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Contents

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:

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y   the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

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1   Scope

The present document is part of a series of documents that specify charging functionality and charging management in GSM/UMTS networks. The GSM/UMTS core network charging architecture and principles are specified in TS 32.240 [1], which provides an umbrella for other charging management TSs that specify:

-    the content of the CDRs per domain / subsystem / service (offline charging);

-    the content of real-time charging messages per domain / subsystem / service (online charging);

-    the functionality of online and offline charging for those domains / subsystems / services;

-    the interfaces that are used in the charging framework to transfer the charging information (i.e. CDRs or charging events).

The complete document structure for these TSs is defined in TS 32.240 [1].

The present document specifies the offline and online charging description for the Proximity-based Services (ProSe), based on the stage 2 description of ProSe in TS 23.303 [238]. This charging description includes the offline and online charging architecture and scenarios specific to the ProSe, as well as the mapping of the common 3GPP charging architecture specified in TS 32.240 [1] onto the ProSe. It further specifies the structure and content of the CDRs for offline charging, and the charging events for online charging. The present document is related to other 3GPP charging TSs as follows:

-    The common 3GPP charging architecture is specified in TS 32.240 [1].

-    The parameters, abstract syntax and encoding rules for the CDRs are specified in TS 32.298 [51].

-    A transaction based mechanism for the transfer of CDRs within the network is specified in TS 32.295 [54].

-    The file based mechanism used to transfer the CDRs from the network to the operator's billing domain (e.g. the billing system or a mediation device) is specified in TS 32.297 [52].

-    The 3GPP Diameter application that is used for ProSe offline and online charging is specified in TS 32.299 [50].

All references, abbreviations, definitions, descriptions, principles and requirements, used in the present document, that are common across 3GPP TSs, are defined in TR 21.905 [100]. Those that are common across charging management in GSM/UMTS domains, services or subsystems are provided in the umbrella TS 32.240 [1] and are copied into clause 3 of the present document for ease of reading. Finally, those items that are specific to the present document are defined exclusively in the present document.

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 TS 32.240: "Telecommunication management; Charging management; Charging Architecture and Principles".

[2] - [9]   Void.

[10]   3GPP TS 32.250: "Telecommunication management; Charging management; Circuit Switched (CS) domain charging".

[11]	3GPP TS 32.251: "Telecommunication management; Charging management; Packet Switched (PS) domain charging".
[12] - [19]	Void.
[20]	3GPP TS 32.260: "Telecommunication management; Charging management; IP Multimedia Subsystem (IMS) charging".
[21] - [29]	Void.
[30]	3GPP TS 32.270: "Telecommunication management; Charging management; Multimedia Messaging Service (MMS) charging".
[31] - [49]	Void.
[50]	3GPP TS 32.299: "Telecommunication management; Charging management; Diameter charging applications".
[51]	3GPP TS 32.298: "Telecommunication management; Charging management; Charging Data Record (CDR) parameter description".
[52]	3GPP TS 32.297: "Telecommunication management; Charging management; Charging Data Record (CDR) file format and transfer".
[53]	Void.
[54]	3GPP TS 32.295: "Telecommunication management; Charging management; Charging Data Record (CDR) transfer".
[55] - [99]	Void.
[100]	3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
[101]	3GPP TS 22.115: "Service aspects; Charging and billing".
[102] - [199]	Void.
[200] - [236]	Void.
[237]	3GPP TS 24.002: "GSM - UMTS Public Land Mobile Network (PLMN) Access Reference Configuration".
[238]	3GPP TS 23.303: "Proximity-based services (ProSe); Stage 2".
[239] - [499]	Void.

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [100] 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 [100].

2G- / 3G-: prefixes 2G- and 3G- refer to functionality that supports only GSM or UMTS, respectively, e.g. 2G-SGSN refers only to the GSM functionality of an SGSN. When the term/prefix is omitted, reference is made independently from the GSM or UMTS functionality.

accounting: process of apportioning charges between the Home Environment, Serving Network and Subscriber.

billing: function whereby CDRs generated by the charging function(s) are transformed into bills requiring payment.

Billing Domain: part of the operator network, which is outside the telecommunication network that receives and processes CDR files from the core network charging functions. It includes functions that can provide billing mediation and billing or other (e.g. statistical) end applications. It is only applicable to offline charging (see "Online Charging System" for equivalent functionality in online charging).

chargeable event: activity utilizing telecommunication network resources and related services for:

- user to user communication (e.g. a single call, a data communication session or a short message); or

- user to network communication (e.g. service profile administration); or

- inter-network communication (e.g. transferring calls, signalling, or short messages); or

- mobility (e.g. roaming or inter-system handover); and

- that the network operator may want to charge for.

As a minimum, a chargeable event characterises the resource / service usage and indicates the identity of the involved end user(s).

charged party: user involved in a chargeable event who has to pay parts or the whole charges of the chargeable event, or a third party paying the charges caused by one or all users involved in the chargeable event, or a network operator.

charging: function within the telecommunications network and the associated OCS/BD components whereby information related to a chargeable event is collected, formatted, transferred and evaluated in order to make it possible to determine usage for which the charged party may be billed (offline charging) or the subscriber's account balance may be debited (online charging).

Charging Data Record (CDR): formatted collection of information about one or more chargeable event(s) (e.g. time of call set-up, duration of the call, amount of data transferred, etc) for use in billing and accounting. For each party to be charged for parts of or all charges of the chargeable event(s) a separate CDR should be generated, i.e. more than one CDR may be generated for a single chargeable event, e.g. because of its long duration, or because more than one charged party is to be charged.

charging event: set of charging information forwarded by the CTF towards the CDF (offline charging) or towards the OCS (online charging). Each charging event matches exactly one chargeable event.

charging function: entity inside the core network domain, subsystem or service that is involved in charging for that domain, subsystem or service.

Credit Control: mechanism which directly interacts in real-time with an account and controls or monitors the charges, related to the service usage. Credit control is a process of: checking if credit is available, credit reservation, deduction of credit from the end user account when service is completed and refunding of reserved credit not used.

domain: part of a communication network that provides network resources using a certain bearer technology.

EPC-level ProSe Discovery: A ProSe Discovery procedure by which the EPC determines the proximity of two ProSe-enabled UEs and informs them of their proximity.

Fully Qualified Partial CDR (FQPC): partial CDR that contains a complete set of the fields specified in the present document. This includes all the mandatory and conditional fields as well as those fields that the PLMN operator has provisioned to be included in the CDR. The first Partial CDR should be a Fully qualified Partial CDR.

GTP': GPRS protocol used for CDR transport. It is derived from GTP with enhancements to improve transport reliability necessary for CDRs.

NOTE: This protocol is not used for tunnelling.

GSM only: qualifier indicating that this clause or paragraph applies only to a GSM system. For multi-system cases this is determined by the current serving radio access network.

in GSM,...: qualifier indicating that this paragraph applies only to GSM System.

in UMTS,...: qualifier indicating that this paragraph applies only to UMTS System.

inter-system change: change of radio access between different radio access technologies such as GSM and UMTS.

Local PLMN: A PLMN which is not the serving PLMN, and in whose radio resources the monitoring UE is authorized by the HPLMN to engage in ProSe Direct Discovery.

middle tier TS: term used for the 3GPP charging TSs that specify the domain / subsystem / service specific, online and offline, charging functionality. These are all the TSs in the numbering range from 3GPP TS 32.250 to 3GPP TS 32.279, e.g. 3GPP TS 32.250 [10] for the CS domain, or 3GPP TS 32.270 [30] for the MMS service. Currently, there is only one "tier 1" TS in 3GPP, which is 3GPP TS 32.240 [1] that specifies the charging architecture and principles. Finally, there are a number of top tier TSs in the 32.29x numbering range ([50] ff) that specify common charging aspects such as parameter definitions, encoding rules, the common billing domain interface or common charging applications.

Model A: involves one UE announcing "I am here"

Model B: involves one UE asking "who is there" and/or "are you there"

offline charging: charging mechanism where charging information **does not** affect, in real-time, the service rendered.

online charging: charging mechanism where charging information **can** affect, in real-time, the service rendered and therefore a direct interaction of the charging mechanism with bearer/session/service control is required.

Online Charging System (OCS): the entity that performs real-time credit control. Its functionality includes transaction handling, rating, online correlation and management of subscriber account balances.

partial CDR: CDR that provides charging information on part of a subscriber session. A long session may be covered by several partial CDRs. Two formats are considered for Partial CDRs. One that contains all of the provisioned fields (FQPC); the second has a reduced format (RPC).

ProSe Direct Discovery: A procedure employed by a ProSe-enabled UE to discover other ProSe-enabled UEs in its vicinity by using only the capabilities of the two UEs with E-UTRA technology.

ProSe Discovery: A process that identifies that a UE that is ProSe-enabled is in proximity of another, using E-UTRA (with or without E-UTRAN) or EPC.

ProSe-enabled Public Safety UE: A UE that the HPLMN has configured to be authorized for Public Safety use, and which is ProSe-enabled and supports ProSe procedures and capabilities specific to Public Safety.

ProSe Function: The ProSe Function is the logical function that is used for network related actions required for ProSe. The ProSe Function plays different roles for each of the features of ProSe. In this version of the specification it is assumed that there is only one logical ProSe Function in each PLMN that supports Proximity Services.
The ProSe Function contains three main sub-functions: Direct Provisioning Function (DPF), Direct Discovery Name Management Function, and EPC-level Discovery Function. The ProSe Function provides the necessary charging functionality for usage of ProSe.

real-time: real-time charging and billing information is to be generated, processed, and transported to a desired conclusion in less than 1 second.

Reduced Partial CDR (RPC): partial CDRs that only provide mandatory fields and information regarding changes in the session parameters relative to the previous CDR.

   EXAMPLE: Location information is not repeated in these CDRs if the subscriber did not change its location.

settlement: payment of amounts resulting from the accounting process.

subscriber: entity (associated with one or more users) that is engaged in a subscription with a service provider. The subscriber is allowed to subscribe and unsubscribe services, to register a user or a list of users authorized to enjoy these services, and also to set the limits relative to the use that associated users make of these services.

user: entity, not part of the 3GPP System, that uses network resources by means of a subscription. The user may or may not be identical to the subscriber holding that subscription.

User Equipment (UE): device allowing a user access to network services. For the purpose of 3GPP specifications the interface between the UE and the network is the radio interface. A User Equipment can be subdivided into a number of domains, the domains being separated by reference points. Currently defined domains are the USIM and ME Domains. The ME Domain can further be subdivided into several components showing the connectivity between multiple functional groups. These groups can be implemented in one or more hardware devices. An example of such a connectivity is the TE – MT interface. Further, an occurrence of a User Equipment is an MS for GSM as defined in TS 24.002 [237].

3.2   Symbols

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

Bpr	Reference point for CDR file transfer between ProSe CGF and the BD.
Bx	Reference point for CDR file transfer between any (generic) 3G domain, subsystem or service CGF and the BD.
Ga	Reference point for CDR transfer between a CDF and the CGF.
PC3	Reference point between UE and the ProSe Function.
PC3ch	Subset of PC3 specific to usage information collection for charging purposes.
Rf	Offline charging reference point between a ProSe Function and the CDF.
Ro	Online charging reference point between a ProSe Function and the OCS.

3.3   Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [100] 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 [100].

3G	3rd Generation
3GPP	3rd Generation Partnership Project
APN	Access Point Name
AVP	Attribute Value Pair
BD	Billing Domain
CDF	Charging Data Function
CDR	Charging Data Record
CGF	Charging Gateway Function
CTF	Charging Trigger Function
ECUR	Event Charging with Unit Reservation
E-UTRA	Evolved Universal Terrestrial Radio Access
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
FQPC	Fully Qualified Partial CDR
GTP	GPRS Tunnelling Protocol
GTP	The GPRS protocol used for CDR transport. It is derived from GTP with enhancements to improve transport reliability necessary for CDRs.
HPLMN	Home PLMN
HSS	Home Subscriber Server
IE	Information Element
IEC	Immediate Event Charging
IMS	IP Multimedia Subsystem
IMSI	International Mobile Subscriber Identity
IP	Internet Protocol
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
ISDN	Integrated Services Digital Network
MCC	Mobile Country Code (part of IMSI)
ME	Mobile Equipment
MNC	Mobile Network Code (part of IMSI)
MSISDN	Mobile Station ISDN number
NE	Network Element
OCS	Online Charging System
PLMN	Public Land Mobile Network
ProSe	Proximity-based Services
PS	Packet-Switched
QoS	Quality of Service
RAN	Radio Access Network
SCUR	Session Charging with Unit Reservation
SIM	Subscriber Identity Module
TR	Technical Report
TS	Technical Specification
UE	User Equipment

UMTS   Universal Mobile Telecommunications System
USIM   User Service Identity Module
VPLMN   Visited PLMN
WLAN   Wireless LAN

4 Architecture considerations

4.1 High level ProSe architecture

Figure 4.1.1 shows the high level view of the non-roaming architecture for ProSe that is defined in TS 23.303 [238]. In this figure, UE A and UE B have subscriptions from the same PLMN.
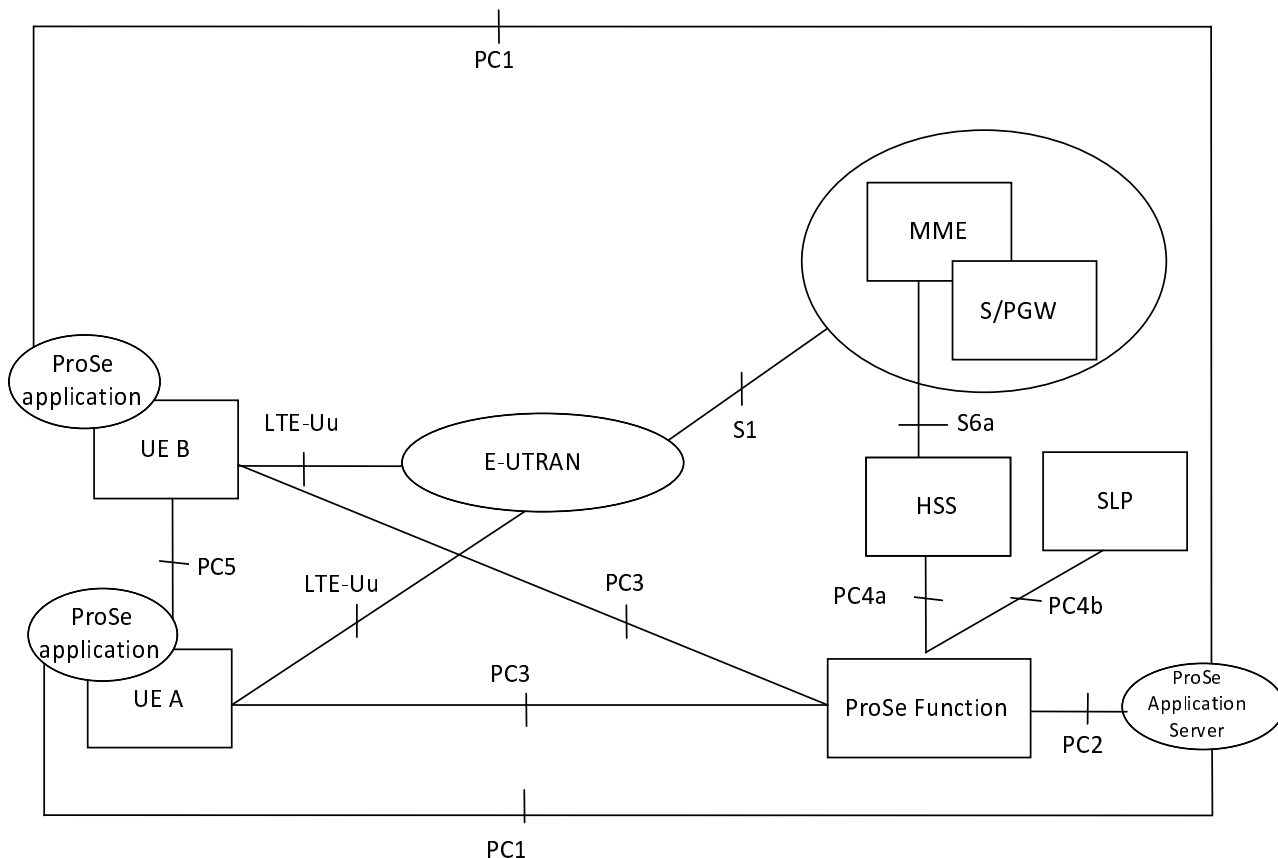
Figure 4.1.1: Non-roaming reference architecture

Figure 4.1.2 shows the high level view of non-roaming inter-PLMN architecture for ProSe defined in TS 23.303 [238]. In this figure, PLMN A is the HPLMN of UE A, and PLMN B is the HPLMN of UE B.

Figure 4.1.2: Inter-PLMN reference architecture

Figure 4.1.3 shows the high level view of the roaming architecture for ProSe as defined in TS 23.303 [238]. In this figure, UE A uses a subscription of PLMN A and UE B uses a subscription of PLMN B; UE A is roaming in PLMN C while UE B is not roaming.
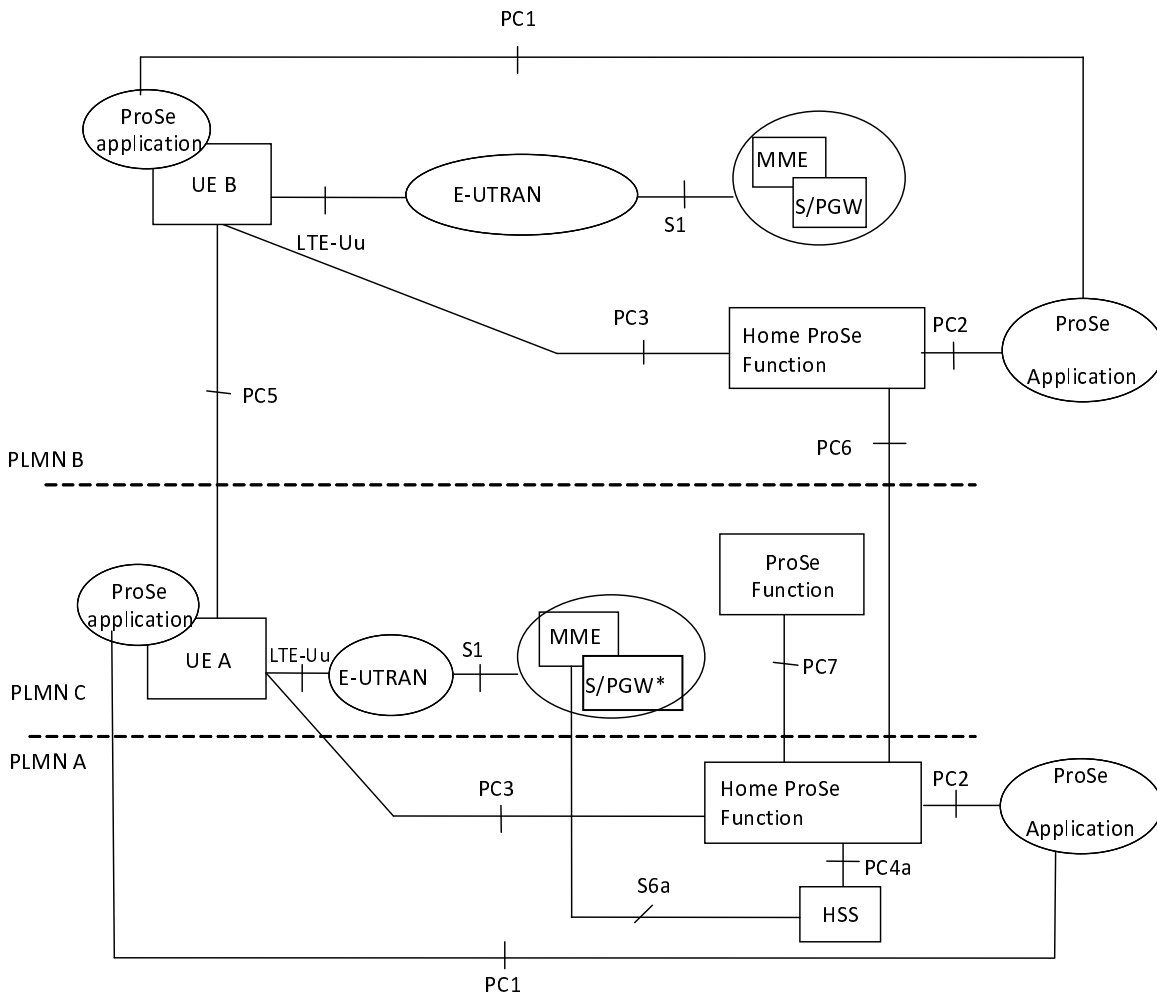
*A ProSe Proxy Function may be needed when PDN GW is located in the VPLMN.

Figure 4.1.3: Roaming reference architecture

NOTE: For EPC-level ProSe discovery the roaming architecture is not specified in this release.

4.2   ProSe offline charging architecture

For ProSe Direct Discovery and EPC-level Discovery services, as described in TS 32.240 [1], the CTF (an integrated component in each charging relevant ProSe Function) generates charging events and forwards them to the CDF. The CDF, in turn, generates CDRs which are then transferred to the CGF. Finally, the CGF creates CDR files and forwards them to the Billing Domain.

If the ProSe Function generating the charging information has an integrated CDF, then the ProSe Function can produce CDRs. The CGF may also be integrated in the ProSe Function, or it may exist as a physically separate entity. If the CGF is external to the ProSe Function, then the CDF forwards the CDRs to the CGF across the Ga interface.
In this case, the relationship between ProSe Function/CDF and CGF is m:1. If the CGF is integrated in the ProSe Function, then there is only an internal interface between the CDF and the CGF. In this case, the relationship between ProSe Function/CDF and CGF is 1:1.

If the CDF is external to the ProSe Function, the charging events are transferred from the ProSe Function to the CDF via the Rf interface specified in TS 32.299 [50]. In this case, the relationship between ProSe Function and CDF is m:1.

When an external CGF is used, this CGF may also be used by other, i.e. non-ProSe, network elements, according to network design and operator decision. It should be noted that the CGF may also be an integrated component of the BD – in this case, the Bx interface does not exist and is replaced by a proprietary solution internal to the BD.

Figure 4.2.1 depicts the architectural options described above.
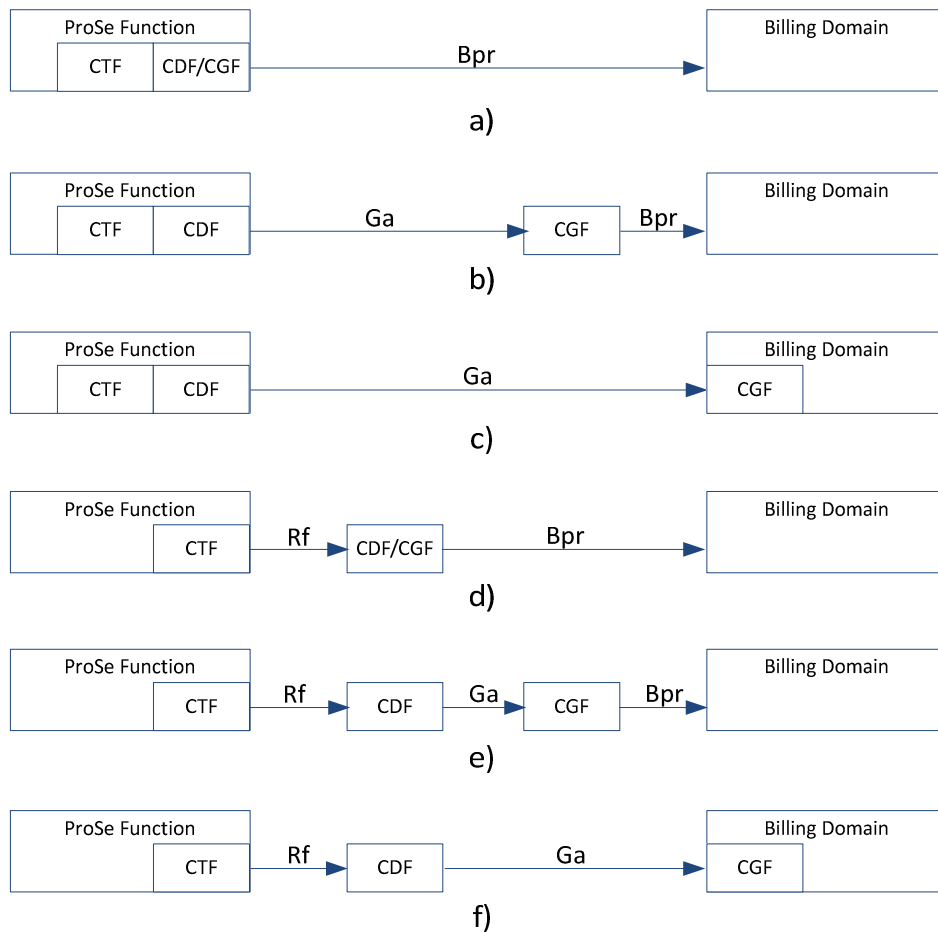
Figure 4.2.1: ProSe offline charging architecture

For the ProSe Direction Communication Service, the CTF is divided into two functional blocks as described in Annex D of TS 32.240 [1]. The Accounting Metrics Collection (AMC) function block is in the UE. The AMC sends usage information collected to the Accounting Data Forwarding (ADF) function block of the CTF in the ProSe Function over the PC3 reference point defined in TS 23.303 [238]. The subset of PC3 specific to usage information collection for charging purposes is denoted as PC3ch in figure 4.2.2.
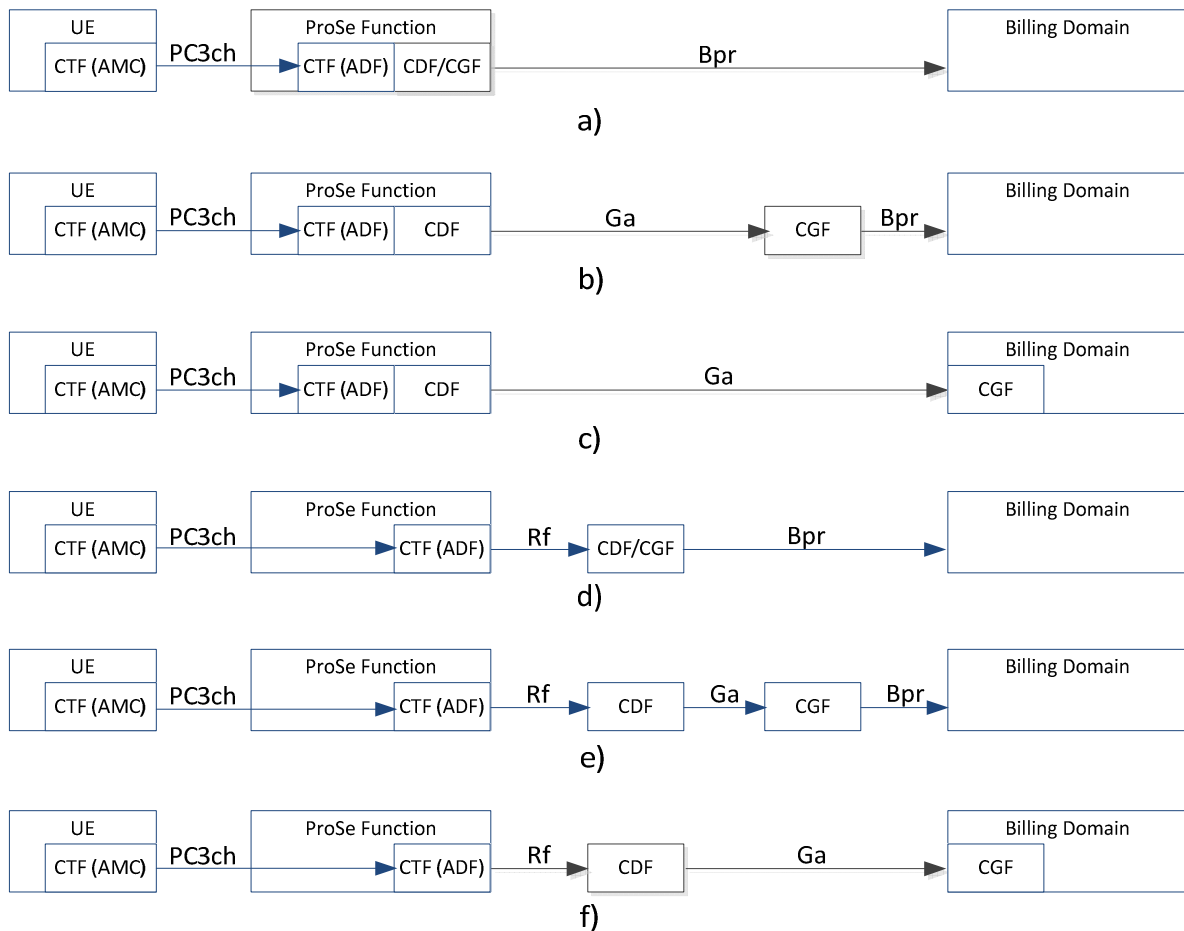
Figure 4.2.2: ProSe Direct Communication offline charging architecture

The PC3 protocol shall allow the following deployment options for the ProSe Function CTF (ADF) for ProSe Direct Communication depicted in figure 4.2.2:

- The ProSe Function CTF (ADF) for ProSe Direct Communication may be deployed in the same system as any combination of the ProSe Function components defined in clause 4.4.1 of TS 23.303 [238] (i.e. Direct Provisioning Function, Direct Discovery Name Management Function, EPC-level Discovery Function).

