



## **Augmented Reality Framework (ARF); Interoperability Requirements for AR components, systems and services; Part 5: External Communications**

[ETSI GS ARF 004-5 V1.1.1 \(2022-12\)](https://standards.iteh.ai/catalog/standards/sist/8f61f281-405e-42bb-9725-d2cf5865582b/etsi-gs-arf-004-5-v1-1-1-2022-12)

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# Foreword

This Group Specification (GS) has been produced by ETSI Industry Specification Group (ISG) Augmented Reality Framework (ARF).

The present document is part 5 of a multi-part deliverable covering Interoperability Requirements for AR components, systems and services, as identified below:

- Part 1: "Overview";
- Part 2: "World Storage and AR Authoring functions";
- Part 3: "World Capture, World Analysis and Scene Management";
- Part 4: "World Analysis, World Storage and Scene Management functions (AR8, AR10, AR11)";
- Part 5: "External Communications".**

The ISG ARF shares the following understanding for Augmented Reality: Augmented Reality (AR) is the ability to mix in real-time spatially-registered digital content with the real world. The present document specifies the interoperability requirements for Reference Points AR1 and AR2 of the reference architecture for AR solutions defined in ETSI GS ARF 003 [1].

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# Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the [ETSI Drafting Rules](#) (Verbal forms for the expression of provisions).

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# 1 Scope

The present document reviews the high level Reference Point requirements between the Scene Management and External Application Support functions as they are described in ETSI GS ARF 003 [1].

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## 2 References

### 2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <https://docbox.etsi.org/Reference/>.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI GS ARF 003 (V1.1.1): "Augmented Reality Framework (ARF) AR framework architecture".

### 2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] IETF RFC 7231: "Hypertext Transfer Protocol (HTTP/1.1): Semantics and Content".

NOTE: Available at <https://www.rfc-editor.org/rfc/rfc7231.txt>.

[i.2] IETF RFC 2974: "Session Announcement Protocol".

NOTE: Available at <https://www.rfc-editor.org/rfc/rfc2974.txt>.

[i.3] IETF RFC 2608: "Service Location Protocol".

NOTE: Available at <https://www.rfc-editor.org/rfc/rfc2608.txt>.

[i.4] IETF RFC 6763: "DNS-Based Service Discovery".

NOTE: Available at <https://www.rfc-editor.org/rfc/rfc6763.txt>.

[i.5] IETF RFC 6762: "Multicast DNS".

NOTE: Available at <https://www.rfc-editor.org/rfc/rfc6762.txt>.

[i.6] W3C® Working Draft, 10 August 2022: "Web of Things (WoT) Discovery".

NOTE: Available at <https://www.w3.org/TR/wot-discovery/>.

[i.7] IETF RFC 6733: "Diameter Base Protocol".

NOTE: Available at <https://www.rfc-editor.org/rfc/rfc6733.txt>.

[i.8] OASIS Standard (7 March 2019): "MQTT Version 5.0".

NOTE: Available at <https://docs.oasis-open.org/mqtt/mqtt/v5.0/os/mqtt-v5.0-os.html>.

[i.9] IEEE 802.3TM-2018: "IEEE Standard for Ethernet".

NOTE: Available at <https://ieeexplore.ieee.org/document/8457469>.

[i.10] IEEE 802.11TM-2020: "IEEE Standard for Information Technology--Telecommunications and Information Exchange between Systems - Local and Metropolitan Area Networks--Specific Requirements - Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications".

NOTE: Available at <https://standards.ieee.org/ieee/802.11/7028/>.

[i.11] IETF RFC 5246: "The Transport Layer Security (TLS) Protocol Version 1.2".

NOTE: Available at <https://www.rfc-editor.org/rfc/rfc5246.txt>.

[i.12] IETF RFC 8446: "The Transport Layer Security (TLS) Protocol Version 1.3".

NOTE: Available at <https://www.rfc-editor.org/rfc/rfc8446.txt>.

[i.13] IETF RFC 9110: "HTTP Semantics".

NOTE: Available at <https://www.rfc-editor.org/rfc/rfc9110.txt>.

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## 3 Definition of terms, symbols and abbreviations

### 3.1 Terms

For the purposes of the present document, the following terms apply:

**AR scene:** information describing the interactive content contributing to an augmented reality experience

**reference point:** point located at the interface of two non-overlapping functions and representing interrelated interactions between those functions

### 3.2 Symbols

Void.

