Botnets

CS-576 Systems Security

Instructor: Georgios Portokalidis

Spring 2018

Botnets

Organize infected hosts (bots) into a network for controlling them

Uses:

- Distributed denial-of-service (DDoS) attacks
- Spamming
- Sniffing traffic
- Keylogging
- Spreading new malware
- Manipulating online polls/games

Command and Control

Control through an IRC server

- Bots join a specific channel on this server and treat incoming messages as commands

Over HTTP

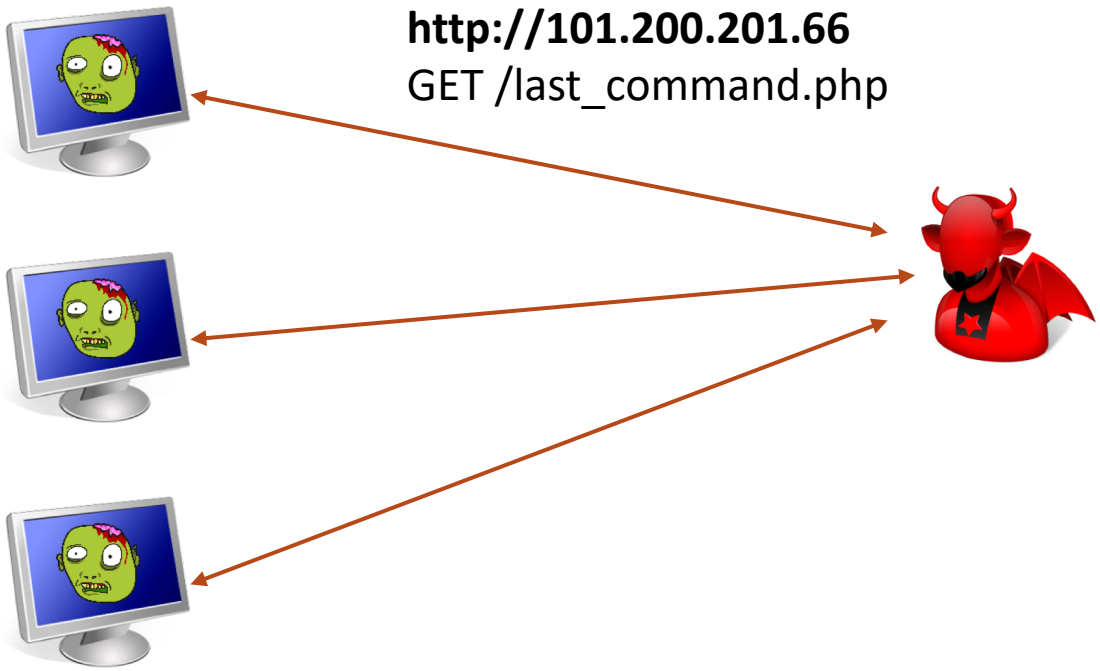
- HTTP cannot be easily filtered by a network administration

