Simulação de ataque DDoS através da ferramenta CORE network emulator

Clarel Spies
Luiza Rabuski

Universidade de Santa Cruz do Sul - UNISC

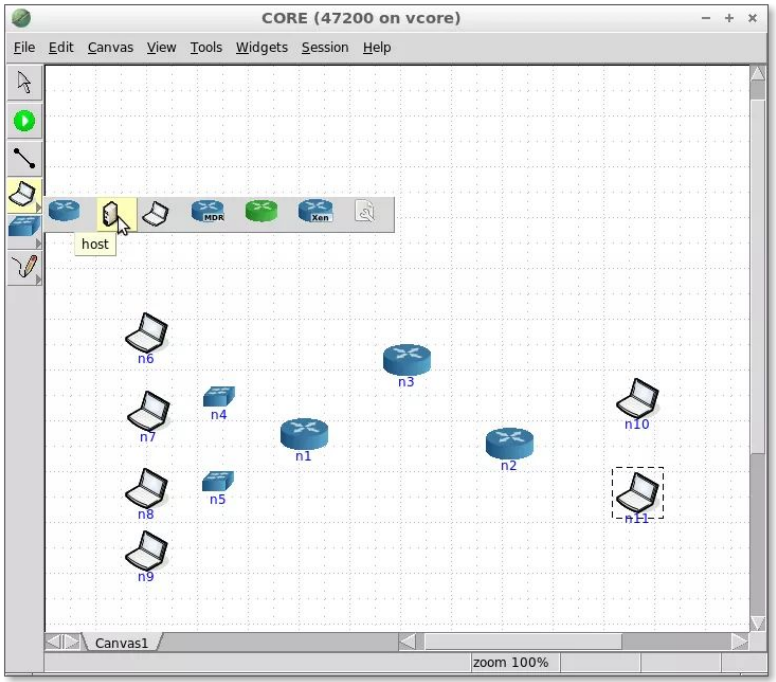
Roteiro

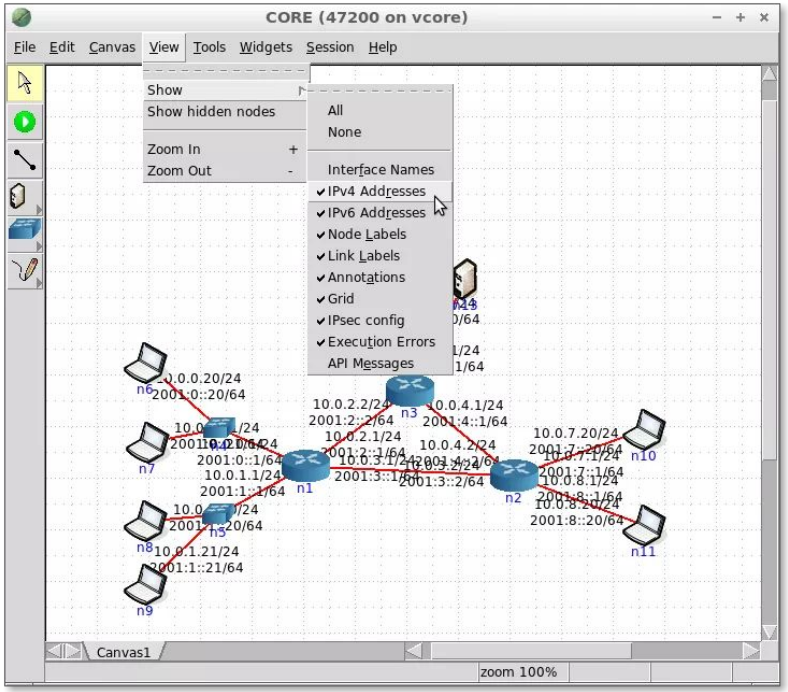
- Introdução ao CORE
- Arquitetura CORE
- DDoS
- Tipos de Ataque
- Simulação de ataque DDoS Ping Flood
- Referências

Common Open Research Emulator (CORE)