### 3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AR	Augmented Reality
AVP	Attribute Value Pair
DNS	Domain Name System
Gb	Gigabit
HTTP	HyperText Transfer Protocol
HTTPS	HyperText Transfer Protocol Secure
IEEE	Institute of Electrical and Electronics Engineers
IoT	Internet of Things
IP	Internet Protocol
LAN	Local Area Network

Mb	Megabit
MQTT	Message Queuing Telemetry Transport
RP	Reference Point
SDO	Standard Development Organization
SM	Scene Management
TCP	Transmission Control Protocol
TLS	Transport Layer Security
URI	Uniform Resource Identifier
URL	Universal Resource Locator
WLAN	Wireless LAN

## 4 Interoperability Requirements for AR3

### 4.1 Scope of the AR3 Reference Point

The AR3 "External Communications" Reference Point (RP), as specified in ETSI GS ARF 003 [1] defines the dialog structure for real-time communication and data exchange between the Scene Management (SM) functions and an external system to ensure that relevant features of such a system are available to SM subfunctions for processing and control. Involved in such activities are the subfunctions "Interaction Technique" and "Virtual Scene Update".

NOTE: In the reference architecture of ETSI GS ARF 003 [1] the external function block is named as "External Application Support". It should be mentioned that for the present document only service-related aspects of this function block are taken into account.

### 4.2 High-level requirements

The characteristics of the External Application Support are described in ETSI GS ARF 003 [1] as repeated here:

*"This function shall handle real-time communication and data exchange between the AR implementation and an external system. An external system may provide data at runtime which can modify the AR scene. It may also receive data or commands from the AR implementation to control the external system. The potential types of external systems can be manifold. It ranges from a simple sensor measuring a certain data value up to a complex system with multiple components. In the present document the required communication and data exchange functionalities are subsumed under the term External Application Support".*

With this description, the communication across RP AR3 can be characterized by three high level requirements that are in sequence and are depicted in Figure 1.

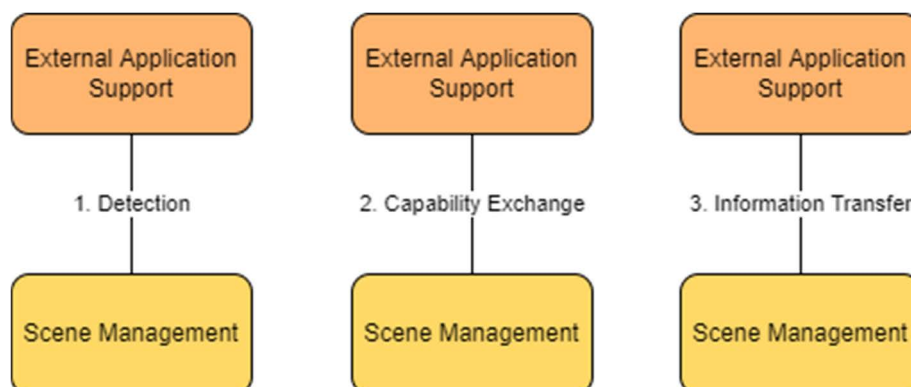


Figure 1: Sequence of AR3 requirements

The requirements of the AR3 reference point depend on the state the SM is in and can be classified as follows:

- Detection of the external application support:
  - Type of support that can be provided to the Scene Management.

- Number of external services of similar type (when available).
- Temporal and/or regional availability of external services; conditions of use.
- Information about possible set-up scenarios for ensuring connectivity.
- Basics about the type of information that can be provided.
- Capability Exchange:
  - Exchange of requests for the type of information to be transferred.
  - Requesting conditions for an information exchange (e.g. temporal, data ranges, resolution, measurement units).
  - Negotiations about the data format of the information to be transferred.
  - In case of multiple external services: identification/marking of information transfer, switching between services.
- Information transfer:
  - Packaging of information in the agreed format.
  - Initializing and closing the information transfer.
  - Metadata unambiguously associated to the information transfer.
  - In case of multiple external services: additional information about the delivering service.

### 4.3 Scene Management Function: Detection of External Application Support

The first set of AR3 requirements applies to the function's detection of services provided by external applications support. This activity is needed as an initial step for a possible future exchange of information between the SM and one or more external services. This function either relies on already known information about possible external services or on the availability of detecting appropriate external information that make themselves known to the SM. The SM function also sets up a list of candidates that are evaluated by the user or the AR implementation prior to the exchange of service-related information.

**RQ-AR3-001** The SM shall have the ability to detect suitable external services provided by external applications support.

Requested information should include:

- Accessibility to external service (e.g. domain name, URL, temporal or regional restrictions, communication scheme (unicast, multicast, broadcast)).
- Characteristics of the external service (e.g. type of information that can be delivered, availability of metadata).
- Capabilities of the external service (e.g. computation support, data storage, etc.):

**RQ-AR3-002** The SM shall have the ability to present detected external services for evaluation in case more than one service is detected.

