Hacking into iOS's VoLTE implementation

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About Us

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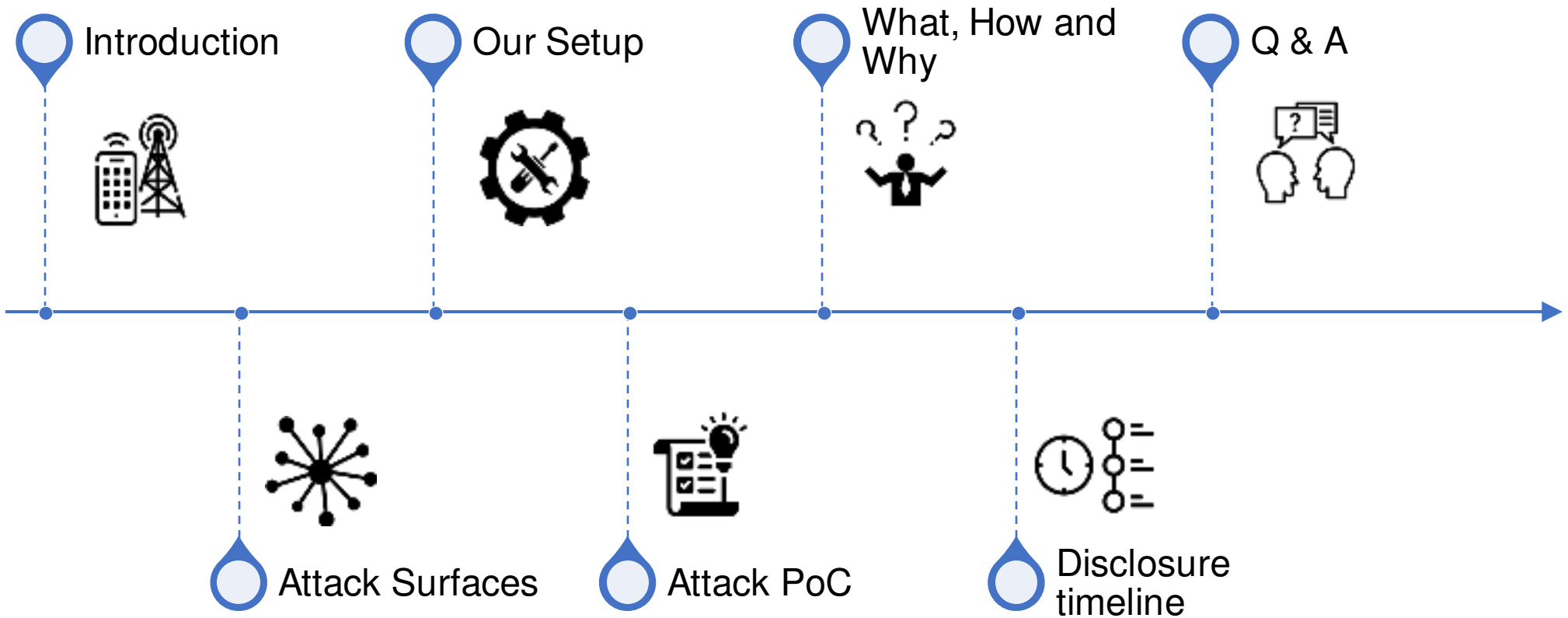
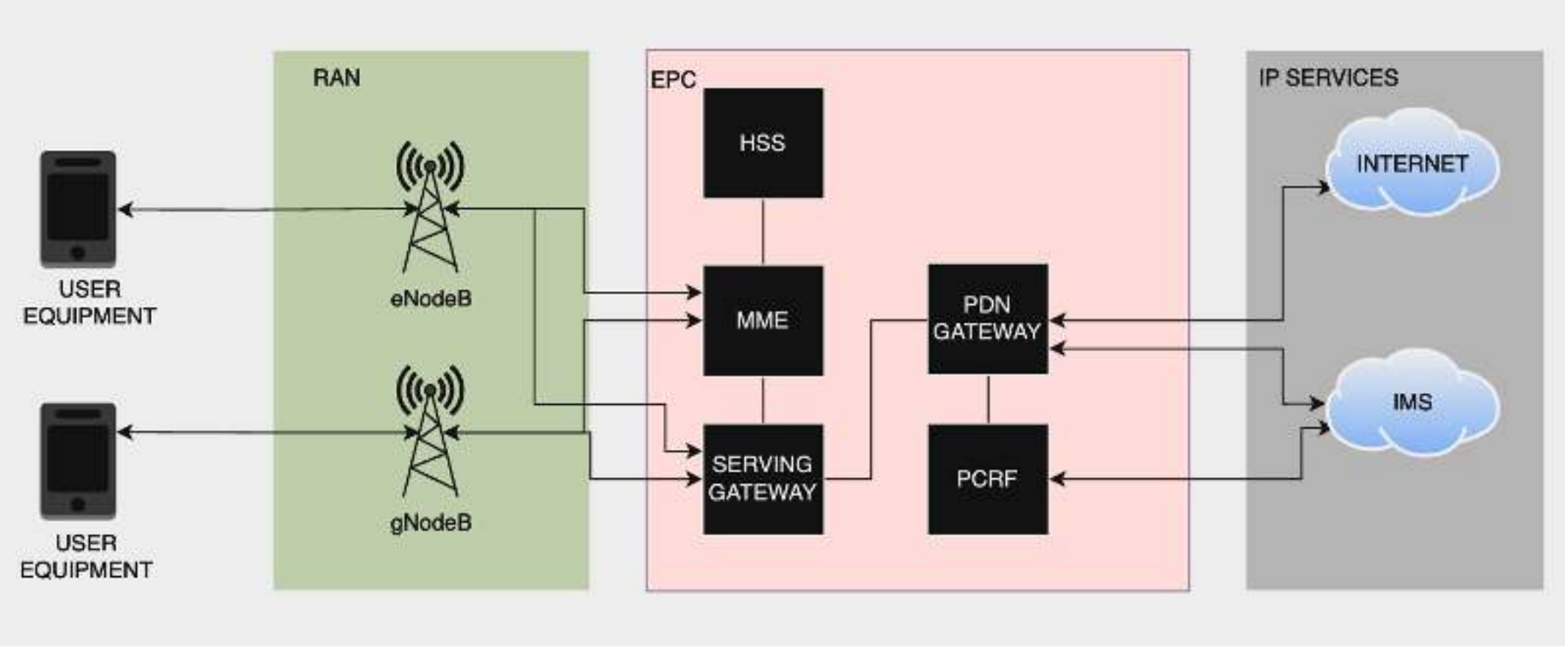
Agenda


Introduction
Our Setup
What, How and Why
Q & A
Attack Surfaces
Attack PoC
Disclosure timeline

Introduction – Glossary

Abbreviations	Functions
RAN	Radio Access Network is the part of a mobile network that connects user devices to the core network through base stations, facilitating wireless communication.
EPC	Evolved Packet Core is the core element in LTE networks that manages data traffic, authentication, and mobility for both voice and data services.
HSS	Home Subscriber Server is a centralized database in the networks that stores subscriber information, facilitating authentication, authorization, and mobility management.
MME	Mobility Management Entity is responsible for tracking and managing the mobility of user devices as they move within the network.
SGW	Serving Gateway is used for routing and forwarding user data packets between the mobile device and external networks.
PGW	Packet Data Network Gateway is used to manage data routing and connectivity between the network and external packet data networks, such as the Internet and IMS.
IMS	IP Multimedia Subsystem enables the delivery of multimedia services, including VoLTE, over IP networks with separation of control and media planes.
CSCF	Call Session Control Function is a component in the IMS architecture that controls the signalling and setup of multimedia sessions, including VoLTE calls.

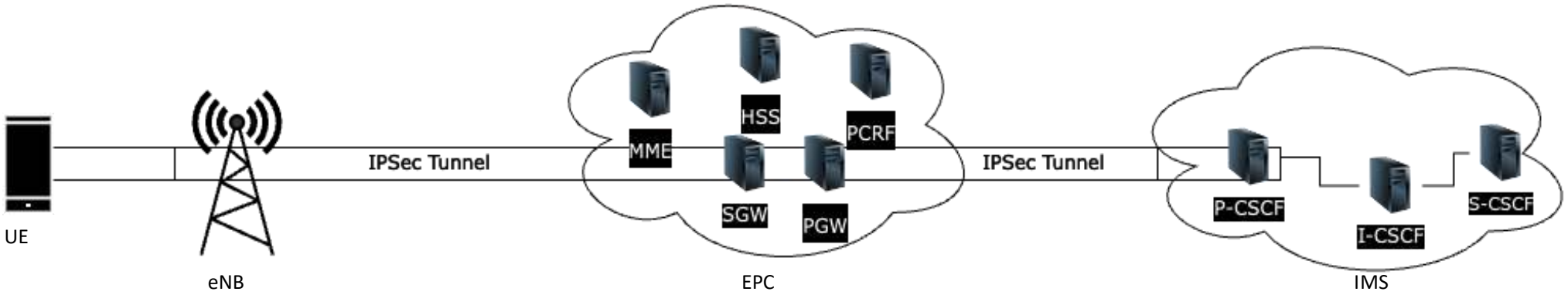
Introduction – LTE/ 5G (NSA) Architecture