Over peer-to-peer protocols

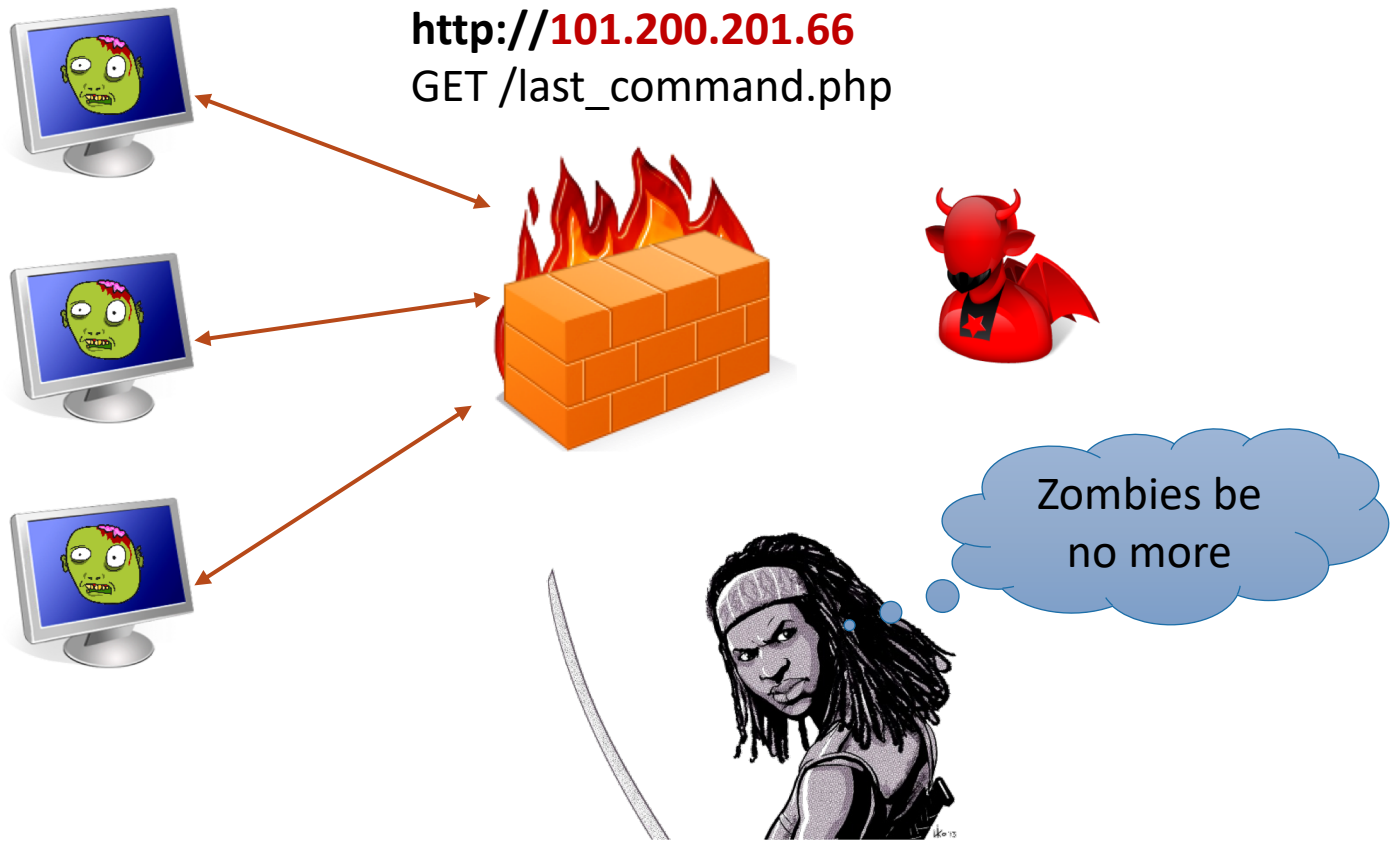
- Prevents a single-point of failure for the botnet

