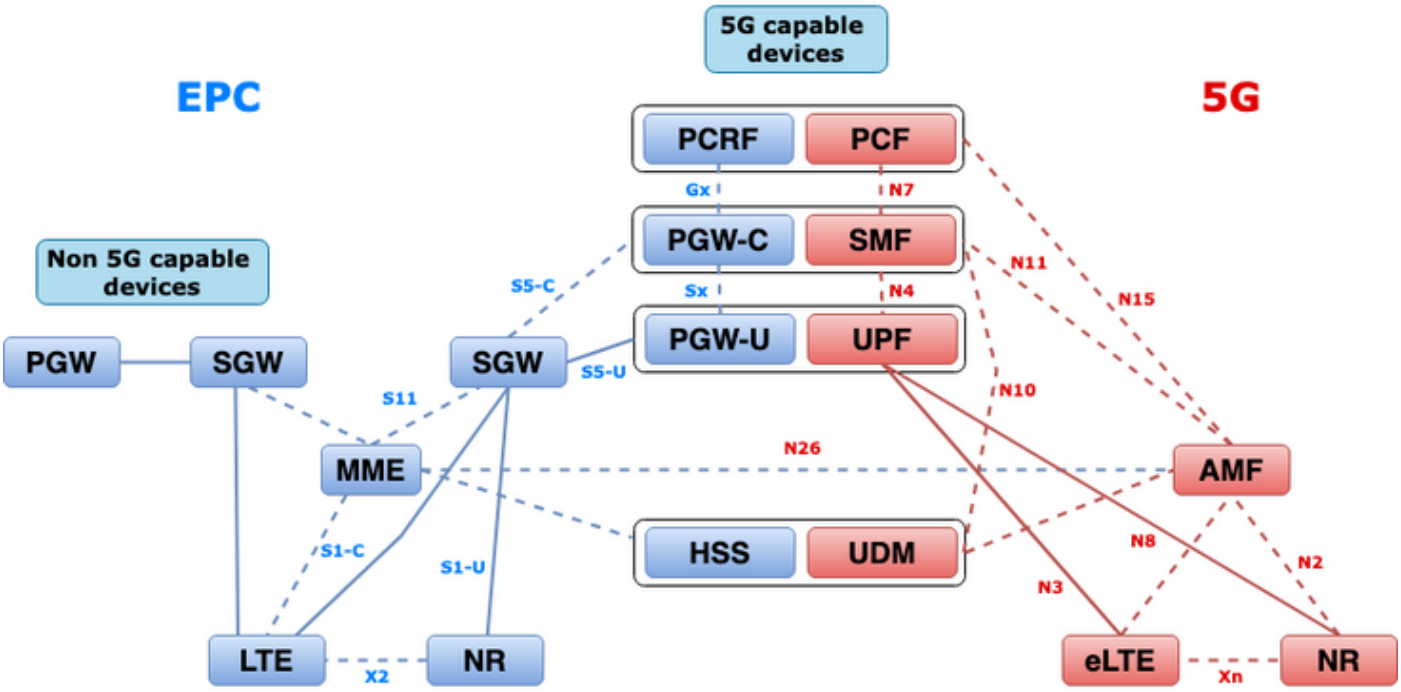
排除SMF/UPF上的用户问题

目录

简介

本文档介绍用于SMF/UPF上的用户问题的CLI命令。此外，它还包含用于5G呼叫流分析的Wireshark过滤器。

1. 4G/5G网际网络架构



2. 5G核心（基于服务）架构

3GPP采用具象状态传输(REST)架构设计模型，支持5G核心上分布式应用与功能之间的通信。

REST依靠标准协议HTTP或HTTPS在实体之间传输呼叫，在该协议中利用唯一的URL标识符（动词或名词）。为REST指定的HTTP方法或谓词如下：

- GET :检索请求中URI寻址的资源
- POST:请求服务器创建新资源
- PUT:用请求的负载（JSON格式）替换（完全）URI寻址的资源
- 补丁程序:更新资源（部分）
- DELETE :删除请求中URI寻址的资源

