Definitely Not Secure (DNS)

NKU NORTHERN KENTUCKY UNIVERSITY

18th Annual
cybersecurity
symposium

DNS

http://slides.dfirmatt.com

Matt Scheurer

About Me

I work for a big well-known organization...

As Vice President (VP) of Computer Security and Incident Response (IR). However, I have many years of hands-on technical experience, including Digital Forensics & Incident Response (DFIR).

I am also a Podcast Host for

ThreatReel

https://threatreel.com

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Where I volunteer...

I am an Official

Advocate
https://www.hackingisnotacrime.org

Advisory Board: Information Technology and Cybersecurity
https://www.mywccc.org/

Women's Security Alliance (WomSA) Technical Mentor
https://www.womsa.org

Disclaimer!

Yes, I have a day job. However…

Opinions expressed are based solely on my own independent security research and do not express or reflect the views or opinions of my employer.

Agenda

- **DNS** Essentials (Primer)
- **DNS** Tools (w/ Demos)
- **DNS** Attacks (w/ Demos)

Definition

D

N

S

Definition

Domain

Name

System

Definition

Domain

Name

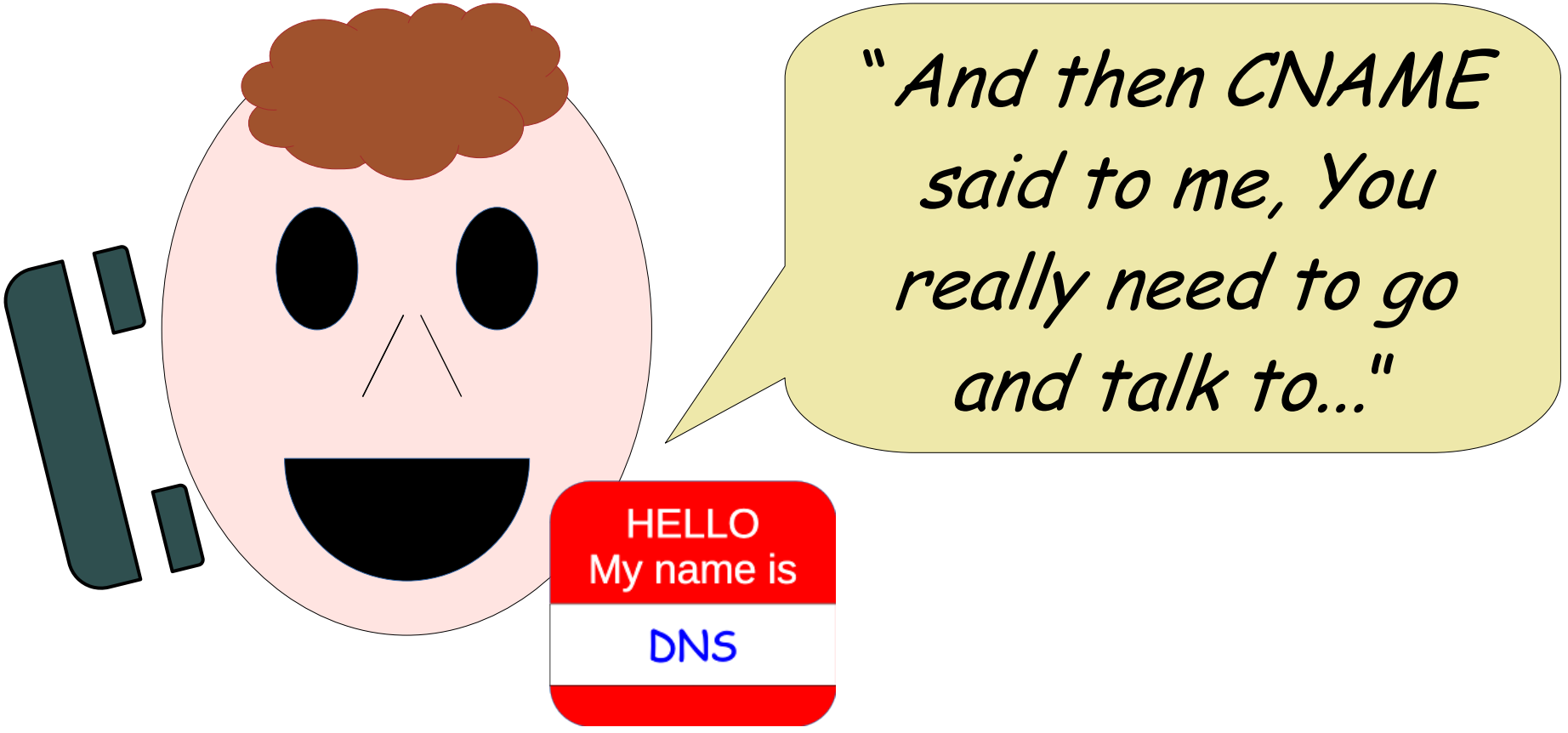
System

NOTE: The ‘**S**’ does not stand for “Security”!

Purpose

The “**Domain Name System**” (DNS) is a vanity protocol making internet and network addressing human-friendly.

DNS gossips a lot!



DNS in the OSI Model

Layer 7)	Application	DNS
Layer 6)	Presentation	
Layer 5)	Session	Port 53
Layer 4)	Transport	**UDP**, TCP
Layer 3)	Network	IP
Layer 2)	Data Link	
Layer 1)	Physical	

