

# SbuSocks: Break the Great Firewall

## CSE534 Project

May10, 2018

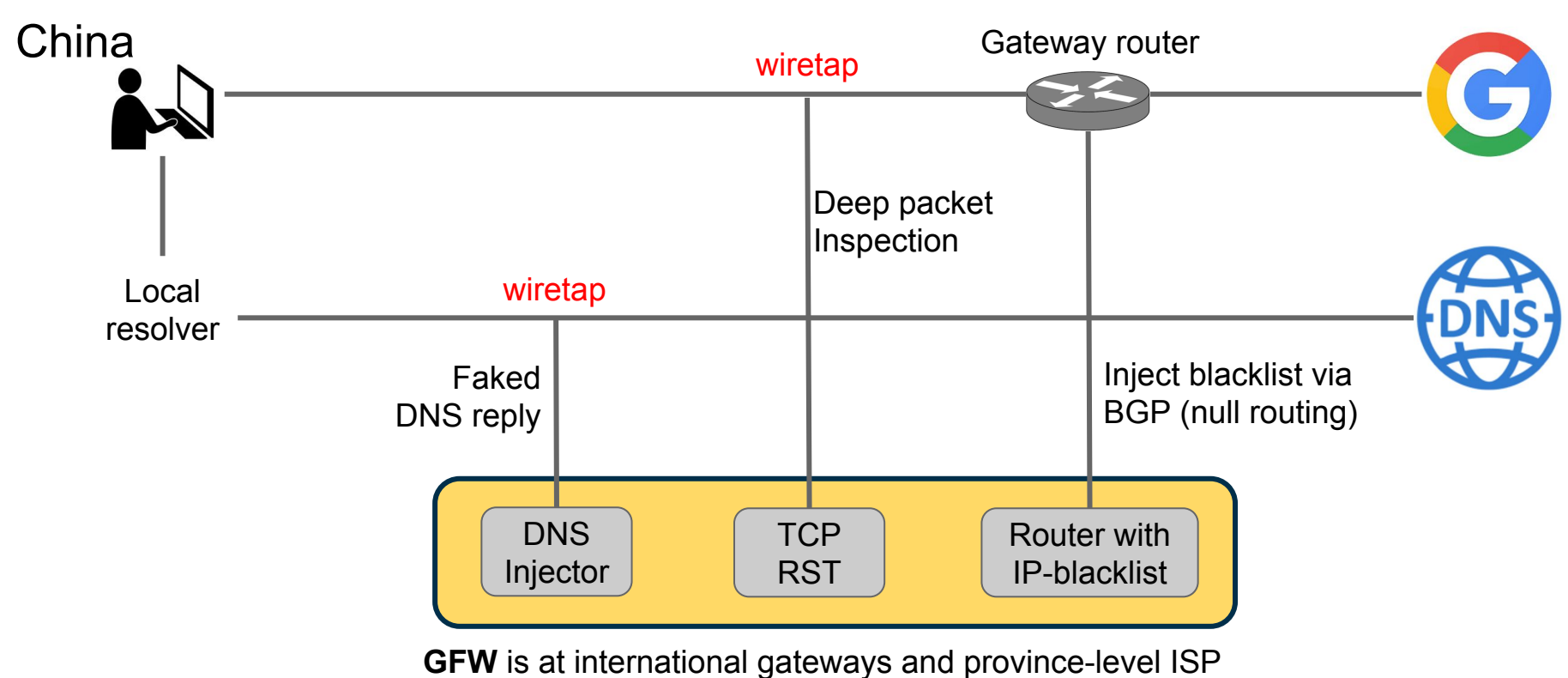


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# GFW: world's largest firewall

## So... How does it work?



# Take-away Message

- The basic methodology for breaking the GFW is to find some **proxy** nodes and **encrypt** the traffic.
- We implemented a tool namely ***SbuSocks***, which successfully breaks GFW following the methodology.

