



# OmniSGW

OmniSGW - (SGW)

OmniTouch



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2. [...](#)
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OmniSGW (SGW) 3GPP LTE (EPC) OmniTouch (UE)

- MME - UE
- eNodeB
- QoS
- SGW-U
- SGW-U

## SGW-C

- MME S11 (GTP-C)
- PGW-C S5/S8 (GTP-C) PDN
- SGW-U Sxa (PCFP)
- eNodeB UE
- SGW-U
- PCFP



SGW-C Elixir/OTP

- MME - S11, S5/S8, Sxa
- MME - UE GenServer
- TEID/SEID ID
- PCFP - SGW-U PCFP

...

Web UI

OmniSGWC v0.0.1 Licensed to KRC © 2025 Omnitouch

Overview

Resources

Configuration

Log

### Application

Memory Usage	BEAM Processes	Uptime
<b>276.36 MB</b>	<b>1129</b>	<b>24d 13h 6m</b>

Running Applications

Main

**sgw\_c**  
0.0.1

System

**apl\_ex**  
1.0.0

**asn1**  
5.3

**bandit**  
1.8.0

**certifi**  
2.15.0

**certmagex**

Select an application to view details



SGW-C 3GPP

## S11 (GTP-C v2)

MME SGW-C

UDP GTP-C 2



- /
- /
- /
- /
- /
- /

S11

## Sxa (PCF)

SGW-C SGW-U  
UDP PCF

- 
- 
- 
- 
- 
- 

[PCF/Sxa](#)

## S5/S8 (GTP-C v2)

SGW-C PGW-C PDN  
UDP GTP-C 2

- 
- 
- 
- 
- 

[S5/S8](#)

## UE

### UE

UE

- IMSI** -
- GUTI** - MME UE
- MSISDN** -
- TAI** -
- TEID - S11** S5/S8
- 

### PDN

PDN UE PGW-C

- APN** -
- ID** - SGW PGW
- TEID** (ID) - S5/S8
- SEID** (ID) - Sxa
- PDN** -
- QoS** - QoS

### QoS

QoS

- PDN** - PDN
- EPS** (ID) -
- QoS** - QCI (QoS) ARP (MBR, GBR)

## PCF

SGW-C SGW-U

- PDR** - (/)
- EAR** -
- QER** (QoS) -
- BAR** -

[Sxa](#)

### SGW-C UE eNodeB

SGW-C UE eNodeB

- MME** - MME SGW
- MME** - MMEs SGW
- 
- UE** - UE

## 

### 

- Elixir -1.16
- Erlang/OTP 26+
- MME SGW-U PGW-C
- LTE EPC

### 

```
[info] OmniSGW...
[info] 127.0.0.40:42068
[info] 127.0.0.10 S11
[info] 127.0.0.15 S5/S8
[info] 127.0.0.20 Sxa
[info] PCF
[info] OmniSGW
```

<http://127.0.0.40:42068/metrics>

## 

config/runtime.exs

### 

```
metrics Prometheus
s11 GTP-C MME S11
s5s8 GTP-C PGW-C S5/S8
sxa PCF SGW-U Sxa
```

[Sxa](#)







# CDR

## SGW-C

OmniSGW Omnitouch



- 1.
2. CDR
3. CDR
4. CDR
- 5.
- 6.
7. CDR
- 8.
- 9.
- 10.



CDR SGW-C CDR

PGW-C CDR EPC



- CSV
- 
- 
- 
- 3GPP - 3GPP TS 32.251 PS TS 32.298 CDR



CDR

CDR

CDR

CDR

CDR

## CDR



<epoch\_timestamp>



1726598022

Unix



- SGW-C: /var/log/sgw\_c/cdrs/

CDR directory



CDR

# CDR

# HH:MM:SS (unix\_timestamp)

# HH:MM:SS (unix\_timestamp)

# <gateway\_name>

# epoch,imsi,event,charging\_id,msisdn,ue\_imei,timezone\_raw,plmn,tac,eci,sgw\_ip,ue\_ip,pgw\_ip,apn,qci,octets\_in,octets\_out



- CDR - Unix
- - Unix
- - SGW-C
- - CSV

## CDR



0	epoch	Unix
1	imsi	
2	event	"default_bearer_start"
3	charging_id	
4	msisdn	ISDN
5	ue_imei	
6	timezone_raw	UE
7	plmn	
8	tac	
9	eci	E-UTRAN
10	sgw_ip	SGW-C S5/S8 IP
11	ue_ip	UE IP IPv4 IPv6
12	pgw_ip	PGW-C S5/S8 IP
13	apn	
14	qci	QoS
15	octets_in	
16	octets_out	



◆◆◆◆◆

1. epoch (◆◆◆)

◆◆◆ Unix ◆◆◆◆◆◆◆◆

◆◆◆ CDR ◆◆◆◆◆◆◆◆

◆◆◆

1726598022 → 2025-09-17 18:53:42 UTC

2. imsi (◆◆◆◆)

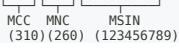
◆◆◆ ◆◆◆◆◆ 15 ◆◆◆◆

◆◆◆ MCCMNC + MSIN

◆◆◆ ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆

310260123456789



◆◆◆ UE ◆◆◆◆◆◆◆◆◆◆◆◆◆◆

3. event (CDR ◆◆◆◆)

◆◆◆ ◆◆◆

◆◆◆ <bearer\_type>\_bearer\_<event>

◆◆

- default\_bearer\_start
- default\_bearer\_update
- default\_bearer\_end
- dedicated\_bearer\_start
- dedicated\_bearer\_update
- dedicated\_bearer\_end

◆◆◆

- ◆◆ EBI◆EPS ◆◆ ID◆◆◆ LBI◆◆◆◆◆ ID◆◆default
- ◆◆ EBI ◆◆◆ LBI◆dedicated

◆◆◆ ◆◆◆◆◆◆◆EBI ◆ LBI ◆◆◆

4. charging\_id (◆◆◆◆◆)

◆◆◆ ◆◆◆ 32 ◆◆◆

◆◆◆ ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆

12345

◆◆◆ ◆ PGW-C ◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆

- ◆◆ SGW ◆ PGW ◆◆◆◆◆◆◆◆
- ◆◆ Diameter Gy/Gz ◆◆◆◆
- ◆◆◆◆◆

5. msisdn (◆◆◆◆)

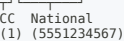
◆◆◆ ◆◆◆◆E.164 ◆◆◆

◆◆◆ ◆◆◆ ISDN ◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆ ◆◆◆◆ + ◆◆◆◆

◆◆◆

15551234567



◆◆◆ UE ◆◆◆◆◆◆◆◆ MME ◆ HSS ◆◆

6. ue\_imei (◆◆◆◆)

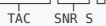
◆◆◆ ◆◆◆◆15 ◆◆◆◆

◆◆◆ TAC◆8◆+ SNR◆6◆+ Spare◆1◆

◆◆◆ ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆

123456789012345



◆◆◆ UE ◆◆◆◆◆ MME ◆◆

7. timezone\_raw (UE ◆◆)

◆◆◆ ◆◆◆◆◆◆◆◆/◆◆◆

◆◆◆ ◆◆◆◆◆◆◆ UE ◆◆◆◆

◆◆◆◆◆ ◆◆◆◆CSV ◆◆◆◆◆◆

◆◆◆◆◆ ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆

, ( )

## 8. plmn ( )

)

)

)

MCC: 505, MNC: 57

↓  
"50557"

↓  
 ) "055570"

↓  
 ) 0x055570 = 349552

)

349552 → MCC: 505, MNC: 57

) MME ) UE )

) )

## 9. tac ( )

) 16 )

) ) UE )

) 0 - 65535

)

1234

) UE ) MME )

)

- )
- )
- TAI )

## 10. eci (E-UTRAN )

) 28 )

) E-UTRAN ) UE )

) eNodeB ID20 + ID8 )

) 0 - 268,435,455

)

5678

) MME ) UE )

)

- )
- )
- )

## 11. sgw\_ip (SGW ) IP)

) IPv4 | IPv6 )

) SGW-C | S5/S8 ) IP ) F-TEID )

) IPv4 | IPv6 )

)

10.0.0.15 (IPv4)  
2001:db8::15 (IPv6)

) S5/S8 )

## 12. ue\_ip (UE IP )

) IPv4 | IPv6 )

) UE | PDN ) IP )

) <ipv4> | <ipv6>

)

172.16.1.100 (IPv4)  
[2001:db8::1 (IPv6)  
172.16.1.100|2001:db8::1 ( )

) PGW-C | PDN ) PAA )

)

- IPv4 | IPv6 )
- IPv6 | IPv6 )
- ) PDN )

## 13. pgw\_ip (PGW ) IP)

) IPv4 | IPv6 )

) PGW-C | S5/S8 ) IP ) F-TEID )

) IPv4 | IPv6 )

)



10.0.0.20 (IPv4)  
2001:db8::20 (IPv6)

PGW-C

#### 14. apn

100

PDN

DNS

internet  
ims  
mms  
enterprise.corporate

MME

- 
- 
- IP

#### 15. qci (QoS)

8

QoS

1 - 9 128-254

QCI

QCI

1	GBR	2	100 ms	10 <sup>-2</sup>	
2	GBR	4	150 ms	10 <sup>-3</sup>	
3	GBR	3	50 ms	10 <sup>-3</sup>	
4	GBR	5	300 ms	10 <sup>-6</sup>	
5	Non-GBR	1	100 ms	10 <sup>-6</sup>	IMS
6	Non-GBR	6	300 ms	10 <sup>-6</sup>	
7	Non-GBR	7	100 ms	10 <sup>-3</sup>	
8	Non-GBR	8	300 ms	10 <sup>-6</sup>	
9	Non-GBR	9	300 ms	10 <sup>-6</sup>	

