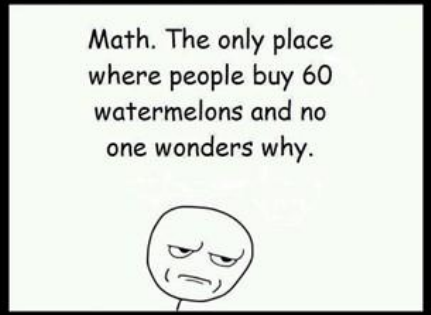
Introducing the RITA Framework

Hunting For Bad Guys On Your Network For Free Using Math!



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Breakdown

- Introduction – John Strand
- Hunting using DNS logs – Joff Thyer
- Hunting for C2 Beacons – Brian Fehrman
- Testing and Validation – Derek Banks
- Conclusions – John Strand

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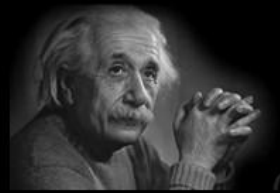
Why Current Strategies Are Not Working

- Offensive: You will need to attack
- Defensive: Know our limitations
- Go back 5 or 6 years… What were they saying to defend networks?
  - Patch
  - AV
  - IDS/IPS
- What are they saying now?
  - Patch
  - AV
  - IDS/IPS
- Do you see the beginning of a bad pattern?
- This section is good for defense and for your attacks against the bad guys

Insanity: doing the same thing over and over again and expecting different results.



Albert Einstein
German Theoretical-Physicist
(1879-1955)

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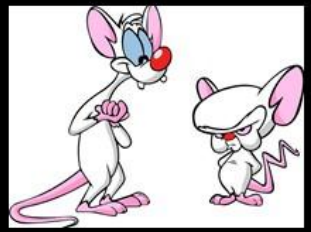
Just a Few Questions

- What are three AV companies?
- What are three IDS companies?
- What are three firewall companies?
- Who are the biggest?
- What is the total market share?

Just a Few More Questions

- Who are your main adversaries?
- China?
- Russia?
- The NSA?
- Organized crime?



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One Last Question

- Do you think these adversaries have the ability to bypass the limited technologies we just mentioned?

Hunt Teaming

- ***Actively*** looking for advanced attackers
- If we can bypass AV/IDS/IPS.. Attackers can too!
- We are looking for beaconing activity
- Involves close coordination with customer team
- Lots of logs and data to analyze
- Oh… And math, there is lots of math as well

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In Short…

Pictured…. Not Hunting.

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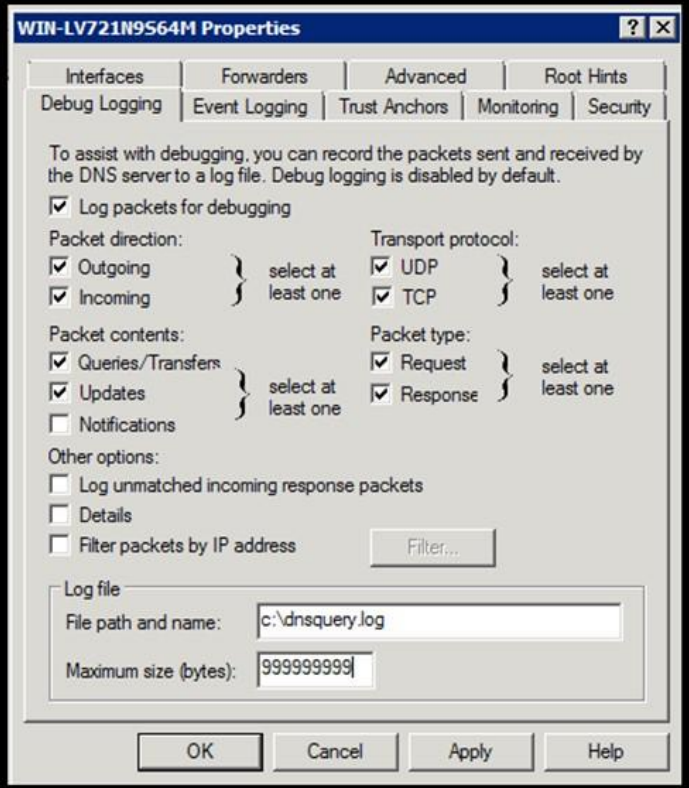
Hunting using DNS Logs