Networking

Mostly UDP Port 53

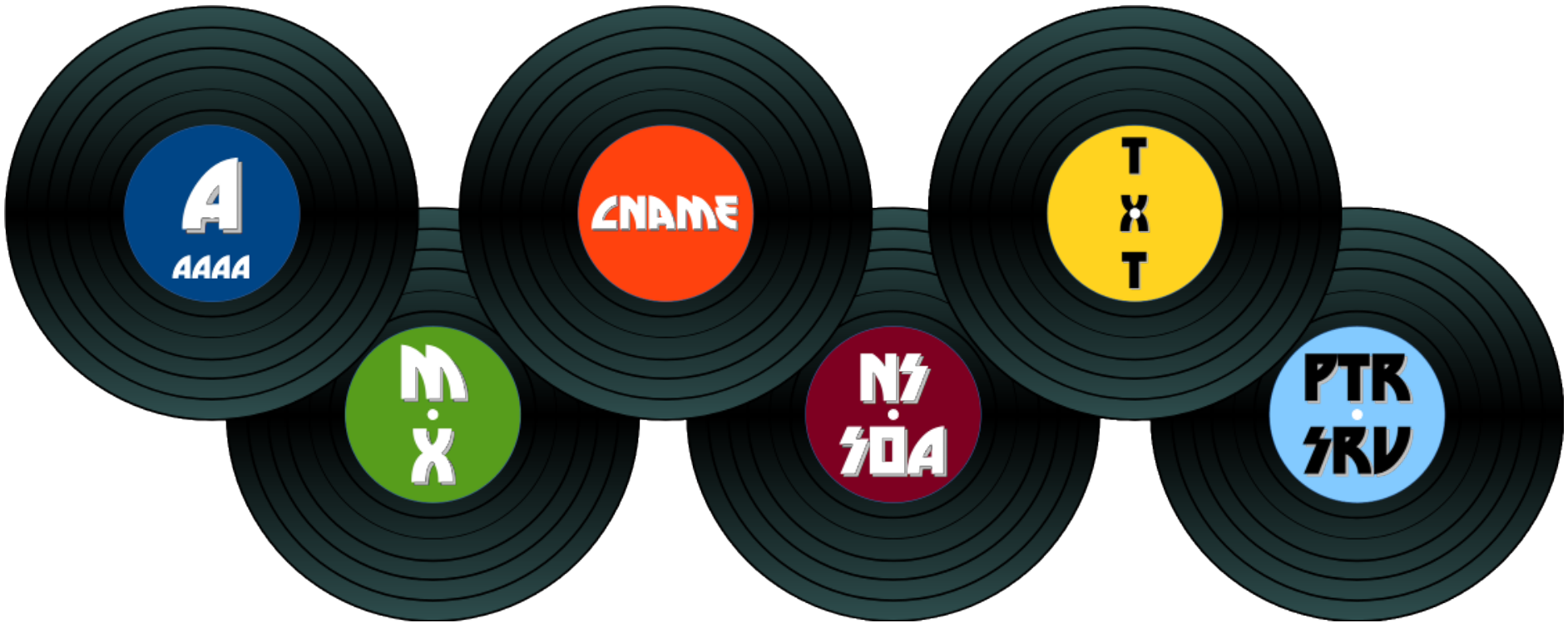
TCP Port 53

- > 512/4096 UDP byte limits
- DNSSEC
- Zone Transfers
  - Heavily restricted today

Other TCP Port 53

- DNS over TLS (DoT)
  - TCP Port 853
- DNS over HTTPS (DoH)
  - TCP Port 443

Foundational DNS Records



More about “TXT”