9 →

PGW-C QoS

#### 16. octets\_in

64

UE

1048576 → 1 MB

SGW-U PFCP

- update
- end
- start 0

#### 17. octets\_out

64

UE →

524288 → 512 KB

SGW-U PFCP

- update
- end
- start 0

1

- 
- 5 10 MB 5 MB
- 

CDR

```
# CDR
# 10:00 (1726570800)
# 11:00 (1726574400)
# sgw-c-01
# epoch,imsi,event,charging_id,msisdn,ue_imei,timezone_raw,plmn,tac,eci,sgw_ip,ue_ip,pgw_ip,apn,qci,octets_in,octets_out
1726570800,3102601111111111,default_bearer_start,10001,15551111111,111111111111111,349552,1000,2000,10.0.0.15,172.16.1.1,10.0.0.20,internet,9,0,0
```

```
1726571000,310260111111111, default_bearer_update,10001,15551111111,111111111111111, , 349552,1000,2000,10.0.0.15,172.16.1.1|,10.0.0.20,internet,9,10485760,5242880
1726571400,310260111111111, default_bearer_end,10001,15551111111,111111111111111, , 349552,1000,2000,10.0.0.15,172.16.1.1|,10.0.0.20,internet,9,10485760,5242880
```

◆◆ 2◆◆◆◆◆◆◆◆◆◆

◆◆◆◆

1. ◆◆◆◆◆◆◆◆IPv4 + IPv6◆
2. ◆◆◆◆◆◆
3. ◆◆◆◆

CDR ◆◆◆◆

```
1726570800,310260222222222, default_bearer_start,10002,15552222222, 222222222222222, , 349552,1001,2001,10.0.0.15,172.16.1.2|2001:db8::2,10.0.0.20,internet,9,0,0
1726571100,310260222222222, default_bearer_update,10002,15552222222, 222222222222222, , 349552,1001,2001,10.0.0.15,172.16.1.2|2001:db8::2,10.0.0.20,internet,9,2097152,1048576
1726571400,310260222222222, default_bearer_update,10002,15552222222, 222222222222222, , 349552,1001,2001,10.0.0.15,172.16.1.2|2001:db8::2,10.0.0.20,internet,9,8388608,4194304
1726571700,310260222222222, default_bearer_update,10002,15552222222, 222222222222222, , 349552,1001,2001,10.0.0.15,172.16.1.2|2001:db8::2,10.0.0.20,internet,9,20971520,10485760
1726572000,310260222222222, default_bearer_end,10002,15552222222, 222222222222222, , 349552,1001,2001,10.0.0.15,172.16.1.2|2001:db8::2,10.0.0.20,internet,9,31457280,15728640
```

◆◆ 3◆◆◆◆◆◆◆◆◆◆

◆◆◆◆

1. ◆◆◆◆◆◆◆◆QCI 9◆
2. ◆◆◆◆◆◆◆◆QCI 6◆
3. ◆◆◆◆◆◆◆◆
4. ◆◆◆◆◆◆
5. ◆◆◆◆◆◆

CDR ◆◆◆◆

```
1726570800,310260333333333, default_bearer_start,10003,15553333333, 333333333333333, , 1258248,1002,2002,10.0.0.15,172.16.1.3|,10.0.0.20,internet,9,0,0
1726571100,310260333333333, dedicated_bearer_start,10004,15553333333, 333333333333333, , 1258248,1002,2002,10.0.0.15,172.16.1.3|,10.0.0.20,internet,6,0,0
1726571400,310260333333333, default_bearer_update,10003,15553333333, 333333333333333, , 1258248,1002,2002,10.0.0.15,172.16.1.3|,10.0.0.20,internet,9,5242880,2097152
1726571700,310260333333333, dedicated_bearer_update,10004,15553333333, 333333333333333, , 1258248,1002,2002,10.0.0.15,172.16.1.3|,10.0.0.20,internet,6,104857600,1048576
1726572000,310260333333333, dedicated_bearer_end,10004,15553333333, 333333333333333, , 1258248,1002,2002,10.0.0.15,172.16.1.3|,10.0.0.20,internet,6,209715200,2097152
1726572000,310260333333333, default_bearer_end,10003,15553333333, 333333333333333, , 1258248,1002,2002,10.0.0.15,172.16.1.3|,10.0.0.20,internet,9,10485760,4194304
```

◆◆◆◆

- ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆10 MB ◆◆◆◆4 MB ◆◆◆◆
- ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆200 MB ◆◆◆◆2 MB ◆◆◆◆
- ◆◆◆◆◆◆◆◆ QCI ◆◆◆◆9 ◆◆◆◆6◆◆◆◆◆◆◆◆ QoS ◆◆

◆◆◆◆

CDR ◆◆◆◆◆◆

CDR ◆◆◆◆◆◆

1. ◆◆◆◆◆◆◆◆◆◆

```
# ◆◆◆◆ CDR ◆◆◆◆SGW-C◆
inotifywait -m /var/log/sgw_c/cdrs/ -e close_write | while read path action file; do
# ◆◆◆◆◆◆◆◆◆◆ CDR
process_cdr "$path$file"
done
```

2. ◆◆◆◆◆◆

```
# ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
tail -F /var/log/sgw_c/cdrs/* | process_cdr_stream
```

◆◆◆◆◆◆◆◆

- ◆◆◆◆◆◆◆◆◆◆◆◆◆◆
- Sxa ◆◆◆◆ - ◆◆ SGW-U ◆◆◆◆◆◆◆◆
- ◆◆◆◆◆◆◆◆◆◆◆◆◆◆

3GPP ◆◆◆◆

- TS 32.251 - ◆◆◆◆◆◆◆◆PS◆◆◆◆◆◆
- TS 29.274 - 3GPP ◆◆◆◆◆◆◆◆EPS◆◆◆◆GTP-C◆◆
- TS 29.244 - CP ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆PFPC◆◆
- TS 32.298 - CDR ◆◆

CDR ◆◆◆◆ SGW-C ◆◆◆◆◆◆◆◆◆◆






◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆ Omnitouch ◆◆◆◆◆◆◆◆

◆◆◆◆◆◆◆◆ 1.0 ◆◆◆◆◆◆◆◆ 2025-12-10



























# SGW-C

  **runtime.exs** 















OmniSGW  Omnitouch    
















---










1.  
  2.    
  3.    
  4. S11   
  5. S5/S8   
  6. Sxa   
  7. CDR  
  8.   
- 



 OmniSGW      config/runtime.exs        

-    
-    (MME, PGW-C, SGW-U)
-   
- CDR  
-   

      -  runtime.exs         

 Web UI      

---



```
# config/runtime.exs
import Config

config :sgw_c,
```



# S11

```
config :sgw_c,  
  s11: %{\br/>    # S11 IPv4 MME  
    local_ipv4_address: "10.0.0.10",  
  
    # IPv6  
    local_ipv6_address: nil,  
  
    #  
    local_port: 2123,  
  
    #  
    message_timeout_ms: 5000,  
  
    #  
    max_retries: 3,  
    retry_backoff_ms: 1000  
  }  
}
```

```
#  
config :sgw_c,  
  s11: %{\br/>    local_ipv4_address: "10.0.0.10" # S11  
  }  
}
```

```
#  
config :sgw_c,  
  s11: %{\br/>    local_ipv4_address: "10.0.0.10" #  
  },  
  sxa: %{\br/>    local_ip_address: "10.1.0.20" #  
  }  
}
```

```
config :sgw_c,  
  s11: %{\br/>    # > 100ms RTT  
    message_timeout_ms: 10000,  
    max_retries: 5,  
  }  
}
```

```
retry_backoff_ms: 2000,  
  
# < 50ms RTT  
message_timeout_ms: 3000,  
max_retries: 2,  
retry_backoff_ms: 500  
}
```

---

## S5/S8

```
config :sgw_c,  
  s5s8: %{  
    # S5/S8 IPv4 PGW  
    local_ipv4_address: "10.0.0.15",  
  
    # IPv6  
    local_ipv6_address: nil,  
  
    #  
    local_port: 2123,  
  
    # PGW-C  
    pgw_peers: [  
      %{  
        ip_address: "10.0.0.20",  
        name: "pgw-c-primary"  
      },  
      %{  
        ip_address: "10.0.0.21",  
        name: "pgw-c-secondary"  
      }  
    ],  
  
    #  
    message_timeout_ms: 5000,  
    max_retries: 3,  
    retry_backoff_ms: 1000  
  }
```

## PGW

```
# PGW  
config :sgw_c,  
  s5s8: %{
```

```

    pgw_peers: [
      %{
        ip_address: "10.0.0.20",
        name: "pgw-c-prod"
      }
    ]
  }
}

# PGW
config :sgw_c,
  s5s8: %{
    pgw_peers: [
      %{ip_address: "10.0.0.20", name: "pgw-c-1"},
      %{ip_address: "10.0.0.21", name: "pgw-c-2"},
      %{ip_address: "10.0.0.22", name: "pgw-c-3"}
    ]
  }
}

# PGW-
config :sgw_c,
  s5s8: %{
    pgw_peers: [
      %{ip_address: "10.0.0.20", name: "pgw-c-primary"},
      %{ip_address: "10.0.0.21", name: "pgw-c-backup"}
    ]
  }
}

```

---

## Sxa

```

config :sgw_c,
  sxa: %{
    # Sxa IP
    local_ip_address: "10.0.0.20",

    #
    local_port: 8805,

    # SGW-U
    peers: [
      %{
        ip_address: "10.0.0.30",
        node_id: "sgw-u-1.example.com"
      }
    ],
  }
}

```

```
# heartbeat_interval_s: 20,  
  
# session_timeout_ms: 5000,  
  
# max_retries: 3  
}
```

## **SGW-U**

```
# SGW-U  
config :sgw_c,  
  sxa: %{  
    peers: [  
      %{  
        ip_address: "10.0.0.30",  
        node_id: "sgw-u-prod-01"  
      }  
    ]  
  }  
}
```

```
# SGW-U  
config :sgw_c,  
  sxa: %{  
    peers: [  
      %{  
        ip_address: "10.0.0.30",  
        node_id: "sgw-u-prod-01"  
      },  
      %{  
        ip_address: "10.0.0.31",  
        node_id: "sgw-u-prod-02"  
      }  
    ]  
  }  
}
```

```
#   
config :sgw_c,  
  sxa: %{  
    heartbeat_interval_s: 10,  
    max_retries: 2  
  }  
}
```

```
# 
```



```
config :sgw_c,  
  sxa: %{\br/>    heartbeat_interval_s: 20,  
    max_retries: 3  
  }
```

```
#   
config :sgw_c,  
  sxa: %{\br/>    heartbeat_interval_s: 40,  
    max_retries: 5  
  }
```

