

ETSI TS 133 558 V17.3.0 (2023-01)



**5G;
Security aspects of enhancement of support
for enabling edge applications
(3GPP TS 33.558 version 17.3.0 Release 17)**



Reference

RTS/TSGS-0333558vh30

Keywords

5G

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - APE 7112B
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

Important notice

The present document can be downloaded from:

<http://www.etsi.org/standards-search>

The present document may be made available in electronic versions and/or in print. The content of any electronic and/or print versions of the present document shall not be modified without the prior written authorization of ETSI. In case of any existing or perceived difference in contents between such versions and/or in print, the prevailing version of an ETSI deliverable is the one made publicly available in PDF format at www.etsi.org/deliver.

Users of the present document should be aware that the document may be subject to revision or change of status.

Information on the current status of this and other ETSI documents is available at

<https://portal.etsi.org/TB/ETSIDeliverableStatus.aspx>

If you find errors in the present document, please send your comment to one of the following services:

<https://portal.etsi.org/People/CommitteeSupportStaff.aspx>

If you find a security vulnerability in the present document, please report it through our
Coordinated Vulnerability Disclosure Program:

<https://www.etsi.org/standards/coordinated-vulnerability-disclosure>

Notice of disclaimer & limitation of liability

The information provided in the present deliverable is directed solely to professionals who have the appropriate degree of experience to understand and interpret its content in accordance with generally accepted engineering or other professional standard and applicable regulations.

No recommendation as to products and services or vendors is made or should be implied.

No representation or warranty is made that this deliverable is technically accurate or sufficient or conforms to any law and/or governmental rule and/or regulation and further, no representation or warranty is made of merchantability or fitness for any particular purpose or against infringement of intellectual property rights.

In no event shall ETSI be held liable for loss of profits or any other incidental or consequential damages.

Any software contained in this deliverable is provided "AS IS" with no warranties, express or implied, including but not limited to, the warranties of merchantability, fitness for a particular purpose and non-infringement of intellectual property rights and ETSI shall not be held liable in any event for any damages whatsoever (including, without limitation, damages for loss of profits, business interruption, loss of information, or any other pecuniary loss) arising out of or related to the use of or inability to use the software.

Copyright Notification

No part may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm except as authorized by written permission of ETSI.

The content of the PDF version shall not be modified without the written authorization of ETSI.

The copyright and the foregoing restriction extend to reproduction in all media.

© ETSI 2023.
All rights reserved.

Intellectual Property Rights

Essential patents

IPRs essential or potentially essential to normative deliverables may have been declared to ETSI. The declarations pertaining to these essential IPRs, if any, are publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "*Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards*", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (<https://ipr.etsi.org/>).

Pursuant to the ETSI Directives including the ETSI IPR Policy, no investigation regarding the essentiality of IPRs, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Trademarks

The present document may include trademarks and/or tradenames which are asserted and/or registered by their owners. ETSI claims no ownership of these except for any which are indicated as being the property of ETSI, and conveys no right to use or reproduce any trademark and/or tradename. Mention of those trademarks in the present document does not constitute an endorsement by ETSI of products, services or organizations associated with those trademarks.

DECT™, **PLUGTESTS™**, **UMTS™** and the ETSI logo are trademarks of ETSI registered for the benefit of its Members. **3GPP™** and **LTE™** are trademarks of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners. **oneM2M™** logo is a trademark of ETSI registered for the benefit of its Members and of the oneM2M Partners. **GSM®** and the GSM logo are trademarks registered and owned by the GSM Association.

Legal Notice

This Technical Specification (TS) has been produced by ETSI 3rd Generation Partnership Project (3GPP).

The present document may refer to technical specifications or reports using their 3GPP identities. These shall be interpreted as being references to the corresponding ETSI deliverables.

The cross reference between 3GPP and ETSI identities can be found under <http://webapp.etsi.org/key/queryform.asp>.

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).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Contents

Intellectual Property Rights	2
Legal Notice	2
Modal verbs terminology.....	2
Foreword.....	4
1 Scope	6
2 References	6
3 Definitions of terms, symbols and abbreviations	7
3.1 Terms.....	7
3.2 Symbols.....	7
3.3 Abbreviations	7
4 Overview	7
5 Security requirements.....	7
5.1 General security requirements.....	7
5.1.1 Authentication and authorization	7
5.1.2 Interface security	8
5.1.3 User consent requirements.....	8
6 Procedures	8
6.1 Security for the EDGE interfaces	8
6.2 Authentication and authorization between EEC and ECS	9
6.3 Authentication and authorization between EEC and EES	9
6.4 Authentication and authorization between EES and ECS	9
6.4.1 General.....	9
6.4.2 Procedure for the authentication and authorization between EES and ECS	9
6.5 Authentication and authorization in EES capability exposure	10
6.6 Authentication and Authorization between EESs.....	10
Annex A (informative): Change history	11
History	12

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
 - 1 presented to TSG for information;
 - 2 presented to TSG for approval;
 - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

In the present document, modal verbs have the following meanings:

- shall** indicates a mandatory requirement to do something
- shall not** indicates an interdiction (prohibition) to do something

The constructions "shall" and "shall not" are confined to the context of normative provisions, and do not appear in Technical Reports.

