

# 4G和5G NSA用户之间基于PRA的差分计费

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## 简介

本文档介绍基于Presence Reporting Area (PRA)的差分国家安全局(NSA)在线计费解决方案。

## 先决条件

### 要求

Cisco 建议您了解以下主题：

- PRA
- 移动管理实体(MME)
- 思科服务网关(SGW)/思科分组数据网络网关(PGW)
- 策略和计费规则功能(PCRF)

此外，

- 支持PRA功能增强的MME，将“S1-U IP地址”映射到“PRA ID”
- PGW支持面向PCRF的PRA触发器
- PCRF在从GW收到presence-reporting-area-status为In area (0)或out of area (1)后安装新的pcc规则库

### 使用的组件

本文档中的信息基于StarOS : 21.28.mx。

本文档中的信息都是基于特定实验室环境中的设备编写的。本文档中使用的所有设备最初均采用原始（默认）配置。如果您的网络处于活动状态，请确保您了解所有命令的潜在影响。

## 背景信息

此功能用于支持在5G NSA设置中区分预付费用户（在线计费）的4G和5G客户计费的要求。

PRA是在3GPP数据包域内定义的区域，用于报告该区域内的UE存在情况，以实现策略控制和/或计费原因。

对于NSA差分更改，PRA功能用于报告4G和5G中的用户存在。

## PRA ID解决方案概述

来自/来自MME的期望：

- MME预计将检测UE从4G到5G覆盖(gNB)的移动，反之亦然，以构建逻辑来通过PRA报告映射此事件。
- PRA ID应与PCRF中配置的差分计费相同。
- 仅适用于DCNR UE。

PCRF订用PRA事件触发器，

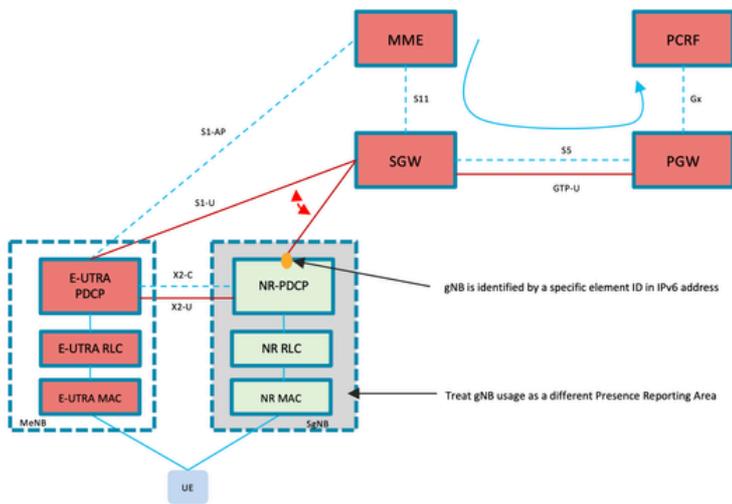
- PGW存储PRA操作并转发到SGW

发生4G到5G过渡时（S1隧道交换机）：

- 根据gNB传输地址，MME将PRA ID状态标记为OPRA（在5G覆盖范围内）/IPRA（在5G覆盖范围内）
- MME将PRA信息传送到SGW，SGW转发到PGW

PGW从SGW接收PRA信息并转发到PCRF

- PCRF根据PRA信息更改规则库
- 用户平面就规则库的更改进行通信



高级设置架构

## 缩写

PRA	Presence报告区域
OCS	在线计费系统
网关	网关(GGSN/PGW)
PCRF	策略和计费规则功能
MOP	程序方法
MME	移动管理实体
SGW	服务网关
PGW	数据包网关