---

## CDR

```
config :sgw_c,  
  cdr: %{\br/>    # CDR  
    gateway_name: "sgw-c-prod-01",  
  
    #  
    rotation_interval_ms: 3600000, # 1  
  
    # CDR  
    directory: "/var/log/sgw_c/cdrs"  
  }
```

```
config :sgw_c,  
  cdr: %{\br/>    # ID  
    gateway_name: System.get_env("HOSTNAME") || "sgw-c-prod-01",  
  
    #  
    rotation_interval_ms: 3600000,  
  
    # CDR  
    directory: System.get_env("CDR_DIR") || "/var/log/sgw_c/cdrs"  
  }
```

```
config :sgw_c,
```

```
cdr: %{
  gateway_name: "sgw-c-prod-high-vol",

  # 00000000000000000000000000000000
  rotation_interval_ms: 1800000, # 30 00

  # 00000000000000000000000000000000
  directory: "/mnt/fast-ssd/sgw_c/cdrs"
}
```

---

0000

00000000

```
import Config

config :sgw_c,
  metrics: %{
    metrics_bind_address: "127.0.0.40",
    metrics_port: 42068,
    poll_interval_ms: 10000
  },
  s11: %{
    local_ipv4_address: "10.0.0.10",
    local_port: 2123,
    message_timeout_ms: 5000,
    max_retries: 3,
    retry_backoff_ms: 1000
  },
  s5s8: %{
    local_ipv4_address: "10.0.0.10",
    pgw_peers: [
      %{ip_address: "10.0.0.20", name: "pgw-c-prod"}
    ],
    message_timeout_ms: 5000,
    max_retries: 3,
    retry_backoff_ms: 1000
  },
  sxa: %{
    local_ip_address: "10.0.0.10",
    peers: [
      %{ip_address: "10.0.0.30", node_id: "sgw-u-prod-01"}
    ],
    heartbeat_interval_s: 20,
    session_timeout_ms: 5000,
    max_retries: 3
  },
}
```

```
cdr: %{
  gateway_name: "sgw-c-prod-01",
  rotation_interval_ms: 3600000,
  directory: "/var/log/sgw_c/cdrs"
}
```



```
import Config

sgw_s11_ip = System.get_env("SGW_S11_IP") || "10.0.0.10"
sgw_s5s8_ip = System.get_env("SGW_S5S8_IP") || "10.0.0.15"
sgw_sxa_ip = System.get_env("SGW_SXA_IP") || "10.0.0.20"
mgt_ip = System.get_env("MGT_IP") || "10.0.0.40"

config :sgw_c,
  metrics: %{
    metrics_bind_address: mgt_ip,
    metrics_port: 42068,
    poll_interval_ms: 5000
  },
  s11: %{
    local_ipv4_address: sgw_s11_ip,
    message_timeout_ms: 5000,
    max_retries: 3,
    retry_backoff_ms: 1000
  },
  s5s8: %{
    local_ipv4_address: sgw_s5s8_ip,
    pgw_peers: [
      %{ip_address: "10.0.0.20", name: "pgw-c-1"},
      %{ip_address: "10.0.0.21", name: "pgw-c-2"},
      %{ip_address: "10.0.0.22", name: "pgw-c-3"}
    ],
    message_timeout_ms: 5000,
    max_retries: 3,
    retry_backoff_ms: 1000
  },
  sxa: %{
    local_ip_address: sgw_sxa_ip,
    peers: [
      %{ip_address: "10.0.0.30", node_id: "sgw-u-1"},
      %{ip_address: "10.0.0.31", node_id: "sgw-u-2"},
      %{ip_address: "10.0.0.32", node_id: "sgw-u-3"}
    ],
    heartbeat_interval_s: 20,
    session_timeout_ms: 5000,
    max_retries: 3
  }
```

```
},
cdr: %{
  gateway_name: System.get_env("HOSTNAME") || "sgw-c-prod-01",
  rotation_interval_ms: 3600000,
  directory: "/var/log/sgw_c/cdrs"
}
```

◆◆◆◆◆

```
import Config
```

```
# ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
```

```
sgw_s11_ip = System.fetch_env!("SGW_S11_IP")
sgw_s5s8_ip = System.fetch_env!("SGW_S5S8_IP")
sgw_sxa_ip = System.fetch_env!("SGW_SXA_IP")
mgt_ip = System.fetch_env!("MGT_IP")
hostname = System.get_env("HOSTNAME")
```

```
# ◆◆◆◆◆ PGW ◆◆◆◆◆JSON ◆◆◆
```

```
pgw_peers_env = System.get_env("PGW_PEERS", "[]")
{:ok, pgw_peers} = Jason.decode(pgw_peers_env)
pgw_peers = Enum.map(pgw_peers, &Map.to_atom/1)
```

```
# ◆◆◆◆◆ SGW-U ◆◆◆
```

```
sgwu_peers_env = System.get_env("SGWU_PEERS", "[]")
{:ok, sgwu_peers} = Jason.decode(sgwu_peers_env)
sgwu_peers = Enum.map(sgwu_peers, &Map.to_atom/1)
```

```
config :sgw_c,
```

```
  metrics: %{
    metrics_bind_address: mgt_ip,
    metrics_port: 42068,
    poll_interval_ms: 5000
  },
  s11: %{
    local_ipv4_address: sgw_s11_ip,
    message_timeout_ms: 5000,
    max_retries: 3,
    retry_backoff_ms: 1000
  },
  s5s8: %{
    local_ipv4_address: sgw_s5s8_ip,
    pgw_peers: pgw_peers,
    message_timeout_ms: 5000,
    max_retries: 3,
    retry_backoff_ms: 1000
  },
  sxa: %{
```

```

local_ip_address: sgw_sxa_ip,
peers: sgwu_peers,
heartbeat_interval_s: 20,
session_timeout_ms: 5000,
max_retries: 3
},
cdr: %{
gateway_name: hostname,
rotation_interval_ms: 1800000, # 30
directory: "/mnt/fast-ssd/sgw_c/cdrs"
}

```

◆◆◆◆◆◆

◆◆◆◆

```

    ◆◆          ◆◆          ◆◆
SGW_S11_IP S11 ◆◆ IP 10.0.0.10
SGW_S5S8_IP S5/S8 ◆◆ IP 10.0.0.15
SGW_SXA_IP Sxa ◆◆ IP 10.0.0.20
MGT_IP      ◆◆◆◆◆◆ 10.0.0.40

```

◆◆◆◆

```

    ◆◆          ◆◆          ◆◆
HOSTNAME  CDR ◆◆◆◆◆◆          ◆◆◆◆◆◆
PGW_PEERS PGW ◆◆◆◆◆ JSON ◆◆   []
SGWU_PEERS SGW-U ◆◆◆◆◆ JSON ◆◆ []
CDR_DIR   CDR ◆◆◆◆           /var/log/sgw_c/cdrs

```

◆◆◆◆

```

export SGW_S11_IP="10.0.0.10"
export SGW_S5S8_IP="10.0.0.15"
export SGW_SXA_IP="10.0.0.20"
export MGT_IP="10.0.0.40"
export HOSTNAME="sgw-c-prod-01"
export PGW_PEERS=' [{"ip_address": "10.0.0.20", "name": "pgw-c-1"} ]'
export SGWU_PEERS=' [{"ip_address": "10.0.0.30", "node_id": "sgw-u-1"} ]'

mix run --no-halt

```

??

??????

??????

```
mix run --no-halt 2>&1 | grep -E "S11|S5/S8|Sxa|Metrics"
```

# ?????

# [info] Starting SGW-C...

# [info] Starting Metrics Exporter on 10.0.0.40:42068

# [info] Starting S11 Broker on 10.0.0.10

# [info] Starting S5/S8 Broker on 10.0.0.15

# [info] Starting Sxa Broker on 10.0.0.20

# [info] OmniSGW successfully started

??????

# ???????

```
curl http://10.0.0.40:42068/metrics | head -20
```

# ?? S11 ???????

```
netstat -an | grep 2123
```

# ??????? S11 ???????

```
tail -f /var/log/sgw_c/sgw_c.log | grep "S11"
```

??????

"??????"

??????

?????

# ???????

```
lsof -i :2123
```

# ???????

```
killall sgw_c
```

# ?

```
config :sgw_c, s11: %{local_port: 2124}
```

"**PGW**"

S5/S8 PGW-C

```
# PGW IP  
ping 10.0.0.20
```

```
#  
iptables -L | grep 2123
```

```
#  
nc -u -v 10.0.0.20 2123
```

"**SGW-U**"

Sxa

```
# SGW-U  
ping 10.0.0.30
```

```
# PFCP  
netstat -an | grep 8805
```

```
# PFCP  
iptables -L | grep 8805
```



Prometheus Grafana

OmniSGW Omnitouch

---



1.
  2.
  3.
  4.  [Prometheus](#)
  5.  [Grafana](#)
  6.
  7.
- 



OmniSGW Prometheus

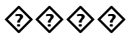


HTTP

```
#          
curl http://127.0.0.40:42068/metrics

#    
curl http://127.0.0.40:42068/metrics > metrics.txt

#    
watch -n 5 'curl -s http://127.0.0.40:42068/metrics | head -30'
```



Prometheus



```

# HELP teid_registry_count TEID
# TYPE teid_registry_count gauge
teid_registry_count 1234

# HELP s11_inbound_messages_total S11
# TYPE s11_inbound_messages_total counter
s11_inbound_messages_total{message_type="create_session_request"} 5432
s11_inbound_messages_total{message_type="delete_session_request"} 5100
s11_inbound_messages_total{message_type="modify_bearer_request"} 12000

```

?

?

?

```

teid_registry_count
├── S11/S5S8 TEID
├── Gauge
├── 0
└── 1234

```

```

seid_registry_count
├── PFCP SGW-U
├── Gauge
├── peer_ip
└── seid_registry_count{peer_ip="10.0.0.30"} 1234

```

```

active_ue_sessions
├── UE
├── Gauge
└── 5000

```

```

active_bearers
├── +
├── Gauge
└── 5500 1 + 0.1

```

```

charging_id_registry_count
├── ID
├── Gauge
└── 5000

```

?

