ePDG P-CSCF Restoration Support

Feature Information

Summary Data

Status:	New Feature
Introduced-In Release:	21.2
Modified-In Release(s):	ePDG
Applicable Product(s):	Cisco ASR 5500, VPC-SI, VPC-DI, UGP
Customer Specific:	No
Default Setting:	Disabled
CDETS ID(s)	CSCvc97504
Related Changes in this Release:	NA
Related Documentation:	ePDG Admin Guide, CLI Ref Guide and RCR

Revision History

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Important   Revision history details are not provided for features introduced before release 21.2.

Revision Details	Release	Release Date
New in this release.	21.2	April 27, 2017

Feature Description

ePDG supports P-CSCF restoration on ePDG(Swu and S2b interface). P-CSCF restoration procedures designed to minimize the time a UE is unreachable for terminating calls after a P-CSCF failure.

P-CSCF restoration generally consists one of the below two ways:

1. Basic mechanism that makes use of a path through HSS/PCRF and PGW to request the release of the IMS PDN connection to the corresponding UE

2. An optional extension that avoids the IMS PDN deactivation and re-activation.

Key functionality of P-CSCF Restoration Support on ePDG:

- Processing of P-CSCF_RESELECTION_SUPPORT Notify payload in IKE-AUTH which when present indicates that the UE supports the P-CSCF restoration extension for untrusted WLAN

- Forwarding of UE capability (i.e. UE support of the P-CSCF restoration extension) in the APCO information element to the PGW over the S2b interface at the IMS PDN connection establishment (or handover) over S2b

- Handling of the updated addresses list of available P-CSCFs towards the UE sent by PGW, using the APCO IE in Update Bearer Req and sending Update Bearer Resp after procedure completion

- Forwading the updated P-CSCF addresses received from PGW to UE in the CFG_REQUEST configuration payload within the INFORMATIONAL request and handling UE's CFG_REPLY Configuration Payload in INFORMATIONAL response

- Handling of cause "Reactivation requested" over S2b in Delete Bearer Request & as a result include REACTIVATION_REQUESTED_CAUSE Notify payload in the INFORMATIONAL request message containing a DELETE payload sent to UE

Use cases for ePDG P-CSCF restoration support

This section describes solutions to support P-CSCF restoration for UEs with WLAN access.

There are two existing mechanisms to handle the P-CSCF restoration support as there are with E-UTRAN access.

- The basic mechanism for the HSS-based solution and for the PCRF-based solution relies on the release of the PDN connection followed by its re-establishment to trigger a new IMS registration by the UE

- The extension mechanism untrusted WLAN accesses to avoid the release of the PDN connection and to trigger a new IMS registration by the UE over the existing PDN connection. The extensions between the UE and the PGW are common for the HSS-based and for the PCRF-based solutions and rely on the same UE behavior

Basic PCSCF Restoration Support For an untrusted WLAN access, on S2b interface the PGW initiates a Delete Bearer Request procedure (GTP) or a Proxy Mobile IPv6 LMA Initiated PDN Connection Deletion procedure (PMIP) to the ePDG which then initiates the release of the associated IKEv2 tunnel. A cause "reactivation requested" (as supported over 3GPP accesses) is added by the PGW over GTP-C based S2b and IKEv2 for untrusted WLAN

As a result of the release of the IMS PDN connection, the UE re-establishes the IMS PDN connection, and also perform a new P-CSCF discovery (as the IMS PDN connection was lost). After discovering a new P-CSCF, the UE will perform a new initial IMS registration towards IMS.

Extended PCSCF Restoration Support An ePDG which supports the P-CSCF restoration extension for untrusted WLAN forwards the UE capability (i.e. UE support of the P-CSCF restoration extension) in the APCO information element to the PGW over the S2b interface at the PDN connection establishment (or handover) over S2b.

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Note The receipt by the PGW of the UE capability indicating the support of P-CSCF restoration for the untrusted WLAN access at the PDN connection establishment (or handover) over the untrusted WLAN access serves also as an indication that the ePDG supports this procedure.