# Socks5 (RFC 1928)

Network Working Group  
Request for Comments: 1928  
Category: Standards Track

M. Leech  
Bell-Northern Research Ltd  
M. Ganis  
International Business Machines  
Y. Lee  
NEC Systems Laboratory  
R. Kuris  
Unify Corporation  
D. Koblas  
Independent Consultant  
L. Jones  
Hewlett-Packard Company  
March 1996

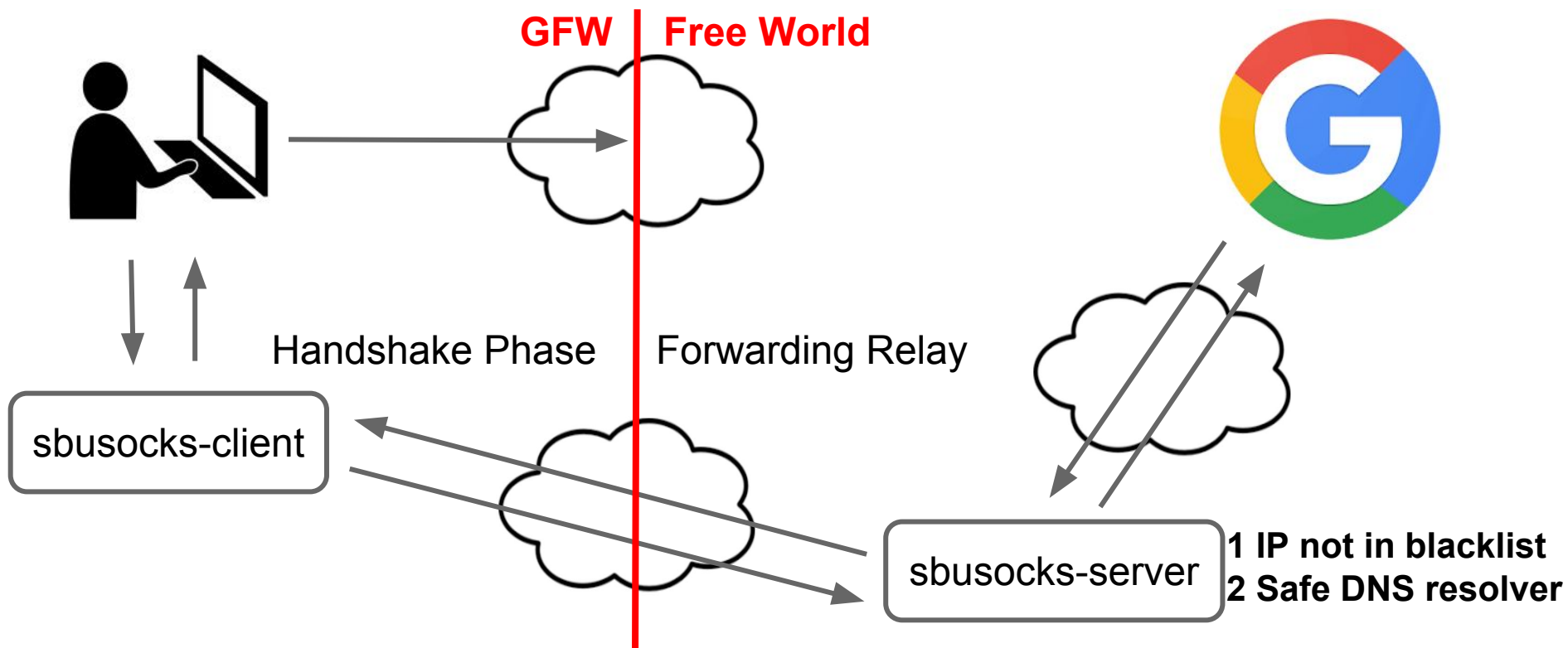
SOCKS Protocol Version 5

Status of this Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

<https://www.ietf.org/rfc/rfc1928.txt>