### S11 MME

```

s11_inbound_messages_total
├── Counter
└── message_type

```

```

├── ? ?
│   ├── create_session_request
│   ├── delete_session_request
│   ├── modify_bearer_request
│   ├── create_bearer_request
│   ├── delete_bearer_request
│   ├── release_access_bearers_request
│   ├── downlink_data_notification
│   └── echo_request
└── ? ? ? s11_inbound_messages_total{message_type="create_session_request"}
5432

```

**S5/S8 ? ? ? ?**

```

s5s8_inbound_messages_total
├── ? ? ? Counter
├── ? ? ? message_type
├── ? ? ? ? S11 ? ? ? ? ? ? ? ?
└── ? ? ? s5s8_inbound_messages_total{message_type="create_session_request"}
4500

```

**Sxa ? ? ? ?**

```

sxa_inbound_messages_total
├── ? ? ? Counter
├── ? ? ? message_type
├── ? ?
│   ├── session_establishment_request
│   ├── session_modification_request
│   ├── session_deletion_request
│   ├── session_report_request
│   ├── association_setup_request
│   └── heartbeat_request
└── ? ? ? sxa_inbound_messages_total{message_type="session_report_request"}
67000

```

? ? ? ?

? ? ? ? ?

```

s11_inbound_duration_seconds
├── ? ? ? Histogram ? ? ? ?
├── ? ? ? S11 ? ? ? ? ? ?
├── ? ? ? ? ? _count, _sum, _bucket
└── ? ? ? s11_inbound_duration_seconds_bucket{le="0.1"} 5000

```

```

s5s8_inbound_duration_seconds
├── ? ? ? Histogram
└── ? ? ? S5/S8 ? ? ? ? ? ?

```

```

sxa_inbound_duration_seconds
├── ? ? ? Histogram

```

|— 333Sxa 333333

### PFCP 333

pfcp\_association\_status

|— 333Gauge  
|— 331333333 033333  
|— 333peer\_ip, node\_id  
|— 333pfcp\_association\_status{peer\_ip="10.0.0.30"} 1

pfcp\_heartbeat\_latency\_ms

|— 333Gauge  
|— 333333333333  
|— 333peer\_ip  
|— 333pfcp\_heartbeat\_latency\_ms{peer\_ip="10.0.0.30"} 15

3333

33333

s11\_inbound\_errors\_total

|— 333Counter  
|— 333error\_type  
|— 33  
|— parse\_error  
|— validation\_error  
|— timeout  
|— other  
|— 333s11\_inbound\_errors\_total{error\_type="timeout"} 12

s5s8\_inbound\_errors\_total

|— 333Counter  
|— 333S5/S8 33

sxa\_inbound\_errors\_total

|— 333Counter  
|— 333Sxa 33

33333333

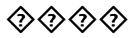
create\_session\_response\_cause

|— 333Counter  
|— 333cause\_code  
|— 3333GPP 333333  
|— 333  
|— cause\_code="0": 33  
|— cause\_code="16": 333333  
|— cause\_code="25": 3333  
|— cause\_code="49": 333333

# Prometheus



```
# Prometheus
wget https://github.com/prometheus/prometheus/releases/download/v2.45.0/
prometheus-2.45.0.linux-amd64.tar.gz
tar xzf prometheus-2.45.0.linux-amd64.tar.gz
cd prometheus-2.45.0.linux-amd64
```



## prometheus.yml:

```
global:
  scrape_interval: 15s
  evaluation_interval: 15s
  external_labels:
    monitor: 'sgw-c-prod'

scrape_configs:
  - job_name: 'sgw-c'
    static_configs:
      - targets: ['127.0.0.40:42068']
        labels:
          instance: 'sgw-c-prod-01'

  - job_name: 'sgw-c-backup'
    static_configs:
      - targets: ['127.0.0.41:42068']
        labels:
          instance: 'sgw-c-prod-02'

alerting:
  alertmanagers:
    - static_configs:
      - targets: ['127.0.0.50:9093']
```

## Prometheus

```
./prometheus --config.file=prometheus.yml \
  --storage.tsdb.path=/var/lib/prometheus \
  --web.console.libraries=consoles \
  --web.console.templates=console_templates
```

## Prometheus

http://localhost:9090

---

# Grafana

??

```
# Docker
docker run -d \
  --name=grafana \
  -p 3000:3000 \
  -e GF_SECURITY_ADMIN_PASSWORD=admin \
  grafana/grafana
```

?????

1. Grafana: <http://localhost:3000>
2. →
3. → Prometheus
4. URL: <http://prometheus:9090>

????????

???

```
1
├── Gauge
├── Gauge
├── S11 /
└── S5/S8 /
```

```
2
├── Sxa /
├── S11 p95
├── S5/S8 p95
└── Sxa p95
```

```
3
├── S11 /
├── S5/S8 /
├── Sxa /
└── PFCP
```

????????

???

```
1
├── S11
├── S5/S8
├── SGW-U
└── Gauge
```

2

```
├─ S11  ? ? ? ? ? ? ? ?
├─ S5/S8  ? ? ? ? ? ? ? ?
├─ Sxa  ? ? ? ? ? ? ? ?
└─  ? ? ? ? ? ? ? ?
```

```
◇ 3 ◇
├─ ? ? ? ? ? ? ? ? ? ?
├─ ? ? ? ? ? ? ? ? ? ?
├─ ? ? ? ? ? ? ? ? ? ?
└─ ? ? ? ? ? ? ? ? ? ?
```

```
◇ ◇ ◇ ◇ ◇ ◇ ◇ ◇ ◇ ◇
```

```
◇ ◇ ◇
```

```
◇ 1 ◇
├─ ? ? ? ? ? ? Gauge + ? ? ?
├─ ? ? ? ? ? ? Gauge + ? ? ?
├─ PFCP ? ? ? ? ? ? ? ? ? ?
└─ ? APN ? ? ? ? ? ? ? ?
```

```
◇ 2 ◇
├─ ? ? ? ? ? ? ? ? ? ?
├─ ? ? ? ? ? ? ? ? ? ?
├─ ? ? ? ? ? ? ? ? ? ?
└─ ? ? ? ? ? ? ? ? ? ? ? ?
```

```
◇ ◇ ◇ ◇ ◇ ◇ ◇ ◇ ◇ ◇
```

```
◇ ◇ ◇ ◇ ◇ ◇
```

```
teid_registry_count
```

```
◇ ◇ ◇ ◇ ◇ ◇ ◇ ◇
```

```
rate(s11_inbound_messages_total{message_type="create_session_request"}[5m])
```

```
S11 ◇ ◇ ◇ ◇ 95 ◇ ◇ ◇ ◇ ◇ ◇
```

```
histogram_quantile(0.95, rate(s11_inbound_duration_seconds_bucket[5m]))
```

```
◇ ◇ ◇ ◇ ◇
```

```
rate(s11_inbound_errors_total[5m]) +
rate(s5s8_inbound_errors_total[5m]) +
rate(sxa_inbound_errors_total[5m])
```

```
PFCP ◇ ◇ ◇ ◇ ◇ ◇
```

```
pfcp_association_status{peer_ip=~"10.0.0.3[0-2]"}
```

---



## sgw-c-alerts.yml:

```
groups:
- name: sgw-c-alerts
  interval: 30s
  rules:
    # 111111
    - alert: SGWCapacityHigh
      expr: (teid_registry_count / 100000) > 0.8
      for: 5m
      annotations:
        summary: "SGW 111111 80%"
        description: "111111{{ $value }} / 100000"

    # 111111
    - alert: S11PeerDown
      expr: absent(s11_inbound_messages_total) > 0
      for: 2m
      annotations:
        summary: "S11 111111"

    - alert: PGWPeerDown
      expr: create_session_response_cause{cause_code="49"} > 100
      for: 2m
      annotations:
        summary: "PGW-C 111111"

    - alert: SGWUAssociationDown
      expr: pfcpc_association_status == 0
      for: 1m
      annotations:
        summary: "SGW-U 111111"
        description: "111111{{ $labels.peer_ip }}"

    # 111111
    - alert: S11LatencyHigh
      expr: histogram_quantile(0.95,
rate(s11_inbound_duration_seconds_bucket[5m])) > 1
      for: 5m
      annotations:
        summary: "S11 11111 1 1"
        description: "p95: {{ $value }}s"

    - alert: S5S8LatencyHigh
      expr: histogram_quantile(0.95,
rate(s5s8_inbound_duration_seconds_bucket[5m])) > 1
      for: 5m
```

```

    annotations:
      summary: "S5/S8 1"

#
- alert: S11ErrorRate
  expr: rate(s11_inbound_errors_total[5m]) > 10
  for: 3m
  annotations:
    summary: "S11"
    description: "{{ $value }} errors/sec"

- alert: SessionEstablishmentFailure
  expr: rate(create_session_response_cause{cause_code!="0"}[5m]) > 20
  for: 3m
  annotations:
    summary: ""
    description: "{{ $value }} failures/sec"

```

## AlertManager

### alertmanager.yml:

```

global:
  resolve_timeout: 5m

route:
  receiver: 'sgw-alerts'
  group_by: ['alertname', 'instance']
  group_wait: 30s
  group_interval: 5m
  repeat_interval: 12h

receivers:
- name: 'sgw-alerts'
  webhook_configs:
  - url: 'http://slack-webhook-url'
  email_configs:
  - to: 'noc@example.com'
    from: 'sgw-alerts@example.com'
    smarthost: 'smtp.example.com:587'

```

1 1 1 1 1 1

### Slack 1 1 1

```

1 SGW 1 1 1
1 1 1 1 1 1
1 1 1 1 1 1 85,000 / 100,000 (85%)
1 1 1 1 1 1 2025-12-10 15:30:00 UTC
1 1 1 1 1 1 1 1 1 1

```

1 1 1 1 1 1 1 1



??[?] S11 ?

SGW-C S11 ? 2 ?  
- MME ?  
- ? SGW-C  
- S11 ?

????? S11 ?

???

????

???? 404

??

```
#  
curl -v http://127.0.0.40:42068/metrics
```

```
#  
tail -f /var/log/sgw_c/sgw_c.log | grep -i metric
```

```
#  
cat config/runtime.exs | grep metrics
```

????

1. ? SGW-C ?
2. ? IP/?
3. ?
4. ?

