

XFLTReaT: a new dimension in tunnelling

Balazs Bucsay / @xoreipeip

Senior Security Consultant @ NCC Group

Bio / Balazs Bucsay

- Hungarian hacker
- Senior Security Consultant @ NCC Group
- Strictly technical certificates: OSCE, OSCP, OSWP, GIAC GPEN, CREST CCT/2
- Lots of experience in offensive security
- Started with ring0 debuggers and disassemblers in 2000 (13 years old)
- Major projects:
 - GI John (2009) – Hacktivity
 - Chw00t (2015) – PHDays, DeepSec, Hacktivity
 - XFLTReaT (2017) – BruCON, HITB GSEC, Shakacon
- Twitter: @xoreipeip
- LinkedIn: <https://www.linkedin.com/in/bucsayb>

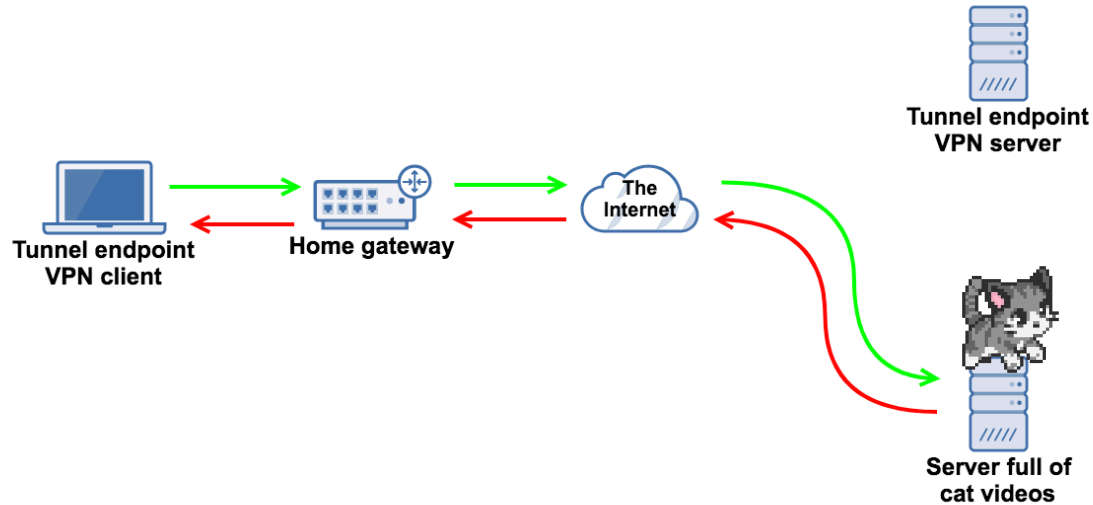
Presentations

- Talks around the world:
 - Singapore (SG) / Hack in the Box GSEC
 - Honolulu (HI) / Shakacon
 - Atlanta (GA) / Hacker Halted
 - Moscow (RU) / PHDays
 - Oslo (NO) / HackCon
 - Vienna (AT) / DeepSec
 - Budapest (HU) / Hacktivity
 - London (UK) / Inf. Gov. & eDiscovery Summit
 - There is some more space here...

Tunnels

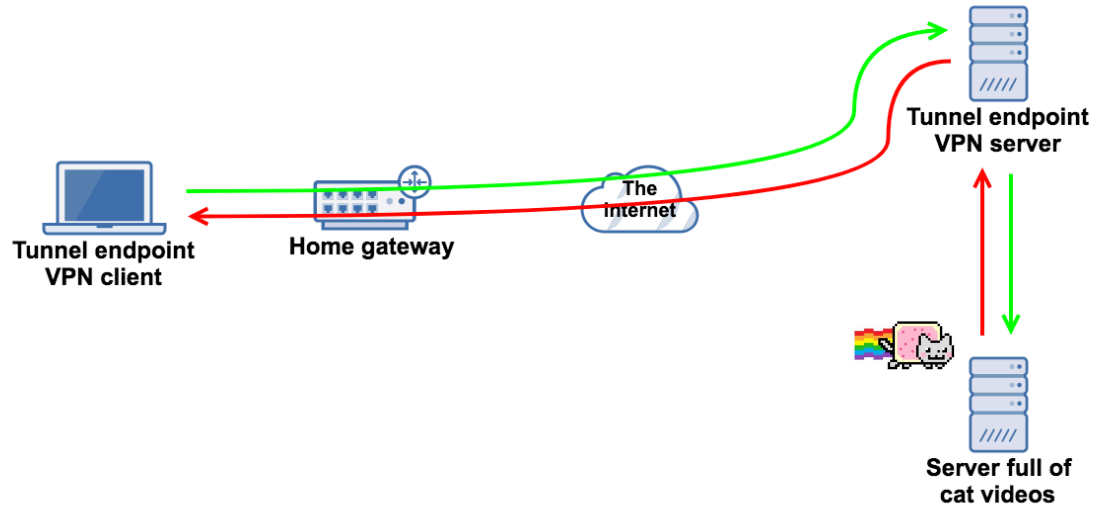


Without a tunnel



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With a tunnel



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Why would one use tunnels?