## 可能的影响和注意事项

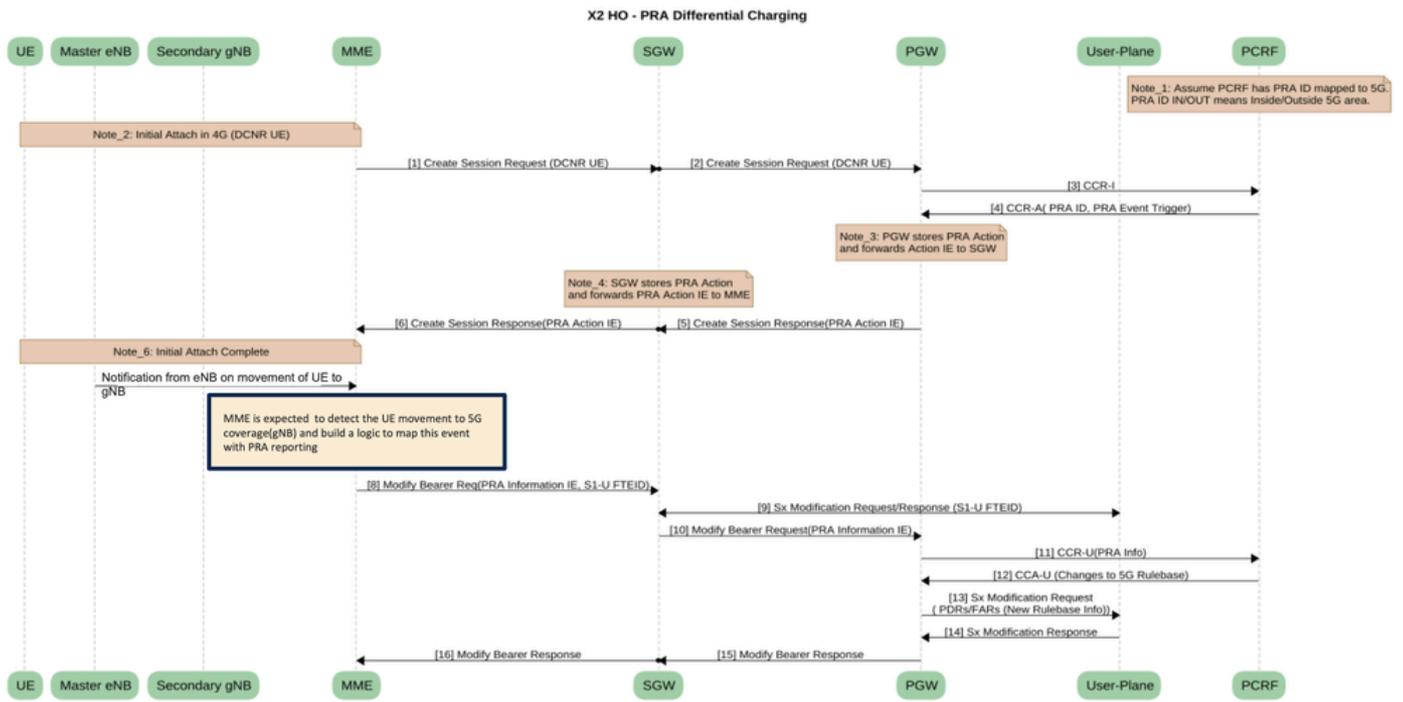
- 仅针对5G NSA部署的Option3x模式推荐的解决方案。
- 由于跟踪UE从4G到5G和5G到4G的移动，因此此跟踪会通知给SGW/PGW，因此预计会有大量的CCR-U。

- MME identifies gNB vs. eNB usage.
- MME sends Modify Bearer Request with Presence Reporting Area to SPGW and then PCRF

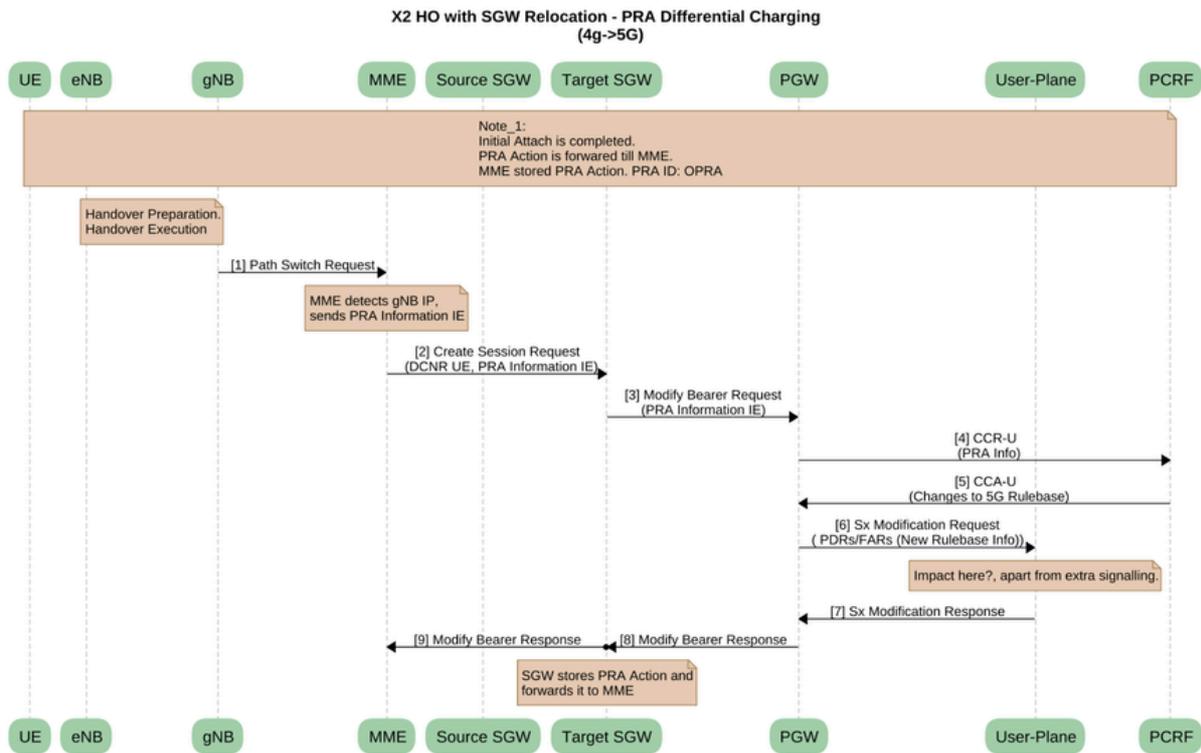
Element	High Level Changes
MME	Vendor specific solution, needs to be consulted with the MME vendor. Identify UE movement to gNB coverage. Send MBRs to PGW.
PGW	Support Presence Reporting Area reports (standard feature) Inform PCRF
SGW	Support Presence Reporting Area reports (standard feature)
PCRF	Support Presence Reporting Area reports (standard feature) Implement policies based on reports