Joff Thyer

C2 hunting using DNS logs

- Compare peer workstation traffic
  - Majority of query types should be of type “A”, “CNAME”, and some “SVC”.
- What if we had an device that exhibited unusual behavior?
  - Receiving *many* NXDomain responses
  - Producing *many* TXT queries
  - Querying with a specific name pattern



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C2 hunting using DNS logs

- Sub-total all queries by
  - Response code
    - Examples: NOERROR, NXDOMAIN
  - Query and Response Types
    - A, CNAME, SRV, SOA, TXT, NS
- Create means, and standard deviations across whole dataset
  - An outlier differs from the mean by two standard deviations.

C2 hunting using DNS logs

```
[*] 192.168.1.21
    [+] ----------------------
    [+]         NOERROR:    409
    [+]        NXDOMAIN:     87
    [+] ----------------------
    [+]           TOTAL:    496
    [+] ----------------------
    [+] Query Types ..........
    [+]         [     A]:    106
    [+]         [   SRV]:    142 * >2 StdDev *
    [+] Response Types .......
    [+]         [     A]:    106
    [+]         [   SRV]:    142 * >2 StdDev *
    [+] ----------------------
```

Visualizing raw DNS stats

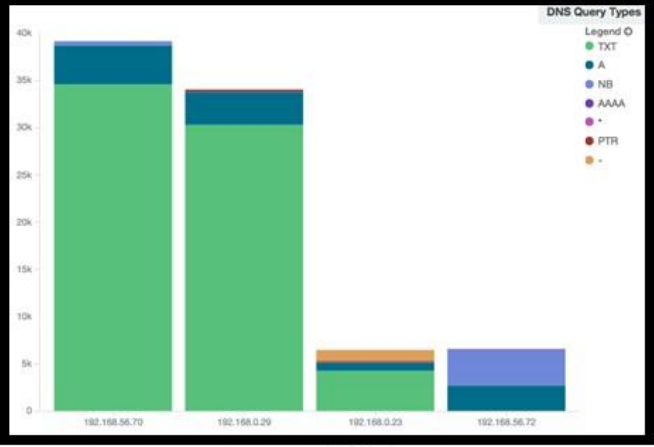

Table | Request | Response | Statistics

Top 4 src.raw	Top 5 qType.raw	Count
192.168.56.70	TXT	34571
192.168.0.29	TXT	30285
192.168.0.23	TXT	4284
192.168.56.70	A	4148
192.168.56.72	NB	3732
192.168.0.29	A	3481

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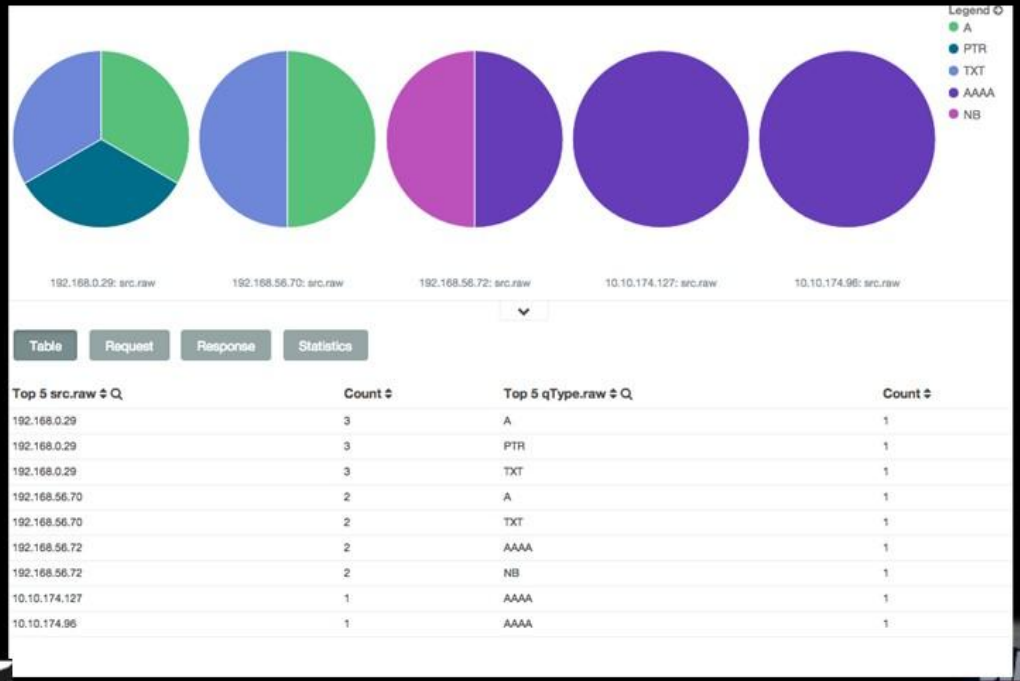
Visualizing Analyzed DNS Data