The constructions "must" and "must not" are not used as substitutes for "shall" and "shall not". Their use is avoided insofar as possible, and they are not used in a normative context except in a direct citation from an external, referenced, non-3GPP document, or so as to maintain continuity of style when extending or modifying the provisions of such a referenced document.

- should** indicates a recommendation to do something
- should not** indicates a recommendation not to do something
- may** indicates permission to do something
- need not** indicates permission not to do something

The construction "may not" is ambiguous and is not used in normative elements. The unambiguous constructions "might not" or "shall not" are used instead, depending upon the meaning intended.

- can** indicates that something is possible
- cannot** indicates that something is impossible

The constructions "can" and "cannot" are not substitutes for "may" and "need not".

- will** indicates that something is certain or expected to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document
- will not** indicates that something is certain or expected not to happen as a result of action taken by an agency the behaviour of which is outside the scope of the present document
- might** indicates a likelihood that something will happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

might not indicates a likelihood that something will not happen as a result of action taken by some agency the behaviour of which is outside the scope of the present document

In addition:

is (or any other verb in the indicative mood) indicates a statement of fact

is not (or any other negative verb in the indicative mood) indicates a statement of fact

The constructions "is" and "is not" do not indicate requirements.

1 Scope

The present document specifies the security features and mechanisms to support the application architecture for enabling Edge Applications in 5G, i.e. security for the interfaces, procedures for the authentication and authorization between the entities of the application architecture, and procedures for the EES capability exposure.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP TS 33.210: "3G security; Network Domain Security (NDS); IP network layer security".
- [3] 3GPP TS 33.501: "Security architecture and procedures for 5G System".
- [4] Void
- [5] 3GPP TS 23.558: "Architecture for enabling Edge Applications."
- [6] 3GPP TS 23.222: "Functional architecture and information flows to support Common API Framework for 3GPP Northbound APIs; Stage 2".
- [7] 3GPP TS 33.122: "Security aspects of Common API Framework (CAPIF) for 3GPP northbound APIs"
- [8] Void
- [9] Void
- [10] 3GPP TS 33.310: "Network Domain Security (NDS); Authentication Framework (AF)".
- [11] 3GPP TS 33.535: "Authentication and Key Management for Applications (AKMA) based on 3GPP credentials in the 5G System (5GS)".
- [12] 3GPP TS 33.222: "Generic Authentication Architecture (GAA); Access to network application functions using Hypertext Transfer Protocol over Transport Layer Security (HTTPS)".
- [13] Void
- [14] Void
- [15] IETF RFC 6749: "The OAuth 2.0 Authorization Framework".
- [16] IETF RFC 6750: "The OAuth 2.0 Authorization Framework: Bearer Token Usage".
- [17] IETF RFC 7519: "JSON Web Token (JWT)".
- [18] IETF RFC 7515: "JSON Web Signature (JWS)".
- [19] IETF RFC 9113: "HTTP/2".
- [20] IETF RFC 9110: "HTTP Semantics".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

4 Overview

The overall application architecture for enabling Edge Applications that is given in TS 23.558 [5], includes several entities, such as 3GPP core network, Edge Enabler Client (EEC) deployed in the UE, Edge Configuration Server (ECS), Edge Enabler Server (EES), and Edge Application Server (EAS). The application architecture for enabling Edge Applications, is defined in TS 23.558 [2] clause 6.2.

This specification captures the following security requirements and procedures:

- Security for the EDGE interfaces: the set of security features that enable network nodes to exchange signalling data and user plane data securely.
- Authentication and Authorization between EEC and ECS/EES: the set of security features that enable the authentication between EEC and ECS/EES, and enable the EEC to be authorized by the ECS/EES.
- Authentication and Authorization between EES and ECS: the set of security features that enable the authentication between EES and ECS, and enable the EES to be authorized by the ECS.
- Authentication and Authorization in EES capability exposure: the set of security features that enable the EAS to be authenticated and authorized by the EES in EES capability exposure.
- Authentication and Authorization in 3GPP Core Network capability exposure: the set of security features that enable the ECS/EES/EAS to be authenticated and authorized by the 3GPP Core Network in 3GPP Core Network capability exposure.

