

ASR5x00:SGSN抑制的扩展比特率下行链路参数

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简介

本文档描述了一种特定场景，其中扩展比特率参数由服务GPRS支持节点(SGSN)抑制。此问题在思科集成多业务路由器(ASR)5x00上报告。

问题

漫游用户在漫游时无法建立分组数据协议(PDP)环境，因为SGSN拒绝资源不足的PDP原因代码字段，因此3G漫游呼叫未正确设置。漫游归属位置寄存器(HLR)在最大比特率下行链路(DL)中发送0 kbps值，并且添加扩展服务质量(QoS)，而不考虑无线接入类型(RAT)类型。但SGSN忽略扩展QoS并以0 kbps的速率向网关GPRS支持节点(GGSN)发送创建PDP请求消息，从而导致无线接入承载(RAB)分配失败。

场景

根据第3代合作伙伴计划(3GPP)技术规范(TS)24.008规范，其明确声明：

下行链路的最大比特率，二进制八位数9（请参阅3GPP TS 23.107 [81]）

编码与上行链路的最大比特率相同。

如果发送实体希望指示下行链路的最大比特率高于8640 kbps，它应将二进制八位数9设置为“11111110”，即8640 kbps，并应将最大比特率值编码为二进制八位数15。

在此版本的协议中，对于本文档中指定的消息，发送实体不应同时请求0 kbps的下行链路最大比特率和上行链路最大比特率。如果任何实体在下行链路的最大比特率和上行链路的最大比特率中都收到0 kbps的请求，则应将其视为语法错误（参见第8条）。

场景 1.

HLR发送8640 kbps，SGSN的行为基于RAT类型。

对于2G:

Thursday October 02 2014

INBOUND>>>> 23:41:57:019 Eventid:87113(0)

==> GSM Mobile Application (MAP) (0x94) (148 bytes)

Component : Invoke(1)

Component Length : Indefinite length format (0x80)

Invoke

Invoke ID

Tag : 0x02

Length : 1 (0x01)

Value : 0x02

Local Operation Code

Tag : 0x02

Length : 1 (0x01)

Value : 0x07

MAP Insert Subscriber Data Request

Ext-QoS Subscribed

Tag : 0x80

Length : 9 (0x09)

Value : 0x01 6b 96 eb fe 74 01 00 00

Allocation/Retention Priority : 1 (0x01)

011. Traffic Class : Interactive Class (0x3)

...0 1... Delivery Order : With delivery order ('yes') (0x1)

.... .011 Delivery of Erroneous SDUs : Erroneous SDUs are not delivered ('no') (0x3)

Maximum SDU Size : 1500 octets (0x96)

Max. bit rate for Uplink : 7424 kbps (0xeb)

Max. bit rate for Downlink : 8640 kbps (0xfe)

0111 Residual BER : 1*10⁻⁵ (0x7)

.... 0100 SDU Error Ratio : 1*10⁻⁴ (0x4)

0000 00.. Transfer Delay : Reserved (0x0)

.... ..01 Traffic Handling Priority : Priority Level 1 (0x1)

Guaranteed bit rate for Uplink : Reserved (0x00)

Guaranteed bit rate for Downlink : Reserved (0x00)

Ext2-QoS Subscribed

Tag : 0x82

Length : 3 (0x03)

Value : 0x00 50 00

000. Spare : 0

...0 Signalling Indication : Not optimised for signalling traffic

.... 0000 Source Statistics Descriptor : Unknown (0x0)

Maximum bit rate for Downlink (Extended) : 22 mbps (0x50)

Guaranteed bit rate for Downlink (Extended) : Use the value indicated by the Guaranteed bit rate for downlink (0x00)

Now if we see create PDP request, we can see this is a 2G call, we cannot provide 8640 kbps so SGSN has downgraded and didn't included extended BIT RATE.

Thursday October 02 2014

<<<<OUTBOUND 23:42:00:845 Eventid:116004(3)

GTPC Tx PDU, from 223.224.40.249:19001 to 223.224.40.1:2123 (166)

TEID: 0x00000000, Message type: GTP_CREATE_PDP_CONTEXT_REQ_MSG (0x10)

Message Type: 0x10 (GTP_CREATE_PDP_CONTEXT_REQ_MSG)

Delivery order: 0x2 (Without delivery order ('no'))

Delivery of erroneous SDU: 0x3 (Erroneous SDUs are not delivered ('no'))

Maximum SDU size: 0x96 (1500 octets)

Max bit rate for uplink: 0x73 (472 kbps)

Max bit rate for downlink: 0x73 (472 kbps)

