

Security Art | August 2011



Sounds Like Botnet

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Intro to VoIP

- It's everywhere
 - Home (Vonage, Skype, TeamSpeak, Comcast, etc...)
 - Office (Cisco, Avaya, Lucent, Asterisk, etc...)
- Easy to deploy
 - Most are “plug and talk” with fancy web interfaces to configure features such as voicemail, forwarding, conference calls, etc...

Overview of SIP

- Request/Response model
- Responsible for setup/teardown of voice/video calls
- Designed to allow “piercing” of firewalls, NAT, etc...
- Security? meh... (basic identification, usually not required in most PBXs, easily sniffed...)

VoIP as a Getaway Car

- So... VoIP can traverse firewalls easily
- And can go outside the corporate network over PSTN lines (no internetz needed...)
- And is rarely monitored (“can you hear me now” ain’t gonna pass through the DLP...)
- EXFILTRATE!

What is a VoIP Botnet

- Take your good ol'e botnet
 - Disconnect all C&C channels
 - Replace with VoIP
 - Profit?
-
- Fully mobilized (NAT piercing)
 - Looks more legit (try to pick THAT out of the traffic)
 - Harder to peek into (can you spell “whazzzzup?” in RTP?)

Who Needs a VoIP Botnet

- Well, everyone...
- Botmaster is more mobile (literally)
- More anonymous C&C servers (conf call bridge numbers are aplenty...)
- Can actually transfer fair amounts of data back/forth (remember the modem days?)
- It's starting to show up as alternative methods of covert communications
 - Sorry spooks... ☹️

VoIP Botnet in Action

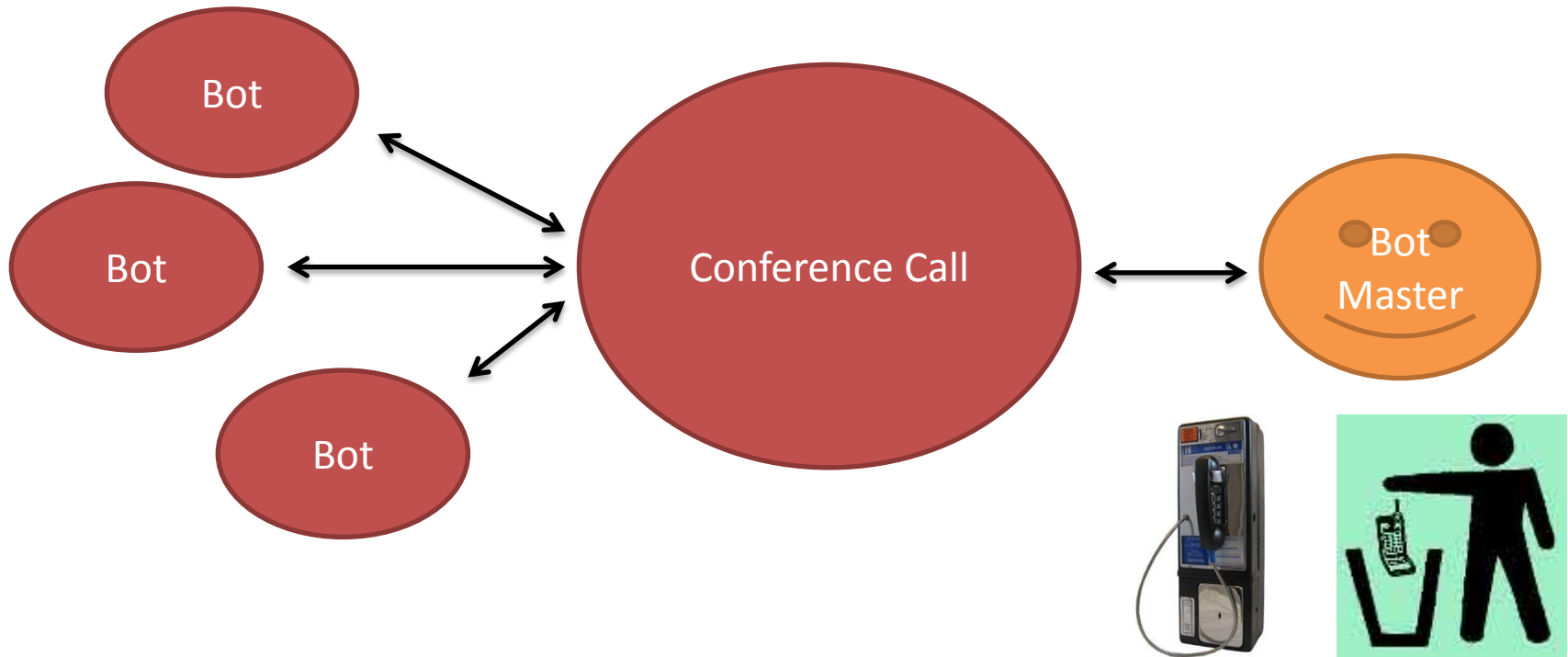
- Red Team Penetration Testing Engagement
- Botnet in No Internet/Closed Networks
- Botnet for VoIP Phones