Introduction – VoLTE Architecture

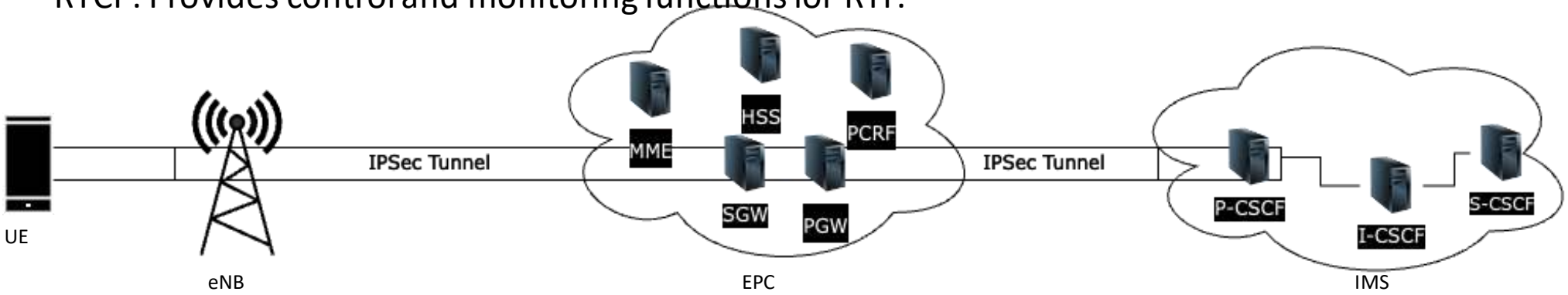
- VoLTE relies on the IMS for delivering multimedia services over IP networks. IMS separates the control plane (call setup and signalling) from the media plane (voice and data transmission).

- The EPC serves as the backbone for VoLTE calls.

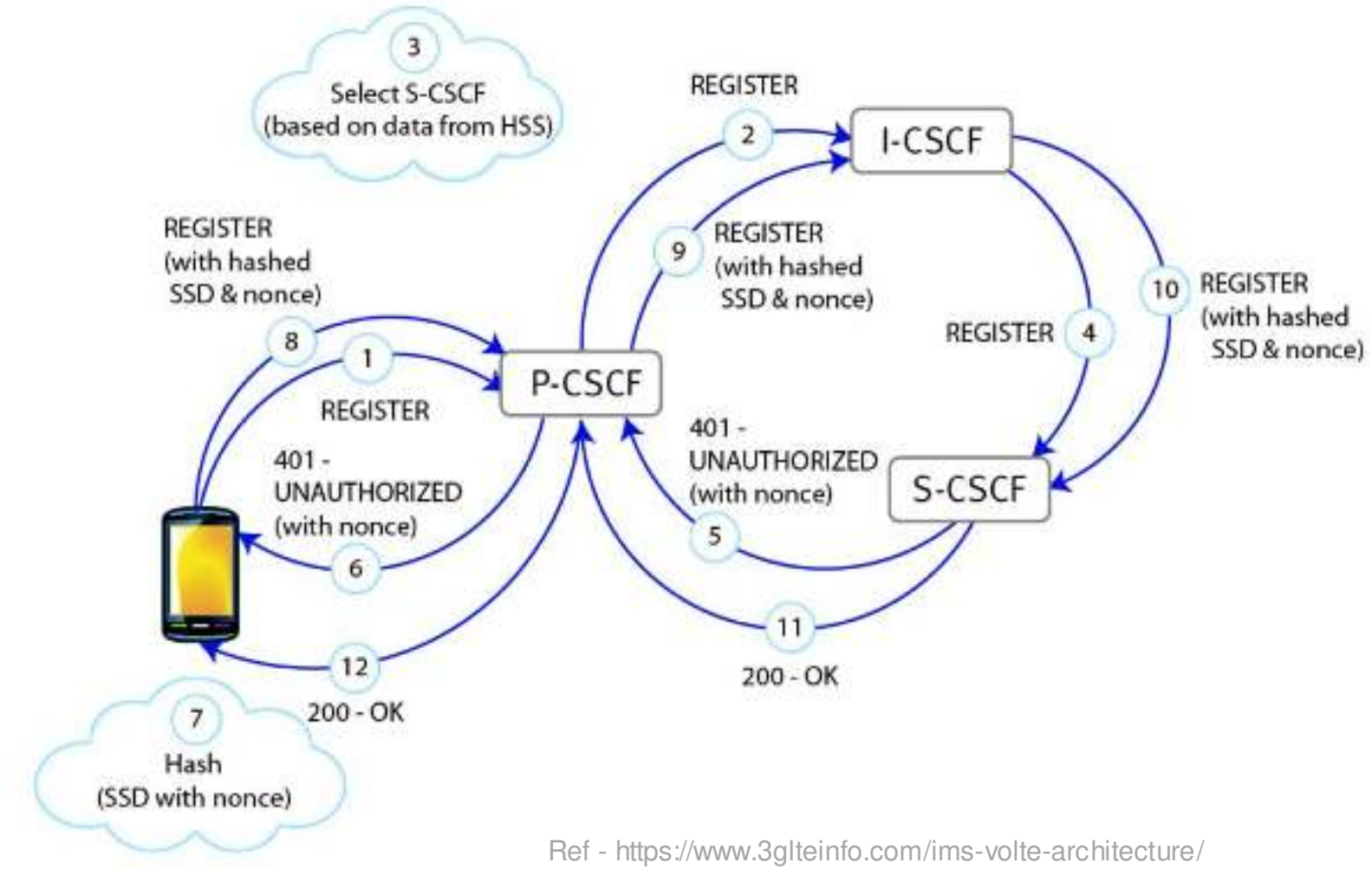


Introduction – VoLTE Protocols

- SIP: Used for call setup, modification, and termination.
- SDP: Describes the multimedia content of a session.
- RTP: Carries the actual voice media during the call.
- RTCP: Provides control and monitoring functions for RTP.