Residual BER: 0x7 (1/100 000 = 1x10⁻⁵)

SDU error ratio: 0x4 (1/10 000 = 1x10⁻⁴)
Transfer delay: 0x01 (10 ms)
Traffic handling priority: 0x1 (Priority level 1)
Guaranteed bit rate (UL): 0xFF (0 kbps)
Guaranteed bit rate (DL): 0xFF (0 kbps)
Spare Octet4: 0x0 (0)
Signalling Indication: 0x0 (No)
Source Statistics Descr: 0x0 (Unknown)
COMMON FLAGS END.
Radio Access Technology: GERAN

对于3G:

Thursday October 02 2014
INBOUND>>>> 23:43:34:993 Eventid:87113(0)

==> GSM Mobile Application (MAP) (0x94) (148 bytes)

MAP Insert Subscriber Data Request
Parameter Sequence Tag

Ext-QoS Subscribed
Tag : 0x80
Length : 9 (0x09)
Value : 0x01 6b 96 eb fe 74 01 00 00
Allocation/Retention Priority : 1 (0x01)
011. Traffic Class : Interactive Class (0x3)
...0 1... Delivery Order : With delivery order ('yes') (0x1)
.... .011 Delivery of Erroneous SDUs : Erroneous SDUs are not delivered ('no') (0x3)
Maximum SDU Size : 1500 octets (0x96)
Max. bit rate for Uplink : 7424 kbps (0xeb)
Max. bit rate for Downlink : 8640 kbps (0xfe)
0111 Residual BER : 1*10⁻⁵ (0x7)
.... 0100 SDU Error Ratio : 1*10⁻⁴ (0x4)
0000 00.. Transfer Delay : Reserved (0x0)
.... ..01 Traffic Handling Priority : Priority Level 1 (0x1)
Guaranteed bit rate for Uplink : Reserved (0x00)
Guaranteed bit rate for Downlink : Reserved (0x00)
Ext2-QoS Subscribed
Tag : 0x82
Length : 3 (0x03)
Value : 0x00 50 00
000. Spare : 0
...0 Signalling Indication : Not optimised for signalling traffic
.... 0000 Source Statistics Descriptor : Unknown (0x0)
Maximum bit rate for Downlink (Extended) : 22 mbps (0x50)
Guaranteed bit rate for Downlink (Extended) : Use the value indicated by the Guaranteed bit rate for downlink (0x00)

Thursday October 02 2014
<<<<OUTBOUND 23:43:41:388 Eventid:116004(3)
GTPC Tx PDU, from 223.224.40.249:19001 to 223.224.40.1:2123 (168)
TEID: 0x00000000, Message type: GTP_CREATE_PDP_CONTEXT_REQ_MSG (0x10)
Sequence Number:: 0x217C (8572)
CHARGING CHARACTERISTIC ENDS.
END USER ADDRESS FOLLOWS:
PDP Type Organisation: IETF

PDP Type Number: IPv4
Address: Empty
END USER ADDRESS ENDS.
Access Point Name: airtelgprs.com
Max bit rate for uplink: 0xEB (7424 kbps)
Max bit rate for downlink: 0xFE (8640 kbps)
Residual BER: 0x7 (1/100 000 = 1x10⁻⁵)
SDU error ratio: 0x4 (1/10 000 = 1x10⁻⁴)
Source Statistics Descr: 0x0 (Unknown)
Ext Max bit rate (DL): 0x50 (22000 kbps) <<<<<< Included in the message.
Ext Guaranteed bit rate(DL): 0x00 (Reserved)
QOS PROFILE ENDS.
COMMON FLAGS END.
Radio Access Technology: UTRAN

场景 2 :

HLR正在发送8640 kbps。

Thursday October 02 2014
INBOUND>>>> 23:43:34:993 Eventid:87113(0)

==> GSM Mobile Application (MAP) (0x94) (148 bytes)