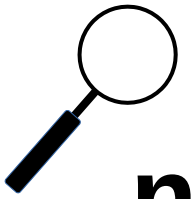
RFC 1035

- 2.3.4 Size limits
  - 255 Characters

“Time to Live” (TTL) Values

Number of seconds DNS resolvers should cache records before refreshing

DNS Tools

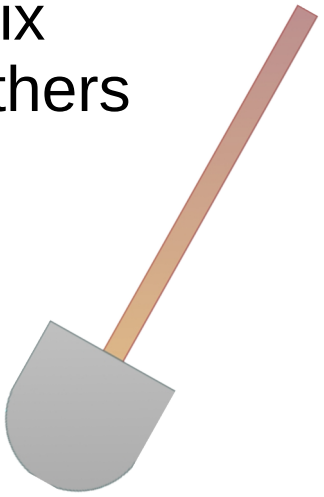


`nslookup`

- Windows
- *nix
- Mainframe
- Others

`dig`

- *nix
- Others



DNS tools demos

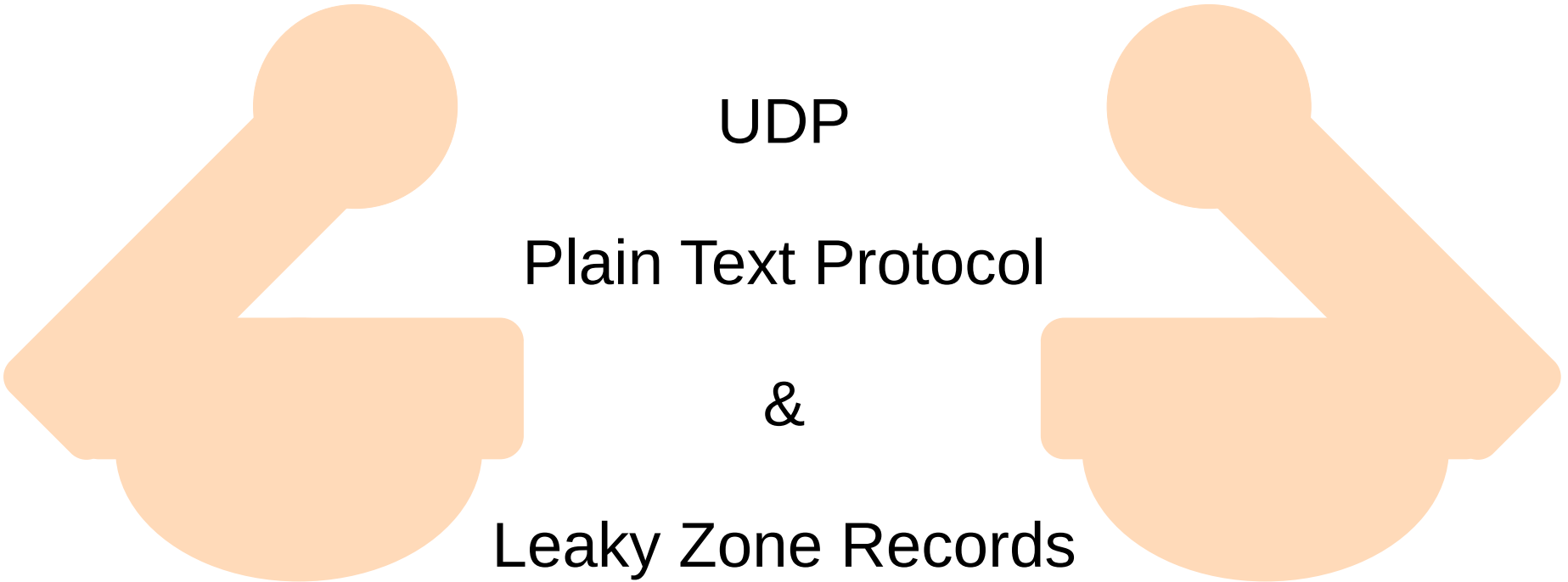
Live Demo

(We'll come back to this, time permitting)

