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Technical Report

3rd Generation Partnership Project; Technical Specification Group SA; Feasibility Study for Proximity Services (ProSe) (Release 12)



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Foreword

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

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 - z the third digit is incremented when editorial only changes have been incorporated in the document.
-

Introduction

1 Scope

The objective is to study use cases and identify potential requirements for operator network controlled discovery and communications between UEs that are in proximity, under continuous network control, and are under 3GPP network coverage, for:

1. Commercial/social use
2. Network offloading
3. Public Safety
4. Integration of current infrastructure services, to assure the consistency of the user experience including reachability and mobility aspects

Additionally, the study item will study use cases and identify potential requirements for

5. Public Safety, in case of absence of EUTRAN coverage (subject to regional regulation and operator policy, and limited to specific public-safety designated frequency bands and terminals)

Use cases and service requirements will be studied including network operator control, authentication, authorization, accounting and regulatory aspects.

The study does not apply to GERAN or UTRAN.

2 References

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

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

- [1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".
- [2] 3GPP website announcement "FCC selects LTE for USA Public Safety"
<http://www.3gpp.org/FCC-selects-LTE-for-USA-Public>
- [3] 3GPP website link to FCC announcement of selection of LTE for USA public safety "FCC TAKES ACTION TO ADVANCE NATIONWIDE BROADBAND COMMUNICATIONS FOR AMERICA'S FIRST RESPONDERS" <http://www.3gpp.org/IMG/pdf/pslstedoc-304244a1.pdf>
- [4] FCC "Third Report and Order and Fourth Further Notice of Proposed Rulemaking" pertaining to Docket Numbers: WT Docket No. 06-150, PS Docket No. 06-229 and WP Docket No. 07-100. The Report and Order was adopted on January 25, 2011 and released on January 26, 2011.
http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-11-6A1.pdf
- [5] National Public Safety Telecommunications Council, 700 MHz Statement of Requirements for Public Safety (SoR) <http://www.npstc.org/statementOfRequirements.jsp>
- [6] U. S. Department of Homeland Security Technology Solutions and Standards Statement of Requirements <http://www.safecomprogram.gov/library/lists/library/DispForm.aspx?ID=302>
- [7] TETRA Release 1: Direct Mode Operation <http://www.tetramou.com/about/page/12026>
- [8] CEPT ECC WG FM PT 49 Radio Spectrum for Public Protection and Disaster Relief (PPDR), Report from FM Project Team 49 (2nd and 3rd meetings) <http://www.cept.org/ecc/groups/ecc/wg-fm/fm-49>

3 Definitions, Symbols and Abbreviations

3.1 Definitions

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

Proximity: proximity is determined (“a UE is in proximity of another UE”) when given proximity criteria are fulfilled. Proximity criteria can be different for discovery and communication.

ProSe Discovery: a process that identifies that a UE is in proximity of another, using E-UTRA.

ProSe Communication: a communication between two UEs in proximity by means of a communication path established between the UEs. The communication path could for example be established directly between the UEs or routed via local eNB(s).

ProSe-enabled UE: a UE that supports ProSe Discovery and/or ProSe Communication. Unless explicitly stated otherwise in this TR, a UE refers to a ProSe-enabled UE.

ProSe-enabled Network: a network that supports ProSe Discovery and/or ProSe Communication. Unless explicitly stated otherwise in this TR, a network refers to a ProSe-enabled network.

Open ProSe Discovery: is ProSe Discovery without explicit permission from the UE being discovered.

Restricted ProSe Discovery: is ProSe Discovery that only takes place with explicit permission from the UE being discovered.

ProSe Group Communication: a one-to-many ProSe Communication, between two or more UEs in proximity, by means of a common communication path established between the UEs.

ProSe Broadcast Communication: a one-to-all ProSe Communication, between all authorized UEs in proximity, by means of a common communication path established between the UEs.

3.2 Symbols

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

3.3 Abbreviations

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

4 Overview

4.1 Data paths for ProSe Communications

Default data path scenario:

Currently, when two UEs in close proximity communicate with each other, their data path (user plane) goes via the operator network. The typical data path for this type of communication is shown in Figure 1, where eNB(s) and/or GW(s) are involved.

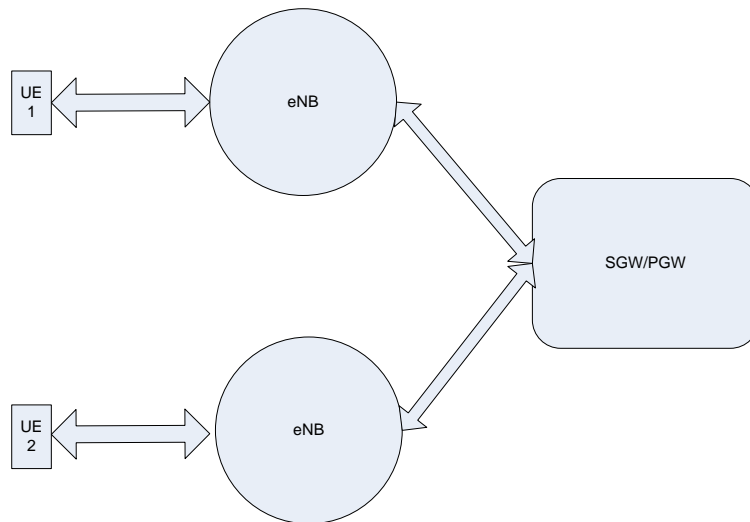


Figure 1: Default data path setup in the EPS for communication between two UEs.

ProSe Communication scenario:

If UEs are in proximity of each other, they may be able to use a local or direct path.

For example, in 3GPP LTE spectrum, the operator can move the data path (user plane) off the access and core networks onto direct links between the UEs. This direct data path is shown in Figure 2.

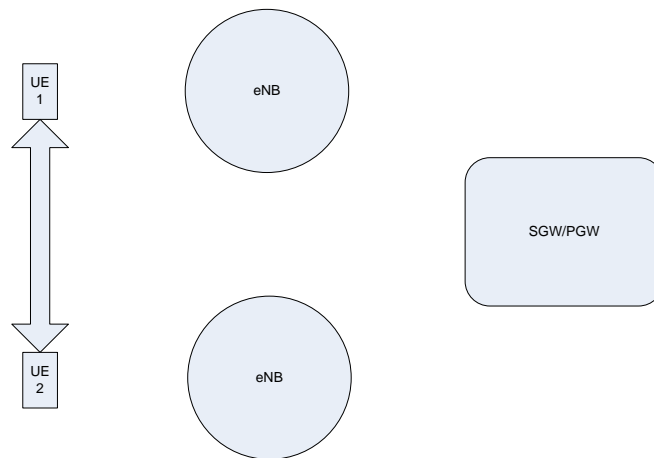


Figure 2: The "direct mode" data path in the EPS for communication between two UEs.

Note: Two eNBs are shown here for illustration.

Another example is when the data path is locally routed via the eNB(s). This locally-routed data path is shown in Figure 3:

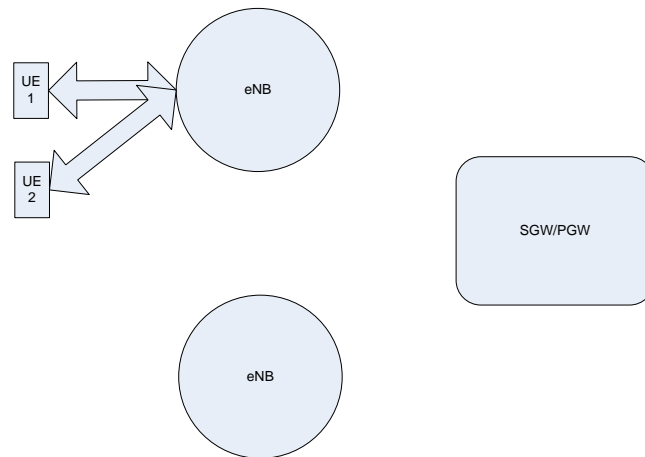


Figure 3: A “locally-routed” data path in the EPS for communication between two UEs when UEs are served by the same eNBs.

4.2 Control paths for ProSe Communication

For the ProSe Communication scenarios depicted in Figure 2 and Figure 3 in clause 4.1, several control path scenarios may apply. The following text and figures provide examples of potential control paths for different situations, understanding that other groups are responsible for defining the specific control paths associated with ProSe.

When the UEs involved in the ProSe Communication are served by the same eNB and network coverage is available, the system can decide to perform ProSe Communication using control information exchanged between the UE, eNB and the EPC (e.g., session management, authorization, security) as shown by the solid arrows in Figure 4. For charging, signalling modifications should be minimized with respect to the existing architecture. The UEs can in addition exchange direct signalling to support the ProSe Communication path as shown by the dashed arrow in Figure 4.