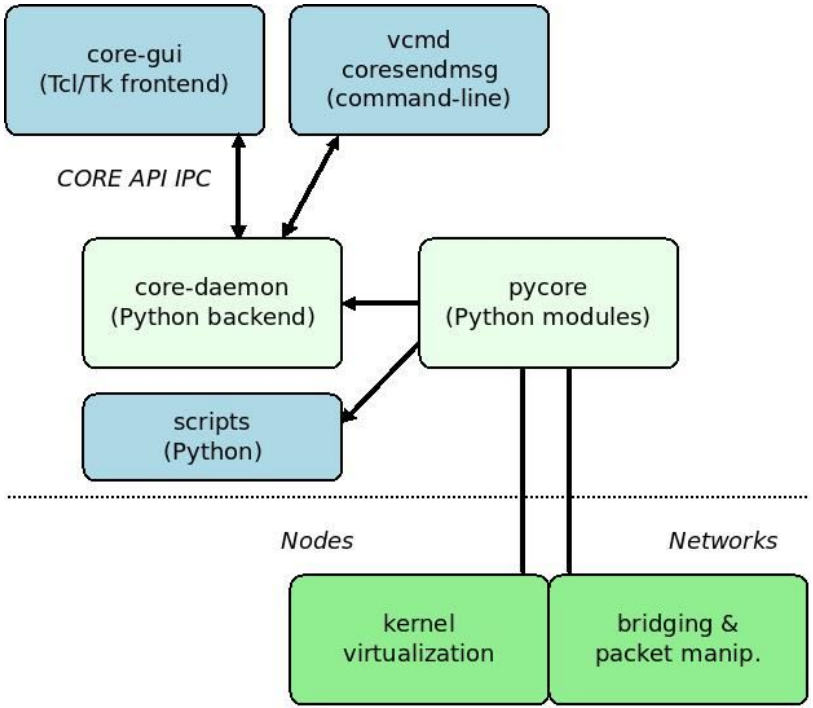
- Permite emular redes de computadores em uma ou várias máquinas.
- Representação real de rede de computadores.
- Interface gráfica GUI.
- Sistema é modular.
- Dois modos de operação da ferramenta: Editar e Executar.

GUI


CORE (47200 on vcore)
File Edit Canvas View Tools Widgets Session Help
host
MDR
Xen
n1
n2
n3
n4
n5
n6
n7
n8
n9
n10
n11
Canvas1
zoom 100%


CORE (47200 on vcore)
File Edit Canvas View Tools Widgets Session Help
Show
Show hidden nodes
Zoom In +
Zoom Out -
All
None
Interface Names
IPv4 Addresses
IPv6 Addresses
Node Labels
Link Labels
Annotations
Grid
IPsec config
Execution Errors
API Messages
10.0.0.20/24
2001:0::20/64
10.0.2.2/24
2001:2::2/64
10.0.2.1/24
2001:2::1/64
10.0.4.1/24
2001:4::1/64
10.0.4.2/24
2001:4::2/64
10.0.7.20/24
2001:7::20/64
10.0.7.1/24
2001:7::1/64
10.0.8.1/24
2001:8::1/64
10.0.8.20/24
2001:8::20/64
10.0.1.21/24
2001:1::21/64
n1
n2
n3
n5
n6
n7
n8
n9
n10
n11
Canvas1
zoom 100%

Arquitetura



Core-daemon (backend) administra sessões de emulação.

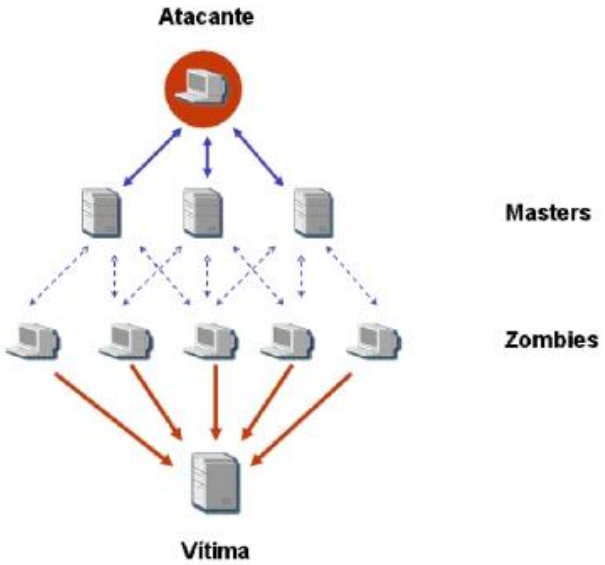
Constrói redes emuladas usando o componente kernel virtualization para nodos virtuais e o componente bridging and packet manipulation para redes virtuais.