- 推荐的解决方案是自定义的，尚未全局实施。
- 需要在VI网络中执行端到端现场测试
- 额外信令造成的CUPS UP/传统SPGW性能影响：
  - 吞吐量影响（SPGW上的额外信令和CUPS解决方案中增加的Sx修改）
  - 在4G/5G之间频繁切换UE将导致PRA信令增加
  - Rulebase更改导致的Slowpath/Fastpath流交换
- Cisco PCRF支持PRA功能
- 启用差分计费将在Gx接口上引起附加信令，这可能会影响PCRF性能。

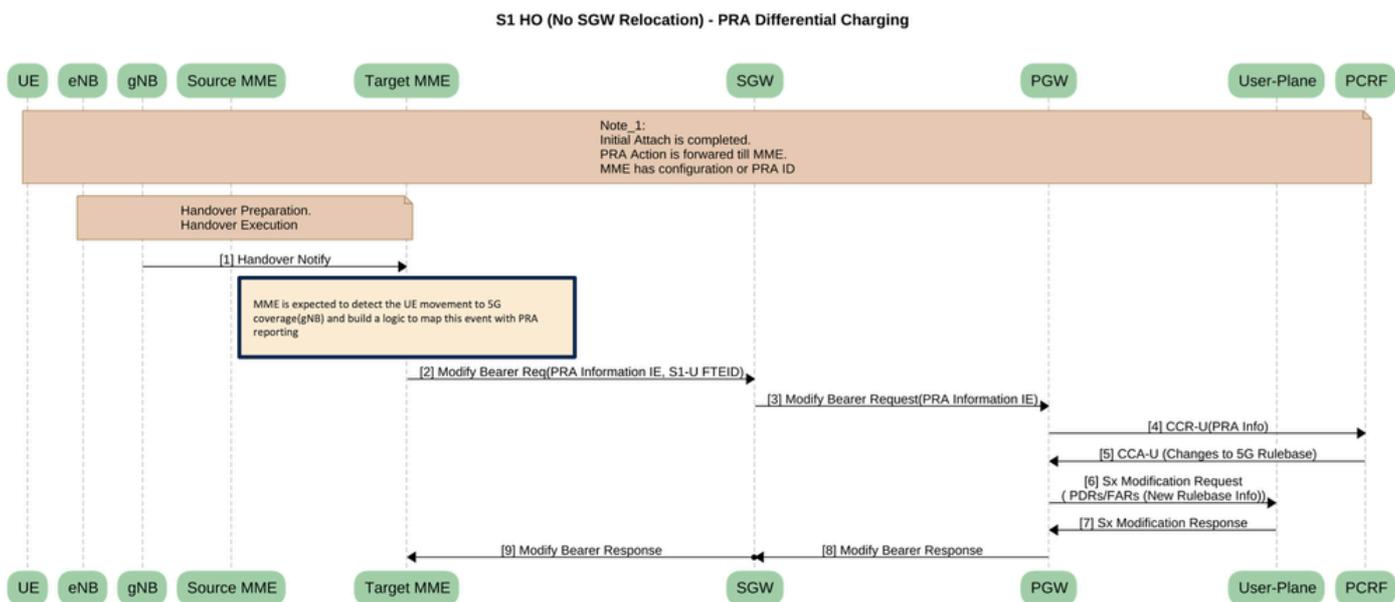
# 流



X2-HO - PRA差分充电

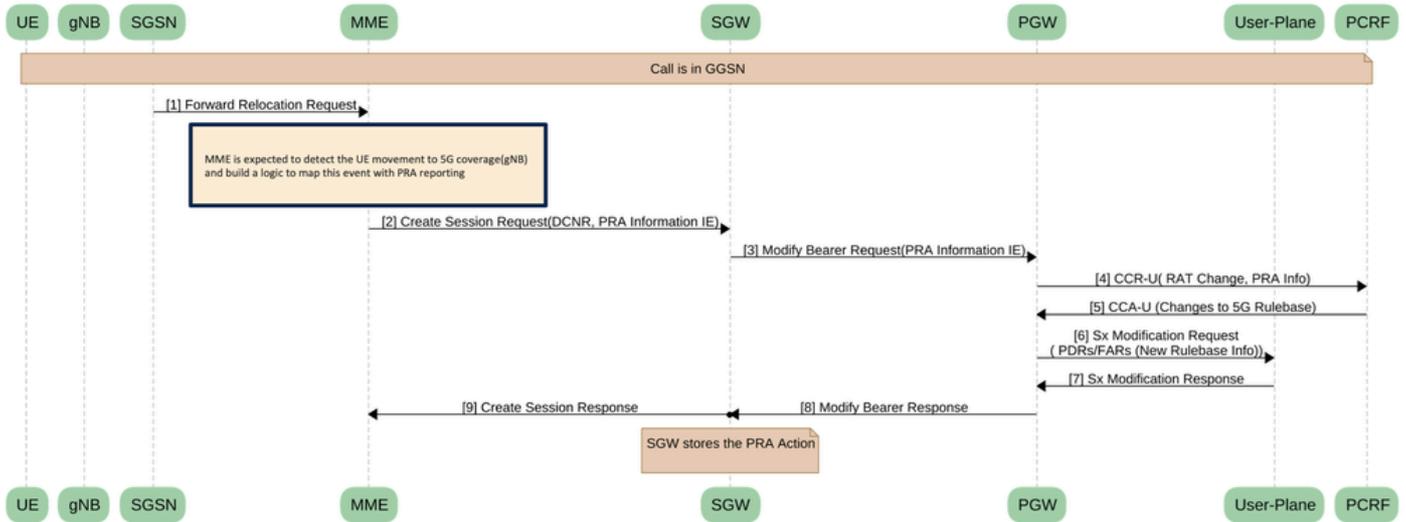


支持SGW重新定位的X2 HO - PRA差分充电(4g\*□g)



S1 HO ( 无SGW重新定位 ) - PRA差分计费

### GnGp (GGSN to PGW) HO - PRA Differential Charging (UE moving to 5g)



GnGp ( GGSN到PGW ) HO - PRA差分充电 ( UE移动到5g )

## 步骤

### MME结束配置更改

- 在mme-service中配置pra-profile并关联pra-profile。
- 最多可将50个IPv4子网和50个IPv6子网添加到pra-profile。  
目前仅支持pra-profile。
- 在任何时间点，从mme-service关联或解析pra-profile都不会重启mme-service。

```

config
  lte-policy
    pra-profile dcnr-5g-radio 5G-PRA
    gnb-s1u ipv6-prefix 2401:4900:4:84a4::/64
    gnb-s1u ipv6-prefix 2401:4900:2b::/48
    gnb-s1u ipv6-prefix 2401:4900:4:8601::2:540d
  exit
end
config
  context s1mme
    mme-service mme
    associate pra-profile dcnr-5g-radio 5G-PRA
  end

```

### GW配置更改

- 在ims-auth-service下配置endcode-supported-feature cno-uli。
- cno-uli启用在线状态报告区域信息报告功能。
- 配置单独的RG。将使用RG报告5G使用情况。

```

configure
 context context_name
  ims-auth-service service_name
  policy-control
  diameter encode-supported-features cno-uli
  { default | no } diameter encode-supported-features
  end

config
active-charging service ECS
  group-of-ruledefs NPR1_5G
  group-of-ruledefs-application gx-alias
  add-ruledef priority 2 ruledef RG_5G_default_IP_ANY_PrePaid
  add-ruledef priority 40 ruledef tethering_ip_ttl_RG
  exit

ruledef RG_5G_default_IP_ANY_PrePaid
  ip any-match = TRUE
  exit

rulebase <rulbase Name>
  action priority 702 static-and-dynamic ruledef RG_5G_default_IP_ANY_PrePaid charging-action 5G_IP_ANY_
  exit
end

