3GPP SA6#2 (25th – 27th Feb'15)

ProSe Status Update

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Outlines

- Status of standards
- General Description
- Architecture
- Topics related to Public Safety use
  - Service provisioning
  - One-to-many Direct Communication
  - Direct Discovery
- Out of coverage operation
- ProSe impacts to EPC procedures
  - Impact in EPC procedures
  - Limited Service state
- Questions

Introduction of Rel-12 standards status

- SA1 Rel-12 work item concluded and aligned with stage 2 & 3
  - TS 22.278 clause 7A and 9.4 defines the stage 1 requirements for ProSe.
- SA2 Rel-12 work item concluded at SA#64 (Jun 2014)
  - TS 23.303 contains the system architecture and stage 2 procedures for ProSe.
- SA3 Rel-12 work item is also concluded at SA#64 (June 2014)
  - TS 33.303 contains the security aspects for ProSe.
- CT has finished stage 3 specifications:
  - TS24.333 (OMA-DM MO); TS24.334 (PC3 interface); TS29.343 (PC2 for EPC-level disc); TS29.344 (PC4a); TS29.345(PC6/7)
- RAN WGs has completed in Dec'2014
  - TS 36.300; TS 36.331; etc

Rel-12 ProSe General Scope

- Original ProSe WID SA2 scope considered the following features:
  - Direct Discovery
    - Open discovery (in coverage, consumer/commercial)
    - Restricted discovery (in coverage, public safety and consumer/commercial)
    - Restricted discovery (out of coverage, public safety)
  - Direct Communication
    - One-to-one communication (commercial/consumer)
    - One-to-many communication (public safety)
    - Support for ProSe UE-Network Relays (public safety)
  - EPC-level discovery (consumer/commercial)
  - EPC support for WiFi direct (consumer/commercial)

Rel-12 ProSe General (cont.)

- The approved TS 23.303 Rel.12 provided stage-2 procedures for only the following features (due to time constraints):
  - Direct Discovery
    - Open discovery (in coverage, consumer/commercial and public safety)
    - ~~Restricted discovery (in coverage, public safety and consumer/commercial)~~
    - ~~Restricted discovery (out of coverage, public safety)~~
  - Direct Communication
    - ~~One-to-one communication (commercial/consumer)~~
    - One-to-many communication (public safety)
    - ~~Support for ProSe UE-Network Relays (public safety)~~
      - Because of lacking the support in RAN WID
  - EPC-level discovery (consumer/commercial)
  - EPC support for WiFi-Direct (consumer/commercial)

Rel-13 ProSe scope for SA2

- Direct Discovery enhancements
  - Restricted ProSe Direct Discovery;
  - Support for model B ProSe Direct Discovery (for open and restricted);
  - Public Safety Discovery (out of coverage)
  - Enhancements to the procedures for Open ProSe Direct Discovery E.g. management of ProSe Application IDs and metadata, revocation of ProSe App. Code

- Direct Communication enhancements
  - ProSe UE-Network relays;
  - ProSe UE-UE relays;
  - ProSe Direct Communication one-to-one for Public Safety use;
  - Requirements for service continuity and QoS/priority/pre-emption of ProSe Direct Communication sessions as defined in TS 22.278

- Status determination and reporting, for Public Safety use
  - E.g. location status, Presence status, Group status, and UE Network Coverage status (over PC5)

- Study architecture enhancements in order to support proximity estimation

* TR 23.713 contains a set of “agreed” solutions and represents the latest status of SA2 development

ProSe Architecture

- Main new functional node is the <u>ProSe Function</u>
- New reference points
  - PC2: ProSe Function- 3rd party app (only used for EPC-level discovery)
  - PC3: UE-ProSe Function in HPLMN,
  - PC4a: ProSe Function-HSS
  - PC4b: ProSe Func – SUPL Locaiton Platform (SLP)
  - PC5: UE-UE, for control and user plane
  - PC6: Inter-PLMN ProSe Function to ProSe Function (HPLMN – LPLMN)
  - PC7: Roaming ProSe Function-ProSe Function (HPLMN – VPLMN)