# Socks 5: Handshake + Forwarding Relay



# Socks5 Protocol

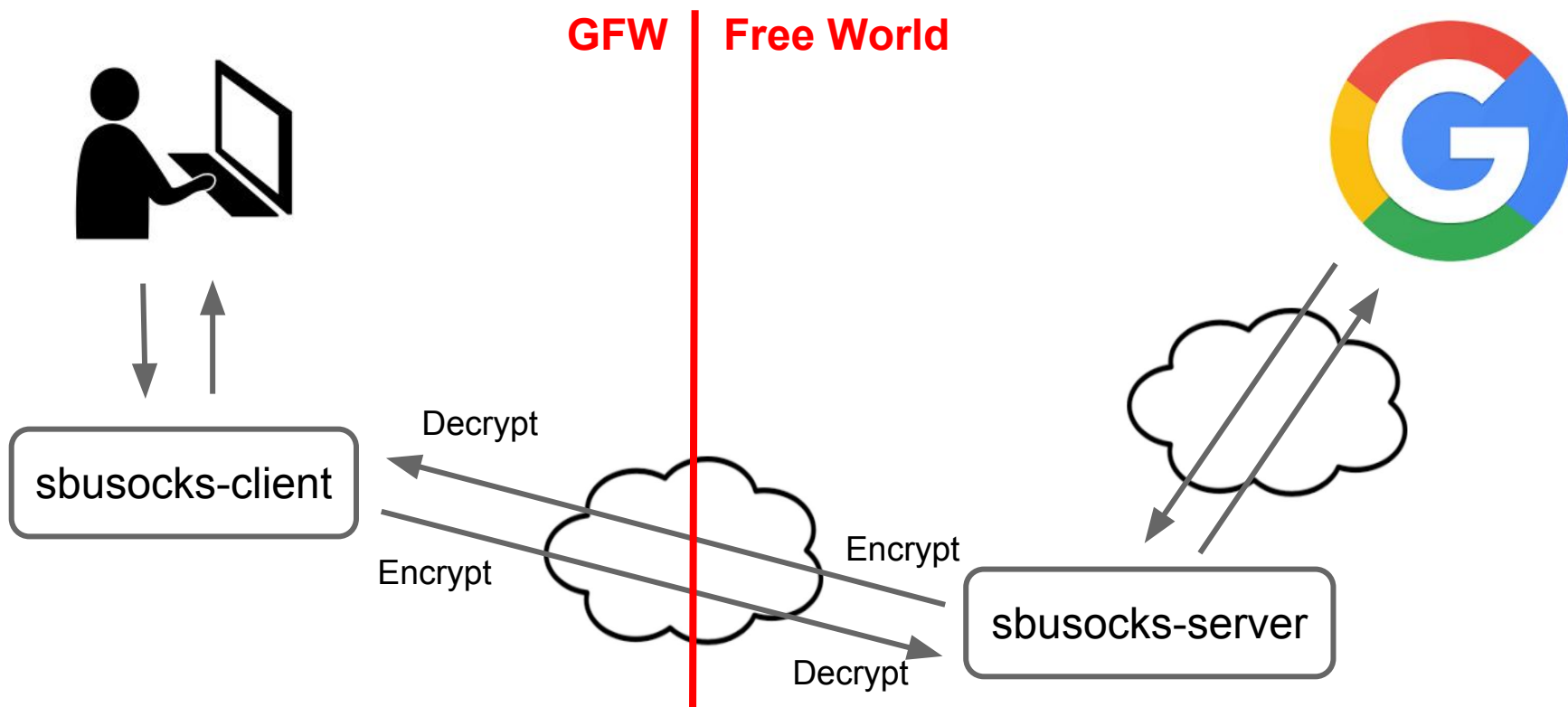
~~IP blacklist~~

~~DNS injection~~

But... How to deal with evil deep packet inspection (DPI) with TCP RST attack?

**Encryption** to the rescue!

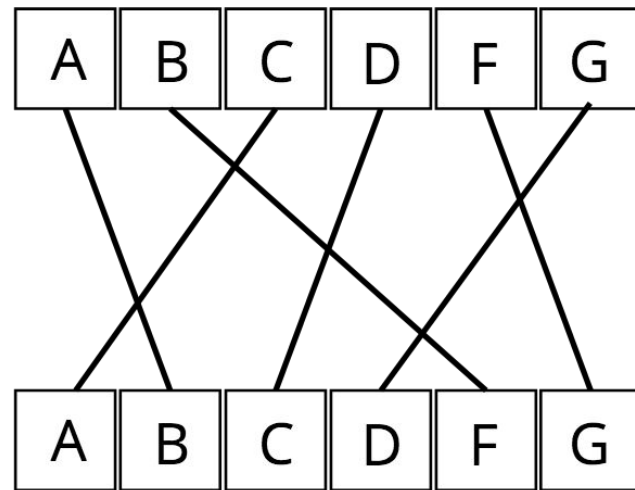
# Encryption: Obfuscate the DPI





# SbuSocks Use: Classic Cryptography

1. Use out-of-band key to set a random state.
2. Use a permutation cipher based on the random state.



b'You cannot see me!' --> b'\xb0\xeaB\xde,cff\xea\xc7\xde\x8e\xf4\xf4\xde\x95\xf4x'

