

排除ASR 5000/5500上的基础设施客户端DNS故障

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简介

本文档介绍如何排除与域名服务(DNS)基础设施相关的问题。这包括各种命令行界面(CLI)、DNS概念以及可能需要收集的其他数据。根据需要提供示例输出，以便更好地解释某些点。

思科聚合服务路由器(ASR)5000/5500上的基础设施DNS负责在配置该路由器的上下文中解析完全限定域名(FQDN)。这通常用于支持入口环境中呼叫控制的各个方面。 例如：

- 以FQDN格式而非IP地址解析任何Diameter终端对等体
- 代理呼叫会话控制功能(P-CSCF)FQDN的解析返回在用户设备(UE)向IP多媒体系统(IIMS)核心注册所需的Diameter S6b响应中
- 高速分组数据服务网关(HSGW)需要进行DNS命名应用命名机构指针(NAPTR)查询，以获得要连接到的分组数据网络网关(PGW)列表（新的或切换的），然后进行DNS AAAA查询，以检索PGW本地IP地址移动锚点(LMA)地址以连接呼叫。
- 移动管理实体(MME)需要进行DNS NAPTR查询，以获得要连接的服务网关(SGW)/PGW对的列表。这包括创建DNS AAAA/A查询以检索这些节点的IP。

配置

DNS作为客户端应用实施非常简单，只需在需要它的环境中执行。以下是此类实施的示例：

```
context ingress
ip name-servers 2001:5555:202:ffff:a0:e:0:3 2001:5555:203:ffff:c0:e:0:3
dns-client HSGW-DNS
bind address 2001:5555:200:1011:342:281::
resolver retransmission-interval 2
resolver number-of-retries 3
exit
exit
```

要进行配置，最低需要的是服务/绑定地址和主（或辅助）DNS服务器地址。

UDP与TCP

DNS可能更复杂的是传输层。虽然DNS查询通常基于UDP，但NAPTR查询（根据请求）可能最终基于TCP。原因是UDP的响应大小存在限制，需要TCP才能通过多个数据包传输响应。数据包流包括初始请求，然后是来自DNS服务器的响应。这会导致通过设置了中继(TC)标志的0负载响应在TCP上重新请求。这意味着客户端应按照RFC 5966的TCP/IP协议重试。随后会进行典型的TCP三向交换，然后再次发出请求。大小何时足够大以需要此？例如，在HSGW中，如果请求是切换，UDP应足够，因为只有一个或几个（如果返回多个服务）PGW FQDN才能连接HSGW。但是，对于新呼叫，可返回的所有可能的PGW的列表可能足够长，需要使用TCP方法。

以下是请求TCP的示例响应（来自Wireshark）：

```
Frame 85: 143 bytes on wire (1144 bits), 143 bytes captured (1144 bits)
Ethernet II, Src: JuniperN_20:e7:f0 (64:87:88:20:e7:f0), Dst:
StarentN_02:b1:9d (00:05:47:02:b1:9d)
802.1Q Virtual LAN, PRI: 0, CFI: 0, ID: 2010
Internet Protocol Version 6, Src: 2001:5555:202:ffff:a0:e:0:3
(2001:5555:202:ffff:a0:e:0:3), Dst: 2001:5555:200:1011:304:281::
(2001:5555:200:1011:304:281::) User Datagram Protocol, Src Port: domain (53),
Dst Port: 35049 (35049)
Domain Name System (response)
[Request In: 81]
[Time: 0.088530870 seconds]
Transaction ID: 0x3b2b
Flags: 0x8780 Standard query response, No error
  1... .. = Response: Message is a response
  .000 0... .. = Opcode: Standard query (0)
  .... .1... .. = Authoritative: Server is an authority for domain
  .... ..1. .... = Truncated: Message is truncated
  .... ..1... .. = Recursion desired: Do query recursively
  .... .... 1... .. = Recursion available: Server can do recursive queries
  .... .... .0... .. = Z: reserved (0)
  .... .... ..0... .. = Answer authenticated: Answer/authority portion
was not authenticated by the server
  .... .... ..0... .. = Non-authenticated data; Unacceptable
  .... .... .... 0000 = Reply code: No error (0)
Questions: 1
Answer RRs: 0
```

```

Authority RRs: 0
Additional RRs: 1
Queries
  APN1.apn.epc.mnc420.mcc300.3gppnetwork.org: type NAPTR, class IN
    Name: APN1.apn.epc.mnc420.mcc300.3gppnetwork.org
    Type: NAPTR (Naming authority pointer)
    Class: IN (0x0001)
Additional records

```

故障排除命令

show dns-client statistics client <DNS Client Name>

这是排除DNS故障的主要命令。以下是运行此命令的一些要点：

- 它必须在定义客户端的上下文中运行。
- 多次运行它，并注意适当统计数据（如超时）的增加。
- 使用统计信息会统计因能够/不能解析DNS而导致的实际呼叫成功/失败。
- DNS解析器统计失败会计算超时次数，而其他失败（如连接被拒绝）则会计算。超时可能是由于TCP连接建立问题。
- 根据这些统计信息，使用SNMP陷阱（和警报）ThreshDNSLookupFailure捕获为DNS故障配置的阈值。示例：**threshold dns-lookup-failure 5 clear 5**。
- 如果主设备发生故障，辅助设备将在大约2秒后尝试（不可配置）。
- 方案CONTEXTSch1和CONTEXTSch2中的批量统计数据变量包含与此命令相关的所有相关DNS基础设施变量。NAPTR查询类型的示例包括以下内容，它们也适用于AAAA和A类型查询：
 dns-primary-ns-naptr-atmptsdns-primary-ns-naptr-failsdns-primary-ns-naptr-succsdns-secondary-ns-naptr-atmptsdns-secondary-ns-naptr-failsdns-secondary-ns-query-timeouts