- **Work VPN** – to access the corporate internal network
- **Hide real IP address**
 - Whistle-blowers/Journalists to communicate anonymously
 - Torrent
- **ISPs filtering some ports (secure IMAP, SMTPS, NetBIOS, ...)**
- **Bypass corporate proxy policy**
- **Bypass captive portals!?**
- **What about you?**

Have you done ... tunnelling?

Protocol	Tool		
TCP			

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Have you done ... tunnelling?

Protocol		Tool		
TCP		OpenVPN	Cisco AnyConnect	
UDP				

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TCP	OpenVPN	Cisco AnyConnect	
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ICMP	Hans	Ping Tunnel	ICMPTx
DNS			

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Have you done ... tunnelling?

Protocol	Tool		
TCP	OpenVPN	Cisco AnyConnect	
UDP	OpenVPN		
ICMP	Hans	Ping Tunnel	ICMPTx
DNS	iodine	DNSScat*	Ozymandns
HTTP CONNECT	Proxifier	OpenVPN	
Pure HTTP	?		
TLS v1.2	?		
TLS v1.2 with Kerberos auth	?		

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Two days on a ferry

(Port TCP/443 unfiltered)



Oh no!
I forgot to set up my
OpenVPN on port
443

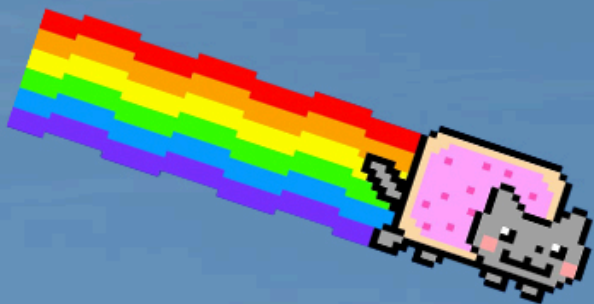


10 hour flight to Japan

(ICMP unfiltered)



Not again!
Why haven't I set up
my ICMP tunnel?



At the airport

(DNS unfiltered)



Bloody hell!
The DNS tunnel
crashed!?

Lol,
lamer. Not mine.
Why not use
XFLTReat?



What did I see?

Get tired of:

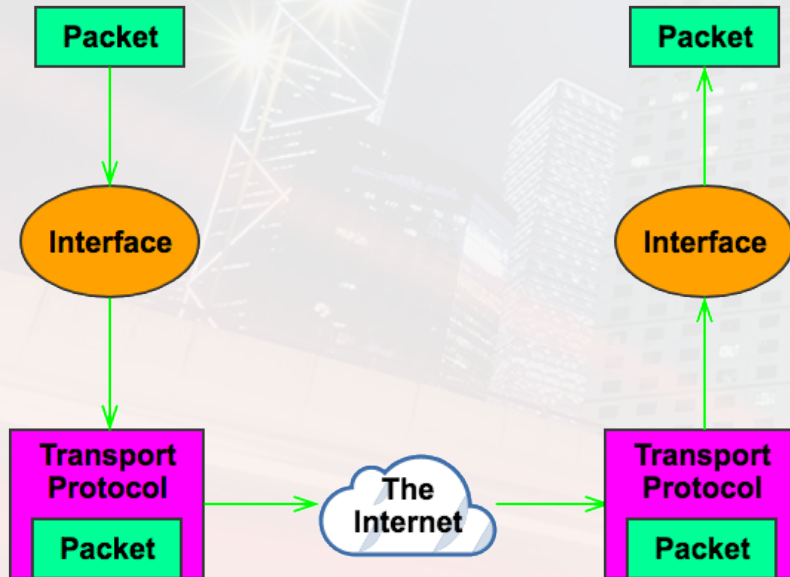
- As many protocols as many solutions
- Hard to modify the existing ones
- No modularity
- Portability issues
- Configuration issues
- Unsupported/EoL tools
- No automation at all
- It is just hard, but it does not have to be!

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XFLTReaT

The beast was born!

Tunnelling theory 101 / MTU



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What is XFLTReaT?