Early DNS Security Woes

- **RFC 1535**
  - A Security Problem and Proposed Correction With Widely Deployed DNS Software
    - https://www.rfc-editor.org/info/rfc1535
    - October, 1993

DNS Weaknesses



UDP

Plain Text Protocol

&

Leaky Zone Records

DNS packet capture

Live Demo

(We'll come back to this, time permitting)

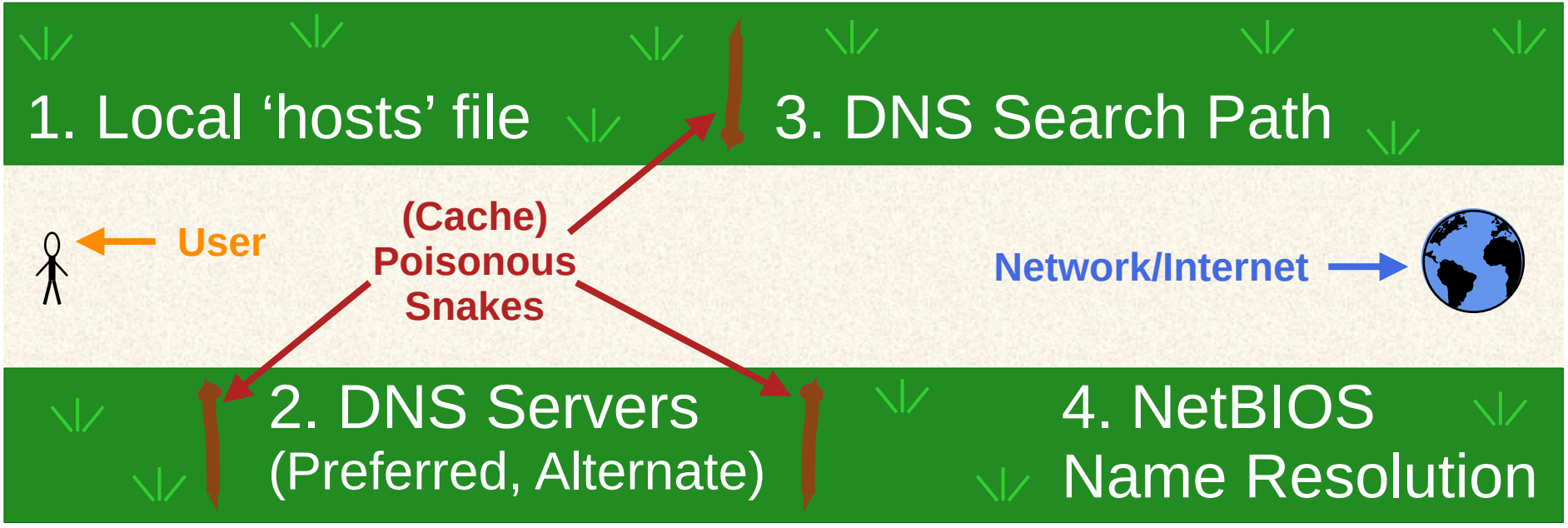
Leaky DNS Zones

Live Demo

(We'll come back to this, time permitting)