- The ProSe Function CTF (ADF) for ProSe Direct Communication may be deployed in a logically or physically separate system from the ProSe Function components defined in clause 4.4.1 of TS 23.303 [238]. To support this deployment scenario, the PC3ch subset of the protocol for usage information report delivery shall not require interaction with any other ProSe Function component for successful and complete processing.

The network ensures that the UE can have IP access to its HPLMN ProSe Function, in non-roaming and roaming case, as defined in TS 23.303 [238].

When the UE is out of coverage, PC3 reference point is not available. UE will store the logged information and upload to the ProSe Function once the PC3 becomes available and the reporting criteria are met. UE's reporting of usage information is only visible to the ProSe Function.

It is mandatory to support at least one of the options Rf, Ga or Bx interfaces from the ProSe Function as described in the specification.

4.3   ProSe online charging architecture

ProSe online charging is based on ProSe function utilizing Ro interface and application towards the OCS as specified in TS 32.299 [50]. The Ro reference point covers all online charging functionality required for ProSe.
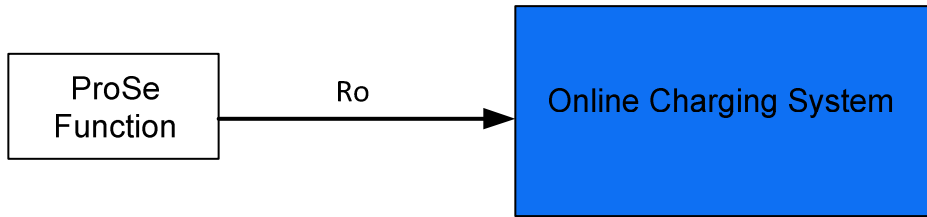
Figure 4.3.1: ProSe online charging architecture

5 ProSe charging principles and scenarios

5.1 ProSe charging principles

5.1.1 Requirements

There are three types of ProSe services defined in TS 23.303 [238]:

- ProSe Direct Discovery,

- ProSe EPC-level Discovery, and

- ProSe one-to-many Direct Communication for Public Safety Use.

The following are high-level charging requirements for ProSe services, derived from the requirements in TS 22.115 [101], and TS 23.303 [238].

ProSe Function shall be able to collect charging information for UEs in HPLMN, in online and offline charging for:

- ProSe Open Direct Discovery Model A;

- ProSe EPC-level Discovery.

ProSe Function shall be able to collect charging information for UEs in VPLMN in offline charging for:

- ProSe Open Direct Discovery for Announce.

ProSe Function shall be able to collect charging information for UEs in VPLMN and Local PLMNS in offline charging for:

- ProSe Open Direct Discovery for Monitor and Match.

ProSe Function shall be able to collect charging information from UEs in HPLMN and VPLMN in offline charging for:

- ProSe one-to-many Direct Communication for Public Safety Use.

For ProSe one-to-many Direct Communication for Public Safety Use, the following requirements apply to the UE delivery of usage information to the ProSe Function:

- When the UE is in E-UTRAN coverage, if the usage information recorded for the current collection period is not empty, it shall report the usage information as configured when the earlier one of the following criteria are met:

  - a configured collection period has elapsed; the end of an associated configured reporting window has not been reached; and the UE temporarily switches to RRC CONNECTED mode; or

  - a configured collection period has elapsed and the end of an associated configured reporting window has been reached.

- When the UE is out of E-UTRAN coverage, the UE shall generate reports from the recorded usage information every collection period and store the non-empty reports in a non-volatile memory, and send the reports once the UE returns to coverage.

- The storage of the usage information and the execution of the reporting procedure shall be in a secure environment in the UE that is trusted by the operator.

  NOTE 1: The secured storage and execution of the reporting procedure do not guarantee that the recording of the usage information is trusted.

  NOTE 2: When the UE operates out of coverage for a long time, the stored reports may reach the limit of the memory. The handling of such situation is determined by UE implementation.

- If a replacement of USIM occurs when UE is out of coverage, the usage information for a given IMSI shall remain stored on the UICC or ME as long as the UE does not use the USIM associated with that IMSI.

- The results of the collection and delivery of usage information reports should not affect the UE's use of the ProSe Direct Communication service.

NOTE 3: For Public Safety use the UE is able to use ProSe Direct Communication service even if there are errors in usage information collection or reporting.

ProSe Function shall be capable of handling the Charging Characteristics. Charging Characteristics can be specific for a subscription or for subscribed services. ProSe Function shall use the Charging Characteristics profile to decide if online or offline charging is used for a user. The Charging Characteristics is provided by the HSS to the ProSe Function as part of the subscription information. Requirements of the use of Charging Characteristics are provided in annex A.

5.1.2 Charging information

5.1.2.1 Charging information for ProSe Direct Discovery

For ProSe Direct Discovery, the ProSe Function shall collect the following charging information:

- identity of the mobile subscriber using the ProSe functionality, e.g. IMSI;

- identity of the PLMN where the ProSe functionality is used;

- specific ProSe functionality used, e.g. Announcing, Monitoring, or Match Report;

- role of the UE in the ProSe, e.g. Announcing UE, Monitoring UE;

- model of the Direct Discovery used by the UE, e.g. Model A, or Model B;

- the validity period associated with ProSe Application Code allocated to an Announcing UE;

- the PLMN ID extracted from the set of Filters provided for a Monitoring UE in a Monitor Request and the maximum validity period associated with the set of Filters;

- the PLMN ID extracted from the ProSe Application Code and the monitored PLMN ID with the timestamp reported by a Monitoring UE in the Match Report message, which is triggered by the Monitoring UE when the ProSe Application Code that matches the Discovery Filters does not have ProSe Application ID already locally stored that correspond to this ProSe Application Code;

- ProSe Application ID used in the ProSe Direct Discovery;

- Application ID related to the ProSe Direct Discovery.

The charging information shall be collected when a UE performs ProSe Direct Discovery, including Announcing Request, Monitoring Request, and Match Report.

5.1.2.2 Charging information for ProSe EPC-level Discovery

For ProSe EPC-level Discovery, the ProSe Function shall collect the following charging information:

- identity of the mobile subscriber using the EPC-level Discovery, e.g. IMSI;

- timestamp of Proximity Request received from UE;

- duration of the EPC-level Discovery services authorized for the UE;

- discovery Range authorized for the UE, e.g. geographic limit;

- timestamp when a Proximity Alert is triggered, and the associated location information;

- WLAN direct communication Assistance Information and associated timestamps, when applicable.

5.1.2.3 Charging information for ProSe one-to-many Direction Communication for Public Safety Use

For the ProSe one-to-many Direct Communication for Public Safety Use, the UE shall collect the following information, and be included in the usage information report to the ProSe Function for charging purposes, if configured by the network:

- UE identity, e.g. IMSI;

- For every collection period:

  - Sequence number of the report;

  - List of the locations of the UE when in coverage, e.g. ECGIs, and the corresponding timestamps;

  - Configured Radio Parameters used for the ProSe Direct Communication, as defined in TS 24.333 [241];

  - List of timestamps of when the UE goes in/out of E-UTRAN coverage;

  - For every ProSe Direct Communication Group (identified by ProSe L2 Group ID):

    - Group Parameters used for the ProSe Direct Communication, as defined in TS 24.333 [241], e.g. ProSe L2 Group ID, IP Multicast Address, Source IP address, etc.;

    - Timestamp of the first one-to-many communication transmission/reception;

    - Identities of the transmitters in the one-to-many communication session, e.g. Source L2 ID and IP address;

    - List of non-zero amount of data transmitted by UE;

      - List of amount of data transmitted by UE when in E-UTRAN coverage at each location, with ECGI and the corresponding timestamps, and indicator of which radio resources used (i.e., operator-provided in coverage or configured) and the radio frequency used;

      - List of amount of data transmitted by UE for each out of E-UTRAN coverage period and the corresponding timestamps and the radio frequency used ;

    - List of non-zero amount of data received by UE;

      - List of amount of data received by UE when in E-UTRAN coverage at each location, with ECGI and the corresponding timestamps, and indicator of which radio resources used (i.e., operator-provided in coverage or configured) and the radio frequency used;

      - List of amount of data received by UE for each out of E-UTRAN coverage period and the corresponding timestamps and the radio frequency used;

- Application specific data, e.g. application specific session floor control information, Application layer User ID of group members in the communication.

The network shall be able to configure the UE with information to be included in the usage information report as per following:

- Whether the Group Parameters need to be reported;

- Whether timestamps of the first transmission/reception need to be reported;

- Whether the amount of data transmitted by UE needs to be reported, and whether with location information;

- Whether the amount of data received by UE needs to be reported, and whether with location information;

- Whether the list of locations of the UE when in E-UTRAN coverage needs to be reported;

- Whether the list of timestamps of when UE goes in/out of E-UTRAN coverage need to be recorded.

- Whether the indicator of radio resources used and radio frequency are to be reported with the amount of data transmitted and received.

5.2 ProSe offline charging scenarios

5.2.1 Basic principles

5.2.1.1 General

The ProSe Functions in HPLMN, VPLMN, and Local PLMNs shall be able to report charging events for CDRs generation by CDF.

In ProSe EPC-level Discovery scenario, the ProSe EPC-level Discovery CDRs (PF-ED-CDR) shall be opened, updated, and closed based on the following:

- Charging data related to ProSe EPC-level Discovery Proximity Request;

- Charging data related to ProSe EPC-level Discovery Proximity Alert;

- Charging data related to ProSe EPC-level Discovery Proximity Request Cancellation.

The contents and purpose of each charging event that triggers CDR creation, information addition, or closure are described in the following clauses.

When the CDF is implemented as a separate entity (than the ProSe Function), the Charging Events triggering and contents for CDRs handling by the CDF are described in clause 5.2.2.

5.2.1.2 ProSe Direct Discovery charging

The charging information on the use of ProSe Direct Discovery is collected by the ProSe Functions in HPLMN, VPLMN, and local PLMNs. Inter-operator charging is supported.

When a charging event is reported to the CDF, it includes relevant information as listed in clause 5.1.2.

The following chargeable events are defined for ProSe Direct Discovery charging:

- Monitor Request received by the ProSe Function in the HPLMN of the Monitoring UE. Upon this event, a PF-DD-CDR is generated.

- Monitor Request received by the ProSe Function of the PLMN providing the Discovery Filter. Upon this event, a PF-DD-CDR is generated.

- Announce Request received by the HPLMN ProSe Function of the Announcing UE. Upon this event, a PF-DD-CDR is generated.

- Announce Request received by the ProSe Function in the VPLMN of the Announcing UE when roaming. Upon this event, PF-DD-CDR is generated.

- Match Report Request received by the ProSe Function in the HPLMN of the Monitoring UE. Upon this event, a PF-DD-CDR is generated.

- Match Report Request received by the ProSe Function in the HPLMN of the Announcing UE. Upon this event, a PF-DD-CDR is generated.

- Match Report Info received by the ProSe Function in the VPLMN of the Announcing UE when roaming. Upon this event, a PF-DD-CDR is generated.

5.2.1.3 ProSe EPC-level Discovery charging

When a charging event is reported to the CDF, it includes relevant information as listed in clause 5.1.2.

The following chargeable events are defined for ProSe EPC-level Discovery charging:

- Proximity Request. Upon this event, a new PF-ED-CDR is opened, and the corresponding EPUID, ALUIDs, Application ID, window, Range, and location of the UE are captured.

- Proximity Request Renewal. Upon this event, an already open PF-ED-CDR for a request is updated with new location of the UE and window.

- Proximity Request Reject. Upon this event, the corresponding PF-ED-CDR is closed, and an indication of the cause for reject is captured.

- Proximity Request Cancellation. Upon this event, the corresponding PF-ED-CDR is closed, and an indication of whether Proximity Alert was sent is captured.

When the CDF is implemented as a separate entity, all these ProSe EPC-level Discovery related chargeable events triggers the CDRs to be constructed, enriched, or closed by CDF, according to description in clause 5.2.2.

5.2.1.4   ProSe Direct Communication charging

Based on the usage information reported by the UE, the ProSe Functions in HPLMN produces CDRs or reports charging events for CDRs generation by CDF. The CDRs or charging events are generated for the ProSe one-to-many Direct Communication for Public Safety use (PF-DC-CDR).

When the CDF is implemented as a separate entity (than the ProSe Function), the charging events triggering and handling are described in clause 5.2.2.3.

For ProSe one-to-many Direct Communication charging, either event based charging or session based charging can be used, depending on configuration of the ProSe Function and CDF.

   NOTE: The charging session does not correspond to any ProSe one-to-many Direct Communication session, as there is no session concept defined for the group communication in TS 23.303 [238].

When a charging event is reported to the CDF, it includes relevant information as listed in clause 5.1.2.

The following chargeable events are defined for ProSe one-to-many Direct Communication charging:

- Received Direct Communication Usage Report (for a group).

If event based charging is used, upon this event, a Charging Data Request[Event] for a specific group is generated.

If session based charging is used, either a Charging Data Request[Start], Charging Data Request[Interim], or Charging Data Request[Stop] for a specific group is generated.

The triggering conditions for the corresponding charging events are defined in clause 5.2.2.3.1.

5.2.2   Rf message flows

5.2.2.1   Offline charging message flow for ProSe Direct Discovery

The following ProSe operation flows are based on the procedures defined in TS 23.303 [238]

5.2.2.1.1   Triggers for charging events from ProSe Function for ProSe Direct Discovery

When a charging event is reported to the CDF, it includes details such as subscriber identifier (e.g. IMSI), PLMN ID, Specific ProSe Direct Discovery Model (e.g. Model A, Model B), Specific ProSe UE's role used (e.g. Announcing UE, Monitoring UE), Specific ProSe functionality used (e.g. Announcing, Monitoring, Match), Allocation of a ProSe App Code to an Announcing UE and the associated period , Allocation of a set of Filters for a Monitoring UE and the associated period, Match of the ProSe App Code at a Monitoring UE and the timestamp and ProSe App ID for ProSe Direct Discovery Announce Request and Monitoring.

As stated above, the trigger conditions described in Table 5.2.2.1.1.1 are applicable for charging information collection.

Charging Data Request[Event] is sent at successful response to different Discovery Request and Discovery Report.

**Table 5.2.2.1.1.1: Charging Data Request messages triggered by messages
for ProSe Function in ProSe Direct Discovery**

Message	Triggering conditions
Charging Data Request[Event]	Discovery Response to Direct Discovery Request with command (Announce, Monitor)
	Announce Auth Ack to Announce Authorization message
	Monitor response to Monitor Request message
	Match Report Ack to Match Report message

5.2.2.1.2 Message flow for ProSe Direct Discovery Announce Request

ProSe Direct Discovery Announce Request allows a ProSe-enabled UE to request a set of ProSe App Code from the HPLMN ProSe Function, with associated validity timer and security materials, to announce over the air. Charging Data Request[Event] is triggered for Announcing UE after ProSe Function responds to the Discovery Request or to the Announce Authorization message.

When the ProSe Application ID has a scope different from PLMN specific scope (i.e. country-wide or global), the message flows are the same as those for the case of PLMN specific ProSe Application ID provided by the HPLMN.

Figure 5.2.2.1.2.1: Message flow for ProSe Direct Discovery Announce Request (non-roaming)

1-3. Announcing UE sends out Discovery Req message and receive Discovery Resp message. The detailed description is defined in TS 23.303 [238].

3a. After the ProSe Function responds with a Discovery Response (ProSe Application Code, validity timer) message, the ProSe Function triggers Charging Data Request[Event] to CDF in HPLMN where event represents Announce. The PF-DD-CDR is generated by CDF for Announcing UE.

3b. The CDF returns Charging Data Response corresponding to the received Charging Data Request[Event].

4. The UE may start announcing the provided ProSe Application Code in HPLMN, using the radio resources authorized and configured by E-UTRAN to be used for ProSe as defined in RAN specifications.
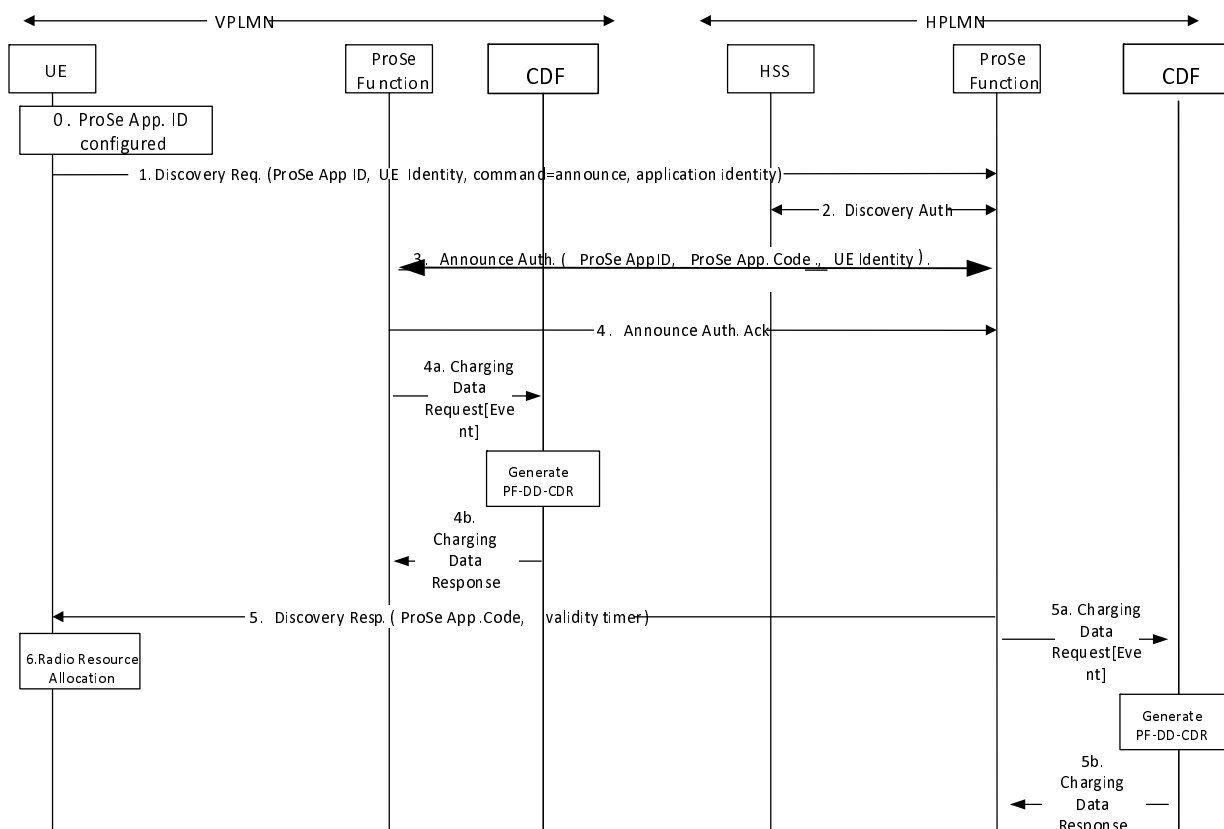
Figure 5.2.2.1.2.2: Message flow for ProSe Direct Discovery Announce Request (roaming)

The UE is only allowed to announce in the bands signalled from VPLMN.

0-4. If the UE is authorized to announce in VPLMN and is triggered to announce, it shall establish a secure connection with the ProSe Function in HPLMN and it shall then send a Discovery Request and then the ProSe Function in VPLMN authorizes the UE to perform ProSe Direct Discovery Announce. The detailed description is defined in TS23.303 [238].

4a. After the ProSe Function in VPLMN responds to the Announce Authorisation message, the ProSe Function in VPLMN sends Charging Data Request[Event] to CDF in VPLMN. The PF-DD-CDR for Announcing UE is generated by the CDF in VPLMN where event represents Announce.

4b. The CDF in VPLMN returns Charging Data Response corresponding to the received Charging Data Request[Event].

5. The ProSe Function in HPLMN shall respond to the UE with a Discovery Response (ProSe Application Code, validity timer) message. The UE will be authorized to announce this ProSe Application Code for the duration of validity timer and if it remains in the same PLMN.

5a. After the ProSe Function in HPLMN responds to the UE with a Discovery Response, the ProSe Function sends Charging Data Request[Event] to CDF in HPLMN. The PF-DD-CDR for Announcing UE is generated by the CDF in HPLMN where event represents Announce.

5b. The CDF in HPLMN returns Charging Data Response corresponding to the received Charging Data Request[Event].

6. The UE may start announcing the provided ProSe Application Code in the VPLMN, using the radio resources authorized and configured by E-UTRAN to be used for ProSe as defined in RAN specifications.

5.2.2.1.3   Message flow for ProSe Direct Discovery Monitor Request

ProSe Direct Discovery Monitor Request allows a ProSe-enabled UE to obtain a set of filters from the HPLMN ProSe Function, which enables the UE to discover Announcing UE of its interest. Charging Data Request[Event] is triggered for Monitoring UE after ProSe Function responds to the Discovery Request or to the Monitor Request message.

When the ProSe Application ID has a scope different from PLMN specific scope (i.e. country-wide or global), the message flows are the same as those for the case of PLMN specific ProSe Application ID provided by the HPLMN.
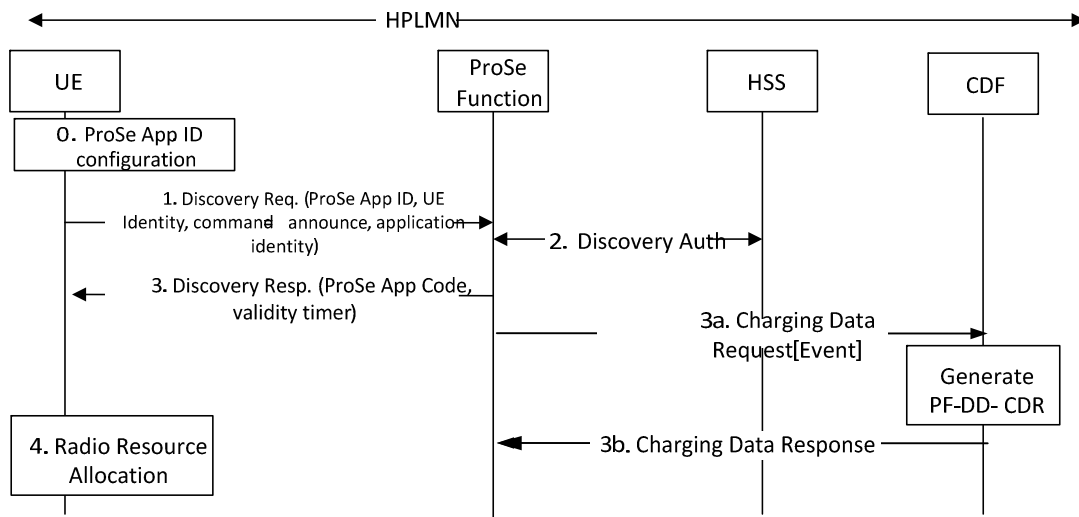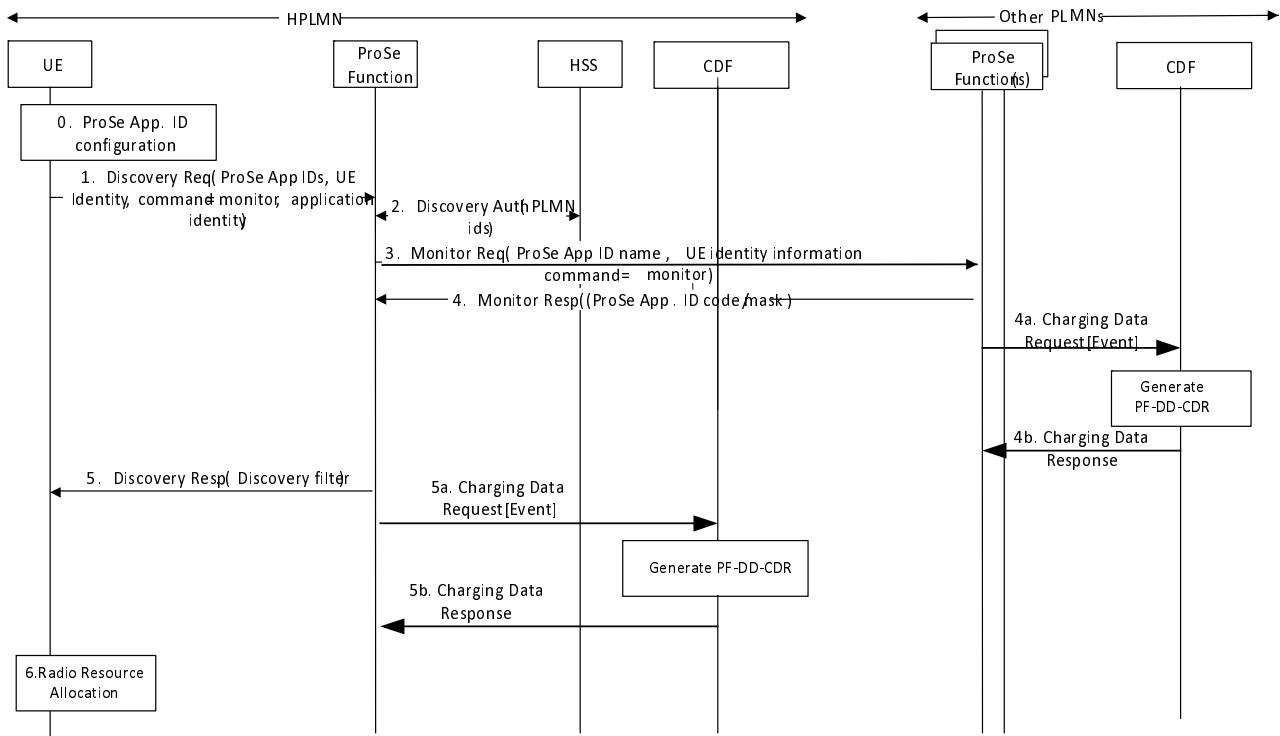

Figure 5.2.2.1.3.1: Message flow for ProSe Direct Discovery Monitor Request (non-roaming)

0-2. Monitoring UE sends out Discovery Req message and if there is no associated UE context, the ProSe Function shall check with HSS the authorization for discovery and create a new context for this UE that contains the subscription parameters for this UE for the duration the Discovery Filters will be valid. The detailed description is defined in TS 23.303 [238].