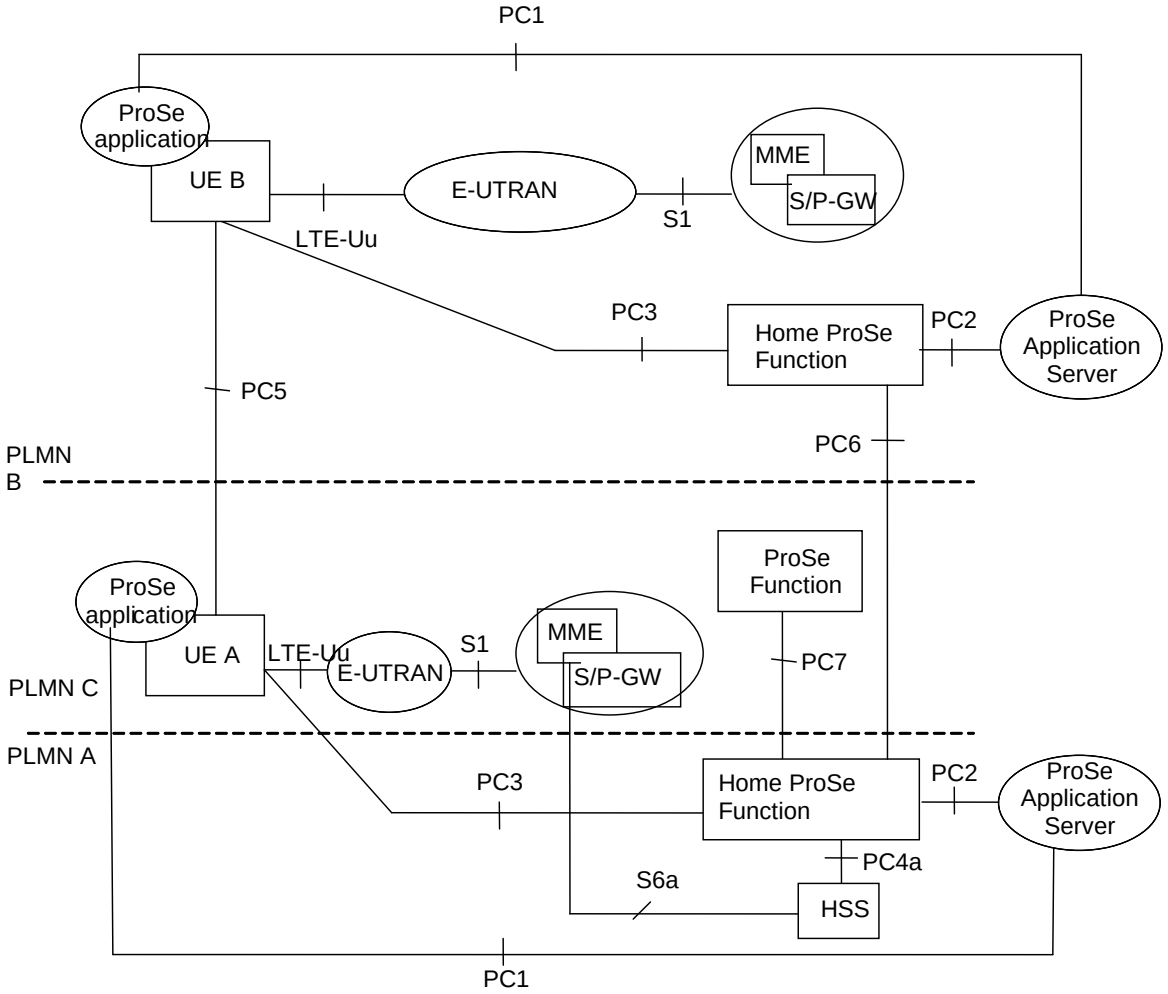


Figure 4.2-3: Roaming Reference Architecture

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.

ProSe Architecture

- The ProSe Function has the following sub-functions:
  - Direct Provisioning Function (DPF): Is used for UE provisioning and PLMN authorisation
  - Direct discovery name mgt server: is used for open discovery for assignment/lookup of ProSe App. IDs/ProSe App. Codes
  - EPC-level discovery Function: is used for performing proximity matching based on location info

Figure 4.4.1-1: UE to ProSe Function Interfaces for each sub-function

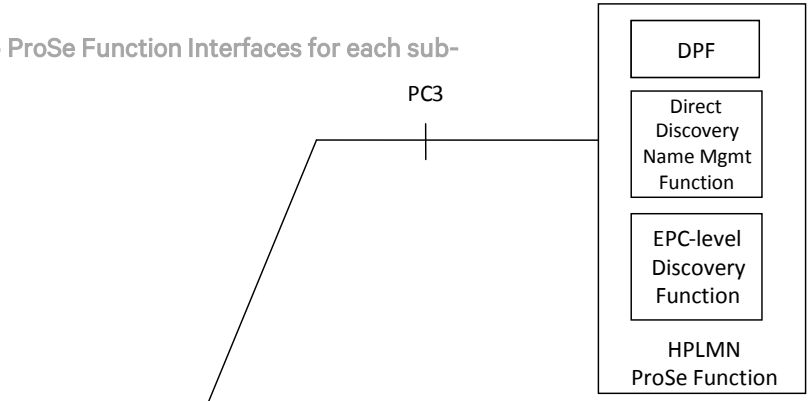
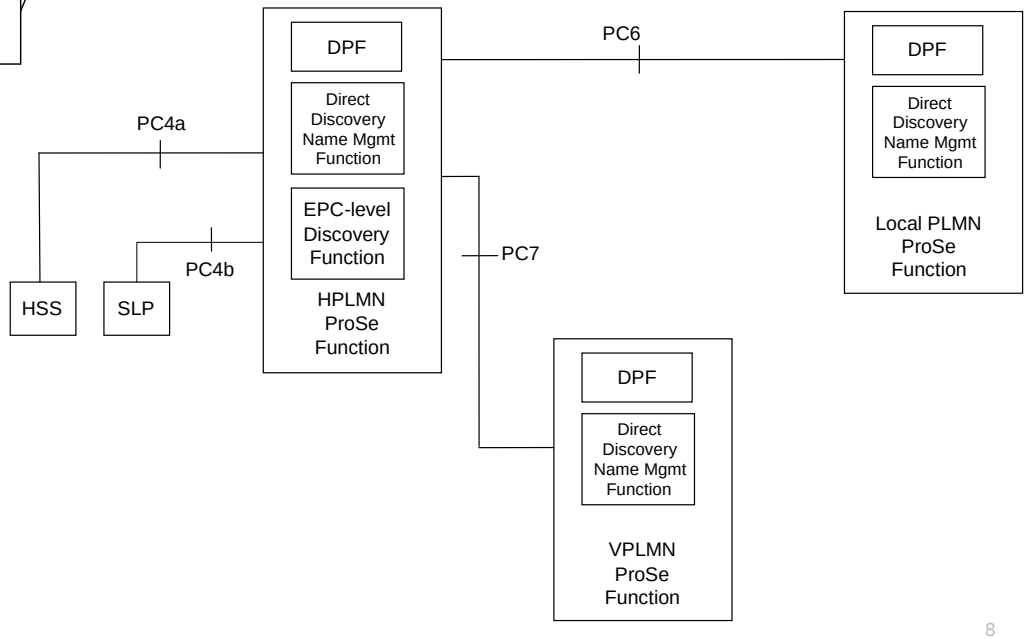


Figure 4.4.1-2: ProSe Function Interfaces to other network elements and PLMNs



Common Functions – Service auth & provisioning

- UE is pre-configured with authorized PLMN list
  - With corresponding parameters and validity timers
  - UE only need to perform Service Authorization if a PLMN is not authorized in pre-configuration
- Service Authorisation & Provisioning Info
  - UE interacts with DPF in HPLMN
  - Indicates whether the UE is authorised for direct discovery and communication per PLMN
  - Uses OMA-DM or preconfigured in UICC
- Additional Provisioning Info for PubS
  - Provided from DPF in HPLMN
  - Configures the UE to operate out of coverage
    - Radio parameters
    - Group ID
    - IP multicast address
    - Security container
  - Uses OMA-DM or pre-configured in UICC