DNS Hijacking

Abuse along the DNS Default Search Order trail



DNSSEC to the rescue?

DNSSEC provides a cryptographic “Chain of Trust” to prevent DNS spoofing and DNS Cache Poisoning

DNSSEC shortcomings

- Lack of adoption
- Configuration woes
- ‘hosts’ file bypass
- AitM / MitM
- Typosquatting

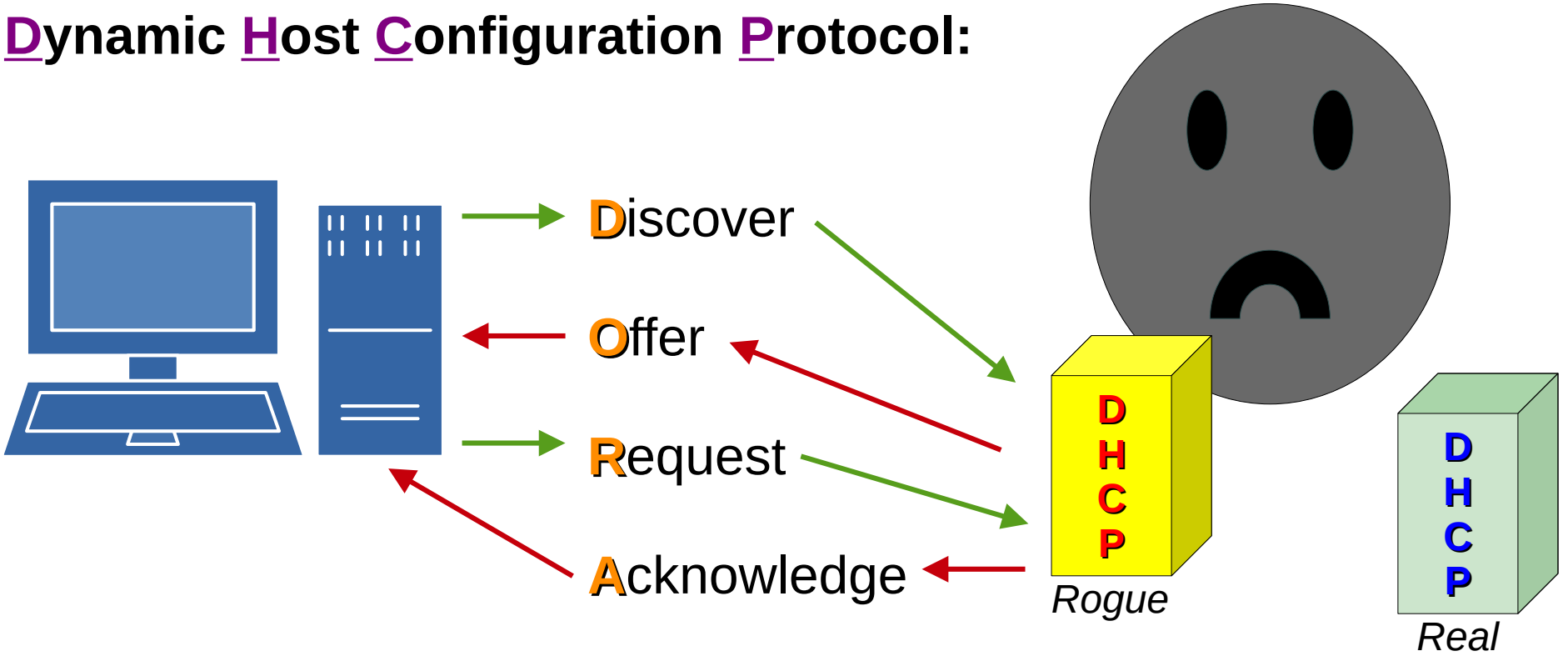
Injecting the “hosts” file

Live Demo

(We’ll come back to this, time permitting)