在本示例输出中，请注意NAPTR故障的增加情况，如主服务器和辅助服务器的使用情况和解析器统计信息（完全停机）所示：

```

[Ingress]HSGW> show dns-client statistics client HSGW-DNS
Monday June 02 00:26:29 UTC 2014
DNS Usage Statistics:
-----
Query Type           Attempts      Successes      Failures
A                    21802         0              21802
SRV                   0             0              0
AAAA                 3934082666   3934060659    21831
NAPTR                1393765619   1387607858    6156730
PTR                   0             0              0
Total                1032902791   1026701221    6200363

DNS Cache Statistics:
-----
Total Lookups      Cache Hits      Cache Hits      Not Found      Hit Ratio
                  (Positive      (Negative      in Cache      (Percentage)
                  Response)      Response)
-----

```

| | | | | | |
|----------------|------------|-----------|-------|-----------|--------|
| Central Cache: | 94085256 | 89157603 | 6114 | 4921539 | 94.77% |
| Local Cache: | 1032902770 | 926126458 | 20175 | 106756137 | 89.66% |

DNS Resolver Statistics:

Primary Name Server : 2001:5555:202:ffff:a0:e:0:3

| Query Type | Attempts | Successes | Failures |
|------------|----------|-----------|----------|
| A | 0 | 0 | 0 |
| SRV | 0 | 0 | 0 |
| AAAA | 66 | 64 | 2 |
| NAPTR | 746 | 37 | 709 |
| PTR | 0 | 0 | 0 |

Total Resolver Queries: 812
 Successful Queries: 101
 Query Timeouts: 705
 Domain Not Found: 1
 Connection Refused: 0
 Other Failures: 5

Secondary Name Server : 2001:5555:203:ffff:c0:e:0:3

| Query Type | Attempts | Successes | Failures |
|--------------|------------|-----------|------------|
| A | 0 | 0 | 0 |
| SRV | 0 | 0 | 0 |
| AAAA | 0 | 0 | 0 |
| NAPTR | 705 | 0 | 703 |
| PTR | 0 | 0 | 0 |

Total Resolver Queries: 705
 Successful Queries: 0
 Query Timeouts: 703
 Domain Not Found: 0
 Connection Refused: 0
 Other Failures: 0

[Ingress]HSGW> show dns-client statistics client HSGW-DNS

Monday June 02 00:32:00 UTC 2014

DNS Usage Statistics:

| Query Type | Attempts | Successes | Failures |
|--------------|-------------------|-------------------|----------------|
| A | 21802 | 0 | 21802 |
| SRV | 0 | 0 | 0 |
| AAAA | 3934232613 | 3934210617 | 21831 |
| NAPTR | 1393923407 | 1387654707 | 6267989 |
| PTR | 0 | 0 | 0 |
| Total | 1033210526 | 1026898028 | 6320622 |

DNS Cache Statistics:

| | Total Lookups | Cache Hits (Positive Response) | Cache Hits (Negative Response) | Not Found in Cache | Hit Ratio (Percentage) |
|----------------|---------------|--------------------------------|--------------------------------|--------------------|------------------------|
| Central Cache: | 94120194 | 89157771 | 6114 | 4956309 | 94.73% |
| Local Cache: | 1033210498 | 926323077 | 20175 | 106867246 | 89.66% |

DNS Resolver Statistics:

Primary Name Server : 2001:5555:202:ffff:a0:e:0:3

| Query Type | Attempts | Successes | Failures |
|--------------|------------|-----------|------------|
| A | 0 | 0 | 0 |
| SRV | 0 | 0 | 0 |
| AAAA | 66 | 64 | 2 |
| NAPTR | 913 | 38 | 873 |

```

PTR                                0                0                0
Total Resolver Queries: 979
Successful Queries:      102
Query Timeouts:         869
Domain Not Found:       1
Connection Refused:     0
Other Failures:         5

```

Secondary Name Server : 2001:5555:203:ffffe:c0:e:0:3

| Query Type | Attempts | Successes | Failures |
|--------------|------------|-----------|------------|
| A | 0 | 0 | 0 |
| SRV | 0 | 0 | 0 |
| AAAA | 0 | 0 | 0 |
| NAPTR | 869 | 0 | 869 |
| PTR | 0 | 0 | 0 |

Total Resolver Queries: 869

```

Successful Queries: 0
Query Timeouts: 869
Domain Not Found: 0
Connection Refused: 0
Other Failures: 0

```

show dns-client cache client <client name> [query-name <query-name> [query-type <NAPTR | AAAA |A>] | [query-type <NAPTR | AAAA |A>]]

此命令报告缓存中各种查询类型的所有已保存响应（尚未过期），包括A、AAAA和NAPTR。这提供了缓存的当前状态，从中可以得出结论，是否会根据缺失的条目发生呼叫故障：

如果没有任何限定符，则显示整个缓存，这可能超出您要排除故障所需的容量。缓存条目有生存时间(TTL)，因此返回的条目仅适用于各个TTL也保留的情况。当您比较所有条目时，TTL可能不同，因此条目在不同时间过期。这是预期。

选择特定查询类型（如NAPTR），并查找应用点名称(APN)结果或特定FQDN（切换）结果。需要查找的内容包括缺少的特定APN、缺少所有APN或缺少切换结果。

示例：

此输出显示APN1和APN2的缓存中的一些条目，这些APN的新呼叫可能需要这些条目。实际列表包括整个服务提供商网络中每个可能的APN(LTE(x-S5-gtp)和eHRPD(x-s2a-pmip))的每个可能的PGW的条目。此处仅x-s2a-pmip相关，因为这是需要通过S2a连接连接到PGW的HSGW。请注意，对于同时从DNS服务器返回的具有相同APN/PGW位置的条目，TTL(1307, 631)相同，而对于应用于不同APN/PGW位置的条目，TTL（1307与631）不同。

```
[Ingress]HSGW> show dns-client cache client HSGW-DNS
```

Monday June 02 00:26:59 UTC 2014

```
Query Name: so01.APN1.apn.epc.mnc485.mcc320.3gppnetwork.org
```

```
Query Type: NAPTR          TTL: 1307 seconds
```