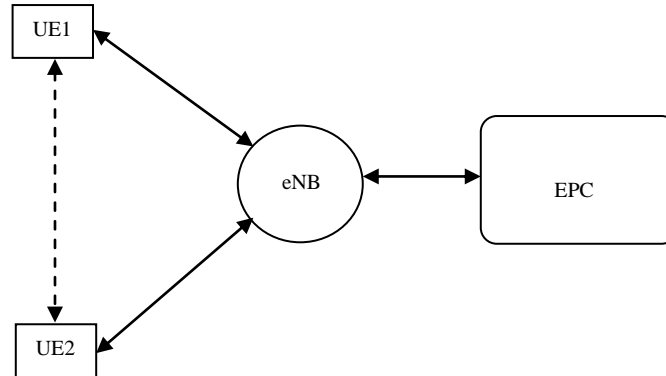


Figure 4: Example control path for network supported ProSe communication for UEs served by the same eNB.

When the UEs involved in the ProSe Communication are served by different eNBs (e.g., border cell, macro/micro cell) and network coverage is available, the system can decide to perform ProSe Communication using control information exchanged between the UE, eNB and the EPC (e.g., session management, authorization, security) as shown by the solid arrows in Figure 5. In this configuration, the eNBs may coordinate with each other through the EPC or communicate directly for radio resource management as shown by the dashed arrow in Figure 5. For charging, signalling modifications should be minimized with respect to the existing architecture. The UEs can in addition exchange direct signalling to support the ProSe Communication path as shown by the dashed arrow in Figure 5.

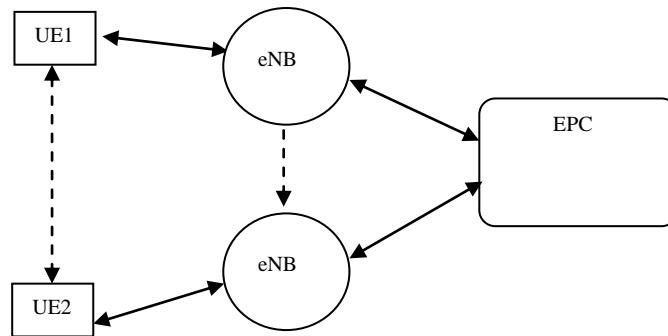


Figure 5: Example control path for network supported ProSe Communication for UEs served by different eNBs.

If network coverage is available to a subset of the UEs, one or more Public Safety UEs may relay the radio resource management control information for other UEs that do not have network coverage.

If network coverage is not available, the control path can be directly between Public Safety UEs, as shown with the solid line in Figure-6. In this configuration, the Public Safety UEs can rely on pre-configured radio resources to establish and maintain the ProSe Communication. Alternatively, a Public Safety Radio Resource Management Function, which can reside in a Public Safety UE, can manage the allocation of radio resources for Public Safety ProSe Communication as shown with the dashed lines in Figure 6.

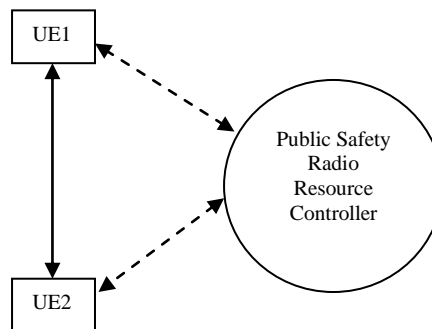


Figure 6: Example control path for Public Safety ProSe Communication for UEs without network support.

4.3 Public Safety use of ProSe

In the United States, LTE has been selected by the FCC as the technology [2][3][4] for the Public Safety Network. In Europe, there is an ongoing discussion on spectrum to be chosen for broadband Public Safety held by CEPT ECC WG FM PT 49 [8]. Additionally, a variety of public safety over ProSe requirements have been defined [5][6][7]. The requirements raise the following points for consideration in developing the ProSe requirements for public safety use.

A public safety UE can operate in the public safety spectrum for public safety service and in the MNO commercial spectrum, for general service (e.g. voice call), however, only the public safety spectrum is used for public safety ProSe.

Public safety UEs using ProSe communicate with each other even though they belong to different HPLMNs.

A public safety UE can automatically use ProSe when network coverage is not available, or the user can manually set the UE to use direct discovery and communication even when network coverage is available.

In addition, the following assumptions are made for public safety ProSe:

- All public safety users utilize ProSe-enabled UEs
- ProSe supports both UE discovery and UE Communication

If and when other regional and/or regulatory requirements are raised, they will be taken into account.

5 Use Cases and Scenarios

5.1 General Use Cases

5.1.1 Restricted ProSe Discovery Use Case

5.1.1.1 Description

This use case describes a basic scenario for ProSe Discovery that can be used for any application. A social networking application is used as an example to illustrate this use case.

5.1.1.2 Pre-Conditions

An operator offers a service which makes use of the ProSe feature, in which:

- A ProSe-enabled UE of a given user is able to discover and be discoverable by the ProSe-enabled UEs of his/her friends;
- A social networking application is enabled to use this ProSe feature.

Mary, Peter and John use a given social networking application. In the context of this application, the following relationships are established:

- Mary and John are friends.
- John and Peter are friends.
- Mary and Peter are *not* friends.
- There might be hundreds of other ProSe-enabled UEs in the vicinity of Mary using the same or other applications

In addition, the following assumptions are made:

- Mary, Peter and John use ProSe-enabled UEs;
- Mary, Peter and John are subscribed to the same cellular operator;
- Mary, Peter and John are currently residing on their HPLMN;
- Mary, Peter and John are subscribed to an operator service that allows them to use ProSe;
- Mary has given permission to John to discover her and vice versa;
- John has given permission to Peter to discover him and vice versa;

The social networking application used by Mary, Peter and John is enabled by the operator to benefit from ProSe.

5.1.1.3 Service Flows

Mary decides to look for a friend via her application, and so do John and Peter. Thus (e.g. following interaction with her application), as Mary's UE comes into proximity of John's and Peter's UEs, the user experience is such that, without any further user interaction with the device:

- Mary's UE detects (for example using direct radio signals or via the operator's network) that John's UE is in its proximity;
- John's UE detects that Mary's UE is in its proximity;
- Mary's social networking application learns that John is in or out of her proximity;
- John's social networking application learns that Mary and Peter are in or out of his proximity;
- Mary's UE does not detect that Peter's UE is in its proximity;

- Peter's UE does not detect that Mary's UE is in its proximity.
- Mary's social networking application does not detect that Peter is in or out of her proximity
- Peter's social networking application does not detect that Mary is in or out of his proximity

As the social network application of Mary detects that John is in her proximity, Mary may decide to transfer data to John via the social networking application.

ProSe Discovery is achievable without any location information.

5.1.1.4 Post-Conditions

None

5.1.1.5 Potential Requirements

General

[PR.1] Based on operator policy and user choice, the proximity of two ProSe-enabled UEs shall be determinable; for example, using direct radio signals or via the operator network.

[PR.98] The operator shall be able to dynamically control the proximity criteria for ProSe discovery. Examples of the criteria include radio range and geographic range.

[PR.2] A discovering UE shall be able to determine whether or not another UE is of interest to it. A ProSe-enabled UE is of interest to a discovering ProSe-enabled UE if its proximity needs to be known by one or more authorized applications on the discovering UE.

[PR.3] Operator policy and user choice can set the ProSe feature of:

- a ProSe-enabled UE to discover other UEs in its proximity but not be discoverable;
- a ProSe-enabled UE to be discoverable by other UEs but not be able to discover other UEs in its proximity;
- a ProSe-enabled UE to discover other UEs in its proximity and be discoverable by other UEs;
- a ProSe-enabled UE to disable the ability to be discoverable by other UEs and to disable the ability to discover other UEs;
- a ProSe-enabled UE to revoke being discoverable by a ProSe-enabled UE (i.e. be discoverable by a UE at one time, and then not discoverable by the same UE at another time);
- a ProSe-enabled UE to discover ProSe-enabled UEs of interest, where interest is defined in a ProSe-enabled application per user, group of users, or category of users;
- a ProSe-enabled UE to restrict discoverability to ProSe-enabled UEs of interest, where interest is defined in a ProSe-enabled application per user, group of users, or category of users.

[PR.97] Operator policy disabling individual ProSe features shall override any user choice.

[PR.4] ProSe Discovery shall support a minimum of three range classes – for example short, medium and maximum range.

[PR.5] The operator shall be able to authorize per subscription which range classes ProSe Discovery is allowed to use.

[PR.6] An application can request to use a certain ProSe Discovery range class.

[PR.7] The impact of ProSe Services (Discovery and Communications) on radio usage, network usage and battery consumption should be minimized.

[PR.8] Subject to user and operator settings, a ProSe-enabled UE shall be discoverable only by other UEs in proximity that are explicitly permitted by the discoverable UE.

[PR.9] ProSe shall support the simultaneous operation of a large number of applications on a UE, ensuring that the 3GPP system provides ProSe Discovery proximity information only to applications that were authorized by the 3GPP system.

[PR.10] An operator shall be able to authorize the use of ProSe Discovery information by an application.

[PR.11] A user shall be able to allow the use of ProSe Discovery information by an application.