The latest and greatest – Domain Generation Algorithms

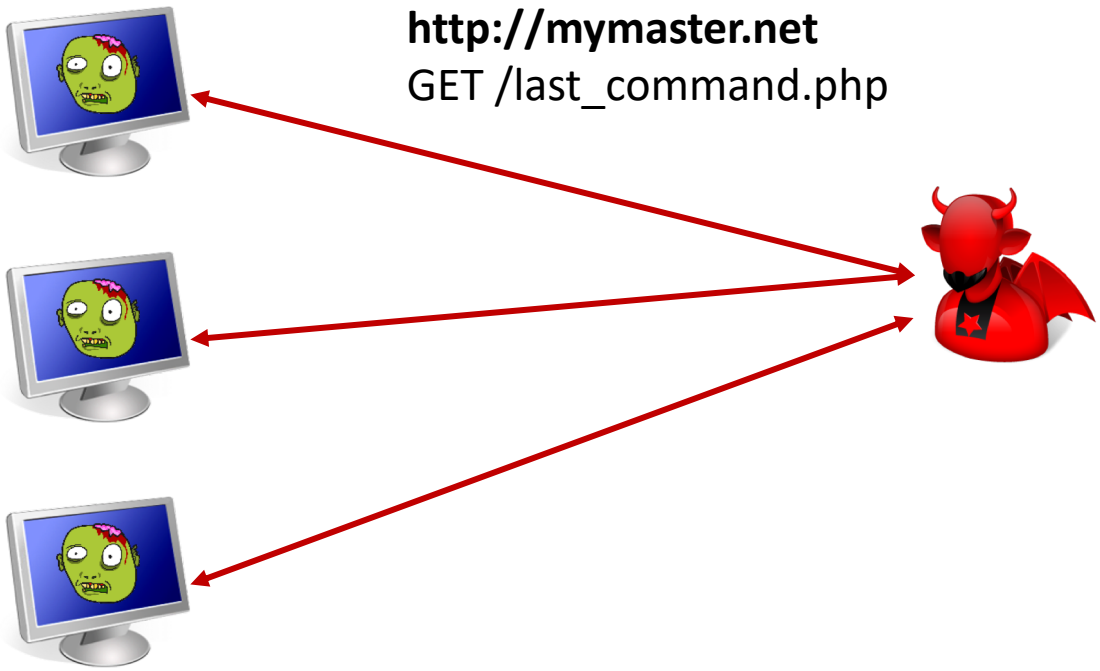
Naïve Command and Control



Naïve Command and Control

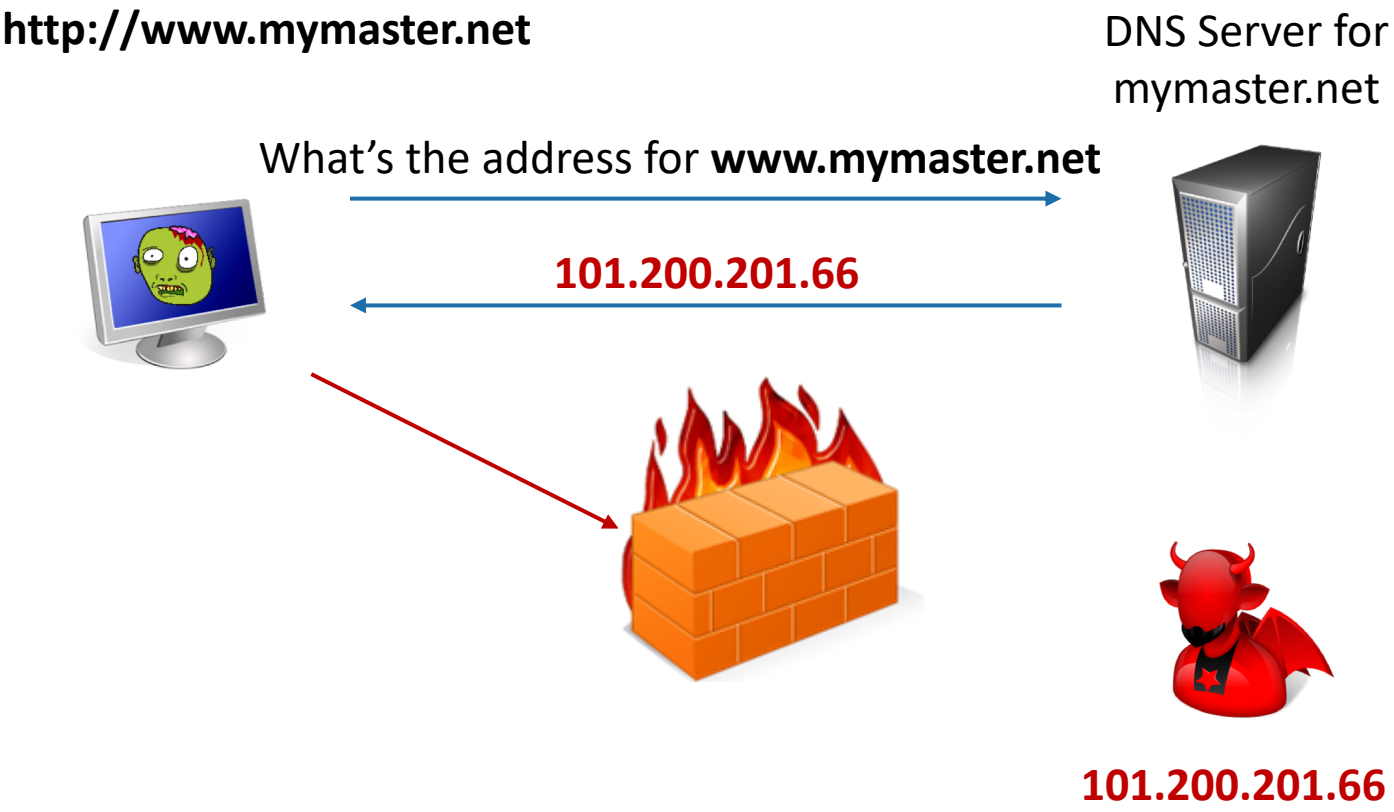


