

LINGI1341 - Analyse de site web

Projet 2 - www.bbc.com

Guillaume Calmant
Université Catholique de Louvain
Sciences informatiques
NOMA : 62991200
Email: guillaume.calmant@student.uclouvain.be

Abstract—This paper has been written for the course of *Computer networks : information transfer* taught by Pr. Olivier Bonaventure at EPL, the polytechnics school of UCL. We were asked to analyze a website chose among others, with some criteria.

I. INTRODUCTION

The British Broadcasting Corporation ¹ is a public service broadcaster located in London. Founded in 1922, the domain of the service was registered in 1994 and the website launched in 1997. To inspect this website, we are going to, firstly, to analyze the *HTTP* traffic. Furthermore, we will perform a *DNS* analysis, followed by an examination of the *TCP* use on the website to conclude with the *DNSSEC* and the *TLS* protocols.

II. HTTP

A. Domains

With an empty cash, using *Chrome* 62.0.3202.89 for *Linux*, we can notice the fast display of the content, inducing certainly a use of *CDNs*², because of the amount of medias presents on the homepage. Thanks to the network inspector we can go deeply, even produce a *HAR*³ file and reveal more than seventy-five different domains contacted in order to display the index. These domains are mainly reached to call scripts, load some medias (images, videos, graphics,...) and harvest analytic data. We will provide the listed domains contacted.

As you can see in annexes, *fig 1*, many of the domains are contacted to harvest analytic data or broadcast images. The analytic part is done by different ways, in example the scripts collect data trough adds ⁴, videos, images and sometimes games. The data is useful for the broadcaster to enhance the performance of the website, deliver more pertinent and cheaper advertisements⁵, have a better knowledge of their users and how their data is distributed in the world. In example, one of the technologies used by *bbc*, developed by *Drawbridge*, can guess if different users consult the website on the same device⁶. Other enhancements are performed, two connections can be

opened when the broadcaster call a domain; some service propose cookies to *sniff* the client's connection⁷, collecting per example data on what website he visited, which was its title, IP address, ... ⁸; etc. All the data is kept⁹, compute and used thanks to diverse techniques of data mining ^{10 11 12}. All the cookies used by *bbc* is listed and detailed at this link: <http://www.bbc.com/usingthebbc/cookies/how-does-the-bbc-use-cookies/>.

B. Resources

For example, we analyze the homepage, Between 130 and 500 (1.2 MB up to 3.6 MB) requests performed depending of the cache, the path, re-transmissions, scroll ,... For a time varying from approximately 2sec (from London, UK with cached data) up to 21sec (Vancouver, Canada with an empty cache). Behind this analysis we can highlight the fact that there is a bad optimization of the resources distributed on this page. It may come from cached elements and render blocking elements (directly impacting on the *DOM* contents loaded) because of the loading time contrast.

From our *HAR* file with no cached elements we can list the resources :

| Object | size (in KB) | Requests |
|--------|--------------|----------|
| Image | 1200 | 81 |
| HTML | 871.9 | 18 |
| Script | 647.1 | 58 |
| CSS | 75.3 | 10 |
| Other | 6.7 | 6 |
| TOTAL | 3600 | 173 |

Clearly, the important number of images and elements are slowing down the display of the page¹³. We can improve this by more compressing images, combining and minifying scripts and enhancing how the data is cached (in the browser). Some of the static have no, or small, *max-age* or *expires* flags value set. It's sometimes due to the analytic and the need of fresh data, however there's no reason for the *favicon*, for example, to expires in 11.1 hours.

¹B.B.C.

²Content Delivery Network, per example *fastly* *akamai*, used by the website, uses to enhance the performances delivering data geographically

³<http://www.softwareishard.com/blog/har-12-spec/>

⁴per example with *adexchange*

⁵Many services proposed to the website managers work on an auction system for using adds

⁶*adsymptotic.com*

⁷*effectivemeasure.net*

⁸*seb.scorecardresearch.com*

⁹"up to 90 days. When it is aggregated to observe trends, it may be used for analytic purposes indefinitely." (<http://www.effectivemeasure.com/privacy-policy/>)

¹⁰*static.adsafeprotected.com*

¹¹<https://www.headerdirect.com>

¹²<https://www.stackadapt.com/privacy>

¹³fig 8

Furthermore, render blocking scripts slow down the *DOM* construction¹⁴. Many third-party, and internal¹⁵, script call *Document.write* and this should be avoid using asynchronously *javascript*¹⁶.

C. TCP ports

With the use of *tcpsnitch*¹⁷ we can retrieve a *.pcap* file from a *firefox*¹⁸ session and perform analyses about the *tcp* ports used thanks to *Wireshark*¹⁹. On this website the only used ports are 80 and 443.

