Screw You and the Script You Rode in On

Presented by:

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Introductions

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Trustwave SpiderLabs

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Agenda

- The Problem
- Current Solutions
- Our Solution
- Examples

The Problem: Automated website access…

- Search engine bots
- Vulnerability scanners
- Spam-bots (pills & porn)
- DDoS attacks
- Miscellaneous crawlers

The Problem: Automated website access…

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- DDoS attacks
- Miscellaneous crawlers

Common Solutions

- Web Application Firewalls
  - Pro:
    - Do a good job of filtering out automated vulnerability scanners
  - Cons:
    - Aren't well suited for identifying non-attacks
    - DDoS attacks will almost always be missed

Common Solutions

- Request Throttling
  - Pros
    - Effective at stopping aggressive crawlers
  - Cons
    - Likely to block aggregated traffic (proxy servers or NAT)
    - Or, aggressive crawling can be passed off as aggregated traffic using forged HTTP headers

Common Solutions

- CAPTCHA
  - Pros:
    - Good protection against simple spam-bots
    - Really hard ones can't be solved by even advanced scripts
  - Cons:
    - Really hard ones can't be solved by even humans
    - Easy ones can be solved by scripts
    - Everyone hates them
    - You can only use them on key components

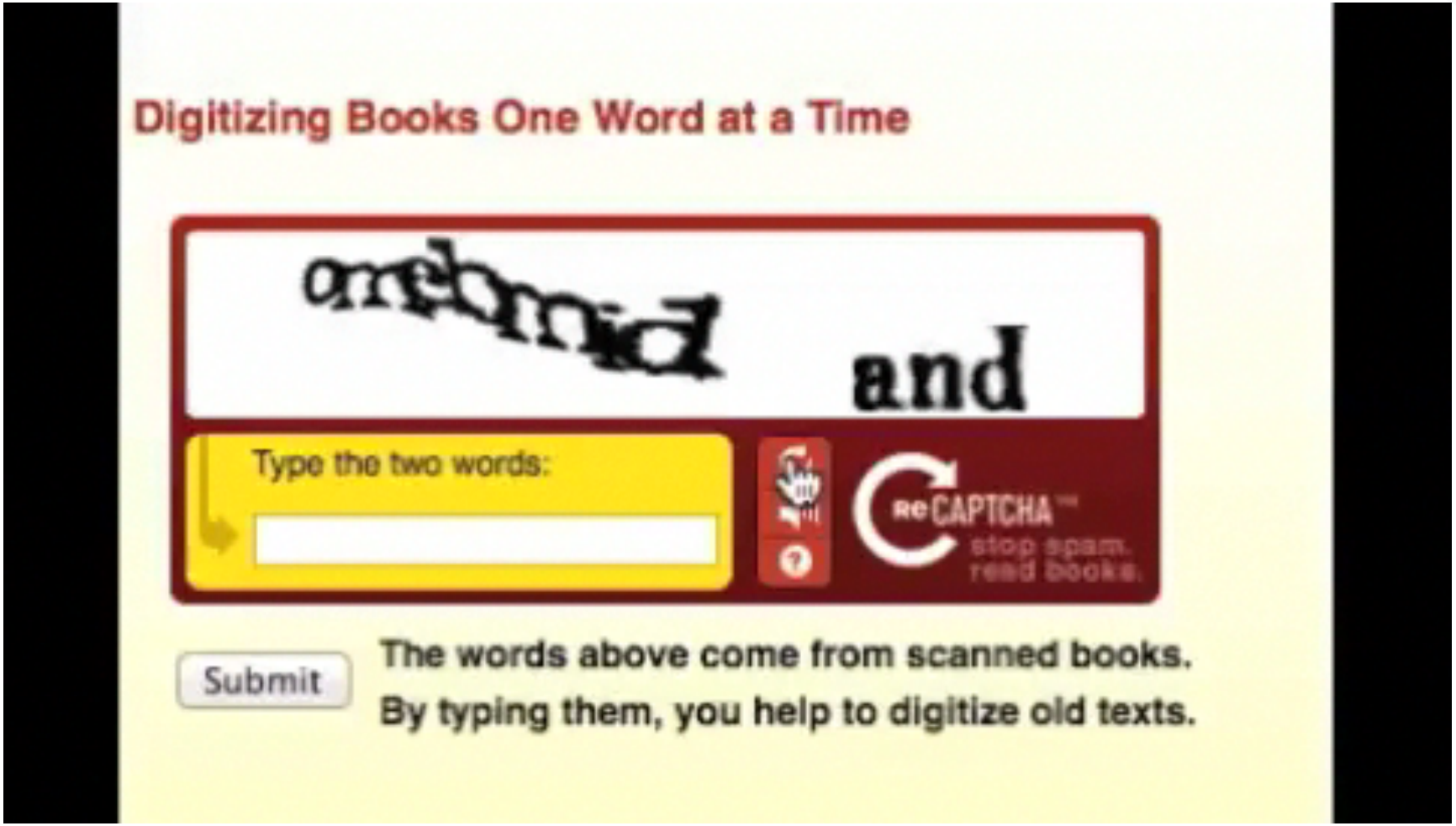
CAPTCHA Scope Limitations

- Generally only used on key operations:
  - Account creation
  - Auction bids
  - Comment posts

CAPTCHA Solving

- OWASP AppSec DC 2012, Gursev Singh Kalra released TesserCap
- Nice automation to solve common CAPTCHA formats using Tesseract
- Accommodations to users introduce weaknesses

reCAPTCHA



Uncommon Solutions

- Honeypot tags (injecting hidden content that only an automated tool would request)
- Pros:
  - Theoretically, very sound. Avoiding it requires extensive client-side DOM modeling to identify which components are visible. Files like robots.txt must be avoided, etc.
- Cons:
  - Must be implemented before the problem occurs
  - Many organizations are currently reluctant to implement

Uncommon Solutions

- Honeypot tags (con't)
- Cons:
  - Only blocks complete crawlers – a price crawler won't request hidden links

