appendix I

### Use case scenarios of accessible service management using user accessibility preference profiles in the IoT services

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

#### I.1. Smart home automation services

Users can interact with Internet of things (IoT) services through various interfaces. For example, users can communicate with smart home services through smart home appliances such as mobile applications and TVs or dedicated interfaces linked to smart home devices through specific home kiosk application as depicted in Figure I.1.



**Figure I.1. Types of user interface that can be used in smart home services**

To use IoT services, users with disabilities should be able to define their accessibility needs in the requested smart home services in advance. Depending on the type of content and service, they can request services by modifying information to suit their needs. For example, when specifying a travel route via IoT services, wheelchair users can check whether it excludes travel routes with steps, such as stairs.

The following functions may be provided based on user preferences.

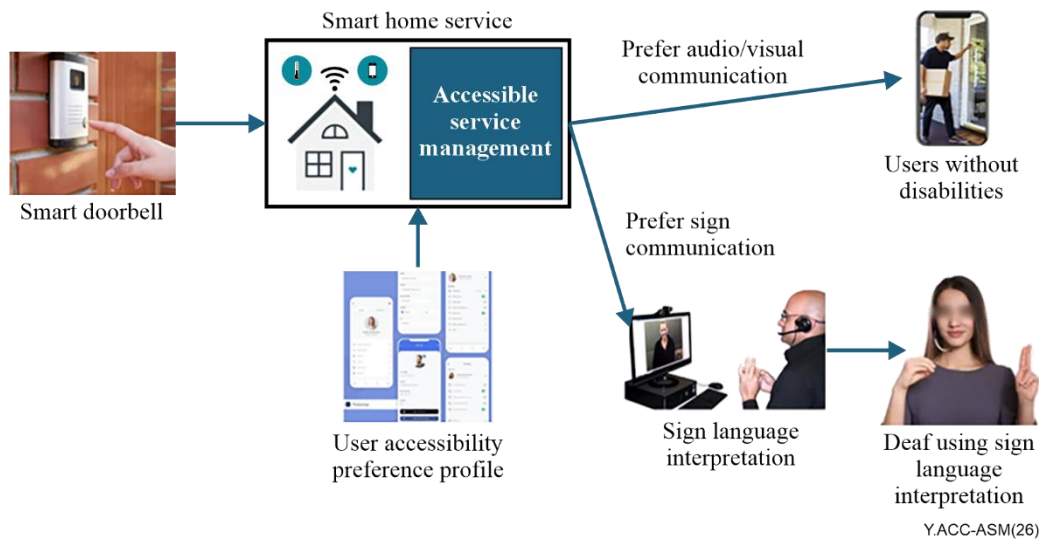
- If the user sets up their own accessibility needs in advance when they install and set up their IoT service in the corresponding device(s) for the first time, they can maintain the same accessibility setting no matter what interface is available to the user to link his or her device to utilize the IoT services. The importance of setting accessibility at the installation stage, maintaining consistency across interfaces, and ensuring interoperability with other interfaces has been noted in [ITU-T Y.4204], and this Recommendation uses the accessibility preference profile to ensure this consistency.

NOTE - User preferences can vary by individual and device environment; therefore, applying a single accessibility preference profile uniformly across all devices without user consent is not advisable. The best approach is to provide mechanisms that allow users to either apply their accessibility preference profile consistently across all devices or to configure it separately for each device, as they choose.

This use case introduces a scenario that leverages this accessibility profile to cover users with disabilities.

Users can communicate with visitors using cameras and smart doorbells installed on the front door. This service can also communicate with visitors using a dedicated terminal installed at home, even if the user does not move from the living room to the front door. In case of absence, it provides a function to check and communicate with visitors remotely using a mobile application.





**Figure I.2. Overview of accessible service management in smart home services**

This service may be extended to be more helpful for persons with disabilities. For example, when this service is connected to the sign language interpretation (SLI) service, a deaf user may communicate with an external visitor via the SLI service. In this case, a dedicated terminal should be installed at the deaf user's home to connect to the SLI service. When the user is absent, the deaf user should connect to the SLI service using a mobile application.

In households where multiple users with different abilities live together, the IoT doorbell service can adapt its interaction methods based on each family member's user accessibility preference profile (UAPP). For example, Figure I.2 provides an overview of accessible service management (ASM) in smart home services to address the needs of a deaf user.

To configure this service, it is necessary to select the service type for each user in advance, and the function for providing appropriate services in IoT services can be easily configured based on the accessibility preference profile of each family member set up in this way.

This service may also be extended to better support the needs of persons with visual disabilities. For example, when the IoT doorbell is activated by a visitor, the system can provide notifications and interaction options tailored to the user's specific UAPP. Blind and low-vision users may have different preferences for receiving and interacting with the notification generated by the doorbell service.

For instance, a blind user may prefer to receive an audio notification through a screen reader on a smartphone or a smart speaker that announces that someone is at the door and optionally describes the visitor's using a connected camera and artificial intelligence (AI)-based recognition service. In contrast, a user with low vision may prefer a visual notification with screen magnification, such as a zoomed-in video stream of the visitor displayed on a TV or mobile device.

## Bibliography

- [[b-ITU-T F.791](#)] Recommendation ITU-T F.791 (2018), *Accessibility terms and definitions*.
- [b-ITU PP Res.175] ITU Plenipotentiary Conference Resolution 175 (Busan, 2014), [Telecommunication/information and communication technology accessibility for persons with disabilities and persons with specific needs](#).
- [b-ITU WTDC AP] ITU World Telecommunication Development Conference (2014), Action plan. In: Final Report World Telecommunication Development Conference (WTDC-14), Dubai, United Arab Emirates, 2014-03-30/04-10, pp. 43-144. Available [viewed 2019-01-09] at <https://www.itu.int/en/ITU-D/Conferences/WTDC/Documents/D-TDC-WTDC-2014-PDF-E.pdf>
- [b-ITU WTDC Res.58] ITU World Telecommunication Development Conference Resolution 58 (Rev Dubai 2014), [Telecommunication/information and communication technology accessibility for persons with disabilities, including persons with age-related disabilities](#). In: Final Report World Telecommunication Development Conference (WTDC-14), Dubai, United Arab Emirates, 2014-03-30/04-10, pp. 396-410 Available [viewed 2019-01-09] at: <https://www.itu.int/en/ITU-D/Conferences/WTDC/Documents/D-TDC-WTDC-2014-PDF-E.pdf>
- [b-UNCRPD] United Nations (2006), *Convention on the rights of persons with disabilities*. New York, NY: United Nations. 37 pp. Available [viewed 2021-02-10] from: [https://treaties.un.org/doc/Publication/CTC/Ch\\_IV\\_15.pdf](https://treaties.un.org/doc/Publication/CTC/Ch_IV_15.pdf)
-