MAP Insert Subscriber Data Request
Parameter Sequence Tag

Ext-QoS Subscribed
Tag : 0x80
Length : 9 (0x09)
Value : 0x01 6b 96 eb fe 74 01 00 00
Allocation/Retention Priority : 1 (0x01)
011. Traffic Class : Interactive Class (0x3)
...0 1... Delivery Order : With delivery order ('yes') (0x1)
.... .011 Delivery of Erroneous SDUs : Erroneous SDUs are not delivered ('no') (0x3)
Maximum SDU Size : 1500 octets (0x96)
Max. bit rate for Uplink : 7424 kbps (0xeb)
Max. bit rate for Downlink : 8640 kbps (0xfe)
0111 Residual BER : 1*10⁻⁵ (0x7)
.... 0100 SDU Error Ratio : 1*10⁻⁴ (0x4)
0000 00.. Transfer Delay : Reserved (0x0)
.... ..01 Traffic Handling Priority : Priority Level 1 (0x1)
Guaranteed bit rate for Uplink : Reserved (0x00)
Guaranteed bit rate for Downlink : Reserved (0x00)
Ext2-QoS Subscribed
Tag : 0x82
Length : 3 (0x03)
Value : 0x00 50 00
000. Spare : 0
...0 Signalling Indication : Not optimised for signalling traffic
.... 0000 Source Statistics Descriptor : Unknown (0x0)
Maximum bit rate for Downlink (Extended) : 22 mbps (0x50)
Guaranteed bit rate for Downlink (Extended) : Use the value indicated by the Guaranteed bit rate for downlink (0x00)

Thursday October 02 2014
<<<<OUTBOUND 23:43:41:388 Eventid:116004(3)
GTPC Tx PDU, from 223.224.40.249:19001 to 223.224.40.1:2123 (168)
TEID: 0x00000000, Message type: GTP_CREATE_PDP_CONTEXT_REQ_MSG (0x10)
Sequence Number:: 0x217C (8572)
CHARGING CHARACTERISTIC ENDS.

END USER ADDRESS FOLLOWS:
PDP Type Organisation: IETF
PDP Type Number: IPv4
Address: Empty
END USER ADDRESS ENDS.
Access Point Name: airtelgprs.com
Max bit rate for uplink: 0xEB (7424 kbps)
Max bit rate for downlink: 0xFE (8640 kbps)
Residual BER: 0x7 (1/100 000 = 1x10⁻⁵)
SDU error ratio: 0x4 (1/10 000 = 1x10⁻⁴)
Source Statistics Descr: 0x0 (Unknown)
Ext Max bit rate (DL): 0x50 (22000 kbps) <<<<<< Included in the message.
Ext Guaranteed bit rate(DL): 0x00 (Reserved)
QOS PROFILE ENDS.
COMMON FLAGS END.
Radio Access Technology: UTRAN

HLR发送0 kbps

Tag : 0x94 Length : 9 (0x09) Value : internet Ext-QoS Subscribed Tag : 0x80 Length : 9 (0x09)
Value : 0x01 71 96 fe ff 74 f9 ff ff Allocation/Retention Priority : 1 (0x01) 011. Traffic
Class : Interactive Class (0x3) ...1 0... Delivery Order : Without delivery order ('no') (0x2)
.... .001 Delivery of Erroneous SDUs : No detect ('-') (0x1) Maximum SDU Size : 1500 octets
(0x96) Max. bit rate for Uplink : 8640 kbps (0xfe) **Max. bit rate for Downlink : 0 kbps (0xff)**
>>>> Here sending entity is requesting 0kbps which is less than 8640 kbps and that is why SGSN
ignores the Extended QoS and does not forward it to GGSN
0111 Residual BER : 1*10⁻⁵ (0x7)
.... 0100 SDU Error Ratio : 1*10⁻⁴ (0x4)
1111 10.. Transfer Delay : 4000 ms (0x3e)
.... ..01 Traffic Handling Priority : Priority Level 1 (0x1)
Guaranteed bit rate for Uplink : 0 kbps (0xff)
Guaranteed bit rate for Downlink : 0 kbps (0xff)
Ext2-QoS Subscribed
Tag : 0x82
Length : 3 (0x03)
Value : 0x00 4f 00
000. Spare : 0
...0 Signalling Indication : Not optimised for signalling
traffic
.... 0000 Source Statistics Descriptor : Unknown (0x0)
Maximum bit rate for Downlink (Extended) : 21 mbps (0x4f)
Guaranteed bit rate for Downlink (Extended) : Use the value
indicated by the Guaranteed bit rate for downlink (0x00)