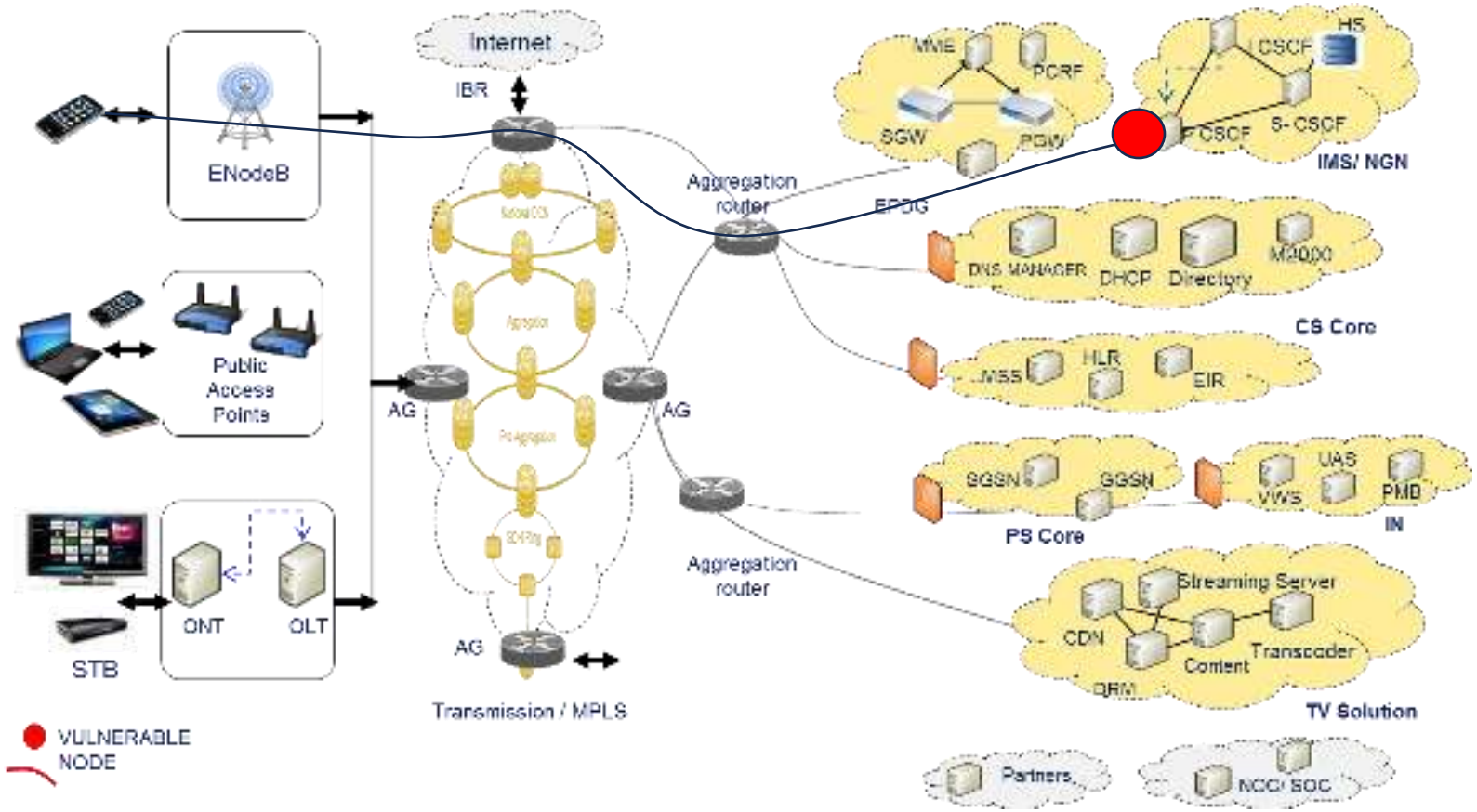
Introduction – VoLTE Registration Flow



Ref - https://www.3glteinfo.com/ims-volte-architecture/

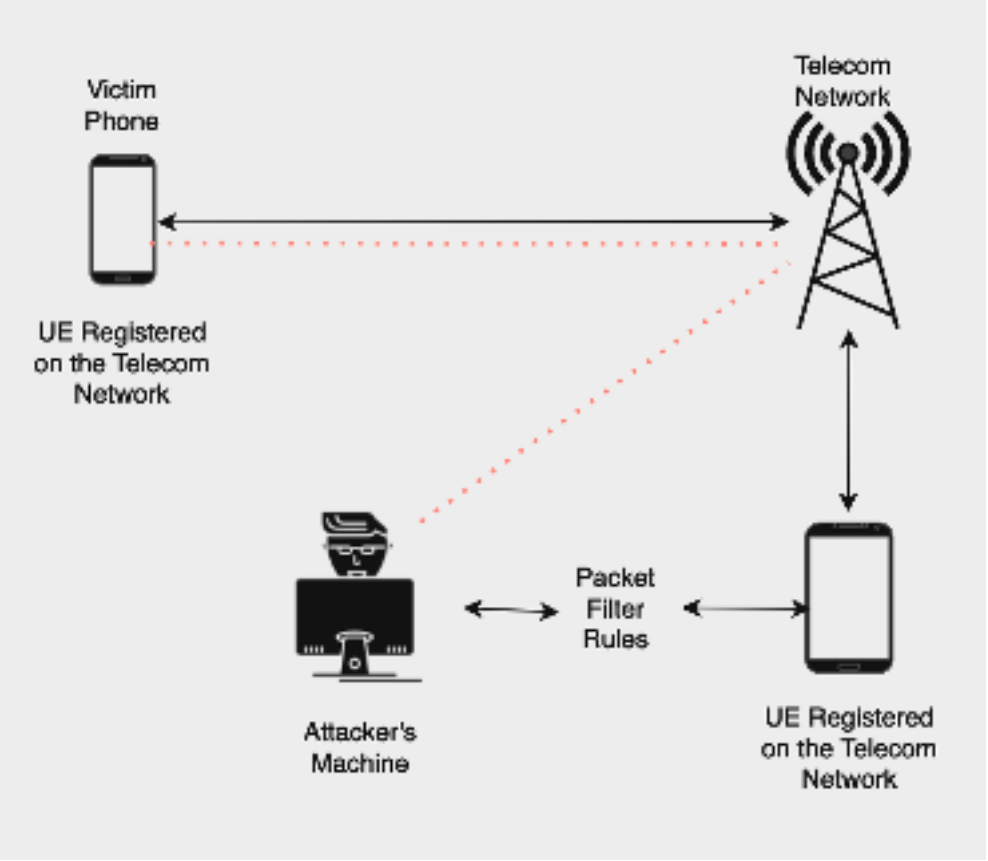
Introduction - Security Issues in VoLTE

- Enumerate services of IMS, EPC and transmission nodes such as aggregation routers, EPDG, UAG / PCSCF
- It is possible to send REGISTER and INVITE SIP requests to identified UAG and CSCF nodes.
- Initiate SIP related attacks like session hijacking, REGISTER and INVITE flooding attacks which introduces a delay and continuous server time-out response
- Targeting other VoLTE users in the network
- Targeting device baseband and fuzzing over SIP protocol



Our Setup

- VoLTE test network using Open5Gs with Kamailio
- SDR - USRP B210 and Bladerf x40
- Test SIMs
- Target iPhone and attacking Android devices
- Attacking Android device is set up working with APN ‘ims’ only mode
- Traffic routing is done using ‘iptables’ rules or forwarding the raw packets using ‘socat’

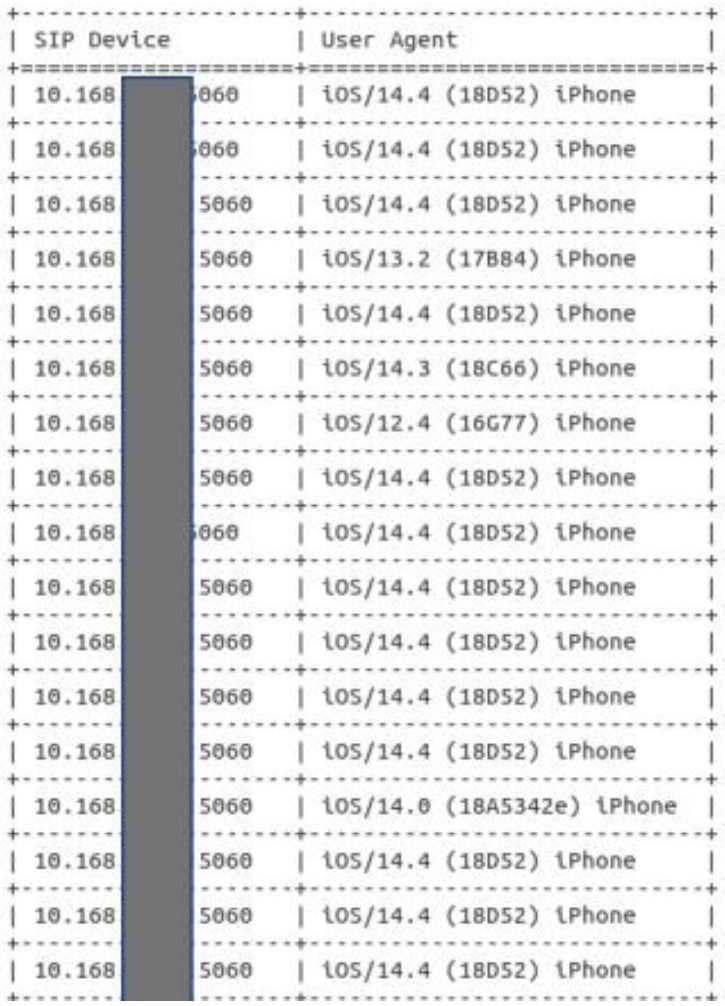


PoC


1:41
FaceTime
Calendar
Photos
Camera
Mail
Clock
Maps
Weather
Reminders
Notes
Stocks
Books
App Store
Podcasts
TV
Health
Home
Wallet
Settings
Clear
Reload
Mark
Desktop ./VOLTE.sh 'SI< targets.txt)'

PoC

Using this technique, identified several million iOS devices which are connected on the VoLTE network



SIP Device	User Agent
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/13.2 (17B84) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.3 (18C66) iPhone
10.168 [redacted] 5060	iOS/12.4 (16G77) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.0 (18A5342e) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone

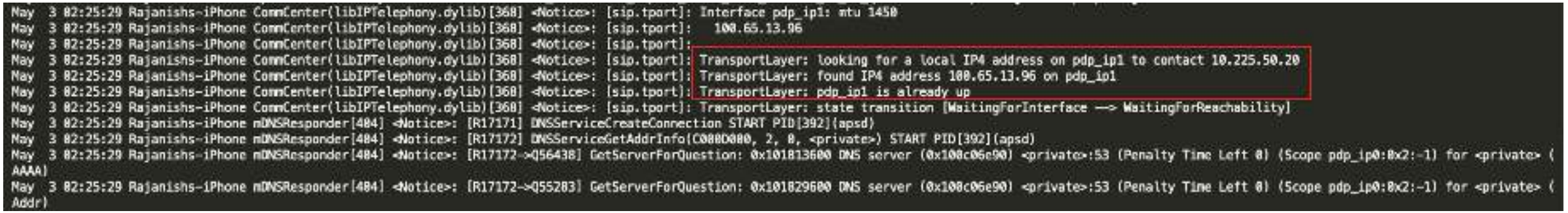
Impact

- **Enumeration**: Enumeration of iOS devices in the LTE network with iOS version to launch targeted attack.
- **PII**: Attacker can get access to critical PII information about the subscriber, like MSISDN, IMEI and phone OS version.
- **Spoofing**: Attacker may use PII information for various malicious purposes like, spoofing, spamming and fraud.
- **Dos**: Attacker may exhaust user equipment with malformed SIP packet making it difficult for the subscribers to make or answer calls.
- **Network congestion:** Attacker may amplify the attack by sending random INVITE packets to all the identified iOS devices, this will make all the devices ring with incoming calls leading to network congestion.
- Further, attacker can perform SIP related attacks including fuzzing, targeting exposed SIP interface of the devices.

What, How and Why?

