基於PRA的4G和5G NSA使用者差分計費

目錄

簡介

必要條件

- 需求
- 採用元件

背景資訊

PRA ID解決方案概述

縮寫

可能的影響和注意事項

程式

MME結束配置更改

GW配置更改

驗證

- Wireshark捕獲MME
- Wireshark捕獲GW

簡介

本文檔介紹基於線上狀態報告區(PRA)的差分國家安全局(NSA)線上計費解決方案。

必要條件

需求

思科建議您瞭解以下主題：

- PRA
- 行動化管理實體(MME)
- 思科服務閘道(SGW)/思科封包資料網路閘道(PGW)
- 原則和計費規則功能(PCRF)

還有，

- 支援PRA功能增強的MME將「S1-U IP地址」對映到「PRA ID」
- PGW支援面向PCRF的PRA觸發器
- PCRF在從GW收到In area (0)或out of area (1)的presence-reporting-area-status後安裝新的pcc規則庫

採用元件

本文檔中的資訊基於StarOS：21.28.mx。

本文中的資訊是根據特定實驗室環境內的裝置所建立。文中使用到的所有裝置皆從已清除（預設）的組態來啟動。如果您的網路運作中，請確保您瞭解任何指令可能造成的影響。

背景資訊

此功能用於支援在5G NSA設定中為預付使用者（線上計費）區分4G和5G客戶計費的要求。

PRA是在3GPP分組域內定義的區域，用於報告該區域內的UE存在情況，以便進行策略控制和/或計費。
對於NSA差分更改，PRA功能用於報告4G和5G中的使用者存在。

PRA ID解決方案概述

MME的期望：

- MME預計將檢測UE從4G到5G覆蓋範圍(gNB)的移動，反之亦然，從而構建邏輯來將此事件與PRA報告進行對映。
- PRA ID應與PCRF中配置的差分計費相同。
- 僅適用於DCNR UE。

PCRF訂閱PRA事件觸發器，

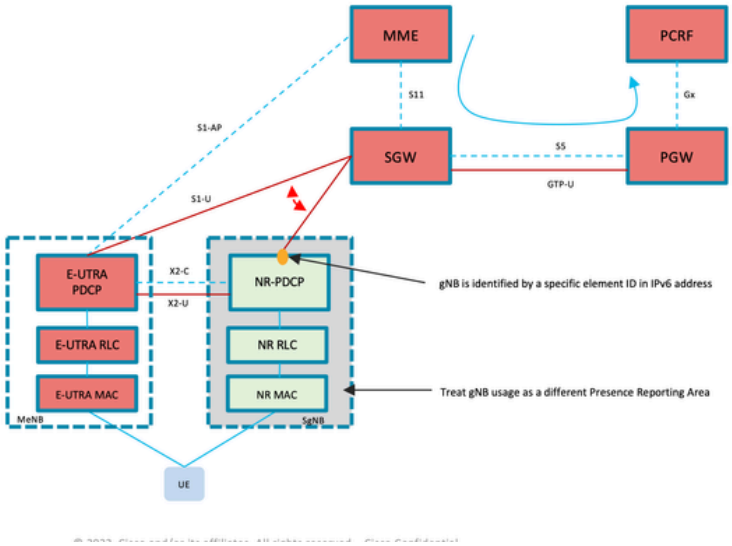
- PGW儲存PRA操作並轉發到SGW

發生4G到5G轉換時（S1通道交換器）：

- 根據gNB傳輸地址，MME將PRA ID狀態標籤為OPRA（在5G覆蓋範圍內）/IPRA（在5G覆蓋範圍內）
- MME將PRA資訊傳送到SGW，SGW轉發到PGW