D. HTTP requests and responses

HTTP uses *TCP* to transfer data, accessing servers thanks to an address trough a port. Some ports are reserved for a range of applications, including *HTTP*. The most used ports for *http* are, 80, 443 (*https*) and 8080 (*webcache*).²⁰ BBC's webserver uses *HTTP/1.1*²¹, by default using a *keep-alive* connection. Thanks to the previous retrieved *.pcap* files we can observe the *tcp* traffic and so the *http* requests and responses.

E. Non-standard and special use of headers

- **X-Cache:** this header is used to inform if a requested file is found or not, cached, in a *CDN* per example. *X-Cache:* HIT means that the requested file was served from cache and MISS a not served file. Other *Varnish*²² headers are used to deal with the cached data, as *X-Cache-Hits*, *X-Cache-Age*, *X-Cache-Action*,... .
- **Access-Control-Allow-Origin:** Header from *CORS*²³, standing for *cross-origin resource sharing*, permit to build a web-page while performing *cross-site HTTP* requests. That means we can retrieve, per example, an image from a *CDN*, text from our personal server and other resources from different domains. This header in particular "indicates whether the response can be shared with resources with the given origin."^{24 25} The wildcard value is not a problem if the cross domain policy is well configured.²⁶ The real question is can I trust these domains and are they secured.²⁷
- **X-PAL-Host:** indicating an address, pal138.back.live.telhc.local:80. After some researches, we find a post²⁸ written by *Tom Pride*²⁹, who perform multiple works for the *bbc*. In this post, Tom asks

for help while configuring *DRDB*³⁰ nodes for the *bbc* and paste his configuration file. Thanks to this we can collect more information on the *bbc*'s servers. We can firstly observe some addresses assigned to nodes: 172.23.8.69 and 172.23.8.70. According to *rfc1918*³¹ these are addresses for private internets. *DRDB* stands for *Distributed Replicated Block Device* and is used to link and synchronize by replication some devices as nodes of the network.³² Furthermore, thanks to *heartbeat*³³, when a server experience errors the second server take automatically its role. "Tom, ... Please don't paste inline this time, ..." ^{34 35}

- **x-amz-...:** headers use by Amazon Simple Storage Service thanks to deliver files.³⁶.
- **Vary :** indicates that a server response is based on the *Origin* header. (*Origin*, *X-CDN*, ...)
- **X-Fastly-...:** headers from *Fastly CDN*.³⁷

We may see here some problems concerning the security and the lack of certain headers, but we can see the missing headers on credentials data:³⁸

- *X-Frame-Options: DENY:* "indicates a policy that specifies whether the browser should render the transmitted resource within a <frame> or an <iframe>."³⁹
- *X-Content-Type-Options: nosniff:* "indicate that the MIME types advertised in the Content-Type headers should not be changed and be followed."⁴⁰
- *x-permitted-cross-domain-policies:none* "instructs Flash and PDF files that they should read"⁴¹, here, none cross domain policies.
- *x-xss-protection:1; mode=block:* "stops pages from loading when they detect reflected cross-site scripting (XSS) attacks."⁴²
- *cache-control:no-cache,private,no-store:* used to define the cache policies.
- *strict-transport-security:max-age=31536000:* to force the use of *https* during the *max-age* time.
- *P3P:policyref= :* to define the *P3P* policies.⁴³ ...

¹⁴fig 9

¹⁵*bbcookies*

¹⁶<https://github.com/kruX/postscribe>

¹⁷<https://github.com/GregoryVds/tcpsnitch>

¹⁸Version 57.0.1 (64 bits) for Ubuntu

¹⁹Version 2.2.6

²⁰Other reserved ports : 9443, 10011 and 11371

²¹<https://tools.ietf.org/html/rfc2616>

²²<https://varnish-cache.org/>

²³https://developer.mozilla.org/en-US/docs/HTTP/Access_control_CORS

²⁴<https://developer.mozilla.org/en-US/docs/Web/HTTP/Headers/Access-Control-Allow-Origin>

²⁵<https://www.w3.org/TR/cors/#resource-implementation>

²⁶<http://www.bbc.com/crossdomain.xml>

²⁷<http://blog.h3xstream.com/2015/04/crossdomainxml-beware-of-wildcards.html>

²⁸<http://narkive.com/sn0WOxkE>

²⁹<https://www.linkedin.com/in/tompride1>

³⁰<https://docs.linbit.com/>

³¹<https://tools.ietf.org/html/rfc1918>

³²see fig 10

³³<http://linux-ha.org/wiki/Heartbeat>

³⁴<https://lists.gt.net/linuxha/pacemaker/75542>

³⁵<https://cwe.mitre.org/data/definitions/200.html>

³⁶<http://docs.aws.amazon.com/AmazonS3/latest/API/Welcome.html>

³⁷<https://docs.fastly.com/guides/api-caching/implementing-api-cache-control>

³⁸after logged in even more headers are used

³⁹<https://tools.ietf.org/html/rfc7034page-4>

⁴⁰<https://developer.mozilla.org/fr/docs/Web/HTTP/Headers/X-Content-Type-Options>