O componente core-daemon é controlado atraves da interface gráfica do usuário, o CORE-GUI (frontend).

Utiliza módulos Python.

Distributed Denial of Service (DDoS)

É uma tentativa de fazer com que um serviço online fique indisponível.



Tipos de Ataque

- SYN Flood

  O objetivo é consumir os recursos de rede e processamento da vítima enviando mais mensagens do que o servidor pode suportar.

  Estas mensagens possuem pacotes SYN que requisitam a abertura de uma conexão com o alvo.

  O servidor aceita a conexão e fica ocioso esperando por uma resposta do cliente confirmando que a conexão foi estabelecida.

Tipos de Ataque

- Ping Flood

  O objetivo é inundar a rede do servidor com a intenção de sobrecarregá-la através da função Ping com mensagens do protocolo ICMP.

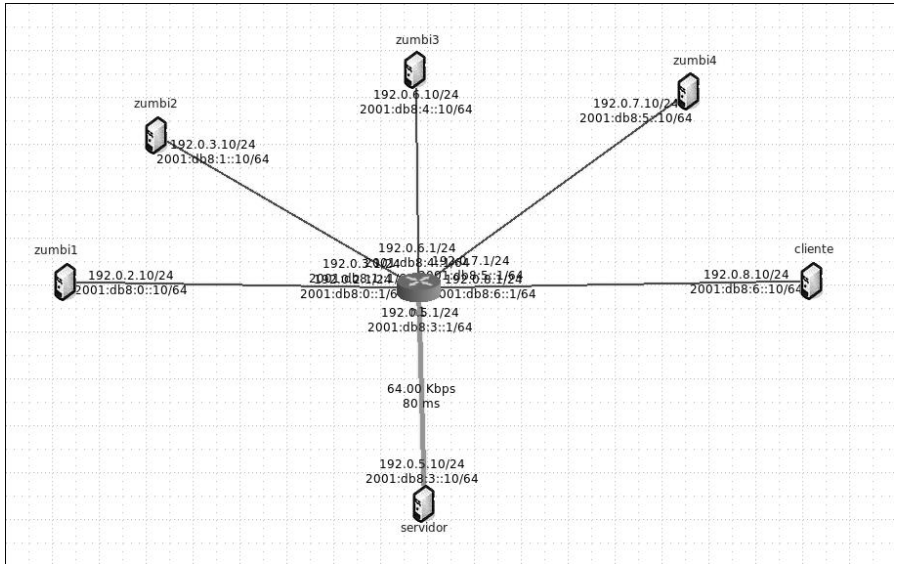
  Através de várias máquinas executando o comando Ping para um mesmo destino, podemos sobrecarregá-lo com mensagens echo request e echo reply.

  Podendo congestionar a rede e fazendo com que o servidor não consiga responder de forma eficiente ou de forma alguma.

- UDP Flood

  Tem como objetivo congestionar a rede do servidor através do envio de diversos pacotes UDP para o servidor.

Cenário para simulação



Formado por quatro máquinas chamadas de zumbis representando os atacantes.

Uma maquina cliente e uma máquina servidor.

Todos ligados a um Router e abstraindo sua rede interna para uma fácil compreensão.

A rede interna do servidor teve a capacidade limitada em 64.000 Kbps para que possamos enchergar o efeito do ataque DDoS em um ambiente reduzido.