PGW從SGW接收PRA資訊並轉發到PCRF

- PCRF根據PRA資訊更改規則庫
- 使用者平面與規則庫的更改通訊



- 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

高級設定架構

縮寫

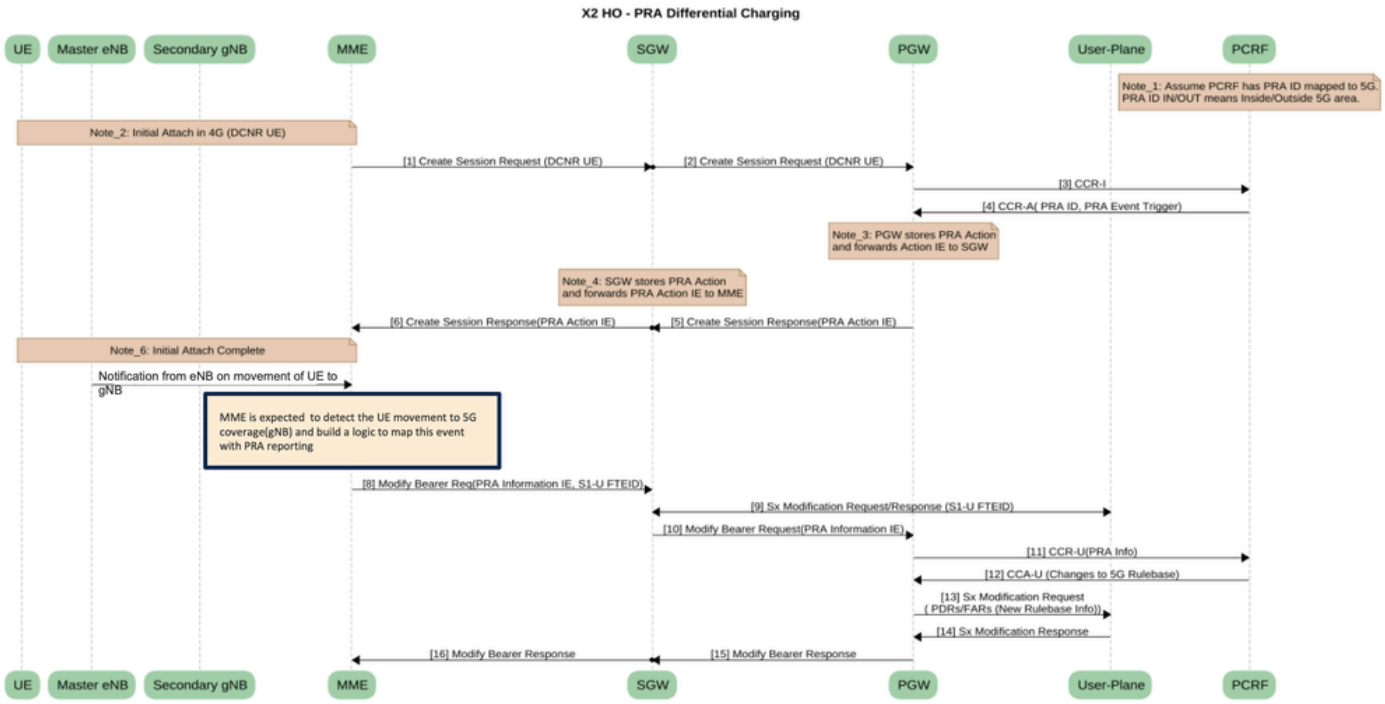
PRA	線上狀態報告區域
OCS	線上計費系統
GW	網關(GGSN/PGW)
PCRF	策略和計費規則功能
MOP	程式方法
MME	移動管理實體
SGW	服務閘道
PGW	資料包網關