ProSe Feature Authorization

[PR.12] The operator shall be able to turn on or off the ProSe Discovery feature in its network.

[PR.13] The operator shall be able to authorize discovery operations for each individual UE.

[PR.14] The operator shall be able to authorize the ability of a UE to be discoverable by other UEs.

[PR.15] The operator shall be able to authorize the ability of a UE to discover other UEs.

Charging

[PR.16] Both the HPLMN and VPLMN operators shall be able to charge for ProSe Discovery features including:

- the ability for a UE to be discoverable including the range class;
- the ability to discover other UEs;
- the event of discovering a UE.

5.1.2 Open ProSe Discovery Use Case

5.1.2.1 Description

This use case describes a case in which UEs discover other UEs without permission by the discoverable UEs.

5.1.2.2 Pre-Conditions

Mary uses a given application. In the context of this application, the following assumptions are made:

- Mary, Store A and Restaurants A, B and C use ProSe-enabled UEs;
- Mary and the owners of the store and restaurant UEs are subscribed to an operator service that allows them to use ProSe;
- There might be hundreds of other stores/restaurants with ProSe-enabled UEs in the vicinity of Mary;
- The operator has enabled the application to access this ProSe feature.

5.1.2.3 Service Flows

As Mary walks into the neighbourhood where Store A is located, Mary is notified of the proximity of Store A.

Mary then decides to look for a restaurant, and thus (e.g., following interaction with her application), Mary is notified of the proximity of Restaurant A. Mary is not notified of the proximity of other establishments which are not determined to be of interest according to the application she is using. After she starts walking towards Restaurant B, Mary is notified of the proximity of Restaurant B, and also of Restaurant C.

5.1.2.4 Post-Conditions

Mary's application is aware of Store A, Restaurants A, B and C.

5.1.2.5 Potential Requirements

[PR.17] Subject to user and operator settings, a ProSe-enabled UE shall be discoverable by all other ProSe-enabled UEs in proximity without explicit permission. The UEs can be

- served by the same PLMN, including when roaming,
- served by different PLMNs, including when roaming.

5.1.3 Discovery Use Case with Subscribers from Different PLMNs

5.1.3.1 Description

This use case describes discovery between UEs camped on different PLMNs.

5.1.3.2 Pre-Conditions

The same pre-conditions as in clause 5.1.1 apply except that

- Mary is a subscriber to operator A and camps on operator A's network;
- John is a subscriber to operator B and camps on operator B's network;

5.1.3.3 Service Flows

As John moves towards Mary, the user experience is such that, without any further user interaction with the UE:

- Mary is notified that John is in her proximity;
- John is notified that Mary is in his proximity.

5.1.3.4 Post-Conditions

John and Mary are aware of their proximity.

5.1.3.5 Potential Requirements

[PR.18] Based on operator policy and user choice, the proximity of two ProSe-enabled UEs camped on different PLMNs shall be determinable.

[PR.19] The operator shall be able to authorize the ability of a UE to discover UEs camping on other PLMNs.

[PR.20] The operator shall be able to charge for the ability to discover UEs camping on other PLMNs.

5.1.4 Discovery Use Case with Roaming Subscribers

5.1.4.1 Description

This use case describes discovery between UEs in different PLMNs under roaming conditions.

5.1.4.2 Pre-Conditions

The same pre-conditions as in clause 5.1.1 apply except that

- Mary is a subscriber to operator A and camps on operator A's network (i.e. her HPLMN);
- John is a subscriber to operator C in a different country and currently roams in operator B's network, which is located in the same country as operator A's network.

5.1.4.3 Service Flows

As John moves towards Mary, the user experience is such that, without any further user interaction with the UE:

- Mary is notified that John is in her proximity;
- John is notified that Mary is in his proximity.

5.1.4.4 Post-Conditions

John and Mary are aware of their proximity.

5.1.4.5 Potential Requirements

[PR.21] All requirements for ProSe Discovery also apply when one or both of the UEs involved in ProSe Discovery are roaming.

[PR.22] The VPLMN operator shall be able to turn on or off the ability for all the inbound roamers from a specific PLMN to be discovered using ProSe Discovery.

[PR.23] The HPLMN operator shall be able to authorize the ability of a UE to discover other UEs in case of roaming in a VPLMN.

[PR.24] The HPLMN operator shall be able to authorize the ability of a UE to be discoverable by other UEs in case of roaming in a VPLMN.

[PR.25] Both the HPLMN and VPLMN operators shall be able to charge for discovery features including :

- The ability to be discoverable;
- The ability to discover;
- The event of discovering a UE.

5.1.5 Network ProSe Discovery Use Case

5.1.5.1 Description

In this use case, the 3GPP network provides ProSe Discovery for ProSe-enabled UEs.

5.1.5.2 Pre-Conditions

- Mary and Peter use ProSe-enabled UEs, subscribe to the same MNO, and currently reside on the HPLMN.
- The MNO network supports ProSe Discovery and Communication.

5.1.5.3 Service Flow

- Mary uses an application on her UE to connect with Peter, causing her UE to request ProSe Discovery from the MNO network.
- The MNO network verifies that Mary's UE has permission to discover Peter's UE and is in proximity of Peter's UE.
- The network informs Mary's and Peter's UEs that they are in proximity.

5.1.5.4 Post-Conditions

Mary's and Peter's UEs have discovered each other.

5.1.5.5 Potential Requirements

[PR.26] An application on a ProSe-enabled UE shall be able to request the network to determine the proximity of another ProSe-enabled UE; the network shall be able to determine proximity of two ProSe-enabled UEs and inform them of their proximity.

[PR.91] The operator shall be able to charge for network ProSe Discovery.

5.1.6 Service Continuity between Infrastructure and E-UTRA ProSe Communication paths

5.1.6.1 Description

5.1.6.2 Pre-Conditions

An operator offers a service which makes use of the ProSe feature, in which :

- The operator is able to establish a new user traffic session using E-UTRA ProSe communication;
- The operator is able to switch user traffic from an infrastructure communication path to an E-UTRA ProSe communication path.

In addition to that, the following assumptions are made:

- Mary and Peter use ProSe-enabled UEs;
- Mary and Peter are subscribed to the same cellular operator;
- Mary and Peter are currently residing on their HPLMN;
- Mary and Peter are subscribed to an operator service that allows them to use ProSe;
- Mary and Peter have performed ProSe discovery and initiation of ProSe communications.

5.1.6.3 Service Flows

Mary and Peter are engaged in a data session (including one or more flows) that is being routed over the MNO's core network infrastructure.

As Peter moves within proximity of Mary, one or more flows of the data session is switched to an E-UTRA ProSe communication path.

At some point later, the data session is switched back to the infrastructure path.

The user experience is such that the switching of the data path is not perceived by the users.

The user experience of the ongoing user traffic sessions is such that any un-switched data flows are not negatively impacted by the switching of other data flows.

5.1.6.4 Post-Conditions

None

5.1.6.5 Potential Requirements

[PR.99] The operator shall be able to dynamically control the proximity criteria for ProSe communication. Examples of the criteria include: radio range, communication range, channel conditions, achievable QoS.

[PR.27] The system shall be capable of establishing a new user traffic session with an E-UTRA ProSe Communication path, and maintaining both of the E-UTRA ProSe Communication path and the infrastructure path simultaneously, when the UEs are determined to be in range allowing ProSe Communication. The UEs can be:

- served by the same PLMN, including when roaming;
- served by different PLMNs, including when roaming.

Note 1: ProSe Communication between UEs served by different PLMNs can be subject to the availability of suitable radio resources (e.g., shared RAN in a MOCN/GWCN environment).

Note 2: ProSe specifications should take into account the relative speed of ProSe-enabled UEs.

[PR.28] The system shall be capable of moving a user traffic session from the infrastructure path to an E-UTRA ProSe Communication path, when the ProSe-enabled UEs are determined to be in range allowing ProSe Communication.

[PR.29] The system shall be capable of monitoring the communication characteristics (e.g. channel condition, QoS of the path, volume of the traffic etc.) on the E-UTRA ProSe communication path, regardless of whether there is data transferred via infrastructure path.

[PR.30] The system shall be capable of moving a user traffic session from an E-UTRA ProSe communication path to an infrastructure path. At a minimum, this functionality shall support the case when the E-UTRA ProSe Communication path is no longer feasible.

[PR.31] The user shall not perceive the switching of user traffic sessions between the E-UTRA ProSe Communication and infrastructure paths when triggered by the network.

[PR.32] The system shall be capable of switching each flow it is aware of between the E-UTRA ProSe Communication and the infrastructure paths, independently.

[PR.33] The establishment of a user traffic session on the E-UTRA ProSe Communication path and the switching of user traffic between an E-UTRA ProSe Communication path and an infrastructure path are under control of the network.

[PR.92] The HPLMN operator shall be able to authorize the ability of a UE to use ProSe Communication, separately for the HPLMN and for roaming in VPLMNs.