VoIP Botnet Architecture

- Telephony systems allows both Unicast and Multicast communication
- Unicast:
 - Bot calls Bot Master
 - Bot Master calls Bot (registered ext. on his PBX)
- Multicast:
 - Bot A calls Conference Call
 - Bot B calls Conference Call
 - Bot Master joins Conference Call

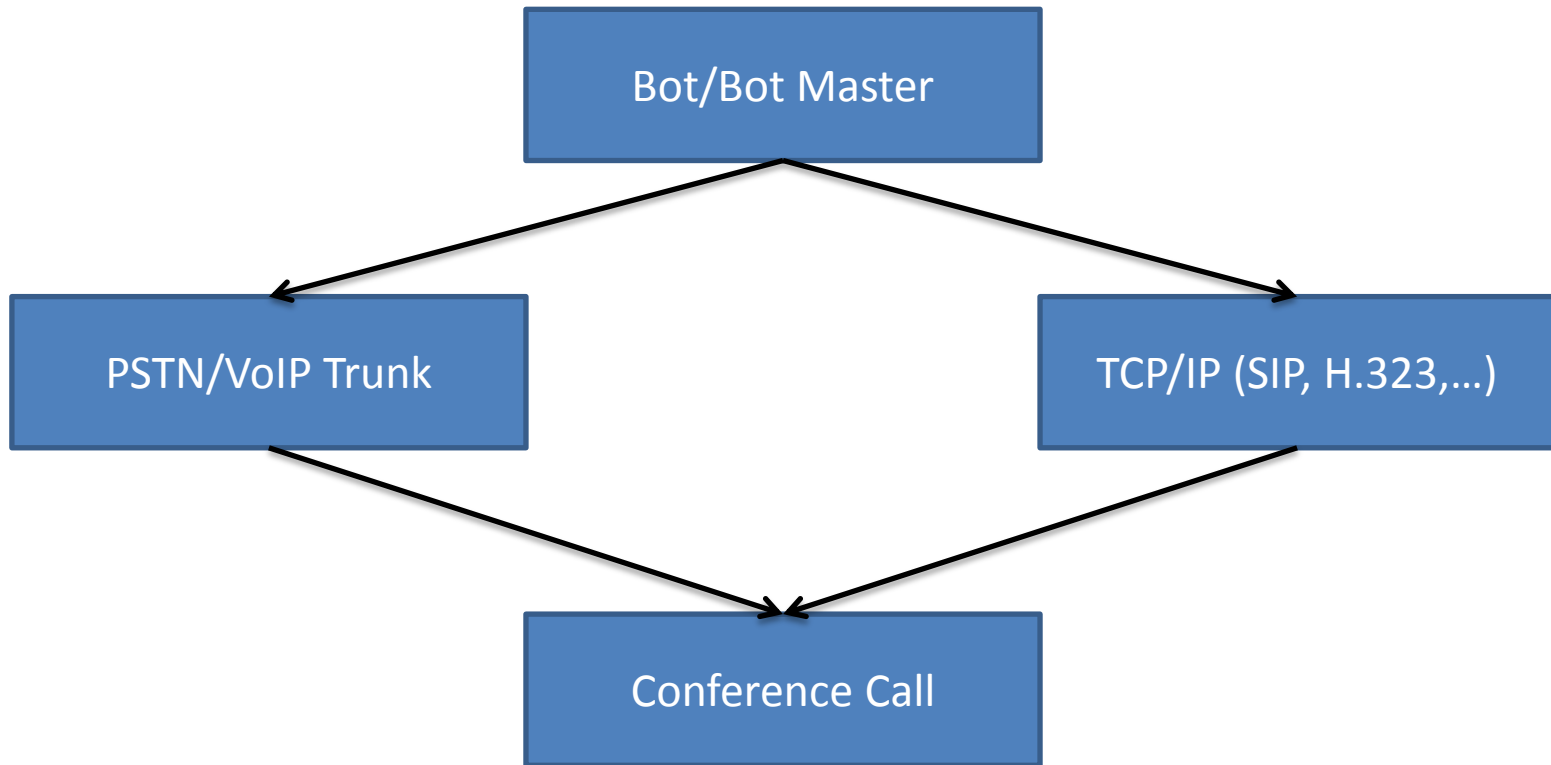
VoIP Botnet Architecture

- Conference Call as “IRC Channel”