基于服务的架构(SBA):一种系统架构，其中系统功能由网络功能(NF)实现。 为使用其服务的授权NF提供服务。

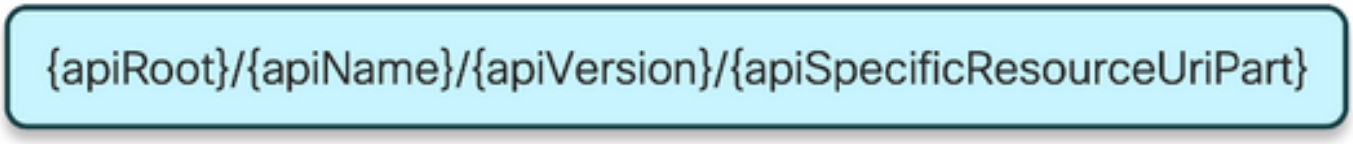
NF服务：NF服务是NF（NF服务生成者）通过基于服务的接口向其他授权NF（NF服务使用者）公开的一种功能。

基于服务的接口(SBI):基于服务的接口表示给定NF如何提供或公开服务集。这是调用NF服务操作的接口。NAMF、NSMF、NUDM、NNRF、NNSSF、Nausf、Nnef、Nsmsf等。

基于服务的接口(SBI)使用TCP上的HTTP/2协议在3GPP定义的NF服务之间通信。TCP提供IETF RFC 5681中指定的传输级拥塞控制机制，可用于两个TCP终端（即逐跳）之间的拥塞控制。HTTP/2还提供流控制机制和流并发限制，如IETF RFC 7540中所指定，这些机制和限制可配置用于连接级拥塞控制。

3.统一资源标识符

5G NF服务可以包含可访问的多个资源。统一资源标识符(URI)是标识特定资源的字符串。



- apiRoot是http://或https://的串联，与权限（主机和可选端口）和可选部署特定字符串相结合。
- apiName通常表示API调用的服务。
- apiVersion是API的版本号。
- apiSpecificResourceUriPart表示API用于访问/操作的特定资源。

4.会话管理功能(SMF)

思科会话管理功能(SMF)是5G核心网络(5GC)的控制平面网络功能(NF)之一。 SMF负责每个会话通过支持的各个功能进行会话管理。

SMF支持会话管理（会话建立、修改、发布）、UE IP地址分配和管理、DHCP功能、与会话管理相关的NAS信令终止、DL数据通知和UPF的流量引导配置，以实现适当的流量路由。（AMF属于EPC世界的MME和PGW功能。）

五、用户平面功能

用户平面功能(UPF)是5G核心网络(5GC)的网络功能(NF)之一。 UPF负责在5G架构中为互联数据网络(DN)提供数据包路由和转发、数据包检测、QoS处理和外部PDU会话。

UPF是一种独特的虚拟网络功能(VNF)，为用户流量提供高性能转发引擎。利用矢量分组处理(VPP)技术，UPF可实现超快速分组转发，同时保持与所有用户平面功能的兼容性。

6. SMF CLI命令

6.1.检查特定用户是否已连接

```
[smf/data] smf# show subscriber namespace smf supi imsi-123969789012404 gr-instance 1
subscriber-details
{
 "subResponses": [
   [
     "roaming-status:visitor-lbo",
     "ue-type:nr-capable",
     "supi:imsi-123969789012404",
     "gpsi:msisdn-22331010101010",
     "pei:imei-123456789012381",
     "psid:1",
     "dnn:testing.com",
     "emergency:false",
     "rat:nr",
     "access:3gpp access",
     "connectivity:5g",
     "udm-uecm:10.10.10.215",
     "udm-sdm:10.10.10.215",
     "auth-status:unauthenticated",
     "pcfGroupId:PCF-dnn=testing.com;",
     "policy:2",
```

```
     "pcf:10.10.10.216",
     "upf:10.10.10.150",
     "upfEpKey:10.10.10.150:20.20.20.202",
     "ipv4-addr:pool1/172.16.0.3",
     "ipv4-pool:pool1",
     "ipv4-range:pool1/172.16.0.1",
     "ipv4-startrange:pool1/172.16.0.1",
     "ipv6-pfx:pool1/2001:db0:0:2::",
     "ipv6-pool:pool1",
     "ipv6-range:pool1/2001:db0::",
     "ipv6-startrange:pool1/2001:db0::",
     "id-index:1:0:32768",
     "id-value:2/3",
     "amf:10.10.10.217",
     "peerGtpuEpKey:10.10.10.150:20.0.0.1",
     "namespace:smf",
     "nf-service:smf"
   ]
 ]
}
```