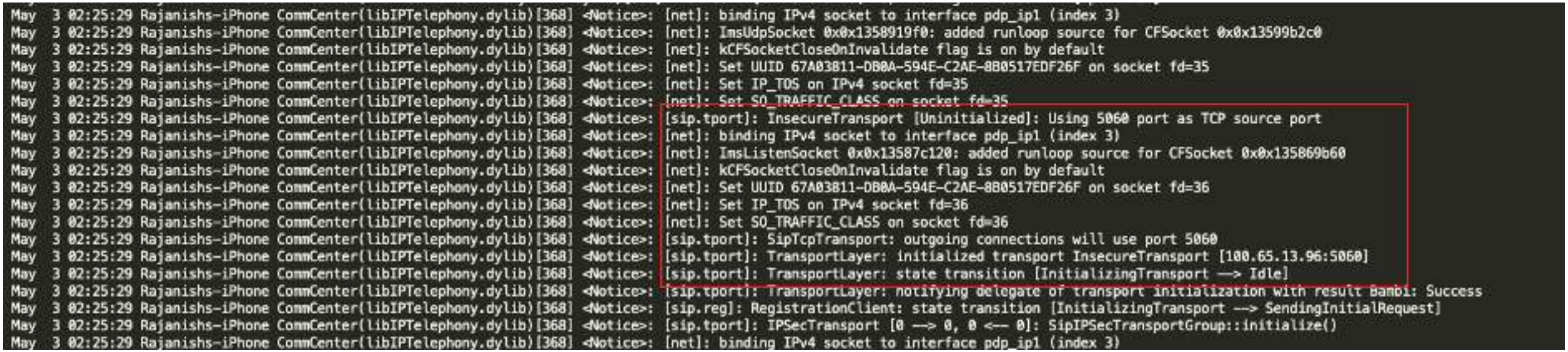
Vulnerability Identification – iOS internals

- As soon as the Airplane mode was turned off the interface (pdp_ip1) is brought online.
- Security policies for pdp_ip1 were updated
- Ipv4 assignment is carried out



Vulnerability Identification – iOS internals

- The default socket for SIP i.e port 5060 is opened and assigned to pdp_ip1
- The device initiates the registration process over the IMS by sending the REGISTER packet utilizing port 5060.



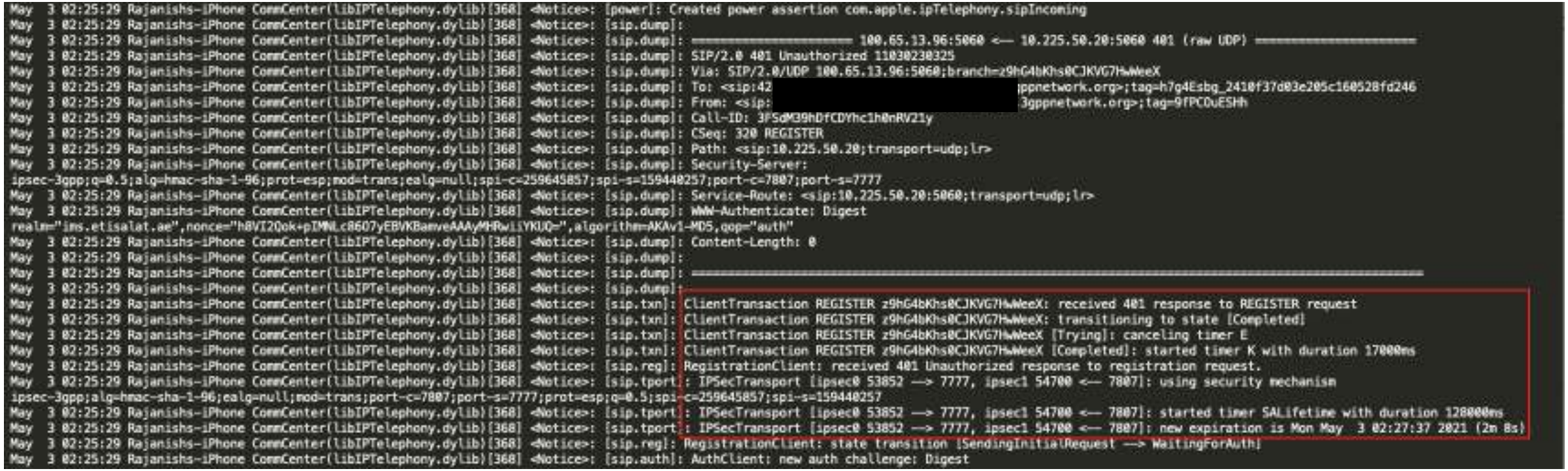
Vulnerability Identification – iOS internals

- The device initiates the registration process over the IMS by sending the REGISTER packet utilizing port 5060.

```
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: InsecureTransport [100.65.13.96:5060]: not adding P-Access-Network-Info to insecure REGISTER
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: InsecureTransport [100.65.13.96:5060]: encoded message is small enough for UDP (1507 bytes)
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]:
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: ========== 100.65.13.96:5060 --> 10.225.50.20:5060 REGISTER (UDP) ==========
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: REGISTER sip:ims.[redacted]3gppnetwork.org SIP/2.0
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: To: <sip:424[redacted]00@ims.mnc002.[redacted]3gppnetwork.org>
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: From: <sip:424[redacted]00@ims.mnc002.[redacted]3gppnetwork.org>;tag=9fPC0uESHh
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Expires: 600000
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Require: sec-agree
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Proxy-Require: sec-agree
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Security-Client: ipsec-3gpp;alg=hmac-md5-96;ealg=aes-cbc;mod=trans;port-c=53852;port-s=54700;prot=esp;spi-c=33392625;s
pi-s=64314874,ipsec-3gpp;alg=hmac-md5-96;ealg=null;mod=trans;port-c=53852;port-s=54700;prot=esp;spi-c=33392625;spi-s=64314874,ipsec-3gpp;alg=hmac-sha-1-96
;ealg=aes-cbc;mod=trans;port-c=53852;port-s=54700;prot=esp;spi-c=33392625;spi-s=64314874,ipsec-3gpp;alg=hmac-sha-1-96;ealg=null;mod=trans;port-c=53852;port-s=54700;prot=esp;spi-c=33392625;spi-s=64314874
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Call-ID: 3FSdM39hDfCDYhc1h0nRV21y
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Session-ID: 7de23403e7c[redacted]e752f47eb2
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Contact: <
sip:100.65.13.96:5060>;+g.3gpp.icsi-ref="urn%3Aurn-7%3A3gpp-service.ims.icsi.mmtel";+g.3gpp.mid-call;+g.3gpp.ps2cs-srvcc-orig-pre-alerting;+g.3gpp.srvcc-alerting;+sip.instance="<urn:gsma:imei:35[redacted]178-7>"
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Authorization: Digest
nonce="",uri="sip:ims.mnc002.[redacted]3gppnetwork.org",realm="ims.mnc002[redacted].3gppnetwork.org",username="42[redacted]00@ims.mnc002.[redacted].3gppnetwork.org",response=""
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: CSeq: 320 REGISTER
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Via: SIP/2.0/UDP 100.65.13.96:5060;branch=z9hG4bKhs0CJKVG7HwWeeX;rport
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Allow: ACK,BYE,CANCEL,INFO,INVITE,MESSAGE,NOTIFY,OPTIONS,PRACK,REFER,UPDATE
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Max-Forwards: 70
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Supported: 100rel,path,replaces
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: User-Agent: iOS/13.2 (17B84) iPhone
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Content-Length: 0
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]:
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: ==========
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]:
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.txn]: added connection user to InsecureTransport [100.65.13.96:5060]
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.txn]: ClientTransaction REGISTER z9hG4bKhs0CJKVG7HwWeeX: started timer F with duration 128000ms
```

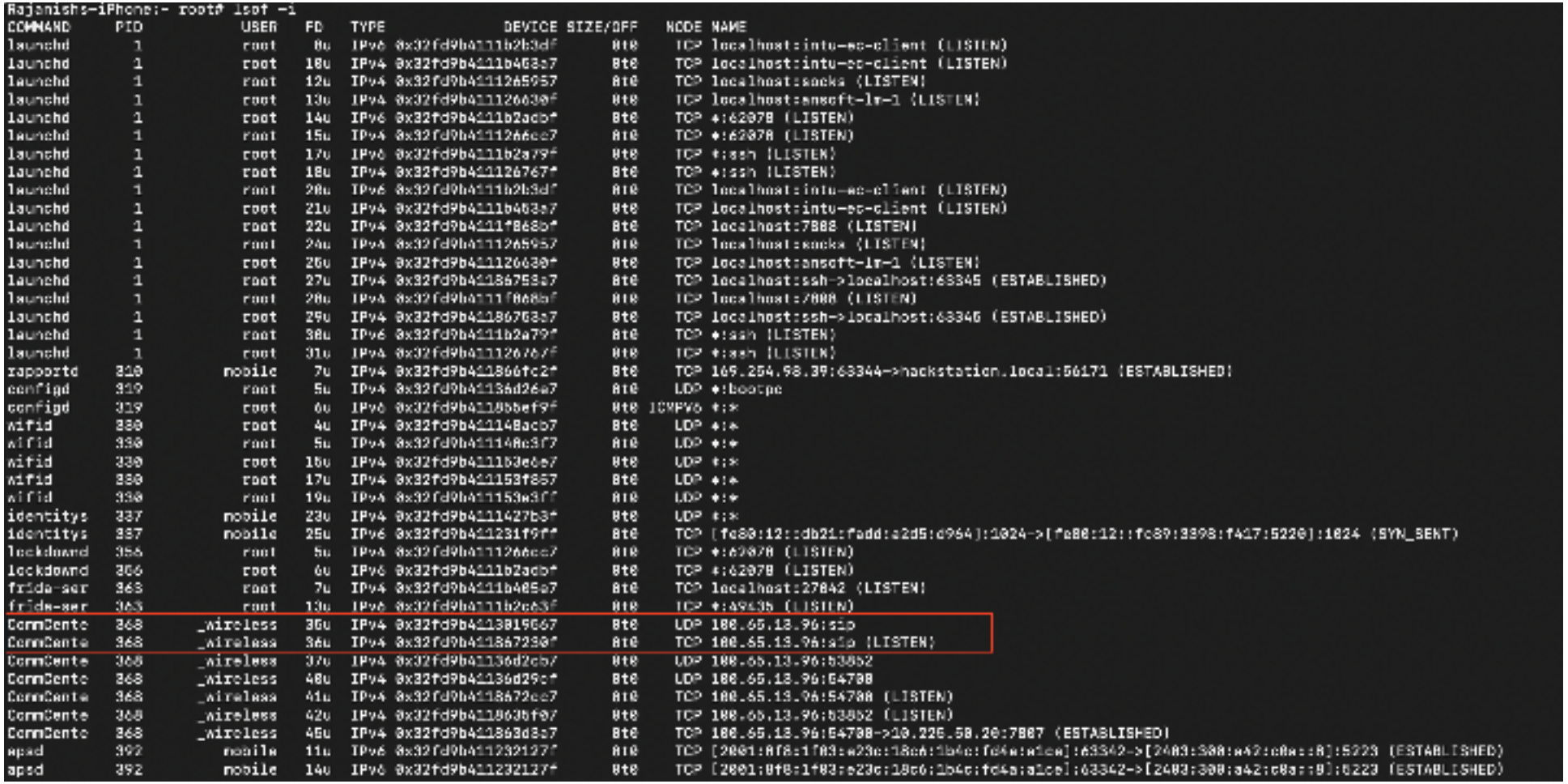
Vulnerability Identification – iOS internals