XFLTReaT (say exfil-treat or exfiltrate)

- Tunnelling framework
- Open-source
- Python based
- OOP
- Modular
- Multi client
- Plug and Play (at least as easy as it can be)
- Check functionality

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Easy, modular, plug & play

- **Install:**
 - **git clone & pip install**
 - **edit config**
 - **run**
- **Tunnels, encryption, authentication etc. are modular**
- **Plug and play:**
 - **Copy new module into modules/, support files to support/**
 - **edit config**
 - **run**

Framework, as it is

You do not have to:

- Set up the routing
- Handle multiple users
- Create and set up an interface or interfaces
- Care about encryption, authentication or encoding

You only have to:

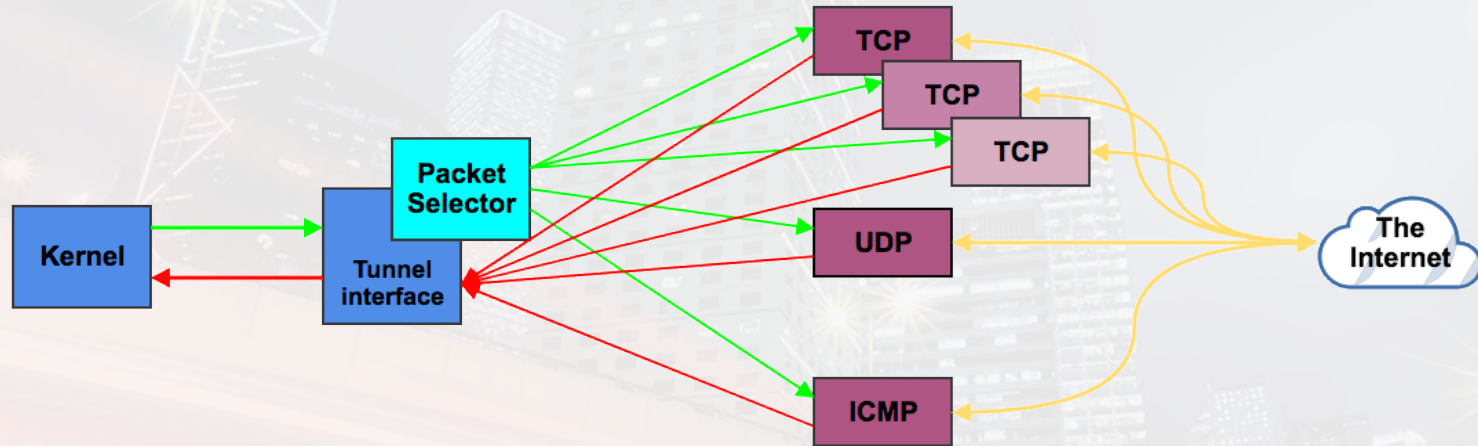
- Encapsulate your packets into your protocol
- Implement protocol related things

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Check functionality

- Easy way to figure out, which protocol is not filtered on the network
- Automated approach: No deep knowledge is needed
- Client sends a challenge over the selected (or all) modules to the server
- If the server responds with the solution:
 - We know that the server is up and running
 - The specific module/protocol is working over the network
 - Connection can be made

One interface to rule them all



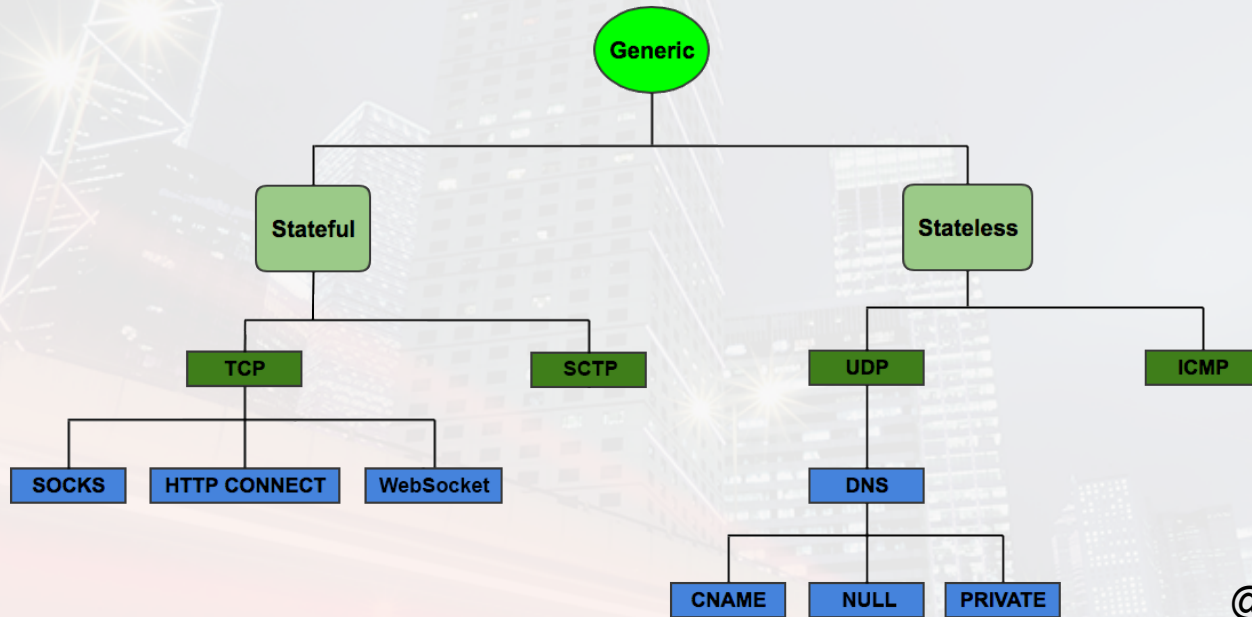
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Channels