注意：如果启用了GEO冗余(GR)功能，则需要检查用户连接到哪个GR实例。

6.2.确定对等IP地址及其状态

```
### NRF Peers
[smf/data] smf# show peers all rpc NRF
GR                                                                  POD
CONNECTED       ADDITIONAL  INTERFACE
INSTANCE  ENDPOINT  LOCAL ADDRESS   PEER ADDRESS       DIRECTION  INSTANCE   TYPE  TIME
RPC  DETAILS     NAME
-------------------------------------------------------------------------------------------------
--------------------------
1         <none>    192.168.109.94  20.20.20.219:8080  Outbound   rest-ep-0  Rest  21 hours
NRF  <none>      nrf

### AMF Peers
[smf/data] smf# show peers all rpc AMF
GR                                                                  POD
CONNECTED       ADDITIONAL  INTERFACE
INSTANCE  ENDPOINT  LOCAL ADDRESS   PEER ADDRESS       DIRECTION  INSTANCE   TYPE  TIME
RPC  DETAILS     NAME
-------------------------------------------------------------------------------------------------
--------------------------
1         <none>    192.168.109.94  10.10.10.217:8086  Outbound   rest-ep-0  Rest  21 hours
AMF  <none>      n11

### UDM Peers
[smf/data] smf# show peers all rpc UDM
GR                                                                  POD
CONNECTED       ADDITIONAL  INTERFACE
INSTANCE  ENDPOINT  LOCAL ADDRESS   PEER ADDRESS       DIRECTION  INSTANCE   TYPE  TIME
RPC  DETAILS     NAME
-------------------------------------------------------------------------------------------------
--------------------------
1         <none>    192.168.109.94  10.10.10.215:8000  Outbound   rest-ep-0  Rest  21 hours
UDM  <none>      n10

### CHF Peers
[smf/data] smf# show peers all rpc CHF
GR                                                                  POD
```

```
CONNECTED       ADDITIONAL  INTERFACE
INSTANCE  ENDPOINT  LOCAL ADDRESS   PEER ADDRESS       DIRECTION  INSTANCE   TYPE  TIME
RPC  DETAILS     NAME
-------------------------------------------------------------------------------------------------
-------------------------
1         <none>    192.168.109.94  20.20.20.218:1090  Outbound   rest-ep-0  Rest  21 hours
CHF  <none>      n40

### PCF Peers
[smf/data] smf# show peers all rpc PCF
GR                                                                  POD
CONNECTED       ADDITIONAL  INTERFACE
INSTANCE  ENDPOINT  LOCAL ADDRESS   PEER ADDRESS       DIRECTION  INSTANCE   TYPE  TIME
RPC  DETAILS     NAME
-------------------------------------------------------------------------------------------------
-------------------------
1         <none>    192.168.109.94  10.10.10.216:8080  Outbound   rest-ep-0  Rest  19 hours
PCF  <none>      n7
```

6.3.确定UPF IP地址

从“show subscriber namespace smf supi imsi-xxxxxxxxxxxxxxx”获取UPF IP，然后从配置中过滤此特定IP地址以确认节点ID:

```
[smf/data] smf# show subscriber namespace smf supi imsi-123969789012404 gr-instance 1 | include
"upf:"
     "upf:10.10.10.150",

[smf/data] smf# show running-config profile network-element upf n4-peer-address ipv4
10.10.10.150
profile network-element upf upf1
 node-id           n4-peer-NAME
 n4-peer-address ipv4 10.10.10.150
 n4-peer-port      8805
 upf-group-profile upf-group1
 dnn-list          [ testing.com ]
 capacity          10
 priority          1
exit
```

6.4过滤特定用户的DNN

```
[smf/data] smf# show subscriber namespace smf supi imsi-123969789012404 gr-instance 1 | include
"dnn:"
     "dnn:testing.com",
```

6.5.启用监控用户

```
[smf/data] smf# monitor subscriber supi imsi-123969789012404 gr-instance 1 nf-service smf
capture-duration 3600 internal-messages yes
supi: imsi-123969789012404
captureDuraiton: 3600
enableInternalMsg: true
enableTxnLog: false
namespace(deprecated. Use nf-service instead.): none
nf-service: smf
gr-instance: 1
```

```
 % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                Dload  Upload   Total   Spent    Left  Speed
100   305  100   103  100   202   3678   7214 --:--:-- --:--:-- --:--:-- 11296
Command: --header Content-type:application/json --request POST --data
{"commandname":"mon_sub","parameters":{"supi":"imsi-
123969789012404","duration":3600,"enableTxnLog":false,"enableInternalMsg":true,"action":"start",
"namespace":"none","nf-service":"smf","grInstance":1}} http://oam-pod:8879/commands
Result start mon_sub, fileName ->logs/monsublogs/smf.imsi-123969789012404_TS_2022-05-
24T18:27:21.343004358.txt
Starting to tail the monsub messages from file: logs/monsublogs/smf.imsi-
123969789012404_TS_2022-05-24T18:27:21.343004358.txt
Defaulting container name to oam-pod.
Use 'kubectl describe pod/oam-pod-0 -n cn-data' to see all of the containers in this pod.
```