Rogue DHCP

Dynamic Host Configuration Protocol:



DHCP Network Settings

IP Address
Subnet Mask
Default Gateway
DNS Servers
Other (WINS for NetBIOS, etc.)

NOTES: NetBIOS = Network Basic Input/Output System, WINS = Windows Internet Name Service

DNS Tunneling

C2 & Data Exfiltration

Live Demo

(We'll come back to this, time permitting)

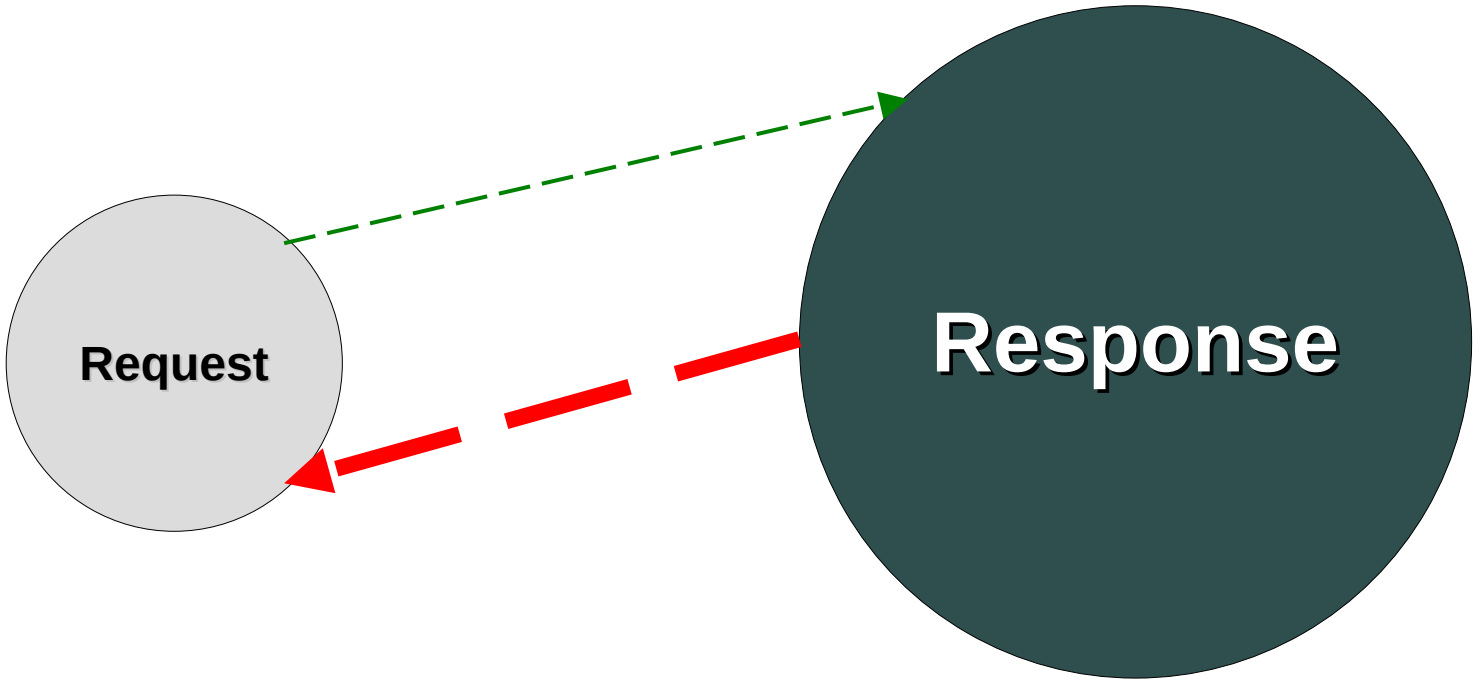
