HTran and the Advanced Persistent Threat

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While researching one of the malware families involved in the RSA breach disclosed in March 2011, Dell SecureWorks CTU observed an interesting pattern in the network traffic of a related sample (MD5:53ba6845f57f8e9ef600ef166be3be14). When the sample under analysis attempted to connect to the C2 server at my.amazingrm.com (203.92.45.2), the server returned a succinct plain-text error message instead of the expected HTTP-formatted response:

```
[SERVER]connection to funn
```

Although the message was seemingly truncated, this pattern was enough to correlate the error string to a known (and fairly old) program called "HUC Packet Transmit Tool", or "HTran", for which source code can be readily found on the Internet: http://read.pudn.com/downloads199/sourcecode/windows/935255/htran.cpp__.htm

HTran is a rudimentary connection bouncer, designed to redirect TCP traffic destined for one host to an alternate host. The source code copyright notice indicates that HTran was authored by "lion", a well-known Chinese hacker and member of "HUC", the Honker Union of China. The purpose of this type of tool is to disguise either the true source or destination of Internet traffic in the course of hacking activity.

HTran contains several debugging messages throughout the source code that are sent to the console or to the connecting client in order to diagnose connection issues. The part of the HTran source code that generated the error message seen in the trojan C2 response is shown below:

```
if(client_connect(sockfd2,host,port2)==0)
{
closesocket(sockfd2);
sprintf(buffer,"[SERVER]connection to %s:%d error\r\n", host, port2);
send(sockfd1,buffer,strlen(buffer),0);
```

The code is written so that if the connection bouncer is unable to connect to the hidden destination in order to relay the incoming traffic, the formatted error message containing the target host and port parameters will be sent to the connecting client. As long as there are no connection issues, HTran might be a useful tool to hide a trojan C2's true location - but, in the case of any connection downtime between the HTran host and the hidden C2, HTran will betray the location of the hidden C2 host.

Instances of HTran on multiple hosts could theoretically be chained together in order to add extra layers of obfuscation. However, in case of the final endpoint C2 being unavailable for any reason, the last link in the HTran chain will still pass its connection failure message up the chain, rendering all of the other layers of obfuscation useless. This tiny bit of error debugging code left in by the author can be quite useful if one wants to track HTran-bounced hacking activity to its source.

HTran Survey

Armed with the knowledge of HTran's transient error message formatting, Dell SecureWorks CTU was able to locate TCP packet captures containing HTran connection errors in response to traffic from other APT-related malware that had been previously executed in our sandnet. The following Snort signatures can be used by other organizations to search for HTran connection error messages in transit on their networks:

```
alert tcp $EXTERNAL_NET any -> $HOME_NET any (msg:"HTran Connection Redirect Failure Message";
flow:established,from_server; dsize:<80; content:"|5b|SERVER|5d|connection|20|to|20|"; depth:22;
reference:url,www.secureworks.com/research/threats/htran/; sid:1111111111;)
alert tcp $EXTERNAL_NET any -> $HOME_NET any (msg:"HTran Connection Redirect Failure Message
(Unicode)"; flow:established,from_server; dsize:<160; content:"|5b00|S|00|E|00|R|00|V|00|E|00|R|
005d00|c|00|o|00|n|00|n|00|e|00|c|00|t|00|i|00|o|00|n|002000|t|00|o|002000|"; depth:44;
reference:url,www.secureworks.com/research/threats/htran/; sid:1111111112;)
```

In addition to locating historical packet captures containing evidence of HTran connection failures, Dell SecureWorks CTU implemented a scanning system which checks for the HTran error message in responses from active probing of more than a thousand IP addresses known to be associated with APT trojan activity currently or in the past. The results of this survey can be seen in the following table:

Malware C2 IP/Port	Associated Hostnames	Host-Related Malware Hashes	Hidden Destination IP/Port
12.38.236.41:443	**epod.businessconsults.net hapyy2010.lflinkup.net info.businessconsults.net pop.businessconsults.net ssa.businessconsults.net sys.businessconsults.net**	**3493fc0e4a76b9d12b68afc46cab7f34 fd4a4ac08f5a7271fbd9b8157d30244e 51744d77fc8f874934d2715656e1a2df**	**112.65.87.58:443 58.247.25.108:443**
173.244.209.196:443	**bbs.india-videoer.com itiupdated.dyndns.info news.india-videoer.com www.india-videoer.com**	**1daa3e392d1fea79badfbcd86d765d32 855cea7939936e86016a0aedee1d2c24**	**123.120.102.251:443**
204.45.228.140:80 204.45.228.140:443	**create301.dyndns.info**	**00b9619613bc82f5fe117c2ca394a328**	**123.120.106.136:8080 123.120.117.98:9000 123.120.126.73:8080 123.120.127.146:9000**
207.225.36.69:443	**leets.hugesoft.org rouji.freespirit.acmetoy.com slnoa.newsonet.net sos.businessconsults.net trb.arrowservice.net ug-aa.hugesoft.org www.optimizon.com**	**cca75af9786d7364866f40b80dddcc5c**	**58.247.240.91:80**
212.125.200.197:443	**inter.earthsolution.org quick.earthsolution.org**	**3a3bf6cab9702d0835e8425f4e9d7a9c**	**223.167.5.10:8000 223.167.5.250:8000 223.167.5.254:8000**

212.125.200.204:443	bah001.blackcake.net caci2.infosupports.com doa.bigdepression.net lucy2.businessconsults.net lucy2.infosupports.com lucy.blackcake.net lucy.businessconsults.net mantech.blackcake.net news.businessconsults.net qiao1.bigdepression.net qiao2.bigdepression.net qiao3.bigdepression.net qiao4.bigdepression.net qiao5.bigdepression.net qiao6.bigdepression.net sports.businessconsults.net srs.infosupports.com	03557c3e5c87e6a121c58f664b0ebf18 8a873136b6e4dd70ff9470288ff99d93 bbf4212f979c32eb6bc43bd8ba5996f9	112.64.214.174:443
220.110.70.51:443	nsweb.hostent.org	c9067c06bb9e8a5304b93687c59e4e15	125.215.189.114:40781
60.249.150.162:443	argentinia.faqserv.com epaserver.toythieves.com mailserver.instanthq.com mailserver.sendsmtp.com moiserver.myftp.info mosfdns.ddns.ms office.lflink.com san.www1.biz seoulsummit.ddns.ms songs.longmusic.com sysinfo.mynumber.org timeforbeat.ns01.us www.cpear.ddns.us yahoo2.epac.to		121.229.201.158:10009 121.229.201.238:10009
64.255.101.100	aar.bigdepression.net conn.gxdet.com db.billten.net ddbb.gxdet.com info.billten.net info.dcfrr.com info.helpngr.net info.new-soho.com info.scitence.net mail.new-soho.com mailsrv.scitence.net news.billten.net news.scitence.net pop.dnsweb.org techniq.whandjg.net webmail.dcfrr.com webmail.whandjg.net	056310138cb5ed295f0df17ac591173d 45a66ae3537488f7d63622ded64461e0 92e28cec1c82f5d82cbd80c64050c5ca ec4d34c742d2d5714c600517f05c2253	112.64.213.249:443
68.96.31.136	gee.safalife.com ghma.earthsolution.org hav.earthsolution.org java.earthsolution.org quiet.earthsolution.org special.earthsolution.org visual.earthsolution.org vop.earthsolution.org vope.purpledaily.com	3a3bf6cab9702d0835e8425f4e9d7a9c 7cb055ac3acbf53e07e20b65ec9126a1	223.167.5.10:8000

72.167.34.54:443	**catalog.earthsolution.org** **ou2.infosupports.com** **ou3.infosupports.com** **ou7.infosupports.com** **www2.wikaba.com** **yang1.infosupports.com** **yang2.infosupports.com**	**47a76cf2e60960405a492bc7f41b0483**	**58.247.27.232:443**