注意：输入Ctrl+C停止捕获。

7. UPF CLI命令

7.1.确定特定用户的呼叫

```
[local]saegw-up1# show subscriber imsi 123969789012404
+-----Access  (S) - pdsn-simple-ip     (M) - pdsn-mobile-ip  (H) - ha-mobile-ip
|     Type:   (P) - ggsn-pdp-type-ppp  (h) - ha-ipsec        (N) - lns-l2tp
|             (I) - ggsn-pdp-type-ipv4                       (G) - IPSG
|             (V) - ggsn-pdp-type-ipv6                       (C) - cscf-sip
|             (z) - ggsn-pdp-type-ipv4v6                     (A) - X2GW
|             (R) - sgw-gtp-ipv4       (O) - sgw-gtp-ipv6    (Q) - sgw-gtp-ipv4-ipv6
|             (W) - pgw-gtp-ipv4       (Y) - pgw-gtp-ipv6    (Z) - pgw-gtp-ipv4-ipv6
|             (B) - pgw-gtp-non-ip     (J) - sgw-gtp-non-ip
|             (@) - saegw-gtp-ipv4     (#) - saegw-gtp-ipv6  ($) - saegw-gtp-ipv4-ipv6
|             (&) - samog-ip           (^) - cgw-gtp-ipv6    (*) - cgw-gtp-ipv4-ipv6
|             (p) - sgsn-pdp-type-ppp  (s) - sgsn            (4) - sgsn-pdp-type-ip
|             (6) - sgsn-pdp-type-ipv6 (2) - sgsn-pdp-type-ipv4-ipv6
|             (L) - pdif-simple-ip     (K) - pdif-mobile-ip  (o) - femto-ip
|             (F) - standalone-fa
|             (e) - ggsn-mbms-ue       (U) - pdg-ipsec-ipv4
|             (E) - ha-mobile-ipv6     (T) - pdg-ssl         (v) - pdg-ipsec-ipv6
|             (f) - hnbgw-hnb          (g) - hnbgw-iu        (x) - s1-mme
|                                      (k) - PCC
|             (X) - HSGW               (n) - ePDG            (t) - henbgw-ue
|             (m) - henbgw-henb        (q) - wsg-simple-ip   (r) - samog-pmip
|             (D) - bng-simple-ip      (l) - pgw-pmip        (3) - GILAN
|             (y) - User-Plane         (u) - Unknown
|             (+) - samog-eogre        (%) - eMBMS-ipv4      (!) - eMBMS-ipv6
|
|+----Access  (X) - CDMA 1xRTT         (E) - GPRS GERAN      (I) - IP
||    Tech:   (D) - CDMA EV-DO         (U) - WCDMA UTRAN     (W) - Wireless LAN
||            (A) - CDMA EV-DO REVA    (G) - GPRS Other      (M) - WiMax
||            (C) - CDMA Other         (J) - GAN             (O) - Femto IPSec
||            (P) - PDIF               (S) - HSPA            (L) - eHRPD
||            (T) - eUTRAN             (B) - PPPoE           (F) - FEMTO UTRAN
||            (N) - NB-IoT             (Q) - WSG             (.) - Other/Unknown
||
||+---Call    (C) - Connected          (c) - Connecting
|||   State:  (d) - Disconnecting      (u) - Unknown
|||           (r) - CSCF-Registering   (R) - CSCF-Registered
|||           (U) - CSCF-Unregistered
|||
|||+--Access  (A) - Attached           (N) - Not Attached
```

```
||||  CSCF    (.) - Not Applicable
||||  Status:
||||
||||+-Link    (A) - Online/Active      (D) - Dormant/Idle
|||||| Status:
||||||
||||||+Network (I) - IP                 (M) - Mobile-IP         (L) - L2TP
||||||||Type:   (P) - Proxy-Mobile-IP    (i) - IP-in-IP          (G) - GRE
||||||||        (V) - IPv6-in-IPv4       (S) - IPSEC             (C) - GTP
||||||||        (A) - R4 (IP-GRE)        (T) - IPv6              (u) - Unknown
||||||||        (W) - PMIPv6(IPv4)       (Y) - PMIPv6(IPv4+IPv6) (R) - IPv4+IPv6
||||||||        (v) - PMIPv6(IPv6)       (/) - GTPv1(For SAMOG)  (+) - GTPv2(For SAMOG)
||||||||        (N) - NON-IP             (x) - UDP-IPv4          (X) - UDP-IPv6
||||||||
||||||||
vvvvvv CALLID   MSID            USERNAME               IP                            TIME-IDLE
------ -------- --------------- ---------------------- ----------------------------- ---------
y.C.AI 01317b22 123969789012404 -                      2001:db0:0:3:0:1:317b:2201,172.16.0.4
00h00m00s
```