The Call

- Calling can be made via TCP/IP or PSTN



Moshi Moshi

- Open-source VoIP Bot written in Python
 - Uses SIP as VoIP Protocol
 - Uses Text-to-speech Engines for Output
 - Uses DTMF Tones for Input
- Download your copy at:
 - <http://code.google.com/p/moshimoshi/>

Press 1 to Continue in I33t Speak

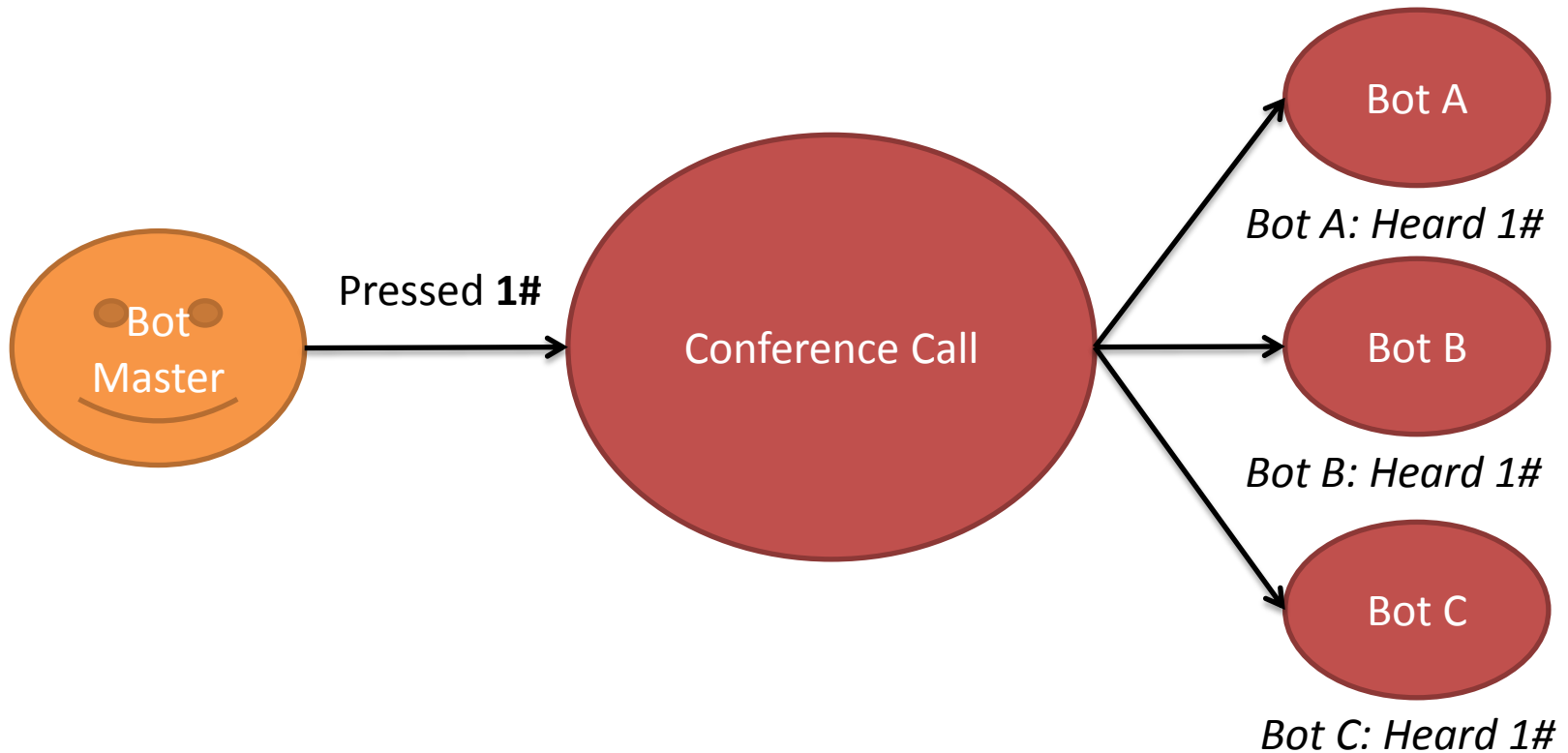
- DTMF (Dual-tone multi-frequency signaling) are used for signaling over telephone lines in the voice-frequency band between telephone handsets and other devices and switching centers.
- DTMF tones are standardized and can be sent and received from any phone