Top 5 src.raw	Count	Top 5 qType.raw	Count
192.168.0.29	3	A	1
192.168.0.29	3	PTR	1
192.168.0.29	3	TXT	1
192.168.56.70	2	A	1
192.168.56.70	2	TXT	1
192.168.56.72	2	AAAA	1
192.168.56.72	2	NB	1
10.10.174.127	1	AAAA	1
10.10.174.96	1	AAAA	1

Hunting for Domain Name Generation Algorithms (DGA)

- "train" a classifier model using
  - Known good domains
    - OpenDNS top 10,000 domains
    - OpenDNS 10,000 random domain names
    - Alexa top 1 million domain names
  - Known DGA domain lists
    - Cryptolocker, and Game over Zeus botnets
  - About 500,000 known words
- Based on some published work from Click Security

DGA Hunt Feature Engineering

- Calculate
  - Length, and entropy
  - N-grams (3,4,5), and distance from legitimate domains and dictionary words
  - Difference between two n-gram distances
- Feed output data into a Random Decision Tree model, and serialize trained data to disk

Hunting for DGA

- Can re-train the classifier at any time with updated datasets
- Python script checks the classification of a domain for “dga”
  - If “dga” found, then update ElasticSearch variable to “behavior: dga”.
- Further experimentation with other feature engineering
  - Eg: Ratios of numbers to vowels/consonents
  - Proportion of domain matching dictionary word

Hunting for C2 Beacons

Brian Fehrman

Beaconing

- Not to be confused with baconing…

Equally Awesome

Beaconing

- Many types of malware call home
- Particularly C2 Channels
- Calls typically happen at predefined intervals

I guess you could say…
It was a dangerous callback.
YEAAAAAAAAAAAAA!

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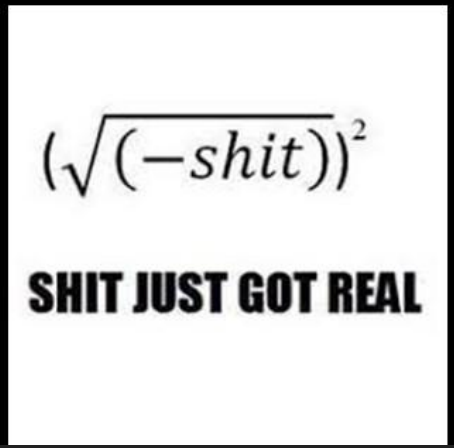
Beaconing

- Bring on the math
- Network connections are time-varying signals
- Signal processing can be applied



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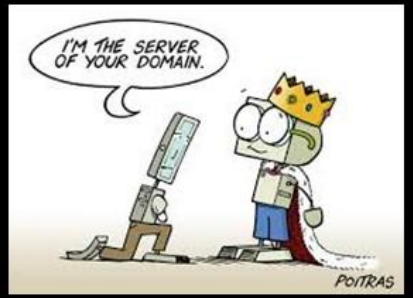
Beaconing