可能的影響和注意事項

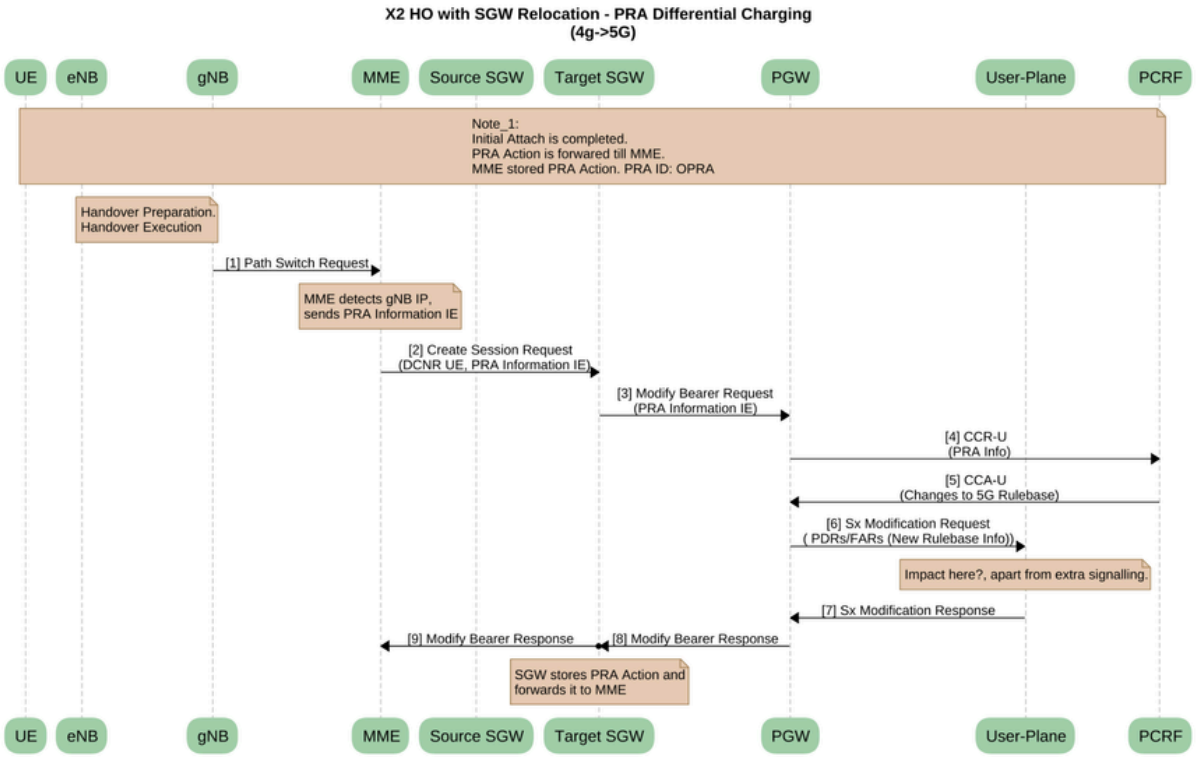
- 僅針對5G NSA部署的Option3x模式建議的解決方案。
- 由於UE移動從4G跟蹤到5G和5G跟蹤到4G，因此此跟蹤會通知到SGW/PGW，因此預計會有大量的CCR-U。

- 建議的解決方案是定製的，尚未全局實施。
- 需要在VI網路中執行端到端現場測試
- 額外信令對CUPS UP/傳統SPGW效能的影響：
  - 吞吐量影響（對SPGW的額外信令+在CUPS解決方案中增加的Sx修改）
  - 在4G/5G之間頻繁切換UE將導致PRA的信令增加
  - 由於Rulebase更改而導致Slowpath/Fastpath流切換
- Cisco PCRF支援PRA功能
- 啟用差分計費將在Gx介面上引起額外的信令，這會影響PCRF效能。