⁴¹<https://danielnixon.org/http-security-headers/>

⁴²<https://developer.mozilla.org/en-US/docs/Web/HTTP/Headers/X-XSS-Protection>

⁴³<https://www.w3.org/2002/04/P3Pv1-header.html>

III. DNS

Thanks to *dig* and *nslookup* commands, *dnsmap*⁴⁴ tool and *.pcap* files we can perform analysis on the *DNS* records and traffic.

A. Domains

| Name servers | IPv4 | IPv6 |
|----------------|---------------|-------------------|
| ns4.bbc.net.uk | 156.154.65.17 | 2610:a1:1014::17 |
| ns3.bbc.co.uk | 156.154.66.17 | 2610:a1:1015::17 |
| ns4.bbc.co.uk | 156.154.67.17 | 2001:502:4612::17 |
| ns3.bbc.net.uk | 156.154.64.17 | 2001:502:f3ff::17 |

Listed above the servers authoritative for the zone *ns.bbc.co.uk*. The start of authority reports a responsible, *hostmaster.bbc.co.uk*, a serial changing when the domain is updated, *2017101601*, the number of seconds before the *NS* servers should update their serial numbers, *1800*, the number of seconds before the *NS* servers should update their serial numbers if previously failed *600*, the number of seconds after which the *NS* expires and the *TTL* or *minimum* field. According to *rfc2308*⁴⁵ this field "has been overloaded in the past to have three different meanings" and is now the time to cache a negative response.

B. TTL

Each record has its own *TTL*, the time in seconds, after which the record is refreshed. Thus a small *TTL* ensures that if a record is invalid, it will not stay too long. We can observe that *BBC*'s records have really short *TTL*, 5 (for *A* and *MX* records) or 15 minutes (for any else record). It can be short for multiple reasons, avoiding cache poisoning is a good one since the broadcaster has been targeted by *DDoS* attacks he's surely concerned by *DNS* attacks. However, *DNSSEC* is not set and thus these *TTLs* are maybe not set for a security purpose. Nevertheless a short *TTL* is recommended for a *DNS* fail-over⁴⁶ mechanism, which is clearly in the spirit of *Linux-HA* and *DRBD*. Shorter *TTL* for *A* and *MX* records are set certainly because, on one hand *IPv4* is still more used than *IPv6* and on the other hand *BBC* surely wants to be easily reached by mails. We can remark the *Pride* has also implemented the *squid-cache* proxy technology reducing bandwidth and response time.

C. Records

The *TXT* records are here used to perform domain validations on keys given for three different services *Microsoft Office 365*, *Amazon SES* and *Dropbox Business*.

D. Other records

Other records can be retrieve in the *DNS* analysis, such as the *SPF* record which stand for sender policy framework. It's an email-validation system ton avoid spamming, spoofing, injecting, etc.⁴⁷ *SPF v=spf1 ip4:212.58.224.0/19 ip4:132.185.0.0/16 ip4:78.136.53.80/28 ip4:78.136.14.192/27 ip4:78.136.19.8/29 ip4:89.234.10.72/29 ip4:74.112.66.33 ip4:208.251.80.51 ip4:89.202.185.0/24 ip4:207.159.133.98*