Cenário sem ataque DDoS

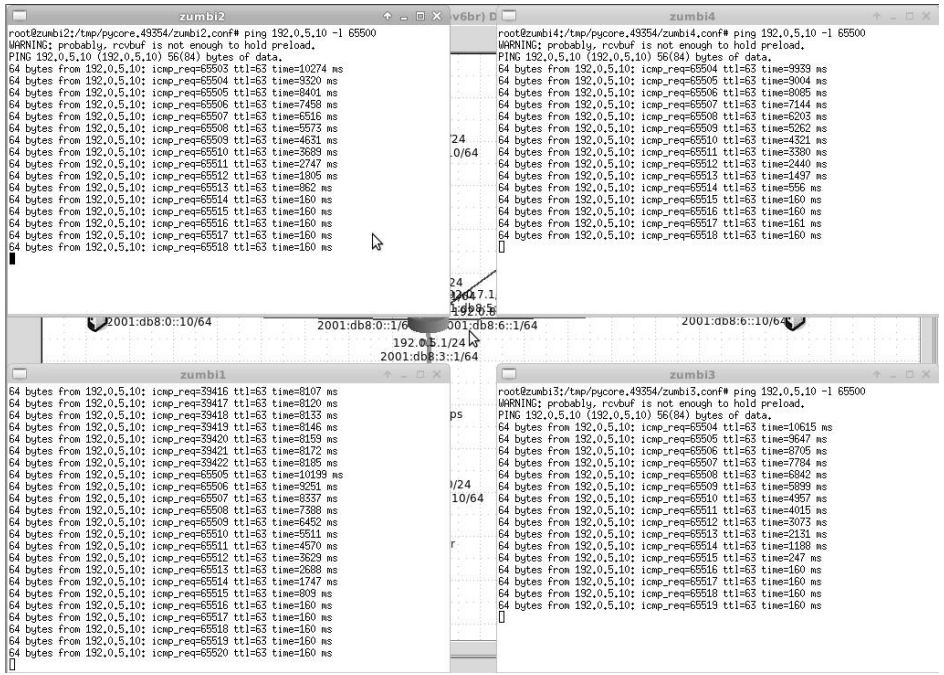
```
root@cliente:/tmp/pycore.51480/cliente.conf# ping 192.0.5.10
PING 192.0.5.10 (192.0.5.10) 56(84) bytes of data.
64 bytes from 192.0.5.10: icmp_req=1 ttl=63 time=320 ms
64 bytes from 192.0.5.10: icmp_req=2 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=3 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=4 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=5 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=6 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=7 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=8 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=9 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=10 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=11 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=12 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=13 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=14 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=15 ttl=63 time=160 ms
64 bytes from 192.0.5.10: icmp_req=16 ttl=63 time=160 ms
^C
--- 192.0.5.10 ping statistics ---
16 packets transmitted, 16 received, 0% packet loss, time 15019ms
rtt min/avg/max/mdev = 160.235/170.298/320.512/38.788 ms
root@cliente:/tmp/pycore.51480/cliente.conf#
```

Resultado do teste Ping para o servidor em ambiente sem ataque.

Não houve nenhuma perda de pacotes durante as tentativas de sucesso.

Houve 16 envios e 16 respostas com um tempo de resposta contínuo em 160ms.

Senário com ataque DDoS

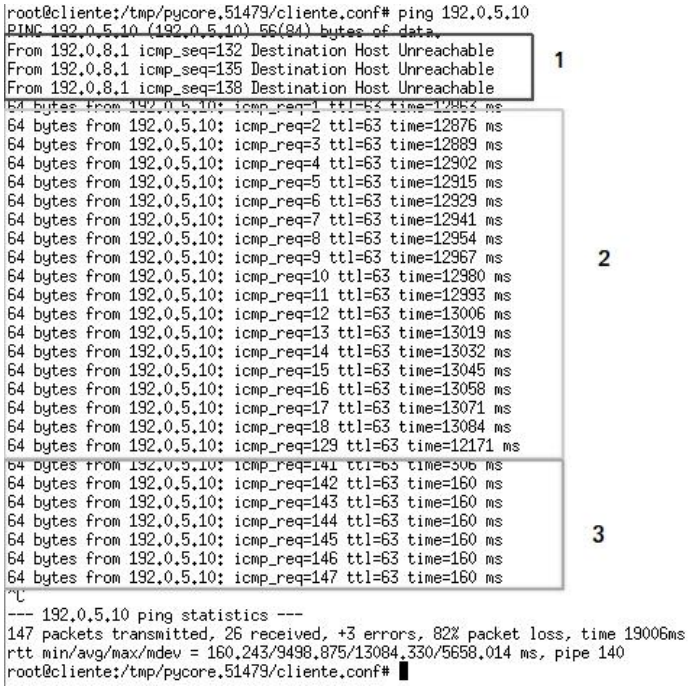


O cliente tentará acessar o servidor em meio a um ataque do tipo Ping Flood realizado por 4 maquinas zumbis.