Answer:

```
Order: 100                Preference: 50000
```

```
Flags: a                  Service: x-3gpp-pgw:x-s5-gtp
```

Regular Expression:

```
Replacement: topon.lb1.pgw01.NYNY.sa008.so.node.epc.mnc485.mcc320.3gppnetwork.org
```

```
Query Name: so01.APN1.apn.epc.mnc485.mcc320.3gppnetwork.org
```

```
Query Type: NAPTR          TTL: 1307 seconds
```

```
Answer:
Order: 100           Preference: 50000
Flags: a             Service: x-3gpp-pgw:x-s2a-pmip
Regular Expression:
Replacement: topon.lb2.pgw01.NYNY.sa008.so.node.epc.mnc485.mcc320.3gppnetwork.org
```

```
Query Name: APN2.apn.epc.mnc485.mcc320.3gppnetwork.org
Query Type: NAPTR    TTL: 631 seconds
```

```
Answer:
Order: 100           Preference: 50000
Flags: a             Service: x-3gpp-pgw:x-s2a-pmip
Regular Expression:
Replacement: topon.lb2.pgw01.BOMA.sa001.mw.node.epc.mnc485.mcc320.3gppnetwork.org
```

```
Query Name: APN2.apn.epc.mnc485.mcc320.3gppnetwork.org
Query Type: NAPTR    TTL: 631 seconds
```

```
Answer:
Order: 100           Preference: 50000
Flags: a             Service: x-3gpp-pgw:x-s5-gtp
Regular Expression:
Replacement: topon.lb1.pgw01.BOMA.sa001.mw.node.epc.mnc485.mcc320.3gppnetwork.org
```

在第二个输出示例中，是从长期演进(LTE)到eHRPD切换所需的NAPTR条目，如特定PGW FQDN位置条目(pgw01.PHLA.xxxxx)所示。与上一输出类似，所使用的相关条目是服务=x-s2a-pmip的条目。请注意，对于同时返回的所有这些条目，TTL(515)相同。唯一的区别是服务。AAAA条目解析表示PGW LMA服务地址的s2a条目，以便随后的代理MIPv6请求可以发送到PGW以继续呼叫建立。

```
Query Name: pgw01.PHLA.sa004.mw.node.epc.mnc485.mcc320.3gppnetwork.org
Query Type: NAPTR    TTL: 515 seconds
```

```
Answer:
Order: 100           Preference: 50000
Flags: a             Service: x-3gpp-pgw:x-s2b-gtp
Regular Expression:
Replacement: topon.lb4.pgw01.PHLA.sa004.mw.node.epc.mnc485.mcc320.3gppnetwork.org
```

```
Query Name: pgw01.PHLA.sa004.mw.node.epc.mnc485.mcc320.3gppnetwork.org
Query Type: NAPTR    TTL: 515 seconds
```

```
Answer:
Order: 100           Preference: 50000
Flags: a             Service: x-3gpp-pgw:x-s2a-pmip
Regular Expression:
Replacement: topon.lb2.pgw01.PHLA.sa004.mw.node.epc.mnc485.mcc320.3gppnetwork.org
```

```
Query Name: pgw01.PHLA.sa004.mw.node.epc.mnc485.mcc320.3gppnetwork.org
Query Type: NAPTR    TTL: 515 seconds
```

```
Answer:
Order: 100           Preference: 50000
Flags: a             Service: x-3gpp-pgw:x-s5-gtp
Regular Expression:
Replacement: topon.lb1.pgw01.PHLA.sa004.mw.node.epc.mnc485.mcc320.3gppnetwork.org
```

```
Query Name: topon.lb2.pgw01.PHLA.sa004.mw.node.epc.mnc485.mcc320.3gppnetwork.org
Query Type: AAAA    TTL: 646 seconds
```

```
Answer:
IPv6 Address: 2001:5555:200:1000:304:200::
```

dns-client query client-name <client name> query-type <NAPTR | AAAA> [query-name <query name>]

这是手动测试命令，用于启动DSN客户端，以便立即检查缓存并报告答案（如果答案存在）。否则，它会尝试查询并报告结果。如果复杂，请确保查询字符串拼写正确：

- 默认情况下，如果仅指定了query-name，则客户端会假设查询类型为A，因此NAPTR和AAAA请求需要查询类型。
- 此处的结果与使用show dns-client cache查询缓存时返回的结果相同。例外情况是，如果查询的内容不在缓存中，则结果具有新的TTL。但是，如果已在缓存中，则TTL在新查询中返回的值和0之间有一定值。

示例（与上一输出中的查询相同）：

```
[Ingress]HSGW> dns-client query client-name HSGW-DNS query-type NAPTR
query-name pgw01.PHLA.sa004.mw.node.epc.mnc420.mcc300.3gppnetwork.org
```

```
Query Name: pgw01.PHLA.sa004.mw.node.epc.mnc420.mcc300.3gppnetwork.org
```

```
Query Type: NAPTR      TTL: 188 seconds
```

```
Answer:
```

```
Order: 100             Preference: 50000
```

```
Flags: a               Service: x-3gpp-pgw:x-s5-gtp
```

```
Regular Expression:
```

```
Replacement: topon.lb1.pgw01.PHLA.sa004.mw.node.epc.mnc420.mcc300.3gppnetwork.org
```

```
Query Name: pgw01.PHLA.sa004.mw.node.epc.mnc420.mcc300.3gppnetwork.org
```

```
Query Type: NAPTR      TTL: 188 seconds
```

```
Answer:
```

```
Order: 100             Preference: 50000
```

```
Flags: a               Service: x-3gpp-pgw:x-s2b-gtp
```

```
Regular Expression:
```

```
Replacement: topon.lb4.pgw01.PHLA.sa004.mw.node.epc.mnc420.mcc300.3gppnetwork.org
```

```
Query Name: pgw01.PHLA.sa004.mw.node.epc.mnc420.mcc300.3gppnetwork.org
```

```
Query Type: NAPTR      TTL: 188 seconds
```

```
Answer:
```

```
Order: 100             Preference: 50000
```

```
Flags: a               Service: x-3gpp-pgw:x-s2a-pmip
```

```
Regular Expression:
```

```
Replacement: topon.lb2.pgw01.PHLA.sa004.mw.node.epc.mnc420.mcc300.3gppnetwork.org
```

```
[Ingress]HSGW> dns-client query client-name HSGW-DNS query-type AAAA
```

```
query-name topon.lb2.pgw01.PHLA.sa004.mw.node.epc.mnc420.mcc300.3gppnetwork.org
```

```
Query Name: topon.lb2.pgw01.PHLA.sa004.mw.node.epc.mnc420.mcc300.3gppnetwork.org
```

```
Query Type: AAAA      TTL: 117 seconds
```

```
Answer:
```

```
IPv6 Address: 2001:5555:200:1000:304:200::
```