| Record type | name | value |
|-------------|------------------------------|--|
| MX | cluster8.eu.messagegabs.com | 85.158.137.99 |
| MX | cluster8.eu.messagegabs.com | 85.158.137.19 |
| MX | cluster8.eu.messagegabs.com | 85.158.140.211 |
| MX | cluster8.eu.messagegabs.com | 85.158.140.195 |
| MX | cluster8.eu.messagegabs.com | 85.158.139.51 |
| MX | cluster8.eu.messagegabs.com | 85.158.139.35 |
| MX | cluster8.eu.messagegabs.com | 85.158.139.19 |
| MX | cluster8a.eu.messagegabs.com | 85.158.139.103 |
| A | bbc.com | 212.58.246.78 |
| A | bbc.com | 212.58.246.79 |
| A | bbc.com | 212.58.244.22 |
| A | bbc.com | 212.58.244.23 |
| AAAA | bbc.com | 2001:41c1:4008::bbc:2 |
| AAAA | bbc.com | 2001:41c1:400c::bbc:1 |
| AAAA | bbc.com | 2001:41c1:400c::bbc:4 |
| AAAA | bbc.com | 2001:41c1:4008::bbc:3 |
| AAAA | bbc.com | 2001:41c1:4008::bbc:4 |
| AAAA | bbc.com | 2001:41c1:400c::bbc:3 |
| AAAA | bbc.com | 2001:41c1:4008::bbc:1 |
| AAAA | bbc.com | 2001:41c1:400c::bbc:2 |
| SOA | ns.bbc.co.uk | 132.185.161.100 |
| NS | ns4.bbc.net.uk | 156.154.65.17 |
| NS | ns4.bbc.net.uk | 2610:a1:1014::17 |
| NS | ns3.bbc.co.uk | 156.154.66.17 |
| NS | ns3.bbc.co.uk | 2610:a1:1015::17 |
| NS | ns4.bbc.co.uk | 156.154.67.17 |
| NS | ns4.bbc.co.uk | 2001:502:4612::17 |
| NS | ns3.bbc.net.uk | 156.154.64.17 |
| NS | ns3.bbc.net.uk | 2001:502:f3ff::17 |
| TXT | bbc.com | MS=ms25863558 |
| TXT | bbc.com | Fzj91DPHcxL3FxKMIBraJ9CajRin4nqr8... |
| TXT | bbc.com | dropbox-domain-verification=mtgv0f2pudoz |

ip4:207.159.133.99 include:msgfocus.com include:email1.com include:mktomail.com include:servers.mcsrv.net include:redsnapper.net ?all

Contained in another *TXT* record, we can find the *SPF* record.

- *TXT bbc.com v=spf1 ip4:212.58.224.0/19 ip4:132.185.0.0/16 ip4:78.136.14.192/27 ip4:78.136.19.8/29 ip4:89.234.10.72/29 ip4:74.112.66.33 ip4:208.251.80.51 ip4:89.202.185.0/24 ip4:207.159.133.98 include:msgfocus.com include:email1.com include:mktomail.com include:servers.mcsrv.net include:redsnapper.net ?all.*

The last record found is the *SRV* informing on the servers services.⁴⁸

- *SRV _sip._tls.bbc.com sip.bbc.com 207.82.79.70 443 0 SRV _sip._tls.bbc.com sip.bbc.com 207.82.79.73 443 0 SRV _xmpp-server._tcp.bbc.com sip.bbc.com 207.82.79.70 5269 0 SRV _xmpp-server._tcp.bbc.com sip.bbc.com 207.82.79.73 5269 0 SRV _sipfederationtls._tcp.bbc.com sip.bbc.com 207.82.79.70 5061 0 SRV _sipfederationtls._tcp.bbc.com sip.bbc.com 207.82.79.73 5061 0*

E. Sub-domains

With the use of the brute-force tool *dnsmap* we can identify more sub-domains than already known from *bbc.com*, listed below. Two of these revealed us an internal *ip* which can be seen as an information exposure.⁴⁹

⁴⁴<https://github.com/makefu/dnsmap>

⁴⁵<https://tools.ietf.org/html/rfc2308>

⁴⁶<https://www.dynu.com/DNS-Failover>

⁴⁷<https://tools.ietf.org/html/rfc7208>

⁴⁸<https://tools.ietf.org/html/rfc2782>

⁴⁹<https://cwe.mitre.org/data/definitions/200.html>

- as.bbc.com : IPv4 address #1: 132.185.162.193.
- av.bbc.com : IPv4 address #1: 207.82.79.75, IPv4 address #2: 207.82.79.72.
- beta.bbc.com : IPv4 address #1: 212.58.244.82, IPv4 address #2: 212.58.246.113.
- li.bbc.com : IPv4 address #1: 95.182.253.49, IPv4 address #2: 95.182.253.48.
- m.bbc.com : IPv4 address #1: 212.58.246.173, IPv4 address #2: 212.58.244.162.
- mobile.bbc.com : IPv4 address #1: 212.58.246.186, IPv4 address #2: 212.58.244.29.
- sandbox.bbc.com : IPv4 address #1: 192.168.193.10.
- search.bbc.com : IPv4 address #1: 212.58.246.160, IPv4 address #2: 212.58.244.157.
- shop.bbc.com : IPv4 address #1: 207.159.133.98.
- test.bbc.com : IPv4 address #1: 212.58.228.13, IPv6 address #1: 2001:41c1:4008:d::bbc:88, IPv6 address #2: 2001:41c1:4008:d::bbc:89.
- tv.bbc.com : IPv4 address #1: 104.120.249.95.
- webmail.bbc.com : IPv4 address #1: 132.185.162.192.
- www.bbc.com : IPv4 address #1: 212.58.246.95, IPv4 address #2: 212.58.244.71.
- localhost.bbc.co.uk : IPv4 address #1: 127.0.0.1.⁵⁰
- er.bbc.co.uk : IPv4 address #1: 10.72.136.19.
- ...