O comando executado é ‘ping 192.0.5.10 -l 65500’. Onde 192.0.5.10 e o endereço do servidor e o -l 65500 representa o parâmetro preload.

Cada uma das maquinas zumbis estará enviando um comando Ping ao servidor com o parâmetro preload configurado 65500.

Cenário com ataque DDoS

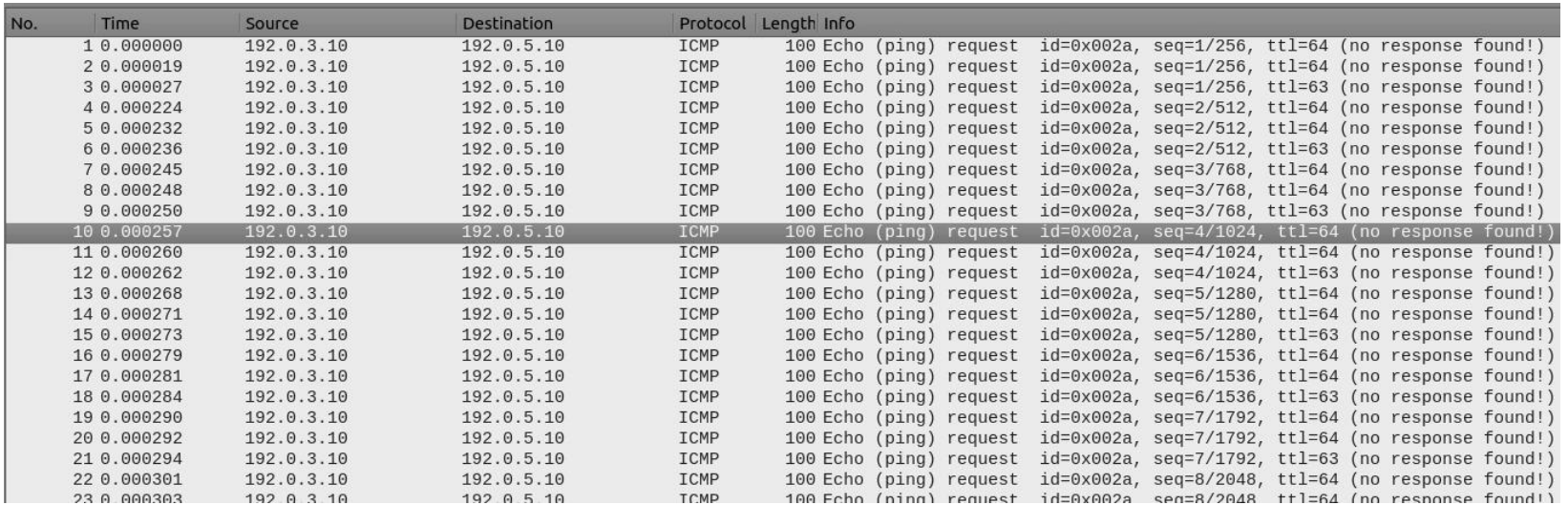


1. Podemos ver que a conexão foi totalmente negada pelo servidor.

2. Foi realizada a comunicação de forma precária com um tempo grande para resposta do servidor.

3. O serviço já normalizado.

Análise do ataque no Wireshark



No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=1/256, ttl=64 (no response found!)
2	0.000019	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=1/256, ttl=64 (no response found!)
3	0.000027	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=1/256, ttl=63 (no response found!)
4	0.000224	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=2/512, ttl=64 (no response found!)
5	0.000232	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=2/512, ttl=64 (no response found!)
6	0.000236	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=2/512, ttl=63 (no response found!)
7	0.000245	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=3/768, ttl=64 (no response found!)
8	0.000248	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=3/768, ttl=64 (no response found!)
9	0.000250	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=3/768, ttl=63 (no response found!)
10	0.000257	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=4/1024, ttl=64 (no response found!)
11	0.000260	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=4/1024, ttl=64 (no response found!)
12	0.000262	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=4/1024, ttl=63 (no response found!)
13	0.000268	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=5/1280, ttl=64 (no response found!)
14	0.000271	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=5/1280, ttl=64 (no response found!)
15	0.000273	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=5/1280, ttl=63 (no response found!)
16	0.000279	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=6/1536, ttl=64 (no response found!)
17	0.000281	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=6/1536, ttl=64 (no response found!)
18	0.000284	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=6/1536, ttl=63 (no response found!)
19	0.000290	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=7/1792, ttl=64 (no response found!)
20	0.000292	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=7/1792, ttl=64 (no response found!)
21	0.000294	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=7/1792, ttl=63 (no response found!)
22	0.000301	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=8/2048, ttl=64 (no response found!)
23	0.000303	192.0.3.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002a, seq=8/2048, ttl=64 (no response found!)