????

?? S11 ? S5/S8 ? Sxa ?

??

1. ?
2. ?
3. ?

????

- ?
- ?
- ?

???

????

??

```
# ????
ps aux | grep sgw_c | grep -v grep | awk '{print $6}'
```

```
# ????
watch -n 5 'ps aux | grep sgw_c'
```

????

1. ??
2. ??
3. ??
4. ??

???

???

- ? 15-30 ?
- ? 15-30 ?
- ? ? ? ? ? ? ? ? ?
- ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

???

- ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
- ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
- ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
- ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

???

- ? ? ? ? ? ? ? ? ? ? ? ? ? ?
- ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?
- ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? +20% ? ? ? ?
- ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

?? - *OmniSGW* ? ? ? ? ? ? ?







• *Omnitouch* ? ? ? ? ? ? ?

?? ? ? ? ? 1.0 ? ? ? ? ? ? 2025-12-10

































# S11

 MME  GTP-C  
















































OmniSGW  Omnitouch     

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1.  
  2.    
  3.  
  4.    
  5.    
  6.    
  7.    
  8.    
  9.    
- 











S11    GTP-C v2  GPRS   -      OmniSGW   MME             UE                      

- GTP-C v2   -        
  -   TEID     -            
  -     -    UE  
  -    -   MME   MME     
  -    -       
  -    -       
- 

## GTP-C 2

-   GTP-C v2 (3GPP TS 29.274)
-   UDP
-   2123    

- [?][?][?][?][?][?][?]
- [?][?][?][?][?][?][?]/[?][?]

## TEID [?][?][?][?][?][?][?][?]

[?][?][?][?][?][?][?][?] TEID [?][?][?][?][?][?][?]

- [?][?] **TEID** - [?] OmniSGW [?][?][?] MME [?][?][?][?][?][?]
- [?][?] **TEID** - [?] MME [?][?][?] MME [?][?][?][?][?][?]

[?][?][?][?][?]

MME → SGW: [?][?][?][?][?][?] OmniSGW [?][?][?] TEID

SGW → MME: [?][?][?][?][?][?] MME [?][?][?] TEID

[?][?][?][?]

[?][?] S11 [?][?][?][?] GTP-C v2 [?][?][?]

GTP-C [?][?]12-16 [?][?][?]

```

├── [?][?][?]3 [?][?][?]0x2[?]GTP-C v2[?]
├── [?][?][?][?][?]1 [?][?]
├── TEID [?][?][?]1 [?][?][?]1[?]TEID [?][?][?]
├── [?][?][?][?][?]8 [?][?][?][?][?][?][?][?]
├── [?][?][?][?][?]16 [?][?][?][?][?][?][?][?][?]
├── TEID[?]32 [?][?][?][?][?][?][?][?][?]
├── [?][?][?][?][?]24 [?][?][?][?][?][?][?]/[?][?][?][?]
└── 00[?][?][?]8 [?][?][?][?][?][?] 0

```

[?][?][?][?][?][?][?]

```

├── [?][?][?][?][?]IE[?]
├── ┌── IE [?][?][?]8 [?][?]
├── │── [?][?][?]16 [?][?]
├── │── [?][?][?][?]
├── └── ... [?][?] IE

```

[?][?]

[?][?][?][?]

```

# config/runtime.exs
config :sgw_c,
  s11: %{
    # S11 [?][?][?][?] IPv4 [?][?]
    local_ipv4_address: "10.0.0.10",

    # [?][?][?][?] IPv6 [?][?][?][?][?][?][?]

```

```
local_ipv6_address: nil,  
  
#   
local_port: 2123,  
  
#   
message_timeout_ms: 5000,  
  
#   
max_retries: 3,  
retry_backoff_ms: 1000  
}
```

```
# MME GTP-C  
iptables -A INPUT -p udp --dport 2123 -s <mme_network>/24 -j ACCEPT
```

```
# MME GTP-C  
iptables -A OUTPUT -p udp --dport 2123 -d <mme_network>/24 -j ACCEPT
```

```
# MME  
ip route add <mme_network>/24 via <gateway_ip> dev eth0
```

```
# MME GTP  
# "S11 Broker connected"
```

```
# S11  
curl http://127.0.0.40:42068/metrics | grep teid_registry_count
```

---

**S11**

MME → OmniSGW

?? ? ? ? ? UE ? ? ? ? ? ? ? ? ? ? PDN ? ? ?

?? ? ? ? ? ? ?

**IE** ? ? ? ? ? ?  
IMSI ? ? ? ? ? ? ? ? ? ? ? ? ?  
MSISDN BCD ? ? ? ?  
MEI ? ? ? ? ? ? ? ? ? ?  
RAT ? ? ? ? ? ? ? ? ? ? EUTRAN ?  
? ? ? ? ? ? ? ? ? ? ? ? ? ? ?  
UE ? ? ? ? ? ? ? ? ? ? UE ? ? ? ? ?  
ULI ? ? ? ? ? ? ? ? ? ? TAI, ECGI ?  
? ? ? ? ? ? ? ? ? ? PLMN MCC/MNC  
APN ? ? ? ? ? ? ? ? ? ?

?? ? ? ? ? ? ? ? ? ? ?

**IE** ? ? ? ? ? ? ? ?  
? ? ? ? ? ? ? ? ? ? ? ? ? ? / ? ? ? ?  
? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? TEID  
PDN ? ? ? ? ? ? ? ? ? ? PGW ? ? ? ? IP ? ? ?  
APN ? ? ? ? ? ? ? ? ? ? APN ? ? ?

?? ? ? ? ? ? ? ? ?

?? ? ? ? ? ? ? ? ? **S11** ?

?? ? ? MME → OmniSGW ? ? ? ? ? ? MME ? ? ?

?? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

?? ? ? ? ? ? ? ? ?

**IE** ? ? ? ? ? ? ? ?  
MEI ? ? ? ? ? ? ? ? ? ? ? ? ?  
ULI ? ? ? ? ? ? ? ? ? ? ? ? ? ?  
UE ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?  
TAI TAI ? ? ? ? ? ? ? ? ?  
ECGI ECGI E-UTRAN ? ? ? ? ? ? ? ? ?

?? ? ? ? ? ? ? ? ? ? ?

**IE** ? ? ? ? ? ? ? ?  
? ? ? ? ? ? ? ? ? ? ? ? ? ?  
? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?

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◆◆◆◆◆◆/◆◆

◆◆◆◆◆ MME ◆ SGW ◆◆

◆◆◆◆◆ QoS ◆◆◆◆◆◆◆◆◆◆

◆◆◆◆◆

- ◆◆◆◆◆◆
- ◆◆◆◆◆
- ◆◆◆◆◆◆

◆◆◆◆◆◆/◆◆

◆◆◆◆◆ MME ◆ SGW◆◆◆ PGW◆◆◆◆

◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆◆◆

◆◆◆◆◆◆◆◆/◆◆

◆◆◆ MME → OmniSGW

◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆

- ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
- ◆◆◆◆◆◆◆◆◆
- ◆ SGW-U ◆◆◆◆◆◆◆◆◆◆
- UE ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆◆◆◆◆◆/◆◆

◆◆◆ OmniSGW → MME ◆ MME → OmniSGW

◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆◆◆

◆◆◆◆◆◆◆◆◆**S11**◆

◆◆◆ PGW-C → OmniSGW → MME

◆◆◆◆◆ MME ◆◆◆◆◆ UE

◆◆◆◆◆

IE ◆◆◆◆◆  
EBI ◆◆ EPS ◆◆ ID  
IMSI ◆◆◆◆◆

◆◆◆◆◆

◆◆◆◆◆

UE ◆◆◆◆◆

◆◆◆◆◆

[UE ◆◆◆]  
↓ (◆◆◆◆◆)  
[◆◆◆◆◆ PGW ◆◆◆]  
↓ (PGW ◆◆)  
[◆◆◆◆◆]  
↓ (PFCP ◆◆◆◆◆)  
[◆◆◆◆◆]

◆◆◆◆◆

◆◆ QoS ◆◆

◆◆◆◆◆ TAU◆

◆ SGW ◆◆◆ TAU◆

- MME ◆◆ UE ◆◆
- ULI/TAI ◆◆◆◆◆ SGW
- SGW ◆◆◆◆ UE ◆◆◆
- ◆◆◆◆◆

◆ SGW ◆◆◆ TAU◆

- ◆ SGW ◆ MME ◆◆◆◆◆
- ◆ SGW ◆◆◆◆◆
- ◆◆ SGW ◆◆ SGW ◆◆◆◆◆
- ◆◆◆◆◆ SGW ◆◆◆◆◆



◆◆◆◆

◆◆◆◆◆◆

◆◆◆◆◆

```
[◆◆◆◆]
  ↓ (◆◆◆◆◆)
[◆◆◆◆◆◆]
  ↓ (PFCP ◆◆◆◆◆)
[◆◆ PGW]
  ↓ (PGW ◆◆◆◆◆)
[◆◆◆◆]
```

---

◆◆◆◆

◆◆◆◆◆

◆◆◆◆ S11 ◆◆◆◆◆

```
# ◆◆ S11 ◆◆◆◆◆
watch -n 1 'curl -s http://127.0.0.40:42068/metrics | grep
s11_inbound'

# ◆◆◆◆◆
# s11_inbound_messages_total{message_type="create_session_request"}
1245
# s11_inbound_messages_total{message_type="delete_session_request"}
1200
# s11_inbound_messages_total{message_type="modify_bearer_request"}
3450
```

◆◆◆◆

◆◆◆◆◆◆◆◆ S11 ◆◆◆

```
Web UI → UE ◆◆◆◆◆

◆◆◆◆◆◆◆◆
- IMSI ◆ GUTI
- ◆◆ TAI◆◆◆◆◆◆◆
- ◆◆ TEID◆◆◆ S11◆
- ◆◆ TEID◆◆◆ MME◆
- ◆◆ QoS ◆◆◆◆◆◆◆◆
- ◆◆◆ PGW-C
```

◆◆◆◆

◆◆◆◆◆◆

```
# ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆  
curl -s http://127.0.0.40:42068/metrics | grep  
modify_bearer_request_total
```

```
# ◆◆◆◆◆◆  
# ◆◆◆◆◆◆ "TAU with SGW change" ◆◆
```

