Local DNS Policy Disclosure

“Comments on Automating Policy Discovery”

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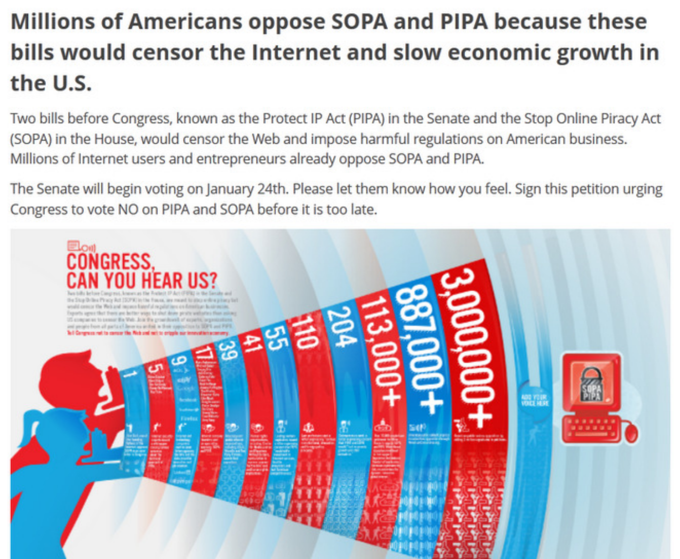
May 13, 2019

Context

- **Caveat: This is replacement talk**
- DNS Filtering perspectives: SOPA/PIPA (Background discussion)

SOPA/PIPA Story

Previously on `google.com`...



Millions of Americans oppose SOPA and PIPA because these bills would censor the Internet and slow economic growth in the U.S.

Two bills before Congress, known as the Protect IP Act (PIPA) in the Senate and the Stop Online Piracy Act (SOPA) in the House, would censor the Web and impose harmful regulations on American business. Millions of Internet users and entrepreneurs already oppose SOPA and PIPA.

The Senate will begin voting on January 24th. Please let them know how you feel. Sign this petition urging Congress to vote NO on PIPA and SOPA before it is too late.

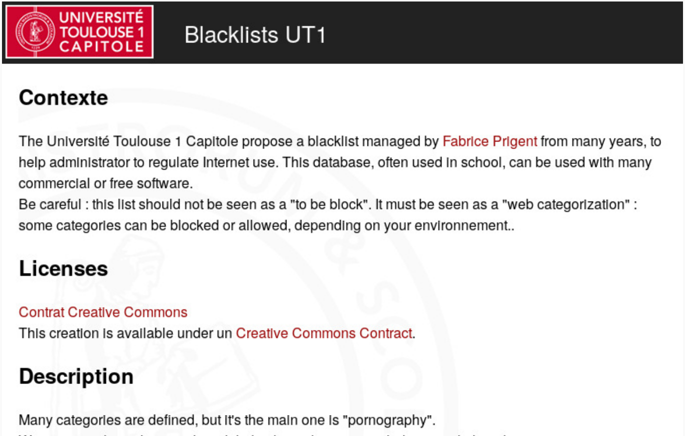
Context

- DNS Filtering perspectives: SOPA/PIPA
- With DOH (and DNSSEC, ECS, etc.) we have new resolution policy issues
- Countless DNS-filtering tools and policy appliances:
    - Many paid for and/or installed by user or site administrator
    - Many opaque and inherent in network access agreements
    - Many illicit or imposed
- Reviewing a few reveals trends

Examples

`https://dsi.ut-capitole.fr/blacklists/index_en.php`

“Be careful : this list should not be seen as a ’to be block’. It must be seen as a ’web categorization’ : some categories can be blocked or allowed, depending on your environnement..”



UNIVERSITÉ TOULOUSE 1 CAPITOLE

Blacklists UT1

Contexte

The Université Toulouse 1 Capitole propose a blacklist managed by Fabrice Prigent from many years, to help administrator to regulate Internet use. This database, often used in school, can be used with many commercial or free software.

Be careful : this list should not be seen as a "to be block". It must be seen as a "web categorization" : some categories can be blocked or allowed, depending on your environnement..