If the Discovery Request is authorized, and the ProSe Application ID sent by the UE in step 1 indicates another Local PLMN then steps 3-6 are executed, otherwise (i.e. the ProSe Application ID indicates HPLMN) only steps 5-6 are executed:

3. The ProSe Function in HPLMN shall contact other Local PLMNs in order to resolve the ProSe Application ID Name(s) to mask(s) that corresponds to this ProSe Application ID Name. The request shall also include the UE identity information e.g. IMSI or MSISDN in order to allow the ProSe Function in Local PLMN to perform charging.

4. If the ProSe Function of the Local PLMN stores valid ProSe Application Code(s) corresponding to the requested ProSe Application ID Name(s), then the ProSe Function of the Local PLMN returns the related mask(s) and the corresponding TTL for each.

4a. After the ProSe Function of the Local PLMN responds to Monitor Request from the ProSe Function of HPLMN, the ProSe Function of the Local PLMN sends Charging Data Request[Event] to CDF in Local PLMN. The PF-DD-CDR is generated for Monitoring UE where Event represents Monitor.

4b. The CDF in Local PLMN returns Charging Data Response corresponding to the received Charging Data Request[Event].

NOTE 1: If the ProSe Function of the Local PLMN does not return any mask, than the ProSe Function in the HPLMN notifies the UE that the Discovery Request has been rejected.

5. The ProSe Function in the HPLMN shall respond with a Discovery Response (Discovery Filter(s), Filter ID) message.

5a. After the ProSe Function in the HPLMN responds with a Discovery Response, the ProSe Function sends Charging Data Request[Event] to CDF in HPLMN. The PF-DD-CDR is generated for Monitoring UE where Event represents Monitor.

5b. The CDF in HPLMN returns Charging Data Response corresponding to the received Charging Data Request[Event].

6. The UE may start monitoring using the Discovery Filter(s) in the radio resources that are authorized and configured by the PLMN(s) to be used for ProSe as defined in RAN specifications.
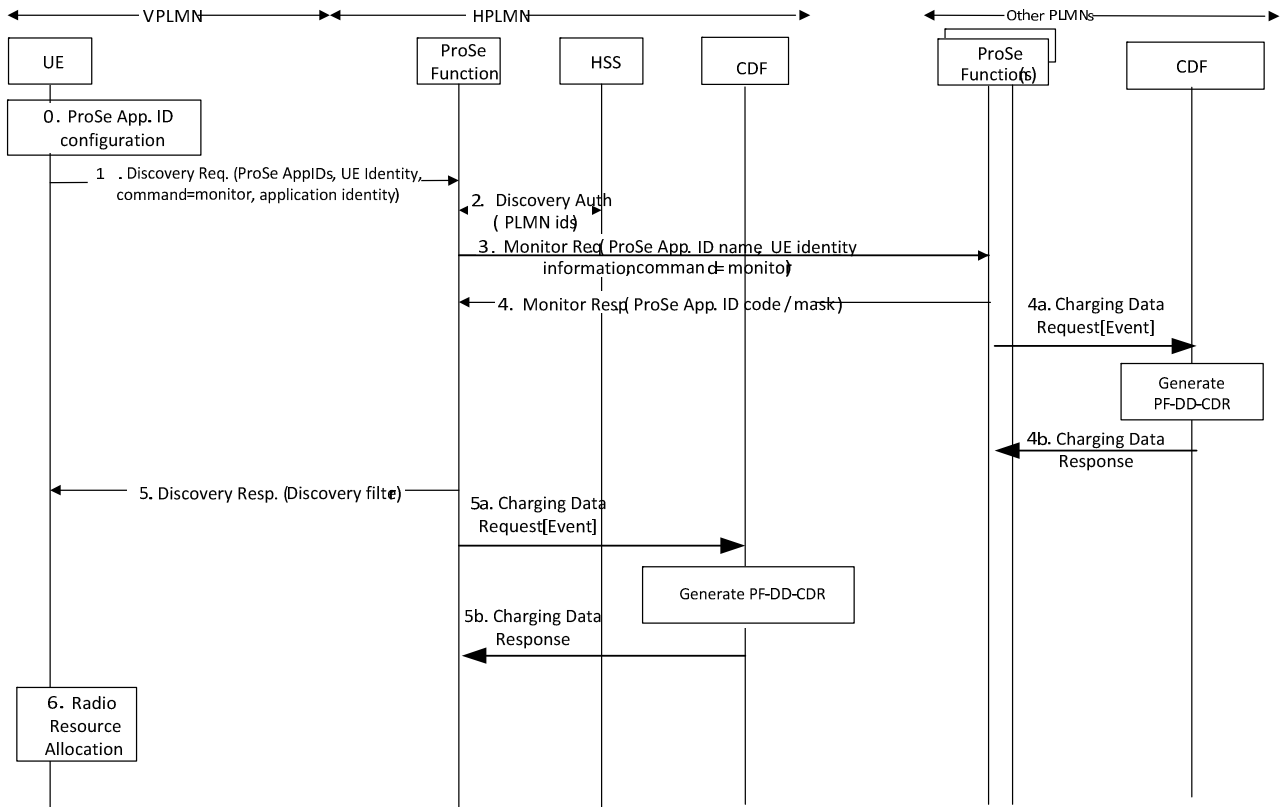
Figure 5.2.2.1.3.2: Message flow for ProSe Direct Discovery Monitor Request (roaming)

0-2. Monitoring UE sends out Discovery Req message and if there is no associated UE context, the ProSe Function shall check with HSS the authorization for discovery and create a new context for this UE that contains the subscription parameters for this UE for the duration the Discovery Filters will be valid. The detailed description is defined in TS 23.303 [238].

If the Discovery Request is authorized, and the ProSe Application ID sent by the UE in step 1 indicates another PLMN and not the HPLMN, then steps 3-6 are executed, otherwise (i.e. the ProSe Application ID indicates HPLMN) only steps 5-6 are executed:

3. The ProSe Function in HPLMN shall contact other PLMNs that are indicated by the ProSe Application ID(s) sent by the UE, in order to resolve the corresponding ProSe Application ID Name(s) to mask(s). The request shall also include the UE identity information e.g. IMSI or MSISDN in order to allow the ProSe Function in Local PLMN to perform charging.

4. If the ProSe Function of the other PLMN stores valid ProSe Application Code(s) corresponding to the requested ProSe Application ID Name(s), then the ProSe Function of the Local PLMN returns the related ProSe Application mask(s) and the corresponding TTL for each. It also includes the PLMN ID of the PLMN that the Announcing UE is registered (if roaming).

4a. After the ProSe Function of the other PLMN responds to Monitor Request from the ProSe Function of HPLMN, the ProSe Function of the other PLMN sends Charging Data Request[Event] to CDF in other PLMN. The PF-DD-CDR is generated for Monitoring UE where Event represents Monitor.

4b. The CDF in other PLMN returns Charging Data Response corresponding to the received Charging Data Request[Event].

NOTE 2: If the ProSe Function of the other PLMN does not return any mask, than the ProSe Function in the HPLMN notifies the UE that the Discovery Request has been rejected.

5. The ProSe Function in the HPLMN responds with a Discovery Response (Discovery Filter(s), Filter ID) message. The Discovery Filter(s) consists of the ProSe Application mask(s). The Discovery Filter(s) include the TTL. The TTL(s) in the Discovery Filter(s) indicate for how long the Discovery Filter(s) are going to be valid.

5a. After the ProSe Function in the HPLMN responds with a Discovery Response, the ProSe Function sends Charging Data Request[Event] to CDF in HPLMN. The PF-DD-CDR is generated for Monitoring UE where Event represents Monitor.

5b. The CDF in HPLMN returns Charging Data Response corresponding to the received Charging Data Request[Event].

6. The UE may start monitoring using the Discovery Filter(s) in the radio resources that are authorized and configured by the PLMN(s) to be used for ProSe as defined in RAN specifications.

5.2.2.1.4 Message flow for ProSe Direct Discovery Match Report

ProSe Direct Discovery Match Report allows a ProSe-enabled UE to report a match of the ProSe Application Code to the HPLMN ProSe Function, and obtain the corresponding ProSe Application ID and metadata. Charging Data Request[Event] is triggered for Monitoring UE after ProSe Function responds to the Match Report message.

When the ProSe Application ID has a scope different from PLMN specific scope (i.e. country-wide or global), the message flows are the same as those for the case of PLMN specific ProSe Application ID.

**Figure 5.2.2.1.4.1: Message flow for Match Report (non-roaming)**

1. If the UE finds ProSe Application Code(s) that matches the Discovery Filters and does not have ProSe Application ID(s) already locally stored that correspond to this ProSe Application Code(s), it shall (re)establish a secure connection with the ProSe Function in HPLMN to which it shall then send a Match Report message.

2. The ProSe Function shall check the context for this UE that contains its subscription parameters. The authorization information also contains the PLMN that this UE is allowed to perform discovery.

3. The ProSe Function analyses the ProSe Application Code received from the UE.

If the PLMN ID that assigned the given ProSe Application Code is another Local PLMN then steps 4-7 are executed, otherwise (i.e. the ProSe Application Code was assigned by HPLMN) only step 7 is executed:

4. The ProSe Function in HPLMN sends a Match Report (ProSe Application Code(s), UE identity) to the ProSe Function of the PLMN that assigned the ProSe Application Code. The UE identity information e.g. IMSI or MSISDN can be used by the ProSe Function in Local PLMN to perform charging.

5. The ProSe Function analyses the ProSe Application Code(s) received from the UE.

6. If the ProSe Application Code is confirmed then the ProSe Function in Local PLMN shall send Match Report Acknowledgement (ProSe Application ID Name(s), validity timer(s)). This message may also contain certain metadata corresponding to the ProSe Application ID Name e.g. postal address, phone number, URL etc.

6a. After the ProSe Function in Local PLMN sends Match Report Acknowledgement, the ProSe Function in Local PLMN sends Charging Data Request[Event] to the CDF in Local PLMN. The PF-DD-CDR is generated for Monitoring UE where Event represents Match.

6b. The CDF in Local PLMN returns Charging Data Response corresponding to the received Charging Data Request[Event].

7. The ProSe Function in HPLMN shall respond to the UE with Match Report Acknowledgment (ProSe Application ID(s), validity timer(s)). This message may also contain certain metadata corresponding to the ProSe Application ID Name e.g. postal address, phone number, URL etc. The validity timer(s) indicate for how long the ProSe Application ID(s) provided are going to be valid. The UE may store the mapping of ProSe Application Code(s) and corresponding ProSe Application ID(s) for the duration of their validity timer.

7a. After the ProSe Function in HPLMN responds to the UE with Match Report Acknowledgment, the ProSe Function in HPLMN sends Charging Data Request[Event] to CDF in HPLMN. The PF-DD-CDR is generated for Monitoring UE where Event represents Match.

7b. The CDF in Local PLMN returns Charging Data Response corresponding to the received Charging Data Request[Event].
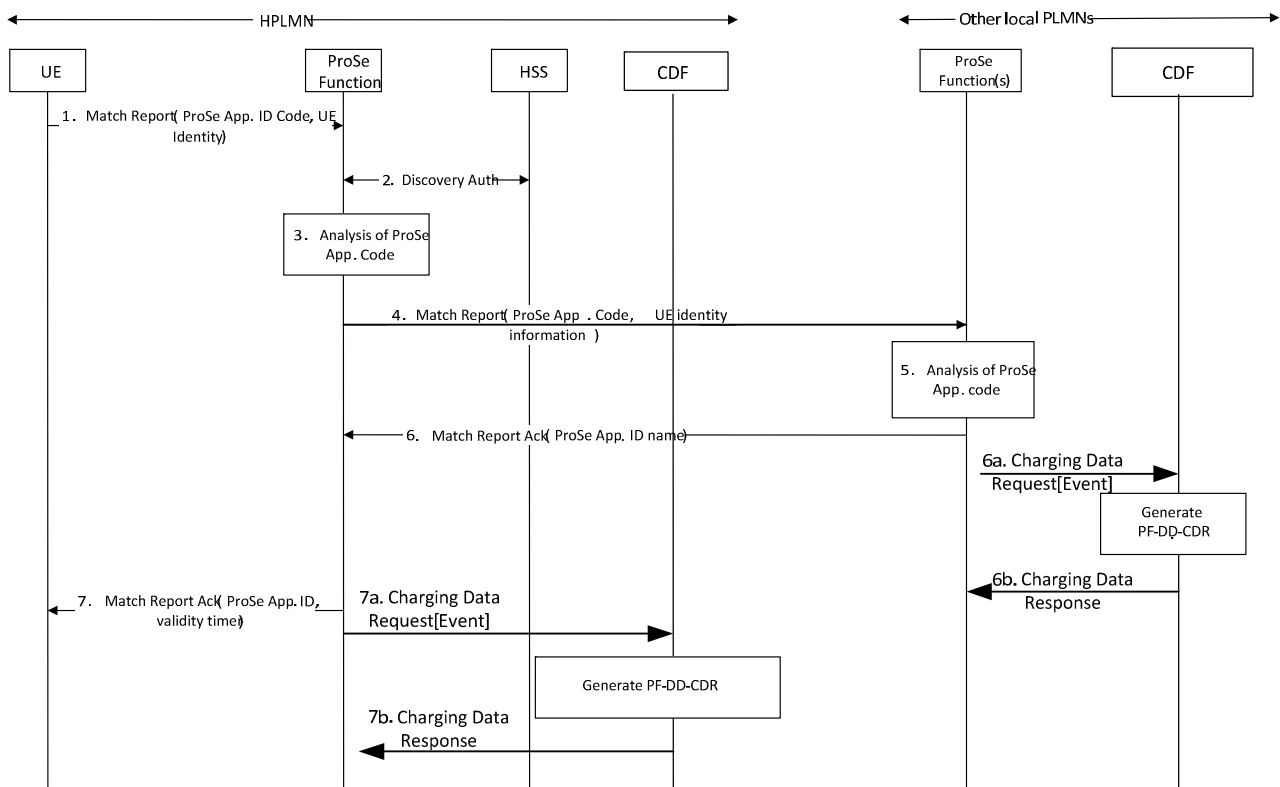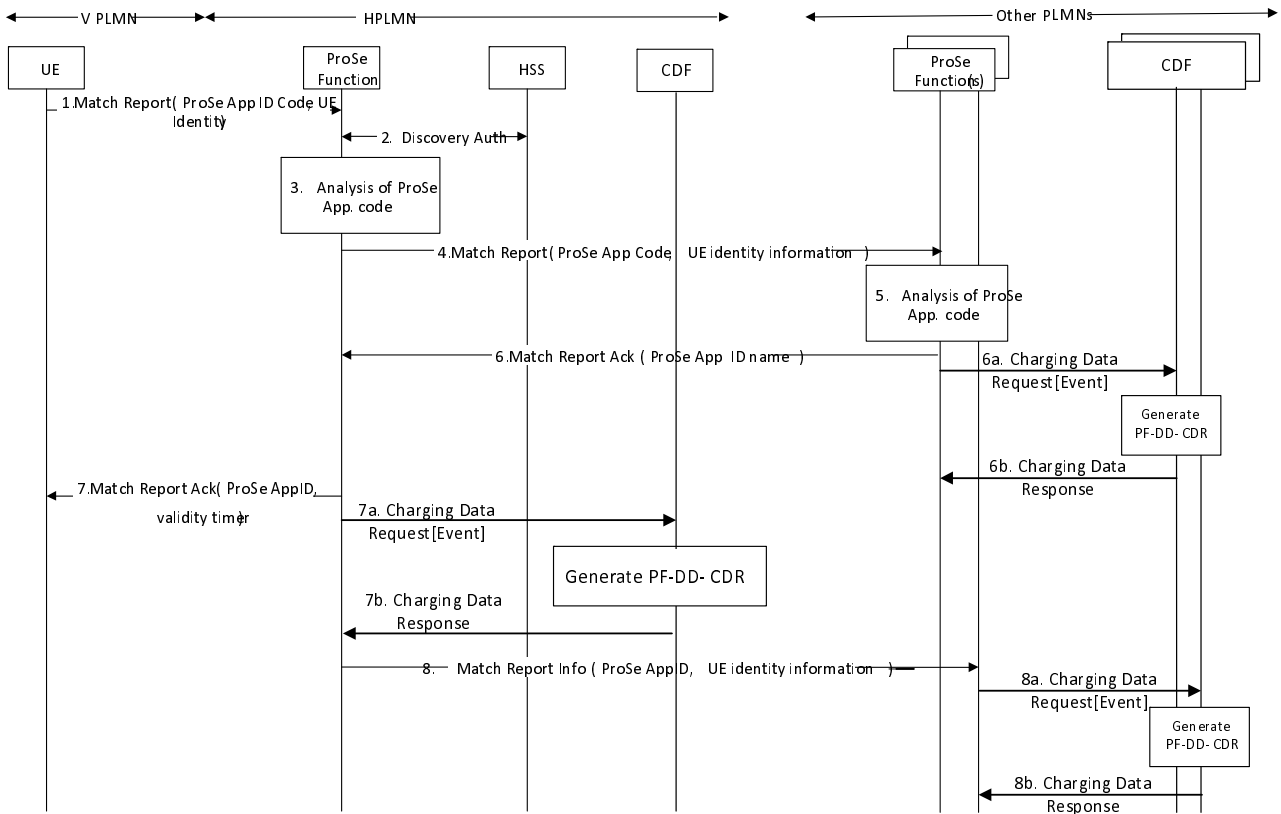
Figure 5.2.2.1.4.2: Message flow for Match Report (roaming)

1. If the UE finds ProSe Application Code(s) that matches the Discovery Filters and does not have ProSe Application ID(s) already locally stored that correspond to this ProSe Application Code(s), it (re)establishes a secure connection with the ProSe Function in HPLMN and sends a Match Report message.

2. The ProSe Function shall check the context for this UE that contains its subscription parameters for this UE. The authorization information also contains the PLMN that this UE is allowed to perform discovery. The UE context also contains the VPLMN ID where the UE is registered.

3. The ProSe Function analyses the ProSe Application Code(s) received from the UE.

If the PLMN ID that assigned the given ProSe Application Code is not the HPLMN, then steps 4-8 are executed, otherwise (i.e. the HPLMN assigned the ProSe Application Code) only steps are executed:

4. The ProSe Function in HPLMN sends a Match Report (ProSe Application Code(s), UE identity, monitored PLMN ID) to the ProSe Function of the PLMN that assigned the ProSe Application Code (i.e. the ProSe Function of the HPLMN of the Announcing UE).

5. The ProSe Function ensures that the received ProSe Application Code is authorized to be transmitted on the monitored PLMN. The ProSe Function analyses the ProSe Application Code(s) received from the UE, and confirms the ProSe Application Code(s).

6. The ProSe Function shall send Match Report Acknowledgement (ProSe Application ID Name(s), validity timer(s)). This message may also contain certain metadata corresponding to the ProSe Application ID Name e.g. postal address, phone number, URL, etc.

6a. After the ProSe Function in other PLMNs sends Match Report Acknowledgement message, the ProSe Function in other PLMNs sends Charging Data Request[Event] to the CDF in other PLMNs. The PF-DD-CDR is generated for the Monitoring UE where Event represents Match.

6b. The CDF in other PLMNs returns Charging Data Response corresponding to the received Charging Data Request[Event].

7. The ProSe Function in HPLMN shall respond to the UE with Match Report Acknowledgment (ProSe Application ID(s), validity timer(s)). This message may also contain certain metadata corresponding to the ProSe Application ID Name e.g. postal address, phone number, URL, etc. The validity timer(s) indicate for how long the ProSe Application ID(s) provided are going to be valid. The UE may store the mapping of ProSe Application Code(s) and corresponding ProSe Application ID(s) for the duration of their validity timer.

7a. After the ProSe Function in HPLMN respond to the UE with Match Report Acknowledgment message, the ProSe Function in HPLMN sends Charging Data Request[Event] to the CDF in HPLMN. The PF-DD-CDR is generated for Monitoring UE where Event represents Match.

7b. The CDF in HPLMNs returns Charging Data Response corresponding to the received Charging Data Request[Event].

8. If in step 4 it was indicated that the Announcing UE is roaming, the ProSe Function in HPLMN may optionally send a Match Report Info (ProSe Application ID(s), UE Identity) to the ProSe Function of the serving PLMN (i.e. VPLMN) of the Announcing UE.

8a. When receiving a Match Report Info message, the ProSe Function in VPLMN of the Announcing UE sends Charging Data Request[Event] to the CDF in VPLMN of the Announcing UE. The PF-DD-CDR is generated for Announcing UE where Event represents Match.

8b. The CDF in VPLMN of the Announcing UE returns Charging Data Response corresponding to the received Charging Data Request[Event].

5.2.2.2 Offline charging message flow for ProSe EPC-level Discovery

5.2.2.2.1 Triggers for charging events

When a charging event is reported to the CDF, it includes details related to the services provided, e.g. the EPUID, ALUID, Application ID, window, Range, location of the UE, and the reasons for triggering the event, e.g. due to Proximity Alert, or timeout of window, user request, etc.

The Proximity Request event is triggered when a ProSe Function responds to the first Proximity Request from a UE or another ProSe Function, with the Proximity Request Ack message. The Proximity Request event for a UE triggers a Charging Data Request[Start] message towards the CDF, and the subsequent Proximity Request for the same ALUID , i.e. Proximity Request Renewal event, triggers a Charging Data Request[Interim] message to the CDF. A Proximity Request Reject event, which is triggered by the ProSe Function responding a Proximity Request Reject to a Proximity Request, shall trigger a Charging Data Request[Stop] message to the CDF.

The Proximity Request Cancellation event is triggered when a ProSe Function responds to a Cancel Proximity Request from a UE or another ProSe Function, with the Proximity Request Cancellation or Cancel Proximity Request Ack message, or a Proximity Request expires. Proximity Request Cancellation event triggers a Charging Data Request[Stop] message to the CDF. It shall indicate if a Proximity Alert has been triggered for the UE.

Table 5.2.2.2.1.1 presents a summary of the messages from the ProSe Function and the triggering conditions.

Table 5.2.2.2.1.1: Triggers for charging events in ProSe EPC-level Discovery

Message	Triggering conditions
Charging Data Request [Start]	ProSe Function responded with Proximity Request Ack to the first Proximity Request for a UE.
Charging Data Request [Interim]	ProSe Function responded with Proximity Request Ack to the renewal Proximity Requests for a UE.
Charging Data Request [Stop]	ProSe Function responded with Proximity Request Reject to the Proximity Request for a UE; or ProSe Function responded with Proximity Request Cancellation or Cancel Proximity Request Ack to the Cancel Proximity Request for a UE, or a Proximity Request expires.

5.2.2.2.2 Message flow for ProSe EPC-level Discovery Proximity Request

ProSe EPC-level Discovery Proximity Request allows a ProSe-enabled UE A to request the network to assist it detecting if UE B is in proximity using architecture specified in Figure 4.1.2, where UE A and UE B are using subscription from different networks. Upon this procedure, Charging Data Request is triggered for UE A and UE B, after the respective ProSe Function responded to the Proximity Request message.

Figure 5.2.2.2.2.1 depicts the message flow for ProSe EPC-level Discovery Proximity Request.
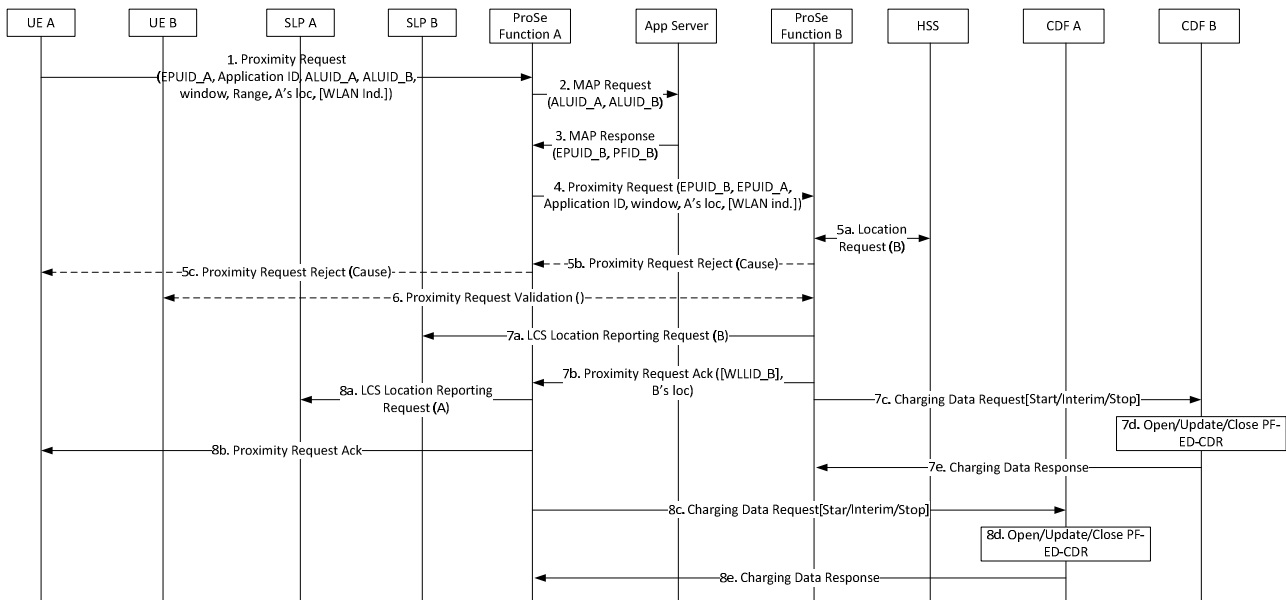
Figure 5.2.2.2.2.1: Message flow for ProSe EPC-level Discovery Proximity Request

1 - 7b. These steps are defined in TS 23.303 [238] clause 5.5.5.

7c. After the ProSe Function B responded to ProSe Function A, the ProSe Function B triggers Charging Data Request[Start/Interim/Stop] according to the conditions specified in clause 5.2.2.2.1 to the corresponding CDF B, where the charging event represents Proximity Request.

7d. The ProSe EPC-level Discovery CDR (PF-ED-CDR) is opened/updated/closed for UE B, according to the Charging Data Request.

7e. The CDF B returns Charging Data Response corresponding to the received Charging Data Request.

8a - 8b. These steps are defined in TS 23.303 [238] clause 5.5.5.

8c. After the ProSe Function A responded to UE A, the ProSe Function A triggers Charging Data Request[Start/Interim/Stop] according to the conditions specified in 5.2.2.2.1 to the corresponding CDF A, where the charging event represents Proximity Request.

8d. The ProSe EPC-level Discovery CDR (PF-ED-CDR) is opened/updated/closed for UE A.

8e. The CDF A returns Charging Data Response corresponding to the received Charging Data Request.

5.2.2.2.3 Message flow for ProSe EPC-level Discovery Proximity Request Cancellation

ProSe EPC-level Discovery Proximity Request cancellation is triggered by either the UE or network. It is cancels the proximity detection for a particular pair of UEs, e.g. UE A and UE B. Therefore, upon this procedure, Charging Data Request[Stop] is triggered for UE A and UE B, after the respective ProSe Function responded to the Cancel Proximity Request message.