<<<<OUTBOUND 16:01:37:890 Eventid:116004(3)
GTPC Tx PDU, from 223.224.40.249:19134 to 112.110.244.80:2123 (169)
TEID: 0x00000000, Message type: GTP_CREATE_PDP_CONTEXT_REQ_MSG (0x10)
Sequence Number:: 0x07AC (1964)
MSISDN ENDS.
QOS PROFILE FOLLOWS (Length = 13)
Alloc./Retention priority: 0x01 (1)
Spare Octet1: 0x0 (0)
Delay class: 0x4 (Delay class 4 (best effort))
Reliability class: 0x3 (Unack. GTP/LLC, Ack. RLC, Protected data)
Peak throughput: 0x09 (Up to 256 000 octets/s)
Spare Octet2: 0x0 (0)
Precedence class: 0x2 (Normal priority)
Spare Octet3: 0x0 (0)
Mean throughput: 0x1F (Best effort)
Traffic class: 0x3 (Interactive class)

```
        Delivery order: 0x2 (Without delivery order ('no'))
Delivery of erroneous SDU: 0x1 (No detect ('-'))
        Maximum SDU size: 0x96 (1500 octets)
        Max bit rate for uplink: 0xFE (8640 kbps)
Max bit rate for downlink: 0xFF (0 kbps)
        Residual BER: 0x7 (1/100 000 = 1x10^-5)
        SDU error ratio: 0x4 (1/10 000 = 1x10^-4)
        Transfer delay: 0x3E (4000 ms)
Traffic handling priority: 0x1 (Priority level 1)
        Guaranteed bit rate (UL): 0xFF (0 kbps)
        Guaranteed bit rate (DL): 0xFF (0 kbps)
        Spare Octet4: 0x0 (0)
        Signalling Indication: 0x0 (No)
        Source Statistics Descr: 0x0 (Unknown)
QOS PROFILE ENDS.
COMMON FLAGS FOLLOW:
Prohibit Payload Compression: no
        MBMS Service Type: Multicast Service
        RAN Procedures Ready: no
MBMS Counting Information: no
        No QoS negotiation: no
                NRSN: no
        Upgrade QoS Supported: no
        Dual Address Bearer Flag: no
COMMON FLAGS END.
Radio Access Technology: UTRAN
USER LOCATION INFORMATION FOLLOWS:
        LOCATION TYPE: SAI
                MCC: 404
                MNC: 70
                LAC: 39012
        CI/SAC/RAC: 23017
USER LOCATION INFORMATION ENDS.
        MS Time Zone: +5:30
        Daylight Saving Time: +0 hour
                IMEI(SV): 3565340544016110
INFORMATION ELEMENTS END.
```

SGSN根据规范行为，根据访问类型和支持的最大QOS。SGSN包括扩展最大比特率DL。

根据规范，仅当用户设备(UE)/无线网络控制器(RNC)支持8640 kbps以上时，才包括二进制八位数15。

在2G的情况下，基站控制器(BSC)不支持更高的QOS，因此不包括扩展比特率。

在漫游场景中，HLR本身发送0 kbps，并且根据3GPP规范，HLR不能将0 kbps作为DL比特率发送。

为什么无线接入承载(RAB)分配失败？

```
Wednesday October 01 2014
INBOUND>>>>> 15:33:04:419 Eventid:87730(0)
```

```
==> Radio Access Network Application Part (RANAP) (21 bytes)
```

RANAP PDU

```
| 0... .... | Ext bit : 0
| .11. .... | Choice index : Outcome (3)
Procedure Code : id-RAB Assignment (0)
Criticality
| 00.. .... | Reject (0)
RAB Assignment Value :
| .001 0001 | Length Determinant : 17
Value :
RAB Assignment Response
| 0... .... | Ext bit : 0
Bit map :
| .0.. .... | RAB Assignment Response Extensions : Not present
RAB Assignment Response IEs
IEs Count : 1
IE : 1
Protocol IE ID : RAB Failed List (35)
Criticality
| 01.. .... | Ignore (1)
RAB Failed List Value :
| .000 1010 | Length Determinant : 10
Value :
IE Container Count : 1
IE Container : 1
IEs Count : 1
IE : 1
Protocol IE ID : RAB Failed Item (34)
Criticality
| 01.. .... | Ignore (1)
RAB Failed Item Value :
| .000 0011 | Length Determinant : 3
Value :
| 0... .... | Ext bit : 0
Bit map :
| .0.. .... | RAB Failed Item Ext IEs : Not present
RAB ID
| ..00 0001 | | 01.. .... | 0x5
Cause
| ..0. .... | Ext bit : 0
| ...0 00.. | Choice index : 0
Radio Network
| .... ..01 | | 0110 .... | invalid-rab-parameters-
combination (23) (0x17)
```

Wednesday October 01 2014

<<<<OUTBOUND 15:33:04:548 Eventid:88113(0)

==>GPRS Mobility/Session Management Message (25 Bytes)

Protocol Discriminator : SM message

1... : TI Flag : (1) allocated by receiver

.000 : TIO : (0)

.... 1010 : Protocol Discriminator : (10)

Message Type: 0x43 (67)

Message : Activate PDP Reject

SM Cause : (26) Insufficient resources

Protocol Configuration Options

Element ID: 39

Length: 20

Configuration Protocol: (0) PPP

Extension Bit : (128)