Dados da máquina zumbi2 capturados pelo Wireshark.

Análise do ataque no Wireshark

No.	Time	Source	Destination	Protocol	Length	Info
2477…	136.889125	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=49435/7105, ttl=63 (reply in 247704)
2477…	136.902115	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=50093/44483, ttl=63 (reply in 247709)
2477…	136.915136	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=50859/43974, ttl=63 (reply in 247714)
2477…	136.928125	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=51602/37577, ttl=63 (reply in 247719)
2477…	136.954088	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=52779/11214, ttl=63 (reply in 247729)
2477…	136.980114	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=53692/48337, ttl=63 (reply in 247739)
2477…	137.019107	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=55079/10199, ttl=63 (reply in 247754)
2477…	137.045129	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=56503/47068, ttl=63 (reply in 247764)
2477…	137.071139	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=58280/43235, ttl=63 (reply in 247774)
2477…	137.084107	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=59716/17641, ttl=63 (reply in 247779)
2477…	137.110131	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=60537/31212, ttl=63 (reply in 247789)
2477…	137.123124	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=61058/33518, ttl=63 (reply in 247794)
2478…	137.135942	192.0.8.1	192.0.8.10	ICMP	128	Destination unreachable (Host unreachable)
2478…	137.135968	192.0.8.1	192.0.8.10	ICMP	128	Destination unreachable (Host unreachable)
2478…	137.136395	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=61794/25329, ttl=63 (reply in 247807)
2478…	137.162132	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=63099/31734, ttl=63 (reply in 247817)
2478…	137.188110	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=64676/42236, ttl=63 (reply in 247827)
2480…	137.747117	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=65501/56831, ttl=63 (reply in 248050)
2480…	137.814223	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002d, seq=4/1024, ttl=64 (no response found!)
2480…	137.814232	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002d, seq=4/1024, ttl=64 (no response found!)
2484…	138.822331	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002d, seq=5/1280, ttl=64 (no response found!)
2484…	138.822343	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002d, seq=5/1280, ttl=64 (no response found!)
2488…	139.829995	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002d, seq=6/1536, ttl=64 (no response found!)
2488…	139.830001	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002d, seq=6/1536, ttl=64 (no response found!)
2489…	139.937098	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002c, seq=65504/57599, ttl=63 (reply in 248923)
2489…	139.952615	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002d, seq=6/1536, ttl=63 (no response found!)
2489…	140.070107	192.0.8.10	192.0.5.10	ICMP	100	Echo (ping) request id=0x002d, seq=6/1536, ttl=63 (reply in 248982)

Dados da máquina cliente capturados pelo Wireshark.

Referências

Core-dev (2012). Core 4.8 documentation. Disponível em: http://downloads.pf.itd.nrl.navy.mil/docs/core/core-html/intro.html. Acesso em 18 maio 2016.

Kumar, A., Sharma, A. K., and Singh, A. (2012). Performance evaluation of centralized multicasting network over icmp ping flood for ddos. International Journal of Computer Applications (0975–8887) Volume.

Oliveira, E., Aschoff, R., Lins, B., Feitosa, E., and Sadok, D. (2007). Avaliação de proteção contra ataques de negação de serviço distribuídos (ddos) utilizando lista de ips confiáveis. VII Simpósio Brasileiro em Segurança da Informação e de Sistemas Computacionais.

Orozco, A. M., Fernandes, A. P., and Costa, G. H. (2014). Simulação de syn flooding attackk no common open research emulator. Revista Competência , 7(1):161–173.