Figure 5.2.2.2.3.1 depicts the message flow for ProSe EPC-level Discovery Proximity Request Cancellation.
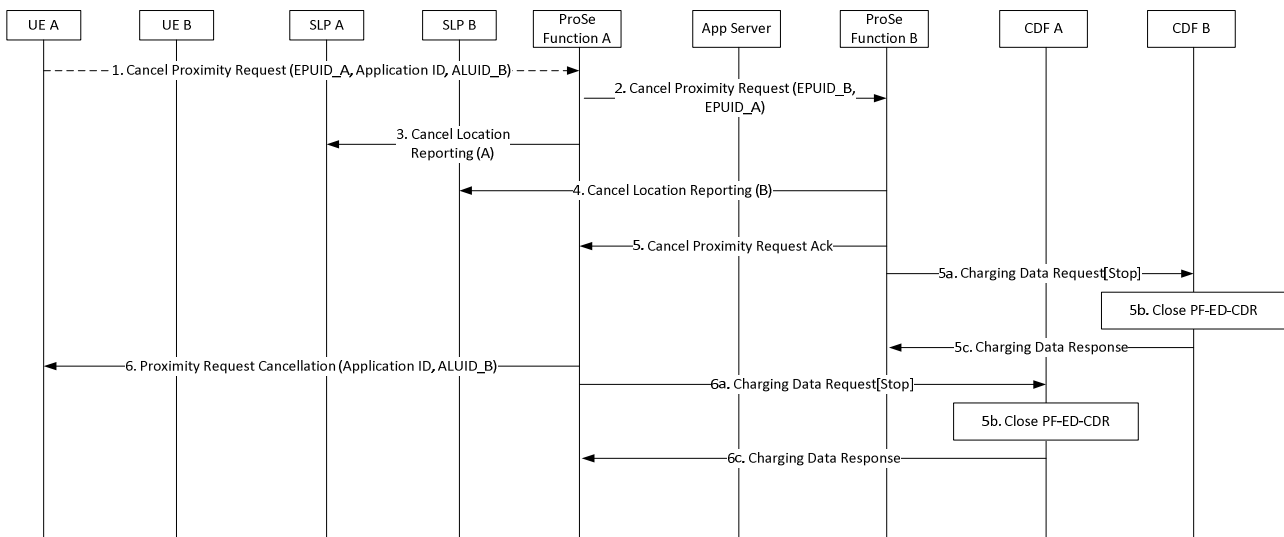
Figure 5.2.2.2.3.1: Message flow for ProSe EPC-level Discovery Proximity Request Cancellation

1 - 5. These steps are defined in TS 23.303 [238] clause 5.5.9.

5a. After the ProSe Function B sends a Cancel Proximity Request Ack to the ProSe Function A, the ProSe Function B triggers Charging Data Request[Stop] to the corresponding CDF B, where the event represents Proximity Request Cancellation. This shall also indicate if a Proximity Alert has been sent to UE B.

5b. The corresponding ProSe EPC-level Discovery CDR (PF-ED-CDR) is closed for UE B.

5c. The CDF B returns Charging Data Response corresponding to the received Charging Data Request.

6. This step is defined in TS 23.303 [238] clause 5.5.9.

6a. After the ProSe Function A sends a Proximity Request Cancellation to the UE A, the ProSe Function A triggers Charging Data Request[Stop] to the corresponding CDF A, where the charging event represents Proximity Request Cancellation. This shall also indicate if a Proximity Alert has been sent to UE A.

6b. The corresponding ProSe EPC-level Discovery CDR (PF-ED-CDR) is closed for UE A.

6c. The CDF A returns Charging Data Response corresponding to the received Charging Data Request.

5.2.2.3 Offline charging message flow for ProSe Direct Communication

5.2.2.3.1 Triggers for charging events at ProSe Function

5.2.2.3.1.1 Triggers for charging events at ProSe Function for event based charging

This reporting is achieved by sending Charging Data Request[Event] from the ProSe Function to the CDF.

The Received Direct Communication Usage Report event for a group is triggered by the ProSe Function receiving a usage information report from the UE for the group over PC3. The ProSe Function goes through the reported usage information, and if it contains valid ProSe Direct Communication usage data for a specific group, the ProSe Function sends the events to the CDF, which triggers the generation of the PF-DC-CDR for a specific group. It is possible that a single UE usage information report triggers multiple Received Direct Communication Usage Report events, each for a particular group.

The ProSe charging operation flows in the following subclauses are based on the above triggers and the procedures defined in TS 23.303 [238].

5.2.2.3.1.2 Triggers for charging events at ProSe Function for session based charging

The ProSe Function may be configured to use session based charging in order to reduce the number of CDRs generated.

The Charging Data Request[Start] is sent when the ProSe Function receives a Received Direct Communication Usage Report event, and there is no open charging session for the group.

The Charging Data Request[Interim] is sent when the ProSe Function receives a Received Direct Communication Usage Report event, and there is an open charging session for the group.

The Charging Data Request[Stop] is sent when the ProSe Function decides one of the following conditions is met:

- operator configured maximum number of reports, or

- operator configured maximum time limit.

5.2.2.3.2 Message flow for ProSe one-to-many Direct Communication when the UE is under coverage of E-UTRAN (event based)

Figure 5.2.2.3.2.1 depicts the message flow for ProSe one-to-many Direct Communication for non-roaming and roaming case, when UE is under coverage of E-UTRAN.

Figure 5.2.2.3.2.1: Offline Charging for ProSe one-to-many Direct Communication

1. The ProSe Function in HPLMN configures the UE on the usage information collection and reporting using the Service authorization and provisioning mechanism defined in TS 23.303 [238]. The configuration parameters are delivered as defined in TS 24.333 [241].

   This step is optional, as the UE can be pre-configured with the corresponding information.

2-3. UE performs one-to-many Direct Communication as defined in TS 23.303 [238].

4. When the UE decides that reporting criteria are met, according to the configuration in step 1, and the connection to the ProSe Function is available, the UE triggers the usage reporting procedure.

NOTE 1: The UE has a connection to the HPLMN ProSe Function when any PDN Connection is available, as specified in TS 23.303 [238].

5. UE sends the usage information report to the ProSe Function, according to the configuration in step 1.

When the usage information report in step 5 includes information for multiple groups, step 6 to 8 are repeated for each of the group.

6. Upon reception of direct communication usage information report, the ProSe Function triggers the Charging Data Request[Event] . The ProSe Function sends the Charging Data Request[Event] to the corresponding CDF.

7. The ProSe one-to-many Direct Communication for Public Safety use CDR (PF-DC-CDR) for the group is generated by CDF for the UE.

8. The CDF returns Charging Data Response corresponding to the received Charging Data Request.

NOTE 2: The delivery of the charging data to the VPLMN in roaming case is handled outside of 3GPP.

NOTE 3: The procedure applies to UE1 to UE3 independently, i.e. each of the UE sends the respective usage information reports about the group communication to the network using either the under coverage procedure or out of coverage procedure.

5.2.2.3.3 Message flow for ProSe one-to-many Direct Communication when the UE is out of coverage of E-UTRAN (event based)

Figure 5.2.2.3.3.1 depicts the message flow for ProSe one-to-many Direct Communication for non-roaming and roaming case, when UE is out of coverage of E-UTRAN.

Figure 5.2.2.3.3.1: Offline Charging for ProSe one-to-many Direct Communication (out of coverage)

1. When the UE is out of coverage of the E-UTRAN, it makes use of the pre-configured resources in USIM or ME for the ProSe one-to-many Direct Communication for public safety use. The mechanism to decide on the resources to use is defined in TS 23.303 [238].

2-3. UE performs one-to-many Direct Communication as defined in TS 23.303 [238].

4. When the UE decides that reporting criteria are met, according to the pre-configuration, the UE create the corresponding usage information report.

5. The UE stores the usage information, when the UE is out of E-UTRAN coverage and has no connection to the HPLMN ProSe Function.

NOTE 1: The usage information is stored in a secure environment in the UE.

6. When the UE comes back to E-UTRAN coverage, it will trigger the reporting of the usage information.

7. UE sends the usage information report to the ProSe Function, according to the pre-configuration or new configuration from the HPLMN ProSe Function.

When the usage information report in step 7 includes information for multiple groups, step 8 to 10 are repeated for each of the group. When the usage information report in step 7 includes multiple reports for a group, e.g. the UE has been out of coverage for a long time, step 8 to 10 are repeated for each of the report.

8. Upon reception of direct communication usage information report, the ProSe Function triggers the Charging Data Request[Event] for each of the group in the report. The ProSe Function sends the Charging Data Request[Event] to the corresponding CDF.

9. The ProSe one-to-many Direct Communication for Public Safety use CDR (PF-DC-CDR) for the group is generated by CDF for the UE.

10. The CDF returns Charging Data Response corresponding to the received Charging Data Request.

NOTE 2: The procedure applies to UE1 to UE3 independently, i.e. each of the UE sends the respective usage information reports about the group communication to the network using either the under coverage procedure or out of coverage procedure.

5.2.2.3.4 Message flow for ProSe one-to-many Direct Communication when the UE is under coverage of E-UTRAN (session based)

Figure 5.2.2.3.4.1 depicts the message flow for session based charging for ProSe one-to-many Direct Communication for non-roaming and roaming case, when UE is under coverage of E-UTRAN.
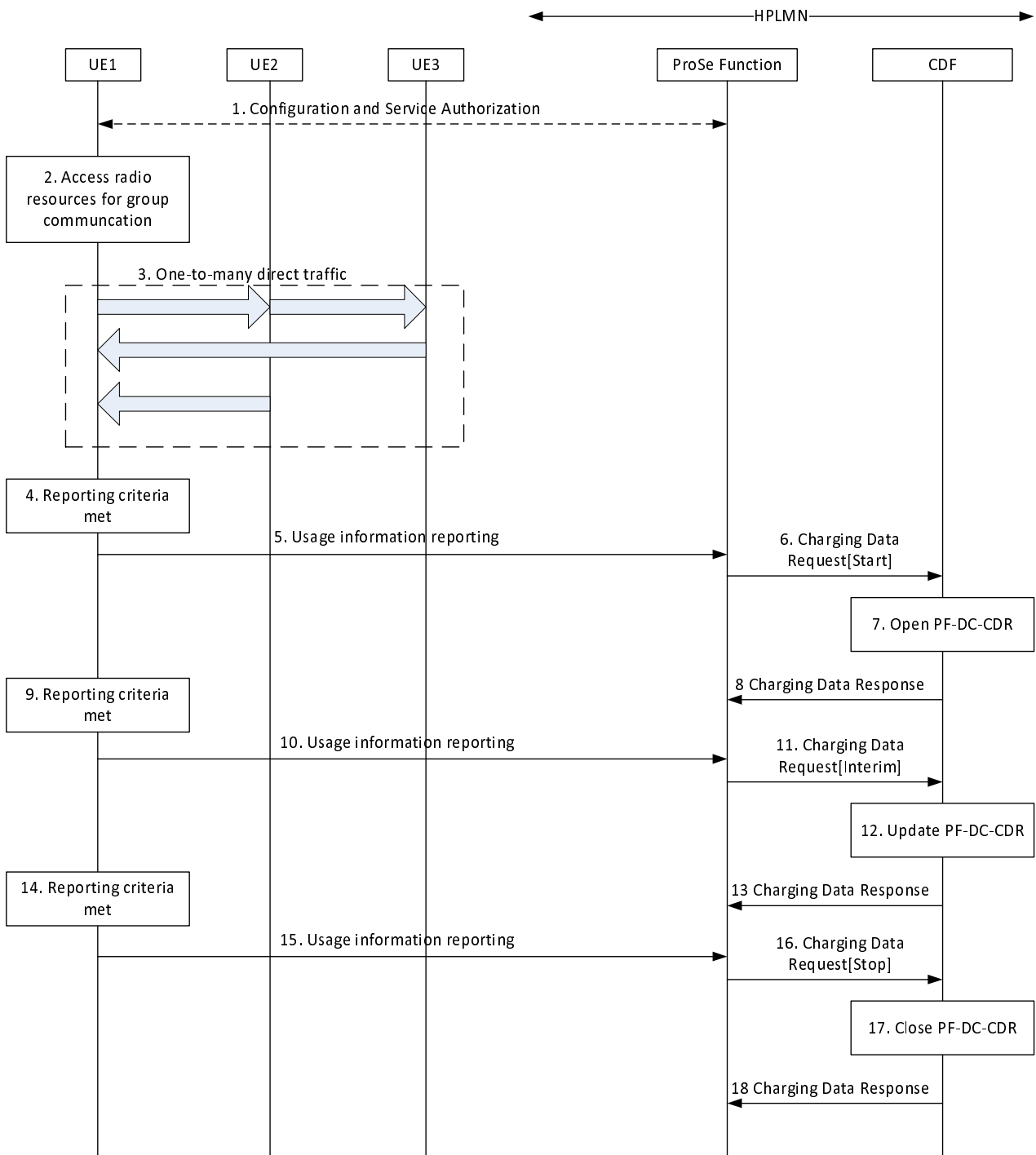
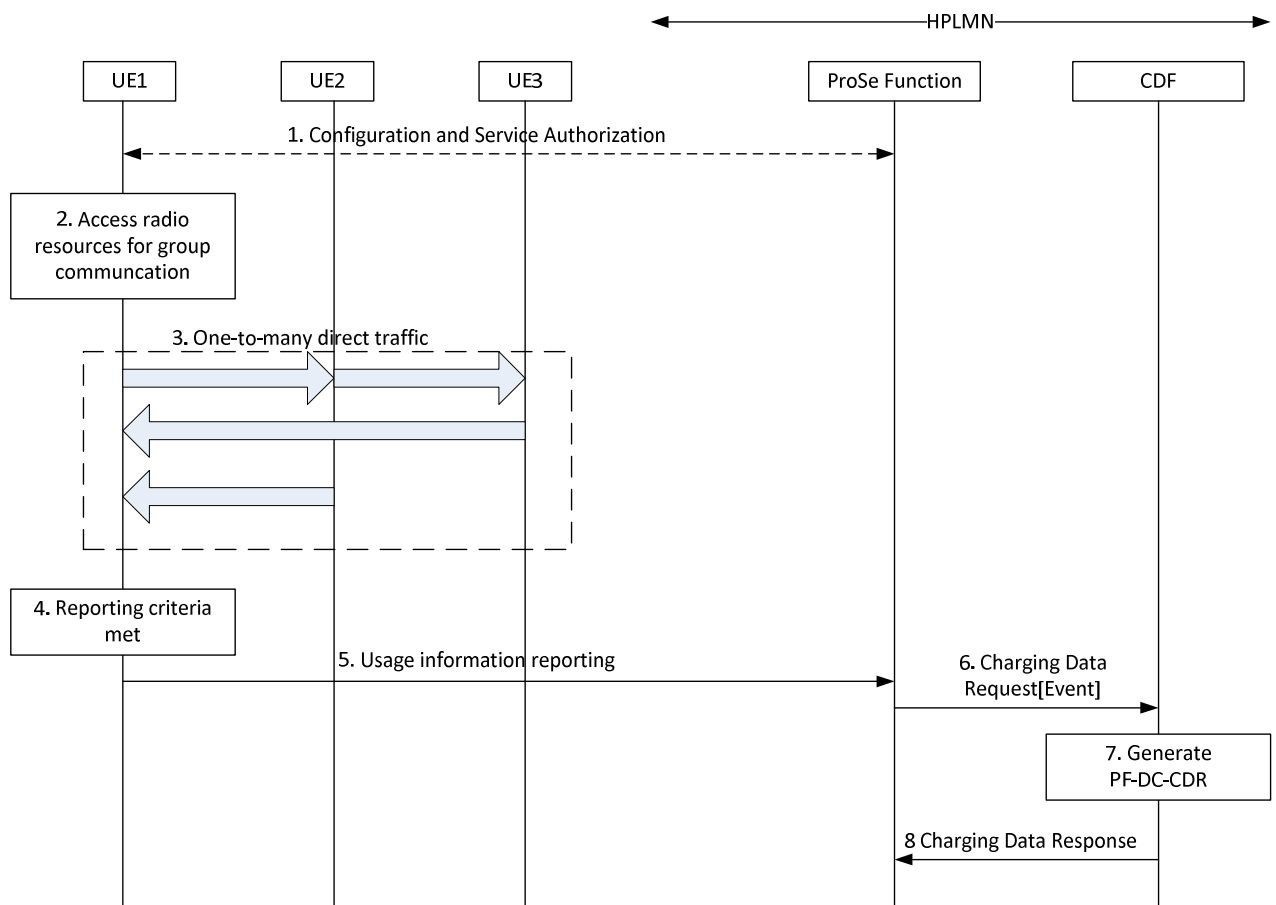**Figure 5.2.2.3.4.1: Offline Charging for ProSe one-to-many Direct Communication
(under coverage, session based charging)**

1. The ProSe Function in HPLMN configures the UE on the usage information collection and reporting using the Service authorization and provisioning mechanism defined in TS 23.303 [238]. The configuration parameters are delivered as defined in TS 24.333 [241].

   This step is optional, as the UE can be pre-configured with the corresponding information.

2-3.   UE performs one-to-many Direct Communication as defined in TS 23.303 [238].

4. When the UE decides that reporting criteria are met, according to the configuration in step 1, and the connection to the ProSe Function is available, the UE triggers the usage reporting procedure.

NOTE 1: The UE is provided a connection to the HPLMN ProSe Function as specified in TS 23.303 [238].

5. UE sends the usage information report to the ProSe Function, according to the configuration in step 1.

When the usage information report in step 5 includes information for multiple groups, step 6 to 8 are repeated for each of the group.

6. If the ProSe Function is configured to use session based charging, upon reception of direct communication usage information report for a group, the ProSe Function triggers the Charging Data Request[Start] when there is no open charging session for the group, according to 5.2.2.3.1.2. The ProSe Function sends the Charging Data Request[Start] to the corresponding CDF, and starts a charging session for the group.

7. The ProSe one-to-many Direct Communication for Public Safety use CDR (PF-DC-CDR) for the group is opened by CDF for the UE.

8. The CDF returns Charging Data Response corresponding to the received Charging Data Request.

9. UE triggers the usage reporting procedure when the reporting criteria are met.

10. UE sends the usage information report to the ProSe Function.

When the usage information report in step 10 includes information for multiple groups, step 11 to 13 are repeated for each of the group.

11. If there is a charging session for the group, upon reception of direct communication usage information report for the group, the ProSe Function triggers the Charging Data Request[Interim], according to clause 5.2.2.3.1.2. The ProSe Function sends the Charging Data Request[Interim] to the corresponding CDF.

12. The ProSe one-to-many Direct Communication for Public Safety use CDR (PF-DC-CDR) for the group is updated by CDF for the UE.

13. The CDF returns Charging Data Response corresponding to the received Charging Data Request.

NOTE 2: Step 9 to 13 may happen multiple times before step 14.

14. UE triggers the usage reporting procedure when the reporting criteria are met.

15. UE sends the usage information report to the ProSe Function.

When the usage information report in step 15 includes information for multiple groups, step 16 to 18 are repeated for each of the group.

16. The ProSe Function decides that the charging session should be closed, according to clause 5.2.2.3.1.2, and triggers the Charging Data Request[Stop]. The ProSe Function sends the Charging Data Request[Stop] to the corresponding CDF.

17. The ProSe one-to-many Direct Communication for Public Safety use CDR (PF-DC-CDR) for the group is closed by CDF for the UE.

18. The CDF returns Charging Data Response corresponding to the received Charging Data Request.

NOTE 3: The procedure applies to UE1 to UE3 independently, i.e. each of the UE sends the respective usage information reports about the group communication to the network using either the under coverage procedure or out of coverage procedure.

5.2.2.3.5 Message flow for ProSe one-to-many Direct Communication when the UE is out of coverage of E-UTRAN (session based)

Figure 5.2.2.3.5.1 depicts the message flow for session based charging for ProSe one-to-many Direct Communication for non-roaming and roaming case, when UE is out of coverage of E-UTRAN.
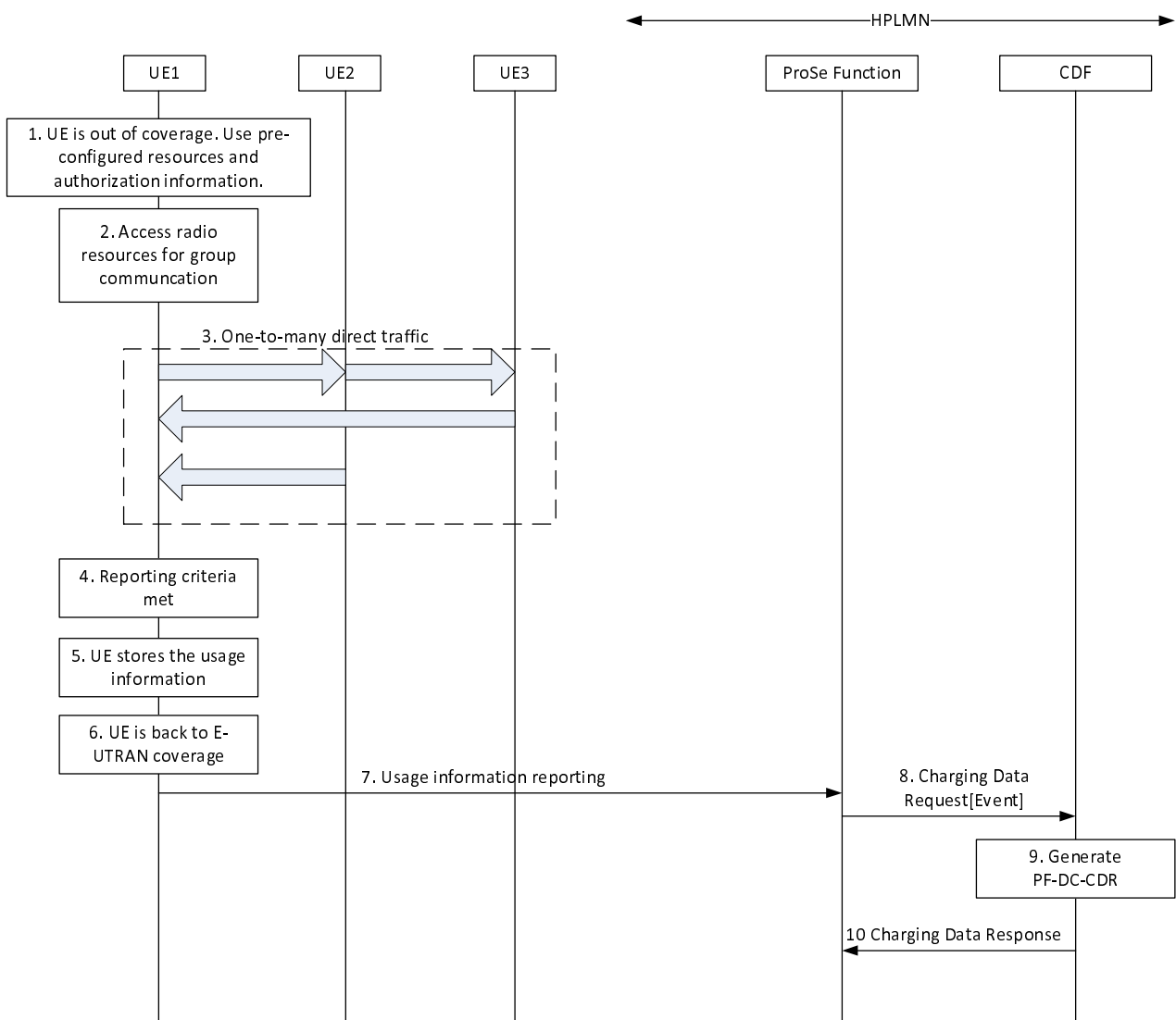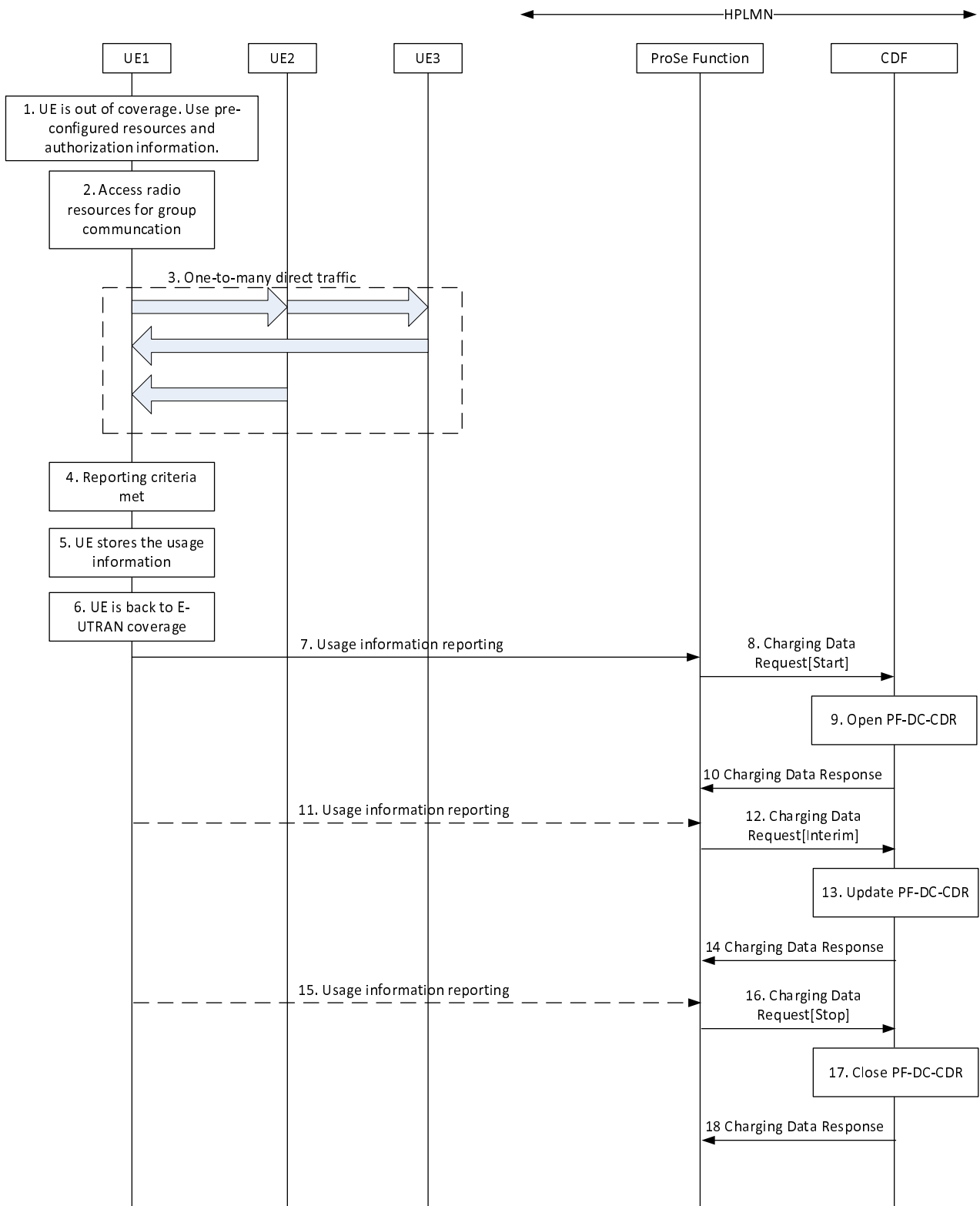
Figure 5.2.2.3.5.1: Offline Charging for ProSe one-to-many Direct Communication (out of coverage, session based)

1. When the UE is out of coverage of the E-UTRAN, it makes use of the pre-configured resources in USIM or ME for the ProSe one-to-many Direct Communication for public safety use. The mechanism to decide on the resources to use is defined in TS 23.303 [238].

2-3. UE performs one-to-many Direct Communication as defined in TS 23.303 [238].

4. When the UE decides that reporting criteria are met, according to the pre-configuration, the UE create the corresponding usage information report.