Slightly Less Naïve C&C

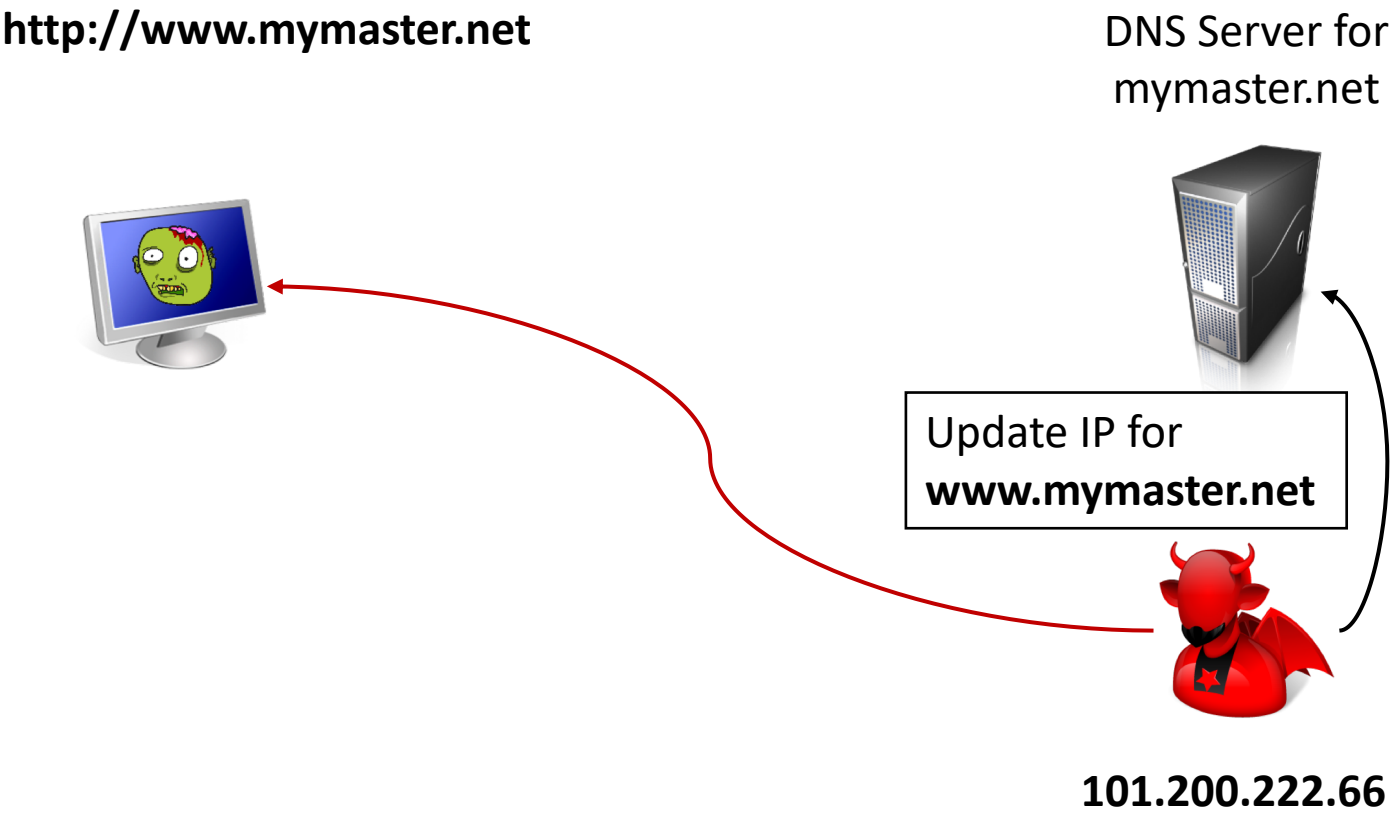


Slightly Less Naïve C&C

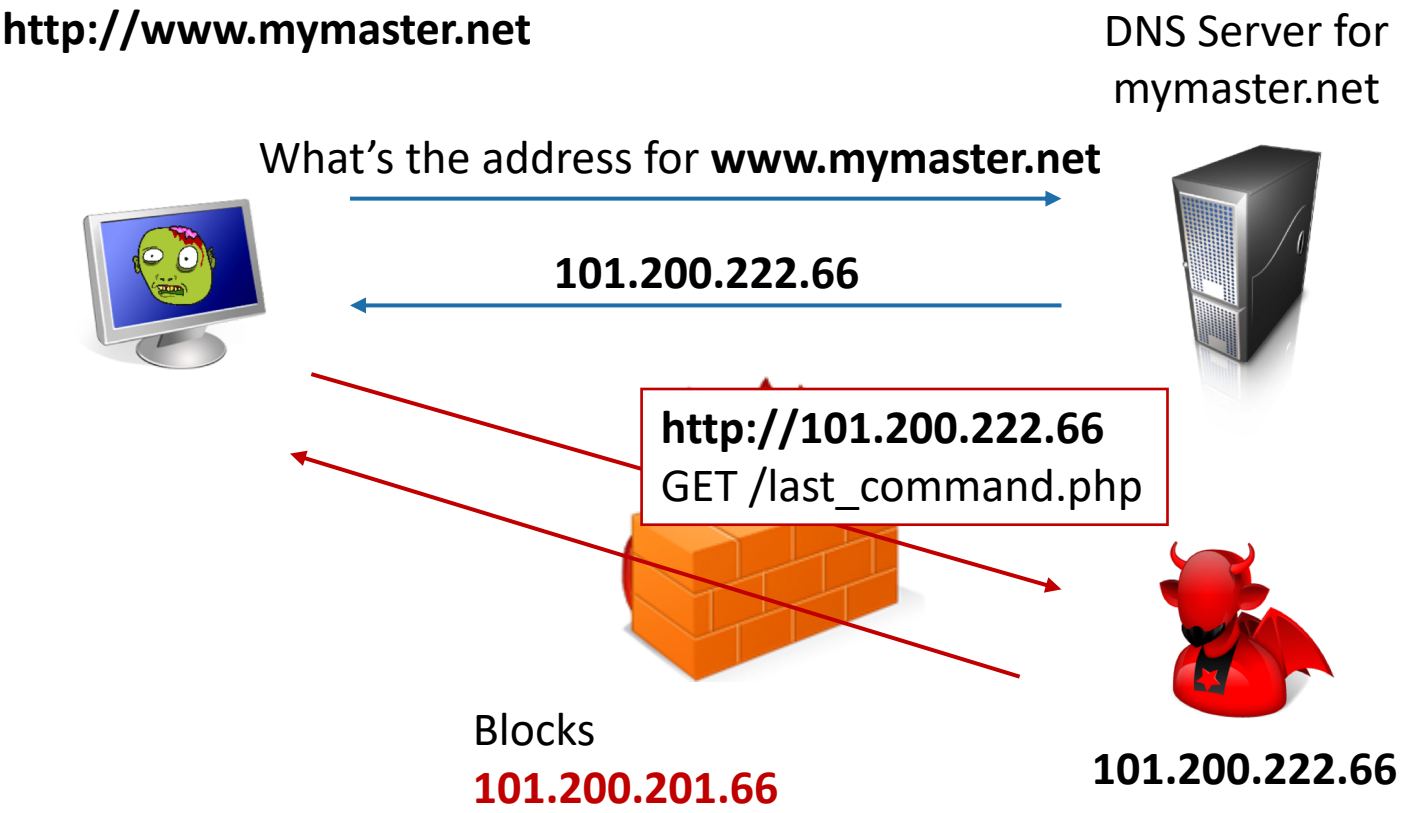
Slightly Less Naïve C&C



Slightly Less Naïve C&C



Slightly Less Naïve C&C



Blocking DNS Lookups

http://www.mymaster.net

What's the address fo
www.mymaster.net

DNS Server for mymaster.net

How can you block certain DNS requests?