此输出显示了基于TCP的查询失败的示例。您不能仅从查询本身就知道这是基于TCP的，但知道基于APN的NAPTR查询响应对于UDP而言太大。

```
[Ingress]HSGW> dns-client query client-name HSGW-DNS query-type NAPTR
```

```
query-name APN1.apn.epc.mnc420.mcc300.3gppnetwork.org
```

```
Query Name: APN1.apn.epc.mnc420.mcc300.3gppnetwork.org
```

```
Query Type: NAPTR      TTL: 0 seconds
```

```
Answer: -Negative Reply-
```

```
Failure Reason: DNS query timed out
```

```
...
```

```
[Ingress]HSGW> dns-client query client-name HSGW-DNS query-type NAPTR
```

```
query-name APN2.apn.epc.mnc420.mcc300.3gppnetwork.org
```

Query Name: APN2.apn.epc.mnc420.mcc300.3gppnetwork.org
Query Type: NAPTR TTL: 60 seconds
Answer: -Negative Reply-
Failure Reason: Connection Refused

监控协议 (DNS选项)

监控协议报告所有DNS基础设施数据包交换。监控用户 (稍后介绍) 不会捕获DNS数据包，即使用户活动是发起DNS交换的原因。

- 查询ID对于将请求与响应进行匹配非常有用。

但是：

- 在切换到TCP时，输出不表示该事实 (如输出所示)。
- 输出中的端口号不一定准确，例如，端口= 0。
- 系统可能会将多个数据包 (如APN查询) 合并到线路上未反映在此输出级别的单个数据包中。这继续显示每个APN的单独数据包。
- 必须小心监控协议，以免系统过载。在执行此操作之前，请咨询技术支持。

```
<<<<OUTBOUND 00:58:57:284 Eventid:5957(3)
DNS PDU Tx
    from : 2001:5555:200:1011:304:281:: : 52816
    to   : 2001:5555:202:fffe:a0:e:0:3 : 0
    bytes : 73
Query ID      : 17034
Type         : Query
Question     : NAPTR ? APN2.apn.epc.mnc420.mcc300.3gppnetwork.org.
Additional   :
Name        : .
Ext-RCODE   : 0
Type       : OPT
UDPsize    : 4096

INBOUND>>>> 00:58:57:469 Eventid:5956(3)
DNS PDU Rx
    from : 2001:5555:202:fffe:a0:e:0:3 : 0
    to   : 2001:5555:200:1011:304:281:: : 0
    bytes : 16738
Query ID      : 17034
Type         : Response
Authoritative Answer : Yes
Response code : Success
Question     : NAPTR ? APN2.apn.epc.mnc420.mcc300.3gppnetwork.org.
Answer       :
Name        : APN2.apn.epc.mnc420.mcc300.3gppnetwork.org.
TTL        : 1800
Type      : NAPTR
Order     : 100
Preference : 50000
Flags    : a
Service : x-3gpp-pgw:x-s2a-pmip
Regexp   :
Replacement : topon.lb2.pgw01.PHLA.sa001.we.node.epc.mnc420.mcc300.3gppnetwork.org.
Name     : APN2.apn.epc.mnc420.mcc300.3gppnetwork.org.
```


TTL : 1800
Type : NAPTR
Order : 100
Preference : 50000
Flags : a
Service : x-3gpp-pgw:x-s5-gtp
Regexp :
Replacement : topon.lb1.pgw01.PHLA.sa001.we.node.epc.

mnc420.mcc300.3gppnetwork.org

本示例显示三个APN最后封装成一个数据包，交换到TCP，每个APN超时2秒，最后重试到同样发生故障的辅助服务器。

主服务器： 2001:5555:202:ffff:a0:e:0:3

辅助服务器:2001:5555:203:ffff:c0:e:0:3

<<<<OUTBOUND 13:03:08:056 Eventid:5957(3)

DNS PDU Tx

from : 2001:5555:200:1011:106:281:: : 35428
to : 2001:5555:202:ffff:a0:e:0:3 : 53
bytes : 78

Query ID : 23363
Type : Query
Opcode : Standard Query
Message Truncated : No
Recursion Desired : Yes
Authentication reqd. : No
Question count : 1
Additional count : 1
Question : NAPTR ? APN1.apn.epc.mnc420.mcc300.3gppnetwork.org.
Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

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<<<<OUTBOUND 13:03:08:057 Eventid:5957(3)

DNS PDU Tx

from : 2001:5555:200:1011:106:281:: : 60489
to : 2001:5555:202:ffff:a0:e:0:3 : 53
bytes : 73

Query ID : 48443
Type : Query
Opcode : Standard Query
Message Truncated : No
Recursion Desired : Yes
Authentication reqd. : No
Question count : 1
Additional count : 1
Question : NAPTR ? APN3.apn.epc.mnc420.mcc300.3gppnetwork.org.
Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT

UDPsize : 4096

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<<<<OUTBOUND 13:03:08:057 Eventid:5957(3)

DNS PDU Tx

from : 2001:5555:200:1011:106:281:: : 34309
to : 2001:5555:202:ffff:a0:e:0:3 : 53
bytes : 73

