Abstract

This document attempts the case for new work that need to be developed for 5G user to improve user reachability outlining the poor radio coverage issue with respect to voice and video services by IMS network. This document also outlines dual access capabilities of 5G user device and user is reachable on each access-type leading to faster user reachability.

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Table of Contents:

1. Introduction.................................................................................2
2. Conventions and Terminology..................................................2
3. Problem Statement........................................................................2
4. 5G IMS system supporting dual-Registration for Dual-Access.........2
5. Security Considerations..............................................................5
6. IANA Considerations..................................................................5
   6.1 IANA Registration of the "dual" Option Tag .........................5
7. Privacy Considerations...............................................................6
8. Acknowledgements......................................................................6
9. References....................................................................................6
   9.1 Normative References.........................................................6
   9.2 Informative References.........................................................6
Authors’ Addresses...........................................................................6

1. Introduction

5G system have been evolved to serve 5G Users with dual access capability at same time. User access to network service for mo-data and mt-data for voice and video or data services via both access type is increased if user’s registration state for a particular service is maintained on each access type independently. In this document, user access to voice and video service is discussed and proposal made to maintain user registration state for each access type of a user at P-CSCF.

2. Conventions and Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

3. Problem Statement

With user registered for a service for only one access type at a time, then probability of user reachability at the time of service delivery leads to considerable amount of delay in UE hunting procedure.

User registered on access type may happen that user goes out of network coverage at the time of serve being delivered. Hunting fails thereby trigger user hunting on another access type.

A considerable amount of delay is incurred on this hunting procedure. This document outlines this problem by proposing a solution of dual-registration in section-4.

4. 5G IMS system supporting dual-Registration for Dual-Access

A simplified 5G-system architecture with dual access is show in Figure 1 below.
UE upon successful attached to 5G-core by either of access type, 3GPP or non-3GPP, received following details:

- UE IP-address
- IMS access IP-address (P-CSCF discovery)

Since UE of 5G System is capable of dual access, implies UE can simultaneously have active connections with both 3GPP and non-3GPP access at same time. This in turn implies UE is reachable via both access type at same time.

Let us consider a simple case where the 5G UE device having dual access capability gets powered-on and both Wifi and RAN network is available.

- UE first get attached to RAN and send fresh Registration request to the IMS network. While sending since Wifi attached procedure was not completed, hence Fresh REGISTRATION request via RAN access with have PANI header=E-UTRAN with no optional tag.

Figure 1: Simplified 5G-system Architecture for Multi access
Upon successful REGISTRATION stores the UE registration data in the following format in Table :1.

Table :1

+---------------------+-------------------+-------------------+-----------------+---------------------+
| PANI | IMSI | IPsec | Call-ID | Register-Timer | P-Associated-URI |
+---------------------+-------------------+-------------------+-----------------+---------------------+

Upon successful Wifi attached procedure was successful, UE also triggers for FRESH REGISTER request to IMS network. Since RAN access was active, hence UE MUST send this FRESH REGISTRATION with PANI header=wlan with option tag=dual, indicating dual registration.

The second registration request triggered via another access type, in this example wifi will be again Un-Protected Registration, i.e. different call-ID and different IPsec as shown in Table :2

Table 2

+---------------------+-------------------+-------------------+-----------------+---------------------+
| PANI | IMSI | IPsec | Call-ID | Register-Timer | P-Associated-URI |
+---------------------+-------------------+-------------------+-----------------+---------------------+
+---------------------+-------------------+-------------------+-----------------+---------------------+
| PANI | IMSI | IPsec | Call-ID | Register-Timer | P-Associated-URI |
+---------------------+-------------------+-------------------+-----------------+---------------------+

Additional optional tag with name=dual, need to send during REGISTRATION to the Network. This parameter will be send to the IMS network along with PANI [RFC7913] header, in the below format

PANI=.......;dual

The Optional tag=dual, initiates the PCSCF to store two entries of a user’s registration data.

Upon successful dual registration, in the above scenario after second registration via wifi access, re-fresh register request is send with change in PANI header value which was sent earlier.

Register request sent on RAN access again will have optional tag=dual.

In case of loss of radio access and non-reachability, a re-register request will be sent to network via other access type to update the network registration status.

For example, dual REGISTERED 5G UE lost connectivity on wifi. Whether or not UE’s initiated de-register request for Wifi access reached IMS network, a re-register request will be sent on RAN access with no optional tag=dual on PANI header. This indicated loss of wifi access type and P-CSCF will mark will update the user registration status stored locally by erasing of wifi access.
- For MT (Mobile terminating) call scenario, terminating S-CSCF will route the INVITE request to the terminating P-CSCF. Terminating P-CSCF will forward the INVITE request based on current registration status of access type.

- If UE had IMS registration successful over both access type RAN and wifi, dual access, indicating UE is reachable over two access type. Terminating P-CSCF forwards INVITE on both access type like a parallel forking. SIP response 183 (Session Progress) received first from either access type will be processed and received on this access type will be discarded. Henceforth, bearer creation over access network via diameter AAR/AAA request with PCF function will be triggered with accepted response of 183 session-progress access-type.

- If UE had registration successful with only single access-type, then terminating P-CSCF forward INVITE on registered access type as a normal procedure.

5. Security Considerations

Security considerations related to the 5G systems are discussed in [NGMN]. Due to the request for intrinsic realization of security such aspects have to be considered by design for architecture and protocols.

Especially as a joint usage of resources and network functions by different separate logical network slices (e.g. in terms of virtual network functions) seems to be inevitable in the framework of 5G the need for strong security measures in such an environment is a major challenge.

6. IANA Considerations

This document registers a new option tag based on the IANA registration process of RFC 3261.

6.1 IANA Registration of the "dual" Option Tag

This specification registers an option tag, dual. The required information for this registration, as specified in RFC 3261, is:

Name : dual

Description: This "dual" tag is for informing the SIP Register Server that about UE dual access mode being currently active.

Usage : "Dual" optional tag to be using with sip header – PANI, abbreviated as P-asserted Network Info.

Scope : User side- it is supported at UE device
        Network side-it is supported at P-CSCF or SBC of IMS network.
7. Privacy Considerations

Support of full privacy of the users (customers and tenants / end service providers) is a basic feature of the next generation trusted and reliable communications offering system. Such a high degree of ensured privacy shall be reflected in the proposed architecture and protocol solutions.

Especially as Identifiers and mapping of locators to them are addressed some privacy concerns arise. Mobility solutions tend to expose unique identifiers. A solution inside the mobile network exposes these identifiers to the network operator, which is not a big deal since the network operator already has information about the device’s location. In contrast, an IP level solution exposes both the identifiers and the locations at the IP layer. That means that web sites, for example, can now track the device’s successive locations by watching the IP address. Solutions such as transporting the identifiers not as part of the IP header should be considered.

8. Acknowledgements

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