101.200.222.66

Blocking DNS Lookups

Block access to untrusted DNS servers

- E.g., Through port number and IP

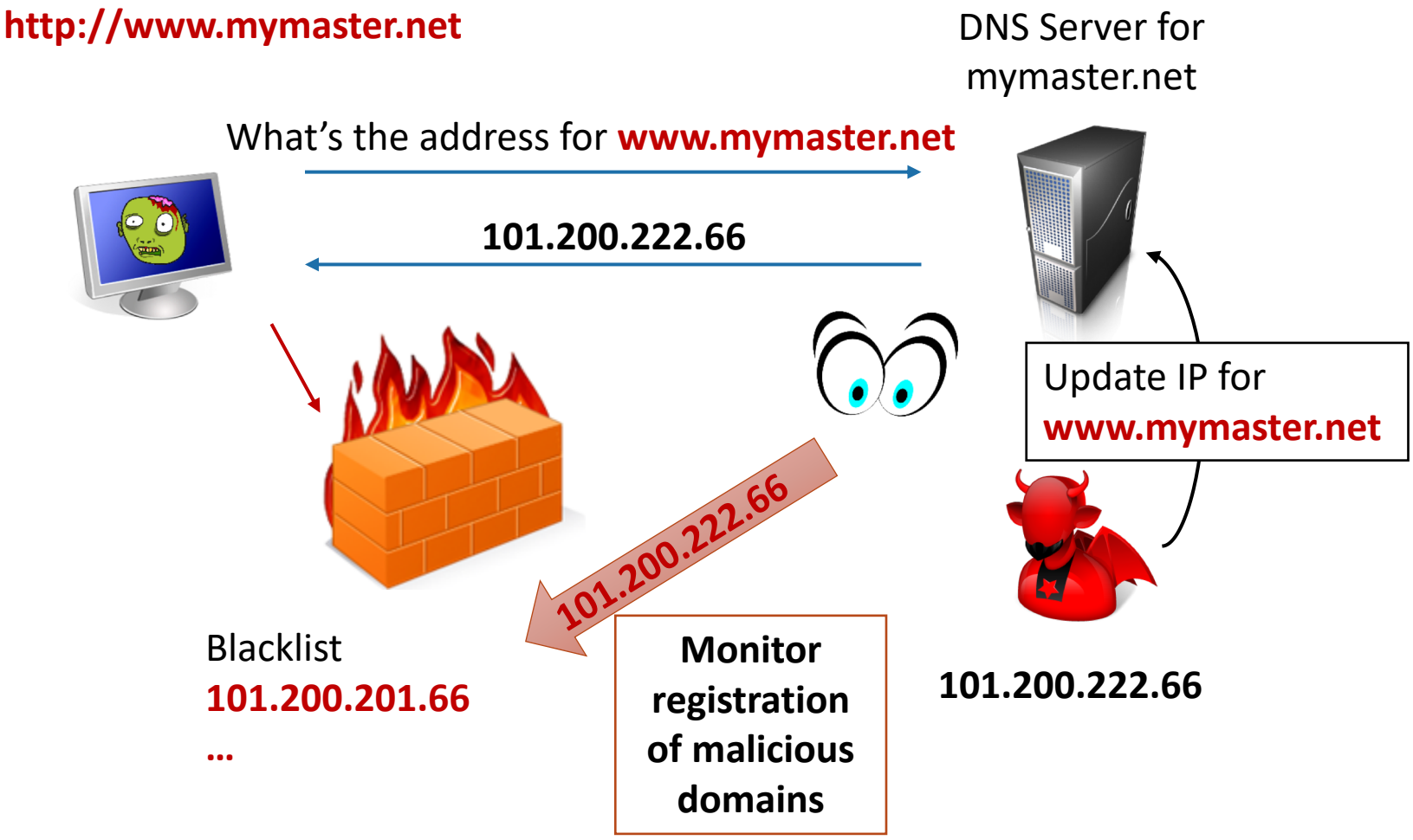
Filter outgoing DNS query packets

Filter incoming DNS response packets