Query ID : 51787
Type : Query
Opcode : Standard Query
Message Truncated : No
Recursion Desired : Yes
Authentication reqd. : No
Question count : 1
Additional count : 1
Question : NAPTR ? APN2.apn.epc.mnc420.mcc300.3gppnetwork.org.
Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

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INBOUND>>>> 13:03:08:064 Eventid:5956(3)

DNS PDU Rx

from : 2001:5555:202:ffff:a0:e:0:3 : 53
to : 2001:5555:200:1011:106:281:: : 35428
bytes : 78

Query ID : 23363
Type : Response
Opcode : Standard Query
Message Truncated : Yes
Recursion Desired : Yes
Recursion Available : Yes
Authenticated Answer : No
Authoritative Answer : Yes
Response code : Success
Question count : 1
Answer count : 0
Authoritative count : 0
Additional count : 1
Question : NAPTR ? APN1.apn.epc.mnc420.mcc300.3gppnetwork.org.
Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

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INBOUND>>>> 13:03:08:064 Eventid:5956(3)

DNS PDU Rx

from : 2001:5555:202:ffff:a0:e:0:3 : 53
to : 2001:5555:200:1011:106:281:: : 60489
bytes : 73

Query ID : 48443
Type : Response
Opcode : Standard Query

Message Truncated : Yes
Recursion Desired : Yes
Recursion Available : Yes
Authenticated Answer : No
Authoritative Answer : Yes
Response code : Success
Question count : 1
Answer count : 0
Authoritative count : 0
Additional count : 1
Question : NAPTR ? APN3.apn.epc.mnc420.mcc300.3gppnetwork.org.
Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

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INBOUND>>>> 13:03:08:069 Eventid:5956(3)

DNS PDU Rx

from : 2001:5555:202:ffff:a0:e:0:3 : 53
to : 2001:5555:200:1011:106:281:: : 34309
bytes : 73

Query ID : 51787
Type : Response
Opcode : Standard Query
Message Truncated : Yes
Recursion Desired : Yes
Recursion Available : Yes
Authenticated Answer : No
Authoritative Answer : Yes
Response code : Success
Question count : 1
Answer count : 0
Authoritative count : 0
Additional count : 1
Question : NAPTR ? APN2.apn.epc.mnc420.mcc300.3gppnetwork.org.
Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

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<<<<OUTBOUND 13:03:08:147 Eventid:5957(3)

DNS PDU Tx

from : 2001:5555:200:1011:106:281:: : 36524
to : 2001:5555:202:ffff:a0:e:0:3 : 0
bytes : 78

Query ID : 23363
Type : Query
Opcode : Standard Query
Message Truncated : No
Recursion Desired : Yes
Authentication reqd. : No
Question count : 1
Additional count : 1
Question : NAPTR ? APN1.apn.epc.mnc420.mcc300.3gppnetwork.org.

Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

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<<<<OUTBOUND 13:03:08:147 Eventid:5957(3)

DNS PDU Tx

from : 2001:5555:200:1011:106:281:: : 36524
to : 2001:5555:202:ffff:a0:e:0:3 : 0
bytes : 73

Query ID : 48443
Type : Query
Opcode : Standard Query
Message Truncated : No
Recursion Desired : Yes
Authentication reqd. : No
Question count : 1
Additional count : 1
Question : NAPTR ? APN3.apn.epc.mnc420.mcc300.3gppnetwork.org.
Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

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<<<<OUTBOUND 13:03:08:147 Eventid:5957(3)

DNS PDU Tx

from : 2001:5555:200:1011:106:281:: : 36524
to : 2001:5555:202:ffff:a0:e:0:3 : 0
bytes : 73

Query ID : 51787
Type : Query
Opcode : Standard Query
Message Truncated : No
Recursion Desired : Yes
Authentication reqd. : No
Question count : 1
Additional count : 1
Question : NAPTR ? APN2.apn.epc.mnc420.mcc300.3gppnetwork.org.
Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

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<<<<OUTBOUND 13:03:10:157 Eventid:5957(3)

DNS PDU Tx

from : 2001:5555:200:1011:106:281:: : 57041
to : 2001:5555:203:ffff:c0:e:0:3 : 0
bytes : 78

Query ID : 23363

Type : Query
Opcode : Standard Query
Message Truncated : No
Recursion Desired : Yes
Authentication reqd. : No
Question count : 1
Additional count : 1
Question : NAPTR ? APN1.apn.epc.mnc420.mcc300.3gppnetwork.org.
Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

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<<<<OUTBOUND 13:03:10:157 Eventid:5957(3)

DNS PDU Tx

from : 2001:5555:200:1011:106:281:: : 57041
to : 2001:5555:203:ffff:c0:e:0:3 : 0
bytes : 73

Query ID : 48443
Type : Query
Opcode : Standard Query
Message Truncated : No
Recursion Desired : Yes
Authentication reqd. : No
Question count : 1
Additional count : 1
Question : NAPTR ? APN3.apn.epc.mnc420.mcc300.3gppnetwork.org.
Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

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<<<<OUTBOUND 13:03:10:157 Eventid:5957(3)

DNS PDU Tx

from : 2001:5555:200:1011:106:281:: : 57041
to : 2001:5555:203:ffff:c0:e:0:3 : 0
bytes : 73

Query ID : 51787
Type : Query
Opcode : Standard Query
Message Truncated : No
Recursion Desired : Yes
Authentication reqd. : No
Question count : 1
Additional count : 1
Question : NAPTR ? APN2.apn.epc.mnc420.mcc300.3gppnetwork.org.
Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