5. The UE stores the usage information, when the UE is out of E-UTRAN coverage and has no connection to the HPLMN ProSe Function.

NOTE 1: The usage information is stored in a secure environment in the UE.

6. When the UE comes back to E-UTRAN coverage, it will trigger the reporting of the usage information.

7. UE sends the usage information report to the ProSe Function, according to the pre-configuration or new configuration from the HPLMN ProSe Function.

When the usage information report in step 7 includes information for multiple groups, step 8 to 10 are repeated for each of the group.

8. If the ProSe Function is configured to use session based charging, upon reception of direct communication usage information report for a group, the ProSe Function triggers the Charging Data Request[Start] when there is no open charging session for the group, according to clause 5.2.2.3.1.2. The ProSe Function sends the Charging Data Request[Start] to the corresponding CDF, and starts a charging session for the group.

9. The ProSe one-to-many Direct Communication for Public Safety use CDR (PF-DC-CDR) for the group is opened by CDF for the UE.

10. The CDF returns Charging Data Response corresponding to the received Charging Data Request.

When the usage information report in step 7 includes multiple reports for a group, e.g. the UE has been out of coverage for a long time, step 12 to 14 and 16 to 18 may be triggered without step 11 or 15.

11. UE sends the usage information report to the ProSe Function when the reporting criteria are met.

When the usage information report in step 11 includes information for multiple groups, step 12 to 14 are repeated for each of the group.

12. If there is a charging session for the group, upon reception of direct communication usage information report for the group, the ProSe Function triggers the Charging Data Request[Interim], according to clause 5.2.2.3.1.2. The ProSe Function sends the Charging Data Request[Interim] to the corresponding CDF.

13. The ProSe one-to-many Direct Communication for Public Safety use CDR (PF-DC-CDR) for the group is updated by CDF for the UE.

14. The CDF returns Charging Data Response corresponding to the received Charging Data Request.

15. UE sends the usage information report to the ProSe Function when the reporting criteria are met.

When the usage information report in step 15 includes information for multiple groups, step 16 to 18 are repeated for each of the group.

16. The ProSe Function decides that the charging session should be closed, according to clause 5.2.2.3.1.2, and triggers the Charging Data Request[Stop]. The ProSe Function sends the Charging Data Request[Stop] to the corresponding CDF.

17. The ProSe one-to-many Direct Communication for Public Safety use CDR (PF-DC-CDR) for the group is closed by CDF for the UE.

18. The CDF returns Charging Data Response corresponding to the received Charging Data Request.

NOTE 2: The procedure applies to UE1 to UE3 independently, i.e. each of the UE sends the respective usage information reports about the group communication to the network using either the under coverage procedure or out of coverage procedure.

5.2.3 CDR generation

5.2.3.1 Triggers for PF-DC-CDR creation and closure

5.2.3.1.1 General

A PF-DC-CDR is used to collect charging information related to the ProSe Direct Communication for a specific group. Multiple direct communication data containers can be included in the PF-DC-CDR.

When a direct communication usage information report for a group is received from the UE, a PF-DC-CDR shall be opened if no open PF-DC-CDR for this group exists.

When event based charging is used, the corresponding containers are added, and the PF-DC-CDR is closed upon receiving the direct communication usage report.

When session based charging is used, the PF-DC-CDR is closed as described in clause 5.2.2.3.1.2.

5.2.3.1.2 Triggers for PF-DC-CDR charging information addition

The "List of direct communication data" attribute of the PF-DC-CDR consists of a set of containers, which are added when the following triggering conditions are encountered.

Any of the following shall result in a set of "List of Direct Communication Data" containers being added to the PF-DC-CDR :

- receipt of a usage information report;

- change of location in the usage information report (i.e. change of cell);

- change of coverage status in the usage information report (i.e. go out of coverage, come back to coverage).

The CDR closure shall result in all active "List of Direct Communication Data" containers to be added to the PF-DC-CDR.

Details of the container are defined in clause 6.1.3.4.

5.2.3.1.3 Triggers for PF-DC-CDR closureThe PF-DC-CDR shall be closed on encountering any of the following trigger conditions:

- When event based charging is used, and the usage information report for the group is received from UE.

- When session based charging is used, and the charging session is closed as described in clause 5.2.2.3.1.2. In this case, a further PF-DC-CDR is opened when another usage information report for the group is received from the UE.

5.2.4 Ga record transfer flows

Details of the Ga protocol application are specified in TS 32.295 [54].

5.2.5 Bx CDR file transfer

Details of the Bx protocol application are specified in TS 32.297 [52].

5.3 ProSe online charging scenarios

5.3.1 Basic principles

5.3.1.1 General

ProSe online charging uses the Debit / Reserve Units operation as specified in TS 32.299 [50].

The charging functions specified for ProSe relate to:

- ProSe Direct Discovery:

    - Announce Discovery Request;

    - Monitor Discovery Request;

    - Match report Discovery Reporting.

- ProSe EPC-level Discovery:

    - Proximity Request.

ProSe charging may use the Immediate Event Charging (IEC) principle or the Event Charging with Unit Reservation (ECUR) principle as specified in TS 32.299 [50].

5.3.1.2 ProSe Direct Discovery charging

The ProSe Functions in HPLMN is responsible for sending Debit/Reserve operation messages to OCS. ProSe charging may use the Immediate Event Charging (IEC) principle or the Event Charging with Unit Reservation (ECUR) principle as specified in TS 32.299 [50]. The Debit operation is performed after discovery authorization of receiving Direct Discovery Request or Match Report Message and the optional refund operation shall be considered if Announce, Monitor and Match operation fails in IEC principle. The Reserve operation is performed after discovery authorization of receiving Direct Discovery Request or Match Report Message and the Debit operation is performed only when Announce, Monitor and Match operation succeeds in ECUR principle.

5.3.1.3 ProSe EPC-Level Discovery charging

Session Charging with Unit Reservation (SCUR) principle is applied to ProSe EPC-Level Discovery online charging.

The following chargeable events are defined for ProSe EPC-level Discovery online charging:

- Proximity Request. Upon this event, a Debit/Reserve Units Request[Initial] message is sent to OCS, and the corresponding EPUID, ALUIDs, Application ID, window, Range, and location of the UE are captured.

- Proximity Request Renewal. Upon this event, a Debit/Reserve Units Request[Update] message is sent to OCS with new location of the UE and window.

- Proximity Request Reject. Upon this event, a Debit/Reserve Units Request[Terminate] message is sent to OCS, and an indication of the cause for reject is captured.

- Proximity Request Cancellation. Upon this event, a Debit/Reserve Units Request[Terminate] message is sent to OCS, and an indication of whether Proximity Alert was sent is captured.

5.3.2 Ro message flows

5.3.2.1 Introduction

The flows described in the present document specify the exchange between the ProSe Function and the OCS for ProSe Services for different charging scenarios.

Debit Units Request message and *Reserve Units Request* message as defined in TS 32.299 [50] are used by the ProSe Function to transfer the collected charging information towards the OCS depending on which mode is used: Immediate Event Charging (IEC) mode or Event Charging with Unit Reservation (ECUR) respectively.

5.3.2.2 ProSe Direct Discovery

5.3.2.2.1 Triggers for online charging from ProSe Function for ProSe Direct Discovery

Table 5.3.2.2.1.1: Debit Units Request messages triggered for ProSe Function in ProSe Direct Discovery

Message	Triggering conditions
Debit Units Request[Event]	After discovery authorization of receiving Direct Discovery Request with command (Announce, Monitor) After discovery authorization of receiving Match Report message

5.3.2.2.2 Message flows for ProSe Direct Discovery Announce Request

Figures 5.3.2.2.2.1 to 5.3.2.2.2.3 define the transactions between ProSe Function and OCS for the successful scenario where an Announcing UE sends a Discovery request in IEC mode for non-roaming case and in IEC and ECUR modes for roaming case.

When the ProSe Application ID has a scope different from PLMN specific scope (i.e. country-wide or global), the message flows are the same as those for the case of PLMN specific ProSe Application ID provided by the HPLMN.

Figure 5.3.2.2.2.1: Message flow for ProSe Direct Discovery Announce Request (IEC for non-roaming)

0. The UE is configured with the data structure of the ProSe Application IDs corresponding to HPLMN. This step is performed using mechanisms that are out of scope of 3GPP.

1. If the UE is authorized to announce in HPLMN and is triggered to announce, it shall establish a secure connection with the ProSe Function and it shall send a Discovery Request (ProSe Application ID, UE Identity, announce command, application identity) message for announcing.

2. If there is no associated UE context, the ProSe Function shall check with HSS the authorization for discovery and create a new context for this UE that contains the subscription parameters for this UE for the duration of the validity timer.

3. ProSe function sends Debit Units Request[Event] indicating Announce to the OCS.

4. The OCS performs Debit Units Request operation for Announcing UE.

5. The OCS returns the Debit Units Response to ProSe Function.

6. If the Discovery Request is authorized, then the ProSe Function shall respond with a Discovery Response (ProSe Application Code, validity timer) message.

7. The UE may start announcing the provided ProSe Application Code in HPLMN, using the radio resources authorized and configured by E-UTRAN to be used for ProSe as defined in RAN specifications.
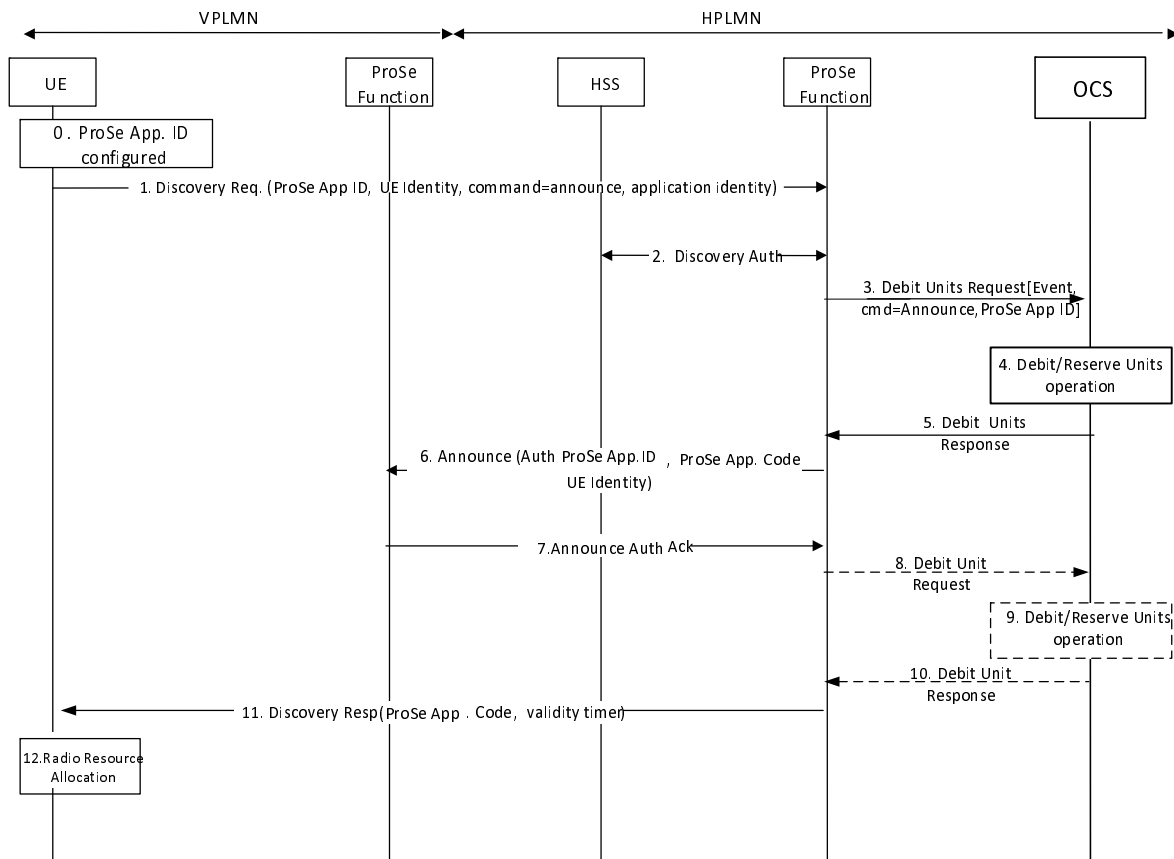
Figure 5.3.2.2.2.2: Message flow for ProSe Direct Discovery Announce Request (IEC for roaming)

0. The UE is configured with the data structure of the ProSe Application IDs corresponding to HPLMN. This step is performed using mechanisms that are out of scope of 3GPP.

1. The UE establishes a secure connection with the ProSe Function in HPLMN and then sends a Discovery Request (ProSe Application ID, UE Identity, announce command, application identity) message for announcing.

2. If there is no associated UE context, the ProSe Function shall check with HSS the authorization for discovery and, if necessary, create a new context for this UE that contains the subscription parameters for this UE for the duration of the validity timer.

3. ProSe Function sends Debit Units Request[Event] indicating Announce to the OCS.

4. The OCS performs Debit Units Request operation for Announcing UE.

5. The OCS returns the Debit Units Response to ProSe Function.

6. If the Discovery Request is authorized then the HPLMN ProSe Function shall request authorisation from the ProSe Function in VPLMN with the Announce Authorisation (ProSe Application ID, ProSe Application Code, UE Identity) message.

7. The ProSe Function in VPLMN authorizes the UE to perform ProSe Direct Discovery announcing.

If the Discovery Request is not authorized, the optional refund steps 8 to 10 are required:

8. ProSe function sends Debit Units Request[Event] to the OCS for refund purpose.

9. The OCS performs Debit Units Request operation for refund.

10. The OCS returns the Debit Units Response to ProSe Function.

11. The ProSe Function in HPLMN shall respond to the UE with a Discovery Response (ProSe Application Code, validity timer) message, when step 7 is successful.

12. The UE may start announcing the provided ProSe Application Code in the VPLMN, using the radio resources authorized and configured by E-UTRAN to be used for ProSe as defined in RAN specifications.
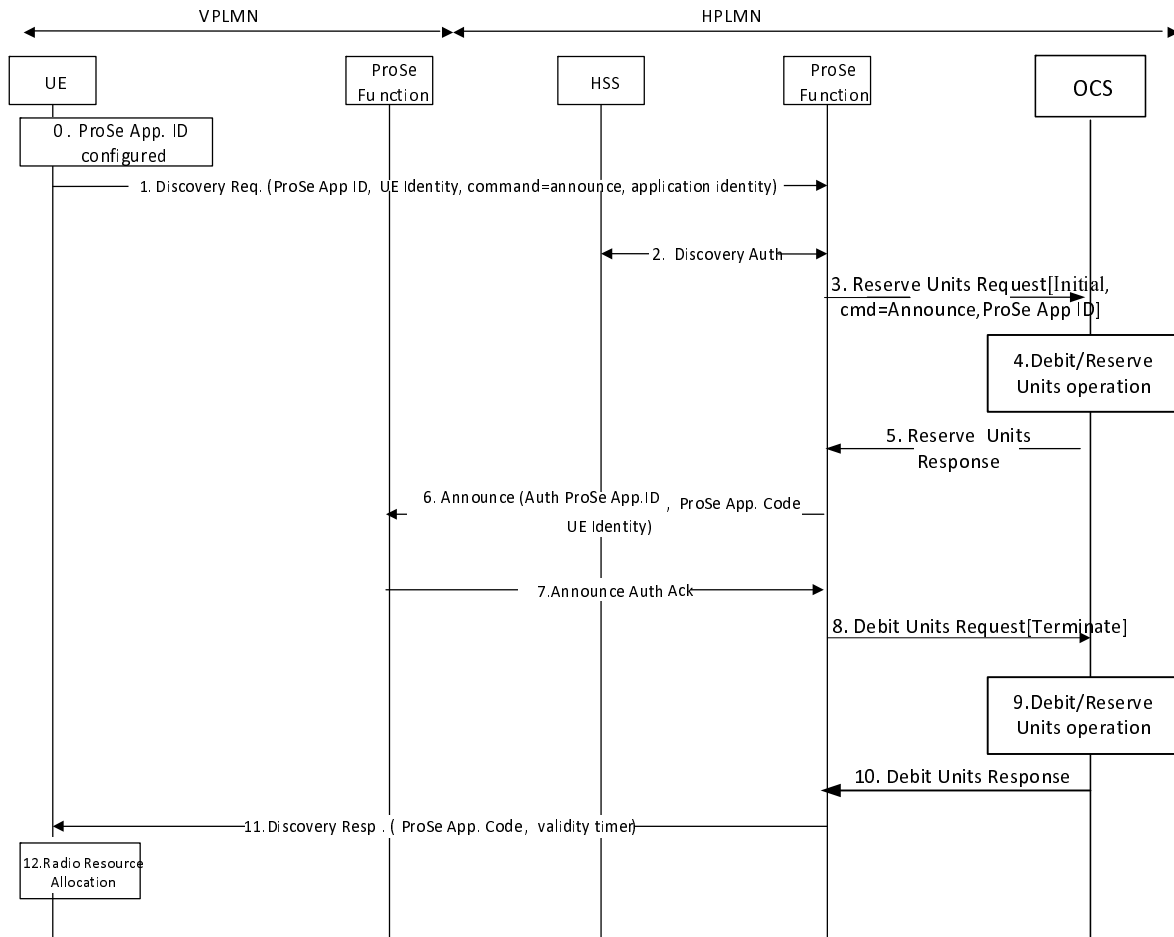
Figure 5.3.2.2.2.3: Message flow for ProSe Direct Discovery Announce Request (ECUR for roaming)

0-2.   same as figure 5.3.2.2.3.2 step 0-2

3. ProSe Function sends Reserve Units Request[Initial, ProSe App ID, cmd = Announce] to the OCS for requesting units.

4. The OCS performs Reserve Units Request operation for Announcing UE.

5. The OCS grants service units in the Reserve Units Response to ProSe Function.

6-7.   same as figure 5.3.2.2.3.2 step 6-7

8. ProSe Function sends Debit Units Request[Terminate] to the OCS indicating granted units are used. On unsuccessful Announce authorization, granted units are returned.

9. The OCS performs Debit Units operation.

10. The OCS returns the Debit Units Response to ProSe Function.

11-12. same as figure 5.3.2.2.3.2 step 11-12.

5.3.2.2.3 Message flows for ProSe Direct Discovery Monitor Request

Figures 5.3.2.2.3.1 to 5.3.2.2.3.4 describe the transactions between ProSe Function and OCS for the successful scenario where a "monitoring UE" sends a Discovery request and gets authorization to access the discovery resources.

When the ProSe Application ID has a scope different from PLMN specific scope (i.e. country-wide or global), the message flows are the same as those for the case of PLMN specific ProSe Application ID provided by the HPLMN.
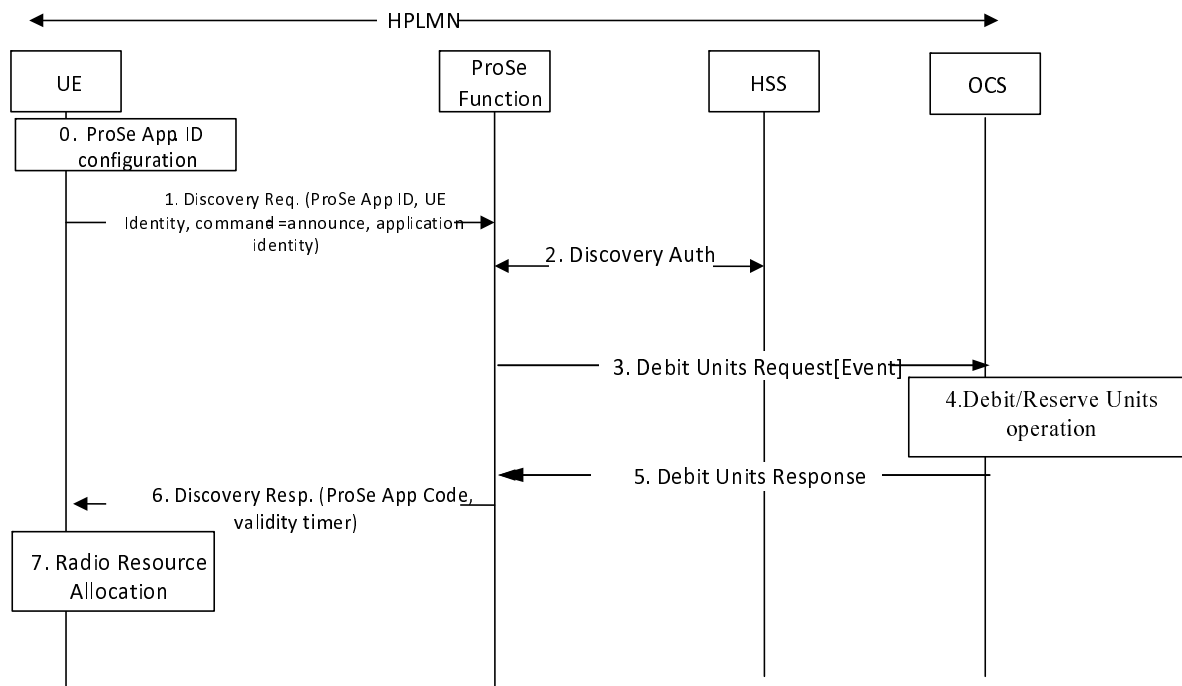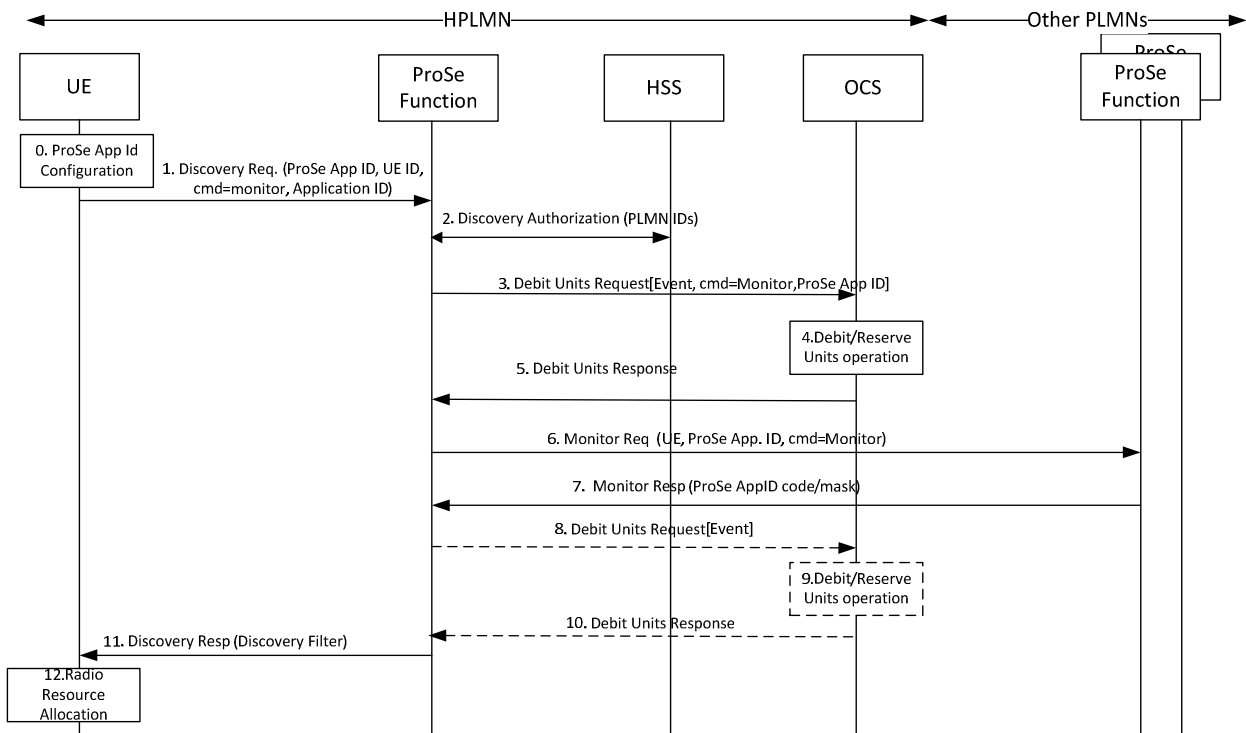

Figure 5.3.2.2.3.1: ProSe Direct Discovery Monitor Request – IEC (non-roaming)

0. The UE is configured with the data structure of the ProSe Application IDs corresponding to PLMNs the UE is authorized to monitor.

1. If the UE is authorized to monitor in at least one PLMN and is interested to monitor certain ProSe Application ID(s), the UE sends a Discovery Request (ProSe Application ID(s), UE Identity, monitor command, application identity) message for monitoring to the ProSe Function.

2. Interaction between ProSe Function and HSS for authorization process for discovery: check if UE is authorized for ProSe discovery service and for this Application ID, retrieval of PLMNs allowed for discovery. A new context for this UE is created if no associated UE context exists.

3. ProSe Function sends Debit Units Request[Event, ProSe App ID, cmd = Monitor] to the OCS.

4. The OCS performs the Debit Units operation for Discovery Monitor Request.

5. The OCS returns the Debit Units Response to ProSe Function.

6. When the ProSe Application ID has PLMN-specific scope, ProSe Function sends Monitor Request to the PLMN indicated by the ProSe Application ID.

7. In case a valid ProSe Application Code corresponding to the requested ProSe Application ID Name, was stored by the ProSe Function of the Local PLMN, it returns Monitor Response [ProSe Application Code and/or ProSe Application Mask].

In case of unsuccessful scenario, the optional refund steps 8 to 10 are required:

8. ProSe function sends Debit Units Request[Event] to the OCS for refund purpose.

9. The OCS performs Debit Units Request operation for refund.

10. The OCS returns the Debit Units Response to ProSe Function.

11. The ProSe Function responds with a Discovery Response [Discovery Filter] message, when step 7 is successful.. The ProSe Function may use the service units granted in step 5 to determine the Time To Live value(s) of the Discovery Filter.