- The registration over 5060 fails with status 401 and a process for secure connection over IPSec is initiated



Vulnerability Identification – iOS internals

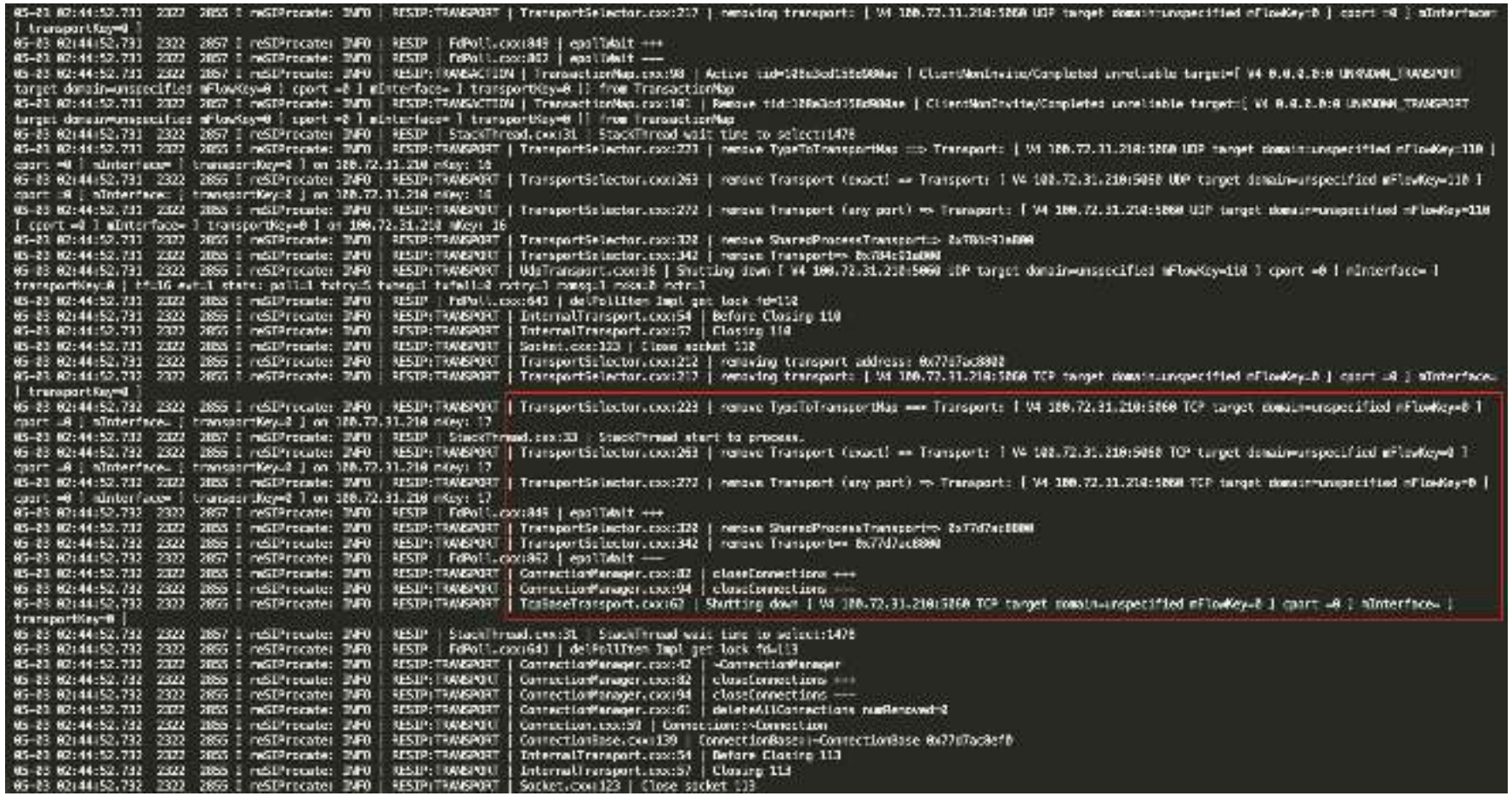
- But the socket connection on 5060 is left as it is and it still continues to listen for incoming SIP traffic.



```
Rajanishs-iPhone:~ root# lsof -i
COMMAND     PID           USER   FD   TYPE             DEVICE SIZE/OFF   NODE NAME
launchd       1           root    8u  IPv6 0x32fd9b4111b2b3df      0t0    TCP localhost:intu-ec-client (LISTEN)
launchd       1           root   18u  IPv4 0x32fd9b4111b463e7      0t0    TCP localhost:intu-ec-client (LISTEN)
launchd       1           root   12u  IPv4 0x32fd9b4111265957      0t0    TCP localhost:socks (LISTEN)
launchd       1           root   13u  IPv4 0x32fd9b411126630f      0t0    TCP localhost:ansoft-lm-1 (LISTEN)
launchd       1           root   14u  IPv6 0x32fd9b4111b2acb7      0t0    TCP *:62078 (LISTEN)
launchd       1           root   15u  IPv4 0x32fd9b4112a6ce7       0t0    TCP *:62078 (LISTEN)
launchd       1           root   17u  IPv6 0x32fd9b4111b2a79f      0t0    TCP *:ssh (LISTEN)
launchd       1           root   18u  IPv4 0x32fd9b4112267677      0t0    TCP *:ssh (LISTEN)
launchd       1           root   20u  IPv6 0x32fd9b4111b2b3df      0t0    TCP localhost:intu-ec-client (LISTEN)
launchd       1           root   21u  IPv4 0x32fd9b4111b463e7      0t0    TCP localhost:intu-ec-client (LISTEN)
launchd       1           root   22u  IPv4 0x32fd9b4111f868b7      0t0    TCP localhost:7888 (LISTEN)
launchd       1           root   24u  IPv4 0x32fd9b4111265957      0t0    TCP localhost:socks (LISTEN)
launchd       1           root   26u  IPv4 0x32fd9b411126630f      0t0    TCP localhost:ansoft-lm-1 (LISTEN)
launchd       1           root   27u  IPv4 0x32fd9b4118675367      0t0    TCP localhost:ssh->localhost:63345 (ESTABLISHED)
launchd       1           root   28u  IPv4 0x32fd9b4111f868b7      0t0    TCP localhost:7888 (LISTEN)
launchd       1           root   29u  IPv4 0x32fd9b4118676367      0t0    TCP localhost:ssh->localhost:63346 (ESTABLISHED)
launchd       1           root   30u  IPv6 0x32fd9b4111b2a79f      0t0    TCP *:ssh (LISTEN)
launchd       1           root   31u  IPv4 0x32fd9b4112267677      0t0    TCP *:ssh (LISTEN)
rapportd    310         mobile    7u  IPv4 0x32fd9b4118660fc2      0t0    TCP 169.254.98.39:63344->hackstation.local:56171 (ESTABLISHED)
configd     319           root    5u  IPv4 0x32fd9b4113ad26a7      0t0    UDP *:bootpc
configd     319           root    6u  IPv6 0x32fd9b4118bbef9f      0t0 ICMPV6 *:*
wifid       330           root    4u  IPv4 0x32fd9b4114bacb7       0t0    UDP *:*
wifid       330           root    5u  IPv4 0x32fd9b4114ac3f7       0t0    UDP *:*
wifid       330           root   15u  IPv4 0x32fd9b4111b3e6e7      0t0    UDP *:*
wifid       330           root   17u  IPv4 0x32fd9b411153f857      0t0    UDP *:*
wifid       330           root   19u  IPv4 0x32fd9b4111153ac3f      0t0    UDP *:*
identitys   337         mobile   23u  IPv4 0x32fd9b4111427b3f      0t0    UDP *:*
identitys   337         mobile   25u  IPv6 0x32fd9b4112317f9f      0t0    TCP [fe80:12::db21:fadd:a2d5:d964]:1024->[fe80:12::fc89:3398:f417:5220]:1024 (SYN_SENT)
lockdownd   356           root    5u  IPv4 0x32fd9b4111266ce7      0t0    TCP *:62078 (LISTEN)
lockdownd   356           root    6u  IPv6 0x32fd9b4111b2acb7      0t0    TCP *:62078 (LISTEN)
frida-ser   363           root    7u  IPv4 0x32fd9b4111b485a7      0t0    TCP localhost:27042 (LISTEN)
frida-ser   363           root   13u  IPv6 0x32fd9b4111b2c63f      0t0    TCP *:49635 (LISTEN)
CommCente   368      _wireless   36u  IPv4 0x32fd9b4113815667      0t0    UDP 100.65.13.96:sip
CommCente   368      _wireless   36u  IPv4 0x32fd9b4118672307      0t0    TCP 100.65.13.96:sip (LISTEN)
CommCente   368      _wireless   37u  IPv4 0x32fd9b4113bd2cb7      0t0    UDP 100.65.13.96:53852
CommCente   368      _wireless   40u  IPv4 0x32fd9b4113bd29c7      0t0    UDP 100.65.13.96:64708
CommCente   368      _wireless   41u  IPv4 0x32fd9b4118672ce7      0t0    TCP 100.65.13.96:54708 (LISTEN)
CommCente   368      _wireless   42u  IPv4 0x32fd9b4113963bf07     0t0    TCP 100.65.13.96:53852 (LISTEN)
CommCente   368      _wireless   46u  IPv4 0x32fd9b4113863d8e7     0t0    TCP 100.65.13.96:64708->10.226.58.20:7807 (ESTABLISHED)
apsd        392         mobile   11u  IPv6 0x32fd9b4111232127      0t0    TCP [2001:0f8:1f03:e23c:18c6:1b4c:fd4a:a1ce]:63342->[2403:300:a42:c0a::8]:5223 (ESTABLISHED)
apsd        392         mobile   14u  IPv6 0x32fd9b4111232127*     0t0    TCP [2001:0f8:1f03:e23c:18c6:1b4c:fd4a:a1ce]:63342->[2403:300:a42:c0a::9]:5223 (ESTABLISHED)
```