- Two domains in signal processing



- Time Domain
  - Connections happening over time

- Frequency Domain
  - The frequency at which the connections occur

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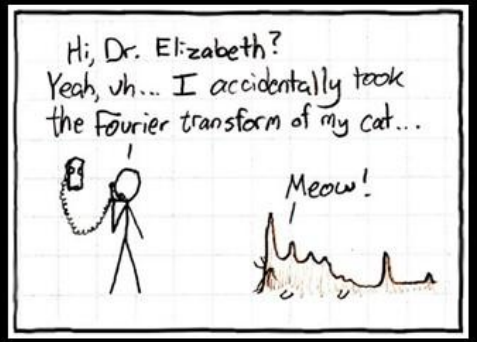
Beaconing

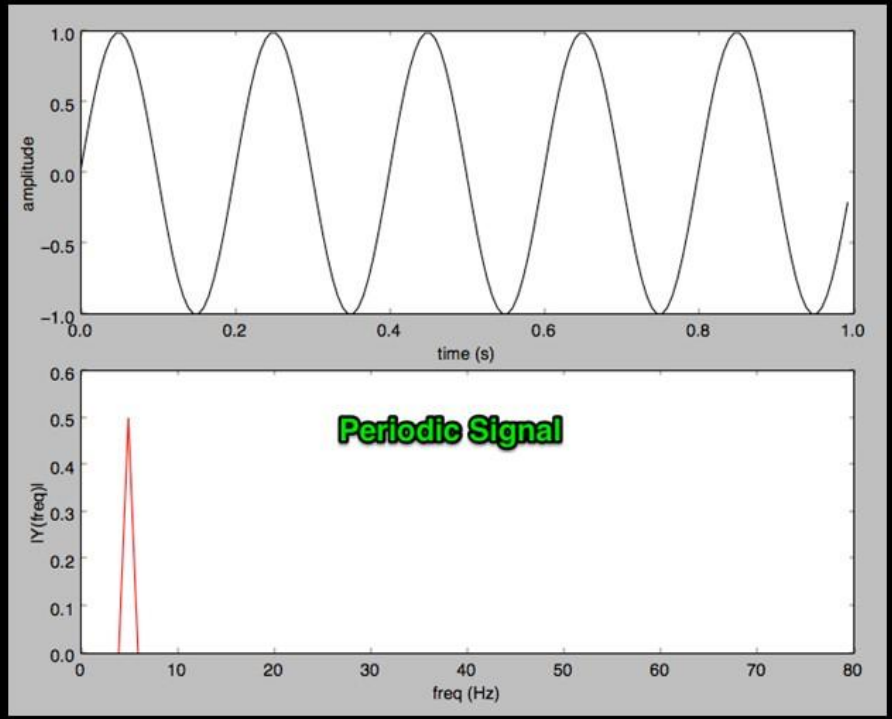
- How can we determine frequency?
- Enter…Fast Fourier Transforms (FFT)
  - technically DFT but lets not go there now
- Transforms signals from time/spatial domain to frequency domain



Beaconing

- So what?
- Most users interact randomly
- Most software does not…including malware
- If something happens at regular intervals, this sticks out in the frequency domain

Beaconing



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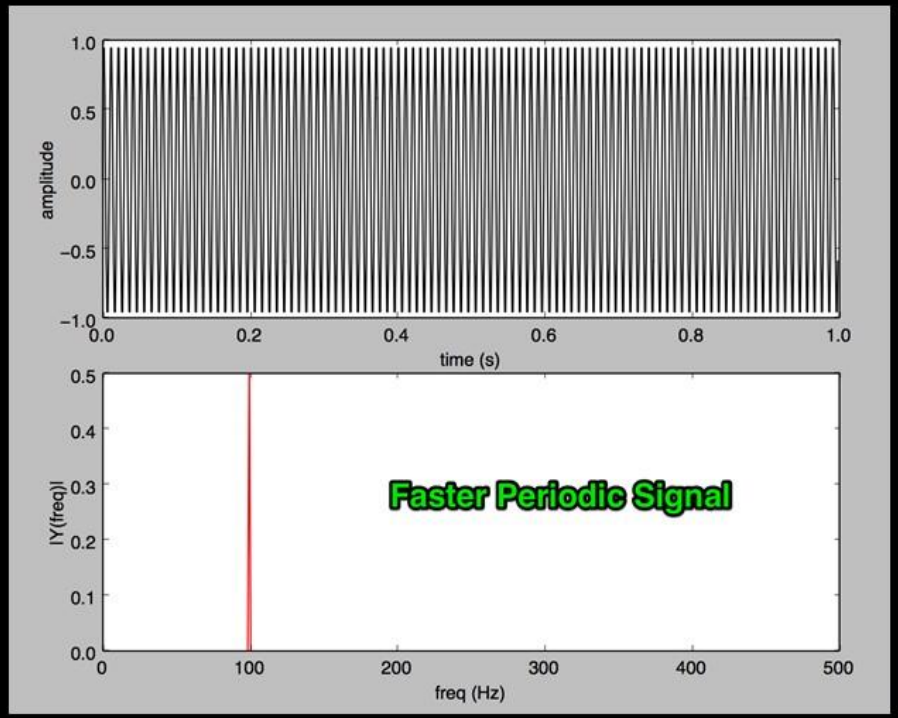
Beaconing