12. The UE may start monitoring using the Discovery Filter in the authorized radio resources.
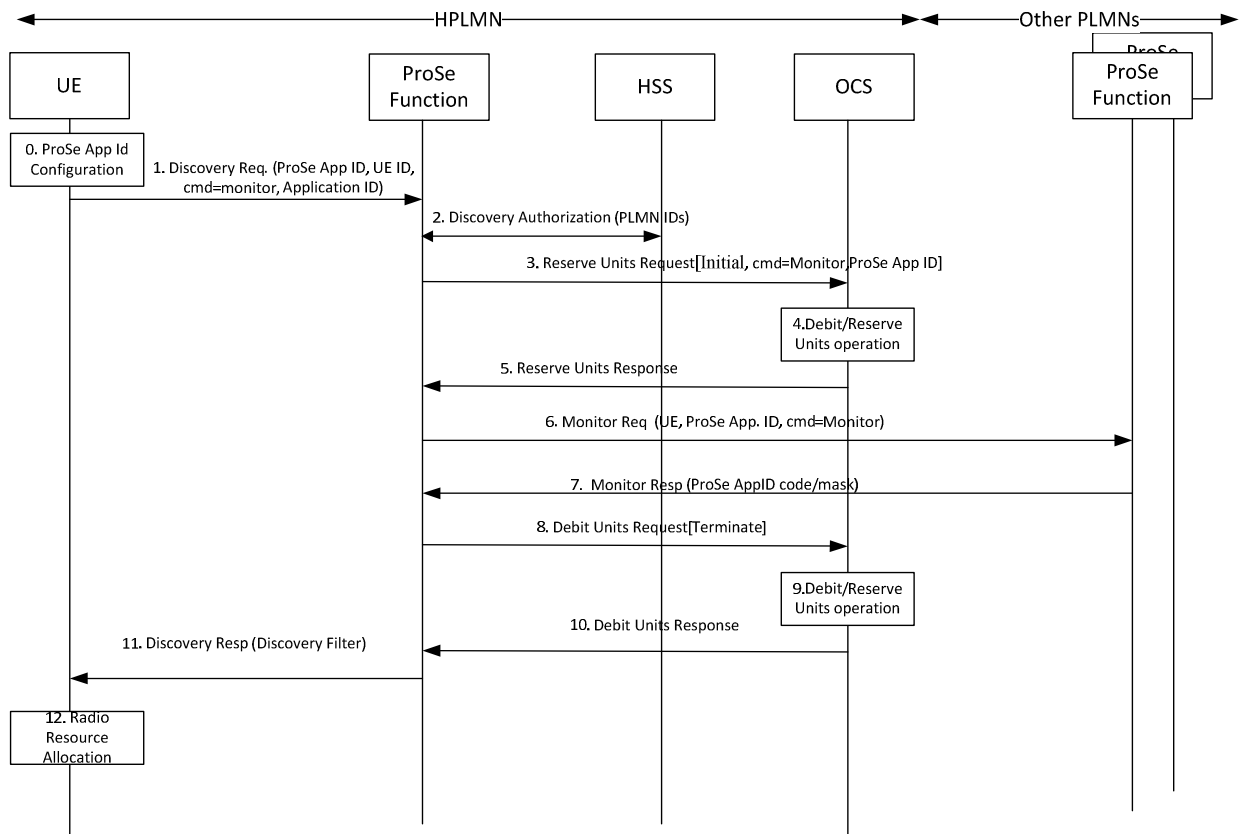
Figure 5.3.2.2.3.2: ProSe Direct Discovery Monitor Request – ECUR (non-roaming)

0-2.　same as figure 5.3.2.2.3.1 step 0-2.

3. ProSe Function sends Reserve Units Request[Initial, ProSe App ID, cmd = Monitor] to the OCS for requesting units.

4. The OCS performs Reserve Units Request operation for Discovery Monitor Request.

5. The OCS grants service units in the Reserve Units Response to ProSe Function.

6-7.　same as figure 5.3.2.2.3.1 step 6-7.

8. ProSe Function sends Debit Units Request[Terminate] to the OCS indicating granted units are used. On unsuccessful Monitor Response, granted units are returned.

9. The OCS performs the Debit Units operation.

10. The OCS returns the Debit Units Response to ProSe Function.

11-12. same as figure 5.3.2.2.3.1 step 11-12.
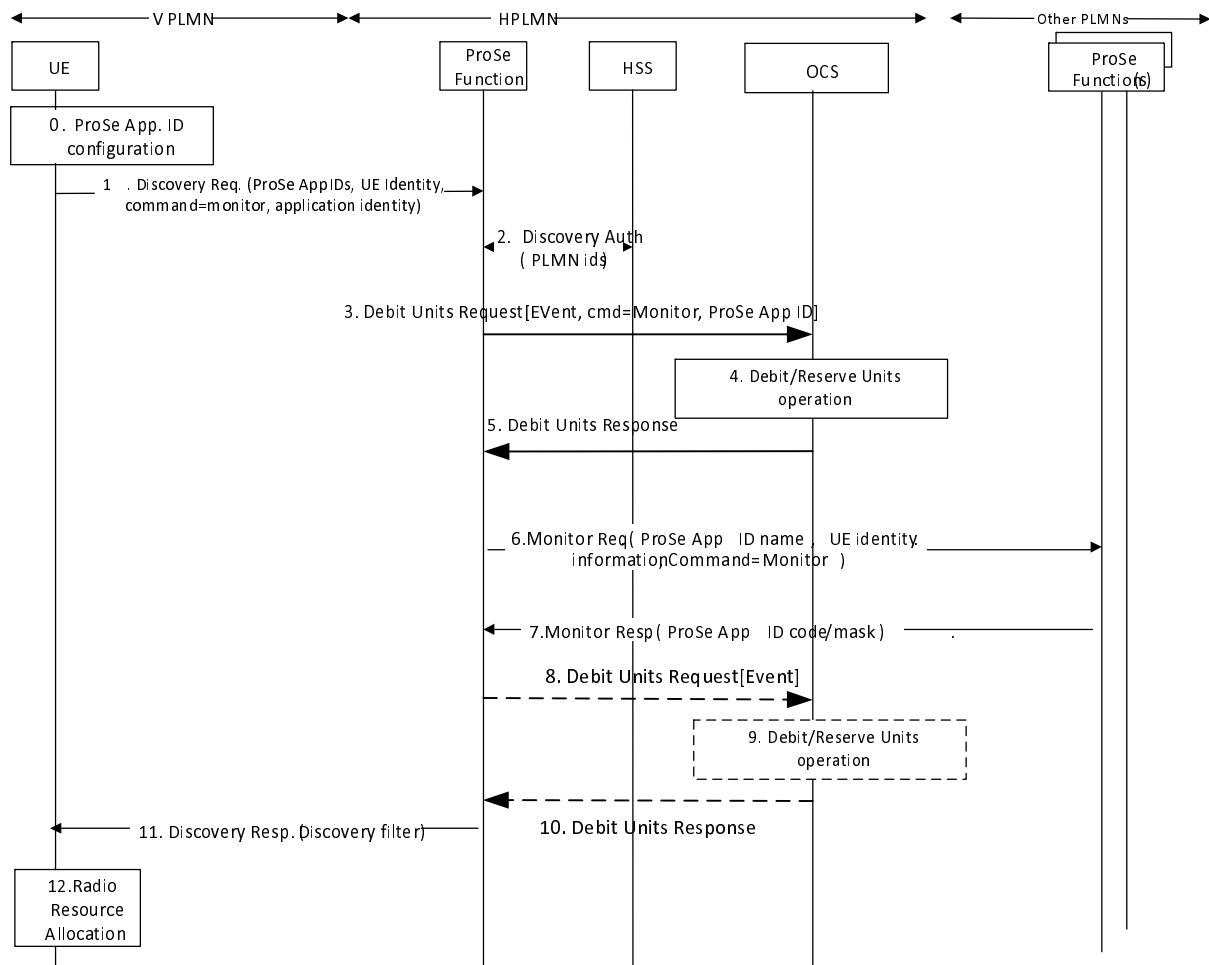
Figure 5.3.2.2.3.3: ProSe Direct Discovery Monitor Request – IEC (roaming)

0. The UE is configured with the data structure of the ProSe Application IDs corresponding to PLMNs the UE is authorized to monitor. This step is performed using mechanisms out of scope of 3GPP.

1. If the UE is authorized to monitor in at least one PLMN and is interested to monitor certain ProSe Application ID(s), it shall establish a secure connection with the ProSe Function in HPLMN and it shall send a Discovery Request (ProSe Application ID(s), UE Identity, Monitor command, application identity) message for monitoring.

2. If there is no associated UE context, the ProSe Function shall check with HSS the authorization for discovery and, if necessary, create a new context for this UE that contains the subscription parameters for this UE for the duration the Discovery Filters will be valid.

3. ProSe Function sends Debit Units Request[Event,ProSe App ID, cmd = Monitor] to the OCS.

4. The OCS performs the Debit Units operation for Discovery Monitor Request.

5. The OCS returns the Debit Units Response to ProSe Function.

6. The ProSe Function in HPLMN shall contact other PLMNs that are indicated by the ProSe Application ID(s) sent by the UE, in order to resolve the corresponding ProSe Application ID Name(s) to mask(s).

7. If the ProSe Function of the other PLMN stores valid ProSe Application Code(s) corresponding to the requested ProSe Application ID Name(s), then the ProSe Function of the Local PLMN returns the related ProSe Application mask(s) and the corresponding TTL for each.

In case of unsuccessful scenario, the optional refund steps 8 to 10 are required:

8. ProSe function sends Debit Units Request[Event] to the OCS for refund purpose.

9. The OCS performs Debit Units Request operation for refund.

10. The OCS returns the Debit Units Response to ProSe Function.

11. The ProSe Function in the HPLMN responds with a Discovery Response (Discovery Filter(s), Filter ID) message, in case step 7 is successful. The Discovery Filter(s) consists of the ProSe Application mask(s), and associated Time To Live value(s) which may be determined according to the service units granted in step 5.

12. The UE may start monitoring using the Discovery Filter(s) in the radio resources that are authorized and configured by the PLMN(s) to be used for ProSe as defined in RAN specifications.
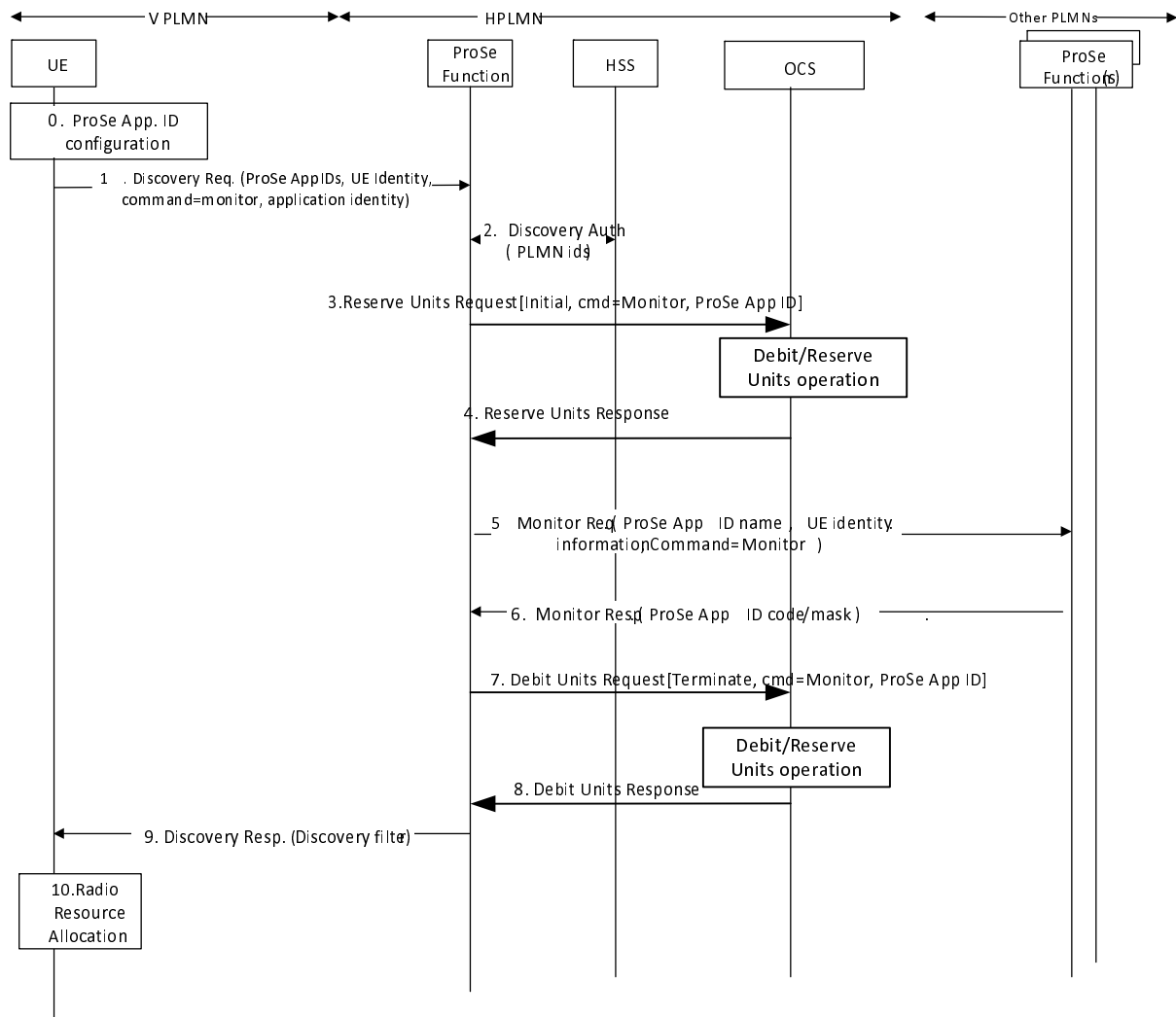
Figure 5.3.2.2.3.4: ProSe Direct Discovery Monitor Request – ECUR (roaming)

0-2.   same as figure 5.3.2.2.3.3 step 0-2.

3. ProSe Function sends Reserve Units Request[Initial, ProSe App ID, cmd = Monitor] to the OCS for requesting units.

4. The OCS grants service units in the Reserve Units Response to ProSe Function.

5-6.   same as figure 5.3.2.2.3.3 step 5-6.

7. ProSe Function sends Debit Units Request[Terminate] to the OCS indicating granted units are used. On unsuccessful Monitor Response, granted units are returned.

8. The OCS returns the Debit Units Response to ProSe Function.

9-10.   same as Figure 5.3.2.2.3.3 step 11-12.

5.3.2.2.4 Message flows for ProSe Direct Discovery Match Report Request

Figures 5.3.2.2.4.1 to 5.3.2.2.4.4 define the transactions between ProSe Function and OCS for the successful scenario where a "Monitoring UE" sends a Match report in non-roaming case and roaming case for IEC and ECUR modes.

When the ProSe Application ID has a scope different from PLMN specific scope (i.e. country-wide or global), the message flows are the same as those for the case of PLMN specific ProSe Application ID.
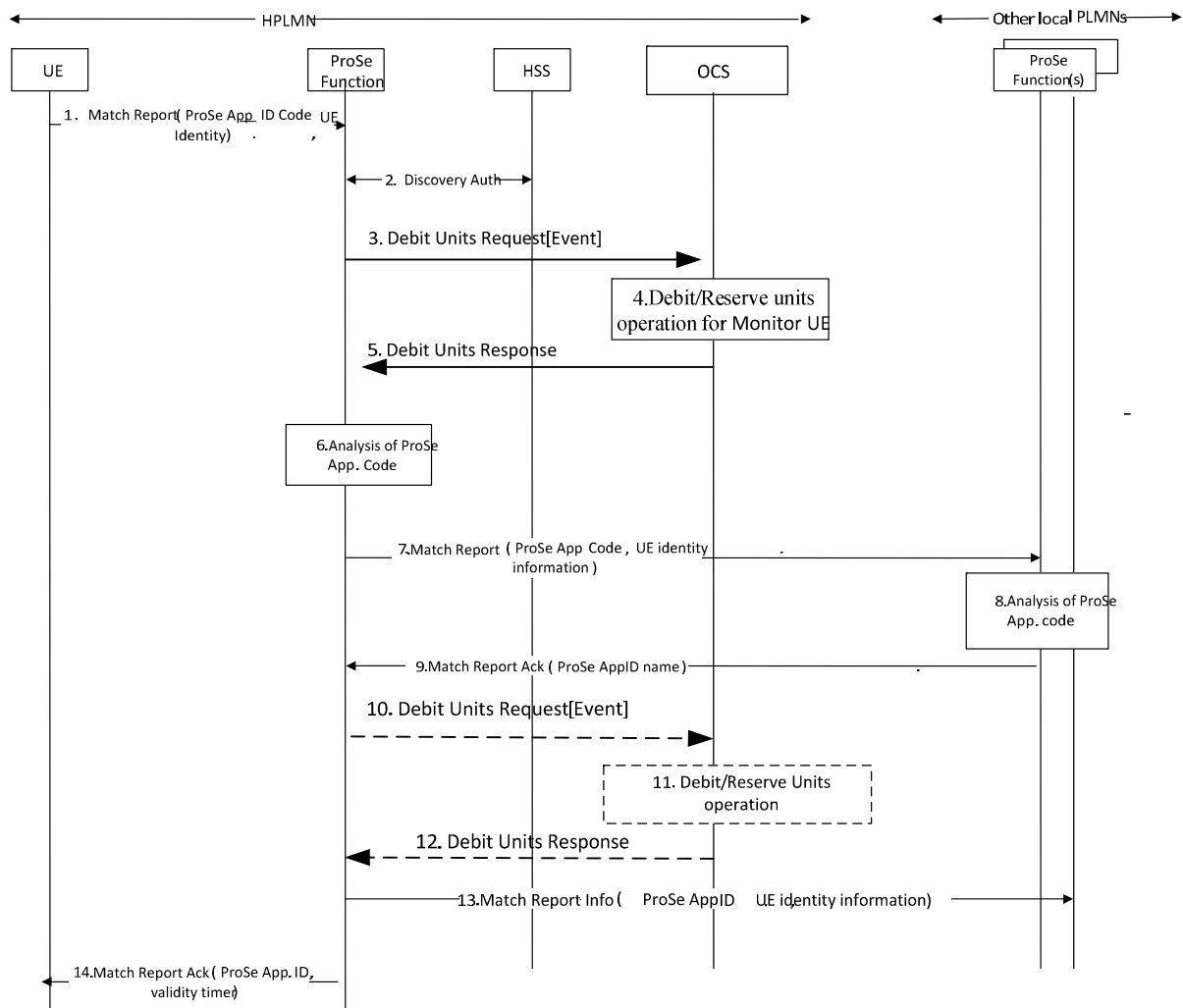
Figure 5.3.2.2.4.1: Message flow for ProSe Direct Discovery Match Report Request (IEC for non-roaming)

1. If the UE finds ProSe Application Code(s) that matches the Discovery Filters and does not have ProSe Application ID(s) already locally stored that correspond to this ProSe Application Code(s), it shall (re)establish a secure connection with the ProSe Function in HPLMN to which it shall then send a Match Report (ProSe Application Code(s), Discovery Filter ID(s), UE Identity) message to the ProSe Function in HPLMN.

2. The ProSe Function shall check the context for this UE that contains its subscription parameters.
   The authorization information also contains the PLMN that this UE is allowed to perform discovery.

3. ProSe Function sends Debit Units Request[Event] indicating "Match" to the OCS.

4. The OCS performs the Debit Units operation for "Match".

5. The OCS returns the Debit Units Response to ProSe Function.

6. The ProSe Function analyses the ProSe Application Code received from the UE.

If the PLMN ID that assigned the given ProSe Application Code is another Local PLMN then steps 7-14 are executed, otherwise (i.e. the ProSe Application Code was assigned by HPLMN) only step 14 is executed:

7. The ProSe Function in HPLMN sends a Match Report (ProSe Application Code(s), UE identity) to the ProSe Function of the PLMN that assigned the ProSe Application Code.

8. The ProSe Function analyses the ProSe Application Code(s) received from the UE.

9. If the ProSe Application Code is confirmed then the ProSe Function in Local PLMN shall send Match Report Acknowledgement (ProSe Application ID Name(s), validity timer(s)).

In case of unsuccessful scenario, the optional refund steps 10 to 12 are required:

10. ProSe function sends Debit Units Request[Event] to the OCS for refund purpose.

11. The OCS performs Debit Units Request operation for refund.

12. The OCS returns the Debit Units Response to ProSe Function.

13. If it was indicated that the announcing UE is roaming during the Monitor Request process, the ProSe Function in HPLMN shall send a Match Report Info (ProSe Application ID(s), UE Identity) to the ProSe Function of the serving PLMN of the Announcing UE.

14. The ProSe Function in HPLMN shall respond to the UE with Match Report Acknowledgment (ProSe Application ID(s), validity timer(s)).

Figure 5.3.2.2.4.2: Message flow for ProSe Direct Discovery Match Report Request (ECUR for non-roaming)

1-2. same as figure 5.3.2.2.4.1 step 1-2.

3. ProSe Function sends Reserve Units Request[Initial, ProSe App ID, cmd = Match] to the OCS for requesting units.

4. The OCS performs the Debit Units operation for "Match".

5. The OCS grants service units in the Reserve Units Response to ProSe Function.

6-9. same as figure 5.3.2.2.4.1 step 6-9.

10. ProSe Function sends Debit Units Request[Terminate] to the OCS with granted units used. On unsuccessful Match Report, granted units are returned.

11. The OCS performs the Debit Units operation for "Match".

12. The OCS returns the Debit Units Response to ProSe Function.

13-14. same as figure 5.3.2.2.4.1 step 13-14.
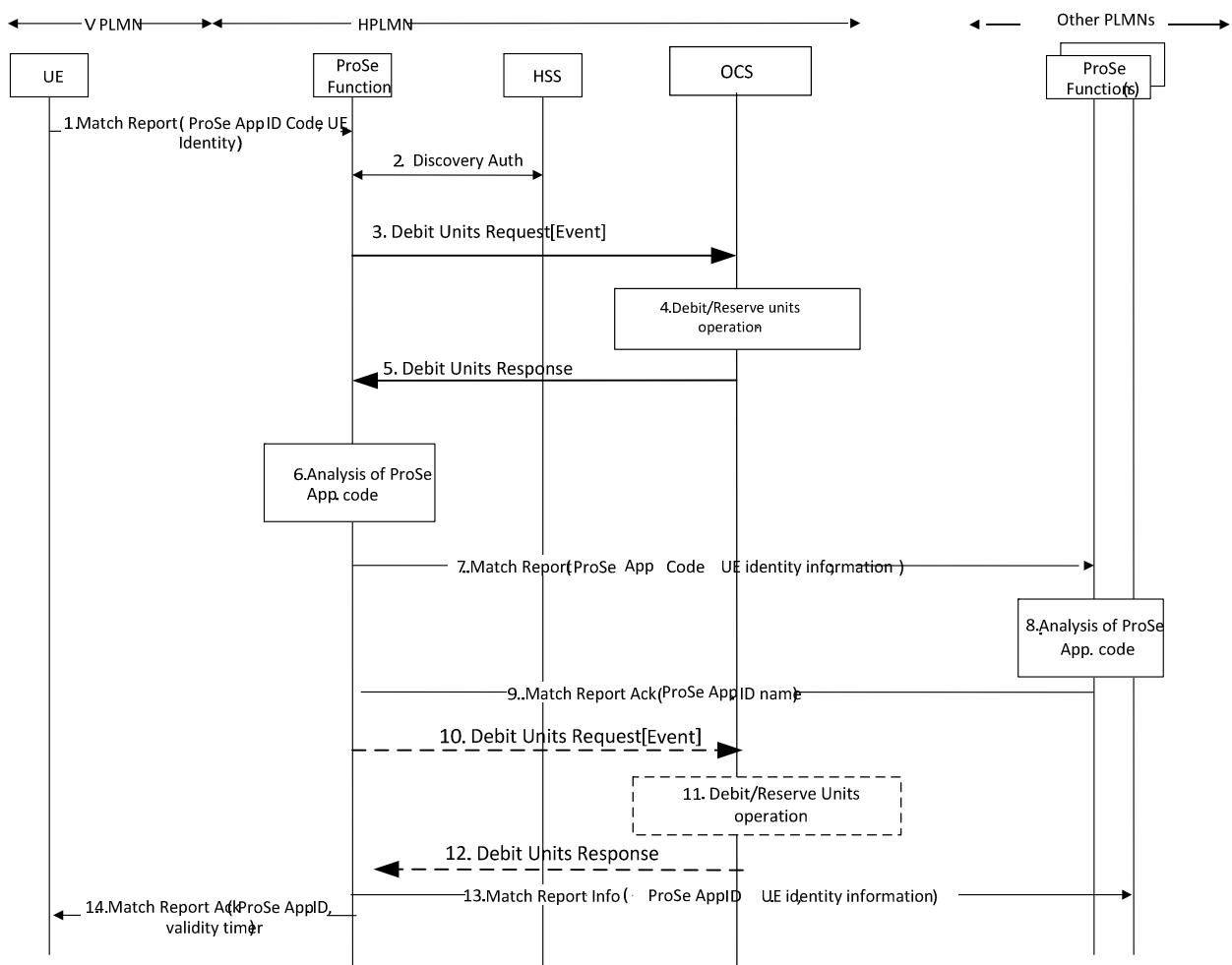
Figure 5.3.2.2.4.3: Message flow for ProSe Direct Discovery Match Report Request (IEC for roaming)

1. If the UE finds ProSe Application Code(s) that matches the Discovery Filters and does not have ProSe Application ID(s) already locally stored that correspond to this ProSe Application Code(s), it (re)establishes a secure connection with the ProSe Function in HPLMN and sends a Match Report (ProSe Application Code(s), Discovery Filter ID(s), UE Identity, VPLMN ID, Monitored PLMN ID) message to the ProSe Function in HPLMN.

2. The ProSe Function shall check the context for this UE that contains its subscription parameters for this UE. The authorization information also contains the PLMN that this UE is allowed to perform discovery.

3. ProSe Function sends Debit Units Request[Event] indicating "Match" to the OCS.

4. The OCS performs the Debit Units operation for "Match".

5. The OCS returns the Debit Units Response to ProSe Function.

6. The ProSe Function analyses the ProSe Application Code(s) received from the UE.

If the PLMN ID that assigned the given ProSe Application Code is not the HPLMN, then steps 7-14 are executed, otherwise (i.e. the HPLMN assigned the ProSe Application Code) only steps 14 is executed:

7. The ProSe Function in HPLMN sends a Match Report (ProSe Application Code(s), UE identity, monitored PLMN ID) to the ProSe Function of the PLMN that assigned the ProSe Application Code (i.e. the ProSe Function of the HPLMN of the "announcing UE").

8. The ProSe Function ensures that the received ProSe Application Code is authorized to be transmitted on the monitored PLMN. The ProSe Function analyses the ProSe Application Code(s) received from the UE, and confirms the ProSe Application Code(s).

9. The ProSe Function shall send Match Report Acknowledgement (ProSe Application ID Name(s), validity timer(s)).

In case of unsuccessful scenario, the optional refund steps 10 to 12 are required:

10. ProSe function sends Debit Units Request[Event] to the OCS for refund purpose.

11. The OCS performs Debit Units Request operation for refund.

12. The OCS returns the Debit Units Response to ProSe Function.

13. If it was indicated that the Announcing UE is roaming during the Monitor Request process, the ProSe Function in HPLMN shall send a Match Report Info (ProSe Application ID(s), UE Identity) to the ProSe Function of the serving PLMN of the Announcing UE.

14. The ProSe Function in HPLMN shall respond to the UE with Match Report Acknowledgment (ProSe Application ID(s), validity timer(s)).

Figure 5.3.2.2.4.4: Message flow for ProSe Direct Discovery Match Report Request (ECUR for roaming)

1-2. same as figure 5.3.2.2.4.3 step 1-2.

3. ProSe Function sends Reserve Units Request[Initial, ProSe App ID, cmd = Match] to the OCS for requesting units.

4. The OCS performs the Debit Units operation for "Match" Report Request.

5. The OCS grants service units in the Reserve Units Response to ProSe Function.

6-9. same as figure 5.3.2.2.4.3 step 6-9.

10. ProSe Function sends Debit Units Request[Terminate] to the OCS with granted units used. On unsuccessful Match Report, granted units are returned.

11. The OCS performs the Debit Units operation for "Match".

12. The OCS returns the Debit Units Response to ProSe Function.

13-14. same as figure 5.3.2.2.4.3 step 13-14.

5.3.2.3 ProSe EPC-level Discovery

5.3.2.3.1 Triggers for ProSe EPC-level Discovery online charging

ProSe EPC-level Discovery Proximity Request allows a ProSe-enabled UE A to request the network to assist it detecting if UE B is in proximity.

Debit/Reserve Unit Request[Initial/Update] is triggered for UE A, when a Proximity Request is received and the App Server provides the valid mapping information. Debit/Reserve Unit Request[Initial] is triggered when there is no active discovery session for the same pair of UE A and UE B identified by EPC ProSe User ID A (EPUID_A) and EPC ProSe User ID B (EPUID_B). Debit/Reserve Unit Request[Update] is triggered when there is an existing discovery session for the same pair of UE A and UE B.

Debit/Reserve Unit Request[Terminate] is triggered for UE A, when a Proximity Request Reject or Proximity Request Cancellation is sent.