5 Security requirements

5.1 General security requirements

The Edge application architecture defined in the TS 23.558 [5] shall satisfy the following requirements.

5.1.1 Authentication and authorization

Authentication and Authorization between Edge Enabler Client (EEC) and Edge Configuration Server (ECS): Edge Configuration Server (ECS) shall be able to provide mutual authentication with Edge Enabler Client (EEC) over EDGE-4 Interface. ECS shall determine whether EEC is authorized to access ECS's services.

Authentication and Authorization between EEC and EES: Edge Enabler Server (EES) shall provide mutual authentication with EEC over EDGE-1 Interface. EES shall determine whether EEC is authorized to access EES's services.

Authentication and Authorization between Edge Enabler Server (EES) and ECS: ECS shall provide mutual authentication with EES over EDGE-6 Interface. ECS shall determine whether EES is authorized to access ECS's services.

Authentication and Authorization between EESs: EES shall provide mutual authentication with another EES over EDGE-9 Interface. EES shall determine whether peer EES is authorized to access EES's services.

Authentication and Authorization in EES capability exposure to EAS: EES shall provide mutual authentication with EAS over EDGE-3 Interface. EES shall determine whether EAS is authorized to access EES's services and expose EEC Capabilities. The Edge application architecture shall support EASs to obtain the user's authorization to access sensitive information (e.g. user's location).

NOTE1: The corresponding security requirements defined in TS 23.558 [5] is AR-5.2.6.2-a/b/d/e/f/g.

5.1.2 Interface security

Confidentiality, integrity, and replay protection shall be supported on the EDGE-1-4 and EDGE 6-9 interfaces.

NOTE 1: The interfaces are defined in the Figure 6.2.4 of TS 23.558 [5]. The corresponding security requirement defined in TS 23.558 [5] is AR-5.2.6.2-c.

NOTE 2: The security requirement of EDGE 5 is out of the scope of this specification, since its details are out of the scope of this release of this specification, according to TS 23.558 [5].

The privacy requirements AR-5.2.6.2-h defined in TS 23.558 [5] are implicitly supported, since all the interfaces will be confidentiality and integrity protected.

5.1.3 User consent requirements

User consent for edge computing shall comply with TS 33.501 [3] (Annex V).

If EES, trusted by the 3GPP Core Network, is utilizing 5GC services without NEF, the EES acts as the consent enforcing entity. Otherwise, if the EES is utilizing 5GC services via NEF, the NEF acts as the consent enforcing entity.

User consent architecture in the present document is only applicable when EES or NEF and data provider are operated by the same entity.

6 Procedures

6.1 Security for the EDGE interfaces

For the interfaces (EDGE-1/4), the EEC, EES and ECS shall support and use HTTP/2 with "https" URIs as specified in RFC 9113 [19] and RFC 9110 [20]. In addition, the TLS profile shall be compliant with the profile given in clause 6.2 of TS 33.210 [2].

For the interfaces EDGE-2/7/8,

- If the NEF APIs are selected, security aspects of Network Exposure Function including the protection of NEF-AF interface and support of CAPIF defined in TS 33.501 clause 12 [2] shall be reused, i.e., use of TLS.
- If the SCEF APIs are selected, the Security procedures for reference point SCEF-SCS/AS defined in TS 33.187 clause 5.5 [3] can be reused here, i.e., use of TLS.

For the interfaces (EDGE-3/6/9), the EAS, EES and ECS shall support and use HTTP/2 with "https" URIs as specified in RFC 9113 [19] and RFC 9110 [20]. In addition, the TLS profile shall be compliant with the profile given in clause 6.2 of TS 33.210 [2].

6.2 Authentication and authorization between EEC and ECS

The ECS shall be configured with the information of authorization methods (token-based authorization or local authorization) used by EESes.

Authentication between EEC and ECS shall be done during the execution of the TLS handshake protocol.. Details of the authentication method (e.g., TLS certificates, usage of AKMA [11] or GBA [12] as methods to arrange the PSK for TLS) are out of scope of the present document. If the EEC sends the GPSI to the ECS, then the ECS shall also authenticate the GPSI. The details of how to authenticate the GPSI is out of scope of the present document.

After successful authentication, the ECS shall authorize the EEC by its local authorization policy.