Our Motivation

- Client's repeated problems with aggressive crawling
- First time was easy to spot
- Second time was a little harder…
- Third time was a huge pain

Our Solution:

- Voigt-Kampff
- Offline log analysis
- Entirely passive
- Designed with the goal to grow into a real-time traffic analysis engine

Voigt-Kampff

- Java-based
- High-performance
  - Designed for multi-core/CPU, high-RAM computers
  - Separate threads for file reading, parsing, analysis
  - Uses java.nio.channels.FileChannel for file reading
  - Regular expressions rarely used, only after initial simpler pattern matching
  - Uses H2 database – easy switching between in-memory and on-disk storage
  - Custom string cache engine (truncated MD5)

Voigt-Kampff

- High-performance (con't)
  - All behavioral pattern analysis done against "long" data type
  - Javolution collections
  - Log file parsing with modified OpenCSV

Voigt-Kampff Techniques

- Confidence score-based
- Per IP-address analysis
- Attempts to categorize as:
  - Search engine
  - Scripting tool
  - Spider
  - Security scanner
  - Unknown automated
  - Link checker
  - Validator
  - Web library
  - Human

Voigt-Kampff Techniques

- Static analysis
  - Performed against every log entry
  - Typically simpler tests
  - Is started while logs still being read
- Dynamic analysis
  - Pattern creation
    - Baseline of "normal" behavior (only works if most behavior is human)
  - Pattern comparison
    - Checks for deviations from normal baselines

Voigt-Kampff Techniques

- Simplest detection with known user agent strings
  - LWP: libwww-perl/5.821
  - Curl: curl/7.9.8 (i686-pc-linux-gnu) libcurl 7.9.8 (OpenSSL 0.9.6b) (ipv6 enabled)
  - Google images: Googlebot-Image/1.0
  - Java: Java/1.6.0_26
  - Nikto: Mozilla/4.75 (Nikto/2.1.2)
- Implemented as static test

Voigt-Kampff Techniques

- Multiple categories of known user agents
  - Link checkers
  - Security scanners
  - Validators
  - Web libraries
  - Search engines

Voigt-Kampff Techniques

- Other simple tests, all implemented as static tests
  - Requests for robots.txt
  - Requests for sitemap.xml
  - Unknown / unique user agents

Voigt-Kampff Techniques

- Anomalous response code rates…
- Baseline:
  - 200 – 80%
  - 304 – 10%
  - 302 – 8%
  - 404 – 2%
- Anomaly:
  - 200 – 50%
  - 404 – 40%
  - 500 – 10%