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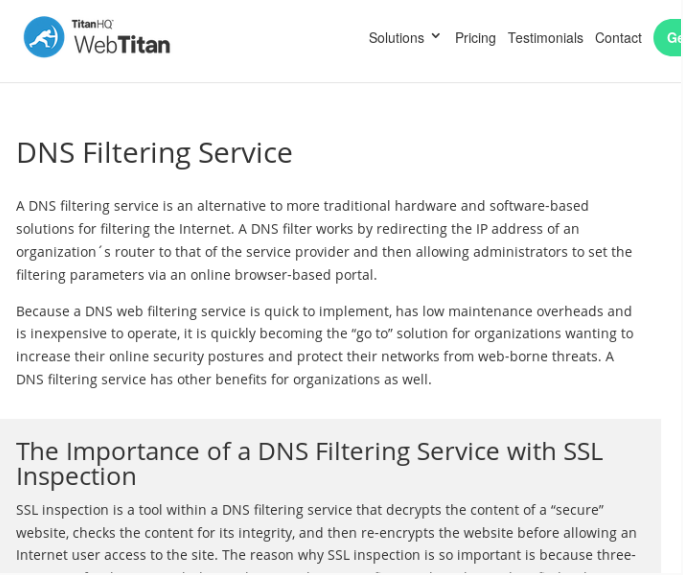
Description

Many categories are defined, but it's the main one is "pornography".

Examples



DNS Filtering Service

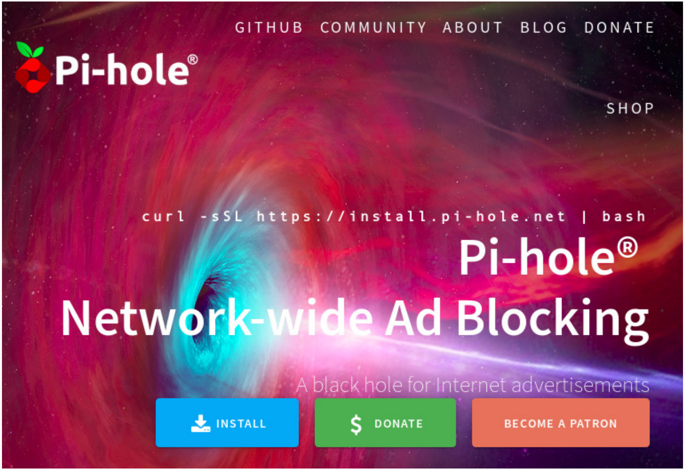
A DNS filtering service is an alternative to more traditional hardware and software-based solutions for filtering the Internet. A DNS filter works by redirecting the IP address of an organization´s router to that of the service provider and then allowing administrators to set the filtering parameters via an online browser-based portal.

Because a DNS web filtering service is quick to implement, has low maintenance overheads and is inexpensive to operate, it is quickly becoming the “go to” solution for organizations wanting to increase their online security postures and protect their networks from web-borne threats. A DNS filtering service has other benefits for organizations as well.

The Importance of a DNS Filtering Service with SSL Inspection

SSL inspection is a tool within a DNS filtering service that decrypts the content of a “secure” website, checks the content for its integrity, and then re-encrypts the website before allowing an Internet user access to the site. The reason why SSL inspection is so important is because three-

Examples



```
curl -sSL https://install.pi-hole.net | bash
```

Pi-hole®

Network-wide Ad Blocking

A black hole for Internet advertisements

Consent

- Existing repositories of DNSBL data
- TODO: survey policy transparency
  - Excellent resource `https://dnsprivacy.org/wiki/\ display/DP/DNS+Privacy+Reference+Material`
- Key to legitimacy: *Informed user consent*
- Policy transparency: the ability of end users to discover rules, limits, protections, and options.
  - Not a new concept
  - 2002 ePrivacy Directive (Cookie Law)
  - GDPR: User control of data
  - And misc laws, policies in US, CA, elsewhere