This collection can include:

- A list of detected external services and a summary of their characteristics.
- A possibility for a human user to detect one or more of these services.
- A presentation of the collection in a format that is machine-readable.

## 4.4 Scene Management Function: Capability Exchange with External Application Support

Once the Scene Management has created a list of available external services for application support, a capability exchange starts with selected external services to decide which external services shall be incorporated for the sake of the AR implementation.

**RQ-AR3-003** The SM shall have the ability to contact external services for a capability exchange.

The parameters for a capability exchange can include:

- Initialization parameters to start the capability exchange with an external service.
- Starting queries to tell the external service in which parameters the SM is interested in.
- Information about the availability of parameters and their representation (e.g. data format, measuring units, age of measured parameters (time stamps), temporal resp. spatial resolution).
- Information about data transfer characteristics (e.g. transmission format, transport protocol, transfer protection).
- Possibilities for monitoring and/or controlling an external service.
- Selected information to tell the external service which parameters shall be made available to the SM.
- Registration of selected parameters for usage by the Scene Management.
- Finalization parameters to stop the capability exchange with an external service.

## 4.5 Information Transfer between External Application Support and Scene Management

Under the control of the Scene Management and following the results of the capability exchange, data available from external services as well as for monitoring and controlling such services are exchanged between the Scene Management and the External Application Support.

**RQ-AR3-004** Data streams shall be exchanged between the Scene Management and at least one external service using formats negotiated during the capability exchange.

Depending on the characteristics of both the external service and the AR scene, it may be useful to add time stamps to the data exchange to facilitate the handling of data by the AR scene or to trigger activities in the external service on the time.

**RQ-AR3-005** Data streams may be extended by time stamps to facilitate synchronization between the SM and an external service.

Time stamps are the most common elements to support synchronization between components of a system. However, implementers are free to support other or supplementary levels of control (e.g. marking the availability of new data, provisioning data only for a certain time span, etc.).

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# Annex A (informative): Standards of Relevance to AR3 Requirements

## A.1 Introduction

This annex includes standards identified by the ETSI ISG ARF while preparing the present document. The intention of this annex is to compile, for informational purposes, those Standards Development Organizations (SDOs) and working groups with relevant activities in the field of supporting data transfer with real-time aspects between different devices using a publicly available network. This annex is not exhaustive and it is expected that there are other standards and SDOs also working in this field but which are not explicitly mentioned in this annex.

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## A.2 Standards Supporting the Detection of External Services

### A.2.1 Overview

Many AR implementations already possess pre-given addresses of external services to contact in order to run the implementation in a smooth and useful way. In almost all cases this is done by using the Hypertext Transfer Protocol (HTTP) as an application layer protocol of the Internet protocol suite by exchanging request and response messages between the AR implementation and the external service, a method known as HTTP Request (for details see section 4 of [i.1]). Where this is not the case, there are existing standards that support the detection of available services in IP-based networks using multicast or broadcast delivery mechanisms. These standards work on the network layer and allow users to find more information about the service they require. The standards identified include:

- IETF RFC 7231 [i.1].
- IETF RFC 2974 [i.2]. [standards.ietf.org/catalog/standards/sist/8f61f281-405e-42bb-9725-d2cf5865582b/etsi-gs-arf-004-5-v1-1-1-2022-12](https://standards.ietf.org/catalog/standards/sist/8f61f281-405e-42bb-9725-d2cf5865582b/etsi-gs-arf-004-5-v1-1-1-2022-12)
- IETF RFC 2608 [i.3].
- IETF RFC 6763 [i.4].
- IETF RFC 6762 [i.5].
- W3C® Working Draft [i.6].

### A.2.2 Session Announcement Protocol

IETF RFC 2974 [i.2] defines the advertisement of sessions, and the possibilities to communicate the relevant session setup information to prospective participants using well-known multicast addresses. The information is periodically distributed by a session directory. The protocol does not contain any rendezvous mechanism, the announcer of a session is not aware of any listeners. The modification of a session is published by announcing a modified session description.

### A.2.3 Service Location Protocol

IETF RFC 2608 [i.3] specifies a flexible and scalable framework for providing hosts with access to information about the existence, location, and configuration of networked services. Traditionally, users have had to find services by knowing the name of a network host which is an alias for a network address. This protocol eliminates the need for a user to know the name of a network host supporting a service. Rather, the user supplies the desired type of service and a set of attributes which describe the service. Based on that description, the Service Location Protocol resolves the network address of the service for the user.

The protocol is intended to function within networks under cooperative administrative control and is as such primarily designed for use within LANs. It support the usage of multicast and unicast delivery of IP packets.