```

## 注意：

- **diameter encode-supported-features**：启用或禁用支持功能AVP的编码和发送。

- 

cno-uli：启用在线状态报告区域信息报告功能。

- 

no：删除以前配置的受支持功能。

- 

default：应用此命令的默认设置。

确认

Wireshark捕获MME

Source	Destination	protocol	EPS Bearer ID	F-TEID IPv4	transportLayerAddress	Action	Inside Presence	AMBR	Info	uEAggregateMax
SGW-S11	MME-S11	GTPv2	5	172.25.64.221		Start Reporting chan...		300000	Create Session Response	
MME-S11	SGW-S11	GTPv2	5	100.92.59.57					Modify Bearer Request	
SGW-S11	MME-S11	GTPv2	5	10.1.159.103					Modify Bearer Response	
ENB	S1-MME	S1AP			2401:4900:4:84a4::82				E-RABModificationIndication	
MME-S11	SGW-S11	GTPv2	5				True		Modify Bearer Request	
SGW-S11	MME-S11	GTPv2	5	10.1.159.103					Modify Bearer Response	
S1-MME	ENB	S1AP							E-RABModificationConfirm	
SGW-S11	MME-S11	GTPv2	5					2000000	Update Bearer Request	
S1-MME	ENB	S1AP							UEContextModificationRequest	2000000000bits/s
MME-S11	SGW-S11	GTPv2	5						Update Bearer Response	
ENB	S1-MME	S1AP							UEContextModificationResponse	
ENB	S1-MME	S1AP							UEContextReleaseRequest [RadioNetwork-cause=user-ina...	
MME-S11	SGW-S11	GTPv2	5	100.92.59.57			False		Modify Bearer Request	
SGW-S11	MME-S11	GTPv2	5					300000	Update Bearer Request	
MME-S11	SGW-S11	GTPv2	5						Update Bearer Response	
SGW-S11	MME-S11	GTPv2	5	10.1.159.103					Modify Bearer Response	
SGW-S11	MME-S11	GTPv2	5					300000	Update Bearer Request	
S1-MME	ENB	S1AP							UEContextModificationRequest	3000000000bits/s
ENB	S1-MME	S1AP							UEContextModificationResponse	
MME-S11	SGW-S11	GTPv2	5						Update Bearer Response	
ENB	S1-MME	S1AP			2401:4900:4:84a4::82				E-RABModificationIndication	
MME-S11	SGW-S11	GTPv2	5				True		Modify Bearer Request	
SGW-S11	MME-S11	GTPv2	5	10.1.159.103					Modify Bearer Response	
S1-MME	ENB	S1AP							E-RABModificationConfirm	
SGW-S11	MME-S11	GTPv2	5					2000000	Update Bearer Request	
S1-MME	ENB	S1AP							UEContextModificationRequest	2000000000bits/s