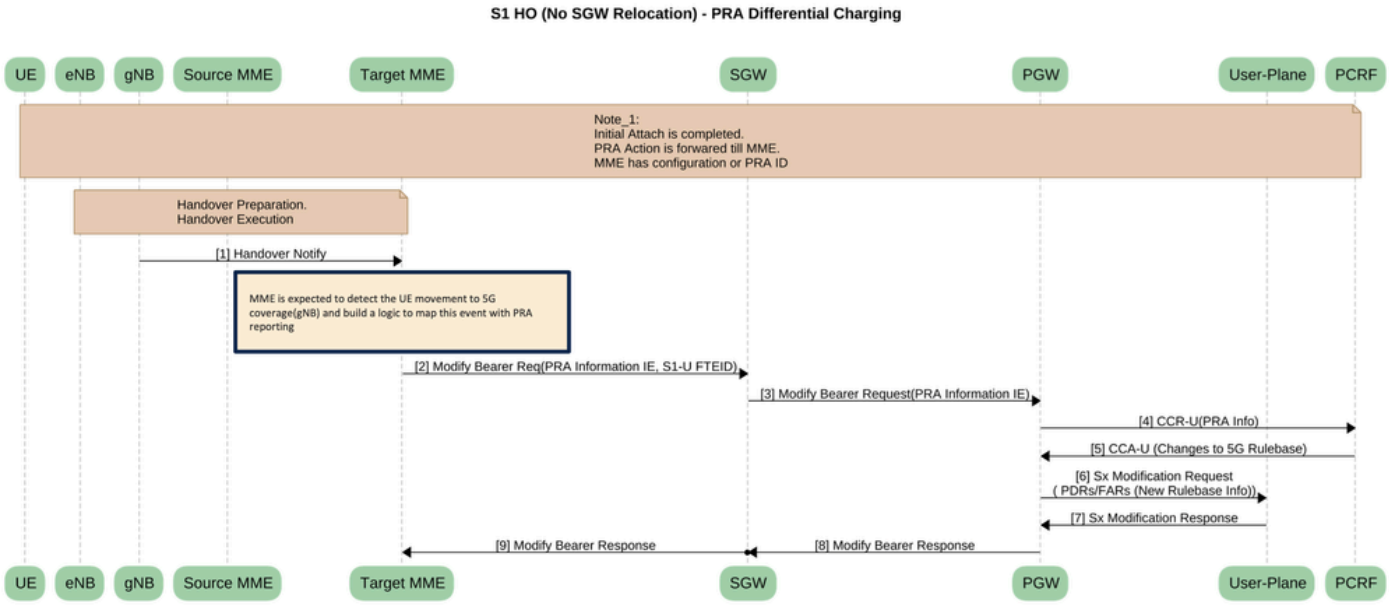
流程



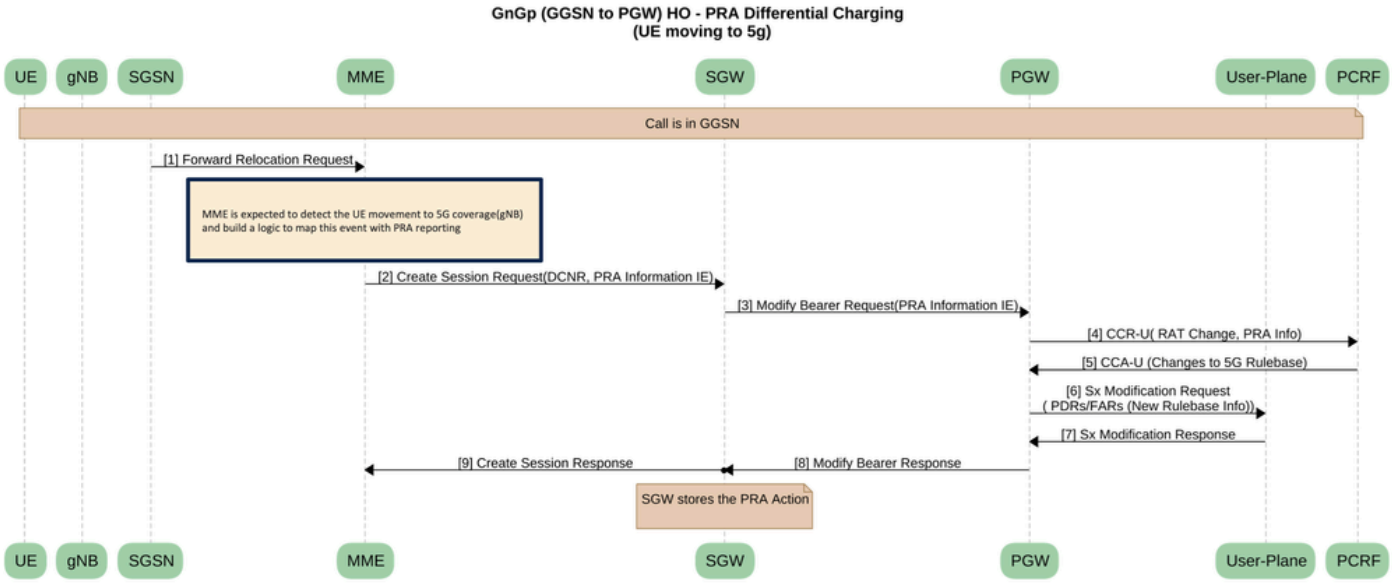
X2-HO - PRA差分充電



含SGW重新定位的X2 HO - PRA差分充電(4g✳□g)