---

◆◆◆◆

◆◆◆◆◆◆

◆◆◆ ◆◆◆◆◆◆◆◆◆◆◆

◆◆◆

1. ◆◆ Web UI → UE ◆◆◆◆◆◆◆◆◆◆
2. ◆◆◆◆◆◆s11\_inbound\_errors\_total
3. ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆◆◆◆◆◆◆◆

◆◆ ◆◆ ◆◆◆◆  
**16** ◆◆◆◆◆◆ ◆◆ SGW-U ◆◆◆PFCP ◆◆◆◆  
**25** IE ◆◆◆◆◆◆ ◆◆◆◆◆◆◆◆◆◆◆◆◆  
**49** PGW ◆◆◆◆◆◆ S5/S8 ◆ PGW-C ◆◆◆◆◆◆  
**65** ◆◆◆◆ APN ◆◆ APN ◆◆

◆◆◆◆◆◆

◆◆◆ "◆◆◆◆◆◆◆◆ TEID"

◆◆◆

```
# ◆◆ TEID ◆◆  
curl -s http://127.0.0.40:42068/metrics | grep teid_registry_count
```

```
# ◆◆ TEID ◆◆  
# Web UI → UE ◆◆ → ◆ IMSI ◆◆
```

◆◆◆◆◆

- ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

- `TEID`
- `MME` `TEID`

`?`

`?`

`?`

1. `/`
2. `"TAU"`
3. `PFCP`

`?`

- `SGW-U`
- `?`
- `?`

`?`

`S11`

`?`

```
#
curl -s http://127.0.0.40:42068/metrics | grep
s11_inbound_duration_seconds

#
curl -s http://127.0.0.40:42068/metrics | grep active_ue_sessions

#
curl -s http://127.0.0.40:42068/metrics | grep active_bearers
```

`?`

1. `?`
2. `PFCP`
3. `SGW-C`
4. `CPU`

`Prometheus` [?](#)

---

???

??

- S11
- RTT
- 

??

- 
- MME
- S11
- 

??

- S11
- S11 MME IP
- 

???







??	??	??	???
??/??	MME → SGW	??	?
??/??	MME → SGW	??	?
??/??	MME ↔ SGW QoS, TAU	??	?
??/??	MME ↔ SGW	??	?
??/??	MME ↔ SGW	??	?
??/??	MME → SGW	??	?
??/??	MME ↔ SGW	??	?
??/??	SGW → MME	??	?
??/??	MME ↔ SGW	??	?

S11 - MME SGW-C





































# S5/S8

 PGW-C  GTP-C  













































OmniSGW  Omnitouch     

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


































































 

1.  
  2.      
  3.  
  4.    
  5.    
  6.    
  7.    
  8.    
  9.    
- 














**S5/S8**     **GTP-C v2**  GPRS     -                         **OmniSGW**    **PGW-C**    
                                         

- **GTP-C v2**   -       
  - **TEID**       -         
  - **PDN**      -   /   /   **PDN**  
  -     -        
  - **ID**   -         
  - **IP**     -  **PGW**    **UE**   **IP**
- 

## **GTP-C** **2**

-    **GTP-C v2** (3GPP TS 29.274)
-    **UDP**
-    **2123**    

- 22232 2322
- 222 2222/22

## TEID 22222222

22 PDN 22222222222222 TEID

- **SGW TEID** - 2 SGW-C 222 PGW 2 S5/S8 2222
- **PGW TEID** - 2 PGW-C 222 SGW 2 S5/S8 2222

```
2222
SGW-C → PGW-C 222222 PGW-C 2 TEID
PGW-C → SGW-C 222222 SGW-C 2 TEID
```

## 22 ID

22 ID 2322222222

- 2222 PGW-C 2222222222
- 2222 SGW-C 222 CDR
- 222 2 SGW 2 PGW CDR 2222222222
- 2222 32 22222222 PDN 2222

22

2222

```
# config/runtime.exs
config :sgw_c,
  s5s8: %{
    # S5/S8 22222 IPv4 22
    local_ipv4_address: "10.0.0.15",

    # 22222 IPv6 22
    local_ipv6_address: nil,

    # 222222222222
    local_port: 2123,

    # PGW-C 222
    pgw_peers: [
      %{
        ip_address: "10.0.0.20",
        name: "pgw-c-primary"
      },
      %{
```

```

        ip_address: "10.0.0.21",
        name: "pgw-c-secondary"
    }
],
#
message_timeout_ms: 5000,
max_retries: 3,
retry_backoff_ms: 1000
}

```

◆◆◆◆

◆◆◆◆◆◆

```

# ◆◆◆◆ PGW-C ◆◆◆ GTP-C
iptables -A INPUT -p udp --dport 2123 -s <pgw_network>/24 -j ACCEPT

```

```

# ◆◆◆ PGW-C ◆◆◆ GTP-C
iptables -A OUTPUT -p udp --dport 2123 -d <pgw_network>/24 -j ACCEPT

```

◆◆◆

```

# ◆◆◆ PGW-C ◆◆◆◆◆
ip route add <pgw_network>/24 via <gateway_ip> dev eth0

```

---

◆◆◆◆

◆◆ **PDN** ◆◆◆◆

◆ MME ◆◆ S11 ◆◆ PDN ◆◆◆◆ SGW-C ◆◆ S5/S8 ◆◆◆ PGW-C◆

◆◆◆◆◆◆◆◆ **SGW-C → PGW-C**◆

◆◆◆◆◆◆◆◆

```

IE ◆◆ ◆◆ ◆◆
IMSI MME ◆◆◆◆◆◆
MSISDN MME ◆◆◆◆◆◆
MEI MME ◆◆◆◆◆◆
◆◆◆◆◆ MME ◆◆◆◆◆ QCI, ARP◆
APN MME ◆◆◆◆◆◆◆◆, ims, mms◆
◆◆◆◆ MME PLMN ◆◆◆ MCC/MNC◆
RAT ◆◆ MME ◆◆◆◆◆◆ EUTRAN◆
ULI MME ◆◆◆◆◆◆◆ TAI, ECGI◆

```

IE 2 2 2 2 2 2  
ID SGW SGW 2 2 2 2 2 2 2

PGW-C → SGW-C

2 2 2 2 2 2

IE 2 2 2 2 2 2  
PGW 2 2 / 2 2 2 2  
PGW 2 2 2 2 2 2 TEID  
PDN 2 2 2 2 PGW 2 2 2 UE IP 2 2  
APN 2 2 PGW APN 2 2 2  
ID PGW PGW 2 2 2 2 2 ID  
TEID PGW S5/S8 2 2 2 2 2

2 2 2 2

2 2 2 2 2 2 2 2 2 2  
**0** 2 2 2 2 2 2 2 2  
**16** 2 2 2 2 2 2 2 2 MME 2 2 2 2 2  
**25** IE 2 2 2 2 2 2 2 2 2 2  
**49** 2 2 2 2 2 2 2 2 PGW-C 2 2 2 2 2  
**64** 2 2 2 2 2 2 2 2  
**65** 2 2 2 2 2 2 2 2 PGW 2 2 2 2  
**72** 2 2 / 2 2 2 2 2 2 2 2 IE 2 2 2 2 2

---

2 2 2 2

QoS

MME S11 QoS SGW-C S5/S8 PGW-C

2 2 2 2 2 2 2 2 2 2

PGW-C S5/S8 2 2 2 2 2 2 2 2

2 2 2 2 2 2 2 2 2 2

2 2 2 2 2 2 2 2 2 2

---



◆◆◆◆

## ◆◆ PDN ◆◆◆◆

◆◆◆◆◆

```

[PDN ◆◆◆]
  ↓ (◆◆ MME ◆◆◆◆◆◆)
[◆◆ PGW ◆◆]
  ↓ (◆◆ PGW ◆◆◆◆)
[◆◆ SGW ◆◆]
  ↓ (TEID ◆◆◆ CDR ◆◆)
[PDN ◆◆◆]

```

◆◆◆◆

## S5/S8 ◆◆◆◆

◆◆◆◆◆◆

◆◆◆◆◆◆/◆◆

- ◆◆◆◆◆◆◆◆◆◆ PDN ◆◆◆◆
- ◆◆◆◆◆◆ UE ◆◆ PDN ◆◆ ~1
- ◆◆◆◆◆◆

◆◆◆◆◆◆/◆◆

- ◆◆◆◆◆◆◆◆ PDN ◆◆◆◆
- ◆◆◆◆◆◆ PDN ◆◆◆◆ ~1
- ◆◆◆◆◆◆

◆◆◆◆◆◆/◆◆

- ◆◆◆◆◆◆ QoS ◆◆◆◆◆◆◆◆
- ◆◆◆◆◆◆◆◆◆◆◆◆ 0 ◆◆◆◆◆◆
- ◆◆◆◆◆◆

◆◆/◆◆◆◆◆◆/◆◆

- ◆◆◆◆◆◆◆◆◆◆◆◆/◆◆
- ◆◆◆◆◆◆◆◆◆◆◆◆ 0 ◆◆◆◆◆◆
- ◆◆◆◆◆◆



s5s8\_inbound\_errors\_total

## PGW

PGW-C



PGW

```
# PGW
curl -s http://127.0.0.40:42068/metrics | grep session_by_pgw_peer
```

---

PGW

PGW

"PGW"

PGW

```
# PGW
curl -s http://127.0.0.40:42068/metrics | grep create_session_response_cause
```

```
# PGW
curl -s http://127.0.0.40:42068/metrics | grep s5s8_peer_status
```

PGW

PGW IP

16 PGW IP

25 PGW

49 PGW APN

72 IE MME

PGW

"PGW"

PGW

1. 1 2 3 4 5 6 7 8 9 10 11 12
2. 1 2 QoS 3 4 5 6 7 8
3. 1 2 PGW 3 4 5 6

1 2 3 4 5

- 1 2 QoS 3 4 5 6
- 1 2 PGW 3 4 5 6 QoS 7
- 1 2 PGW 3 4 5 6 PCRF/7 8 9 10

1 2 3 4 5 6

1 2 3 "S5/S8 4 5 6 7"

1 2 3

```
# 1 2 3 4
```

```
curl -s http://127.0.0.40:42068/metrics | grep  
s5s8_inbound_duration_seconds
```

```
# 1 2 3 4
```

```
curl -s http://127.0.0.40:42068/metrics | grep s5s8_timeout_total
```

1 2 3 4 5

- 1 2 3 4 RTT 5 6 7 8 9 message\_timeout\_ms
- 1 2 3 4 5 6
- 1 2 PGW CPU/3 4 5 6 7
- 1 2 3 4 5 6

1 2 **ID** 3 4 5

1 2 3 "CDR 4 5 6 7 ID 8 9 10"

1 2 3

- 1 2 PGW 3 4 5 6 7 8 9 10 ID
- 1 2 CDR 3 4 5 6 7 8 9 10 ID
- 1 2 SGW 3 PGW CDR

1 2 3 4 5

- 1 2 PGW 3 4 5 6 7 8 9 10 ID
- 1 CDR 2 3 4 5 6 7 8 9 10 11 ID

1 2 3 4 5 6 7 8 9 Prometheus 10 11 12 13 14 15 [16 17 18 19 20 21 22](#)

---

???