[PR.93] The HPLMN operator shall be able to authorize the ability of a UE to use ProSe Communication to communicate with a ProSe-enabled UE served by a different PLMN.

[PR.94] The VPLMN operator shall be able to turn on or off the ability for all the inbound roamers from a specific PLMN to use ProSe Communication.

[PR.34] The Radio Access Network shall control the radio resources associated with the E-UTRA ProSe Communication path.

[PR.35] The ProSe mechanism shall allow the operator to change the communication path of a user traffic session without negatively affecting the QoS of the session.

[PR.36] The ProSe mechanism shall allow the operator to change the communication path of one user traffic session of a UE without negatively affecting the communication paths of other ongoing user traffic sessions of this UE or of other UEs.

[PR.37] The ProSe mechanism shall allow the operator to change the communication path of a user traffic session according to decisions based upon the QoS requirements of the session and the QoS requirements of other ongoing sessions of this UE or of other UEs.

[PR.38] The system shall be capable of selecting the most appropriate communications path, according to operator preferences. The criteria for evaluation may include the following, although not restricted to:

- System-specific conditions: backhaul link, supporting links or core node (EPC) performance;
- Cell-specific conditions: cell loading;
- ProSe Communication and infrastructure path conditions: communication range, channel conditions and achievable QoS;
- Service-type conditions: APN, service discriminator.

[PR.95] Both the HPLMN and VPLMN operators shall be able to charge for ProSe Communication.

5.1.7 Operator A uses ProSe to Enhance Location and Presence Services

5.1.7.1 Description

ProSe is providing relatively limited enhancements to the presence and location information already present in 3GPP networks and by itself is able to detect a strict subset of the information available in the operator network.

5.1.7.2 Pre-Conditions

Carmen is using a UE that enhances its location information by means of ProSe and she is able to access all the services activated in her network profile (Presence, RCS etc.)

Carmen enters a meeting room and so she sets her status to "In a meeting" in her presence client.

5.1.7.3 Service Flows

During the discussion, Carmen realizes that she needs expert support and so she checks her presence client to see if one of her colleagues is close to the meeting room and is currently in "Free" status. The location information, integrated with information provided by ProSe about UEs in proximity, shows 10 colleagues in the area, three of them in close proximity and one of them she knows is an expert on the subject.

She starts an RCS chat with him to ask for direct support at the meeting.

Carmen and her colleague haven't perceived anything unusual in their services activities and the use of ProSe was transparent to the different activated services in their user profiles. The effect of ProSe is that it integrates user location information with location information available by other means.

5.1.7.4 Post-Conditions

None

5.1.7.5 Potential Requirements

[PR.39] ProSe proximity information shall be integrated with the Location and Presence information used by the network to offer its services.

[PR.40] The location and presence services should be capable of indicating proximity information to their service clients.

[PR.41] The proximity information should be displayed by the UE to the user via a Location and Presence Client.

[PR.42] The availability or unavailability of ProSe proximity information shall not disrupt the user experience while using the different location and presence services.

5.1.8 ProSe for Large Numbers of UEs

5.1.8.1 Description

This use case describes a scenario involving a large number of UEs, and proposes ProSe requirements for such dense environments.

5.1.8.2 Pre-Conditions

- Smart parking meters are ProSe-enabled UEs;
- John's car has a UE which is ProSe-enabled.

5.1.8.3 Service Flows

- John is going to the football stadium to attend a game. As he drives around the stadium parking lot, parking meters in unoccupied parking spaces broadcast their presence.
- John's car's UE receives these broadcasts and the car's parking application which uses ProSe, displays the results
- John chooses a spot, and the parking application responds by assisting him to locate the spot, and pay for parking once he enters it. The parking application may make use of additional info (e.g., map, payment credentials, etc.) obtained by means other than ProSe.
- There may be hundreds or thousands of other users with ProSe-enabled UEs running parking applications and other applications making use of ProSe concurrently.

5.1.8.4 Post-Conditions

John and the Stadium Management experienced convenience and improved efficiency through proximity based services in the presence of many other ProSe enabled UEs.

5.1.8.5 Potential Requirements

[PR.43] ProSe Discovery and Communication shall take into account the potentially large numbers of concurrently participating ProSe-enabled UEs.

5.1.9 ProSe-assisted WLAN Direct Communications Use Case

5.1.9.1 Description

This use case describes how WLAN direct communication can be used between ProSe-enabled UEs.

5.1.9.2 Pre-Conditions

- Bob and John are subscribers to a mobile data service from an MNO;
- Bob and John both carry UEs that have WLAN capabilities;
- Both UEs are enabled for ProSe Discovery and Communication;
- Bob and John use ProSe-enabled applications on their UEs;
- The 3GPP network has the capability to provide WLAN configuration information to ProSe-enabled UEs;
- Bob has clicked the ProSe-enabled UE to send an HD video to John.

5.1.9.3 Service Flows

- The 3GPP EPC determines proximity of Bob's and John's UEs and provides them with WLAN configuration information to assist with WLAN direct connection establishment.
- Bob's and John's UEs use the configuration information to verify feasibility of the WLAN direct connection and establish ProSe-assisted WLAN direct communications.
- The ProSe-enabled application on Bob's UE streams the HD video to the ProSe-enabled application on John's UE using the established WLAN connection.

5.1.9.4 Post-Conditions

John has received Bob's HD video via the ProSe-enabled application on his UE.

5.1.9.5 Potential Requirements

[PR.44] Subject to operator policy and user consent, a ProSe-enabled UE with WLAN capability shall be able to establish ProSe-assisted WLAN direct communications with another ProSe-enabled UE when in WiFi Direct communications range, based on ProSe Discovery and WLAN configuration information from the 3GPP EPC.

[PR.45] The 3GPP EPC shall be able to provide configuration information to ProSe-enabled UEs for the purpose of establishing ProSe-assisted WLAN direct communications.

[PR.100] The EPC shall be able to provide configuration information that enables confidentiality and integrity on the ProSe-assisted WLAN direct communications link.

[PR.101] The HPLMN operator shall be able to authorize ProSe-assisted WLAN direct communications for a ProSe-enabled UE, separately for use in the HPLMN and when roaming in VPLMNs.

[PR.102] The HPLMN operator shall be able to authorize a ProSe-enabled UE to engage in ProSe-assisted WLAN direct communications with a ProSe-enabled UE being served by a different PLMN.

[PR.103] The VPLMN operator shall be able to turn on or off ProSe-assisted WLAN direct communications for inbound roamers.

[PR.104] Both the HPLMN and VPLMN operators shall be able to charge for ProSe-assisted WLAN direct communications.

5.1.10 Service Management and Continuity for ProSe-assisted WLAN Direct Communications

5.1.10.1 Description

This use case demonstrates service management and continuity for ProSe Communication via WLAN.

5.1.10.2 Pre-Conditions

- Bob and John are subscribers to a mobile data service from an MNO.
- Bob and John carry UEs that have WLAN capabilities.

- Both UEs are enabled for ProSe Discovery and Communication.
- The 3GPP System is capable of switching an infrastructure communication path to a WLAN ProSe communication path and back again.

5.1.10.3 Service Flows

- Bob and John are engaged in a data session (including one or more flows) that is being routed over the MNO's core network infrastructure.
- When Bob and John move within WLAN communication range, the 3GPP System switches their data session to the WLAN ProSe communication path.
- Later, when Bob and/or John move out of WLAN communication range, the 3GPP System switches their data session back to the MNO's infrastructure path.

5.1.10.4 Post-Conditions

None.

5.1.10.5 Potential Requirements

[PR.47] Subject to operator policy and user consent the EPC and a ProSe-enabled UE shall be capable of negotiating the move of a traffic flow between the infrastructure path and the ProSe-assisted WLAN direct path.

[PR.48] There shall be no RAN impact due to the service continuity between the infrastructure communication path and WLAN direct path.

[PR.105] The infrastructure network shall be able to determine whether two ProSe-enabled UEs are within WLAN direct communications range and whether the WLAN direct link can provide the necessary QoS to support the end user application.

[PR.106] The infrastructure network shall ensure service continuity for ProSe-assisted WLAN direct communications flows and be capable of considering QoS requirements of all data flows when negotiating a communications path switch for a given end user application.

[PR.107] The system shall be capable of establishing a new user traffic session for a ProSe-assisted WLAN direct communications path.

5.1.11 Use Case for ProSe Application Provided by the Third-Party Application Developer

5.1.11.1 Description

The operator may provide ProSe capability features in a series of APIs to third-party application developers for application development. Benefiting from the cooperation between the operator and third-party application developers, the user can download and use a rich variety of new ProSe applications created by third-party application developers.

If the third-party application developer wants to use ProSe capability features to develop a new application, the third-party application developer may need to sign a contract with the operator at first. The contract may include a third-party application developer ID, the application ID and so on.

The operator will store the contracted information of this third-party application developer in their network. The third-party application developer develops new ProSe applications using the ProSe APIs.

Users receive the ProSe applications created by the third-party application developers from various application distribution channels, e.g. an Operator application distributor or App Store.