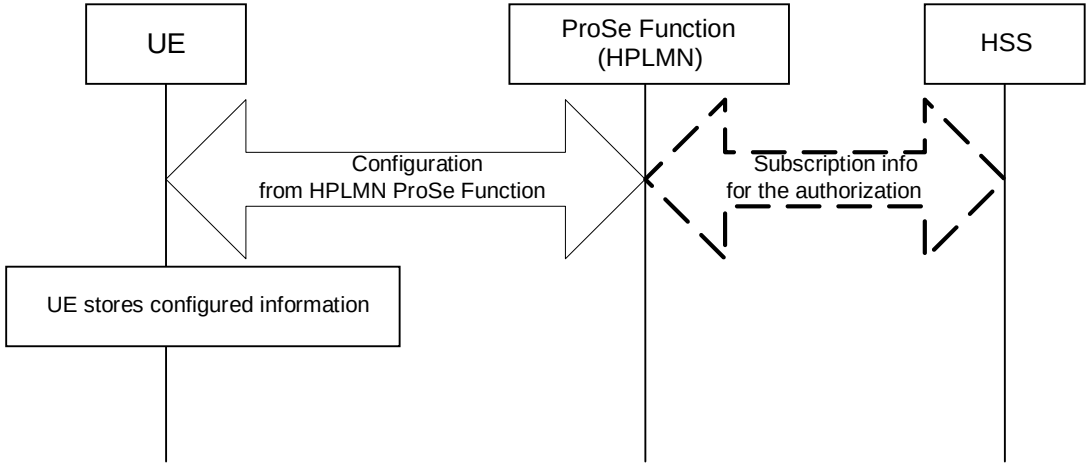


Figure 5.2-1: Pre-configuration for ProSe Direct Discovery or ProSe Direct Communication or both

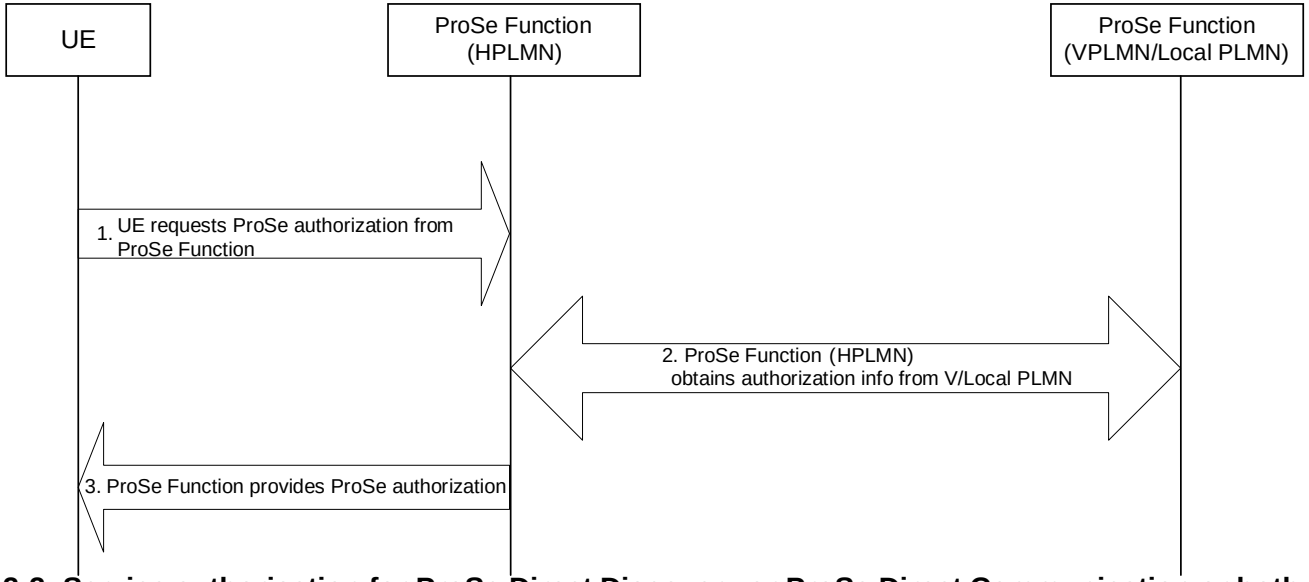


Figure 5.2-2: Service authorisation for ProSe Direct Discovery or ProSe Direct Communication or both

Common Functions – service revocation

- Service revocation
  - Can be triggered by HSS or ProSe Func
  - The ProSe Func can be in HPLMN, VPLMN or LPLMN
  - UE is informed of the revocation by the ProSe Service Notification message immediately, or at next time communicating with the ProSe Func
    - This is up to operator policy
  - eNB is updated on the "ProSe Authorized" indication by MME, if S1 bearer is established

