

Browser Fingerprinting

Goldfinger

Product Components

- Mongo Database
- Backend JavaScript - NodeJS
- Frontend JavaScript Toolkit - Fingerprinting
- WordPress Plugin
- Client side plugin - Control Group
- Analysis Script

Designs and Implementation

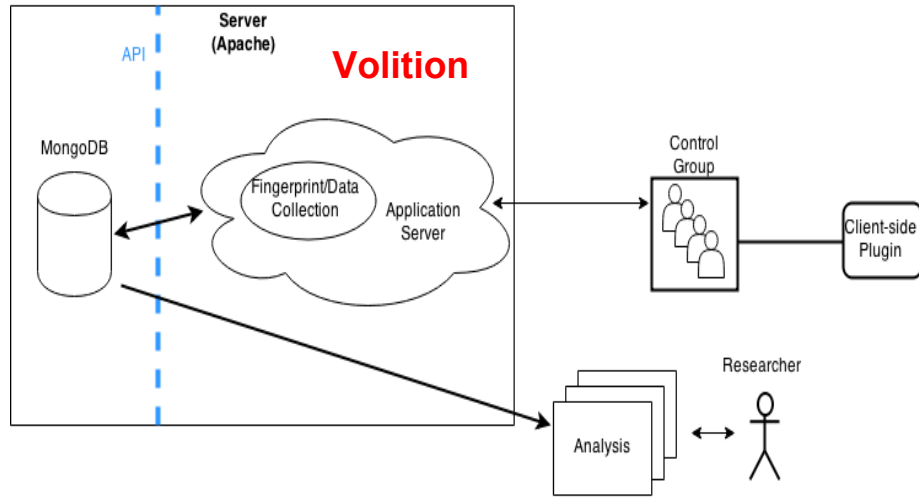


Figure 1: Standalone Single Server Architecture

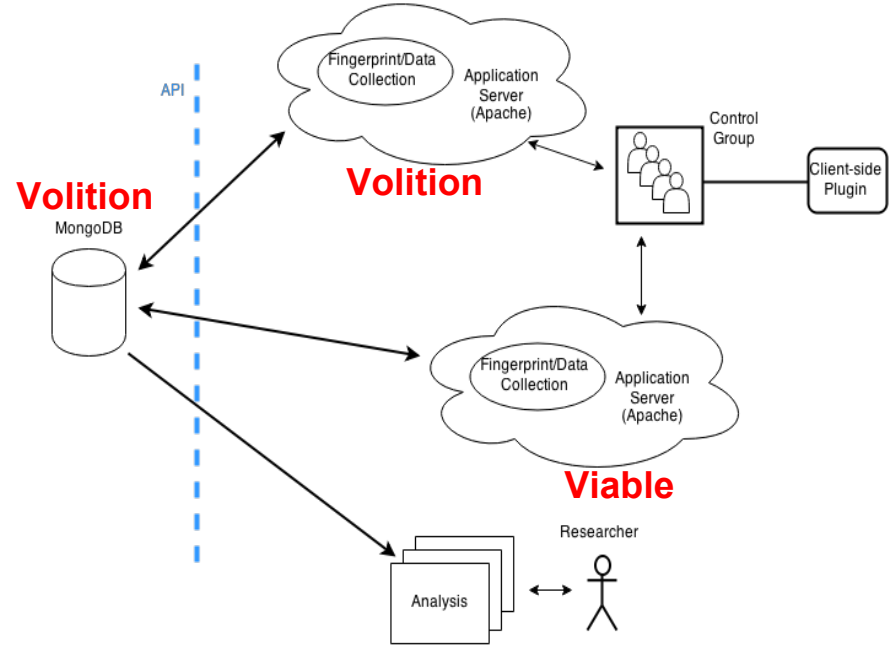


Figure 2: Multiple Application Server, Single Database Architecture

Toolkit

- JavaScript file pulls information from browser on page load, and sends to database
- Collects:
 - User Agent, Browser Plugin Details, Time Zone, Screen Size and Color Depth, System Fonts, and Cookies Enabled (boolean)
- Also collects username
- Detects control plugin