Vulnerability Identification – Android

- Android operating system terminates the socket connection to PORT 5060 if it is not being utilized it can be seen from the logs below.



PoC

1. Identification of iOS devices on the network.

SIP Device	User Agent
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
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10.168 [redacted] 5060	iOS/13.2 (17B84) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
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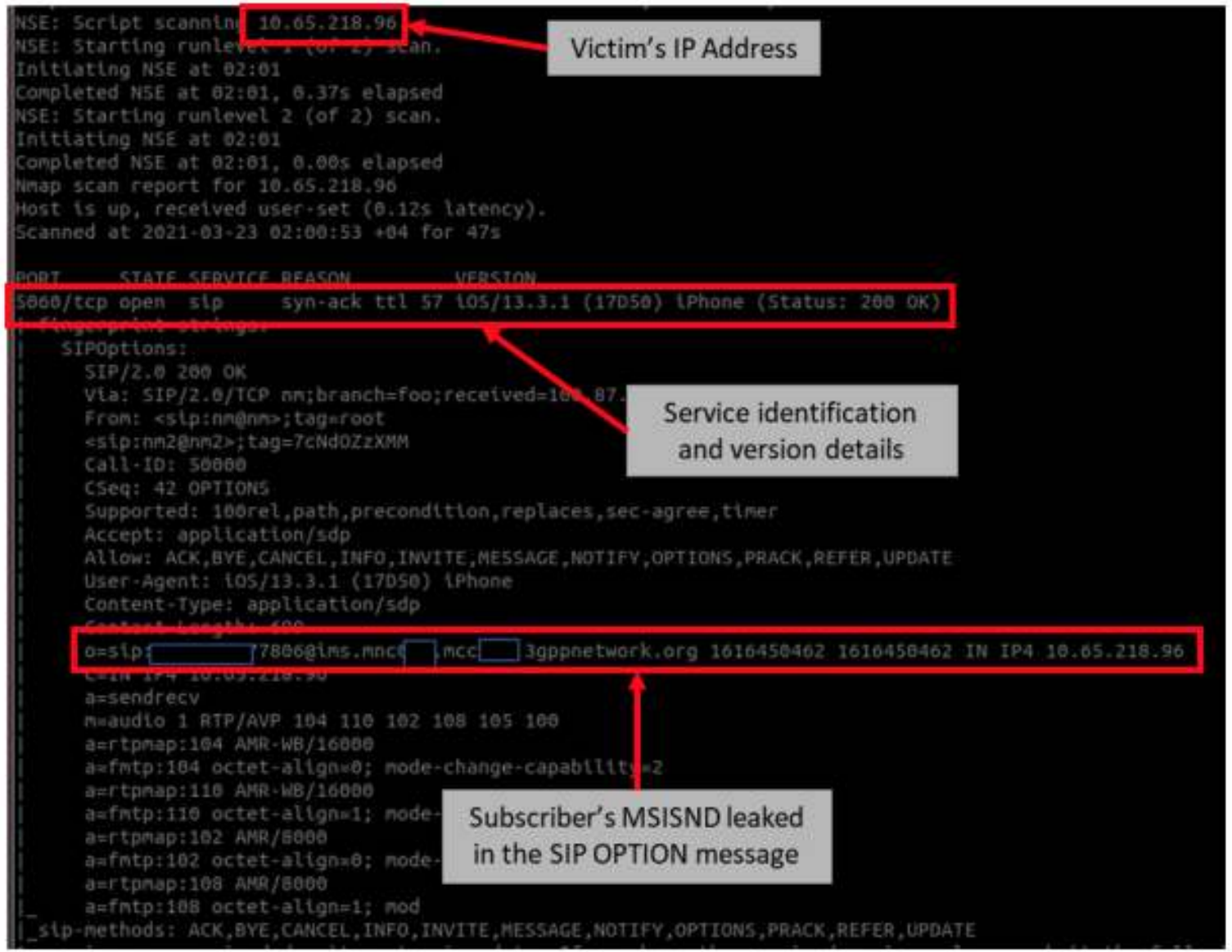
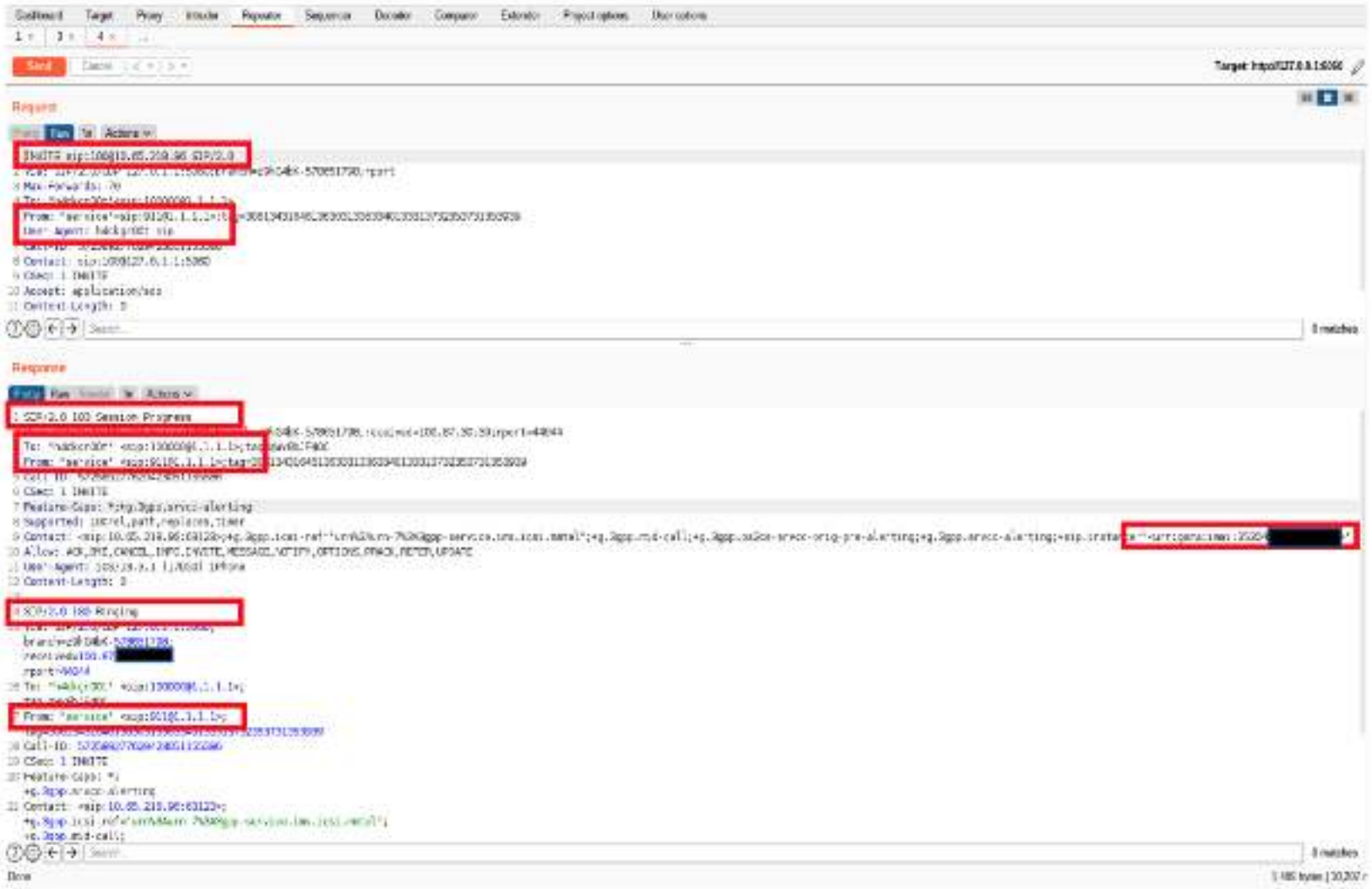
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.0 (18A5342e) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 5060	iOS/14.4 (18D52) iPhone