7.2.获取用户级信息（如ruledef、pdr、far、qer、urr）

```
show subs user-plane-only full callid 01317b22
show subs data-rate call 01317b22
show subscribers user-plane-only callid 01317b22 pdr full all
show subscribers user-plane-only callid 01317b22 far full all
show subscribers user-plane-only callid 01317b22 qer full all
show subscribers user-plane-only callid0 1317b22 urr full all
```

> **注意**：在本例中，我们使用01317b22作为callid。但是，您需要根据从步骤7.1获得的输出使用调用。

7.3.启用监控用户

```
[local]saegw-up1# monitor subscriber imsi 123969789012404
-------------------------------------------------------------------------------
Matching Call Found:
-------------------------------------------------------------------------------
 MSID/IMSI   : 123969789012404            Callid      : 01317b22
 IMEI        : 123456789012381            MSISDN      : 22331010101010
 Username    : n/a                        SessionType : uplane-ipv4v6
 Status      : Active                     Service Name: upf
 Src Context : up                         Dest Context: ISP
-------------------------------------------------------------------------------
C - Control Events  (ON )      11 - PPP         (ON )  21 - L2TP        (ON )
D - Data Events     (ON )      12 - A11         (ON )  22 - L2TPMGR     (OFF)
E - EventID Info    (ON )      13 - RADIUS Auth (ON )  23 - L2TP Data   (OFF)
I - Inbound Events  (ON )      14 - RADIUS Acct (ON )  24 - GTPC        (ON )
O - Outbound Events (ON )      15 - Mobile IPv4 (ON )  25 - TACACS  (ON )
S - Sender Info     (OFF)      16 - A11MGR      (OFF)  26 - GTPU        (OFF)
T - Timestamps      (ON )      17 - SESSMGR     (ON )  27 - GTPP        (ON )
X - PDU Hexdump     (OFF)      18 - A10         (OFF)  28 - DHCP        (ON )
A - PDU Hex/Ascii   (OFF)      19 - User L3     (OFF)  29 - CDR         (ON )
+/- Verbosity Level (  1)      31 - Radius COA  (ON )  30 - DHCPV6      (ON )
L - Limit Context   (OFF)      32 - MIP Tunnel  (ON )  53 - SCCP        (OFF)
M - Match Newcalls  (ON )      33 - L3 Tunnel   (OFF)  54 - TCAP        (OFF)
R - RADIUS Dict: (no-override) 34 - CSS Data    (OFF)  55 - MAP         (ON )
G - GTPP Dict: (no-override)   35 - CSS Signal  (OFF)  56 - RANAP       (OFF)
Y - Multi-Call Trace (OFF)     36 - EC Diameter (ON )  57 - GMM         (ON )
```

```
H - Display ethernet (OFF)     37 - SIP (IMS)   (OFF)  58 - GPRS-NS     (OFF)
                       39 - LMISF (OFF)
U - Mon Display     (ON )      40 - IPSec IKEv2 (OFF)  59 - BSSGP       (OFF)
V - PCAP Hexdump     (OFF)     41 - IPSG RADIUS (ON )  60 - CAP         (ON )
F - Packet Capture: (Full Pkt) 42 - ROHC        (OFF)  64 - LLC         (OFF)
/ - Priority        (  0)      43 - WiMAX R6    (ON )  65 - SNDCP       (OFF)
N - MEH Header      (OFF)      44 - WiMAX Data  (OFF)  66 - BSSAP+      (OFF)
W - UP PCAP Trace   (ON )      45 - SRP         (OFF)  67 - SMS         (OFF)
                               68 - OpenFlow(ON )
                              46 - BCMCS SERV AUTH(OFF)
                              47 - RSVP        (ON )
                              48 - Mobile IPv6 (ON )  69 - X2AP        (ON )
                                                   77 - ICAP/UIDH   (ON )
                              50 - STUN (IMS)  (OFF)  78 - Micro-Tunnel(ON )
                              51 - SCTP        (OFF)
                              72 - HNBAP       (ON )  79 - ALCAP       (ON )
                              73 - RUA         (ON )  80 - SSL         (ON )
                              74 - EGTPC       (ON )
                              75 - App Specific Diameter  (OFF)
                              81 - S1-AP       (ON )  82 - NAS         (ON )
                              83 - LDAP        (ON )  84 - SGS         (ON )
                              85 - AAL2        (ON )  86 - S102         (ON )
                              87 - PPPOE  (ON )
                              88 - RTP(IMS)    (OFF)  89 - RTCP(IMS)   (OFF)
                              91 - NPDB(IMS)  (OFF)
                              92 - SABP  (ON )
                              94 - SLS   (ON )
                              96 - SBc-AP  (ON )
                              97 - M3AP    (ON )
                              49 - PFCP    (ON )
                              76 - NSH    (ON )
 (Q)uit,   <ESC> Prev Menu,   <SPACE> Pause,   <ENTER> Re-Display Options
*** User L3 PDU Decodes (ON ) ***
*** GTPU PDU Decodes (ON ) ***
*** CSS Data Decodes (ON ) ***
*** CSS Signaling (ON ) ***
*** session initiation protocol (SIP) decodes (ON ) ***
*** IPSEC IKE Subscriber (ON ) ***
*** Real Time Transport Protocol(RTP) decodes (ON ) ***
*** Real Time Transport Control Protocol(RTCP) decodes (ON ) ***
*** PDU Hex+Ascii dump (ON ) ***
*** PDU Hexdump (ON ) ***
*** Multi-Call Trace (ON ) ***
*** Verbosity Level (  2) ***
*** Verbosity Level (  3) ***
*** Verbosity Level (  4) ***
*** Verbosity Level (  5) ***
```