Example Fingerprint

_id: 5542e158d3fbe43c652a74dd
appCodeName: Mozilla
appName: Netscape
cookieEnabled: true
language: en-US
platform: Linux x86_64
userAgent: Mozilla/5.0 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/42.0.2311.135 Safari/537.36
ip: 50.204.167.25
latitude: 39.0012
longitude: -76.9317
country: United States
timezone: America/New_York
screenSize: 1920x1080x24
plugins: Chrome PDF Viewer,mhjfmbdgcjfbpaeojofohoeofgiehjai,,Shockwave Flash,libpepflashplayer.so,,Chrome Remote Desktop Viewer,internal-remoting-viewer,,Widevine Content Decryption Module,libwidevinecdmadapter.so,,Native Client,internal-nacl-plugin,,Chrome PDF Viewer,internal-pdf-viewer,
fonts: Flash:Abyssinica SIL,Bitstream Charter,Century Schoolbook L,Courier 10 Pitch,DejaVu Sans,DejaVu Sans Mono,DejaVu Serif,Droid Sans,Droid Sans Fallback,Droid Sans Mono,Droid Serif,FreeMono,FreeSans,FreeSerif,gargi,Garuda,Khmer OS,Khmer OS System,Kinnari,Liberation Mono,Liberation Sans,Liberation Sans Narrow,Loma,Meera,Monospace,Mukti Narrow,NanumBarunGothic,NanumGothic,NanumMyeongjo,Nimbus Mono L,Nimbus Sans L,Norasi,Padauk,Padauk Book,Phetsarath OT,Purisa,Rekha,Sans,Sawasdee,Serif,TakaoPGothic,Tibetan Machine Uni,Tlwg Typist,Tlwg Typo,TlwgMono,TlwgTypewriter,Ubuntu,Ubuntu Condensed,Ubuntu Mono,Umpush,URW Bookman L,URW Chancery L,URW Gothic L,URW Palladio L,Waree
md5: 2e279f0505e81e7cae4af4ccae8d4efa
timestamp: 2015-04-30 22:13:44 -04:00
control: e9503cd682a4ecddf23b2852d5ea15cb
username: david

WordPress Plugin

- PHP triggers JavaScript Toolkit
- Associates user with fingerprint
- Easy to install
 - Configuration script to choose database server

WordPress



Username

david

Password

.....

☐ Remember Me

Log In

Comments

Appearance

Plugins

Installed Plugins

Add New

Editor

Plugins

[Add New](#)

All (3) | **Active (1)** | Inactive (2) | Recently Active (1)

Bulk Actions ▾ [Apply](#)

<input type="checkbox"/>	Plugin	Description
<input type="checkbox"/>	Gold Fingerprint Deactivate	This will fingerprint anyone who visits the page, Version .1 By Group 12 Visit plugin site

Control User Plugin/Extension

- Easy to install
- Easy to uninstall
- Identify fingerprint uniqueness without login



Goldfinger Control 1.26.5

DESC

[Details](#)

ID: cdlldfghehnnecdmgjnghfadaihnedlnm

Inspect views: [background.html](#)

☐ Allow in incognito

Fingerprint Types

Fingerprints:

md5: c527f3c1e803631f81aeef5119669c4f

control: null

username: null

User does not have control plugin and is not logged in

md5: 2e279f0505e81e7cae4af4ccae8d4efa

control: e9503cd682a4ecddf23b2852d5ea15cb

username: david

User has control plugin and is logged into WordPress.
(Fingerprint from earlier in preview mode)

Analysis Scripts

- Example scripts for analysis of data:
 - Fingerprint uniqueness
 - Filter by value
 - Sort by attribute
 - Anomaly Detection
- Serve as examples of a wide range of possible analyses

Non Unique Fingerprints

md5: 2e279f0505e81e7cae4af4ccae8d4efa
control: null
username: cmisc435

md5: 2e279f0505e81e7cae4af4ccae8d4efa
control: null
username: david

Get Uniqueness of DB

```
{ "2e279f0505e81e7cae4af4ccae8d4efa": [ "cmisc435", "david" ], "nonUniqueFingerprints": 2, "totalFingerprints": 8, "uniquePercent": 75 }
```