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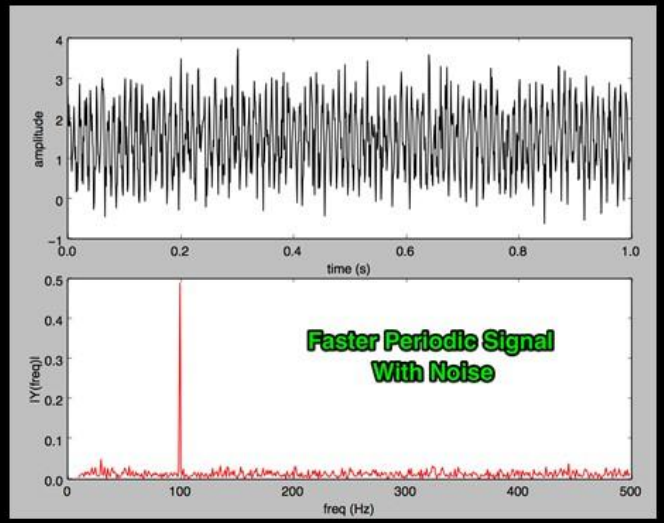
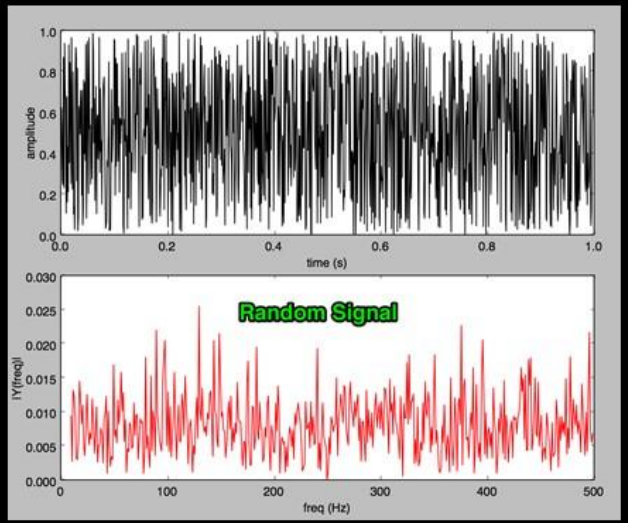
Beaconing





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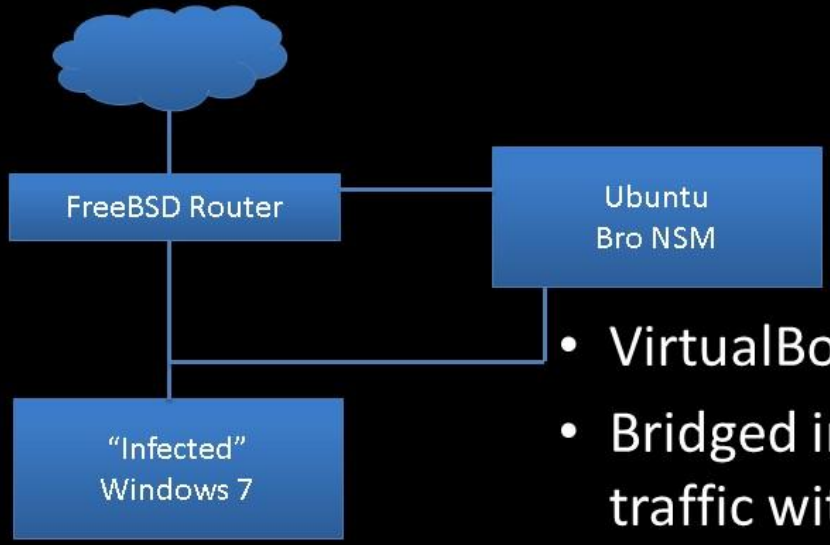
Testing and Validation
Derek Banks