注意：根据用户问题启用必要的选项（VoLTE呼叫的A、X、Y、19、26、34、35和37、40、88、89是最常见的选项，加上详细程度5）。 输入Q以停止监控器用户。

7.4.获取特定用户的慢速路径/vpp PCAP

```
[local]saegw-up1# monitor subscriber imsi 123969789012404
-------------------------------------------------------------------------
Matching Call Found:
-------------------------------------------------------------------------
 MSID/IMSI   : 123969789012404            Callid      : 01317b22
 IMEI        : 123456789012381            MSISDN      : 22331010101010
 Username    : n/a                        SessionType : uplane-ipv4v6
```

```
 Status      : Active                      Service Name: upf
 Src Context : up                          Dest Context: ISP
-------------------------------------------------------------------------
C - Control Events  (ON )      11 - PPP         (ON )  21 - L2TP        (ON )
D - Data Events     (ON )      12 - A11         (ON )  22 - L2TPMGR     (OFF)
E - EventID Info    (ON )      13 - RADIUS Auth (ON )  23 - L2TP Data   (OFF)
I - Inbound Events  (ON )      14 - RADIUS Acct (ON )  24 - GTPC        (ON )
O - Outbound Events (ON )      15 - Mobile IPv4 (ON )  25 - TACACS  (ON )
S - Sender Info     (OFF)      16 - A11MGR      (OFF)  26 - GTPU        (OFF)
T - Timestamps      (ON )      17 - SESSMGR     (ON )  27 - GTPP        (ON )
X - PDU Hexdump     (OFF)      18 - A10         (OFF)  28 - DHCP        (ON )
A - PDU Hex/Ascii   (OFF)      19 - User L3     (OFF)  29 - CDR         (ON )
+/- Verbosity Level (  1)      31 - Radius COA  (ON )  30 - DHCPV6      (ON )
L - Limit Context   (OFF)      32 - MIP Tunnel  (ON )  53 - SCCP        (OFF)
M - Match Newcalls  (ON )      33 - L3 Tunnel   (OFF)  54 - TCAP        (OFF)
R - RADIUS Dict: (no-override) 34 - CSS Data    (OFF)  55 - MAP         (ON )
G - GTPP Dict: (no-override)   35 - CSS Signal  (OFF)  56 - RANAP       (OFF)
Y - Multi-Call Trace (OFF)     36 - EC Diameter (ON )  57 - GMM         (ON )
H - Display ethernet (OFF)     37 - SIP (IMS)   (OFF)  58 - GPRS-NS     (OFF)
                        39 - LMISF (OFF)
U - Mon Display     (ON )      40 - IPSec IKEv2 (OFF)  59 - BSSGP       (OFF)
V - PCAP Hexdump    (ON)      41 - IPSG RADIUS (ON )  60 - CAP         (ON )
F - Packet Capture: (Full Pkt) 42 - ROHC        (OFF)  64 - LLC         (OFF)
/ - Priority        (  0)      43 - WiMAX R6    (ON )  65 - SNDCP       (OFF)
N - MEH Header      (OFF)      44 - WiMAX Data  (OFF)  66 - BSSAP+      (OFF)
W - UP PCAP Trace   (ON )      45 - SRP         (OFF)  67 - SMS         (OFF)
                               68 - OpenFlow(ON )
                             46 - BCMCS SERV AUTH(OFF)