After successful authentication and authorization, the ECS decides whether OAuth 2.0 [15] access tokens are required for the candidate EESes using the configuration information and issues separate EES access tokens to be used for each candidate EESes that use token-based authorization. The ECS, EEC and EES respectively assume the role of authorization server, client and resource server roles defined in [15]. "Client Credentials" grant type and bearer tokens [16] shall be used. JSON Web Token (JWT) as specified in IETF RFC 7519 [17] for encoding and the JSON signature profile as specified in IETF RFC 7515 [18] for protection of tokens shall be followed. This token profile also applies for clause 6.3 of the present document. The claims of the EES service tokens in the form of JWT [17] shall include the ECS FQDN (issuer), EEC ID (client_id), GPSI (subject), expected EES service name(s) (scope), EES FQDN (audience), expiration time (expiration). The ECS shall send the service response back to the EEC, which may include EES access token(s).

6.3 Authentication and authorization between EEC and EES

Authentication between EEC and EES shall be done during the execution of the TLS handshake protocol.. Details of the authentication method (e.g., TLS certificates, usage of AKMA [11] or GBA [12] as methods to arrange the PSK for TLS) are out of scope of the present document. If the EEC sends the GPSI to the EES, then the EES shall also authenticate the GPSI. The details of how to authenticate the GPSI is out of scope of the present document.

For authorization of EEC by the EES, the EEC shall send the OAuth 2.0 [15] access token, if received from the ECS, to the EES. The token profile is specified in clause 6.2 of the present document. If the EES requires access token for authorization, then the EES shall authorize the EEC by using the token. Otherwise, the EES shall authorize the EEC by its local authorization policy.

After successful authentication and authorization, the EES shall process the request and sends the service response back to the EEC.

6.4 Authentication and authorization between EES and ECS

6.4.1 General

The detailed service procedures between EES and ECS are described in TS 23.558 [5].

6.4.2 Procedure for the authentication and authorization between EES and ECS

Pre-requisite:

- EES obtains onboarding information within the same PLMN domain or from a third-party domain. The information includes the Edge Configuration Server Address and Root CA certificate details, it may include an enrolment token.

NOTE1: The provisioning and usage of the onboarding information are out of the scope of this document.

- The EES and ECS are provisioned with credentials for the mutual authenticated TLS.

TLS shall be used to provide integrity protection, replay protection, and confidentiality protection for the interface between the EES and the ECS.

Security profiles for TLS implementation and usage shall follow the profiles given in clause 6.2 of TS 33.210 [2]. The certificates shall follow the profile given in clause 6.1.3a of TS 33.310 [10]. The identities in the end-entity certificates shall be used for authentication and policy checks. Identities in the end-entity certificate shall be based on endpoint information (e.g., URI, FQDN, IP address) as described in the TS 23.558 [5].

The ECS shall authorize the EES based on local authorization policy.

6.5 Authentication and authorization in EES capability exposure

According to clause 8.7.3 of TS 23.558 [5], the EES may re-expose the network capabilities of the 3GPP core network to the EAS(s) as per the CAPIF architecture specified in TS 23.222 [6]. If the CAPIF architecture is used, the CAPIF functional security model specified in TS 33.122 [7] shall be used for Authentication and authorization in EES capability exposure.

If CAPIF is not used, mutual authentication with TLS certificates using TLS shall be used. The TLS and certificates shall follow the profiles defined in TS 33.210 [2] and TS 33.310 [10], and the authorization is based on local authorization policy at the EES.

NOTE: Void

6.6 Authentication and Authorization between EESs

As specified in clause 6.1, TLS is used for EDGE-9 reference point (between edge enabler servers) security. For authentication between EESs, X.509 certificates shall be used. The certificates shall follow the profile given in clause 6.1.3a of TS 33.310 [10]. The identities in the end-entity certificates shall be used for authentication and policy checks. Identities in the end-entity certificate shall be based on endpoint information (e.g., URI, FQDN, IP address) as described in TS 23.558 [5].

Authorization between EESs is based on local authorization policy.

Annex A (informative): Change history

Change history							
Date	Meeting	TDoc	CR	Rev	Cat	Subject/Comment	New version
2022-03	SA#95e	SP-220189				Presented for information and approval	1.0.0
2022-03	SA#95e					Upgrade to change control version	17.0.0
2022-06	SA#96	SP-220558	0001	2	F	Editorial corrections and technical clarifications	17.1.0
2022-06	SA#96	SP-220558	0002	1	F	Clarification of access token usage in EC	17.1.0
2022-09	SA#97e	SP-220879	0006	-	F	Corrections and clarifications on the usage of HTTPS and X.509 certificates	17.2.0
2022-12	SA#98e	SP-221158	0008	-	F	Addressing authentication and authorization for EDGE-9	17.3.0

History

Document history		
V17.0.0	May 2022	Publication
V17.1.0	July 2022	Publication
V17.2.0	September 2022	Publication
V17.3.0	January 2023	Publication