S1 HO（無SGW重新定位） - PRA差分計費



GnGp（GGSN到PGW）HO - PRA差分計費（UE移動到5g）

程式

MME結束配置更改

- 在mme-service中配置pra-profile並關聯pra-profile。
- 最多可將50個IPv4子網和50個IPv6子網增加到pra-profile。
  目前只支援pra-profile。
- 在任何時間點，從mme-service關聯或解析pra-profile都不會重新啟動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啟用線上狀態報告區域資訊報告功能。
- 配置單獨的RG。RG將用於報告5G使用情況。

```
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
```

附註：

- **diameter encode-supported-features** ：啟用或停用受支援功能AVP的編碼和傳送。

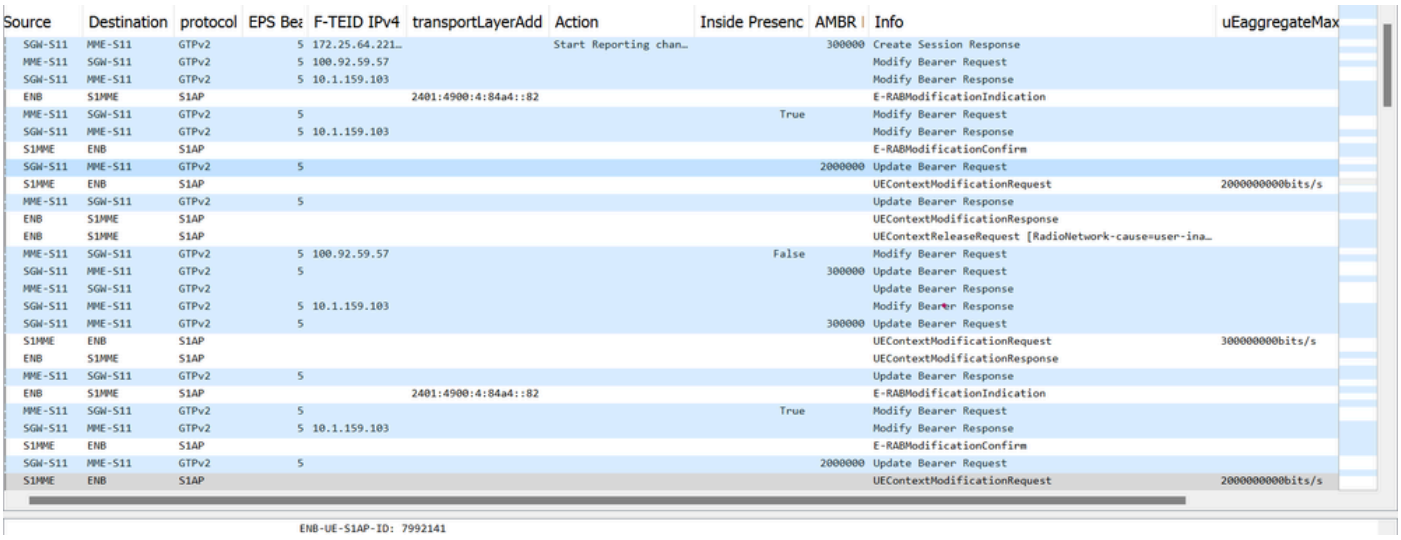
  - cno-uli ：啟用線上狀態報告區域資訊報告功能。

  - no ：刪除以前配置的支援功能。

  - default：套用此命令的預設設定。

驗證

Wireshark捕獲MME



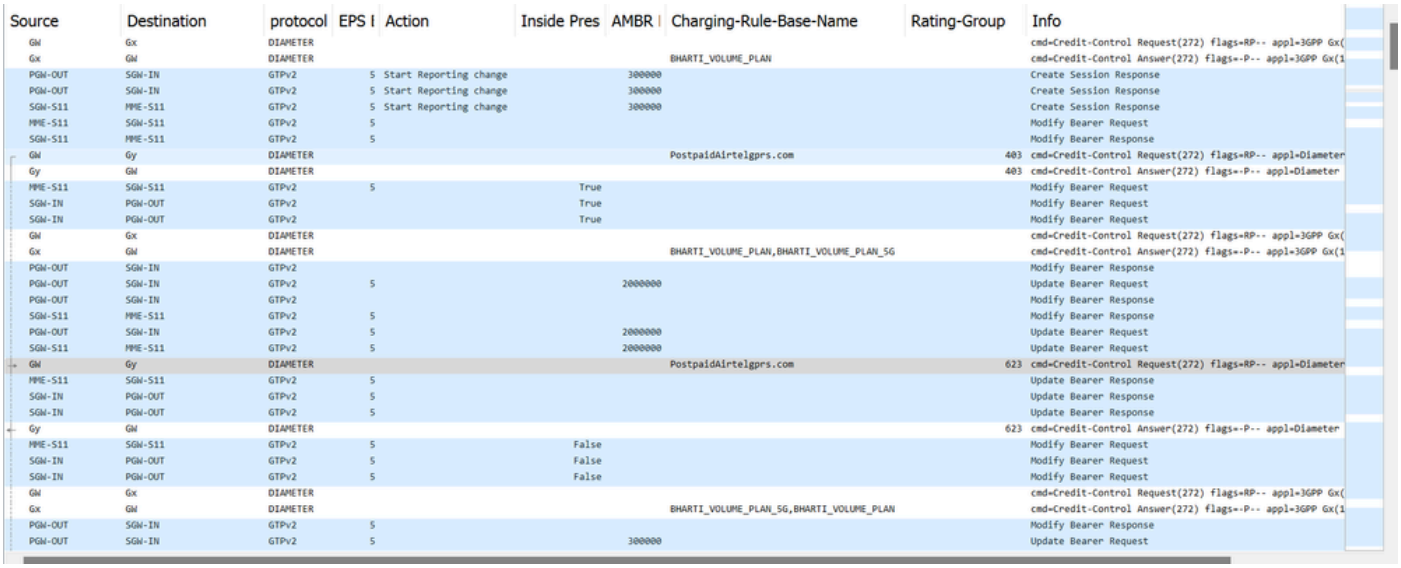
Source	Destination	protocol	EPS Bea	F-TEID IPv4	transportLayerAdd	Action	Inside Presenc	AMBR	Info	uEaggregateMax
SGW-S11	MME-S11	GTPv2	5	172.25.64.221…		Start Reporting chan…		300000	Create Session Response	
MME-S11	SGW-S11	GTPv2	5	100.92.59.57					Modify Bearer Request	
SGW-S11	MME-S11	GTPv2	5	10.1.159.103					Modify Bearer Response	
ENB	S1MME	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	
S1MME	ENB	S1AP							E-RABModificationConfirm	
SGW-S11	MME-S11	GTPv2	5					2000000	Update Bearer Request	
S1MME	ENB	S1AP							UEContextModificationRequest	2000000000bits/s
MME-S11	SGW-S11	GTPv2	5						Update Bearer Response	
ENB	S1MME	S1AP							UEContextModificationResponse	
ENB	S1MME	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							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	
S1MME	ENB	S1AP							UEContextModificationRequest	300000000bits/s
ENB	S1MME	S1AP							UEContextModificationResponse	
MME-S11	SGW-S11	GTPv2	5						Update Bearer Response	
ENB	S1MME	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	
S1MME	ENB	S1AP							E-RABModificationConfirm	
SGW-S11	MME-S11	GTPv2	5					2000000	Update Bearer Request	
S1MME	ENB	S1AP							UEContextModificationRequest	2000000000bits/s