Debit/Reserve Unit Request[Initial/Update] is triggered for UE B, when a Proximity Request is received. Debit/Reserve Unit Request[Initial] is triggered when there is no active discovery session for the same pair of UE A and UE B identified by EPC ProSe User ID A (EPUID_A) and EPC ProSe User ID B (EPUID_B). Debit/Reserve Unit Request[Update] is triggered when there is an existing discovery session for the same pair of UE A and UE B.

Debit/Reserve Unit Request[Terminate] is triggered for UE B, when a Proximity Request Reject or Proximity Request Cancellation is sent.

5.3.2.3.2   Message flow for ProSe EPC-level Discovery Proximity Request

Figure 5.3.2.3.2.1 depicts the message flow for ProSe EPC-level Discovery Proximity Request for UE A.

Figure 5.3.2.3.2.1: Message flow for ProSe EPC-level Discovery Proximity Request (UE A)

1 - 3. These steps are defined in TS 23.303 [238] clause 5.5.5.

4a. ProSe Function A sends Debit/Reserve Units Request[Initial/Update] according to the conditions specified in 5.3.2.3.1 to the corresponding OCS A.

4b. The OCS A performs Debit/Reserve Units operation for the UE.

4c. The OCS A returns the Debit Units Response to ProSe Function A.

5. ProSe Functions A sends the Proximity Request to ProSe Function B if step 4c indicates success.

6. ProSe Function B triggers the corresponding EPC-level discovery procedure for UE B, as depicted in figure 5.3.2.3.2.2.

7a ProSe Function B rejects the Proximity Request with the Proximity Request Reject (Cause) message.

If ProSe Function received Proximity Request Reject in step 7a, the following step 7b to 7e will executed. Otherwise, step 8 to 9b will be executed.

7b. ProSe Function A sends the Proximty Request Reject (Cause) to UE A.

7c ProSe Function A sends Debit/Reserve Units Request[Terminate] the corresponding OCS A.

7d. The OCS A performs Debit/Reserve Units operation for the UE.

7e. The OCS A returns the Debit Units Response to ProSe Function A.

8. ProSe Function B sends Proxmity Request Ack message to ProSe Function A.

9a. ProSe Function A sends LCS Locaiton Reporting Request for UE A to SLP A.

9b. ProSe Function A sends Proximity Request Ack to UE A.

Figure 5.3.2.3.2.2 depicts the message flow for ProSe EPC-level Discovery Proximity Request for UE B.
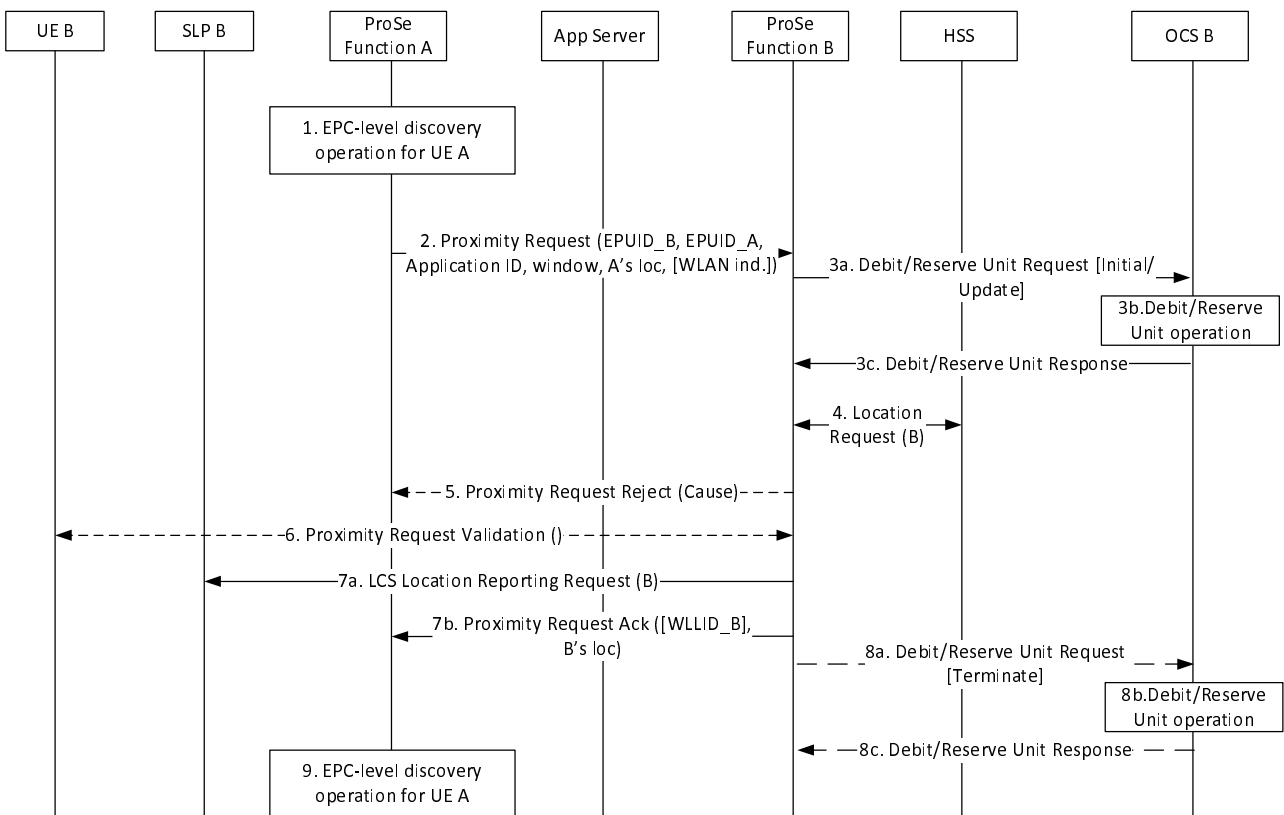
Figure 5.3.2.3.2.2: Message flow for ProSe EPC-level Discovery Proximity Request (UE B)

1. EPC-level discovery operation for UE A is executed, as depicted in step 1 to 4c in figure 5.3.2.3.2.2.

2. ProSe Functions A sends the Proximity Request to ProSe Function B.

3a. ProSe Function B sends Debit/Reserve Units Request[Initial/Update] according to the conditions specified in 5.3.2.3.1 to the corresponding OCS B.

3b. The OCS B performs Debit/Reserve Units operation for the UE.

3c. The OCS B returns the Debit Units Response to ProSe Function B.

4. If step 3c indicates success, the ProSe Function B obtains from HSS the last known location of UE B.

5. ProSe Function B may reject the request based on the information obtained in step 4, and send a Proximity Request Reject (Cause) message to ProSe Function A.

6. ProSe Function B validates the Proximity Request with UE B if it decides to accept the Proximity Request.

7a. ProSe Function B sends LCS Location Reporting Request to SLP B for UE B.

7b. ProSe Function B sends Proximity Request Ack message to the ProSe Function A.

The following step 8a to 8c are executed only when 5 is executed or step 6 validation fails.

8a. ProSe Function B sends Debit/Reserve Units Request[Terminate] the corresponding OCS B.

8b. The OCS B performs Debit/Reserve Units operation for the UE.

8c. The OCS B returns the Debit Units Response to ProSe Function B.

9. EPC-level discovery operation for UE A is executed, as depicted in step 7a to 9b in figure 5.3.2.3.2.2.

5.3.2.3.3   Message flow for ProSe EPC-level Discovery Proximity Request Cancellation

ProSe EPC-level Discovery Proximity Request cancellation is triggered by either the UE or network. It is cancels the proximity detection for a particular pair of UEs, e.g. UE A and UE B. Therefore, upon this procedure, Debit/Reserve Unit Request[Termiante] is triggered for UE A and UE B, after the respective ProSe Function responded to the Cancel Proximity Request message.

Figure 5.3.2.3.3.1 depicts the message flow for ProSe EPC-level Discovery Proximity Request Cancellation.
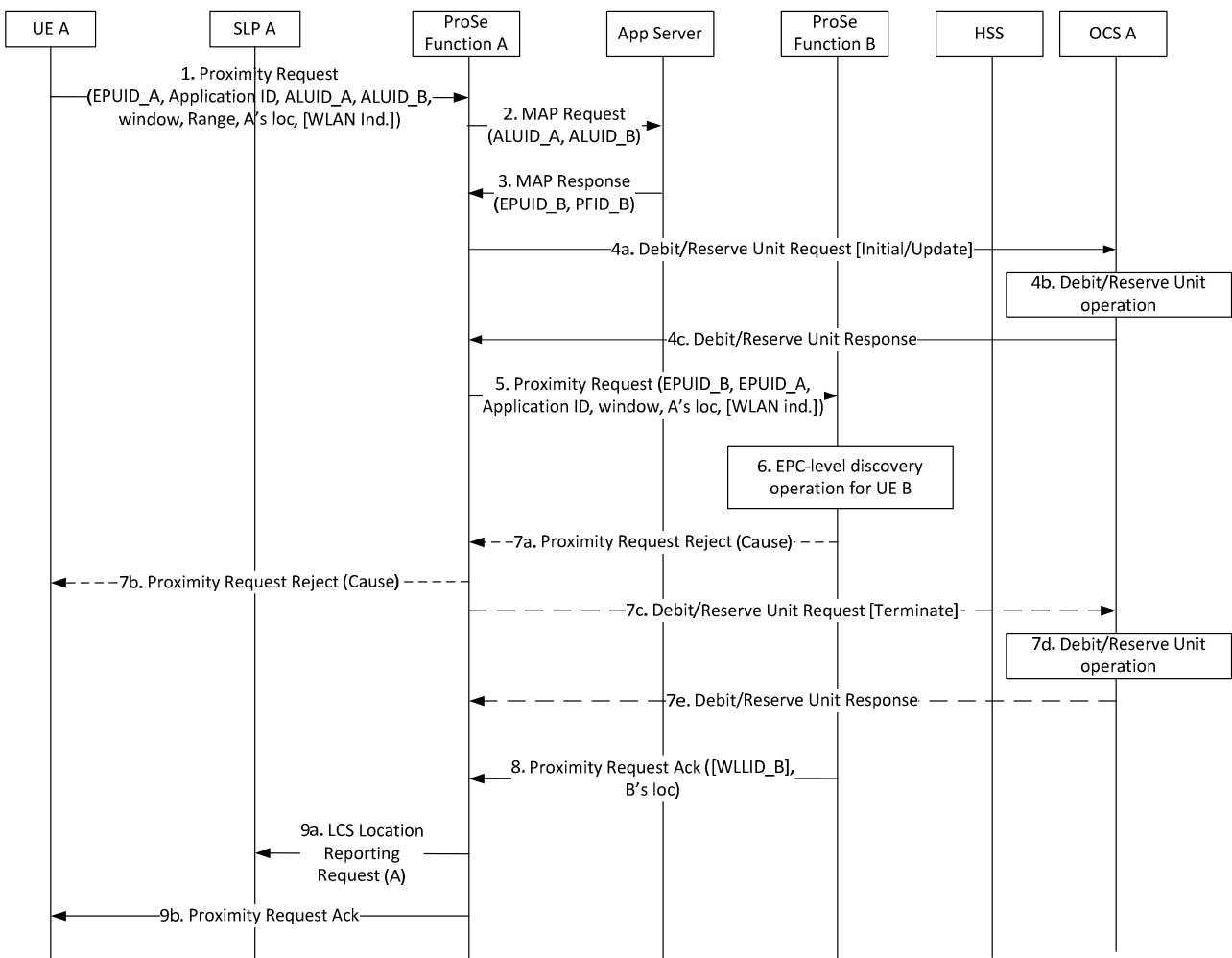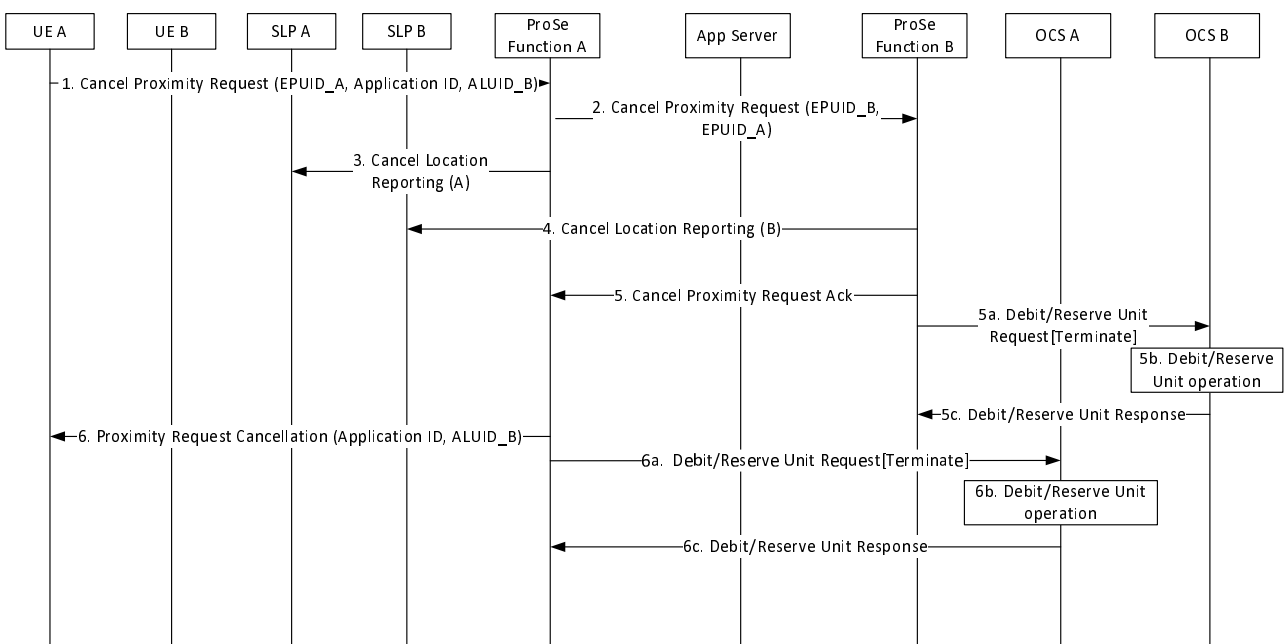

Figure 5.3.2.3.3.1: Message flow for ProSe EPC-level Discovery Proximity Request Cancellation

1 - 5. These steps are defined in TS 23.303 [238] clause 5.5.9.

5a. After the ProSe Function B sends a Cancel Proximity Request Ack to the ProSe Function A, the ProSe Function B triggers Debit/Reserve Units Request[Termiante] to the corresponding OCS B. This shall also indicate if a Proximity Alert has been sent to UE B.

5b. OCS B perform the Debit/Reserve Unit operation for UE B.

5c. The OCS B returns Debit/Reserve Units Response.

6. This step is defined in TS 23.303 [238] clause 5.5.9.

6a. After the ProSe Function A sends a Proximity Request Cancellation to the UE A, the ProSe Function A triggers Debit/Reserve Units Request[Termiante] to the corresponding OCS A. This shall also indicate if a Proximity Alert has been sent to UE A.

6b. OCS A perform the Debit/Reserve Unit operation for UE A.

6c. The OCS A returns Debit/Reserve Units Response.

6 Definition of charging information

6.1 Data description for ProSe offline charging

6.1.1 Rf message contents

6.1.1.1 General

The ProSe Offline Charging uses the Charging Data Transfer messages Charging Data Request and Charging Data Response defined in TS 32.299 [50].

The Charging Data Request can be of type event and includes all charging information. The Charging Data Response is an acknowledgement of the Charging Data Request.

Table 6.1.1.1.1 describes the use of these messages for offline charging.

Table 6.1.1.1.1: Offline charging messages reference table

Message	Source	Destination
Charging Data Request	ProSe Function	CDF
Charging Data Response	CDF	ProSe Function

This clause describes the different fields used in the Charging Data messages and the category in the tables are used according to the charging data configuration defined in clause 5.4 of TS 32.240 [1].

6.1.1.2 Charging Data Request message

Table 6.1.1.2.1 illustrates the basic structure of a Charging Data Request message from the ProSe Function as used for ProSe offline charging.

Table 6.1.1.2.1: Charging Data Request message contents

Information Element	Category	Description
Session Identifier	M	Described in TS 32.299 [50]
Originator Host	M	Described in TS 32.299 [50]
Originator Domain	M	Described in TS 32.299 [50]
Destination Domain	M	Described in TS 32.299 [50]
Operation Type	M	Described in TS 32.299 [50]
Operation Number	M	Described in TS 32.299 [50]

Information Element	Category	Description
Operation Identifier	O_C	Described in TS 32.299 [50]
User Name	O_C	Described in TS 32.299 [50]
Destination Host	O_C	Described in TS 32.299 [50]
Operation Interval	O_C	Described in TS 32.299 [50]
Origination State	O_C	Described in TS 32.299 [50]
Origination Timestamp	O_C	Described in TS 32.299 [50]
Proxy Information	O_C	Described in TS 32.299 [50]
Route Information	O_C	Described in TS 32.299 [50]
Operation Token	O_M	This field identifies the Proximity-based Services.
Service Information	O_M	This field holds the ProSe specific information described in clause 6.3.

NOTE: Detailed descriptions of the information elements are provided in TS 32.299 [50].

6.1.1.3   Charging Data Response message

Table 6.1.1.3.1 illustrates the basic structure of a Charging Data Response message as used for the ProSe function.

Table 6.1.1.3.1: Charging Data Response message contents

Information Element	Category	Description
Session Identifier	M	Described in TS 32.299 [50]
Operation Result	M	Described in TS 32.299 [50]
Originator Host	M	Described in TS 32.299 [50]
Originator Domain	M	Described in TS 32.299 [50]
Operation Type	M	Described in TS 32.299 [50]
Operation Number	O_C	Described in TS 32.299 [50]
Operation Identifier	O_C	Described in TS 32.299 [50]
Operation Interval	O_C	Described in TS 32.299 [50]
Error Reporting Host	O_C	Described in TS 32.299 [50]
Origination State	O_C	Described in TS 32.299 [50]
Origination Timestamp	O_C	Described in TS 32.299 [50]
Proxy Information	O_C	Described in TS 32.299 [50]

NOTE: Detailed descriptions of the information elements are provided in TS 32.299 [50].

6.1.2   Ga message contents

Refer to clause 5.2.4 for further information.

6.1.3   CDR description on the Bx interface

6.1.3.1   General

The following standard CDR content and format are considered:

-    PF-DD-CDR generated based on ProSe Direct Discovery information from the ProSe function;

-    PF-ED-CDR generated based on ProSe EPC-level Discovery from the ProSe function.

-    PF-DC-CDR generated based on ProSe Direct Communication from the ProSe function.

For each of the CDR types, a parameter table, which gives a short description of the parameters, is provided. The category in the tables are used according to the charging data configuration defined in clause 5.4 of TS 32.240 [1].

6.1.3.2   Direct Discovery charging data in ProSe Function (PF-DD-CDR)

If the collection of CDR data is enabled then the charging data specified in table 6.1.3.2.1 shall be available for direct discovery request.

Table 6.1.3.2.1: ProSe Function Direct Discovery data (PF-DD-CDR)

Field	Category	Description
Record Type	M	ProSe Direct Discovery record.
Retransmission	O_C	This parameter, when present, indicates that information from retransmitted Accounting Requests has been used in this CDR.
Served IMSI	C	IMSI of the served party.
Announcing UE HPLMN Identifier	O_M	PLMN identity of Announcing UE HPLMN.
Announcing UE VPLMN Identifier	O_C	PLMN identity of Announcing UE VPLMN.
Monitoring UE HPLMN Identifier	O_C	PLMN identity of monitoring UE HPLMN.
Monitoring UE VPLMN Identifier	O_C	PLMN identity of monitoring UE VPLMN.
Monitored PLMN Identifier	O_C	Monitored PLMN ID in Match_Report request, as defined in TS23.303 [238] clause 5.3.4. It corresponds to the Announcing UE VPLMN Identifier when roaming and Announcing UE HPLMN Identifier when non-roaming.
Role of ProSe Function	O_M	This field indicates the CDR resource ProSe Function resides in which PLMN, i.e. in HPLMN, VPLMN or local PLMN.
ProSe Application ID	O_C	The identities used for ProSe Direct Discovery, identifying application related information for the ProSe-enabled UE. (see note)
Application ID	O_C	A globally unique identifier identifying a specific 3rd party application.
ProSe Event Type	O_C	This IE holds the event which triggers the charging message delivery, e.g. Announcing, Monitoring, or Match Report.
Direct Discovery Model	O_C	model of the Direct Discovery used by the UE, e.g. Model A, or Model B.
Node ID	O_C	The identifier of the ProSe Function.
ProSe Function IP Address	O_C	The IP address of the ProSe Function.
ProSe Function ID	O_C	The FQDN that identifies the ProSe Function.
Validity Period	O_C	Time interval during which user is authorized for using ProSe Direct Discovery functionality (e.g. announcing, monitoring, match reporting).
Role of UE	O_C	Role of the UE using ProSe, e.g. Announcing UE, Monitoring UE.
ProSe Request Timestamp	O_C	The time when ProSe Request is received from UE.
PC3 Control Protocol Cause	O_C	This field holds the particular reason why a DISCOVERY_REQUEST or Match_Report messages from the UE have been rejected by the ProSe Function.
Monitoring UE Identifier	O_C	Identifier of the party who initiate monitor/match report, i.e. IMSI, which corresponds to UE Identifier parameter in monitor/match report request, as defined in TS 23.303 [238].
Charging characteristics	M	The Charging Characteristics applied to the ProSe direct discovery.
Charging Characteristics Selection Mode	O_M	Holds information about how Charging Characteristics were selected.
Record Extensions	O_C	A set of network operator/manufacturer specific extensions to the record. Conditioned upon the existence of an extension.
NOTE: For the CDR generated for announcing UE in match report event, it holds the ProSe application id name.		

6.1.3.3 ProSe EPC-level Discovery charging data in ProSe Function (PF-ED-CDR)

If enabled, a ProSe EPC-level Discovery record shall be produced for each EPC-level discovery request for a specific user received from a ProSe enabled UE. Renewal requests for a specific user are captured in the same CDR as the initial request. The fields in the record are specified in table 6.1.3.3.1.

Table 6.1.3.3.1: ProSe Function EPC-level Discovery data (PF-ED-CDR)

Field	Category	Description
Record Type	M	ProSe Function EPC-level Discovery record.
Retransmission	O_C	This parameter, when present, indicates that information from retransmitted Accounting Requests has been used in this CDR.
Served IMSI	C	IMSI of the served party.
ProSe Function PLMN Identifier	O_C	PLMN identity of ProSe function.

Field	Category	Description
Application ID	O_C	A globally unique identifier identifying a specific 3rd party application.
ProSe Function ID	O_C	The FQDN that identifies a ProSe Function.
ProSe Function IP Address	O_C	The IP address of the ProSe Function.
Role of UE	O_C	role of the UE using ProSe, e.g. requestor UE, requested UE
ProSe Request Timestamp	O_C	The time when ProSe Request is received from UE.
PC3 EPC Control Protocol Cause	O_C	This field holds the particular reason why a Proximity request messages from the UE have been rejected by the ProSe Function.
Requestor Application Layer User ID	O_C	The user identifier designated in 3rd party application for the user who initiate EPC-level ProSe discovery request.
WLAN Link Layer ID	O_C	This field holds WLAN Link Layer ID.
Requestor EPC ProSe User ID	O_C	The identifier generated in ProSe Function for UE who initiate EPC-level ProSe discovery request.
Requested Application Layer User ID	O_C	The user identifier designated in 3rd party application for the user who is targeted in proximity request.
Requested PLMN Identifier	O_C	The PLMN identifier of the user who is targeted in proximity request.
Time Window	O_C	The time interval in minutes during which a proximity request is valid.
Range Class	O_C	A range class for a specific proximity request.
UE Location	O_C	The UE location with the best known accuracy (e.g. Cell ID or geo-location coordinates).
Proximity Request Renewal Info Block List	O_C	This is a list of information blocks that are added by each of the Proximity Request renewal messages captured in the CDR. The information block contains information of the renewal request, e.g. timestamp, time window, range class, and UE location. The definition of the information block is in table 6.1.3.3.2.
Proximity Alert Indication	O_C	Indication of whether proximity alert has been sent before proximity request cancellation.
Proximity Alert Timestamp	O_C	The time stamp when proximity alert is sent, to indicate two UEs are in proximity.
Proximity Cancellation Timestamp	O_C	The time stamp when proximity request cancellation is requested.
Reason for Cancellation	O_C	The reason for cancellation of an EPC-level discovery request i.e. proximity alerted, time expired with no renewal, requestor cancellation.
Charging characteristics	M	The Charging Characteristics applied to the ProSe EPC-Level discovery.
Charging Characteristics Selection Mode	O_M	Holds information about how Charging Characteristics were selected.
Cause for Record Closing	M	The reason for the release of record from this ProSe Function.
Record Extensions	O_C	A set of network operator/manufacturer specific extensions to the record. Conditioned upon the existence of an extension.

Table 6.1.3.3.2: ProSe Function EPC-level Discovery Proximity Request Renewal Info Block

Field	Category	Description
ProSe Request Timestamp	O_C	The time when ProSe Renewal Request is received from UE.
Time Window	O_C	The time interval in minutes during which a proximity renewal request is valid.
Range Class	O_C	A range class for a specific proximity renewal request.
UE Location	O_C	The UE location with the best known accuracy (e.g. Cell ID or geo-location coordinates) at the time fo the renewal request.

6.1.3.4 Direct communication charging data in ProSe Function (PF-DC-CDR)

If the collection of CDR data is enabled then the charging data specified in table 6.1.3.4.1 shall be available for Direct Communication request.

Table 6.1.3.4.1: ProSe Function Direct Communication data (PF-DC-CDR)

Field	Category	Description
Record Type	M	ProSe Direct Communication record.
Retransmission	O_C	This parameter, when present, indicates that information from retransmitted Charging Data Request has been used in this CDR.
Served IMSI	C	IMSI of the served party.
ProSe Function PLMN Identifier	O_M	PLMN identity of HPLMN ProSe function.
Node ID	O_C	The identifier of the ProSe Function.
ProSe Function IP Address	O_C	The IP address of the ProSe Function.
ProSe Function ID	O_C	The FQDN that identifies the ProSe Function.
Record Opening Time	M	Time stamp when the CDR is open.
ProSe UE ID	O_C	A link layer identifier assigned by the EPS that uniquely represents the UE in the context of ProSe Direct Communication.
Source IP address	O_C	The IP address UE used as source address for performing ProSe Direct Communication.
ProSe Layer-2 Group ID	O_C	The identifier of a ProSe communication group, uniquely represents a specific one-to-many ProSe Direct Communication and is included in CDRs for each participantes in the specific group.
ProSe Group IP multicast addresses	O_C	The IP multicast address to be used for performing ProSe Direct Communication.
List of Direct Communication Data	O_M	A list of changes in trigger conditions (e.g. change of cell, go out of coverage, come back to coverage, etc.) for a specific ProSe group communication. Each change is time stamped. Trigger condition is used to categorize data volumes, such as per coverage status duration.
Charging characteristics	M	The Charging Characteristics applied to the ProSe group communication.
Charging Characteristics Selection Mode	O_M	Holds information about how Charging Characteristics were selected.
Cause for Record Closing	M	The reason for the release of record from this ProSe Function.
Record Extensions	O_C	A set of network operator/manufacturer specific extensions to the record. Conditioned upon the existence of an extension.

The components of the Direct Communication Data Container are defined in following table.