When the user activates the application, the application will request access to ProSe capability features. At operator defined intervals, the operator's network interacts with the ProSe-enabled UE to identify, authenticate, authorize, charge and enable ProSe capability features.

In order to reduce the interaction frequency between the operator's network and the ProSe-enabled UE, the frequency of this interaction should be considered and may be per operator-configuration of the UE.

5.1.11.2 Pre-Conditions

- ProSe capability features are provided in a consistent series of APIs.
- Third-party application developer B signs a contract with Operator A for using the ProSe APIs.
- Third-party application developer B develops a ProSe application X based on these ProSe APIs.
- Third-party application developer C doesn't sign a contract with Operator A for using the ProSe APIs.
- Third-party application developer C develops a ProSe application Y based on these ProSe APIs.
- Alice is a subscriber of Operator A.
- Alice downloads and installs the ProSe application X and ProSe application Y on her ProSe-enabled UE.

5.1.11.3 Service Flows

- Alice runs the ProSe application X on her ProSe-enabled UE.
- ProSe application X requests the ProSe-enabled UE to use ProSe capability features by ProSe APIs.
- Operator A's network interacts with Alice's ProSe-enabled UE to authenticate and authorize the ProSe application X.
- The ProSe application X is authorized to use ProSe capability features.
- Alice runs the ProSe application Y on her ProSe-enabled UE.
- ProSe application Y requests the ProSe-enabled UE to use ProSe capability features by ProSe APIs.
- Operator A's network interacts with Alice's ProSe-enabled UE to identify, authenticate and authorize the ProSe application Y.
- The ProSe application Y is rejected to use ProSe capability features.

5.1.11.4 Post-Conditions

- Alice enjoys the ProSe capability feature enhancements on Application X.
- Charging data are generated and collected for ProSe capability feature access of application X.
- Charging data are generated and collected for the rejected attempt to use ProSe capability feature by application Y.

5.1.11.5 Potential Requirements

[PR.49] The operator's network and the ProSe-enabled UE shall provide a mechanism to identify, authenticate and authorize the third-party application to use ProSe capability features.

[PR.89] The operator's network shall authorize the third-party application to set the ability of a UE to discover.

[PR.90] The operator's network shall authorize the third-party application to set the ability of a UE to be discovered.

[PR.50] The operator's network shall be able to store information of third-party application developers, such as the third-party application developer ID, the application ID and so on.

[PR.88] The HPLMN operator shall be able to charge for use of ProSe Discovery and Communication by an application.

[PR.52] The minimum ProSe capability features may include the following:

- Announce – a service method by which an application is able to announce UEs within proximity.
- Monitor – a service method that shall enable an application to monitor for UEs within proximity.
- Communicate – a service method that shall enable an application to communicate with UEs within proximity.

5.1.12 Concurrent E-UTRAN Infrastructure and WLAN Proximity Communication

5.1.12.1 Description

This use case describes how E-UTRAN infrastructure communication and WLAN ProSe communication can be concurrently used between ProSe enabled UEs.

5.1.12.2 Pre-conditions

- Mary, Bob and John are subscribers to mobile data service from an MNO.
- Mary, Bob and John carry UEs that have WLAN capabilities.
- Three UEs are within proximity and enabled for ProSe Discovery and Communication. Bob and John are within the WLAN range and have entered a preference to use WLAN ProSe communication.

5.1.12.3 Service Flow

- Mary chats with John after Mary's and John's UEs establish an E-UTRAN infrastructure communication.
- Bob's UE looks for John's UE, triggering Bob's UE to discover John's UE using ProSe Discovery.
- Bob's UE streams the HD video to John's UE after establishing WLAN ProSe communication, while Mary continues to chat with John using their existing E-UTRAN infrastructure communication.

5.1.12.4 Post-conditions

- Mary continues to chat with John.
- John has received Bob's HD video.

5.1.12.5 Potential Requirements

[PR.108] Subject to operator policy and user consent the EPS shall be capable of maintaining existing E-UTRAN infrastructure communications while ProSe WLAN communication is established by a given ProSe-enabled UE.

[PR.109] Subject to operator policy and user consent the EPS shall be capable of establishing new E-UTRAN infrastructure communications while ProSe WLAN communication is on-going for a given ProSe-enabled UE.

5.1.13 Network Offloading via WLAN ProSe Communication

5.1.13.1 Description

This use case describes network data offloading via WLAN ProSe Communication.

5.1.13.2 Pre-conditions

Bob and John are subscribers to a mobile data service from an MNO.

Bob and John carry UEs that have WLAN capabilities.

Both UEs are enabled for ProSe Discovery and Communication.

5.1.13.3 Service Flow

Bob and John are engaged in a data session (including one or more flows) that is being routed over the MNO's core network, which is currently congested.

Due to the congestion, the 3GPP EPC checks if any data sessions can be offloaded and finds that Bob's and John's data session can be offloaded to a WLAN direct connection.

The 3GPP EPC sends them a request to connect directly via WLAN.

Bob's and John's UEs determine whether they are willing to connect directly via WLAN. After Bob's and John's UEs respond to the 3GPP EPC positively, the 3GPP EPC moves their data session from the infrastructure path to their WLAN direct path in order to reduce the system congestion.

Later, when the MNO's network congestion subsides, the 3GPP EPC shall be able to request to switch Bob's and John's data session back to the MNO's infrastructure path.

5.1.13.4 Post-conditions

MNO's network congestion is reduced.

5.1.13.5 Potential Requirements

[PR.110] The EPC shall be able to request the UE to perform a path switch between the infrastructure path and WLAN direct path for some or all of UE's sessions based on load in 3GPP networks.

5.2 Public Safety Use Cases

5.2.1 General

It is noted that the following use cases and requirements are specific needs that are applicable for public safety in addition to those general use cases and requirements in the preceding clause.

5.2.2 ProSe Discovery Within Network Coverage

5.2.2.1 Description

This use case describes the scenario where a given UE discovers one or more other UEs while in network coverage, with ProSe Discovery always enabled.

5.2.2.2 Pre-Conditions

An operator offers a service which makes use of the ProSe feature.

Officer A, Officer B, and Officer C use ProSe-enabled public safety UEs, and are all within network coverage.

Officer A, Officer B, and Officer C have configured ProSe Discovery on their UE's such that they can discover other UEs and be discovered by other UEs.

Officer A is not in proximity to Officer B and Officer C, who are both within proximity of each other.

Officer B's UE and Officer C's UE have discovered each other.

5.2.2.3 Service Flows

Officer A moves into proximity of Officer B and Officer C.

Officer A's UE discovers Officer B's UE and Officer C's UE upon entering proximity.

Officer B's UE and Officer C's UE discover Officer A's UE upon entering proximity.

5.2.2.4 Post-Conditions

None.

5.2.2.5 Potential Requirements

[PR.53] A ProSe-enabled public safety UE with ProSe Discovery enabled and configured to discover other public safety UEs shall be able to discover other discoverable public safety UEs, under network coverage.

Note: A network operator can provide additional services for public safety UEs that are under network coverage, such as providing accurate location information through GPS data.

[PR.54] A user of a ProSe-enabled public safety UE shall be able to activate or deactivate the UE's ProSe Discovery feature while under network coverage, if allowed by the operator.

5.2.3 ProSe Discovery Out of Network Coverage

5.2.3.1 Description

This use case describes the scenario where a given UE discovers one or more other UEs while out of network coverage, with ProSe Discovery always enabled.

5.2.3.2 Pre-Conditions

An operator offers a service, which makes use of the ProSe feature.

Officer A, Officer B, and Officer C use ProSe-enabled public safety UEs, and Officer A is in network coverage while Officers B and C are out of network coverage.

Officer A, Officer B, and Officer C have activated ProSe Discovery on their UEs such that they can discover other UEs and be discovered by other UEs.

Officer A is not in proximity to Officers B and C, who are both within proximity of each other.

Officer B's UE and Officer C's UE have discovered each other.

5.2.3.3 Service Flows

Officer A moves into proximity of Officers B and C.

Officer A's UE discovers Officer B's UE and Officer C's UE upon entering proximity.

Officer B's UE and Officer C's UE discover Officer A's UE upon entering proximity.

5.2.3.4 Post-Conditions

None.

5.2.3.5 Potential Requirements

[PR.55] A ProSe-enabled public safety UE with ProSe Discovery enabled shall be able to discover other discoverable public safety UEs when some or all of the UEs involved in ProSe Discovery are out of network coverage.

[PR.56] A user of a ProSe-enabled public safety UE shall be able to activate or deactivate the UE's ProSe Discovery feature when out of network coverage.

5.2.4 Can Discover But Not Discoverable

5.2.4.1 Description

This use case describes the scenario where a given UE is able to discover other UEs, but is not discoverable by other UEs.

5.2.4.2 Pre-Conditions

An operator offers a service, which makes use of the ProSe feature.

Officer A, Officer B, and Officer C use ProSe-enabled public safety UEs, and some or all of them are out of network coverage.