- **There are two channels in every tunnel**
 - **Data:** data transmission
 - **Control:** control messages
 - Check message/response
 - Authentication related messages
 - Logoff message
 - Dummy message for keep-alive and query request
 - Auto-tune messages
 - etc.

Ease of development

Module tree



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Ease of use/development

- Only web traffic allowed?

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Ease of use/development

- Only web traffic allowed? **Set your server on port TCP/80**
- Only ICMP type 0 allowed?

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Ease of use/development

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Ease of use/development

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- Special authentication over HTTP proxy?

Ease of use/development

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- Special authentication over HTTP proxy? **Implement the auth, change the config**
- Want to send data over text/SMS? **Handle connection with your phone from a module**
- **PROTIP: just use the source!**

SCTP + WebSocket

- **SCTP module created and submitted by @info_dox**
 - Best example of how easy to create a standard tunnel
 - Please use the next-version branch for developing
 - Create issues
- **WebSocket module added**
 - Created a new tunnel in 3-4 hours
 - Ideal for proxies if WebSocket is supported
- **What is your next module?**

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DEMO

A few technical details

- **TCP is pretty easy**
 - New connection/new thread for all users
- **UDP introduced new challenges**
 - Stateless - One socket for all users
 - Sender address needs to be checked
- **ICMP**
 - Just like UDP it is stateless as well
 - Identifier and sequence tracking (for NAT/Firewalls)
 - As many request as many answers

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DNS module

- **The DNS module is not 100% yet**
- **Zonefile support included**
- **Supports A/CNAME, PRIVATE and NULL records (easily extendable)**
- **Tested with Bind9**
- **Auto tune functionality checks:**
 - Which is the best encoding and length for upstream
 - Which is the best encoding, length and record type down downstream
- **Example: NULL record with no encoding with 300bytes downstream**

Why tunnelling can't be done over A record

- **Question of all time!**
- **A request with CNAME answer is possible**
- **A request with A answer is not**
- **A / AAAA records can have 4/16 bytes long payload**
- **Simple TCP ACK packet is 66 bytes**
 - This means 17 DNS packets / ACK
 - 338 packets for a full size TCP packet (with MTU set 1350)

Offense

- **Bypass basic obstacles**
 - Specific ports are unfiltered (TCP / UDP)
 - DNS allowed
 - ICMP allowed
- **Bypass not that basic obstacles**
 - Specific protocol allowed (IPS or any other active device in place)
 - Special authentication required
- **Exfiltrate information from internal networks**
- **Get unfiltered internet access**

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Defense for companies

Check your network settings

- Check functionality
- Try to exfiltrate data – check whether your active network device can catch it

Captive portals

- Drop all packets that are addressed to external until not authenticated
- All DNS query should have the same response (the portal)

Defense for companies

No solution is 100% secure

- **Do not route your network to the internet**
 - Disable all traffic between the internet and internal network
- **Use HTTP Proxy and enforce it**
 - Whitelist ports (80 and 443, would you need anything else?)
 - Blacklist websites (does not really help on XFLTRaT)
- **DNS**
 - Filter external DNS queries if possible (let HTTP proxy do the resolving)

Defense for companies

No solution is 100% secure

- **Do you have an inventory? (IP, owner, purpose, location)**
- **Do baselining (Use Netflow or Bro)**
 - Check relation between IPs
 - What are the top talker source IPs (bytes, packets, flows)?
 - What are the top destination IPs (bytes, packets, flows)?
- **Any unusual activity should generate an alert/be blocked when you are done**

Already released

<http://xfltreat.info>

<https://github.com/earthquake/XFLTReaT>

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TODO

- **Commenting**
- **Bug fixes**
- **Authentication + encryption modules**
- **Multi OS support**
- **New modules**
- **You can help if you would like! (use next-version branch)**

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Q&A - Thank you for your attention

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