PoC

2. Sending crafted SIP INVITE packet to confirm remote device is responding to incoming SIP request

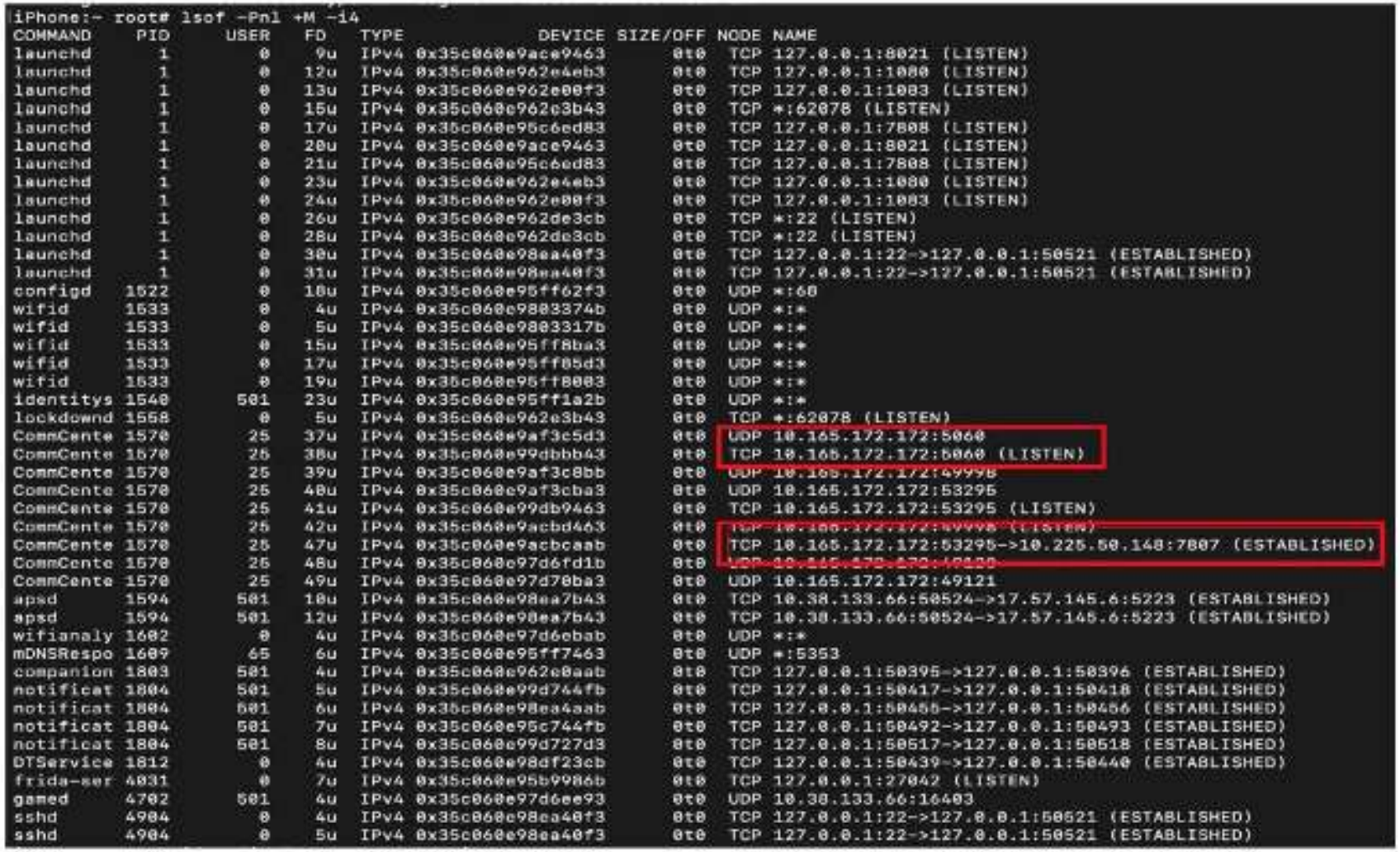


PoC

3. Trace captured on Wireshark where the device accepts incoming traffic and the call is initiated.

PoC

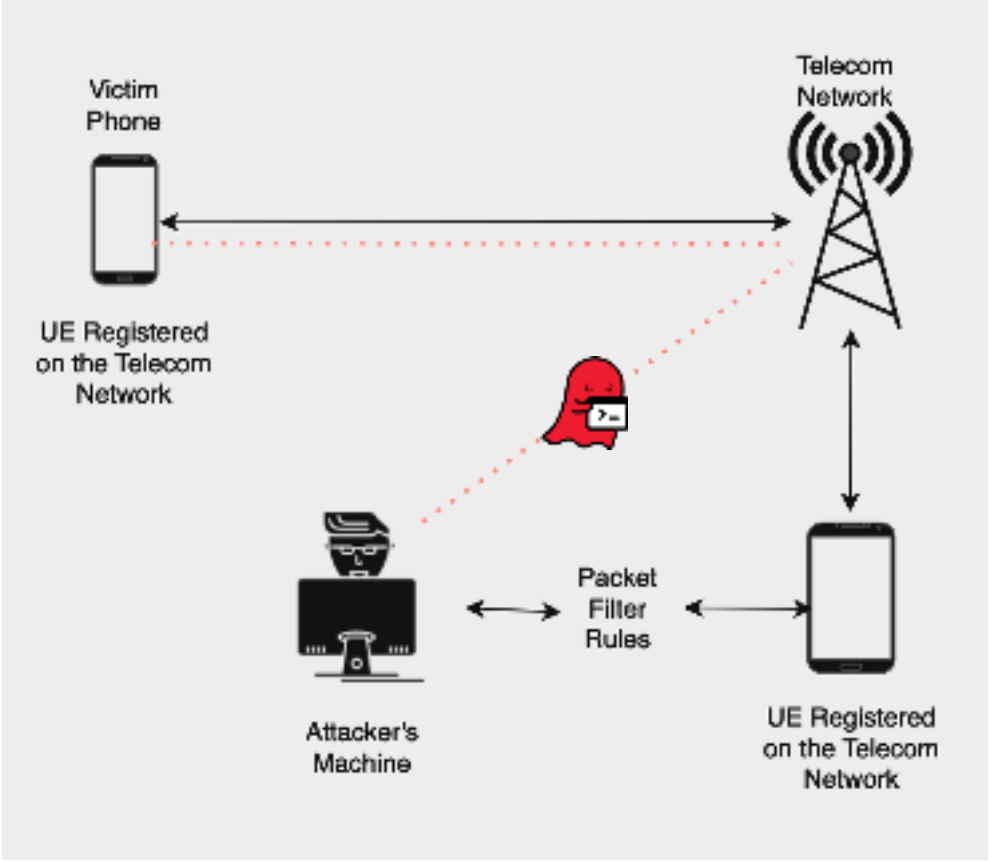
4. The iOS device still continues to listen on SIP port 5060 despite an already established and serving call session



```
iPhone:~ root# lsof -Pnl +M -i4
COMMAND     PID      USER   FD   TYPE             DEVICE SIZE/OFF NODE NAME
launchd       1         0    9u  IPv4 0x35c060e9ace9463       0t0  TCP 127.0.0.1:8021 (LISTEN)
launchd       1         0   12u  IPv4 0x35c060e962e4eb3       0t0  TCP 127.0.0.1:1080 (LISTEN)
launchd       1         0   13u  IPv4 0x35c060e962e00f3       0t0  TCP 127.0.0.1:1083 (LISTEN)
launchd       1         0   15u  IPv4 0x35c060e962c3b43       0t0  TCP *:62078 (LISTEN)
launchd       1         0   17u  IPv4 0x35c060e95c6ed83       0t0  TCP 127.0.0.1:7888 (LISTEN)
launchd       1         0   20u  IPv4 0x35c060e9ace9463       0t0  TCP 127.0.0.1:8021 (LISTEN)
launchd       1         0   21u  IPv4 0x35c060e95c6ed83       0t0  TCP 127.0.0.1:7888 (LISTEN)
launchd       1         0   23u  IPv4 0x35c060e962e4eb3       0t0  TCP 127.0.0.1:1080 (LISTEN)
launchd       1         0   24u  IPv4 0x35c060e962e00f3       0t0  TCP 127.0.0.1:1083 (LISTEN)
launchd       1         0   26u  IPv4 0x35c060e962de3cb       0t0  TCP *:22 (LISTEN)
launchd       1         0   28u  IPv4 0x35c060e962de3cb       0t0  TCP *:22 (LISTEN)
launchd       1         0   30u  IPv4 0x35c060e98ea40f3       0t0  TCP 127.0.0.1:22->127.0.0.1:50521 (ESTABLISHED)
launchd       1         0   31u  IPv4 0x35c060e98ea40f3       0t0  TCP 127.0.0.1:22->127.0.0.1:50521 (ESTABLISHED)
configd    1522         0   18u  IPv4 0x35c060e95ff62f3       0t0  UDP *:68
wifid      1533         0    4u  IPv4 0x35c060e9803374b       0t0  UDP *:*
wifid      1533         0    5u  IPv4 0x35c060e9803317b       0t0  UDP *:*
wifid      1533         0   15u  IPv4 0x35c060e95ff8ba3       0t0  UDP *:*
wifid      1533         0   17u  IPv4 0x35c060e95ff85d3       0t0  UDP *:*
wifid      1533         0   19u  IPv4 0x35c060e95ff8083       0t0  UDP *:*
identitys  1540       501   23u  IPv4 0x35c060e95ff1a2b       0t0  UDP *:*
lockdownd  1558         0    5u  IPv4 0x35c060e962e3b43       0t0  TCP *:62078 (LISTEN)
CommCente  1570        25   37u  IPv4 0x35c060e9af3c5d3       0t0  UDP 10.165.172.172:5060
CommCente  1570        25   38u  IPv4 0x35c060e99dbbb43       0t0  TCP 10.165.172.172:5060 (LISTEN)
CommCente  1570        25   39u  IPv4 0x35c060e9af3c8bb       0t0  UDP 10.165.172.172:49998
CommCente  1570        25   40u  IPv4 0x35c060e9af3cba3       0t0  UDP 10.165.172.172:53295
CommCente  1570        25   41u  IPv4 0x35c060e99db9463       0t0  TCP 10.165.172.172:53295 (LISTEN)
CommCente  1570        25   42u  IPv4 0x35c060e9acbd463       0t0  TCP 10.165.172.172:49998 (LISTEN)
CommCente  1570        25   47u  IPv4 0x35c060e9acbcaab       0t0  TCP 10.165.172.172:53295->10.225.50.148:7807 (ESTABLISHED)
CommCente  1570        25   48u  IPv4 0x35c060e97d6fd1b       0t0  UDP 10.165.172.172:49120
CommCente  1570        25   49u  IPv4 0x35c060e97d70ba3       0t0  UDP 10.165.172.172:49121
apsd       1594       501   10u  IPv4 0x35c060e98ea7b43       0t0  TCP 10.38.133.66:50524->17.57.145.6:5223 (ESTABLISHED)
apsd       1594       501   12u  IPv4 0x35c060e98ea7b43       0t0  TCP 10.38.133.66:50524->17.57.145.6:5223 (ESTABLISHED)
wifianaly  1602         0    4u  IPv4 0x35c060e97d6ebab       0t0  UDP *:*
mDNSRespo  1609        65    6u  IPv4 0x35c060e95ff7463       0t0  UDP *:5353
companion  1803       501    4u  IPv4 0x35c060e962e0aab       0t0  TCP 127.0.0.1:50395->127.0.0.1:50396 (ESTABLISHED)
notificat  1804       501    5u  IPv4 0x35c060e99d744fb       0t0  TCP 127.0.0.1:50417->127.0.0.1:50418 (ESTABLISHED)
notificat  1804       501    6u  IPv4 0x35c060e98ea4aab       0t0  TCP 127.0.0.1:50455->127.0.0.1:50456 (ESTABLISHED)
notificat  1804       501    7u  IPv4 0x35c060e95c744fb       0t0  TCP 127.0.0.1:50492->127.0.0.1:50493 (ESTABLISHED)
notificat  1804       501    8u  IPv4 0x35c060e99d727d3       0t0  TCP 127.0.0.1:50517->127.0.0.1:50518 (ESTABLISHED)
DTService  1812         0    4u  IPv4 0x35c060e98df23cb       0t0  TCP 127.0.0.1:50439->127.0.0.1:50440 (ESTABLISHED)
frida-ser  4031         0    7u  IPv4 0x35c060e95b9986b       0t0  TCP 127.0.0.1:27042 (LISTEN)
gamed      4702       501    4u  IPv4 0x35c060e97d6ee93       0t0  UDP 10.38.133.66:16403
sshd       4904         0    4u  IPv4 0x35c060e98ea40f3       0t0  TCP 127.0.0.1:22->127.0.0.1:50521 (ESTABLISHED)
sshd       4904         0    5u  IPv4 0x35c060e98ea40f3       0t0  TCP 127.0.0.1:22->127.0.0.1:50521 (ESTABLISHED)
```