ENB-UE-S1AP-ID: 7992141

當UE移至5G, Inside Presence Reporting時，顯示為True。

當UE移動到4G, Inside Presence Reporting顯示為False時。

Wireshark捕獲GW



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

您可以看到UE何時移至RG： 623報告的5G區域使用率，而對於RG： 403報告的4G使用率。

當UE在5G中時，DRA將接收區域(0)中的Presence-reporting-area-status；當UE在4G中時，DRA將接收區域(1)之外的區域(0)。

```
Supported-Features: 0000010a4000000c000028af000002758000001000028af000000010000027680000010…
    AVP: Vendor-Id(266) l=12 f=-M- val=10415
    AVP: Feature-List-ID(629) l=16 f=V-- vnd=TGPP val=1
    AVP: Feature-List(630) l=16 f=V-- vnd=TGPP 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 QCIs: Not supported
            .... ...0 .... .... .... .... .... .... = P-CSCF Restoration Enhancement: Not supported
            .... .... 1... .... .... .... .... .... = Presence Reporting Area Information reporting: Supported
```

CCRI

當MME報告存在報告區域為true時，GW將 **CCR-I** 與PCRF **Presence Reporting Area Information : Supported**.

```
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: 00000b05800000f000028af800000000000b05800000f000028af80000000
        AVP: Presence-Reporting-Area-Identifier(2821) l=15 f=V-- vnd=TGPP val=800000
        AVP: Presence-Reporting-Area-Identifier(2821) l=15 f=V-- vnd=TGPP 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=TGPP 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)
```

CCA-I

```
> AVP: Session-Id(263) l=71 f=-M- val=0001-diamproxy.upe.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.upe.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)
v 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)
    v Presence-Reporting-Area-Information: 00000b058000000f000028af8000000000000b078000001000028af00000000
        > AVP: Presence-Reporting-Area-Identifier(2821) l=15 f=V-- vnd=TGPP val=800000
        v 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	Destinati	APN-Agg	CC-Req	Prese	RAT	QoS-	Info	Charging-Rule-Ba	Event-Trigger
GW-GX	DRA-GX	2147484000	INITIAL_RE…		EUTRAN	QCI_9	cmd=Credit-Control Request(…		
DRA->PCRF	PCRF	2147484000	INITIAL_RE…		EUTRAN	QCI_9	cmd=Credit-Control Request(…		
PCRF	DRA->PCRF	300000000	INITIAL_RE…			QCI_9	cmd=Credit-Control Answer(2…	BHARTI_NPR1	QOS_CHANGE,RAT_CHANGE,PLMN_CHANGE,DEFAULT_EPS_BEARER_QOS_CHANGE,REVALIDATION_TIMEOUT
DRA-GX	GW-GX	300000000	INITIAL_RE…			QCI_9	cmd=Credit-Control Answer(2…	BHARTI_NPR1	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_NPR1,BHARTI_NPR1_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_NPR1,BHARTI_NPR1_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	300000000	UPDATE_REQ…			QCI_9	cmd=Credit-Control Answer(2…	BHARTI_NPR1_5G,BHARTI_NPR1	QOS_CHANGE,RAT_CHANGE,PLMN_CHANGE,DEFAULT_EPS_BEARER_QOS_CHANGE,REVALIDATION_TIMEOUT
DRA-GX	GW-GX	300000000	UPDATE_REQ…			QCI_9	cmd=Credit-Control Answer(2…	BHARTI_NPR1_5G,BHARTI_NPR1	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_NPR1,BHARTI_NPR1_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_NPR1,BHARTI_NPR1_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，每當DRA從GW收到In area (0)或out of area (1)的presence-reporting-area-status時，它都將以GAN和EUTRAN的形式分別向PCRF傳送大鼠型別。基於這種鼠型PCRF正在改變規則庫，並修改4G和5G的QOS。

關於此翻譯

思科已使用電腦和人工技術翻譯本文件，讓全世界的使用者能夠以自己的語言理解支援內容。請注意，即使是最佳機器翻譯，也不如專業譯者翻譯的內容準確。Cisco Systems, Inc. 對這些翻譯的準確度概不負責，並建議一律查看原始英文文件（提供連結）。