Voigt-Kampff Techniques

- Anomalous file not founds (depends on real 404 codes)…
  - 3032 -- /scripts/tracking.js
  - 4268 -- /images/spacer.gif
  - 1 -- /admin.aspx
  - 4729 -- /css/tables.css

Voigt-Kampff Techniques

- Anomalous file not founds (depends on real 404 codes)…
  - 3032 -- /scripts/tracking.js
  - 4268 -- /images/spacer.gif
  - 1 -- /admin.aspx <--------
  - 4729 -- /css/tables.css

Voigt-Kampff Techniques

- Application entry point (no referer header, or external referer header)
- Most applications will have a relatively small number of entry points
  - Main page
  - Key Google results
  - Login pages
  - Popular bookmarks

Voigt-Kampff Techniques

- Dependency requests: JavaScript, style sheets, images, etc.
- Automated tools may not request dependencies they don't use (especially large files)
- Passive dependency mapping isn't easy. Based on referer headers in proximity to original request.
- Requires ALL logs from a web site

Voigt-Kampff Techniques

- Multiple user agents per IP over small time
- Could be aggregated traffic (NAT or proxy)
- Could be automated tool trying to mask its signature
- Low confidence level

Voigt-Kampff Techniques

- Average request rate (requests per IP over a one minute period)
- Could be aggregated traffic (NAT or proxy)
- Low confidence level

Voigt-Kampff Techniques

- Request delays
- Standard deviation for delay between requests for an IP address
- If a client is very consistent in how frequently it sends requests, that is very suspicious

Voigt-Kampff Techniques

- Navigational patterns

Voigt-Kampff Techniques

- Navigational patterns

Voigt-Kampff CLI

```
usage: voigtkampff [options] <filename>
 -v,--verbose                    Increase verbose output. Can be used multiple
                                 times.
 -r,--recursive                  Use <logfile> as a directory and recursively search
                                 for all log files
 -f,--file <filename>            additional log file(s) to parse, can be used multiple
                                 times
 -o,--format <format string>     A W3C or format string defining the columns. For
                                 example, -o "%h %l %u %t \"%r\" %>s %b \"%{Referer}i
                                 \"\%{User-agent}i\"" or -o "date time c-ip
                                 cs-username s-ip s-port cs-method cs-uri-stem
                                 cs-uri-query sc-status cs(User-Agent)"
                                 If this is ommited, voigtkampff will look for a file
                                 header, then try to guess the format.
 -D,--skip-dependencies          Do NOT perform dependency request analysis. This is
                                 useful if you are missing log files from a load
                                 balanced website.
 -m,--all-memory                 Keep all databases in memory for faster performance.
 -r,--report <filename>          Report file name. Defaults to report.html
```

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Voigt-Kampff CLI

```
./voigtkampff -v -v -m ex20120320.log

345 [main] INFO root -
Lines read: 0
Requests parsed: 0
Parsing queue: 0
Static tests: 0

5354 [main] INFO root -
Lines read: 399,960
Requests parsed: 199,722
Parsing queue: 200,495
Static tests: 0

6385 [Static testing thread 0] INFO root - Flushing string cache with 23184
records
10354 [main] INFO root -
Lines read: 562,267
Requests parsed: 382,584
Parsing queue: 167,704
Static tests: 10,799
```

Voigt-Kampff CLI

```
991071 [Log parsing thread 1] INFO root - Exiting after 28735316 jobs on Log
parsing thread 1
991071 [Log parsing thread 2] INFO root - Exiting after 28735316 jobs on Log
parsing thread 2
991071 [Log parsing thread 0] INFO root - Exiting after 28735316 jobs on Log
parsing thread 0
```

Voigt-Kampff CLI

```
=====================================
IP Address - 28.481.381.45
Total score - 100
Possible profiles -
=====================================

The user-agent string matches a known scanner: Mozilla/4.75 (Nikto/2.1.2)


=====================================
IP Address - 132.278.184.28
Total score - 78
Possible profiles - Unknown automated tool
=====================================

The IP had an unusually high number of 404 response codes from the server. 11.31%
of the IP's responses were this code, while most clients averaged 1.02%
The IP had an unusually high number of 500 response codes from the server. 5.2% of
the IP's responses were this code, while most clients averaged 0.29%
```

Voigt-Kampff Release

- Not today ☹
- As soon as Trustwave Legal approves it on our return

Questions or Ideas?

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Survey

https://www.surveymonkey.com/s/Research12_Byrne_Henderson

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