ENB-UE-S1AP-ID: 7992141

当UE移动到5G, Inside Presence Reporting时, 显示为True。

当UE移动到4G, Inside Presence Reporting显示为False时。

### Wireshark捕获网关

Source	Destination	protocol	EPS Bearer ID	Action	Inside Pres	AMBR	Charging-Rule-Base-Name	Rating-Group	Info
GM	Gx	DIAMETER					BHARTI_VOLUME_PLAN		cmd-Credit-Control Request(272) flags=RP-- appl=3GPP Gx(1)
Gx	GM	DIAMETER							cmd-Credit-Control Answer(272) flags=P-- appl=3GPP Gx(1)
PGW-OUT	SGW-IN	GTPv2	5	Start Reporting change		300000			Create Session Response
PGW-OUT	SGW-IN	GTPv2	5	Start Reporting change		300000			Create Session Response
SGW-S11	MME-S11	GTPv2	5	Start Reporting change		300000			Create Session Request
MME-S11	SGW-S11	GTPv2	5						Modify Bearer Request
SGW-S11	MME-S11	GTPv2	5						Modify Bearer Response
GM	Gy	DIAMETER					PostpaidAirtelgprs.com	403	cmd-Credit-Control Request(272) flags=RP-- appl=Diameter
Gy	GM	DIAMETER						403	cmd-Credit-Control Answer(272) flags=P-- appl=Diameter
MME-S11	SGW-S11	GTPv2	5		True				Modify Bearer Request
SGW-IN	PGW-OUT	GTPv2	5		True				Modify Bearer Request
SGW-IN	PGW-OUT	GTPv2	5		True				Modify Bearer Request
GM	Gx	DIAMETER					BHARTI_VOLUME_PLAN,BHARTI_VOLUME_PLAN_5G		cmd-Credit-Control Request(272) flags=RP-- appl=3GPP Gx(1)
Gx	GM	DIAMETER							cmd-Credit-Control Answer(272) flags=P-- appl=3GPP Gx(1)
PGW-OUT	SGW-IN	GTPv2	5			2000000			Modify Bearer Request
PGW-OUT	SGW-IN	GTPv2	5						Update Bearer Request
PGW-OUT	SGW-IN	GTPv2	5						Modify Bearer Response
SGW-S11	MME-S11	GTPv2	5						Modify Bearer Response
PGW-OUT	SGW-IN	GTPv2	5			2000000			Update Bearer Request
SGW-S11	MME-S11	GTPv2	5			2000000			Update Bearer Request
GM	Gy	DIAMETER					PostpaidAirtelgprs.com	623	cmd-Credit-Control Request(272) flags=RP-- appl=Diameter
MME-S11	SGW-S11	GTPv2	5						Update Bearer Response
SGW-IN	PGW-OUT	GTPv2	5						Update Bearer Response
SGW-IN	PGW-OUT	GTPv2	5						Update Bearer Response
Gy	GM	DIAMETER						623	cmd-Credit-Control Answer(272) flags=P-- appl=Diameter
MME-S11	SGW-S11	GTPv2	5		False				Modify Bearer Request
SGW-IN	PGW-OUT	GTPv2	5		False				Modify Bearer Request
SGW-IN	PGW-OUT	GTPv2	5		False				Modify Bearer Request
GM	Gx	DIAMETER					BHARTI_VOLUME_PLAN_5G,BHARTI_VOLUME_PLAN		cmd-Credit-Control Request(272) flags=RP-- appl=3GPP Gx(1)
Gx	GM	DIAMETER							cmd-Credit-Control Answer(272) flags=P-- appl=3GPP Gx(1)
PGW-OUT	SGW-IN	GTPv2	5						Modify Bearer Request
PGW-OUT	SGW-IN	GTPv2	5			300000			Update Bearer Request

您可以看到UE何时移动到RG : 623报告的5G区域使用率, 而对于RG : 403报告的4G使用率。

当UE在5G中时, DRA会收到区域(0)中的Presence-reporting-area-status, 当UE在4G中时, DRA会收到区域(1)之外的PRESENCE-reporting-area-status。

```

  Supported-Features: 0000010a4000000c000028af0000027580000010000028af000000010000027680000010...
    > AVP: Vendor-Id(266) l=12 f=M- val=10415
    > AVP: Feature-List-ID(629) l=16 f=V-- vnd=3GPP val=1
    > AVP: Feature-List(630) l=16 f=V-- vnd=3GPP val=8388609
      AVP Code: 630 Feature-List
      > AVP Flags: 0x80, Vendor-Specific: Set
      AVP Length: 16
      AVP Vendor Id: 3GPP (10415)
      > GX Feature-List Flags: 0x00800001
        0... .. = CondPolicyInfo: Not supported
        .0.. .. = NetLoc-Untrusted-WLAN: Not supported
        ..0. .... = TSC: Not supported
        ...0 .... = NBIFOM: Not supported
        ....0... .. = ExUsage: Not supported
        .....0.. .. = ResShare: Not supported
        .....0. .... = Mission Critical QCI: Not supported
        .....0. .... = P-CSCF Restoration Enhancement: Not supported
        .....1... .. = Presence Reporting Area Information reporting: Supported
        .....0. .... = DAN and/or NAF release cause: Not supported