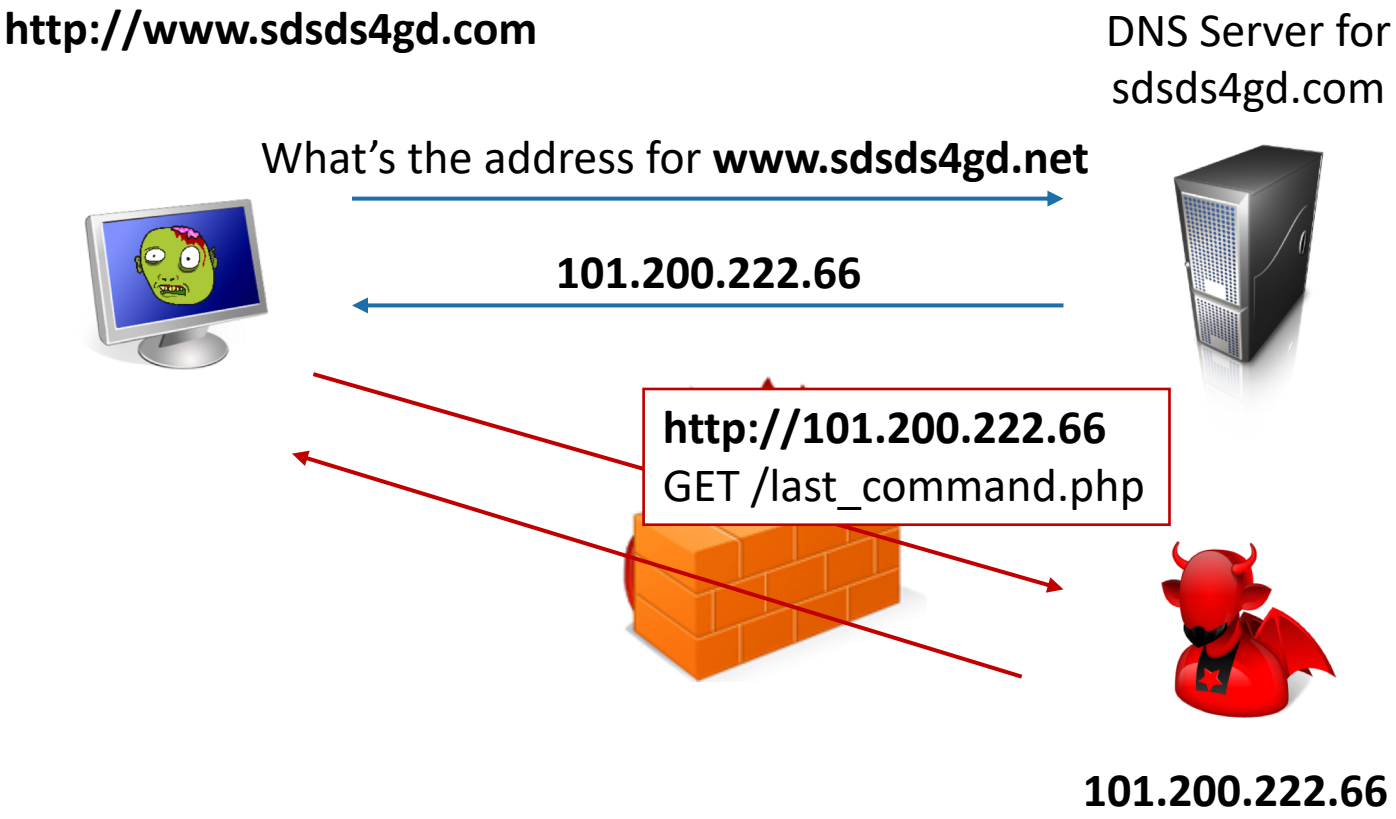
All of the above is probably required, because

- Custom DNS server can be run on arbitrary port
- Custom DNS server over HTTPS
- Could-based DNS available