此图显示了包装到一个数据包#10中的三个APN。1 - 3中的原始UDP请求在4、5和7中响应，TCP握手由数据包6、8和9组成。在这种情况下，在服务器通过数据包11首次确认基于TCP的查询后，立即在数据包12中重置连接。这些是您的问题类型可能需要排除故障：

| No. | Time | Source | Destination | Info |
|-----|----------|------------|-------------|--|
| 1 | 09:03:08 | HSGW | DNS_Server | Standard query 0x5b43 NAPTR APNinternet.apn |
| 2 | 09:03:08 | HSGW | DNS_Server | Standard query 0xbd3b NAPTR APNims.apn.epc. |
| 3 | 09:03:08 | HSGW | DNS_Server | Standard query 0xca4b NAPTR APNapp.apn.epc. |
| 4 | 09:03:08 | DNS_Server | HSGW | Standard query response 0x5b43 |
| 5 | 09:03:08 | DNS_Server | HSGW | Standard query response 0xbd3b |
| 6 | 09:03:08 | HSGW | DNS_Server | febooti-aw > domain [SYN] Seq=1097052319 win |
| 7 | 09:03:08 | DNS_Server | HSGW | Standard query response 0xca4b |
| 8 | 09:03:08 | DNS_Server | HSGW | domain > febooti-aw [SYN, ACK] Seq=172420703 |
| 9 | 09:03:08 | HSGW | DNS_Server | febooti-aw > domain [ACK] Seq=1097052320 Ack |
| 10 | 09:03:08 | HSGW | DNS_Server | Standard query 0xca4b NAPTR APNapp.apn.epc. |
| 11 | 09:03:08 | DNS_Server | HSGW | domain > febooti-aw [ACK] Seq=1724207040 Ack |
| 12 | 09:03:08 | DNS_Server | HSGW | domain > febooti-aw [RST, ACK] Seq=172420704 |

```

# Frame 10: 318 bytes on wire (2544 bits), 318 bytes captured (2544 bits)
# Linux cooked capture
# Internet Protocol Version 6, Src: HSGW, Dst: DN
# Transmission Control Protocol, Src Port: febooti-aw (36524), Dst Port: domain
# Domain Name System (query)
  Length: 78
  Transaction ID: 0x5b43
  # Flags: 0x0100 Standard query
  Questions: 1
  Answer RRs: 0
  Authority RRs: 0
  Additional RRs: 1
  # Queries
    # APNinternet.apn.epc.mnc420.mcc300.3gppnetwork.org: type NAPTR, class IN
# Domain Name System (query)
  Length: 73
  Transaction ID: 0xbd3b
  # Flags: 0x0100 standard query
  Questions: 1
  Answer RRs: 0
  Authority RRs: 0
  Additional RRs: 1
  # Queries
    # APNims.apn.epc.mnc420.mcc300.3gppnetwork.org: type NAPTR, class IN
  # Additional records
# Domain Name System (query)
  Length: 73
  Transaction ID: 0xca4b
  # Flags: 0x0100 standard query
  Questions: 1
  Answer RRs: 0
  Authority RRs: 0
  Additional RRs: 1
  # Queries
    # APNapp.apn.epc.mnc420.mcc300.3gppnetwork.org: type NAPTR, class IN
  # Additional records
  
```

最后，从同一捕获中，以下是通过UDP的NAPTR查询的成功查询和响应，然后是所需的AAA查询和响应，以解析NAPTR查询返回的FQDN。此输出与以文本形式保存的Wireshark跟踪匹配：

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<<<<OUTBOUND 13:03:11:535 Eventid:5957(3)

DNS PDU Tx

from : 2001:5555:200:1011:106:281:: : 38819

to : 2001:5555:202:fffe:a0:e:0:3 : 53

bytes : 87

Query ID : 55982

Type : Query

Opcode : Standard Query

Message Truncated : No

Recursion Desired : Yes

Authentication reqd. : No

Question count : 1

Additional count : 1

Question : NAPTR ? pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.3gppnetwork.org.

Additional :

Name : .

Ext-RCODE : 0

EDNS Version : 0

Class : 4096

Data Length : 0

Type : OPT

UDPsize : 4096

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INBOUND>>>> 13:03:11:543 Eventid:5956(3)

DNS PDU Rx

from : 2001:5555:202:fffe:a0:e:0:3 : 53

to : 2001:5555:200:1011:106:281:: : 38819

bytes : 307

Query ID : 55982

Type : Response

Opcode : Standard Query

Message Truncated : No

Recursion Desired : Yes

Recursion Available : Yes

Authenticated Answer : No

Authoritative Answer : Yes

Response code : Success

Question count : 1

Answer count : 2

Authoritative count : 0

Additional count : 1

Question : NAPTR ? pgw02.PHLA.sa002.so.node.epc.mnc420.

mcc300.3gppnetwork.org.

Answer :

Name : pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.3gppnetwork.org.

TTL : 1800

Class : IN

Data Length : 99

Type : NAPTR

Order : 100

Preference : 50000

Flags : a

Service : x-3gpp-pgw:x-s2a-pmip

Regexp :

Replacement : topon.lb2.pgw02.PHLA.sa002.so.node.epc.mnc420.

mcc300.3gppnetwork.org.

Name : pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.

3gppnetwork.org.

TTL : 1800

Class : IN

Data Length : 97

Type : NAPTR
Order : 100
Preference : 50000
Flags : a
Service : x-3gpp-pgw:x-s5-gtp
Regexp :
Replacement : topon.lb1.pgw02.PHLA.sa002.so.node.epc.mnc420.
mcc300.3gppnetwork.org.

Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

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<<<<OUTBOUND 13:03:11:543 Eventid:5957(3)

DNS PDU Tx

from : 2001:5555:200:1011:106:281:: : 50002

to : 2001:5555:202:fffe:a0:e:0:3 : 53

bytes : 97

Query ID : 1974

Type : Query

Opcode : Standard Query

Message Truncated : No

Recursion Desired : Yes

Authentication reqd. : No

Question count : 1

Additional count : 1

Question : AAAA? topon.lb2.pgw02.PHLA.sa002.so.node.epc.

mnc420.mcc300.3gppnetwork.org.

Additional :

Name : .