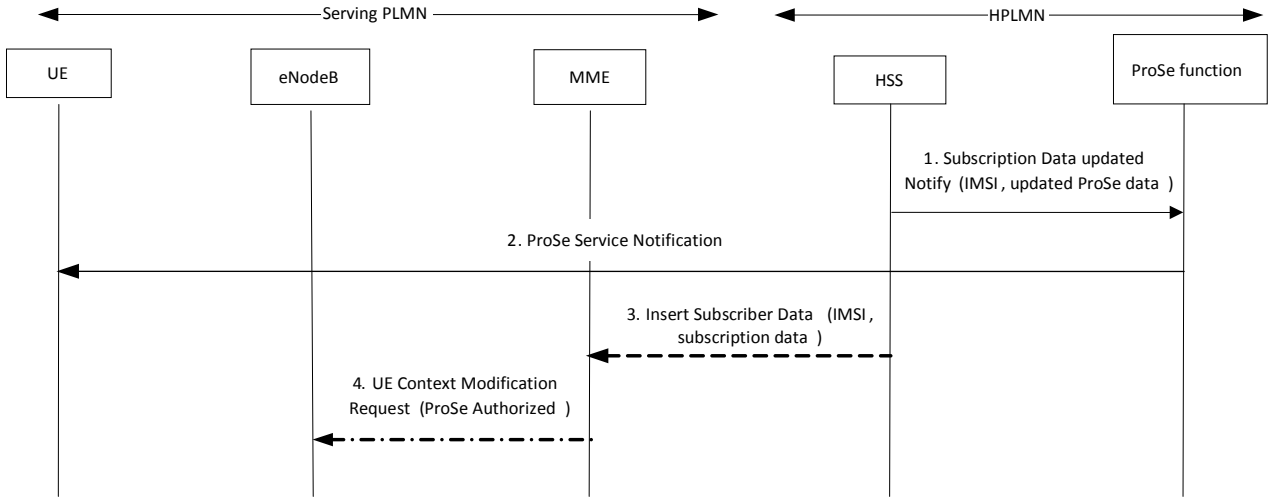


Figure 5.2.2.2-1: HSS triggered ProSe direct services revocation

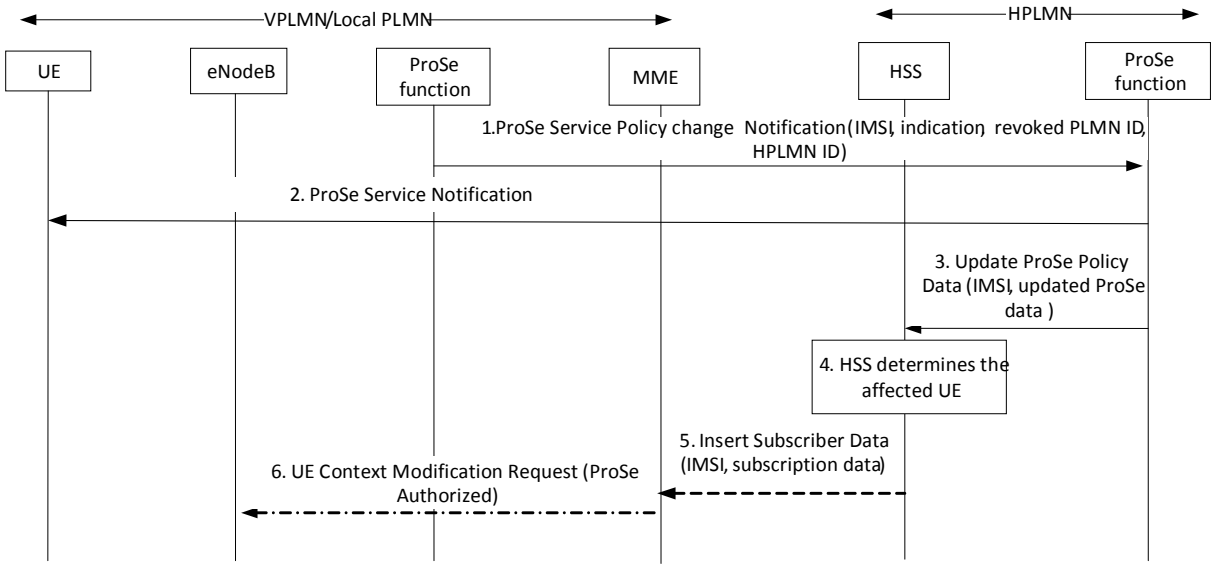


Figure 5.2.2.4-1: ProSe Function triggered ProSe direct services revocation(roaming)

Direct Communication (one-to-many) -General

- Applicability
  - One-to-many ProSe Direct Communication is applicable only to ProSe-enabled Public Safety UEs and when authorised, can apply when the UE is served by E-UTRAN and when the UE is outside of E-UTRA coverage.
- General concept
  - One-to-many ProSe Direct Communication is connectionless.
    - There is no signalling over PC5 control plane.
  - There is no QoS support apart from priority handling.
  - The radio layer provides a user plane communication service for transmission of IP packets between UEs engaged in direct communication.
  - Members of a group share a secret from which a group security key may be derived to encrypt all user data for that group.
  - Authorisation for one-to-many ProSe Direct Communication is configured in the UE by the ProSe Function using PC3 reference point.
  - ProSe UE configuration parameters (e.g. including ProSe Group IP multicast addresses, ProSe Group IDs, Group security material, radio related parameters) are configured in the UE.

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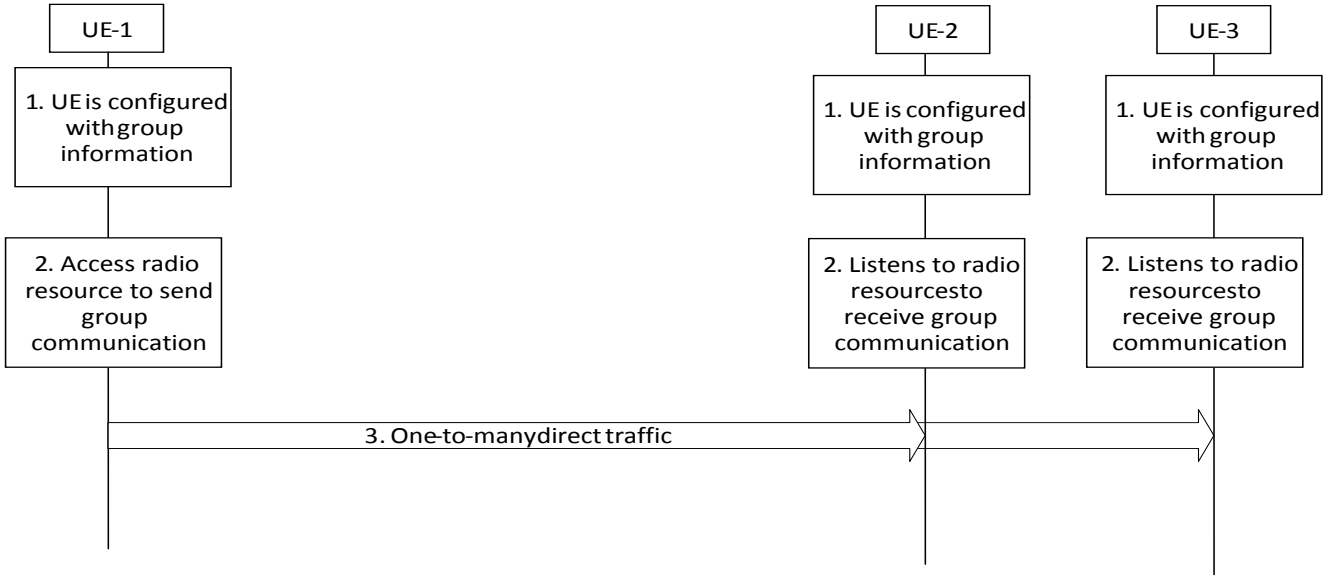
Direct Communication (one-to-many)- transmission

1. UE is configured with the related information for one-to-many ProSe Direct Communication as defined in slide 7. The UE obtains the necessary group context (ProSe Layer-2 Group ID, ProSe Group IP multicast address) to transmit IP-layer transport of data, and also the radio resource related parameters used for the Direct Communication.

2. The originating UE finds the appropriate radio resource to conduct one-to-many ProSe Direct Communication. If the UE is "served by E-UTRAN" it always uses the resources signalled from the network. If the UE is not "served by E-UTRAN" it uses the appropriate radio resources for this purpose.

3. The originating UE sends the IP data to the IP multicast address using the ProSe Layer-2 Group ID as Destination Layer-2 ID.