# Introduce SbuSocks

SbuSocks = Socks 5 + Encryption

<https://github.com/caitaozhan/CSE534-Project>

# Experiment: 8 People in 5 Cities across China



SbuSocks	Hypothesis	Test
Socks5+Encryption	Break GFW	Break GFW
Socks5	Blocked	Break GFW

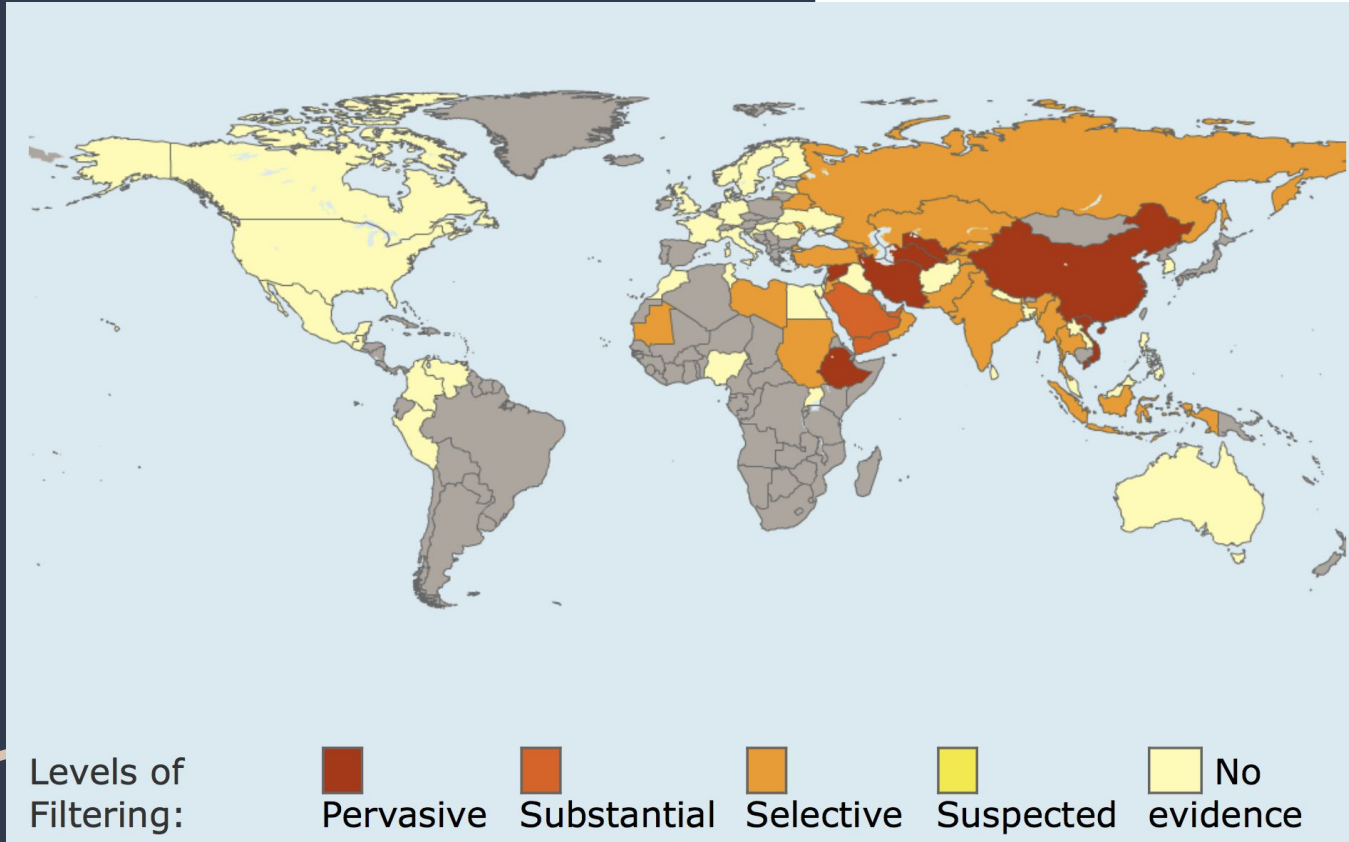
# More Take-away Messages

- GFW will **let** *very small scale suspicious traffic* **go**, due to economic reasons.