Test Environment



- VirtualBox on single host
- Bridged interface to sniff traffic with Bro
- Python Script to simulate additional traffic

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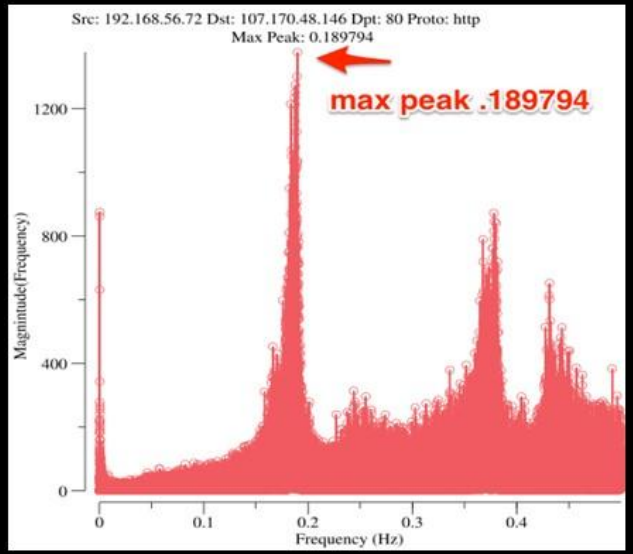
HTTP Beaconing

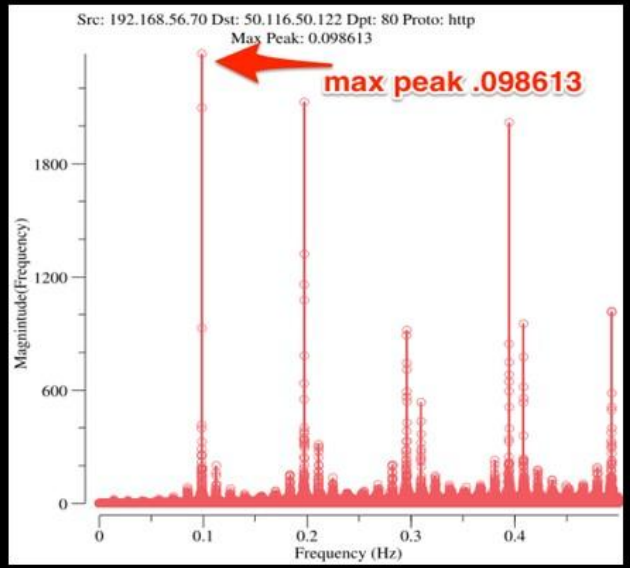
- Powershell Empire
  - C2 over HTTP
  - Default Five Second Interval Configuration
  - T=1/f (Hz)
    - 5.3 seconds



Sep 16	00:00:04	CTibsBQrPD21kqrk4	192.168.56.72	49828	107.170.48.146	80	1	GET	107.170.48.146	/admin/get.php	-
Sep 16	00:00:09	CbS6RR2XvFqstlaZS	192.168.56.72	49829	107.170.48.146	80	1	GET	107.170.48.146	/login/process.jsp	-
Sep 16	00:00:15	CMAOx54cahdZ8AWMFh	192.168.56.72	49830	107.170.48.146	80	1	GET	107.170.48.146	/news.asp	-
Sep 16	00:00:20	Cnktgv45Sys7WQm4v8	192.168.56.72	49832	107.170.48.146	80	1	GET	107.170.48.146	/news.asp	-
Sep 16	00:00:26	CpCJi02n633bq8fRYa	192.168.56.72	49834	107.170.48.146	80	1	GET	107.170.48.146	/login/process.jsp	-
Sep 16	00:00:31	CkFhSQuaOFLoa2rPf	192.168.56.72	49835	107.170.48.146	80	1	GET	107.170.48.146	/admin/get.php	-
Sep 16	00:00:37	CV4Y1W1nsW5l2i1WW1	192.168.56.72	49836	107.170.48.146	80	1	GET	107.170.48.146	/login/process.jsp	-