Protocol/Container ID: (0x8021) Protocol ID: IPCP

Length: 0x10

Protocol/Container Content: 0x03 01 00 10 81 06 70 6e f0 01 83 06 70 6e f0 05

Wednesday October 01 2014

<<<<OUTBOUND 15:33:04:548 Eventid:87731(0)

==> Radio Access Network Application Part (RANAP) (42 bytes)

RANAP PDU

| 0... | Ext bit : 0

| .00. | Choice index : Initiating Message (0)

Procedure Code : id-Direct Transfer (20)

Criticality

| 01.. | Ignore (1)

Direct Transfer Value :

| .010 0110 | Length Determinant : 38

Value :

Direct Transfer

| 0... | Ext bit : 0

Bit map :

| .0.. | Direct Transfer Extensions : Not present

Direct Transfer IEs

IEs Count : 2

IE : 1

Protocol IE ID : NAS PDU (16)

Criticality

| 01.. | Ignore (1)

NAS PDU Value :

| .001 1010 | Length Determinant : 26

Value :

| .001 1001 | Length Determinant : 25

0x8a431a271480802110030100108106706ef0018306706ef005

==>GPRS Mobility/Session Management Message (25 Bytes)

Protocol Discriminator : SM message

1... : TI Flag : (1) allocated by receiver

.000 : TIO : (0)

.... 1010 : Protocol Discriminator : (10)

Message Type: 0x43 (67)

Message : Activate PDP Reject

SM Cause : (26) Insufficient resources

Protocol Configuration Options

Element ID: 39

Length: 20

Configuration Protocol: (0) PPP

Extension Bit : (128)

Protocol/Container ID: (0x8021) Protocol ID: IPCP

Length: 0x10

Protocol/Container Content: 0x03 01 00 10 81 06 70 6e f0 01 83 06 70

6e f0 05

根据24.008，仅当最大比特率DL大于8640 kbps（二进制八位数9）时，才在创建PDP环境请求中包含二进制八位数15或扩展最大比特率DL。在演进的高速分组接入(HSPA+)中，SGSN支持高达21 mbps，因此，如果您连接到支持8640 kbps以上的高速分组接入(HSPA)或HSPA+,SGSN将授权包括扩展DL比特率，以支持任何要求QOS更高，具体取决于您可能用于所需应用的流量类。

如果SGSN要求下行/上行链路速度大于8700 kbps，则使用最大比特率(MBR)下行/上行链路的扩展信息元素(IE)。由于常规邮件大小不允许发送超过8640 kbps的值，因此扩展MBR IE用于发送附加值。如果MBR扩展不足，则您甚至可以使用MBR Ext-2。

在上一个示例中，常规MBR使用一个二进制八位数发送0xFE（转换为8640 kbps），但一旦MBR-ext二进制八位数0x50与原始MBR二进制八位数相乘，它就变为22000 kbps。

在漫游场景中，HLR提供0 kbps作为其最大比特率DL。

根据规范23.107，最大比特率(kbps):在一段时间内，通用移动通信系统(UMTS)和服务接入点(SAP)处UMTS传送的最大位数，除以该时间段的持续时间。只要流量遵循令牌桶算法，其中令牌速率等于最大比特率，而桶大小等于最大服务数据单元(SDU)大小，则流量就与最大比特率一致。不应将一致性定义解释为必需的实现算法。令牌桶算法在附件B中描述。最大比特率是用户或应用程序可以接受或提供的上限。所有RAB属性都可根据网络条件满足最高比特率的流量。

目的:

- 1)将传输的比特率限制到具有此类限制的应用或外部网络
- 2)允许为能够以不同速率运行的应用（例如具有自适应编解码器的应用）定义最大所需RAB比特率。

如果HLR为漫游用户提供0 kbps的上限，则SGSN不包括24.008规范中所述的限制的扩展比特率。

解决方法

如果在HLR中进行更改不可行，您可以选择通过映射到默认接入点名称(APN)来提供默认QoS。

如本示例所示，对漫游用户所做的配置更改示例具有默认QoS。在2G的情况下，SGSN默认发送472kbps，其硬编码：

```
sgsn-global
```

```
imsi-range mcc xxx mnc xx msin first xxxxxxxxxx last xxxxxxxxxx operator-policy < name >
```

```
operator-policy name < name >
```

```
associate call-control-profile < name >
```

```
apn default-apn-profile < name >
```

```
apn-profile < name >
```

```
qos prefer-as-cap local
```

```
qos class interactive mbr-up < value >
```

```
qos class interactive mbr-down < value >
```