                             47 - RSVP        (ON )
                             48 - Mobile IPv6 (ON )  69 - X2AP        (ON )
                                                  77 - ICAP/UIDH   (ON )
                             50 - STUN (IMS)  (OFF)  78 - Micro-Tunnel(ON )
                             51 - SCTP        (OFF)
                             72 - HNBAP       (ON )  79 - ALCAP       (ON )
                             73 - RUA         (ON )  80 - SSL         (ON )
                             74 - EGTPC       (ON )
                             75 - App Specific Diameter  (OFF)
                             81 - S1-AP       (ON )  82 - NAS         (ON )
                             83 - LDAP        (ON )  84 - SGS         (ON )
                             85 - AAL2        (ON )  86 - S102         (ON )
                             87 - PPPOE  (ON )
                             88 - RTP(IMS)    (OFF)  89 - RTCP(IMS)   (OFF)
                             91 - NPDB(IMS)  (OFF)
                             92 - SABP  (ON )
                             94 - SLS   (ON )
                             96 - SBc-AP  (ON )
                             97 - M3AP    (ON )
                             49 - PFCP    (ON )
                             76 - NSH    (ON )
 (Q)uit,   <ESC> Prev Menu,   <SPACE> Pause,   <ENTER> Re-Display Options
```

注意：可以使用选项V启用监控用户，以生成慢速路径/vpp PCAP。从“dir /hd-raid/records/hexdump”下载慢速路径/vpp PCAP。

8.每个SBI接口对Wireshark的有用过滤器

8.1. NG应用协议(NGAP)

NG应用协议(NGAP)在NG-RAN节点和接入和移动管理功能(AMF)之间提供控制平面信令。 此处提供了一些用于NG应用协议的有用Wireshark过滤器：

```
ngap.RAN_UE_NGAP_ID == <NGAP_ID>
ngap.procedureCode == 29
ngap.pDUSessionID == 5
```

8.2. NRF接口

NF存储库功能(NRF)支持服务发现功能，并维护NF配置文件和可用NF实例。（不在EPC世界中）。 此处提供一些用于NRF接口的有用Wireshark过滤器：

```
http2.header.value contains "/nnrf-nfm/v1/nf-instances/"
http2.header.value == "/nnrf-nfm/v1/nf-instances/xxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx"
json.value.string == "REGISTERED"
json.value.string == "UNDISCOVERABLE"
```

8.3. UDM注册/订用（N10接口）

统一数据管理(UDM)支持生成身份验证和密钥协议(AKA)凭证、用户标识处理、访问授权和订用管理。（属于EPC世界的HSS功能）。 下面是一些用于N10接口的有用Wireshark过滤器：

```
## Registration
http2.header.value contains "/nudm-uecm/v1/imsi-" && http2.header.value contains
"/registrations/smf-registrations"

## DELETE Registration
http2.header.value == "DELETE" && http2.header.value contains "/registrations/smf-registrations"

## Subscription
http2.header.value contains "/nudm-sdm/v2/imsi-" && http2.header.value contains "/sdm-
subscriptions"

## Subscription Fetch
http2.header.value contains "/nudm-sdm/v2/" && http2.header.value contains "/sm-
data?dnn=<dnn_name>&plmn-id="
```