HTTP Beaconing

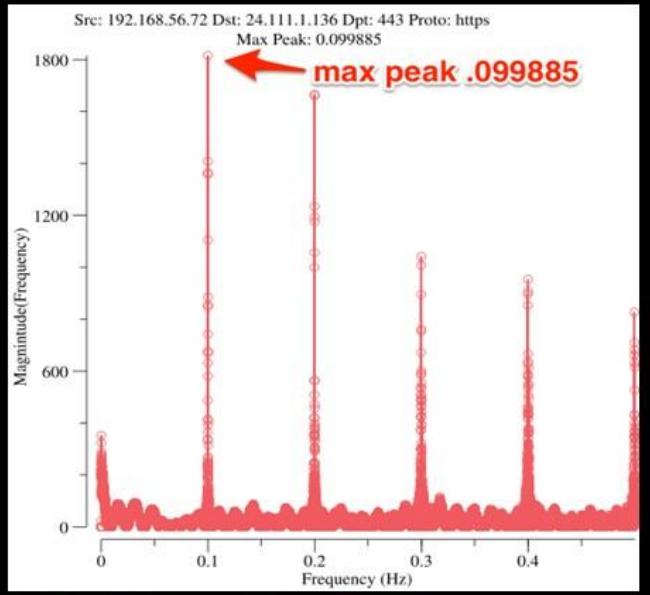
- VSAgent
  - Custom written malware
  - C2 via HTTP Viewstate
  - T=1/f (Hz)
    - 10.2 seconds



Sep 16	19:00:06	CWQSKa480hAaDFYpK9	192.168.56.70	49725	50.116.50.122	80	1	POST	vsagent.blackhillsinfosec.com
Sep 16	19:00:16	CKIW5k4dgXMDLfhKG5	192.168.56.70	49726	50.116.50.122	80	1	POST	vsagent.blackhillsinfosec.com
Sep 16	19:00:26	CLml964iCOIugWVOF6	192.168.56.70	49727	50.116.50.122	80	1	POST	vsagent.blackhillsinfosec.com
Sep 16	19:00:36	CZGvp2lavczMBUgHd	192.168.56.70	49728	50.116.50.122	80	1	POST	vsagent.blackhillsinfosec.com
Sep 16	19:00:46	CPPdMfiMCObMFAYoc	192.168.56.70	49729	50.116.50.122	80	1	POST	vsagent.blackhillsinfosec.com
Sep 16	19:00:56	CosWA81DeXhW9taC3e	192.168.56.70	49730	50.116.50.122	80	1	POST	vsagent.blackhillsinfosec.com
Sep 16	19:01:07	CaSa9B3x1fCY9gMk57	192.168.56.70	49731	50.116.50.122	80	1	POST	vsagent.blackhillsinfosec.com

HTTPS Beaconing

- Meterpreter
  - reverse_https module
  - TLS Encrypted C2 Channel
  - T=1/f (Hz)
    - 10 seconds



Sep 16	15:00:01	CIzovx3XUqblvJz0y	192.168.56.72	50681	24.111.1.136	443	TLSv12
Sep 16	15:00:11	Ctsujd46BF6s3XW3W5	192.168.56.72	50685	24.111.1.136	443	TLSv12
Sep 16	15:00:21	CPHVOY1y8u3lBQ2QMh	192.168.56.72	50686	24.111.1.136	443	TLSv12
Sep 16	15:00:31	C3HSk52hxonXEZeH6i	192.168.56.72	50689	24.111.1.136	443	TLSv12
Sep 16	15:00:41	ClnvN7x0crD7ZxTee	192.168.56.72	50692	24.111.1.136	443	TLSv12
Sep 16	15:00:51	Cn2NTz2J1EWkGrJE64	192.168.56.72	50694	24.111.1.136	443	TLSv12