??

- **PGW** PGW-C
- ? ? ? ? ? ? ? ? ? ? ? ? ? ?
- ? ? ? ? ? ? ? ? ? ? ? ? ? ? 5-10
- ? ? ? ? 2-3 ? ? ? ? ? ? ? ? ?

??

- ? ? ? ? ? ? ? ? ? ? ? ? ? ?
- **APN** SGW APN PGW APN
- ? ? ? ? ? ? ? ? ? ? ? ? ? ?
- ? ? ? ? ? ? ? ? PGW IP

???

- ? ? ? ? ? ? ? ? ? ? ? ? ? ? PGW
- ? ? ? ? ? ? ? ? ? ? + ? ? ? ? ? ? ? ?
- **QoS** PGW QoS
- ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ID

???

### S11 ↔ S5/S8



### S5/S8 ↔ Sxa



◊ ◊ ◊ ◊ ◊ ◊ ◊ ◊



◊ ◊ S11 ◊ ◊ ◊ ◊ ◊ ◊



UE

OmniSGW Omnitouch



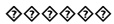
- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.



UE SGW-C

- MME - S11
- PGW-C - S5/S8
- SGW-U - Sxa

IMSI PDN



UE

UE



UE

- [No Session]
  - ↓ (Create Session Request from MME)
- [Creating Session - PGW]
  - ↓ (Create Session Response from PGW)
- [Creating Session - User Plane]
  - ↓ (PCF Session Establishment Response)
- [Session Active]
  - ↓ (Modify Bearer Request or bearer changes)
- [Session Modifying]
  - ↓ (Modification Complete)
- [Session Active]
  - ↓ (Delete Session Request or network error)
- [Session Terminating]
  - ↓ (All responses received, CDR logged)
- [Session Terminated]



```

Session State:
- IMSI: Mobile subscriber identity
- GUTI: Temporary ID from MME
- Location:
  - TAI: Current tracking area
  - ECI: Current cell
  - Timezone: UE timezone
- PDN Connections: Array of PDN connection contexts
  - APN: Access Point Name
  - TEID (S11): To MME
  - TEID (S5/S8): To PGW-C
  - Charging ID: From PGW-C
  - UE IP: From PGW-C
  - PGW-C Address: S5/S8 peer
  - Bearers: Default + Dedicated
    - EBI: Bearer ID
    - QCI: QoS class
    - ARP: Priority
    - GBR: Guaranteed rate
    - MBR: Maximum rate
- Charging: Charging ID, event log
  
```



PDN

- QoS: QCI 9
- PDN
- PDN
- PDN



QoS

- QoS: QCI 1-8
- PDN
- PDN

◆◆◆◆◆◆

Application Trigger  
↓  
PGW-C Policy Decision (via PCRF)  
↓  
Create Bearer Request (S5/S8)  
↓  
SGW forwards to MME (S11)  
↓  
MME activates bearer on RAN  
↓  
Create Bearer Response back through SGW to PGW

◆◆◆◆◆◆

Network or Application Decision  
↓  
Delete Bearer Request (S5/S8)  
↓  
SGW forwards to MME (S11)  
↓  
MME deactivates bearer on RAN  
↓  
Delete Bearer Response back through SGW to PGW

◆◆ QoS ◆◆

◆◆◆◆◆◆

◆◆ MME ◆◆◆◆ SGW ◆◆◆◆

◆◆◆ UE ◆◆◆ MME ◆◆◆◆◆

◆◆◆◆◆

- ◆◆◆◆◆◆
- ◆ TEID ◆◆◆◆
- ◆◆◆◆◆◆◆◆
- ◆ CDR ◆◆◆◆◆◆◆◆ Charging ID

◆ MME ◆◆◆◆ SGW ◆◆◆◆

◆◆◆ UE ◆◆◆◆◆ MME◆◆◆◆◆ SGW

◆◆◆◆◆

- ◆◆◆◆◆◆◆◆ CDR ◆◆◆◆◆◆◆◆
- ◆◆◆◆◆◆◆◆◆◆ Charging ID
- ◆◆◆◆◆◆◆◆
- ◆◆◆◆◆◆◆◆ SGW-U ◆◆◆◆

◆◆◆◆◆◆◆◆ TAU◆

◆ SGW ◆◆◆◆ TAU◆

UE ◆◆◆◆  
↓  
MME ◆◆ TAU Accept  
↓  
MME ◆◆ SGW ◆◆◆◆◆◆  
↓  
SGW ◆◆◆◆◆◆ TAI, ECI◆  
↓  
◆◆◆◆◆◆

◆ SGW ◆◆◆◆ TAU◆

- ◆◆◆◆ MME ◆◆
- ◆◆◆◆◆ SGW
- ◆ CDR ◆ SGW ◆ SGW ◆◆◆◆

◆◆◆◆◆

◆◆◆◆◆

◆◆◆◆◆◆◆◆

- ◆ SGW-U ◆◆◆ - ◆◆◆◆◆◆◆◆
- ◆ PDR ◆◆ - ◆◆◆◆◆◆◆◆◆◆
- ◆◆◆◆◆ - ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
- ◆◆◆◆◆ - S11/S5/S8 ◆◆◆◆◆

◆◆◆◆◆◆◆

◆◆◆◆◆◆◆◆

- ◆ SGW-U ◆◆◆◆◆ - ◆◆◆◆◆◆◆◆◆◆
- ◆ SGW-U ◆◆◆◆◆ - ◆◆◆◆◆
- ◆ GTP ◆◆ - ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
- ◆◆◆◆◆◆◆◆ - ◆◆◆◆◆

◆◆◆◆◆

◆◆◆◆◆◆◆◆

- ◆◆◆◆◆ - ◆◆◆◆◆◆◆◆◆◆
- ◆◆◆◆◆ - ◆◆◆◆◆◆◆◆◆◆
- ◆◆◆◆◆ - ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆
- ◆◆◆◆◆ - ◆◆◆◆◆ TEID

◆◆◆◆◆◆

◆◆◆◆◆

◆◆ Web UI ◆◆◆◆◆◆◆◆

- ◆◆ http://<sgw-ip>:<port>/ue\_sessions
- ◆◆◆◆◆◆◆ UE ◆◆
- ◆ IMSI◆GUTI ◆◆◆◆◆◆◆◆



- 4.
  - (TAI, ECI)
  - QoS
  - PGW-C
  - TEID
  - Charging ID

UE

OmnisGWC v0.0.1

Overview

Resources

Configuration

Log

Overview

Showing 1-10 c

IMEI	IMSI	MSISDN	PLMN	MME IP	STATUS
				10.157.12.15	Authenticated
				10.157.12.15	Authenticated
				10.157.12.15	Authenticated
				10.157.12.16	Authenticated
				10.157.12.15	Authenticated
				10.157.12.16	Authenticated
				10.157.12.15	Authenticated

TEIDs PDN

item Details

IMEI	
IMSI	
MSISDN	
MME S11 TEID	0x77A5B6E7
SGW S11 TEID	0x48DEEB54
Tracking Area Code	1
ECI	51203
Bearer	... (5) 5
PDN Sessions	... (5) 5

1549932480 / buffer / 2 (Charging ID, DL Action, DL Rule ID...)

... (APN, Default EBI, PDN Address Allocation...)

IMEI	IMSI	MSISDN	PLMN	MME IP	STATUS
				10.157.12.15	Authenticated

Web UI

```
# curl -s http://10.0.0.40:42068/metrics | grep active_ue_sessions
# curl -s http://10.0.0.40:42068/metrics | grep active_bearers
# APN
curl -s http://10.0.0.40:42068/metrics | grep sessions_by_apn
# s11_inbound_messages_total
curl -s http://10.0.0.40:42068/metrics | grep s11_inbound_messages_total
```

Prometheus

1. API
- 2.
- 3.
4. CDR

```
# curl -s http://10.0.0.40:42068/metrics | \
```

```
grep -E "active_ue_sessions|active_bearers" | \
awk '{print $NF}'
```

```
# 80% 
# 
```

```

1. S11 
2. S11 
3. PGW 
4. Charging ID 

PGW S5/S8 
IP PGW IP 
APN PGW APN 
SGW-U SGW-U 
PGW PGW

```

```

1. SGW-U 
2. SGW-U 
3. PGW 
4.

```

```

SGW-U SGW-U 
PGW PGW 
RTT

```

```

1. RTT 
2. PFCP 
3. 
4.

```

```

PFCP BAR 
PDR PFCP 
SGW-U

```

```
S11/S5S8
```

```
curl -s http://10.0.0.40:42068/metrics | \
grep "inbound_duration_seconds"
```

```
curl -s http://10.0.0.40:42068/metrics | \
grep queue_depth
```

```
top -n1 | head -1

1. RTT 
2. SGW-C 
3. 
4.

```

**CDR**

```
CDR

1. CDR 
2. 
3. 
4.

```

```

# CDR 
tail -f /var/log/sgw_c/cdrs/*

# 
ls -la /var/log/sgw_c/cdrs/

# 
chmod 755 /var/log/sgw_c/cdrs/

CDR CDR

```





# Sxa

**PCFP** SGW-U

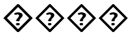
OmniSGW Omnitouch



- 1.
- 2.
- 3.
4. **PCFP**
- 5.
6. **PCFP**
- 7.
- 8.
- 9.