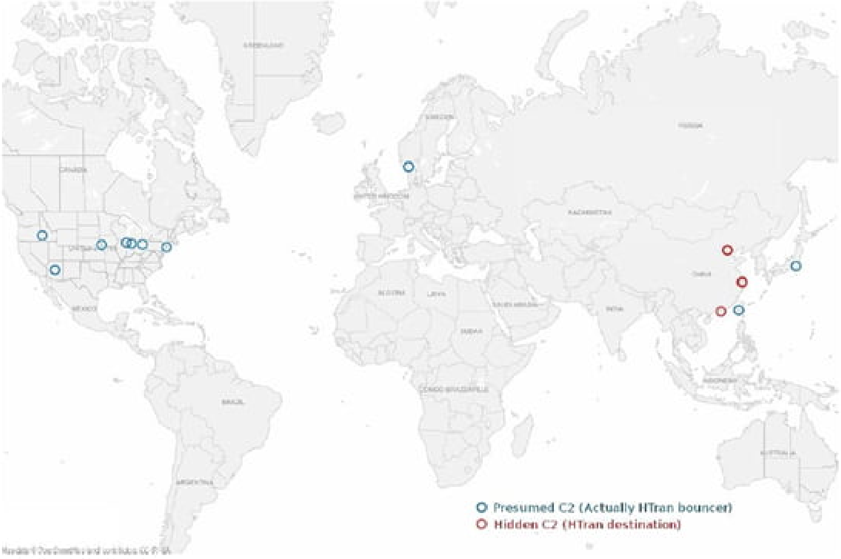
HTran Survey Results

The hostnames in the table were gathered using passive DNS records showing that at one point in time they pointed to the IP address in question. The hostnames may currently be pointed at different IP addresses than shown, as they are rotated frequently. The domains involved are all known to be connected to a variety of different Advanced Persistent Threat (APT) trojans. In cases where a related sample has been analyzed by Dell SecureWorks CTU, the MD5 hash of the sample is provided.

The survey of HTran traffic shows a clear pattern that can be seen by analyzing the Autonomous System Number (ASN) owner of each hidden IP address:

```
17621  |  112.64.213.249  |  CNCGROUP-SH China Unicom Shanghai network
17621  |  112.64.214.174  |  CNCGROUP-SH China Unicom Shanghai network
17621  |  112.65.87.58    |  CNCGROUP-SH China Unicom Shanghai network
4134   |  121.229.201.158 |  CHINANET-BACKBONE No.31,Jin-rong Street
4134   |  121.229.201.238 |  CHINANET-BACKBONE No.31,Jin-rong Street
4808   |  123.120.106.136 |  CHINA169-BJ CNCGROUP IP network China169 Beijing Province Network
4808   |  123.120.117.98  |  CHINA169-BJ CNCGROUP IP network China169 Beijing Province Network
4808   |  123.120.126.73  |  CHINA169-BJ CNCGROUP IP network China169 Beijing Province Network
4808   |  123.120.127.146 |  CHINA169-BJ CNCGROUP IP network China169 Beijing Province Network
4515   |  125.215.189.114 |  ERX-STAR PCCW IMSBiz
60055  |  223.167.5.10    |  CNCGROUP-SH China Unicom Shanghai network
60055  |  223.167.5.250   |  CNCGROUP-SH China Unicom Shanghai network
60055  |  223.167.5.254   |  CNCGROUP-SH China Unicom Shanghai network
17621  |  58.247.240.91   |  CNCGROUP-SH China Unicom Shanghai network
17621  |  58.247.25.108   |  CNCGROUP-SH China Unicom Shanghai network
17621  |  58.247.27.232   |  CNCGROUP-SH China Unicom Shanghai network
```

Every hidden IP address observed in the HTran error messages captured during our survey is located on just a few different networks in the People's Republic of China (PRC). In almost every case, the observable C2 is in a different country, most likely the same country in which the victim institution is located.


○ Presumed C2 (Actually HTran bouncer)
○ Hidden C2 (HTran destination)

It's not surprising that hackers using a Chinese hacking tool might be operating from IP addresses in the PRC. Most of the Chinese destination IPs belong to large ISPs, making further attribution of the hacking activity difficult or impossible without the cooperation of the PRC government.

Conclusion

Over the past ten years, we have seen dozens of families of trojans that have been implicated in the theft of documents, email and computer source code from governments, industry and activists. Typically when hacking or malware traffic is reported on the Internet, the location of the source IP is not a reliable indicator of the true origin of the activity, due to the wide variety of programs designed to tunnel IP traffic through other computers. However, occasionally we get a chance to peek behind the curtain, either by advanced analysis of the traffic and/or its contents, or due to simple programmer/user error. This is one of those cases where we were lucky enough to observe a transient event that showed a deliberate attempt to hide the true origin of an APT. This particular hole in the operational security of a certain group of APT actors may soon be closed, however it is impossible for them to erase the evidence gathered before that time. It is our hope that every institution potentially impacted by APT activity will make haste to search out signs of this activity for themselves before the window of opportunity closes.