Ext-RCODE : 0

EDNS Version : 0

Class : 4096

Data Length : 0

Type : OPT

UDPsize : 4096

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INBOUND>>>> 13:03:11:551 Eventid:5956(3)

DNS PDU Rx

from : 2001:5555:202:fffe:a0:e:0:3 : 53

to : 2001:5555:200:1011:106:281:: : 50002

bytes : 125

Query ID : 1974

Type : Response

Opcode : Standard Query

Message Truncated : No

Recursion Desired : Yes

Recursion Available : Yes

Authenticated Answer : No

Authoritative Answer : Yes

Response code : Success

Question count : 1

Answer count : 1

Authoritative count : 0

Additional count : 1

Question : AAAA? topon.lb2.pgw02.PHLA.sa002.so.node.epc.

mnc420.mcc300.3gppnetwork.org.

Answer :
Name : topon.lb2.pgw02.PHLA.sa002.so.node.epc.mnc420.
mcc300.3gppnetwork.org.
TTL : 1800
Class : IN
Data Length : 16
Type : AAAA
Address : 2001:5555:200:1000:201:201::

Additional :
Name : .
Ext-RCODE : 0
EDNS Version : 0
Class : 4096
Data Length : 0
Type : OPT
UDPsize : 4096

Corresponding Wireshark trace:

Frame 25: 151 bytes on wire (1208 bits), 151 bytes captured (1208 bits)
Linux cooked capture

Internet Protocol Version 6, Src: HSGW, Dst: DNS_Server
User Datagram Protocol, Src Port: 38819 (38819), Dst Port: domain (53)

Domain Name System (query)

[Response In: 26]
Transaction ID: 0xdaae
Flags: 0x0100 Standard query
Questions: 1
Answer RRs: 0
Authority RRs: 0
Additional RRs: 1
Queries

pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.3gppnetwork.org: **type NAPTR**, class IN

Additional records

<Root>: type OPT
Name: <Root>
Type: OPT (EDNS0 option)
UDP payload size: 4096
Higher bits in extended RCODE: 0x0
EDNS0 version: 0
Z: 0x0
Data length: 0

Frame 26: 371 bytes on wire (2968 bits), 371 bytes captured (2968 bits)
Linux cooked capture

Internet Protocol Version 6, Src: DNS_Server, Dst: HSGW
User Datagram Protocol, Src Port: domain (53), Dst Port: 38819 (38819)

Domain Name System (response)

[Request In: 25]
[Time: 0.008125000 seconds]
Transaction ID: 0xdaae
Flags: 0x8580 Standard query response, No error
Questions: 1
Answer RRs: 2
Authority RRs: 0
Additional RRs: 1
Queries

pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.3gppnetwork.org: **type NAPTR**, class IN

Answers

pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.3gppnetwork.org:

type NAPTR, class IN, order 100, preference 50000, flags a

Name: pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.3gppnetwork.org

Type: NAPTR (Naming authority pointer)
Class: IN (0x0001)
Time to live: 30 minutes
Data length: 99
Order: 100
Preference: 50000
Flags length: 1
Flags: "a"
Service length: 21
Service: "x-3gpp-pgw:x-s2a-pmip"
Regex length: 0
Regex: ""
Replacement length: 70
Replacement: **topon.lb2.pgw02.PHLA.sa002.so.node.epc.**

mnc420.mcc300.3gppnetwork.org

pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.3gppnetwork.org:

type NAPTR, class IN, order 100, preference 50000, flags a
Name: pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.3gppnetwork.org
Type: NAPTR (Naming authority pointer)
Class: IN (0x0001)
Time to live: 30 minutes
Data length: 97
Order: 100
Preference: 50000
Flags length: 1
Flags: "a"
Service length: 19
Service: "x-3gpp-pgw:x-s5-gtp"
Regex length: 0
Regex: ""
Replacement length: 70
Replacement: **topon.lb1.pgw02.PHLA.sa002.so.node.epc.**

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Additional records

<Root>: type OPT
Name: <Root>
Type: OPT (EDNS0 option)
UDP payload size: 4096
Higher bits in extended RCODE: 0x0
EDNS0 version: 0
Z: 0x0
Data length: 0

Frame 27: 161 bytes on wire (1288 bits), 161 bytes captured (1288 bits)

Linux cooked capture

Internet Protocol Version 6, Src: HSGW, Dst: DNS_Server

User Datagram Protocol, Src Port: 50002 (50002), Dst Port: domain (53)

Domain Name System (query)

[Response In: 28]

Transaction ID: 0x07b6

Flags: 0x0100 Standard query

Questions: 1

Answer RRs: 0

Authority RRs: 0

Additional RRs: 1

Queries

topon.lb2.pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.3gppnetwork.org:

type AAAA, class IN

Additional records

<Root>: type OPT
Name: <Root>
Type: OPT (EDNS0 option)

```
UDP payload size: 4096
Higher bits in extended RCODE: 0x0
EDNS0 version: 0
Z: 0x0
Data length: 0
```

Frame 28: 189 bytes on wire (1512 bits), 189 bytes captured (1512 bits)

Linux cooked capture

Internet Protocol Version 6, Src: DNS_Server , Dst: HSGW

User Datagram Protocol, Src Port: domain (53), Dst Port: 50002 (50002)

Domain Name System (response)

[Request In: 27]

[Time: 0.007622000 seconds]

Transaction ID: 0x07b6

Flags: 0x8580 Standard query response, No error

Questions: 1

Answer RRs: 1

Authority RRs: 0

Additional RRs: 1

Queries

```
topon.lb2.pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.3gppnetwork.org:
    type AAAA, class IN
```

Answers

```
topon.lb2.pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.3gppnetwork.org:
    type AAAA, class IN, addr 2001:5555:200:1000:201:201::
    Name: topon.lb2.pgw02.PHLA.sa002.so.node.epc.mnc420.mcc300.3gppnetwork.org
    Type: AAAA (IPv6 address)
    Class: IN (0x0001)
    Time to live: 30 minutes
    Data length: 16
    Addr: 2001:5555:200:1000:201:201::
```

Additional records

```
<Root>: type OPT
    Name: <Root>
    Type: OPT (EDNS0 option)
    UDP payload size: 4096
    Higher bits in extended RCODE: 0x0
    EDNS0 version: 0
    Z: 0x0
    Data length: 0
```