In the P-CSCF restoration extension procedure for untrusted WLAN access, the PGW sends the updated list of the addresses of available P-CSCFs towards the UE via the ePDG, using the APCO IE in Update Bearer Request message. Same will be communicated to UE via Configuration payload in Information request message.

Assumptions and Limitations

1. P-CSCF restoration is valid only for GTP interface.(PMIP not covered.)

2. P-CSCF restoration in ICSR downgrade will return "success" message, which is not a correct message, but PGW will treat it as restoration is successful and will not further send DSR, which ideally should be the case.

Flows

Basic Restoration Mechanism

HSS-based/PCRF-based basic mechanisms displayed in the below is based on the same principles i.e to disconnect the UE when P-CSCF failure is detected, which then re-establishes the connection via an alternate available P-CSCF.

Both the mechanisms have the same effect in ePDG, which will be handling PGW initiated Delete Bearer Request procedure (GTP) with cause "reactivation requested" (as supported over 3GPP accesses) and then translate it over IKEv2 (SWu) INFORMATIONAL request message containing DELETE payload with REACTIVATION_REQUESTED_CAUSE Notify payload towards UE resulting in deactivation.

After deactivation it is up to the UE to re-establish a new IMS PDN connection and performs a new P-CSCF discovery.

Figure 1: HSS based basic P-CSCF restoration for WLAN
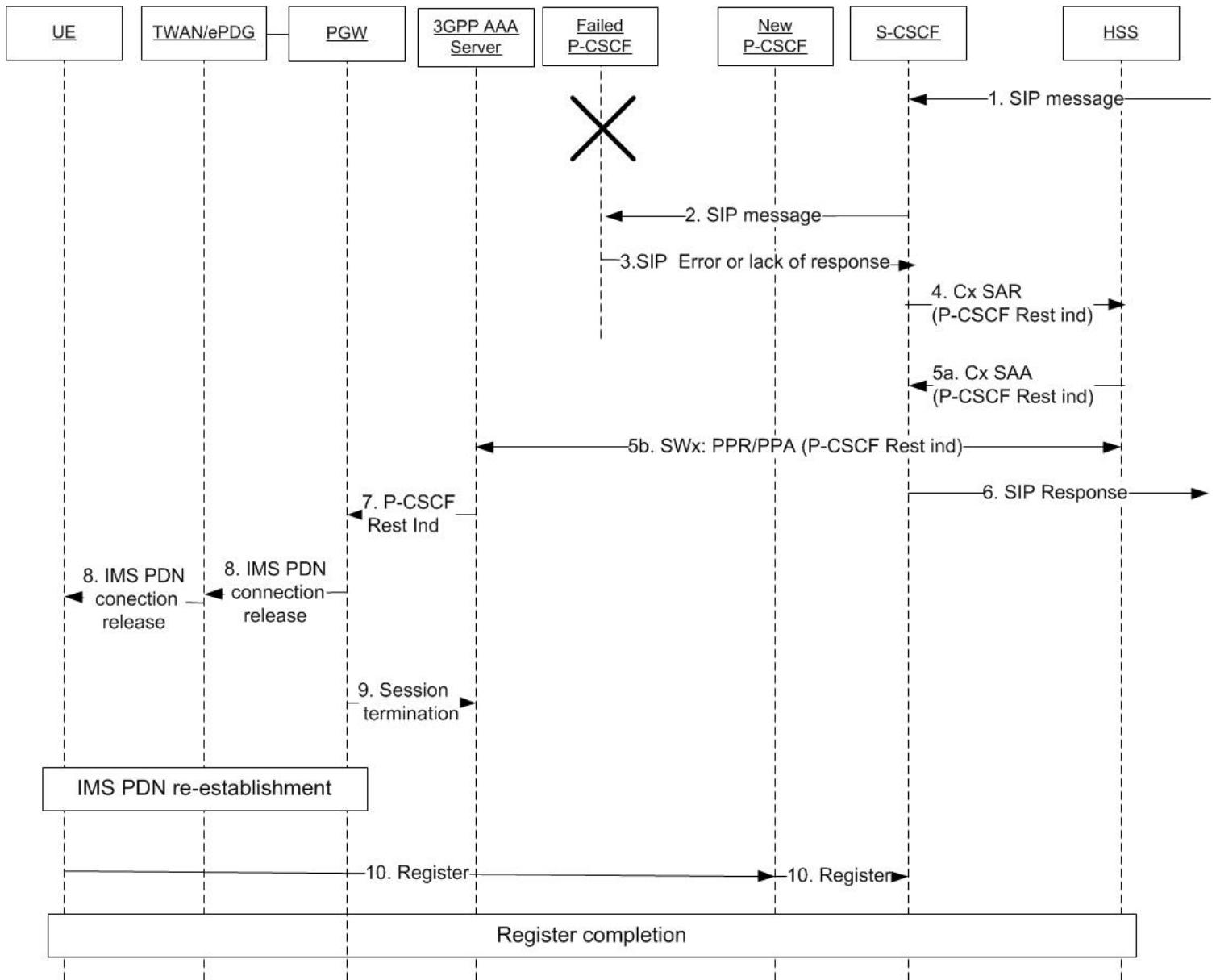