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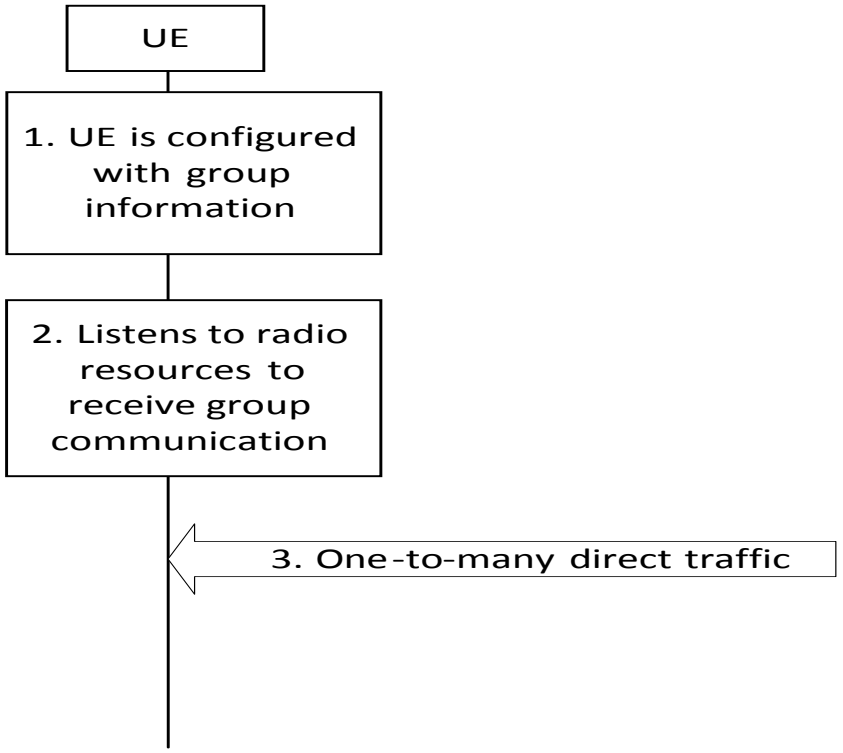
Direct Communication one-to-many - reception

1. UE is configured with the related information for one-to-many ProSe Direct Communication as defined in slide 7. The UE obtains the necessary group context (ProSe Layer-2 Group ID, Group IP multicast address) to receive IP-layer transport of data, and also the radio resource related parameters used for the Direct Communication.

2.The receiving UE listens to the allocated radio resource to receive one-to-many ProSe Direct Communication.

3.The receiving UE filters out the received packet based on the ProSe Layer-2 Group ID contained in the Destination Layer-2 ID and if it matches the Group IDs configured, delivers the packet to upper layers. The user plane packets will be delivered to the IP stack that filters the packets based on the Group IP multicast address.



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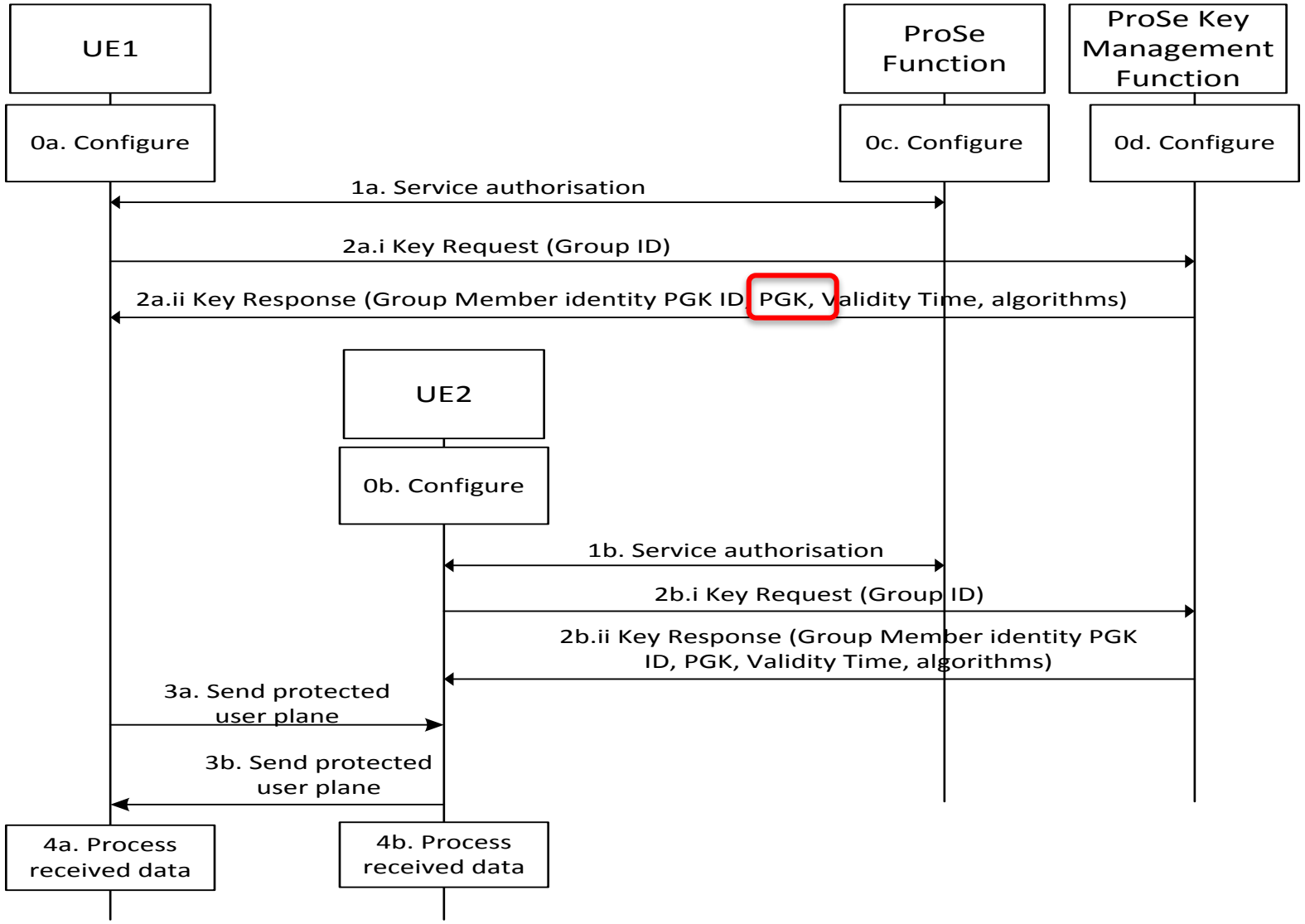
Direct Communication (one-to-many) - security

