SURVEY OF SECURITY VULNERABILITIES IN SESSION INITIATION PROTOCOL

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Outline

- VoIP security issue
- SIP security
- Media security
- Solution

VoIP security issue

- PSTN rely on closed network
- VoIP is based on an open environment
- VoIP inherit vulnerabilities from underlying transport protocols
    - IP, UDP, TCP

VoIP security issue

- Some security mechanisms have been proposed for SIP-based infrastructures, but vulnerabilities still exist
- Exhaust available resources
- Discover vulnerabilities in the applications

SIP security (DoS)

- Denial of Service (DoS), interruption/destruction of service provisioning
- Distributed Denial of Service (DDoS), use multiple computers to paralyze the target system
    - flood target’s bandwidth
    - consume target’s resources

SIP security (DDoS)

- Flooding Registrar Server
- Attacker launches an attack against a REGISTRAR by employing lots of **registration requests**
    - Guess legitimate users’ passwords
    - Cause a DoS in the SIP registrar

SIP security (DDoS)

- Flooding Proxy Server and End-User Terminal
- Attacker launches several **SIP INVITE**
  - SIP proxy must keep the connection state until redirect transaction has been replied
  - Paralyze proxy server & end user

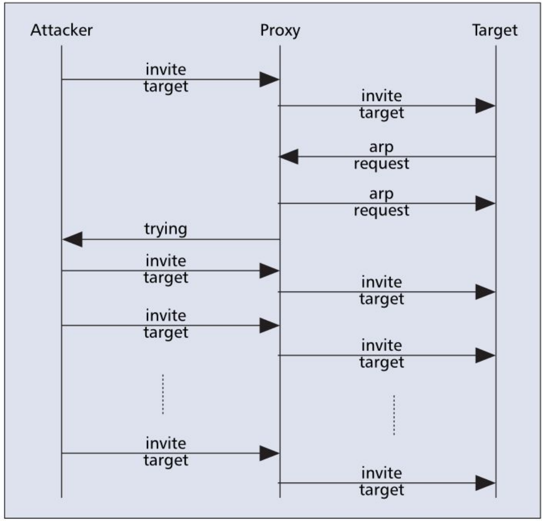
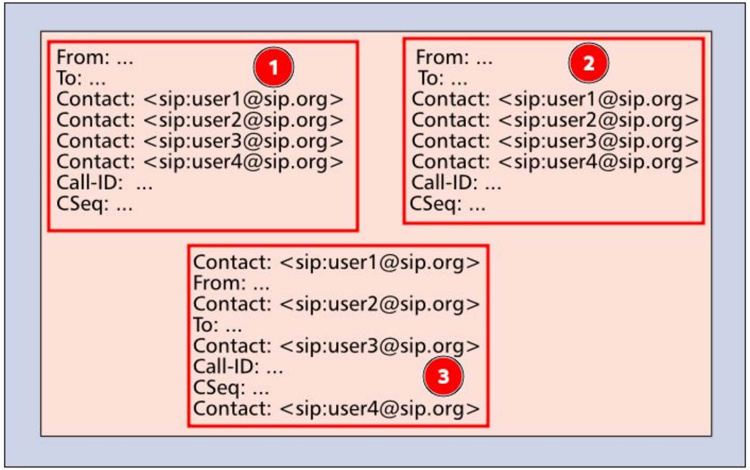


Figure 6. *Flood with INVITE messages.*

SIP security (Parser Attack)

- SIP is a text-based protocol, so an efficient parser is important
- Some message headers are vital for processing (e.g. To, Via, etc.)



```
From: ...
To: ...
Contact: <sip:user1@sip.org>
Contact: <sip:user2@sip.org>
Contact: <sip:user3@sip.org>
Contact: <sip:user4@sip.org>
Call-ID:  ...
CSeq: ...
```

```
From: ...
To: ...
Contact: <sip:user1@sip.org>
Contact: <sip:user2@sip.org>
Contact: <sip:user3@sip.org>
Contact: <sip:user4@sip.org>
Call-ID: ...
CSeq: ...
```

```
Contact: <sip:user1@sip.org>
From: ...
Contact: <sip:user2@sip.org>
To: ...
Contact: <sip:user3@sip.org>
Call-ID: ...
CSeq: ...
Contact: <sip:user4@sip.org>
```

■ **Figure 8.** *Multiple header possibilities.*

SIP security (Application Attack)

- BYE/CANCEL Attack
- Attacker needs to learn all necessary session parameters Session-ID, RTP Port, etc.