Table 6.1.3.4.2: Structure of the Direct Communication Data Container

Field	Category	Description
Local Sequence Number	O_C	The sequence number of the Direct Communication data container, which is increased by 1 for each container closed
Time of First Usage	O_C	The time when collection of charging data in this container is started, i.e. the first one-to-many communication transmission/reception.
Time of Last Usage	O_C	The time when collection of charging data in this container is stopped, i.e. the last one-to-many communication transmission/reception.
Change Time	O_C	The time when the container is closed and reported due to ProSe charging condition change.
Coverage status	O_C	Whether UE is served by E-UTRAN or not, i.e. in coverage, out of coverage.
User Location Information	O_C	The locations of the UE, e.g. ECGIs
Data Volume Transmitted	O_C	Amount of data transmitted by UE.
Data Volume Received	O_C	Amount of data received by UE.
Change Condition	O_C	ProSe specific reason for closing the container, e.g. change of Cell, go out of coverage, come back to coverage.
VPLMN Identifier	O_C	Indentifier of PLMN which UE visits.
Usage information report sequence number	O_C	The sequence number of usage information report, which is used to generate the container.

6.2 Data description for ProSe online charging

6.2.1 Ro message contents

6.2.1.1 General

The ProSe Online Charging uses the Debit / Reserve Units Request and Debit / Reserve Units Response messages defined in TS 32.299 [50].

Table 6.2.1.1.1 describes the use of these messages for online charging.

Table 6.2.1.1.1: Online charging messages reference table

Message	Source	Destination
Debit / Reserve Units Request	ProSe Function	OCS
Debit / Reserve Units Response	OCS	ProSe Function

The structure of the Debit / Reserve Units Request and Debit / Reserve Units Reponse messages defined in the following clauses. The category in the tables are used according to the charging data configuration defined in clause 5.4 of TS 32.240 [1].

6.2.1.2 Debit / Reserve Units Request message

Table 6.2.1.2.1 illustrates the basic structure of a Debit / Reserve Units Request message from the ProSe Function as used for ProSe online charging.

Table 6.2.1.2.1: Debit / Reserve Units Request message contents

Information Element	Category	Description
Session Identifier	M	Described in TS 32.299 [50]
Originator Host	M	Described in TS 32.299 [50]
Originator Domain	M	Described in TS 32.299 [50]
Destination Domain	M	Described in TS 32.299 [50]
Operation Type	M	Described in TS 32.299 [50]
Operation Number	M	Described in TS 32.299 [50]
Operation Identifier	O_M	Described in TS 32.299 [50]
User Name	O_C	Described in TS 32.299 [50]
Destination Host	O_C	Described in TS 32.299 [50]
Operation Interval	O_C	Described in TS 32.299 [50]
Origination State	O_C	Described in TS 32.299 [50]
Origination Timestamp	O_C	Described in TS 32.299 [50]
Proxy Information	O_C	Described in TS 32.299 [50]
Route Information	O_C	Described in TS 32.299 [50]
Operation Token	O_M	Described in TS 32.299 [50]
Service Information	O_M	This field holds the ProSe specific information described in clause 6.3

NOTE: Detailed descriptions of the information elements are provided in TS 32.299 [50].

6.2.1.3 Debit / Reserve Units Response message

Table 6.2.1.3.1 illustrates the basic structure of a Debit / Reserve Units Response message as used for the ProSe function.

Table 6.2.1.3.1: Debit / Reserve Units Response message contents

Information Element	Category	Description

Information Element	Category	Description
Session Identifier	M	Described in TS 32.299 [50]
Operation Result	M	Described in TS 32.299 [50]
Originator Host	M	Described in TS 32.299 [50]
Originator Domain	M	Described in TS 32.299 [50]
Operation Type	M	Described in TS 32.299 [50]
Operation Number	M	Described in TS 32.299 [50]
Operation Identifier	O_M	Described in TS 32.299 [50]
Operation Interval	O_C	Described in TS 32.299 [50]
Error Reporting Host	O_C	Described in TS 32.299 [50]
Origination State	O_C	Described in TS 32.299 [50]
Origination Timestamp	O_C	Described in TS 32.299 [50]
Proxy Information	O_C	Described in TS 32.299 [50]

NOTE: Detailed descriptions of the information elements are provided in TS 32.299 [50].

6.3 ProSe charging specific parameters

6.3.1 Definition of ProSe charging information

6.3.1.1 ProSe charging information assignment for Service Information

The components in the Service Information that are used for ProSe charging can be found in table 6.3.1.1.1.

Table 6.3.1.1.1: Service Information used for ProSe charging

Information Element	Category	Description
Service Information	O_M	This is a structured IE and holds the 3GPP specific parameter as defined in TS 32.299 [50].
Subscriber Identifier	O_C	This IE contains the identification of the user (e.g. IMSI), for offline charging only.
PS Information	O_C	This is a structured IE and hold PS specification parameters. The complete structure is defined in TS 32.251 [11].
Node Id	O_C	This IE holds the name of the Node.
User Location Info	O_C	This IE indicates details of where the UE is currently located (e.g. SAI, TAI, RAI, CGI, ECGI or access-specific user location information).
Change Condition	O_C	This field holds the reason for sending Charging Data Request from the ProSe Function.
Charging Characteristics	O_c	The Charging Characteristics applied to the ProSe service.
Charging Characteristics Selection Mode	O_c	Holds information about how Charging Characteristics were selected.
ProSe Information	O_M	This is a structured IE and holds the ProSe specific parameters. The details are defined in clause 6.3.1.2.

6.3.1.2 Definition of the ProSe Information

ProSe specific charging information is provided within the ProSe Information. The fields of the ProSe Information are indicated with the node (ProSe Function) from which the information is sent.

The detailed structure of the ProSe Information can be found in table 6.3.1.2.1.

Table 6.3.1.2.1: Structure of the ProSe Information

Information Element	Category	Description

Information Element	Category	Description
Announcing UE HPLMN Identifier	O_M	PLMN identity of HPLMN for announcing UE. This field holdes PLMN identity of HPLMN for UE requested to be monitored in monitor/match report procedure.
Announcing UE VPLMN Identifier	O_C	PLMN identity of VPLMN for announcing UE. This field correspondes to Monitored PLMN ID in match report request, as defined in TS23.303 [238] clause 5.3.4. In this case it"s the same with announcing UE HPLMN Identifier when non-roaming
Monitoring UE HPLMN Identifier	O_C	PLMN identity of HPLMN for monitoring UE.
Monitoring UE VPLMN Identifier	O_C	PLMN identity of VPLMN for monitoring UE.
Monitored PLMN Identifier	O_C	Monitored PLMN ID in Match_Report request, as defined in TS23.303 [238] clause 5.3.4. It corresponds to the Announcing UE VPLMN Identifier when roaming and Announcing UE HPLMN Identifier when non-roaming.
Role of ProSe Function	O_M	This IE indicates the CDR resource ProSe Function resides in which PLMN, i.e. in HPLMN, VPLMN or local PLMN.
ProSe Application ID	O_C	The identities used for ProSe Direct Discovery, identifying application related information for the ProSe-enabled UE. Note: For the CDR generated for announcing UE in match report event, it holds the ProSe application id name.
Application ID	O_C	A globally unique identifier identifying a specific 3rd party application.
ProSe functionality	O_C	This IE holds the ProSe functionality UE is requesting, e.g. direct discovery, EPC-level discovery, group communication.
ProSe Event Type	O_C	This IE holds the event which triggers the charging message delivery, e.g. Announcing, Monitoring, or Match Report.
Direct Discovery Model	O_C	model of the Direct Discovery used by the UE, e.g. Model A, or Model B.
ProSe Function IP Address	O_C	The IP address of the ProSe Function.
ProSe Function ID	O_C	The FQDN that identifies a ProSe Function.
Validity Period	O_C	Time interval during which user is authorized for using ProSe Direct Discovery functionality (e.g. announcing, monitoring, match reporting).
Role of UE	O_C	Role of the UE using ProSe served by the ProSe Function, e.g. Announcing UE, Monitoring UE, requestor UE, requested UE.
ProSe Request Timestamp	O_C	The time when ProSe Request is received from UE.
PC3 Protocol Cause	O_C	This IE holds the particular reason why a DISCOVERY_REQUEST or Match_Report messages from the UE have been rejected by the ProSe Function in PC3 interface.
Monitoring UE Identifier	O_C	Identifier of the party who initiate monitor/match report, i.e. IMSI, which corresponds to UE Identifier parameter in monitor/match report request, as defined in TS 23.303 [238].
ProSe Function PLMN Identifier	O_C	PLMN identity of ProSe function.
Requestor PLMN Identifier	O_C	The PLMN identifier of the user who initiate proximity request.
Requestor Application Layer User ID	O_C	The user identifier designated in 3rd party application for the user who initiate EPC-level ProSe discovery request.
WLAN Link Layer ID	O_C	This IE holds WLAN Link Layer ID.
Requestor EPC ProSe User ID	O_C	The identifier generated in ProSe Function for UE who initiate EPC-level ProSe discovery request.
Requested Application Layer User ID	O_C	The user identifier designated in 3rd party application for the user who is targeted in proximity request.
Requested PLMN Identifier	O_C	The PLMN identifier of the user who is targeted in proximity request.
Time Window	O_C	The time interval in minutes during which a proximity request is valid.
Range Class	O_C	A range class for a specific proximity request.
UE Location	O_C	The UE location with the best known accuracy (e.g. Cell ID or geo-location coordinates)
Proximity Alert Indication	O_C	Indication of whether proximity alert has been sent before proximity request cancellation.
Proximity Alert Timestamp	O_C	The time stamp when proximity alert is sent, to indicate two UEs are in proximity.
Proximity Cancellation Timestamp	O_C	The time stamp when proximity request cancellation is requested.
Reason for Cancellation	O_C	The reason for cancellation of an EPC-level discovery request i.e. proximity alerted, time expired with no renewal, requestor cancellation.
PC3 EPC Control Protocol Cause	O_c	This field holds the particular reason why a Proximity request messages from the UE have been rejected by the ProSe Function.

Information Element	Category	Description
ProSe UE ID	O_C	A link layer identifier assigned by the EPS that uniquely represents the UE in the context of ProSe Direct Communication.
Source IP address	O_C	The IP address UE used as source address for performing ProSe direct communication.
ProSe Layer-2 Group ID	O_C	The identifier of a ProSe communication group, uniquely represents a specific one-to-many ProSe Direct Communication and is included in CDRs for each participantes in the specific group.
ProSe Group IP multicast addresses	O_C	The IP multicast address to be used for performing ProSe direct communication.
Direct Communication Data Container	O_M	This field holds the container associated to a trigger conditions (e.g. change of Cell, go out of coverage, come back to coverage, etc.) on a specific ProSe group communication.
Local Sequence Number	O_C	The sequence number of the Direct Communication data container, which is increased by 1 for each container closed
Time of First Usage	O_C	The time when collection of charging data in this container is started, i.e. the first one-to-many communication transmission/reception.
Time of Last Usage	O_C	The time when collection of charging data in this container is stopped, i.e. the last one-to-many communication transmission/reception.
Change Time	O_C	The time when the container is closed and reported due to ProSe charging condition change.
Coverage status	O_C	Whether UE is served by E-UTRAN or not, i.e. in coverage, out of coverage.
User Location Information	O_C	The locations of the UE, e.g. ECGIs
Data Volume Transmitted	O_C	Amount of data transmitted by UE.
Data Volume Received	O_C	Amount of data received by UE.
Change Condition	O_C	ProSe specific reason for closing the container, e.g. change of Cell, go out of coverage, come back to coverage.
VPLMN Identifier	O_C	Indentifier of PLMN which UE visits.
Usage information report sequence number	O_C	The sequence number of usage information report, which is used to generate the container.

6.3.2 Formal ProSe charging parameter description

6.3.2.1 ProSe CDR parameters

The detailed definitions, abstract syntax and encoding of the ProSe CDR parameters are specified in TS 32.298 [51].

6.3.2.2 ProSe AVPs

The detailed definitions of ProSe AVPs are specified in TS 32.299 [50].

6.3.3 Detailed message format for offline charging

The following clause specifies per Operation Type the charging data that are sent by ProSe Function for different functionality, i.e. Direct Discovery, EPC_Level Discovery and Direct Communication.

The Operation Types are listed in the following order: S (Start)/I (Interim)/S (Stop)/E (Event). Therefore, when all Operation Types are possible it is marked as SISE. If only some Operation Types are allowed for a node, only the appropriate letters are used (i.e. SIS or E) as indicated in the table heading. The omission of an Operation Type for a particular field is marked with "-" (i.e. SI-E). Also, when an entire field is not allowed in a node the entire cell is marked as "-".

Table 6.3.3.1 illustrates the basic structure of the supported fields in the *Charging Data* Request message for ProSe offline charging.

Table 6.3.3.1: Supported fields in *Charging Data Request* message

Information Element	Service Type	Direct Discovery	EPC_Level Discovery	Direct Communication
	Supported Operation Types	S/I/S/E	S/I/S/E	S/I/S/E
Session Identifier		---E	SIS-	SISE
Originator Host		---E	SIS-	SISE
Originator Domain		---E	SIS-	SISE
Destination Domain		---E	SIS-	SISE
Operation Type		---E	SIS-	SISE
Operation Number		---E	SIS-	SISE
Operation Identifier		---E	SIS-	SISE
User Name		---E	SIS-	SISE
Destination Host		---E	SIS-	SISE
Operation Interval		---E	SIS-	SISE
Origination State		---E	SIS-	SISE
Origination Timestamp		---E	SIS-	SISE
Proxy Information		---E	SIS-	SISE
Route Information		---E	SIS-	SISE
Operation Token		---E	SIS-	SISE
Service Information with PS, IMS and ProSe Information				
Subscription Id		---E	SIS-	SISE
Node Id		---E	SIS-	SISE
Node Functionality		---E	SIS-	SISE
Announcing UE HPLMN Identifier		---E	-	-
Announcing UE VPLMN Identifier		---E	-	-
Monitoring UE HPLMN Identifier		---E	-	-
Monitoring UE VPLMN Identifier		---E	-	-
Role of ProSe Function		---E	-	-
ProSe Application ID		---E	-	-
Application ID		---E	SIS-	-
ProSe functionality		---E	-	-
ProSe Event Type		---E	-	-
Direct Discovery Model		---E	-	-
ProSe Function IP Address		---E	SIS-	SISE
ProSe Function ID		---E	SIS-	SISE
Validity Period		---E	-	-
Role of UE		---E	SIS-	-
ProSe Request Timestamp		---E	SIS-	-
PC3 Control Protocol Cause		---E	-	-
Monitoring UE Identifier		---E	-	-
Requestor PLMN Identifier		-	SIS-	-
Requestor Application Layer User ID		---E	SIS-	-
WLAN Link Layer ID		---E	SIS-	-
Requestor EPC ProSe User ID		---E	SIS-	-
Requested Application Layer User ID		---E	SIS-	-
Requested PLMN Identifier		---E	SIS-	-
Time Window		---E	SI--	-
Range Class		---E	S---	-
User Location Info		---E	SIS-	-
Proximity Alert Indication		---E	--S-	-
Proximity Alert Timestamp		---E	--S-	-
Proximity Cancellation Timestamp		---E	SIS-	-
Reason for Cancellation		---E	SIS-	-
PC3 EPC Control Protocol Cause		-	--S-	-
Charging Characteristics		---E	SIS-	SISE
Charging Characteristics Selection Mode		---E	SIS-	SISE
Change Condition		-	SIS-	SISE
ProSe UE ID		-	-	SISE
Source IP address		-	-	SISE
ProSe Layer-2 Group ID		-	-	SISE
ProSe Group IP multicast addresses		-	-	SISE

Direct Communication Data Container	-	-	SISE

Table 6.3.3.2 illustrates the basic structure of the supported fields in the *Charging Data* Responsemessage for ProSe offline charging.

Table 6.3.3.2: Supported fields in *Charging Data* Response message

Information Element	Service Type	Direct Discovery	EPC_Level Discovery	Direct Communication
	Supported Operation Types	S/I/S/E	S/I/S/E	S/I/S/E
Session Identifier		---E	SIS-	SISE
Operation Result		---E	SIS-	SISE
Originator Host		---E	SIS-	SISE
Originator Domain		---E	SIS-	SISE
Operation Type		---E	SIS-	SISE
Operation Number		---E	SIS-	SISE
Operation Identifier		---E	SIS-	SISE
Operation Interval		---E	SIS-	SISE
Error Reporting Host		---E	SIS-	SISE
Origination State		---E	SIS-	SISE
Origination Timestamp		---E	SIS-	SISE
Proxy Information		---E	SIS-	SISE
Route Information		---E	SIS-	SISE

6.3.4   Detailed Message Format for online charging

The following table specifies per Operation type the charging data that are sent ProSe Function network element for:

The Operation types are listed in the following order: I [initial]/U [update]/T [terminate]/E [event]. Therefore, when all Operation types are possible it is marked as IUTE. If only some Operation types are allowed for a node, only the appropriate letters are used (i.e. IUT or E) as indicated in the table heading. The omission of an Operation type for a particular field is marked with "-" (i.e. IU-E). Also, when an entire filed is not allowed in a node the entire cell is marked as "-".

Note that not for all structured fields the individual field members are listed in the table. Detailed descriptions of the fields are provided in TS 32.299 [50].

Table 6.3.4.1 illustrates the basic structure of the supported fields in the Debit / Reserve Units Request for ProSe online charging.

Table 6.3.4.1: Supported fields in *Debit / Reserve Units Request* message

Information Element	Sevice Type	Direct Discovery	EPC_Level Discovery
	Supported Operation Types	**I/U/T/E**	**I/U/T/E**
Session Identifier		I-TE	IUT-
Originator Host		IUTE	IUT-
Originator Domain		IUTE	IUT-
Destination Domain		IUTE	IUT-
Operation Identifier		IUTE	IUT-
Operation Token		IUTE	IUT-
Operation Type		IUTE	IUT-
Operation Number		IUTE	IUT-
Destination Host		IUTE	IUT-
User Name		IUTE	IUT-
Origination State		IUTE	IUT-
Origination Timestamp		IUTE	IUT-
Subscriber Identifier		IUTE	IUT-
Termination Cause		--TE	--T-
Requested Action		IUTE	IUT-
Multiple Operation		IU-E	IU--
Multiple Unit Operation		IUTE	IUT-
Subscriber Equipment Number		IUTE	IUT-
Route Information		IUTE	IUT-
Service Information		IUTE	IUT-
Service Information with PS Information			
Subscription Id		IUTE	IUT-
Node Id		IUTE	IUT-
Node Functionality		IUTE	IUT-
Announcing UE HPLMN Identifier		IUTE	-
Announcing UE VPLMN Identifier		IUTE	-
Monitoring UE HPLMN Identifier		IUTE	-
Monitoring UE VPLMN Identifier		IUTE	-
Role of ProSe Function		IUTE	-
ProSe Application ID		IUTE	
Application ID		IUTE	IUT-
ProSe functionality		IUTE	-
ProSe Event Type		IUTE	-
Direct Discovery Model		IUTE	-
ProSe Function IP Address		IUTE	IUT-
ProSe Function ID		IUTE	IUT-
Validity Period		IUTE	-
Role of UE			IUT-
ProSe Request Timestamp		IUTE	IUT-
PC3 Control Protocol Cause		--TE	-
Monitoring UE Identifier		IUTE	IUT-
Requestor PLMN Identifier		-	IUT-
Requestor Application Layer User ID		-	IUT-
WLAN Link Layer ID		-	IUT-
Requestor EPC ProSe User ID		-	IUT-
Requested Application Layer User ID		-	IUT-
Requested PLMN Identifier		-	IUT-
Time Window		-	IU--
Range Class		-	I---
User Location Info		-	IU--
Proximity Alert Indication		-	--T-
Proximity Alert Timestamp		-	--T-
Proximity Cancellation Timestamp		-	--T-
Reason for Cancellation		-	--T-
PC3 EPC Control Protocol Cause		-	--T-
Charging characteristics		IUTE	IUT-
Charging Characteristics Selection Mode		IUTE	IUT-

Change Condition		-	-
ProSe UE ID		-	-
Source IP address		-	-
ProSe Layer-2 Group ID		-	-
ProSe Group IP multicast addresses		-	-
Direct Communication Data Container		-	-

Table 6.3.4.2 illustrates the basic structure of the supported fields in the Debit / Reserve Units Response for ProSe online charging.

Table 6.3.4.2: Supported fields in *Debit / Reserve Units Response* Message

Information Element	Sevice Type	Direct Discovery	EPC_Level Discovery
	Supported Operation Types	I/U/T/E	I/U/T/E
Session Identifier		IUTE	IUT-
Operation Result		IUTE	IUT-
Originator Host		IUTE	IUT-
Originator Domain		IUTE	IUT-
Operation Identifier		IUTE	IUT-
Operation Type		IUTE	IUT-
Operation Number		IUTE	IUT-
Operation Failover		IUTE	IUT-
Multiple Unit Operation		IUTE	IUT-
Operation Failure Action		IUTE	IUT-
Redirection Host		IUTE	IUT-
Redirection Host Usage		IUTE	IUT-
Redirection Cache Time		IUTE	IUT-
Route Information		IUTE	IUT-
Failed parameter		IUTE	IUT-
Service Information		IUTE	IUT-

6.4 Bindings for ProSe offline charging

This clause aims to describe the mapping between the Diameter Accounting AVPs, IEs and CDR parameters for ProSe offline charging.

Table 6.4.1 describes the mapping of the Diameter Accounting AVPs, IEs, and CDR parameters of PF-DD-CDR, PF-ED-CDR and PF-DC-CDR in ProSe offline charging.

Table 6.4.1: Bindings of CDR Parameters, Information Elements and AVPsCDR Parameter	Information Element	AVP
	Service Information	**Service-Information**
Served IMSI	Subscriber Identifier	Subscription-Id
	ProSe Information	**ProSe-Information**
Announcing UE HPLMN Identifier	Announcing UE HPLMN Identifier	Announcing-UE-HPLMN-Identifier
Announcing UE VPLMN Identifier	Announcing UE VPLMN Identifier	Announcing-UE-VPLMN-Identifier
Application ID	Application ID	ProSe-3rd-Party-Application-ID
Direct Communication Data Container	Direct Communication Data Container	ProSe-Direct-Communication-Data-Container
Change Time	Change Time	Change-Time
Coverage status	Coverage status	Coverage-status
Data Volume Transmitted	Data Volume Transmitted	Accounting-Output-Octets
Data Volume Received	Data Volume Received	Accounting-Input-Octets
Local Sequence Number	Local Sequence Number	Local-Sequence-Number
Service Change Condition	Change Condition	Change-Condition
Time of First Usage	Time of First Usage	Time-First-Usage
Time of Last Usage	Time of Last Usage	Time-Last-Usage
Usage information report sequence number	Usage information report sequence number	Usage-information-report-sequence-number
User Location Information	User Location Info	3GPP-User-Location-Info
VPLMN Identifier	VPLMN Identifier	Visited-PLMN-Id
Direct Discovery Model	Direct Discovery Model	ProSe-Direct-Discovery-Model
Layer2 Group ID	ProSe Layer-2 Group ID	Layer-2-Group-ID
Monitoring UE Identifier	Monitoring UE Identifier	Monitoring-UE-Identifier
Monitoring UE HPLMN Identifier	Monitoring UE HPLMN Identifier	Monitoring-UE-HPLMN-Identifier
Monitoring UE VPLMN Identifier	Monitoring UE VPLMN Identifier	Monitoring-UE-VPLMN-Identifier
Monitored PLMN Identifier	Monitored PLMN Identifier	Monitored-PLMN-Identifier
PC3 Control Protocol Cause	PC3 Control Protocol Cause	PC3-Control-Protocol-Cause
PC3 EPC Control Protocol Cause	PC3 EPC Control Protocol Cause	PC3-EPC-Control-Protocol-Cause
ProSe Application ID	ProSe Application ID	ProSe-App-Id
ProSe Event Type	ProSe Event Type	ProSe-Event-Type
ProSe Function ID	ProSe Function ID	ProSe-Function-ID
ProSe Function IP Address	ProSe Function IP Address	ProSe-Function-IP-Address
ProSe Request Timestamp	ProSe Request Timestamp	ProSe-Request-Timestamp
ProSe UE ID	ProSe UE ID	ProSe-UE-ID
Proximity Alert Indication	Proximity Alert Indication	Proximity-Alert-Indication
Proximity Alert Timestamp	Proximity Alert Timestamp	Proximity-Alert-Timestamp
Proximity Cancellation Timestamp	Proximity Cancellation Timestamp	Proximity-Cancellation-Timestamp
Proximity Request Renewal Info Block List	Proximity Request Renewal Info Block List	-
ProSe Request Timestamp	ProSe Request Timestamp	ProSe-Request-Timestamp
Range Class	Range Class	ProSe-Range-Class
Time Window	Time Window	Time-Window
UE Location	User Location Info	3GPP-User-Location-Info
Range Class	Range Class	ProSe-Range-Class
Reason for Cancellation	Reason for Cancellation	ProSe-Reason-for-Cancellation
Requested Application Layer User ID	Requested Application Layer User ID	Target-App-Layer-User-Id
Requested PLMN Identifier	Requested PLMN Identifier	Requested-PLMN-Identifier
Requestor Application Layer User ID	Requestor Application Layer User ID	Origin-App-Layer-User-Id
Requestor EPC ProSe User ID	Requestor EPC ProSe User ID	Requesting-EPUID
Requestor PLMN Identifier	Requestor PLMN Identifier	Requestor-PLMN-Identifier
Role of ProSe Function	Role of ProSe Function	Role-Of-ProSe-Function
Role of UE	Role of UE	ProSe-Role-Of-UE
Source IP address	Source IP address	ProSe-Source-IP-Address
Time Window	Time Window	Time-Window
ProSe Group IP multicast addresses	ProSe Group IP multicast addresses	ProSe-Group-IP-multicast-addresses
ProSe Function PLMN Identifier	ProSe Function PLMN Identifier	ProSe-Function-PLMN-Identifier
Record Type	Prose Functionality	Prose-Functionality
Validity Period	Validity Period	ProSe-Validity-Timer
WLAN Link Layer ID	WLAN Link Layer ID	WLAN-Link-Layer-Id
	PS Information	**PS-Information**
Cause for Record Closing	Change Condition	Change-Condition
Charging characteristics	Charging characteristics	3GPP-Charging-Characteristics

Charging Characteristics Selection Mode	Charging Characteristics Selection Mode	Charging-Characteristics-Selection-Mode
Node Id	Node Id	Node-ID
UE Location	User Location Info	3GPP-User-Location-Info

Annex A (normative): Charging Characteristics

A.1 General

Charging Characteristics can be supplied by the HSS to the HPLMN ProSe Function of a UE as part of the subscription information. The VPLMN ProSe Function or Local PLMN ProSe Function does not need the Charging Characteristics, as they only support offline charging for the UE.

Refer to TS 32.251 [11] Annex A for charging characteristic examples.

The ProSe Function applies a pre-configured default if no Charging Characteristics are supplied by the HSS. The ProSe Function shall support the following Charging Characteristics default configurations:

- the home default behaviour for subscribers of the ProSe Function's PLMN, and uses ProSe in the HPLMN;

- the roaming default behaviour for subscribers of the ProSe Function's PLMN, but uses ProSe in a different PLMN.

It is possible that different parameters are configured for different ProSe services.

Annex B (informative):
Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
2015-03	SA#67	SP-150069	01	-	Corrections to UE requirements for ProSe Direct Communication Charging	12.0.0	12.1.0
			02	1	Consistency correction to charging information for ProSe Direct Discovery		
			03	1	Adding additional ProSe Information element		
			04	1	Adding bindings for ProSe offline charging		
			05	1	Correction of triggers for ProSe PF-DC-CDR charging information addition		
			06	1	Remove editor's note for PF-ED-CDR		

History

Document history		
V12.0.0	January 2015	Publication
V12.1.0	April 2015	Publication