Asterisk as C&C and DTMF

- Asterisk is free software that transforms a computer into a communication server
- We're using *AsteriskNow 1.7.1 Linux Distribution*
- MeetMe is a conference bridge for Asterisk and supports passing DTMF through the conference.
- To pass DTMF through the conference add 'F' option to **MEETME_OPTS** at **extensions.conf**

DTMF Pass through/Relaying

- Conf. Call to relay DTMF to other calls



DTMF Tones as C&C

- The (made-up) Rules
 - ‘*’ is End of Line (EOL)
 - ‘#’ is a delimiter (i.e. Space)
- Examples
 - ‘0#*’ invoke command 0 without arguments
 - ‘1#123#*’ invoke command 1 with one arg ‘123’
 - ‘2#1#2#*’ invoke command 2 with args ‘1’ and ‘2’
- It’s your rules – go wild...

Ring, Ring!

Text-to-Speech as Data Leakage

- It's only natural that since we don't have visuals in phone conversation, to use voice
- Passwords, documents, settings and acknowledgements can all be read back
- Some systems (Mac, Windows) includes built-in Text-to-Speech engines, others requires installation
- External utilities can be used to convert different formats (e.g. Microsoft Word) into simpler text files

Talk to me... Woo hoo!

The Getaway: Modulation

- Take any arbitrary binary data
- Devise a way to transform bytes to sounds
 - PoC: every $\frac{1}{2}$ byte \rightarrow one of 16 octaves within the human audible range ($\sim 200\text{Hz}$ - $\sim 2000\text{Hz}$)
- Record each $\frac{1}{2}$ byte octave
 - PoC uses $\frac{1}{2}$ second tones (for legibility in a conference 😊)
- Music to my ears...

Demo: Binary Data Modulation -> Data Exfiltration

- Transform data to sound
- Dial, leave a message...
- Transform recorded message to data
- Profit?

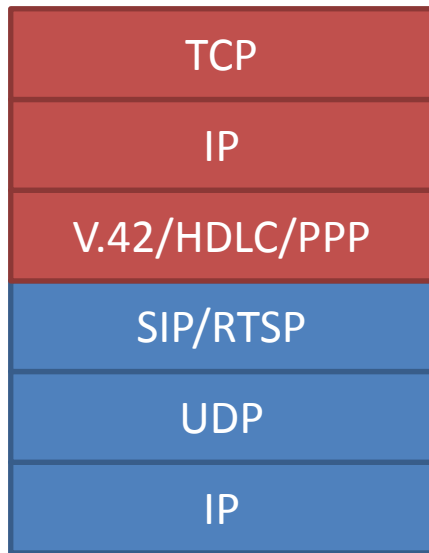
ET Phone Home!

VoIP as VPN

- Alternative unmonitored Internet access
 - No DLP
 - No Firewalls
 - No IDS/IPS/DPI
- Allows using already-existing C&C protocols
 - IRC
 - HTTP
- Bot Master can easily explore his Botnet
 - `nmap -sS 10.0.0.0/8`

TCP/IP over VoIP

- Bring back Modems to the game
- Use V.42/HDLC/PPP protocols



- Works with Hardware Modems
- Works with Software Modems
- Works within Voice frequency band
- Works under poor connectivity conditions
- Two-way communication channel

Did You Hear That?

- VoIP Botnets are as good and even better in some cases, than IRC, P2P, and HTTP Botnets.
- VoIP Botnets strengths:
 - Can be operated from a payphone, or a Mobile.
 - Can be accessed from both PSTN and Internet
 - Are not blocked by your typical IDS/IPS signatures

Countermeasures

- Separate VoIP from Corporate Network
 - Yes, COMPLETELY!
- Monitor VoIP Activity
 - It's your data. Same as you do for web/emails...
- Consider whitelisting Conf. Call Numbers

The Future Sound of Botnets

- Hearing is Believing
 - Speech-to-Text as Input
- Going Mobile
 - Text-to-SMS as Output
 - SMS-to-Voice Calls as Input
- Meeting new Appliances
 - T.38 (Fax) as Output (e.g. “Screen Shots”)
- Meeting old Appliances
 - Modem (PPP) as Input/Output (e.g. “Internal VPN”)

Questions?

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Thanks!

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