Extended Restoration Mechanism

This mechanism aims to avoid the IMS PDN deactivation and re-activation, by introducing a update procedure to inform the UE about the change in P-CSCF address. This triggers the UE to initiate a new IMS registration towards an available P-CSCF over the existing IMS PDN connection.

Extended Restoration Mechanism has the following phases:

- Capability exchange Phase i.e Swu notify exchange.

- Updation Phase [Post P-CSCF failure]: Getting new PCSCF info in UBR and conveying same to UE.

The UE which supports the P-CSCF restoration extension for the untrusted WLAN access, sends PCSCF_RESELECTION_SUPPORT notify payload to the ePDG in the IKEv2 message (IKE-AUTH) during establishment (or handover) of the IMS PDN connection over the untrusted WLAN access.

Upon receiving the UE capability, the P-CSCF restoration extension for untrusted WLAN supporting ePDG will forward the same in the APCO information element to the PGW over the S2b interface in Create Session Request.

Figure 2: PCRF Based Extended P-CSCF Restoration for Un-Trusted WLAN Access
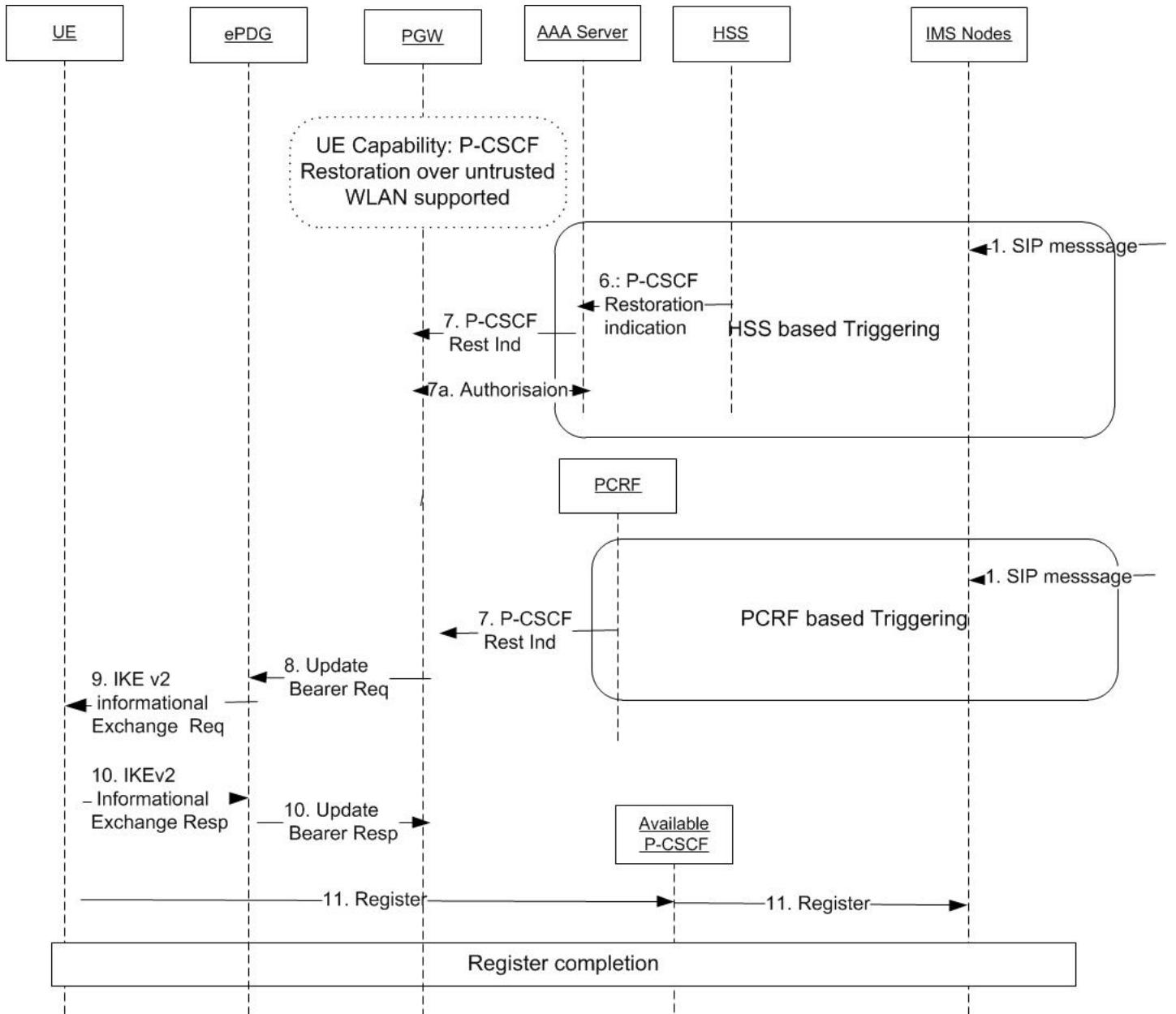
In case of Extenstion P-CSCF restoration

- If both UE and ePDG support P-CSCF restoration and PGW was updated of this support in Create Session Request, the PGW will send an Update Bearer Request (as described in 3GPP TS 29.274 [10]) to the ePDG including the APCO information element set with a list of available P-CSCFaddresses.