Locational Anomaly

```
cmsc435@volition:~/dev$ node AnomalyDetection.js
Please enter a JSON pair of what you would like to constrict the elements to have in common
```

```
    e.g. {"username":"bob"}
{"Attribute":"Value"}= {"username":"gold_user"}
Please enter an attribute that you would like to find anomalies in
    e.g. timestamp
```

```
Attribute= location
looking for anomalies in location among elements with {"username":"gold_user"}
lats:
39.0012,33.9849,39.0012,39.0012
longs:
-76.9317,-81.025,-76.9317,-76.9317
37.747125
4.718112316874988
-77.955025
3.141582166875003
0.7181485929428018 0.7181485929428022
0.04163225622387988 0.041632256223879845
0.7181485929428018 0.7181485929428022
0.7181485929428018 0.7181485929428022
anoms
[ [ 33.9849, -81.025 ] ]
```

```
platform: MacIntel
userAgent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_10_2) AppleWebKit/600.4.10 (KHTML, like Gecko) Version/8.0.4 Safari/600.4.10
ip: 207.144.189.194
latitude: 33.9849
longitude: -81.025
country: United States
timeZone: America/New_York
screenSize: 1440x900x24
plugins: AdobeAAMDetect,AdobeAAMDetect.plugin,AdobeExManDetect,AdobeExManDetect.plugin,Default Browser Helper,Default
Browser.plugin,Shockwave Flash,Flash Player.plugin,Google Talk Plugin,googletalkbrowserplugin.plugin,Java Applet Plug-
in,JavaAppletPlugin.plugin,Google Talk Plugin Video Renderer,oidbrowserplugin.plugin,QuickTime Plug-in 7.7.3,QuickTime Plugin.plugin,Sh
rowser Plug-in,SharePointBrowserPlugin.plugin,Silverlight Plug-in,Silverlight.plugin,WebKit built-in PDF,
fonts: Flash:Abadi MT Condensed Extra Bold,Abadi MT Condensed Light,Adobe Caslon Pro,Adobe Devanagari,Adobe Garamond Pro,American
Typewriter,Andale Mono,Apple Chancery,Apple Color Emoji,Apple Symbols,Arial,Arial Black,Arial Narrow,Arial Rounded MT Bold,Arial Unic
MS,Ayuthaya,Bangla MN,Bangla Sangam MN,Baskerville,Baskerville Old Face,Batang,Bauhaus 93,Bell MT,Bernard MT Condensed,Birch Std,L
Std,Bodoni Ornaments,Book Antiqua,Bookman Old Style,Braggadocio,Britannic Bold,Calibri,Calisto MT,Cambria,Cambria
Math,Candara,Century,Century Gothic,Century Schoolbook,Chalkboard,Chalkduster,Chaparral Pro,Cochin,Colonna MT,Comic Sans
MS,Consolas,Constantia,Cooper Black,Copperplate,Copperplate Gothic Bold,Copperplate Gothic Light,Corbel,Courier,Courier New,Curlz
MT,Desdemona,Devanagari Sangam MN,Didot,Edwardian Script ITC,Engravers MT,Euphemia UCAS,Eurostile,Footlight MT Light,Franklin Go
Book,Franklin Gothic Medium,Gabriola,Garamond,Georgia,Giddyup Std,Gill Sans,Gill Sans MT,Gloucester MT Extra Condensed,Goudy
Style,Gujarati Sangam MN,Gulim,Gurmukhi MN,Gurmukhi Sangam MN,Haettenschweiler,Harrington,Helvetica,Helvetica Neue,Herculanum,Ho
Text,Impact,Imprint MT Shadow,InaiMathi,Kannada MN,Kannada Sangam MN,Khmer MN,Khmer Sangam MN,Kino MT,Krungthep,Lao MN,L
Sangam MN,LiHei Pro,LiSong Pro,Lithos Pro,Lucida Blackletter,Lucida Bright,Lucida Console,Lucida Grande,Lucida Sans Unicode,Luminari,M
MN,Malayalam Sangam MN,Matura MT Script Capitals,Meiryo,Microsoft Himalaya,Microsoft Sans Serif,Microsoft Tai Le,Microsoft Yi
Baiti,MingLiU,MingLiU-ExtB,MingLiU_HKSCS,MingLiU_HKSCS-ExtB,Minion Pro,Mistral,Modern No. 20,Monaco,Monotype Corsiva,MS Go
Mincho,MS PGothic,MS PMincho,MS Reference Sans Serif,Myanmar MN,Myanmar Sangam MN,Myriad Arabic,Myriad Hebrew,Myriad Pro,Na
Brush Script,Nanum Pen Script,NanumGothic,NanumMyeongjo,News Gothic MT,OCR A Std,Onyx,Oriya MN,Oriya Sangam MN,Osaka,Osaka-
Mono,Palatino,Palatino Linotype,Papyrus,Perpetua,Plantagenet Cherokee,Playbill,PMingLiU,PMingLiU-ExtB,PT Mono,PT Sans,PT Sans Caption
Sans Narrow,PT Serif,PT Serif Caption,Rockwell,Rockwell Extra Bold,Rosewood Std,Sathu,Seravek,Shree Devanagari 714,SignPainter-
HouseScript,Silom,SimHei,SimSun,SimSun-ExtB,Sinhala MN,Sinhala Sangam MN,Snell Roundhand,Stencil,STFangsong,STHeiti,STIXGeneral-
Bold,STIXGeneral-Italic,STKaiti,STSong,STXihei,Tahoma,Tamil MN,Tamil Sangam MN,Telugu MN,Telugu Sangam MN,Thonburi,Times New
Roman,Trajan Pro,Trattatello,Trebuchet MS,Tw Cen MT,Verdana,Wide Latin,Wingdings,Wingdings 2,Wingdings 3,Zapfino
timestamp: 2015-04-30 23:17:55 -04:00
control: null
username: gold_user
```

```
_id: 5542f1a2d3f8e43c652a74e7
appName: Mozilla
appCodeName: Mozilla
appName: Netscape
cookieEnabled: true
language: en-US
platform: MacIntel
userAgent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_9_5) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/42.0.2311.135 Safari/537.36
ip: 50.204.167.25
latitude: 39.0012
longitude: -76.9317
country: United States
```