*Thank  
you*



# Motivation



China

Ethiopia

Iran

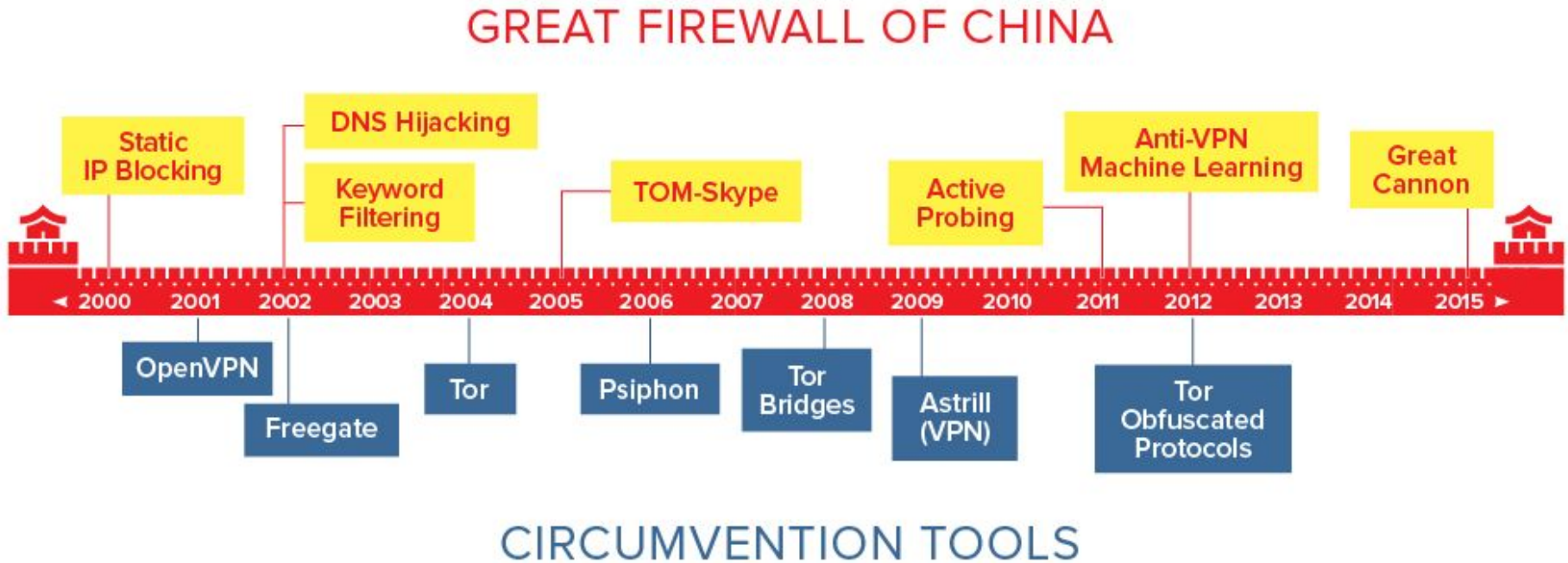
Syria

Turkmenistan

Uzbekistan

Vietnam

# Related Work: the arms race



# Socks5 Protocol Handshake Details

VER	NMETHODS	METHODS
1	1	1 to 255

1. Application → Client

VER	METHOD
1	1

2. Client → Application

VER	CMD	RSV	ATYP	DST.ADDR	DST.PORT
1	1	X'00'	1	Variable	2

3. Client → Server

VER	REP	RSV	ATYP	BND.ADDR	BND.PORT
1	1	X'00'	1	Variable	2

4. Server → Client



# Why Socks5

- Elusive.
- Easy to deploy.
- A lot of applications support socks5 protocol. We only need to implement the responding part.

# More on Traffic Encryption Obfuscation

- *Encryption is a method, the goal is obfuscation!*
- **Randomization:** randomize every byte in the packet payload.
- **Mimicry:** masquerade as a whitelisted protocol.
- **Tunneling:** Use a special protocol, such as VPN.

# GFW's New Weapons

1. Active Probing
2. Machine learning
3. DDos attack

The arms race goes on and on...

# TCP Relay

## Server

Forward streams from the client to the target destination

Forward responses from the target destinations to the client.

## Client

Forward streams from the local applications to the server.

Forward streams from the server to local applications

# Future Work: Detecting TCP RST Attack

- One major way GFW perform blocking is using TCP RST Attack.
- TCP RST Attack is triggered by keywords. Once GFW detect that the packet contain such keyword, it will send TCP RST to both end of the TCP connection.
- One way to solve this problem is to send an ACK to server/client after receive RST. If RST is send by client/server, then connection ends; if not, RST will be dropped.
- Current detecting system need both server and client implementation.