- The ePDG will initiate an IKEv2 informational exchange procedure (as described in 3gpp 24.302) towards the UE to forward the list of available P-CSCF addresses received from the PGW.

- The UE will send a response to the ePDG which then sends an Update Bearer Response to the PGW.

Detailed Description

Capability support for a subscriber .

UE will share its P-CSCF restoration capability in 1st IKE_auth.

(First IKE AUTH request from Initiator)

HDR, SK { IDi, CERT, AUTH,

CP(CFG_REQUEST),

SAi2, TSi, TSr,

N(P-CSCF_RESELECTION_SUPPORT) } -----> ePDG

As part of this feature enhancement, the following new Private Notify Message status types will be supported.

Notify Message	Value (in decimal)	Descriptions
REACTIVATION_REQUESTED_CAUSE	40961	The IPsec tunnel associated to a PDN connection is released with a cause requesting the UE to reestablish the IPsec tunnel for the same PDN Connection after its release.
P-CSCF_RESELECTION_SUPPORT	41304	This status when present indicates that the UE supports the P-CSCF restoration extension for untrusted WLAN

P-CSCF_RESELECTION_SUPPORT Notify payload

The P-CSCF_RESELECTION_SUPPORT Notify payload is used to indicate the support by the UE of the P-CSCF restoration extension for untrusted WLAN.

The P-CSCF_RESELECTION_SUPPORT Notify payload is coded according to below figures.