**Sxa** PCFP OmniSGW SGW-U QoS



- **PCFP v1.0** -
- **SEID** -
- - /
- -
- **QoS** -
- -
- -



## **PCFP 1.0**

- PCFP v1.0 (3GPP TS 29.244)
- UDP
- 8805
-

- $\diamond\diamond\diamond\diamond$  CP  $\diamond$  UP  $\diamond\diamond\diamond\diamond$

## SEID $\diamond\diamond\diamond\diamond\diamond\diamond\diamond$

$\diamond\diamond\diamond\diamond\diamond\diamond$  SEID  $\diamond\diamond\diamond\diamond$

- **CP SEID** -  $\diamond$  SGW-C  $\diamond\diamond\diamond\diamond$  SGW-U  $\diamond\diamond\diamond\diamond$
- **UP SEID** -  $\diamond$  SGW-U  $\diamond\diamond\diamond\diamond$  SGW-C  $\diamond\diamond\diamond\diamond$

$\diamond\diamond\diamond\diamond$   
 SGW-C  $\rightarrow$  SGW-U:  $\diamond\diamond$  SGW-U  $\diamond$  UP SEID  
 SGW-U  $\rightarrow$  SGW-C:  $\diamond\diamond$  SGW-C  $\diamond$  CP SEID

$\diamond\diamond\diamond\diamond\diamond$

$\diamond\diamond$

$\diamond\diamond\diamond$

```
# config/runtime.exs
config :sgw_c,
  sxa: %{
    # Sxa  $\diamond\diamond\diamond\diamond$  IP  $\diamond\diamond$ 
    local_ip_address: "10.0.0.20",

    #  $\diamond\diamond\diamond\diamond\diamond\diamond$ 
    local_port: 8805,

    #  $\diamond\diamond\diamond$  SGW-U  $\diamond\diamond\diamond$ 
    peers: [
      %{
        ip_address: "10.0.0.30",
        node_id: "sgw-u-1.example.com"
      },
      %{
        ip_address: "10.0.0.31",
        node_id: "sgw-u-2.example.com"
      }
    ],

    #  $\diamond\diamond\diamond\diamond\diamond\diamond$ 
    heartbeat_interval_s: 20,

    #  $\diamond\diamond\diamond\diamond\diamond\diamond$ 
    session_timeout_ms: 5000,

    #  $\diamond\diamond\diamond\diamond\diamond\diamond$ 
    max_retries: 3
```



1. [?][?][?][?][?]

- o [?][?][?][?][?][?][?][?]
- o [?][?][?][?][?][?][?][?]
- o [?][?][?][?][?][?][?]

2. [?][?][?][?][?]

- o [?][?][?][?][?][?][?][?][?][?][?][?][?][?][?]
- o [?][?] SGW-U [?][?][?][?][?][?]
- o [?][?][?][?][?][?][?][?][?][?][?][?][?]

3. [?][?][?][?][?]

- o [?][?][?][?][?][?] SGW-U [?][?][?][?][?][?][?][?]
- o PDR [?][?][?][?][?][?][?][?][?][?][?][?]
- o [?][?][?][?][?][?][?][?][?][?][?][?][?][?]

[?][?][?][?]

[?][?][?][?]

[?][?][?] MME [?][?][?][?][?][?][?][?][?] S11 [?][?][?]

[?][?][?][?][?][?][?][?]

[?][?]                      [?][?]

CP SEID [?] SGW-C [?][?][?][?][?][?]

PDRs [?][?][?][?][?][?][?][?][?][?][?]

FARs [?][?][?][?][?][?]

QERs QoS [?][?][?][?]

BAR [?][?][?][?][?][?][?][?]

[?][?] PDR [?][?][?][?][?][?][?][?]

[?][?][?][?][?]

[ [?][?][?] ]

↓ ( [?][?][?][?] )

[ [?][?][?] ]

↓ ( [?][?][?][?] )

[ [?][?][?][?] ]

[?][?][?][?][?]

[?][?][?] MME [?][?][?][?][?][?][?][?][?] QoS [?][?][?][?][?][?]

[?][?][?][?][?]

QoS PDRs FARS eNodeB SGW-U  
 PDR FARS QER  
 PDR FARS QER

MME

MME

MME

```

[ ]
  ↓ ( )
[ ]
  ↓ ( )
[ ]
  
```

## PFCP

### PDR

PDR

PDR

IP UE IP 10.45.0.50  
 IP IP 8.8.8.8  
 IP IP TCP 6 UDP 17  
 1024-65535  
 80 HTTP 443 HTTPS  
 TEID GTP-U

### PDR

```

PDR
├── PDR ID
│   ├──
│   └── APN
│       ├── UE IP / IP
│       └──
├── FAR ID
├── QER ID QoS
└──
  
```







- o **?? SGW** **???? MME** **???**
- o **? SGW** **???????** **SGW**
- o **???????**

**BAR** **???**



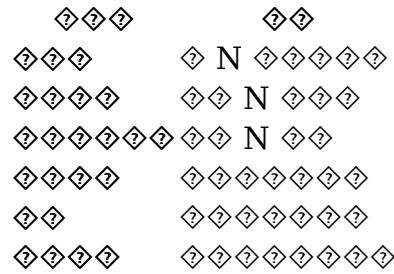
**???**

**?????**

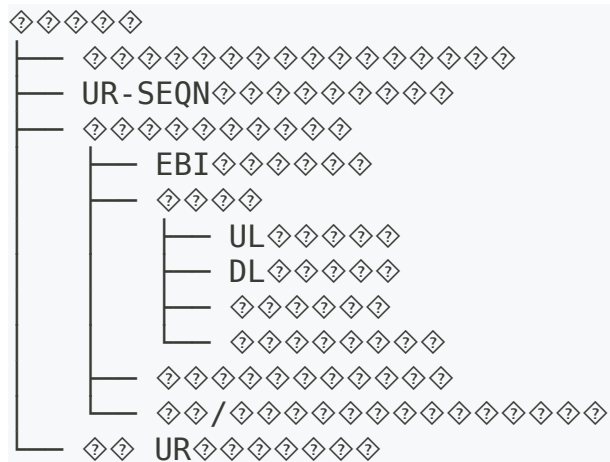
**SGW-U** **SGW-C** **????????????????**

**?????**

**???????**



**?????**









## CDR











---
























### PFCP

    PFCP  

```
#         
curl -s http://127.0.0.40:42068/metrics | grep pfcp_association
```







```
#       
# pfcp_association_status{peer_ip="10.0.0.30"} 1 (   )   
# pfcp_association_status{peer_ip="10.0.0.31"} 1 (   )
```








```
# Web UI → SGW-U      
#                  
```

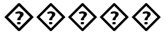


    PFCP  







```
#        
curl -s http://127.0.0.40:42068/metrics | grep seid_registry_count
```

```
#     SGW-U     
curl -s http://127.0.0.40:42068/metrics | grep seid_by_peer
```

```
#       /    
curl -s http://127.0.0.40:42068/metrics | grep usage_octets_rate
```



  PFCP       

```
#     PFCP     
watch -n 1 'curl -s http://127.0.0.40:42068/metrics | grep sxa_inbound'
```

```
#       
#   
sxa_inbound_messages_total{message_type="session_establishment_response"}   
5432   
#   
sxa_inbound_messages_total{message_type="session_modification_response"}   
12100   
# sxa_inbound_messages_total{message_type="session_report_request"} 67000
```

◆◆◆◆◆◆

◆◆◆◆◆◆ SGW-U ◆◆◆◆◆◆

```
# ◆◆◆◆◆◆/◆◆  
curl -s http://127.0.0.40:42068/metrics | grep sxa_session_establishment
```

```
# ◆◆ PDR ◆◆◆◆  
curl -s http://127.0.0.40:42068/metrics | grep pdr_installation
```

```
# ◆◆◆◆  
curl -s http://127.0.0.40:42068/metrics | grep sxa_timeout_total
```

---

◆◆◆◆

◆◆◆◆

◆◆◆ “◆◆◆◆◆◆”

◆◆◆

1. ◆◆◆◆◆◆ping <sgwu\_ip>
2. ◆◆◆◆◆netstat -an | grep 8805
3. ◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆◆◆◆◆◆

◆◆          ◆◆          ◆◆◆◆

◆◆◆◆◆    ◆◆◆◆    ◆◆◆ SGW-U ◆◆◆

◆◆◆◆◆    ◆◆◆◆◆◆◆◆◆◆◆◆

**SGW-U** ◆◆◆ ◆◆◆    ◆◆ SGW-U ◆◆

◆◆ **ID** ◆◆◆◆◆◆◆◆◆◆◆◆◆◆

◆◆◆◆◆◆

◆◆◆ “◆◆◆◆◆◆”

◆◆◆

```
# ◆◆◆◆  
curl -s http://127.0.0.40:42068/metrics | grep seid_registry_count
```

```
# ◆◆◆◆◆◆◆◆◆◆◆◆  
tail -f /var/log/sgw_c/sgw_c.log | grep "◆◆◆◆"
```

◆◆◆◆◆

SGW-U " " SGW-U  
PDR "IE"  
SEID "SEID" SGW-U  
" " SGW-U

" "

```
#  
curl -s http://127.0.0.40:42068/metrics | grep  
session_report_request_total
```

```
# CDR  
tail -f /var/log/sgw_c/cdrs/<timestamp>
```

- SGW-U
- 
- CDR
- SGW-U

PFCP

```
#  
curl -s http://127.0.0.40:42068/metrics | grep  
sxa_inbound_duration_seconds
```

```
#  
curl -s http://127.0.0.40:42068/metrics | grep seid_by_peer
```

```
#  
curl -s http://127.0.0.40:42068/metrics | grep pfcqueue_depth
```

1. SGW-U
- 2.
- 3.
4. SGW-C

---

???

??

- ???? 20-30 ?
- ???? RTT 5-10 ?
- ???? 2-3 ?
- ???? SGW-U ?

??

- ???? SGW-U ?
- ???? ?
- ???? ?
- ???? ?

????

- ???? PFCP ?
  - ???? S11 ? PFCP ?
  - ???? ?
  - ???? SGW-U ?
-