Other DNS Spoofing

ARP Poisoning

DNS Server Record Changes

Domain Registration Takeover

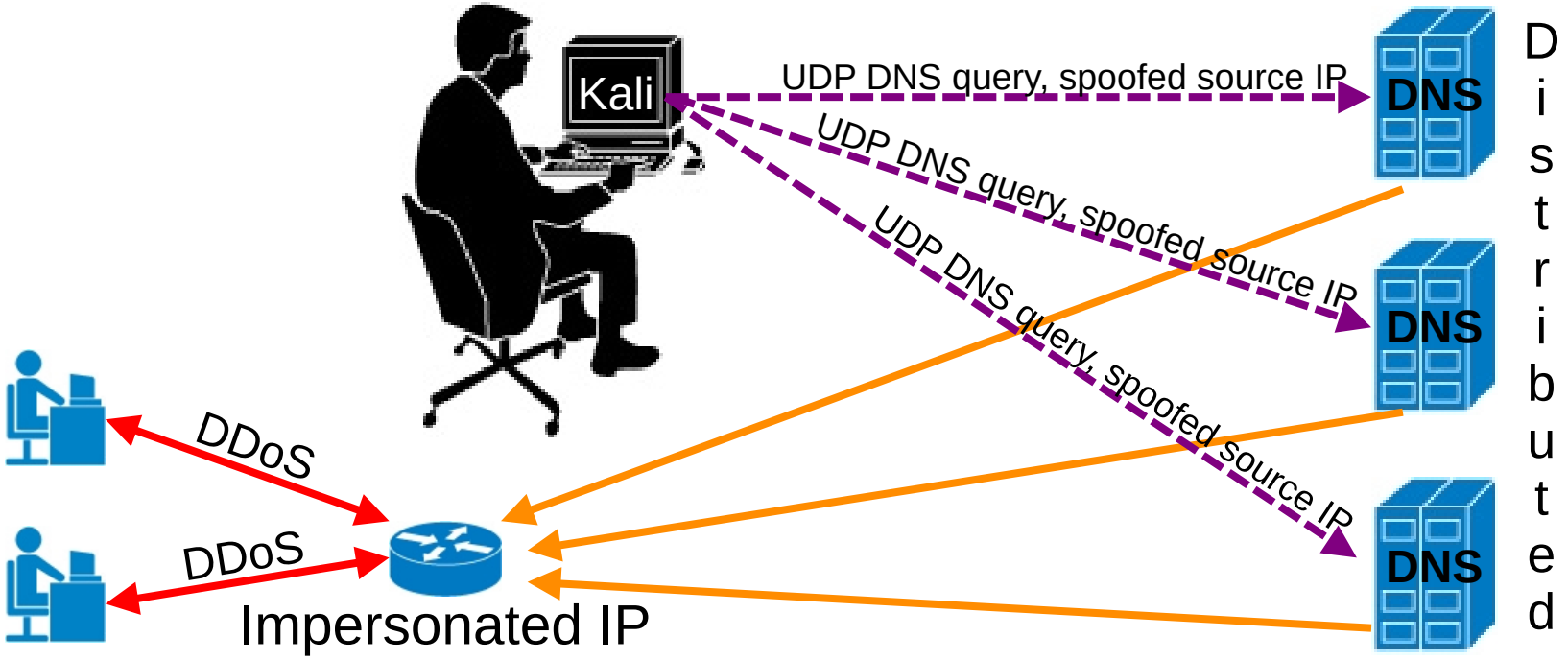
DNS Amplification Attacks



Too many large responses: Denial of Service (DoS)

DNS Reflection

How Reflection Attacks Work



Questions

Who?

What?

When?

Where?

Why?

How?

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