Protocol id: Set to 0

SPI Size: Set to 0

Notify Message type: The Notify Message Type field is set to value 41304 to indicate the P-CSCF_RESELECTION_SUPPORT

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| Important | -From Rel 13, 3gpp started using IANA number for notify payloads which belong to private range. For features, which configure notify-status-value from private range can lead to collision and operator will have to be careful while configuring non-collision numbers. |

RFC 4306 IKEv2 Private Use Status Range - integer 40960 to 65535.

This can have conflict with above Notify 3gpp standard value, one should configure it carefully.

Message	IE	Descriptions
Delete Bearer Request	CAUSE	cause "reactivation requested" is sent over GTP-C based S2b during deactivation of IMS session in basic mechanism of P-CSCF restoration. This cause will come in Delete bearer request for default bearer. Value is 8
Create Session Request	APCO	Additional Parameter List : container identifier 0012H (P-CSCF Re-selection support); When the container identifier indicates P-CSCF Re-selection support, the container identifier contents field is empty and the length of container identifier contents indicates a length equal to zero. If the container identifier contents field is not empty, it shall be ignored. This PCO parameter may be present only if a container with P-CSCF IPv4 Address Request or P-CSCF IPv6 Address Request is present.
Update Bearer Request	APCO	Additional Parameter List : container identifier 0001H (P-CSCF IPv6 Address) or 000CH (P-CSCF IPv4 Address) or both.

Capability support on ePDg for said subscriber session:

During the set up (or handover) of the PDN connection, the ePDG should indicate capability to support the extended P-CSCF restoration using PCO/APCO.

Following Container ID is used for P-CSCF Re-Selection support indication (PCO/APCO):

0012H (P-CSCF Re selection support)

External Interfaces

S2b Interface:

Support of Additional Parameter list

0012H: MS->N/w IE: APCO: P-CSCF Re-selection support

0001H: N/w->MS IE: APCO: P-CSCF IPv6 Address

000CH: N/w->MS IE: APCO: P-CSCF IPv4 Address

Cause code: 8 Reactivation Requested

SWu:

Notify payload:

40961: REACTIVATION_REQUESTED_CAUSE

41304: P-CSCF_RESELECTION_SUPPORT

Configuring P-CSCF Restoration Support

Below new CLI commands are introduced to configure P-CSCF Restoration Support:

```
Configure
        call-control-profile profile_name
        [remove] wlan pcscf-restoration
    end
```

Monitoring and Troubleshooting the P-CSCF Restoration Support

Below show commands are introduced as part of P-CSCF Restoration Support:

show call-control-profile full {name <name> | all}

- WLAN Access:

- P-CSCF Restoration

show crypto ikev2 security-associations

- P-CSCF Re-sel Supported

- 1 Total IKEv2 Informational CFG_REQ Sent

- 1 Total IKEv2 Informational CFG_RSP Rcvd

- 0 Total IKEv2 Informational CFG_REQ Collisions

show crypto ikev2 security-associations

Total IKEv2 Informational Statistics:

- CFG Req Sent

- CFG Reply Rcvd

- CFG Req Collisions

Total IKEv2 Notify Message Receive Statistics:

- P-CSCF Re-sel Supported

Total IKEv2 Notify Payload Sent Statistics

- Re-Activation Request

Total IKEv2 Notify Payload Received Statistics

- P-CSCF Re-sel Supported

show epdg statistics

- Total P-CSCF Re-sel success

GTP Related reasons:

- ePDG P-CSCF Restoration

show session disconnect-reasons

Disconnect Reason	Num Disc	Percentage
ePDG-pcscf-restoration		

show subs full

- P-CSCF Restoration Supported

Bulkstats

Below new statists are introduced to support P-CSCF Restoration Support.

epdg and epdg-apn schema

- num-gtp-pcscf-restoration-success
- sess-disconnect-epdg-pcscf-restoration

system schema

- ikev2-info-cfg-rsprecv
- ikev2-info-cfg-reqcoll
- ikev2-notifpaysent-reactreq
- ikev2-notifpayrecv-pcscfreselsupp
- ikev2-notifrecv-pcscfreselsupp