8.4. AMF（N11接口）

访问和移动管理功能(AMF)支持终止NAS信令、NAS加密和完整性保护、注册管理、连接管理、移动管理、访问身份验证和授权以及安全情景管理。（AMF是EPC世界中MME功能的一部分）。 下面是一些用于N11接口的有用Wireshark过滤器：

```
## Filter all SM-Context packages
http2.header.value contains "/nsmf-pdusession/v1/sm-contexts"

## Filter SM-Context Release
http2.header.value contains "/nsmf-pdusession/v1/sm-contexts" && http2.header.value contains
"/release"

## Filter SM-Context Retrieve
http2.header.value contains "/nsmf-pdusession/v1/sm-contexts" && http2.header.value contains
"/retrieve"

## Filter SM-Context Modify
http2.header.value contains "/nsmf-pdusession/v1/sm-contexts" && http2.header.value contains
"/modify"

## Filter all UE-Context packages
http2.header.value contains "/namf-comm/v1/ue-contexts/imsi-"
```

```
## Filter all UE-Context Assign-EBi
http2.header.value contains "/namf-comm/v1/ue-contexts/imsi-" && http2.header.value contains
"/assign-ebi"

## Filter all UE-Context N1N2-Message
http2.header.value contains "/namf-comm/v1/ue-contexts/imsi-" && http2.header.value contains
"/n1-n2-message"

## Filter all UE-Context Assign-EBi/N1N2-Message for specific SUPI
http2.header.value == "/namf-comm/v1/ue-contexts/imsi-xxxxxxxxxxxxxxx/assign-ebi"
http2.header.value == "/namf-comm/v1/ue-contexts/imsi-xxxxxxxxxxxxxxx/n1-n2-messages"
```

8.5. PCF（N7接口）

策略控制功能(PCF)支持统一策略框架，为CP功能提供策略规则，并访问UDR中用于策略决策的订用信息（PCF是EPC世界的PCRF功能的一部分）身份验证服务器功能(AUSF)用作身份验证服务器（EPC世界的HSS的一部分）。 此处为N7接口提供了一些有用的Wireshark过滤器：

```
### Filter all SM-Policy packages
http2.header.value contains "/npcf-smpolicycontrol"

## Filter SM-Policy Create Request
http2.header.value == "/npcf-smpolicycontrol/v1/sm-policies"

## Filter all SM-Policy from specific SUPI
http2.header.value contains "/npcf-smpolicycontrol/v1/sm-policies" && http2.header.value
contains "imsi-xxxxxxxxxxxxxxx"

## Filter SM-Policy Update
http2.header.value contains "/npcf-smpolicycontrol/v1/sm-policies/ism.5.imsi-" &&
http2.header.value contains "/update"

#### Filter SM-Policy Delete
http2.header.value contains "/npcf-smpolicycontrol/v1/sm-policies/ism.5.imsi-" &&
http2.header.value contains "/delete"

#### Filter SM-Policy Update Notification
http2.header.value contains "smPoliciesUpdateNotification"
```

8.6. CHF（N40接口）

计费功能(CHF)是5G SA核心网络功能，支持3GPP融合计费系统功能。CHF支持多种服务的在线和离线计费功能，包括5G和4G核心集成。下面是一些用于N40接口的有用Wireshark过滤器：

```
http2.header.value == "/nchf-convergedcharging/v2/chargingdata/"
http2.header.value contains "/nchf-convergedcharging/"
```

8.7.代码错误和RST_STREAM等其他有用过滤器

```
## PDU session establishment accept
nas_5gs.sm.message_type == 0xc2

## PDU session establishment reject
nas_5gs.sm.message_type == 0xc3

## GTPv2 (filter specific IMSI)
e212.imsi == xxxxxxxxxxxxxxx
```

```
## GTPv2 (S5/S8 interface type)
gtpv2.f_teid_interface_type == 6

## GTPv2 (S2b ePDG interface type)
gtpv2.f_teid_interface_type == 30

## Search for Specific Errors
http2.header.value == 400
http2.header.value == 404
http2.header.value == 413
http2.header.value == 410
http2.header.value == 409
http2.header.value == 500
json.value.string == CONTEXT_NOT_FOUND
json.value.string == USER_NOT_FOUND

## RST_STREAM
http2.rst_stream.error
```

注意：请考虑到，要可视化HTTP2协议，您需要从Analyze中对Wireshark上的端口号进行相应**解码**。选择**Decode** 作为选项。

```
Field      Value            Type             Default               Current

TCP port   <port_number>    Integer, base 10 none                  HTTP2
```

文件名	**建议的alt-text**
diagram_internetworking.png	4G/5G网际互联架构
uri.png	统一资源标识符