日志

在版本12.2中添加了一项功能，在两分钟内出现大量连接拒绝错误时，会触发为DNS客户端配置的IP地址在中断情况下重新绑定。日志条目示例为：

```
[vpn 5795 error] [1/0/30805 <vpnmgr:4> vpnmgr_msg.c:13773]
[context: Ingress, contextID: 4] [software internal system syslog]
Ingress: Rebinding DNS-CLIENT as connection refused errors
(<# of failures>) occuring continously
```

示例：

```
Jun  2 00:03:36 [10.142.250.226.171.216] evlogd: [local-60sec36.031]
[vpn 5450 error] [1/0/30805 <vpnmgr:4> vpnmgr_msg.c:13680] [context: Ingress,
contextID: 4] [software internal system syslog] Connection
refused for DNS query on QNAME:APN1.apn.epc.mnc420.mcc300.3gppnetwork.org
```

and QTYPE:NAPTR..... Many more of these logs

```
Jun  2 00:05:35 [10.142.250.226.171.216] evlogd: [local-60sec35.058]
[vpn 5450 error] [1/0/30805 <vpnmgr:4> vpnmgr_msg.c:13680]
[context: Ingress, contextID: 4] [software internal system syslog]
Connection refused for DNS query on QNAME:APN1.apn.epc.mnc420.mcc300.3gppnetwork.org
and QTYPE:NAPTR
```

```
Jun  2 00:05:35 [10.142.250.226.171.216] evlogd: [local-60sec35.058]
[vpn 5795 error] [1/0/30805 <vpnmgr:4> vpnmgr_msg.c:13773]
[context: Ingress, contextID: 4] [software internal system syslog]
Ingress: Rebinding DNS-CLIENT as connection refused errors (3132) occurring continuously
```

数据包捕获

在需要捕获数据包以确定从DNS服务器发回和发回的内容时，已发现一些棘手的DNS问题。统计信息和监控协议可能无法提供足够的信息。

- 技术支持能够使用TCP转储设备捕获DNS数据包，并可能建议在故障排除过程中采用这种方法。
 -
- 捕获点可以基于任何能够干预和协商TCP/IP连接的防火墙非常重要。可能需要多个捕获点来查找问题的根本原因。
- 使用Wireshark中的**Follow TCP stream**菜单选项过滤特定的TCP连接，以便更轻松地在文件中浏览多个TCP数据流。

排除与呼叫控制相关的DNS故障

如前所述，DNS本身不起作用，但它是呼叫控制流的启用者或组件。例如，在eHRPD的情况下，当需要确定PGW连接时，在呼叫点需要DNS。如果在流中的此点发生故障，则相应的呼叫控制统计信息会反映此情况。

show hsgw-service statistics

如果DNS失败，预计“No PGW Available”计数器将增加。由于呼叫在尝试向PGW发出请求之前会失败，因此“show mag statistics”不会捕获此信息（这些事件将不会计入绑定更新发送）

示例：

```
[Ingress]HSGW> show hsgw statistics all
Monday June 02 00:49:06 UTC 2014
```

```
Total PDNs Rejected Reason:
No PGW Available: 9549866
```

```
[Ingress]HSGW> show hsgw statistics all
Monday June 02 00:49:16 UTC 2014
```

No PGW Available: 9554113

监控用户

请注意，DNS数据包本身未在监控用户中捕获。尽管它们确实由单个用户活动触发，但它们独立于给定用户工作，必须由监控协议捕获，如前所述。

DNS基础设施控制消息，例如“用户配置文件中APN <APN Name>的LMA地址不可用，PDN连接失败”，并且VSNCP Conf-Rej以“Error-Code(6)=No-PDN-GW-Available(3)”发送给用户。

示例：

```
INBOUND>>>> 00:25:26:925 Eventid:25000(0)PPP Rx PDU (72)VSNCP 72:
Conf-Req(2), OUI=cf0002(3GPP2) , PDN-ID(1)=00, PDN-APN-Name(2)=\013APN1,
PDN-Type(3)=IPv4,IPv6(3), PDN-Address(4)=(Null), PCO(5)
{Protocol(0) = PPP(0), {IPCP
(1): Conf-Req(1), Pri-DNS=0.0.0.0, Sec-DNS=0.0.0.0}, IPv6-DNS-Address(2)=Req, IP-Address-
Allocation-via-NAS-Signaling(3), }, Attach-Type(7)=Initial(1),
IPv4-Default-Router-Address(8)=0.0.0.0, Address-Allocation-Cause(9)=Null(0)

***CONTROL*** 00:25:27:054 Eventid:11813
No LMA address available for APN
```

```
Monday June 02 2014
<<<<OUTBOUND 00:25:27:054 Eventid:25001(0)
PPP Tx PDU (14)
VSNCP 14: Conf-Req(1), OUI=cf0002(3GPP2) , PDN-ID(1)=00
```

```
Monday June 02 2014
<<<<OUTBOUND 00:25:27:054 Eventid:25001(0)
PPP Tx PDU (52)
VSNCP 52: Conf-Rej(2), OUI=cf0002(3GPP2) , PDN-ID(1)=00, PDN-APN-Name(2)=\013APN1,
PDN-Type(3)=IPv4,IPv6(3), PDN-Address(4)=(Null), PCO(5){Protocol(0)
= PPP(0), }, Attach-Type(7)=Initial(1), IPv4-Default-Router-Address(8)=0.0.0.0,
Address-Allocation-Cause(9)=Null(0), Error-Code(6)=No-PDN-GW-Available(3)
```

日志

查找与呼叫控制相关的任何错误日志。

示例：

```
Jun 2 00:25:27 [10.142.250.226.171.216] evlogd: [local-60sec27.054]
[sessmgr 11813 error] [15/0/5827 <sessmgr:71> sessmgr_mag.c:3595]
[callid 14ec7ad1] [context: Ingress, contextID: 4] [software internal
system protocol-log syslog] No LMA address available for APN
```

相关信息

- [ASR5000系统管理指南 — 思科系统](#)
- [RFC 5966](#)
- [技术支持和文档 - Cisco Systems](#)

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