Root Cause

- VoLTE enabled iOS devices are always listening on interface “pdp_ip1” on Port 5060 irrespective of them being connected with the P-CSCF (IMS) on a different port.
- While the call is established via IMS channel, it is observed the devices continue to listen for incoming SIP traffic.
- Attacker on the operator’s network can identify these devices and gain information like, iOS version, IMEI number and MSISDN of the subscriber
- Attacker on the operator’s network can make spoof calls directly interacting with the devices itself by crafting malformed SIP packets.



Issue Mitigation

- Fix implementation was done on iOS 15.2(19C5036e) and libIPTelephony terminates and destroys the ImsTcpSocket connection after the IPSec Tunnel has been established.

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Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [net]: ImsTcpSocket: Remote end closed connection
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [net]: ImsTcpSocket: remote end closed connection
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [default]: TcpConnection 100.104.36.221:5060 <-> 10.225.50.20:5060: canceling timer ShutdownWait
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [sip.tport]: TcpConnection 100.104.36.221:5060 <-> 10.225.50.20:5060: removing myself from transport
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [sip.tport]: TcpConnection 100.104.36.221:5060 <-> 10.225.50.20:5060: KeepAlives not enabled for non-TLS connection
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [sip.tport]: InsecureTransport [100.104.36.221:5060]: terminating
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [sip.tport]: closing UDP transport
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [net]: ImsSocket 0x0x141dd6980: invalidating socket 39
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [net]: ImsSocket 0x0x14315eb50: invalidating socket 40
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [sip.tport]: TcpConnection 100.104.36.221:5060 <-> 10.225.50.20:5060: Connection closed by both sides.
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [sip.tport]: TcpConnection 100.104.36.221:5060 <-> 10.225.50.20:5060: KeepAlives not enabled for non-TLS connection
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [sip.tport]: TcpConnection 100.104.36.221:5060 <-> 10.225.50.20:5060: closing connection
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [net]: ImsSocket 0x0x141ddce10: invalidating socket 40
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [net]: destroying ImsTcpSocket 0x0x141ddce10
```

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Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [default]: TcpConnection 100.104.36.221:5060 <-> 10.225.50.20:5060: timer IdleTimeout fired
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [net]: shutting down socket
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [sip.tport]: TcpConnection 100.104.36.221:5060 <-> 10.225.50.20:5060: Connection shutdown attempted. Result = Bambi: Success
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [timer]: registering timer TcpConnection 100.104.36.221:5060 <-> 10.225.50.20:5060.0x143170990.ShutdownWait
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [default]: TcpConnection 100.104.36.221:5060 <-> 10.225.50.20:5060: started timer ShutdownWait with duration 1000ms
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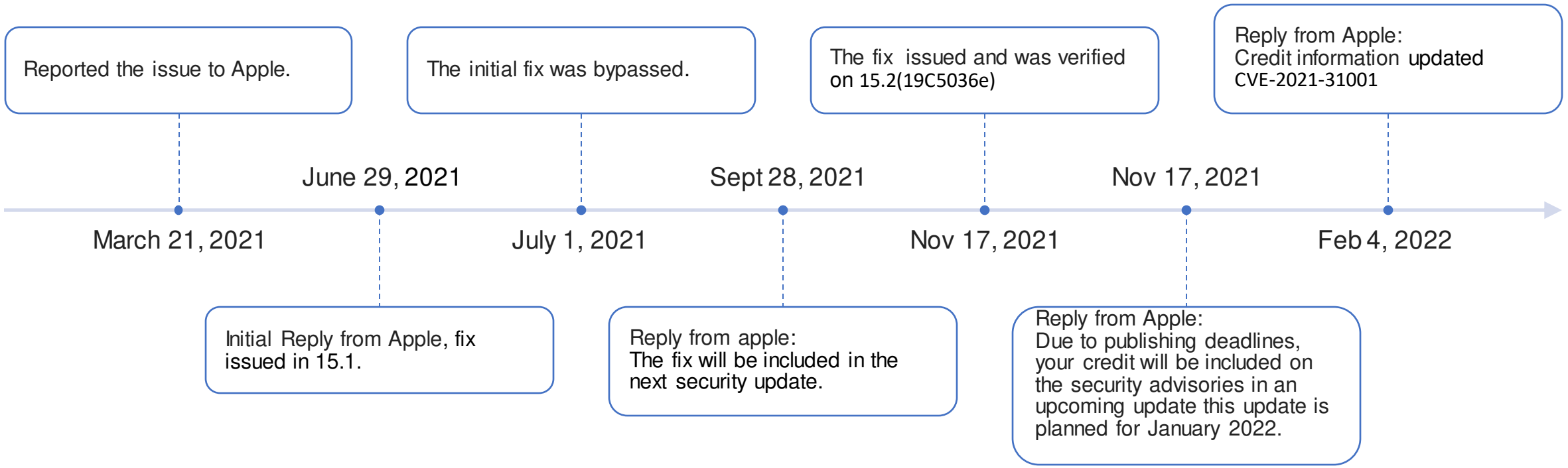
Issue Timeline



THANK YOU!

"Great things are done by a series of small things brought together."

Vincent Van Gogh