```

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CCR-I

当MME报告存在报告区域为true时，GW将 CCR-I 发送到PCRF，并 Presence Reporting Area Information : Supported.

```

  AVP: Presence-Reporting-Area-Information(2822) l=44 f=V-- vnd=3GPP
    AVP Code: 2822 Presence-Reporting-Area-Information
    > AVP Flags: 0x80, Vendor-Specific: Set
    AVP Length: 44
    AVP Vendor Id: 3GPP (10415)
  Presence-Reporting-Area-Information: 00000b05800000f000028af80000000000b05800000f000028af80000000
    > AVP: Presence-Reporting-Area-Identifier(2821) l=15 f=V-- vnd=3GPP val=800000
      AVP: Presence-Reporting-Area-Identifier(2821) l=15 f=V-- vnd=3GPP val=800000
        AVP Code: 2821 Presence-Reporting-Area-Identifier
        > AVP Flags: 0x80, Vendor-Specific: Set
        AVP Length: 15
        AVP Vendor Id: 3GPP (10415)
        Presence-Reporting-Area-Identifier: 800000
        Padding: 00
  AVP: Event-Trigger(1006) l=16 f=VM- vnd=3GPP val=CHANGE_OF_UE_PRESENCE_IN_PRESENCE_REPORTING_AREA_REPORT (48)
    AVP Code: 1006 Event-Trigger
    > AVP Flags: 0xc0, Vendor-Specific: Set, Mandatory: Set
    AVP Length: 16
    AVP Vendor Id: 3GPP (10415)
    Event-Trigger: CHANGE_OF_UE_PRESENCE_IN_PRESENCE_REPORTING_AREA_REPORT (48)

```

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CCA-I

```

> AVP: Session-Id(263) l=71 f=-M- val=0001-diamproxy.ue.pracups.gx;221084798;329321261;63a0c5ba-2d02
> AVP: Auth-Application-Id(258) l=12 f=-M- val=3GPP Gx (16777238)
> AVP: Origin-Host(264) l=37 f=-M- val=0001-diamproxy.ue.pracups.gx
> AVP: Origin-Realm(296) l=41 f=-M- val=pgw.mnc054.mcc405.3gppnetwork.org
> AVP: Destination-Realm(283) l=35 f=-M- val=delsdp85vip.airtelindia.com
> AVP: CC-Request-Type(416) l=12 f=-M- val=UPDATE_REQUEST (2)
> AVP: CC-Request-Number(415) l=12 f=-M- val=1
> AVP: Destination-Host(293) l=33 f=-M- val=delsdp85a.airtelindia.com
> AVP: Origin-State-Id(278) l=12 f=-M- val=1670878206
> AVP: Subscription-Id(443) l=40 f=-M-
> AVP: Subscription-Id(443) l=44 f=-M-
> AVP: Framed-IP-Address(8) l=12 f=-M- val=100.72.107.141 (100.72.107.141)
> AVP: Framed-IPv6-Prefix(97) l=18 f=-M- val=2401:4900:5db1:f7e7::/64
> AVP: User-Equipment-Info(458) l=44 f=-M-
> AVP: Called-Station-Id(30) l=22 f=-M- val=airtelgprs.com
> AVP: Event-Trigger(1006) l=16 f=VM- vnd=TGPP val=CHANGE_OF_UE_PRESENCE_IN_PRESENCE_REPORTING_AREA_REPORT (48)
> AVP: Access-Network-Charging-Address(501) l=18 f=VM- vnd=TGPP val=117.96.117.8 (117.96.117.8)
✓ AVP: Presence-Reporting-Area-Information(2822) l=44 f=V-- vnd=TGPP
  AVP Code: 2822 Presence-Reporting-Area-Information
  > AVP Flags: 0x80, Vendor-Specific: Set
  AVP Length: 44
  AVP Vendor Id: 3GPP (10415)
  ✓ Presence-Reporting-Area-Information: 00000b05800000f000028af80000000000b07800001000028af00000000
    > AVP: Presence-Reporting-Area-Identifier(2821) l=15 f=V-- vnd=TGPP val=800000
    ✓ AVP: Presence-Reporting-Area-Status(2823) l=16 f=V-- vnd=TGPP val=In area (0)
      AVP Code: 2823 Presence-Reporting-Area-Status
      > AVP Flags: 0x80, Vendor-Specific: Set
      AVP Length: 16
      AVP Vendor Id: 3GPP (10415)
      Presence-Reporting-Area-Status: In area (0)