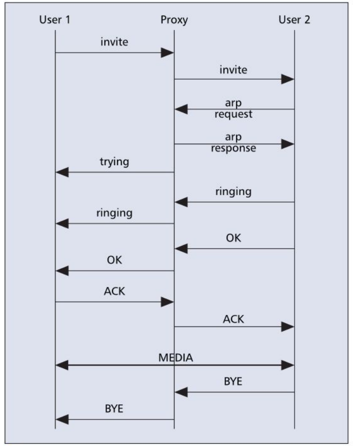


Figure 9. *Normal session termination.*

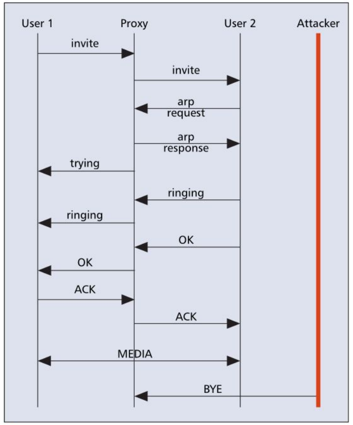


Figure 10. *BYE attack.*

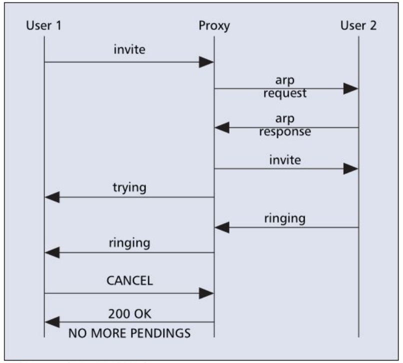


Figure 11. *CANCEL request.*

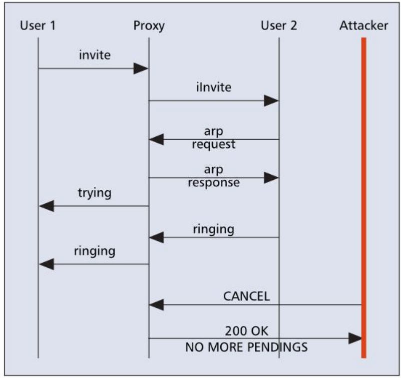
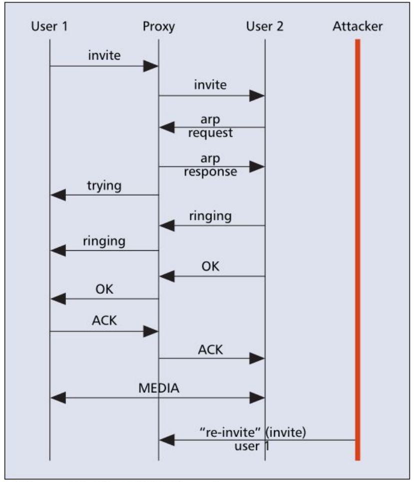


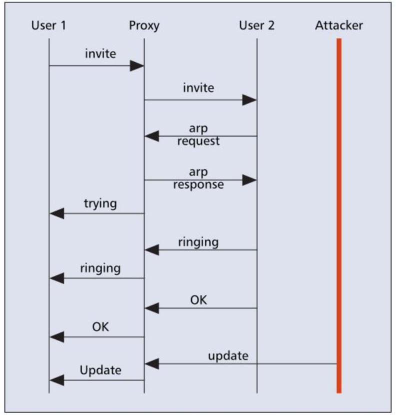
Figure 12. *CANCEL attack.*

SIP security (Application Attack)