IV. TCP

Again the retrieved files with the help of *tcpshitch* will help us to perform analyzes. Also we add to *wireshark* the *tcp.flags.reset==1 or tcp.flags.fin==1* filter to have a better sketch of the used *tcp* connections. So we can observe only one connection to *bbc.com* and five simultaneous *tcp* connections when communicating to an *akamai* server.⁵¹ To learn more about the options used by *tcp* protocol on the *BBC* website, we can make further investigations using *tracebox*⁵². Performing these analysis highlights the fact that the *tcp* protocol on the broadcaster side is the most basic version of *tcp*. It does not implements the padding, the fast open or the explicit congestion notification option. So basically it only supports window scale, timestamps and selective acknowledgements. Also during the research we noticed that each connection terminate with the *FIN* bit set and not the *RST*.

V. TLS AND DNSSEC

As previously seen the *DNSSEC* is not configured for *bbc.com*⁵³, confirmed by *Verisign labs*⁵⁴. For *TLS*, *SSL Labs*⁵⁵ give a grade of *A* for every tested

addresses. The broadcaster uses *TLS v1.2*⁵⁶ and thanks to *OpenSSL* we can ask the certificate. Then we retrieve multiple information in the *SSL* certificate, for example the *British Broadcasting Corporation* has the serial *18EBFFD5FE552205E9EE29DB* and the fingerprint *E14E0B9F8C3F3BA7A2F0F2C6ECCE8983C38349955ED591964275A18D61129171*. Using the protocol versions and features, we can inform us on what is supported by the server. It only supports *secure renegotiation* and *downgrade protection* features and has a weak *triple data encryption*. To conclude this section, it does not support compression and may be vulnerable to *CRIME*⁵⁷.

VI. CONCLUSION

The British broadcaster uses multiple *CDNs* in order to deliver information in an efficiently manner to his public and also make a lot of analytic to enhance the visit of the users on the website. We have seen the impact of resources on a the the loading of a page and the importance of avoiding render blocking elements. We listed and detailed some non-standard headers and special use of generic headers, discovering some technologies implemented on the web-server and much more. Then we performed a *DNS* detailing some records and reveal internals *ips*. *TCP* section has mainly highlights the possibility of a browser and a server to communicate trough simultaneous *TCP* connections. We finally noticed some potentially weaknesses trough the *TLS* paragraph and remind the importance of paying attention even in a "secure" protocol.

VII. ANNEXES

⁵⁰<https://www.acunetix.com/vulnerabilities/web/same-site-scripting>

⁵¹see fig 11

⁵²<http://www.tracebox.org>

⁵³see fig 12

⁵⁴<http://dnssec-debugger.verisignlabs.com>

⁵⁵<https://www.ssllabs.com/ssltest>

⁵⁶not vulnerable to CVE-2014-3566

⁵⁷<https://cve.mitre.org/cgi-bin/cvename.cgi?name=cve-2012-4929>

Fig. 1. Domains contacted for the index page (excluding domains belonging to *bbc*)