Officer A and B have configured ProSe Discovery on their UEs such that they can discover other UEs and be discovered by other UEs.

Officer C has enabled ProSe Discovery on his/her UE that is configured such that it can discover other UEs but cannot be discovered by other UEs.

Officer A, Officer B, and Officer C are all within proximity of each other.

5.2.4.3 Service Flows

Officer A's UE discovers Officer B's UE.

Officer B's UE discovers Officer A's UE.

Officer C's UE discovers Officer A's UE and Officer B's UE.

Officer A's UE and Officer B's UE do not discover Officer C's UE.

5.2.4.4 Post-Conditions

None.

5.2.4.5 Potential Requirements

[PR.57] The configuration of a ProSe-enabled public safety UE that allows the UE to discover other discoverable public safety UEs shall be independent from its configuration to allow or not to allow other ProSe-enabled public safety UEs to discover it.

5.2.5 Basic ProSe One-to-One Direct User Traffic Initiation in Public Safety Spectrum Dedicated to ProSe

5.2.5.1 Description

This use case describes the case where a given public safety UE initiates one-to-one direct user traffic session with another UE.

5.2.5.2 Pre-Conditions

An operator offers a service, which makes use of the ProSe feature.

Officer A and Officer B use ProSe-enabled public safety UEs.

Officer A and Officer B are subscribed to a Public Safety service that allows them to use ProSe.

5.2.5.3 Service Flows

The two public safety UEs discover each other via ProSe Discovery.

Officer A wants to communicate with Officer B, or vice versa. Officer A's UE and Officer B's public safety UE are able to initiate a direct connection and exchange user traffic over the air using the public safety spectrum.

5.2.5.4 Post-Conditions

Officer A communicates with Officer B using one-to-one direct communication.

5.2.5.5 Potential Requirements

[PR.58] Two public safety UEs shall be capable of establishing a secure direct connection and exchange user traffic on public safety spectrum dedicated to ProSe services, assuming they are in radio range, are authenticated and authorized.

[PR.59] The operator shall be able to authorize public safety UEs to establish data sessions between them using ProSe via network control when there is network coverage for at least one of the two public safety UEs. An operator shall be able to configure a Public Safety UE (e.g., in the USIM or ME) with the permission to establish data session between one or more UEs without prior registration into the network.

[PR.117] The system shall enable public safety UEs to mutually authenticate each other without network coverage.

5.2.6 UE with Multiple One-to-One Direct User Traffic Sessions in Public Safety Spectrum Dedicated to ProSe

5.2.6.1 Description

This use case describes the case where a given UE can maintain one-to-one user traffic sessions with several other UEs concurrently.

5.2.6.2 Pre-Conditions

The preconditions are as in clause 5.2.5 with the additions below:

Officer C uses a ProSe-enabled public safety UE;

Officer C is subscribed to a Public Safety service that allows him/her to use ProSe.

5.2.6.3 Service Flows

The three UEs discover each other via ProSe Discovery.

Officer A wants to communicate with Officer B and Officer C concurrently.

While Officer A's UE and Officer B's UE exchange user traffic via a direct connection, Officer A's UE and Officer C's UE are able to initiate an additional ProSe direct connection and exchange user traffic over the air using the public safety spectrum.

5.2.6.4 Post-Conditions

Officer A communicates with Officer B and Officer C concurrently.

5.2.6.5 Potential Requirements

[PR.60] A public safety UE shall be capable of establishing one-to-one ProSe direct connection and exchange user traffic with multiple UEs concurrently, on public safety spectrum dedicated to ProSe services, assuming they are in radio range, are authenticated and authorized.

5.2.7 ProSe Group

5.2.7.1 Description

This use case describes the scenario where a user wants to communicate the same information concurrently to two or more other users using ProSe Group Communications. The UEs of all users in the scenario belong to a common communications group.

5.2.7.2 Pre-Conditions

An operator offers a service, which makes use of the ProSe feature.

Officer A, Officer B, and Officer C use ProSe-enabled public safety UEs.

Officer A, B, and C's UEs are configured to belong to communications group X.

Officer C has disabled ProSe Discovery on his/her UE.

Officer A, Officer B, and Officer C are subscribed to a Public Safety service that allows them to use ProSe.

Officer A's UE has discovered Officer B's UE via ProSe Discovery.

Officer A's UE has not discovered Officer C's UE via ProSe.

5.2.7.3 Service Flows

Officer A's UE transmits data using ProSe Group Communications to Officer B and Officer C's UEs concurrently.

5.2.7.4 Post-Conditions

None.

5.2.7.5 Potential Requirements

[PR.61] A Public Safety UE shall be capable of transmitting data to a group of Public Safety UEs using ProSe Group Communications with a single transmission, assuming they are within transmission range, authenticated and authorized.

[PR.118] Authentication shall allow for security-enablement of large groups, regardless of whether group members have discovered each other.

[PR.62] A Public Safety UE shall be capable of transmitting data to a group of Public Safety UEs directly using ProSe Group Communications.

[PR.63] A Public Safety UE shall be capable of receiving a ProSe Group Communications transmission, of which it is a group member, regardless of whether or not it has been discovered by the transmitting UE.

Group management is outside the scope of ProSe.

5.2.8 ProSe Broadcast

5.2.8.1 Description

This use case describes the scenario where a given UE initiates a ProSe Broadcast Communication transmission to all UEs within transmission range.

5.2.8.2 Pre-Conditions

An operator offers a service, which makes use of the ProSe feature.

Fire-fighters A-D, E-H and an incident commander use ProSe-enabled public safety UEs.

Fire-fighters A-D, E-H and an incident commander are subscribed to a Public Safety service that allows them to use ProSe.

Fire-fighters A-D's UEs are configured to belong to communications group X.

Fire-fighters E-H's UEs are also configured to belong to communications group Y, which is separate from fire-fighters A-D.

The incident commander's UE is configured to belong to communication group X and communication group Y.

5.2.8.3 Service flows

After arriving at the scene of a fire, fire-fighters A-D's UEs discover each other and communicate among themselves in communications group X using ProSe Group Communications.

Later, fire-fighters E-H also arrive on the fire scene and communicate among themselves in communications group Y using ProSe Group Communications.

At some point, the incident commander wants to provide the same information concurrently to all of the fire-fighters at the scene of the incident within transmission range.

The incident commander's UE transmits a ProSe Broadcast Communications message to all of the fire-fighters' UEs. A single transmission is received by all of the fire-fighters' UEs rather than individual transmissions being sent to each of the fire-fighters.

5.2.8.4 Post-Conditions

None.

5.2.8.5 Potential Requirements

[PR.64] An authorized public safety UE shall be capable of sending a broadcast message to all authorized public safety UEs within transmission range, regardless of group membership, using ProSe Broadcast Communications in a single transmission.

5.2.9 ProSe Relay

5.2.9.1 Description

This use case describes the scenario where a given UE acts as a communication relay for one or more UEs.

5.2.9.2 Pre-Conditions

An operator offers a service, which makes use of the ProSe feature.

Officer A, Officer B, and Officer C use ProSe-enabled public safety UEs.

Officer B's UE has a relay capability allowing it to receive and re-transmit ProSe Communications.

Officer A, Officer B, and Officer C are subscribed to a Public Safety service that allows them to use ProSe.

Officer A's UE, Officer B's UE, and Officer C's UE have each been configured to belong to communications group X.

Officer A's UE is within transmission range of Officer B's UE, and Officer B's UE is within transmission range of Officer C's UE, but Officer C's UE is not within transmission range of Officer A's UE.

5.2.9.3 Service Flows

Officer A wants to communicate with Officer B and Officer C in communications group X via ProSe Group Communications.

Officer B enables his/her UE to act as a relay for ProSe Group Communications.

Officer A's UE transmits a message to Officer B's UE using ProSe Group Communications.

Officer B's UE relays (receives and then re-transmits) the communication from Officer A's UE to Officer C's UE, all using ProSe Group Communications.

Officer B continues to act as a ProSe Group Communications relay until Officer C is back within transmission range of Officer A and Officer B.

5.2.9.4 Post-Conditions

None.

5.2.9.5 Potential Requirements

[PR.65] An authorized public safety UE may be capable of acting as a relay for other public safety UEs.

[PR.66] An authorized public safety UE shall be capable of being enabled/disabled by a user or system to act as a relay for other public safety UEs.

[PR.67] The user of a ProSe-enabled public safety UE acting as a relay should not perceive service degradation due to the relay.

5.2.10 ProSe Hybrid and Range Extension

5.2.10.1 Description

This use case describes the scenario where a given UE communicates using the network infrastructure and using ProSe Communications concurrently. This use case also describes the scenario where a given UE acts as a communication relay for one or more UEs so that the latter UE(s) can get communication towards the network.

5.2.10.2 Pre-Conditions

An operator offers a service, which makes use of the ProSe feature.

Officer A, Officer B, and Officer C use ProSe-enabled public safety UEs.