- Per-group keys (PGK), provisioned into each member UE
  - Traffic keys (PTK, PEK) are unique per UE
  - UE layer 2 ID (Group member ID) is provided by network



* This is based TS 33.303

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Communication Data format (just for information)

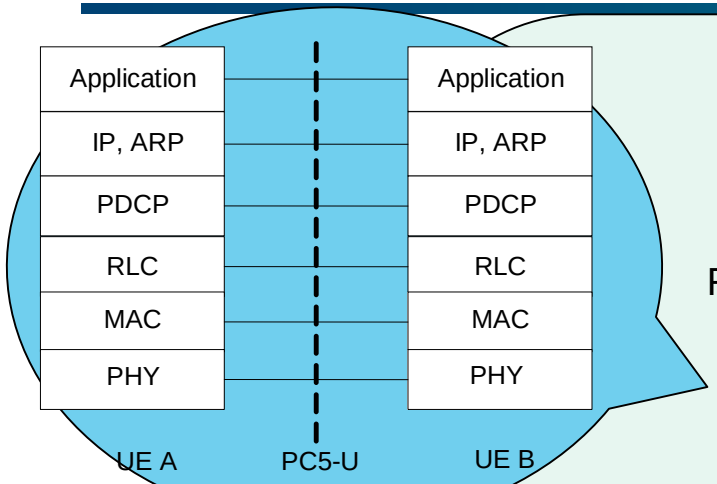

Figure 5.1.2.1-1: User Plane for PC5 interface

IP packet

Source IP address	Dest. IP address	UDP/RTP/…

PDCP PDU

Type	PGK ID	PTK ID	PDCP SN / Cntr	Encrypted Data
3bits	5bits	16bits	16bits	

Type indicates IP or ARP.

One IP packet per PDCP PDU. No "D/C" flag. No integrity

RLC PDU

RLC UM header	Data	Data	Data

5 bit SN field header is supported for RLC in case of D2D. Other headers in 6.2.1.3 of TS36.322 are not supported.

MAC PDU

Dest. L2 ID	Source L2 ID	MAC subheader1	…	MAC subheaderN	MAC SDU 1	…	MAC SDU N	Pad
16bits	24bits							

L1 SA subframe

SA L1 ID	L1 config	CRC
8bits		24

MCS, TA, Time and Frequency location of data

MAC PDU	CRC
	24

L1 data subframe

ProSe L2 Group ID
24 bits

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Direct Discovery -General

- General concept
  - ProSe Direct Discovery is defined as the process that detects and identifies another UE in proximity using E-UTRA direct radio signals.
  - Two types of ProSe Direct Discovery: open and restricted.
    - Open is the case where there is no explicit permission that is needed from the UE being discovered
    - ~~Restricted discovery only takes place with explicit permission from the UE that is being discovered (not defined in rel.12)~~
  - ProSe Direct Discovery can be a standalone service enabler that could for example use information from the discovered UE for certain applications in the UE that are permitted to use this information e.g. "find a taxi nearby", "find me a coffee shop".
- UE Roles
  - *Announcing UE*: The UE announces certain information that could be used by UEs in proximity that have permission to discover.
  - *Monitoring UE*: The UE that monitors certain information of interest in proximity of announcing UEs.
- Assumptions
  - The UE can act as "announcing UE" only in the band designated by the serving PLMN but may act as a "monitoring" UE also in the resources of other PLMN(s) in the same area if authorised. These PLMNs are called Local PLMNs.

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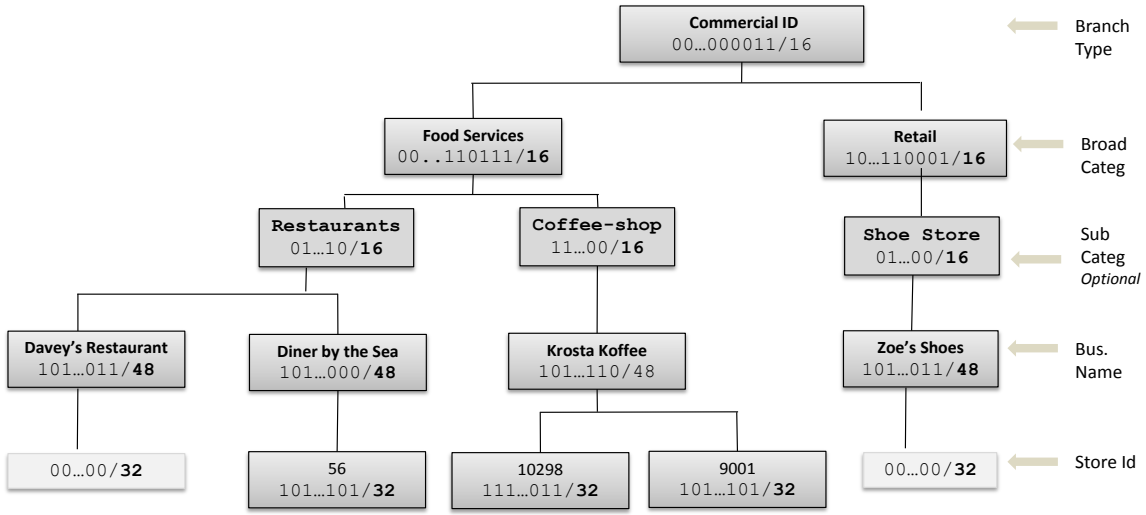
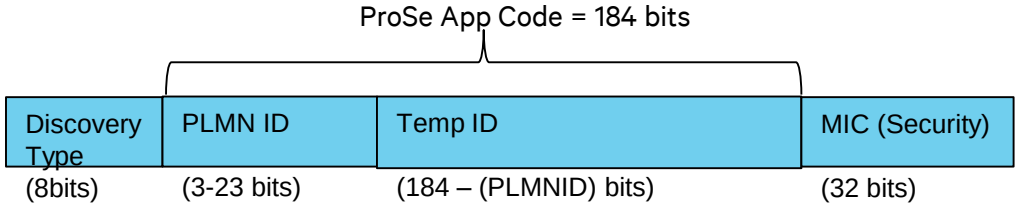
Direct Discovery- General