| Domain | Type | Server | Organization |
|-----------------------------------|----------------|-------------------|----------------------------|
| acuityplatform.com | Adds/Analytics | Apache | AcuityAds Inc |
| ad.crowdnlr.net | Analytics | Nginx | Lotame Solutions, Inc. |
| adservice.google.com | Adds/Analytics | | Google Inc. |
| b.scorecardresearch.com | Analytics | | TMRG, Inc |
| b1sync.zemanta.com | Adds/Analytics | | Outbrain |
| bcp.crowdnlr.net | Analytics | Nginx | Lotame Solutions, Inc. |
| bh.contextweb.com | Analytics | Jetty | ContextWeb |
| bttrack.com | Analytics | Apache | Domains By Proxy, LLC |
| cm.g.doubleclick.net | Adds/Analytics | Google App Engine | Google Inc. |
| csi.gstatic.com | CDN/Analytics | | Google Inc. |
| dev.visualwebsiteoptimizer.com | Analytics | | Privacy Protect, LLC |
| dmpsync.3lift.com | Adds/Analytics | | Wohis Privacy Service |
| dpm.demdex.net | Analytics | | Adobe Systems Incorporated |
| dsp.videostat.com | Adds/Analytics | Nginx | Giant Media |
| dt.adsafeprotected.com | Adds/Analytics | Nginx | Integral Ad Science, Inc. |
| eb2.3lift.com | Adds/Analytics | | Wohis Privacy Service |
| edigitalsurvey.com | Analytics | | Maruadr |
| ev.lrtb.woobi.com | Adds/Analytics | | Social Tokens Ltd |
| googleads.g.doubleclick.net | Adds | Google App Engine | Google Inc. |
| ib.3lift.com | Adds/Analytics | | Wohis Privacy Service |
| ib.adnxs.com | Adds/Analytics | Apache | AppNexus |
| idsync.ricdn.com | CDN | | LiveRamp, Inc. |
| match.adsrvr.org | Analytics | Windows Server | Domains By Proxy, LLC |
| me-cdn.effective-measure.net | Analytics | Nginx | Effective Measure |
| p.adsymptotic.com | Adds/Analytics | Apache | Drawbridge Inc |
| pagead2.googlesyndication.com | Adds | | Google Inc. |
| ping.chartbeat.net | Analytics | Nginx | Chartbeat |
| pix.impedesk.com | Adds/Analytics | Nginx | Infectious Media |
| pixel-a.sitescout.com | Adds | Apache | Centro Media, Inc |
| pixel.adsafeprotected.com | Adds/Analytics | Nginx | Integral Ad Science, Inc. |
| pixel.tapad.com | Analytics | Nginx | Tapad, Inc. |
| pixels.dsp.theadtech.com | Analytics | Nginx | |
| pr-bh.ytp.yahoo.com | Adds/Analytics | Apache | Yahoo! Inc. |
| px.adhigh.net | Analytics | Nginx | GetIntent Ltd |
| px.powerlinks.com | Analytics | Nginx | PowerLinks Media Limited |
| r.nexac.com | Adds/Analytics | | Oracle Corporation |
| rp.wallet.com | Adds/Analytics | | RadiumOne, Inc. |
| rtb.gumgum.com | Adds/Analytics | Nginx | Oracle Corporation |
| s.effective-measure.net | Adds/Analytics | Nginx | |
| seb.scorecardresearch.com | Analytics | Apache | TMRG, Inc |
| securepubads.g.doubleclick.net | Adds | | Google Inc. |
| sp.mdolabs.com | Analytics | | ComScore, Inc |
| stag.mdolabs.com | Analytics | | ComScore, Inc |
| static.adsafeprotected.com | Adds/Analytics | Nginx | Integral Ad |
| static.chartbeat.com | Analytics | Nginx | Chartbeat |
| su.addthis.com | Analytics | | Oracle Corporation |
| sync-tm.everesttech.net | Analytics | Jetty | Adobe Systems |
| sync.go.sonobi.com | Adds/Analytics | | |
| sync.header.direct | Adds/Analytics | | TripleLift |
| sync.ipredictive.com | Analytics | Apache | Adelphic, Inc. |
| sync.mathtag.com | Analytics | Apache | Contact Privacy |
| sync.srv.stackadapt.com | Adds/Analytics | Nginx | Collective Roll |
| tags.bluekai.com | Analytics | | Oracle Corporation |
| tags.crowdnlr.net | Analytics | Nginx | Lotame Solutions, Inc. |
| tlx.3lift.com | Adds/Analytics | | Wohis Privacy Service |
| tpc.googlesyndication.com | Adds/Analytics | | Google Inc. |
| triplelift.px.ace.advertising.com | Adds/Analytics | | Wohis Privacy Service |
| triplelift.rtb.adx1.com | Adds/Analytics | | Wohis Privacy Service |
| uid.metadsp.co.uk | Adds/Analytics | Apache | Netnames Ltd |
| www.storygize.net | Adds/Analytics | | Privacy Protect, LLC |
| x.bidswitch.net | Adds/Analytics | Nginx | |

Fig. 2. Oracle Data Cloud services (http://www.bluekai.com/consumers_howdoesitwork.php)
How Does It Work?

Here's a step-by-step process of how the Oracle Data Cloud interacts with consumers:

- ✓ Jasmine is shopping online for air travel between New York to Hawaii. As she visits different online travel sites that partner with Oracle Data Cloud, we store an anonymous cookie on her browser.
- ✓ Because of her activity, Oracle Data Cloud associates Jasmine's computer as being interested in Hawaiian travel. If Jasmine visits the Oracle Data Cloud she will notice that Hawaiian travel is noted as one of her interests.
- ✓ As a result, Oracle Data Cloud's marketing partners will show interest-based ads on Jasmine's computer that are relevant to Hawaii travelers. (For a limited amount of time.)
- ✓ From the Oracle Data Cloud, Jasmine can update her preferences by removing her Hawaiian travel interest segment or opting out from cookie-based interest-based advertising facilitated by the Oracle Data Cloud (BlueKai and DataLogix) in the Oracle Data Cloud Registry

Fig. 3. Storygize solutions(<http://www.storygize.com/>)