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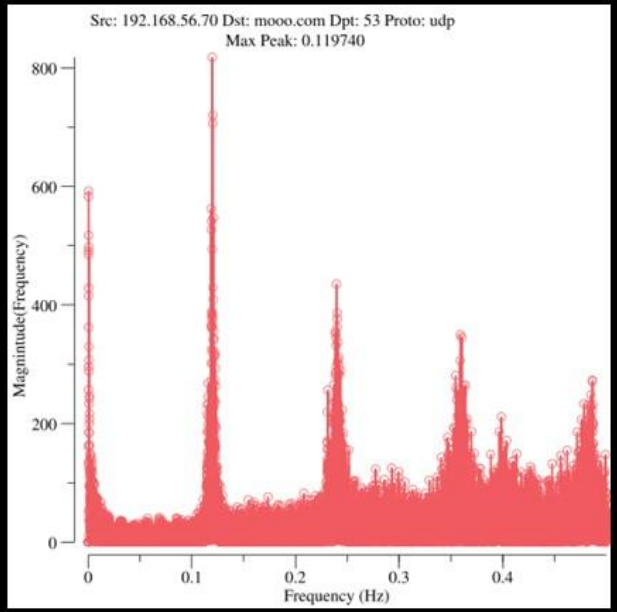
DNS Beaconing

- DNSCat
  - C2 via DNS TXT records
  - One Second Interval




```
Sep 16 08:00:00 COAOKuU8Ju1Elrzvl      192.168.56.70   60515   8.8.8.8 53      udp     20211   1dab0117815db6915c.a.bovine1234.mooo.com
Sep 16 08:00:01 COAOKuU8Ju1Elrzvl      192.168.56.70   60515   8.8.8.8 53      udp     31978   77a30117815db6915c.a.bovine1234.mooo.com
Sep 16 08:00:02 COAOKuU8Ju1Elrzvl      192.168.56.70   60515   8.8.8.8 53      udp     18725   10420117815db6915c.a.bovine1234.mooo.com
Sep 16 08:00:03 COAOKuU8Ju1Elrzvl      192.168.56.70   60515   8.8.8.8 53      udp     17594   706b0117815db6915c.a.bovine1234.mooo.com
Sep 16 08:00:04 COAOKuU8Ju1Elrzvl      192.168.56.70   60515   8.8.8.8 53      udp     21778   69980117815db6915c.a.bovine1234.mooo.com
Sep 16 08:00:06 COAOKuU8Ju1Elrzvl      192.168.56.70   60515   8.8.8.8 53      udp     21411   06160117815db6915c.a.bovine1234.mooo.com
Sep 16 08:00:07 COAOKuU8Ju1Elrzvl      192.168.56.70   60515   8.8.8.8 53      udp     5239    585e0117815db6915c.a.bovine1234.mooo.com
```

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Conclusions
John Strand

What did you think security was going to be?

YOU HAVE BEEN HACKED !

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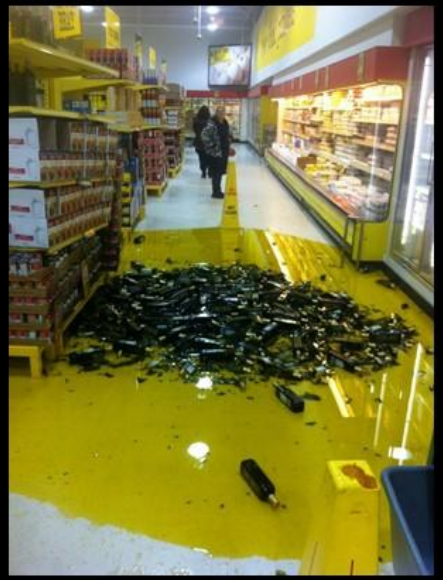
What did you get?



Cleanup… Aisle 3

Come and Play

- RITA Download
  - https://github.com/blackhillsinfosec/rita.git
- You will need…
  - A Debian Based Distrobution
  - ELK Stack
  - SciPy Libraries
  - Flask
- I will be releasing videos next week on the framework
  - Because that and PowerPoint is what I do…
- This is an invitation
  - Something sucks? Make a recommendation
  - This is the beginning of a framework
  - dev-hunt@blackhillsinfosec.com
- We have a great group working on this