- Identities
  - ***ProSe App. ID***: The ProSe Application ID is an identity used for ProSe Direct Discovery, identifying application related information for the ProSe-enabled UE. Each ProSe Application ID could be globally unique, e.g. in case of open Direct Discovery, it unambiguously identifies a service across all 3GPP PLMNs
    - Example:prose.commercialID.retail.shoe-store.zoe's shoes.10298.mcc<mcc>.mnc<mnc>
  - ***ProSe Application Code***: The ProSe Application Code is associated with the ProSe Application ID and contained in the discovery message that is transmitted over the radio interface (on PC5) by a ProSe-enabled UE engaged in the ProSe Direct Discovery procedure. The ProSe Application Code is allocated per "announcing" UE and per application and has an associated validity timer that runs both in the ProSe Function and in the UE.
- Concept of ProSe App. Code matching and partial matching
  - ProSe Application Code matching all components of the ProSe App. Code. In ProSe Application Code matching, the "monitoring" UE shall consider it a full match, if both PLMN ID and temporary identity match with the corresponding contents of the Discovery Filter.
  - A partial match is obtained if the PLMN ID matches fully and the temporary identity matches partially with the corresponding contents of the Discovery Filter.



Example ProSe App. ID tree for the commercial branch



PC5 message and ProSe App. Code
as defined by CT1 (TS24.334) and CT4 (TS23.003)

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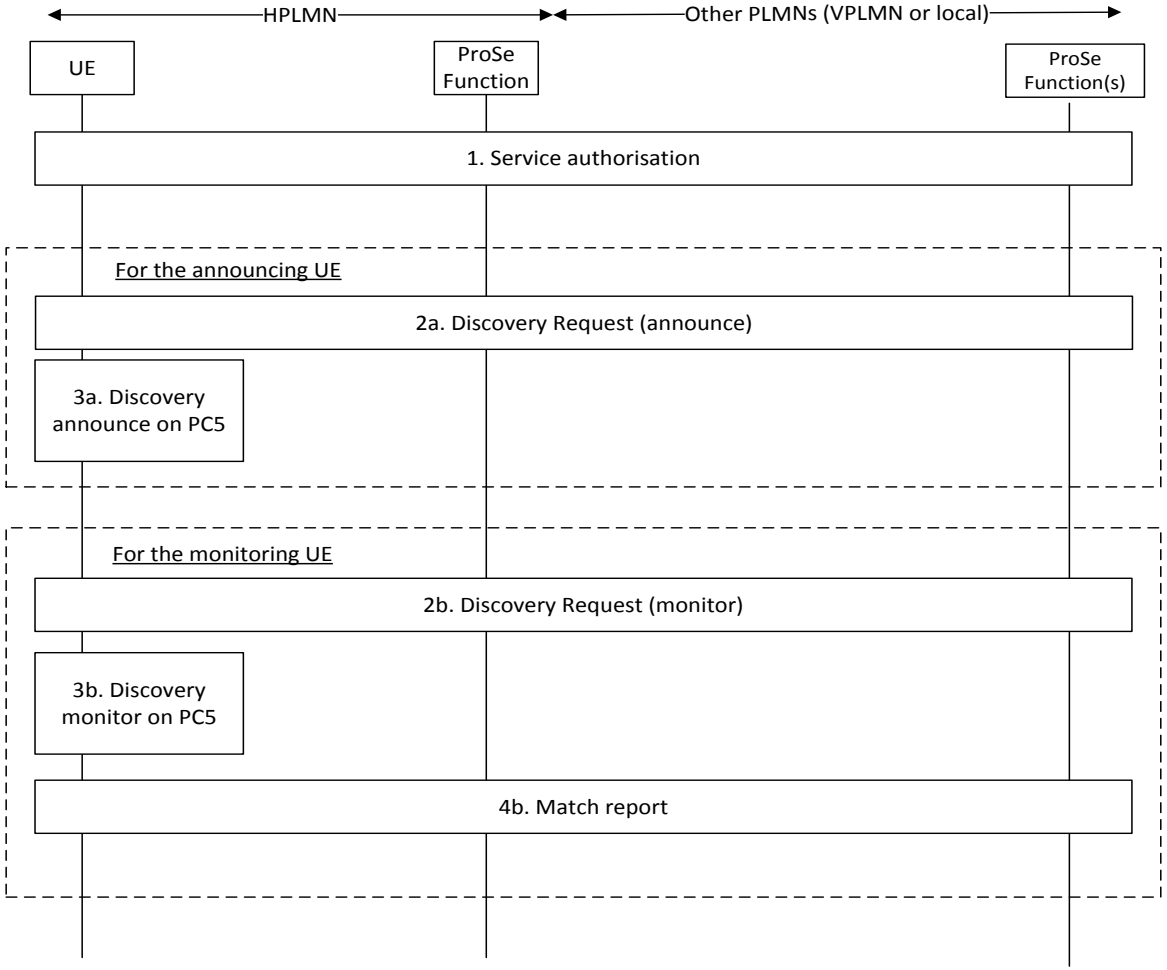
Direct Discovery – Basic steps

- 1. Service authorisation
  - Provides a list of PLMNs that the UE is allowed to "announce/monitor"
- 2a. Discovery request (for announcing UE)
  - Announce: UE sends a ProSe App. ID indicating what it wants to announce and gets a ProSe App. Code from the ProSe Function in HPLMN
- 2b. Discovery request (for monitoring UE)
  - Monitor: UE sends a ProSe App. ID indicating what it wants to monitor and gets a Discovery Filter from the ProSe Function in HPLMN
- 3. Match report (for monitoring UE)
  - Monitoring UE sends ProSe App. Code(s) it receives OTA to its HPLMN ProSe Function for checking and interpretation
  - The HPLMN ProSe Function passes ProSe App.Code(s) to ProSe Function(s) of the PLMN that issued codes
  - This ProSe functions checks ProSe App. Code(s) and if successful any meta-data to the HPLMN ProSe function of the monitoring UE