Officer A's UE has a relay capability allowing it to receive and re-transmit ProSe and network communications.

Officer A, Officer B, and Officer C are subscribed to a Public Safety service that allows them to use ProSe.

Officer A's UE, Officer B's UE, and Officer C's UE have each been configured to belong to communications group X.

Officer A and B are within network coverage and not in ProSe Group Communications range of each other, while Officer C is out of network coverage but within ProSe Group Communications transmission range of Officer A.

5.2.10.3 Service Flows

Officer A communicates information to Officer B and C in communications group X.

When Officer A transmits, Officer A's and Officer C's UEs exchange data using ProSe Group Communications, while Officer A's and Officer B's UEs exchange data using group communications via the network.

Officer C wants to communicate with Officer B, who can be reached via the network, in communications group X via ProSe Group Communications.

Officer A enables his/her UE to act as a relay for ProSe Communications and Network Communication.

Officer A's UE relays (receives and then re-transmits) the communication between Officer B's UE and Officer C's UE.

Officer A is able to continue to act as the relay until Officer B is back within transmission range of Officer A and Officer C.

5.2.10.4 Post-Conditions

None.

5.2.10.5 Potential Requirements

[PR.68] An authorized public safety UE shall be capable of communication using the network infrastructure and off network ProSe concurrently.

[PR.69] An authorized public safety UE shall be capable of being enabled/disabled to act as a relay to/from the network for other public safety UEs unable to access the network.

[PR.70] Based on operator policy and user choice, service continuity should be provided so that the system shall be able to initiate or move user traffic session of a ProSe-enabled UE that has lost connection to the network to a communication path via a ProSe-enabled UE that is in ProSe communication range and has connectivity to the network.

[PR.119] In addition, the system shall be able to move the user traffic session back to the infrastructure communication path when the UE moves back into network coverage. The user may inhibit the switch back to the infrastructure communication path.

[PR.71] Based on operator policy, the operator network shall be able to control the relay of network services between UEs communicating by means of ProSe.

[PR.72] Based on operator policy, the operator network shall be able to control the ProSe communication between public safety UEs out of coverage that are in ProSe communication with a public safety UE in coverage, which is acting as a relay.

5.2.11 ProSe Range

5.2.11.1 Description

This use case describes the scenario where a given UE is within a building and uses ProSe Communications to exchange user traffic to/from UEs outside of a building.

5.2.11.2 Pre-Conditions

An operator offers a service, which makes use of the ProSe feature.

Officer A, Officer B, and Officer C use ProSe-enabled public safety UEs.

Officer A, Officer B, and Officer C are subscribed to a Public Safety service that allows them to use ProSe.

Officer C has disabled ProSe Discovery on his/her UE.

Officer A is inside a building, and Officer's B and C are outside of the same building.

5.2.11.3 Service Flows

Officer A's UE discovers Officer B's UE via ProSe Discovery.

Officer A's UE does not discover Officer C's UE via ProSe Discovery.

Officer A's UE exchanges data using ProSe Communications to/from Officer B and Officer C's UEs.

5.2.11.4 Post-Conditions

None.

5.2.11.5 Potential Requirements

SA1 would encourage solutions taking into account the following expectation:

[PR.73] It is desirable that an authorized public safety UE supports the capability to exchange data via ProSe from within a building to public safety UEs outside the building using a power class 3 EUTRA UE.

5.2.12 Public Safety Implicit Discovery

5.2.12.1 Description

This use case describes a scenario for ProSe public safety in which public safety officials need to communicate without an explicit ProSe Discovery event.

5.2.12.2 Pre-Conditions

Public safety officials arrive at a disaster site with their ProSe-enabled UEs. ProSe Discovery has been disabled on each UE by agreement among the officials.

5.2.12.3 Service Flows

The public safety officials determine the situation requires them to use ProSe Communication. They activate ProSe Communication on their UEs and communicate with each other as they proceed about their duties on the site. As the officials move about the site, communications will be received when the UEs are within communication range.

5.2.12.4 Post-Conditions

As ProSe Discovery is not performed, there is no explicit prior indication whether communication with a particular official will succeed at any given time. For this situation, that is an acceptable level of communication.

5.2.12.5 Potential Requirements

[PR.74] Authorized ProSe-enabled public safety UEs shall be able to communicate with other authorized ProSe-enabled public safety UEs without explicit discovery.

[PR.75] The ProSe-enabled public safety UEs shall provide the ability for the end user to activate/deactivate ProSe Communication.

[PR.76] A ProSe-enabled public safety UE shall support independent activation/deactivation of ProSe Discovery and ProSe Communication.

5.2.13 Co-existence of ProSe Communication and E-UTRAN communication

5.2.13.1 Description

This use case describes a scenario in which ProSe Discovery and Communications has been established between two UEs when no network coverage is available. The two UEs, while still performing ProSe Communications, then move back into network coverage with minimal impact on communication via the network.

5.2.13.2 Pre-Conditions

Officer A and Officer B are at a disaster site with ProSe-enabled UEs.

Officer A and Officer B are underground where there is no network coverage.

Officers A's UE and Officer B's UE are within proximity of each other.

Officer C and Officer D are at a disaster site with ProSe-enabled UEs and are within network coverage.

Officer C and Officer D are in communication via the E-UTRAN network.

5.2.13.3 Service Flows

Officers A's UE discovers Officer B's UE using ProSe Discovery.

Officer A establishes ProSe Communication with Officer B.

Officer A and Officer B emerge from the building and are once again in network coverage and are in proximity of Officers C and D.

5.2.13.4 Post-Conditions

ProSe Communication continues between Officers A and B.

Communication via the E-UTRAN network continues between Officers C and D.

5.2.13.5 Potential Requirements

[PR.123] ProSe-enabled public safety UEs when using ProSe Communications should have no impact on communication between other UEs communicating via E-UTRAN.

6 Potential Requirements

6.1 General

The following contains additional requirements not mentioned in clause 5.

6.2 Additional Operational Requirements

[PR.124] The operator network shall be able to continuously control the use of and resources for ProSe Discovery and ProSe Communication between UEs, as long as at least one of these UEs is under network coverage and using operator's spectrum.

[PR.125] ProSe communication and ProSe Discovery shall not adversely affect other services.

[PR.77] ProSe services are available to ProSe-enabled UEs that are registered to a PLMN, and are under coverage of the E-UTRAN of said PLMN, potentially served by different eNBs. In this case E-UTRAN resources involved in ProSe services will be under real time 3GPP network control.

[PR.78] Subject to operator policy and user consent, a ProSe-enabled UE should be capable of establishing the E-UTRAN infrastructure path and ProSe communication path concurrently.

[PR.79] The network should be able to collect Discovery information regarding which ProSe-enabled UEs are discovered to be in proximity of a given UE. Restrictions from contracts and regulation on data collection apply.

[PR.80] ProSe services are not available to ProSe-enabled UEs out of E-UTRAN coverage except in the following case:

ProSe-enabled public safety UEs can use ProSe services when operating on public safety spectrum dedicated to ProSe services even when not under E-UTRAN coverage. In this case, at least a one-time pre-authorization to use ProSe services is needed.

[PR.81] Re-authorization and specific configurations, including spectrum configurations, of public safety UEs shall be subject to public safety operator policy.

[PR.82] When operating ProSe, the EPS shall be able to support regional or national regulatory requirements, (e.g. lawful interception, PWS).

[PR.120] The ProSe system shall:

- Allow a UE to selectively discover other UEs of interest;
- Ensure that 3GPP UE/subscriber identifiers are not disclosed to unauthorized parties when ProSe Discovery and Communication is used;
- Allow both granting and revocation of discovery permissions;
- Enable applications to individually request the setting of discovery parameters, such as discovery range class;
- Allow a Public Safety UE to be able to determine by itself that a discovered UE is a Public Safety UE.

[PR.116] Subject to operator policies MOCN networks shall support establishing ProSe Communication between two UEs camping on the same radio access network but served by different MOCN PLMNs.

6.3 Additional Charging Requirements

[PR.83] When a ProSe-enabled UE uses ProSe Communication, both the HPLMN and VPLMN operator shall be able to collect accounting data for ProSe communication including:

- activation/deactivation of the ProSe Communication feature
- ProSe Communication initiation/termination
- ProSe Communication duration, and amount of data transferred

- ProSe ability to charge for QoS (e.g. levels of availability, allocated resource)
- Inter-operator ProSe Communication
- Inter-operator ProSe signalling

The above requirements do not apply to public safety communications outside network coverage.

6.4 Additional Security Requirements

[PR.111] The system shall ensure the confidentiality of user data and network signalling over the direct link to a level comparable with that provided by the existing 3GPP system.

[PR.112] The system shall ensure the integrity of user data and network signalling over the direct link to a level comparable with that provided by the existing 3GPP system.

[PR.96] The level of security provided by the existing EPS shall not be adversely affected when ProSe discovery and communications are enabled.

[PR.85] The system shall ensure that ProSe Discovery respects privacy.

[PR.86] The system shall ensure the authenticity of the ProSe Discovery information provided to the discoverer.