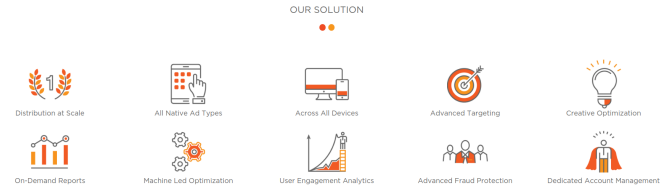


Fig. 4. statistics on the har file produce, the 11/16/2017 at 14:11:37, with Chrome (<http://www.softwareishard.com/blog/har-viewer/>)

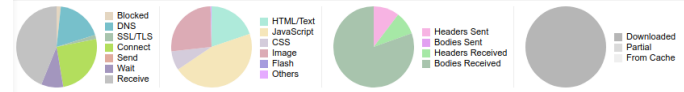


Fig. 5. statistics on the har file produce, the 11/28/2017 at 15:11:00, with Chrome (<http://www.softwareishard.com/blog/har-viewer/>)



Fig. 6. Content size by content type
Done with www.meta-chart.com
Data from tools.pingdom.com

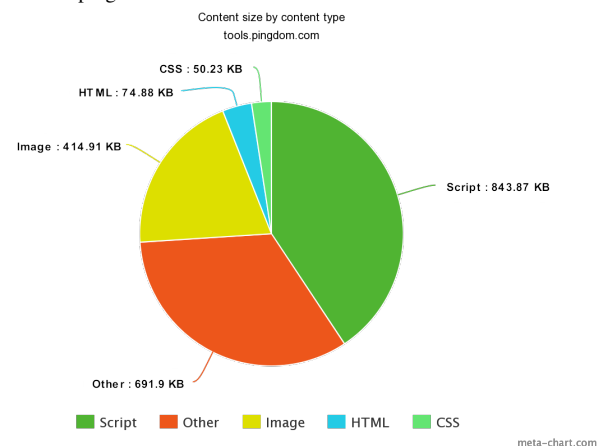
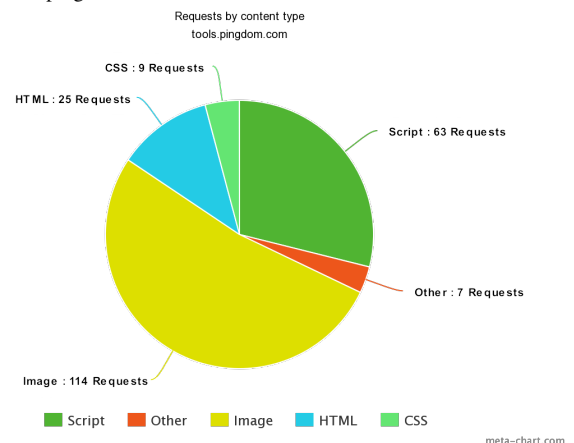


Fig. 7. Requests by content type
Done with www.meta-chart.com
Data from tools.pingdom.com



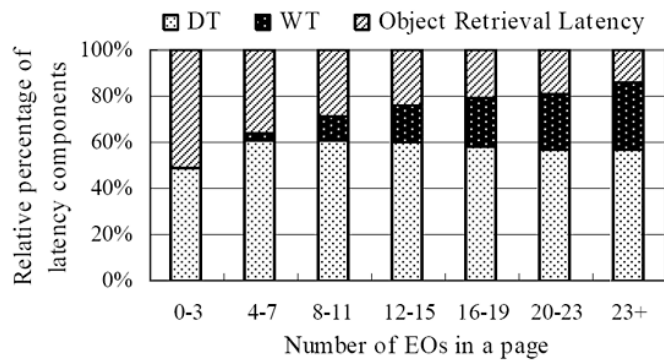


Fig. 8. Figure II-3. Relative distribution of latency components showing that object overhead dominates web page latency. Website Optimization: Speed, Search Engine & Conversion Rate Secrets by Andrew B. King