- More details for the procedures in Annex



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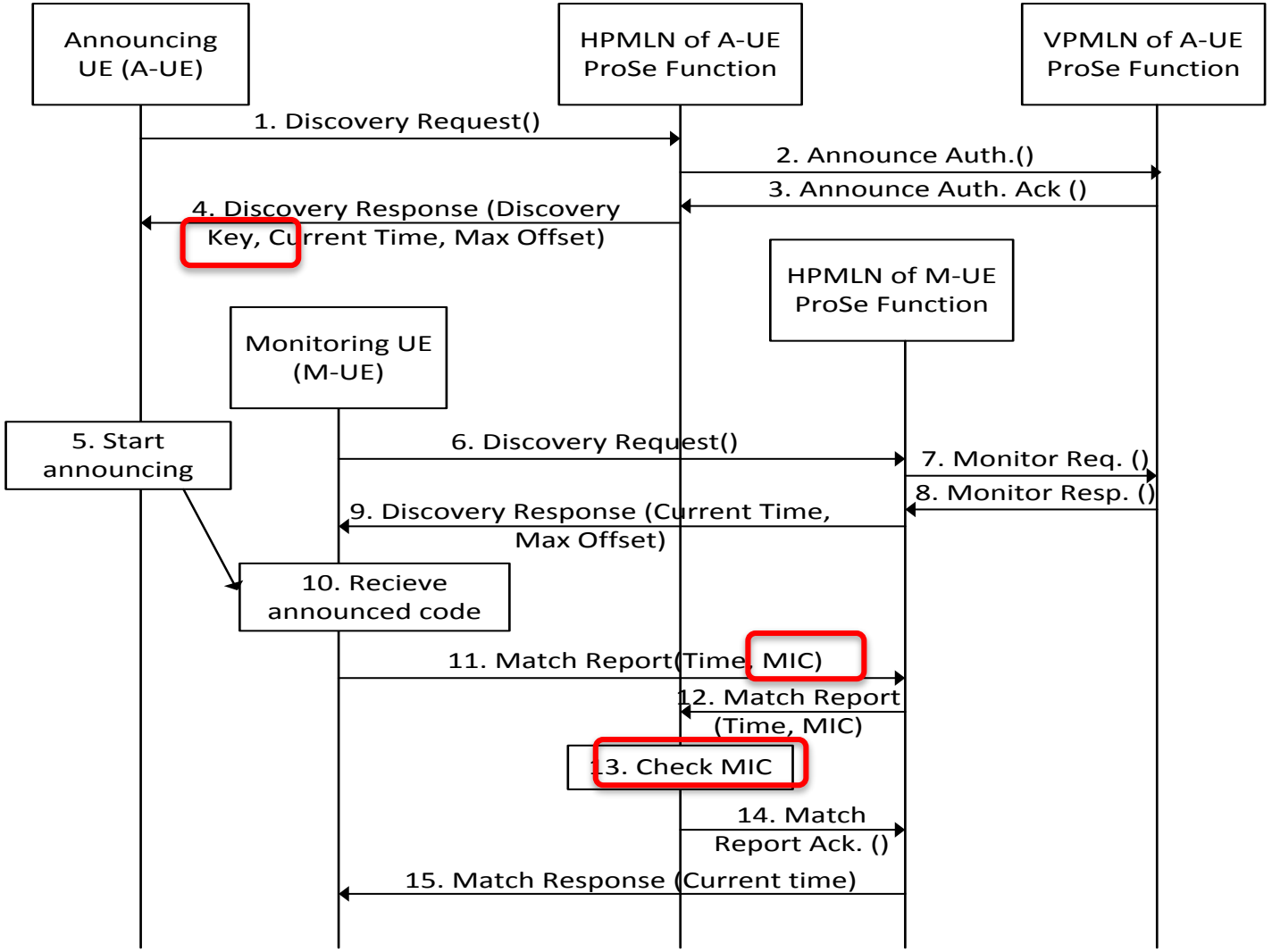
Direct Discovery- Security

- Integrity protection of OTA code, with network-side checking
  - Verification of the MIC always happen at the HPLMN of the Announcing UE;
  - Network provides current time to the UE at Discovery Request
  - UE reports the time of the code match in the Match Report
    - This is verified during the MIC check.



* This is based on TS 33.303

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Out of coverage operation

- Rel-12 ProSe supports ProSe Direct Communication when out of E-UTRAN coverage
- When out of coverage, UE uses pre-configured radio resources for Direct Communication
  - Provided via Service Authorization and Provisioning
- A ProSe UE may have simultaneous in-coverage and out-of-coverage communication
  - In order to communicate with another out-of-coverage

- Out of coverage means out of E-UTRAN coverage

ProSe impacts to EPC procedures

- In certain cases (Type 2 Discovery, mode 1 communication) E-UTRAN needs be aware of whether a UE is capable and authorised for D2D service (Direct Discovery or Direct Communication) in order to be able to schedule resources, etc.
- Therefore EPC needs to inform E-UTRAN whether a UE is capable and authorised to perform ProSe Direct Discovery, ProSe Direct Communication or both.
- As a result of that the following changes are described in TS 23.303 in the EPC procedures described in TS 23.401:
  - E-UTRAN Attach
    - ProSe-enabled UE includes the ProSe capability indication as part of the "UE Network Capability" in the Attach Request message. MME stores this information for ProSe operation. ProSe capability can indicate whether the UE is capable of supporting one or more of the following: ProSe Direct Discovery, ProSe Direct Communication and act as a ProSe UE-to-Network Relay.
    - MME may include a "ProSe authorised" indication in the S1 AP Initial Context Setup Request, indicating that the UE is authorised to use ProSe, if the MME is configured to indicate "ProSe authorised" to E-UTRAN.
  - Service Request procedure
    - MME may include a "ProSe authorised" indication in the S1 AP Initial Context Setup Request, indicating that the UE is authorised to use ProSe, if the MME is configured to indicate "ProSe authorised" to E-UTRAN.
  - PS handover procedure
    - Intra-E-UTRAN S1-based handover procedures for ProSe-enabled UE are performed with the following additions:
      - The target MME includes a "ProSe authorised" indication in the S1-AP Handover Request message and/or SA1-AP Context Modification message, meaning that the UE is authorised to use ProSe.
    - For X2-based handover, the source eNodeB includes a "ProSe authorised" indication in the X2-AP Handover Request message to the target eNodeB, or by MME in the Path Switch Request Ack message.

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Limited service state/ACB operation

- A ProSe UE is able to perform ProSe Direct Communication in limited service state
  - Using pre-configured out-of-coverage radio resources, or network signaled common resources pool (Mode 2)
  - ProSe UE follows normal limited service state operation over Uu (no special Access Class is needed)

- ProSe UE follows normal ACB procedures when ACB is enabled.

Thank you

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