[PR.87] The system shall be able to restrict ProSe Discovery information to the ProSe-enabled UEs that have been authorized by the users and network operators.

[PR.121] The permission to be discoverable is given by the user and shall be executed by the system, subject to operator control, on a per-application basis.

[PR.122] An operator shall be able to configure a UE with the permission to be discoverable or not by one or more UEs, without prior registration to the network, for example to provide the means for an enterprise or Public Safety organization to set permissions for its users.

[PR.113] Existing 3GPP security mechanisms shall be reused whenever possible and appropriate.

[PR.114] ProSe services shall respect local regulatory frameworks on the use of licensed spectrum

[PR.115] ProSe (Discovery and Communication), shall support regional or national regulatory requirements, (e.g. lawful interception).

6.5 Consolidated Potential Requirements

6.5.1 Requirements for Proximity Services

6.5.1.1 General feature requirements

The following are general feature CPRs for ProSe.

CPR.6 [PR.4] ProSe Discovery shall support a minimum of three range classes – for example short, medium and maximum range.

CPR.12 [PR.29] The system shall be capable of monitoring the communication characteristics (e.g. channel condition, QoS of the path, volume of the traffic etc.) on the E-UTRA ProSe Communication path, regardless of whether there is data transferred via infrastructure path.

CPR.13 [PR.34] The Radio Access Network shall control the radio resources associated with the E-UTRA ProSe Communications path.

CPR.15 [PR.39, PR.40, PR.42] ProSe proximity information shall be suitable for integration with the Location and Presence information used by the network to offer its services.

6.5.1.2 WLAN access requirements

The following are WLAN access CPRs for ProSe.

6.5.1.3 Public Safety specific requirements

The following are Public Safety CPRs for ProSe.

CPR.21 [PR.55, PR.56, PR.80] ProSe services are not available to ProSe-enabled UEs out of E-UTRAN coverage, except in the following cases:

- ProSe-enabled public safety UEs can use ProSe services when operating on public safety spectrum dedicated to ProSe services even when not under E-UTRAN coverage. In this case, at least a one-time pre-authorization to use ProSe services is needed.
- A ProSe-enabled public safety UE with ProSe Discovery enabled shall be able to discover other discoverable public safety UEs when some or all of the UEs involved in ProSe Discovery are out of network coverage.

CPR.25 [PR.61] A public safety UE shall be capable of transmitting data to a group of public safety UEs using ProSe Group Communications with a single transmission, assuming they are within transmission range and authorized.

CPR.26 [PR.62] A public safety UE shall be capable of transmitting data to a group of public safety UEs directly using ProSe Group Communications.

CPR.27 [PR.63] A public safety UE shall be capable of receiving a ProSe Group Communications transmission, of which it is a group member, regardless of whether or not it has been discovered by the transmitting UE.

CPR.28 [PR.64] An authorized public safety UE shall be capable of sending a broadcast message to all authorized public safety UEs within transmission range, regardless of group membership, using ProSe Broadcast Communications in a single transmission.

CPR.29 [PR.65] An authorized public safety UE may be capable of acting as a relay for other public safety UEs.

CPR.30 [PR.66] An authorized public safety UE shall be capable of being enabled/disabled by a user or system to act as a relay for other public safety UEs.

CPR.31 [PR.67] The user of a ProSe-enabled public safety UE acting as a relay should not perceive service degradation due to the relay.

CPR.32 [PR.68] An authorized public safety UE shall be capable of communication using the network infrastructure and off network ProSe concurrently.

CPR.34 [PR.70] Based on operator policy and user choice, the system shall be able to initiate or move user traffic session of a ProSe-enabled public safety UE that has lost connection to the network to a communication path via a ProSe-enabled public safety UE that is in ProSe Communication range and has connectivity to the network.

CPR.36 [PR.72] Based on operator policy, the operator network shall be able to control the ProSe Communication between public safety UEs out of coverage that are in ProSe Communication with a public safety UE in coverage, which is acting as a relay.

CPR.38 [PR.81] Re-authorization and specific configurations, including spectrum configurations, of public safety UEs shall be subject to public safety operator policy.

6.5.2 Security, Authorization and Privacy

The following are CPRs for ProSe security, authorization and privacy.

CPR.40 [PR.85] The system shall ensure that ProSe Discovery respects privacy.

CPR.42 [PR.87] The system shall be able to restrict ProSe Discovery information to the ProSe-enabled UEs that have been authorized.

CPR.44 [PR.82] When operating ProSe, the EPS shall be able to support regional or national regulatory requirements, (e.g. lawful interception, PWS).

CPR.45 [PR.13] The operator shall be able to authorize discovery operations for each individual UE.

CPR.48 [PR.49] The operator's network and the ProSe-enabled UE shall provide a mechanism to identify, authenticate and authorize the third-party application to use ProSe capability features.

6.5.3 Charging Aspects

The following are CPRs for charging aspects.

7 Conclusion and recommendations

The Feasibility Study for Proximity Services (ProSe) Technical Report analyses several use cases of ProSe for both general and public safety use. The use cases address two key aspects of ProSe:

- Discovery, and
- Communication via an optimized path.

Taking into consideration the Use Cases and Scenarios defined in Clause 5, new potential requirements related to UE operations, network operations, charging and security for ProSe have been identified in Clause 5 with additional potential requirements in Clauses 6.1, 6.2, 6.3, and 6.4.

It is recommended to proceed with normative work.

Annex <1>: WLAN handling in ProSe

Discovery:

Discovery of ProSe-enabled UEs is only based on E-UTRA radio.

Communication:

- a) UEs may use E-UTRA for communication
- b) UEs may also use WLAN for communication

The WLAN communication has no impact on specifications under responsibility of RAN WGs. The 3GPP EPC may provide configuration that includes parameters to be used for setting up WLAN communication.

Use cases that include EPC management of the WLAN session and those that cover use of WLAN without EPC management can be considered.

Annex <2>: Potential Requirement Trace

Requirement ID	TR Clause
[PR.1]	5.1.1
[PR.2]	5.1.1
[PR.3]	5.1.1
[PR.4]	5.1.1
[PR.5]	5.1.1
[PR.6]	5.1.1
[PR.7]	5.1.1
[PR.8]	5.1.1
[PR.9]	5.1.1
[PR.10]	5.1.1
[PR.11]	5.1.1
[PR.12]	5.1.1
[PR.13]	5.1.1
[PR.14]	5.1.1
[PR.15]	5.1.1
[PR.16]	5.1.1
[PR.17]	5.1.2
[PR.18]	5.1.3
[PR.19]	5.1.3
[PR.20]	5.1.3
[PR.21]	5.1.4
[PR.22]	5.1.4
[PR.23]	5.1.4
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[PR.38]	5.1.6
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[PR.41]	5.1.7
[PR.42]	5.1.7
[PR.43]	5.1.8
[PR.44]	5.1.9
[PR.45]	5.1.9
[PR.46]	void
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[PR.48]	5.1.10
[PR.49]	5.1.11
[PR.50]	5.1.11

Requirement ID	TR Clause
[PR.51]	void
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[PR.55]	5.2.3
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[PR.93]	5.1.6
[PR.94]	5.1.6
[PR.95]	5.1.6
[PR.96]	6.4
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[PR.99]	5.1.6
[PR.100]	5.1.9

Requirement ID	TR Clause
[PR.101]	5.1.9
[PR.102]	5.1.9
[PR.103]	5.1.9
[PR.104]	5.1.9
[PR.105]	5.1.10
[PR.106]	5.1.10
[PR.107]	5.1.10
[PR.108]	5.1.12
[PR.109]	5.1.12
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[PR.116]	6.2
[PR.117]	5.2.5
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[PR.123]	5.2.13
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[PR.145]	Unassigned
[PR.146]	Unassigned
[PR.147]	Unassigned
[PR.148]	Unassigned
[PR.149]	Unassigned
[PR.150]	Unassigned

Annex <3>: Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
2011-11					<i>Skeleton presented to SA1#56</i>		0.0.1
2011-11					<i>Skeleton agreed to in SA1#56</i>	0.0.1	0.0.2
2011-11					<i>Output of SWG in SA1#56</i>	0.0.2	0.1.0
2012-02					<i>Output of SWG in SA1#57</i>	0.1.0	0.2.0
2012-05					<i>Output of SWG in SA1#58</i>	0.2.0	0.3.0
2012-08					<i>Output of SWG in SA1#59</i>	0.3.0	0.4.0
2012-08					<i>Additional changes from SWG in SA1#59</i>	0.4.0	0.5.0
2012-08					<i>Raised to v.1.0.0 by MCC for presentation to SA#57</i>	0.5.0	1.0.0
2012-09					<i>Rapporteur revisions.</i>	1.0.0	1.0.1
2012-11					<i>Output of SWG in SA1#60</i>	1.0.1	1.1.0
2012-11					<i>Raised to v.2.0.0 by MCC for submission to SA#58 approval</i>	1.1.0	2.0.0