Sort By Attribute, Filter By Value

```
What attribute would you like to sort by? timestamp
null:
2015-04-30 22:13:19 -04:00
david:
2015-04-30 22:13:44 -04:00
null:
2015-04-30 22:16:24 -04:00
null:
2015-04-30 22:18:41 -04:00
null:
2015-04-30 22:42:32 -04:00
cmssc435:
2015-04-30 22:43:23 -04:00
gold_user:
2015-04-30 22:45:42 -04:00
null:
2015-04-30 22:46:45 -04:00
Joe:
2015-04-30 22:49:08 -04:00
Evan:
2015-04-30 22:53:27 -04:00
gold_user:
2015-04-30 23:17:55 -04:00
gold_user:
2015-04-30 23:23:14 -04:00
gold_user:
2015-04-30 23:23:19 -04:00
```

```
cmssc435@volition:~/dev$ node FilterByValue.js
Queries should be phrased in JSON format.
E.G. { "username": "bob" }. For inequality, the value should be a second JSON pair
E.G. {"latitude": {"$gt": 30, "$lt": 40}, "longitude": {"$gt": -80, "$lt": -70}}
What attribute/value would you like to sort by?{"platform": "Linux x86_64"}
{ platform: 'Linux x86_64' }
null
david
null
cmssc435
null
null
```

Next Steps

- Further functionality validation
- Sample study
 - 25+ users
 - ~Seven days
 - Involvement of control users

Browser Fingerprinting

Goldfinger

David Banks, Mitchell Tracy, Richard Lou, Joseph Brosnihan, Jeremy Feldman,
Aaron Lopez, Evan Fischell