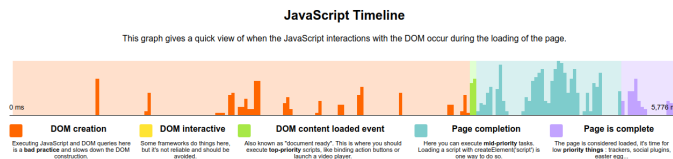


Fig. 9. <http://yellowlab.tools> analyze on bbc.com

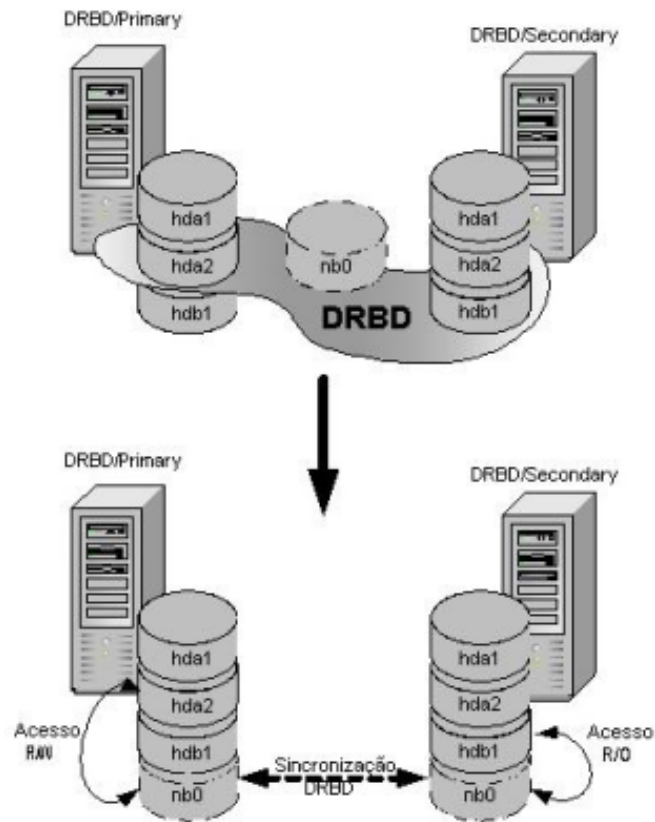


Fig. 10. DRBD concept overview from https://upload.wikimedia.org/wikipedia/commons/5/5b/DRBD_concept_overview.png

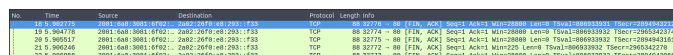


Fig. 11. Akamai tcp connection

| | |
|------------|---|
| com | <ul style="list-style-type: none"> Found 1 DS records for com in the . zone DS=30909/SHA-256 has algorithm RSASHA256 Found 1 RRSIGs over DS RRset RRSIG=46809 and DNSKEY=46809 verifies the DS RRset Found 2 DNSKEY records for com DS=30909/SHA-256 verifies DNSKEY=30909/SEP Found 1 RRSIGs over DNSKEY RRset RRSIG=30909 and DNSKEY=30909/SEP verifies the DNSKEY RRset |
| bbc.com | <ul style="list-style-type: none"> No DS records found for bbc.com in the com zone No DNSKEY records found www.bbc.com is a CNAME to www-bbc-com.bbc.net.uk No RRSIGs found |
| uk | <ul style="list-style-type: none"> Found 1 DS records for uk in the . zone DS=43876/SHA-256 has algorithm RSASHA256 Found 1 RRSIGs over DS RRset RRSIG=46809 and DNSKEY=46809 verifies the DS RRset Found 2 DNSKEY records for uk DS=43876/SHA-256 verifies DNSKEY=43876/SEP Found 1 RRSIGs over DNSKEY RRset RRSIG=43876 and DNSKEY=43876/SEP verifies the DNSKEY RRset |
| net.uk | <ul style="list-style-type: none"> Found 1 DS records for net.uk in the uk zone DS=7686/SHA-256 has algorithm RSASHA256 Found 1 RRSIGs over DS RRset RRSIG=43056 and DNSKEY=43056 verifies the DS RRset Found 1 DNSKEY records for net.uk DS=7686/SHA-256 verifies DNSKEY=7686 Found 1 RRSIGs over DNSKEY RRset RRSIG=7686 and DNSKEY=7686 verifies the DNSKEY RRset |
| bbc.net.uk | <ul style="list-style-type: none"> No DS records found for bbc.net.uk in the net.uk zone ns0.ft.bbc.co.uk returns FORMERR for bbc.net.uk/DNSKEY ns0.tcams.bbc.co.uk returns FORMERR for bbc.net.uk/DNSKEY ns0.thdow.bbc.co.uk returns FORMERR for bbc.net.uk/DNSKEY ns0.rboov.bbc.co.uk returns FORMERR for bbc.net.uk/DNSKEY Failed to get DNSKEY RR set for zone bbc.net.uk ns0.tcams.bbc.co.uk returns FORMERR for www-bbc-com.bbc.net.uk/A ns0.ft.bbc.co.uk returns FORMERR for www-bbc-com.bbc.net.uk/A ns0.thdow.bbc.co.uk returns FORMERR for www-bbc-com.bbc.net.uk/A ns0.rboov.bbc.co.uk returns FORMERR for www-bbc-com.bbc.net.uk/A No response from bbc.net.uk nameservers |

Fig. 12. <http://dnssec-debugger.verisignlabs.com/www.bbc.com>