- Re-INVITE/UPDATE Attack
- Modify the parameters of the dialog-session



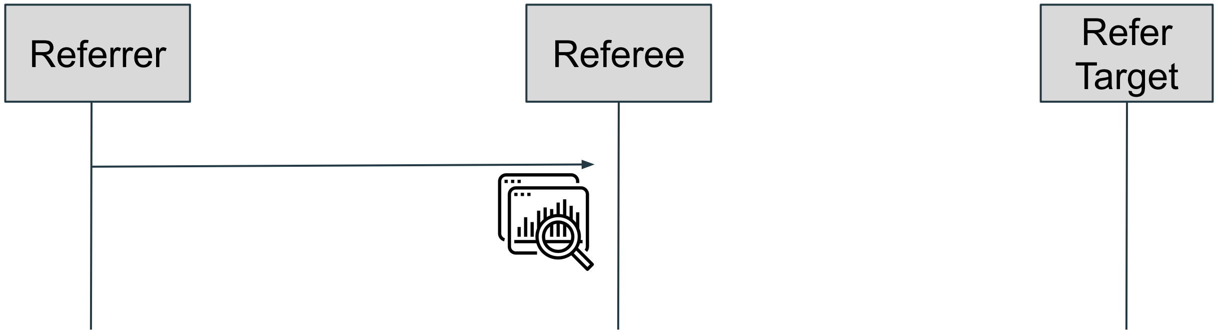
■ **Figure 13.** *"Re-INVITE" attack.*



■ **Figure 14.** *UPDATE attack.*

SIP security (Application Attack)

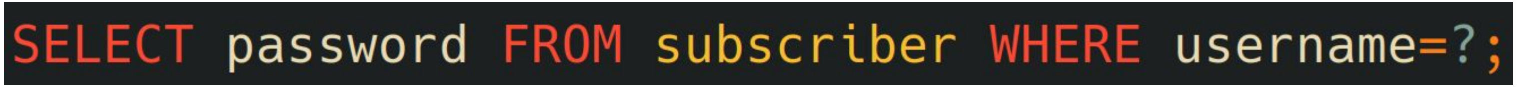
- REFER Attack
- MITM(Man In The Middle) attacks



SIP security (Application Attack)

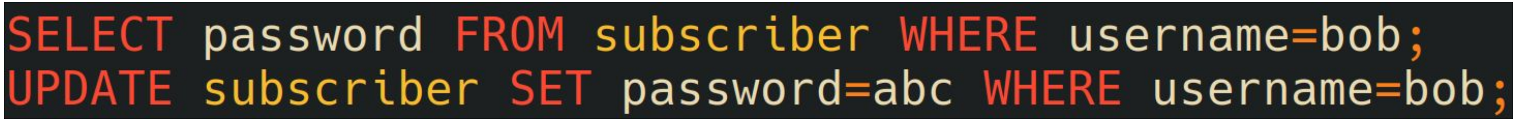
- SQL Injection Attack
- SIP relies on databases such as MySQL, Postgress, etc. to store administer user credentials and appropriate data (e.g. user name, password)
- The utilization of WEB interfaces for the provision of SIP services makes this attack more attractive

SQL injection example

- User need input username and password
- 

```
SELECT password FROM subscriber WHERE username=?;
```

- bob; UPDATE subscriber SET password=abc WHERE username=bob



```
SELECT password FROM subscriber WHERE username=bob;
UPDATE subscriber SET password=abc WHERE username=bob;
```

Media security

- RTP doesn’t provide any mechanisms for eavesdropping(竊聽) or other attacks. (Not encrypted)

Solution (Encryption)

- Prevent eavesdropping
- IPsec (Internet Protocol Security)
- TLS (Transport Layer Secure)
- S/MIME (Secure Multipurpose Internet Mail Extensions)
- SRTP (Secure RTP)
    - SRTP encrypts only payload of a voice packet without adding additional encryption headers

Solution (AAA)

- Authentication
    - Identifying a user
- Authorization
    - Determining user privilege
- Accounting
    - Monitors/Control the resources a user consumes

Solution (SIP Parser, SQL)

- Server Application Side
  - Check if the input is malicious
- Database API
  - Only one SQL statement can be executed during one system call
- Database Side
  - Restrict user permissions

Solution (Flooding)

- None of the underlying security mechanisms to prevent SIP flooding
- Ban malicious users

Conclusion

- Easy
  - Eavesdropping, Forge(偽造)
- Medium
  - Parser, SQL Attack
- Hard
  - Flooding Attack

Thank you for your listening!