```

## CCR-U

Source	Destination	APN-Aggr	CC-Req	Prese	RAT	QoS-	Info	Charging-Rule-Ba	Event-Trigger
GW-GX	DRA-GX	2147484900	INITIAL_REQ		EUTRAN	QCI_9	cmd=Credit-Control Request(		
DRA->PCRF	PCRF	2147484900	INITIAL_REQ		EUTRAN	QCI_9	cmd=Credit-Control Request(		
PCRF	DRA->PCRF	3000000000	INITIAL_REQ			QCI_9	cmd=Credit-Control Answer(2	BHARTI_NPRI1	QOS_CHANGE,RAT_CHANGE,PLMN_CHANGE,DEFAULT_EPS_BEARER_QOS_CHANGE,REVALIDATION_TIMEOUT
DRA-GX	GW-GX	3000000000	INITIAL_REQ			QCI_9	cmd=Credit-Control Answer(2	BHARTI_NPRI1	QOS_CHANGE,RAT_CHANGE,PLMN_CHANGE,DEFAULT_EPS_BEARER_QOS_CHANGE,REVALIDATION_TIMEOUT,CHANGE_OF_UE_PRESENCE_IN_PRESENCE_REPORTING_AR
GW-GX	DRA-GX		UPDATE_REQ	In area			cmd=Credit-Control Request(		CHANGE_OF_UE_PRESENCE_IN_PRESENCE_REPORTING_AREA_REPORT
DRA->PCRF	PCRF		UPDATE_REQ		GAN		cmd=Credit-Control Request(		
PCRF	DRA->PCRF	2000000000	UPDATE_REQ			QCI_6	cmd=Credit-Control Answer(2	BHARTI_NPRI1,BHARTI_NPRI1_5G	QOS_CHANGE,RAT_CHANGE,PLMN_CHANGE,DEFAULT_EPS_BEARER_QOS_CHANGE,REVALIDATION_TIMEOUT
DRA-GX	GW-GX	2000000000	UPDATE_REQ			QCI_6	cmd=Credit-Control Answer(2	BHARTI_NPRI1,BHARTI_NPRI1_5G	QOS_CHANGE,RAT_CHANGE,PLMN_CHANGE,DEFAULT_EPS_BEARER_QOS_CHANGE,REVALIDATION_TIMEOUT,CHANGE_OF_UE_PRESENCE_IN_PRESENCE_REPORTING_AR
GW-GX	DRA-GX		UPDATE_REQ	Out of			cmd=Credit-Control Request(		CHANGE_OF_UE_PRESENCE_IN_PRESENCE_REPORTING_AREA_REPORT
DRA->PCRF	PCRF		UPDATE_REQ		EUTRAN		cmd=Credit-Control Request(		
PCRF	DRA->PCRF	3000000000	UPDATE_REQ			QCI_9	cmd=Credit-Control Answer(2	BHARTI_NPRI1_5G,BHARTI_NPRI1	QOS_CHANGE,RAT_CHANGE,PLMN_CHANGE,DEFAULT_EPS_BEARER_QOS_CHANGE,REVALIDATION_TIMEOUT
DRA-GX	GW-GX	3000000000	UPDATE_REQ			QCI_9	cmd=Credit-Control Answer(2	BHARTI_NPRI1_5G,BHARTI_NPRI1	QOS_CHANGE,RAT_CHANGE,PLMN_CHANGE,DEFAULT_EPS_BEARER_QOS_CHANGE,REVALIDATION_TIMEOUT,CHANGE_OF_UE_PRESENCE_IN_PRESENCE_REPORTING_AR
GW-GX	DRA-GX		UPDATE_REQ	In area			cmd=Credit-Control Request(		CHANGE_OF_UE_PRESENCE_IN_PRESENCE_REPORTING_AREA_REPORT
DRA->PCRF	PCRF		UPDATE_REQ		GAN		cmd=Credit-Control Request(		
PCRF	DRA->PCRF	2000000000	UPDATE_REQ			QCI_6	cmd=Credit-Control Answer(2	BHARTI_NPRI1,BHARTI_NPRI1_5G	QOS_CHANGE,RAT_CHANGE,PLMN_CHANGE,DEFAULT_EPS_BEARER_QOS_CHANGE,REVALIDATION_TIMEOUT
DRA-GX	GW-GX	2000000000	UPDATE_REQ			QCI_6	cmd=Credit-Control Answer(2	BHARTI_NPRI1,BHARTI_NPRI1_5G	QOS_CHANGE,RAT_CHANGE,PLMN_CHANGE,DEFAULT_EPS_BEARER_QOS_CHANGE,REVALIDATION_TIMEOUT,CHANGE_OF_UE_PRESENCE_IN_PRESENCE_REPORTING_AR

## GW - DRA - PCRF

在此，您可以看到，每当DRA从GW接收In area (0)或out of area (1)的presence-reporting-area-status时，它都将以GAN和EUTRAN的形式向PCRF发送rat类型。在此基础之上，PCRF正在改变规则库和修改4G和5G的QOS。

## 关于此翻译

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