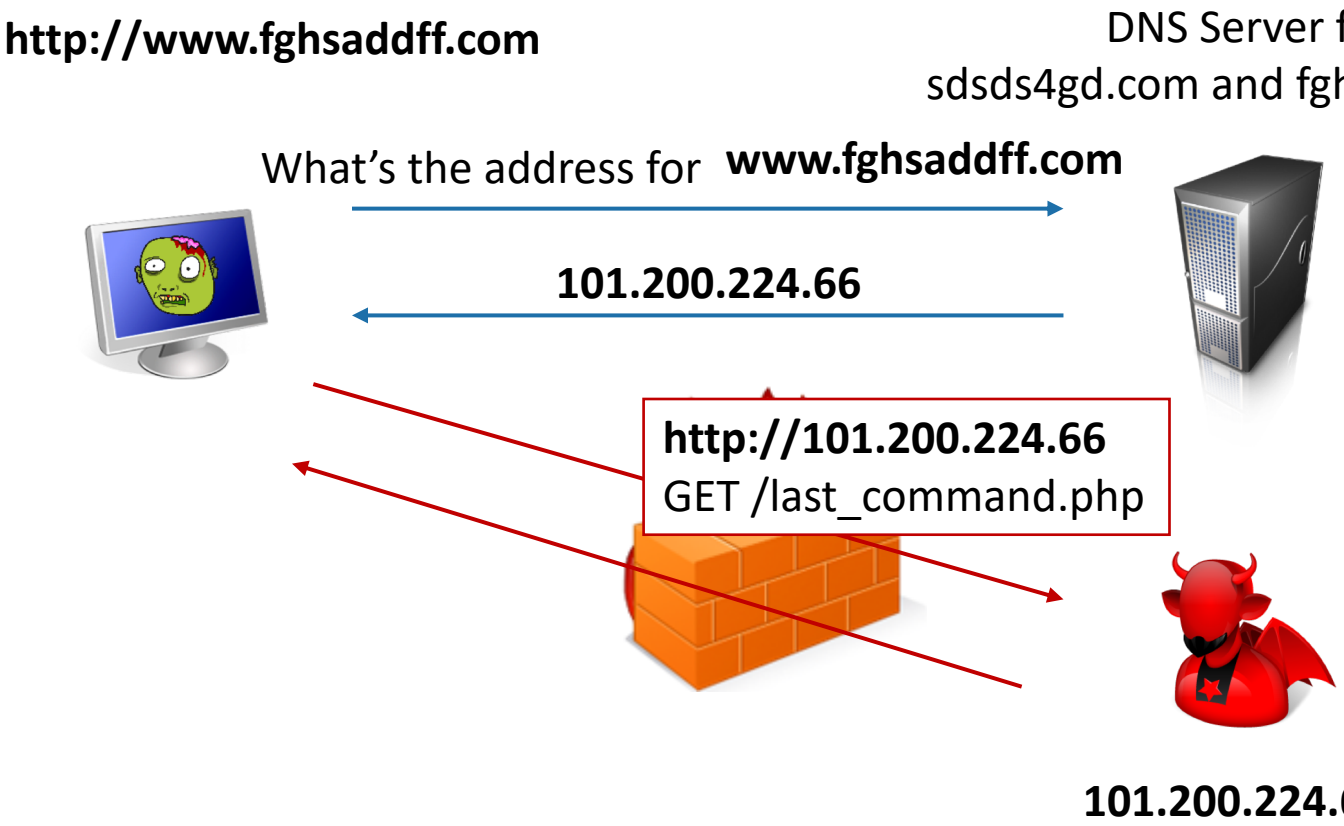
Blacklisting C&C



Less Naïve C&C



Less Naïve C&C



Domain Generation Algorithms (DGAs)

Bots use DGAs to automatically generate domain names

- E.g., using a pseudorandom number generator

The master registers the domain names before they are used

###.133. ###.247 – idpd1y###-elywj.com
###.133. ###.247 – k7-cwubgsrqj###rb.com
###.133. ###.247 – omz###1k1vgrqf.com
###.133. ###.247 – taqwucpzj###an.com
###.133. ###.247 – vhrey###-ooz6ig.com
###.133. ###.75 – o###pp1k1vgrqf.com
###.133. ###.75 – rm6dol7###cxje-ajl.com
###.133. ###.191 – id###yzib-e###j.com
###.133. ###.191 – k7-c###gsrqjebzrb.com
###.133. ###.191 – ###gpp1k1vgrqf.com
###.133. ###.191 – rm6dol###wcxje-ajl.com
###.133. ###.191 – taqwucpzj###an.com
###.133. ###.191 – vhreyveh-ooz###.com

DGA-based Solutions

Identify DGA-generated domains

- Reverse engineer algorithms
- Look for high-entropy domain names
- Look for domain names with no words in any language

Prevent communication with known DGA-generated domain names

Be proactive → register domains before the botnet master