Short Idea

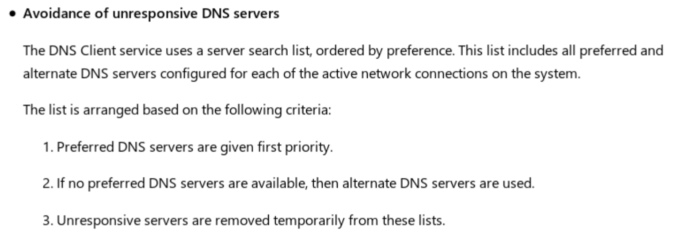
- Perhaps a neutrally operated global zone, such as `example.com` or `icann.org`, or `dnspolicy.arpa`, could be instrumented with child labels that DNS filtration tools {may, should, will} edit to exhibit user policy choice.
    - E.g., `IN A? $NONCE.dnspolicy.arpa`, global wildcard returns `NXDOMAIN`. DNS filters adjust `RCODE=0`.
    - Perhaps indicated `RDATA` offers local policy guidelines (or `127/8` if none etc.)
    - Other behavioral labels:
        - `refused.dnspolicy.arpa`, SHOULD globally and locally returns `RCODE=5`
        - `nxdomain.dnspolicy.arpa`, SHOULD globally and locally returns `RCODE=3`
- Policy choices thereby optionally disclosed to the browser (FP vs FN trade off)
- DOH UI selection may address this proof of DNS policy.

Existing DNS/RDATA Policy Checks and Behaviors

- RFC 2606, RFC 6761: `.example, .localhost`, etc.
- Also `example.com`, etc., devoid of meaningful L7, for leak-free docs
- Similarly, `constoso.com` is “globally local”, and used for MS training/documentation
- Chrome 3x random `HEAD` requests, detecting `NXDOMAIN` rewriting, “error path correction”, and DNS hijacking
- The `IANA` operated pTLD list contains zone data for roots, some such as `.onion` with policy instructions (e.g., `RCODE=5`, do not iterate, etc.)

Why REFUSED child entry?

- Users have mixed resolution paths: filter/no-filter
- Informed consent requires transparency in all paths



- **Avoidance of unresponsive DNS servers**

  The DNS Client service uses a server search list, ordered by preference. This list includes all preferred and alternate DNS servers configured for each of the active network connections on the system.

  The list is arranged based on the following criteria:

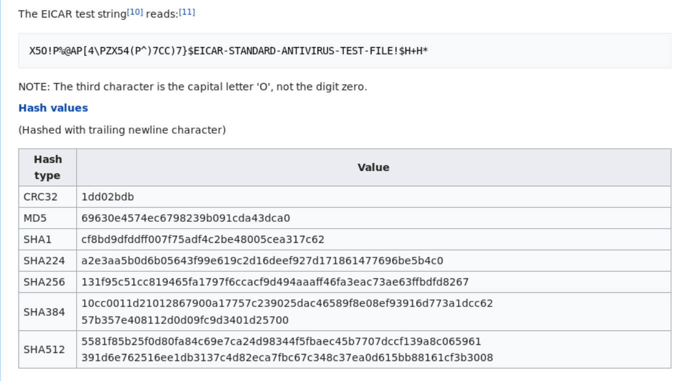
  1. Preferred DNS servers are given first priority.
  2. If no preferred DNS servers are available, then alternate DNS servers are used.
  3. Unresponsive servers are removed temporarily from these lists.

`https://docs.microsoft.com/en-us/\`
`previous-versions//cc977482(v=technet.10)`

`https://docs.microsoft.com/en-us/\`
`previous-versions/windows/it-pro/\`
`windows-server-2003/cc779517(v=ws.10)`

Cf: EICAR File

The AV industry uses a non-malicious string for testing.



The EICAR test string[10] reads:[11]

```
X5O!P%@AP[4\PZX54(P^)7CC)7}$EICAR-STANDARD-ANTIVIRUS-TEST-FILE!$H+H*
```

NOTE: The third character is the capital letter 'O', not the digit zero.

Hash values

(Hashed with trailing newline character)

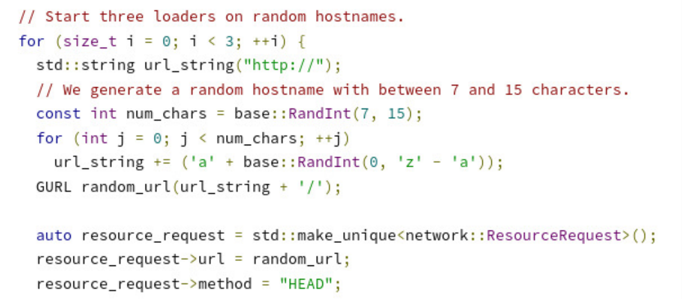
Hash type	Value
CRC32	1dd02bdb
MD5	69630e4574ec6798239b091cda43dca0
SHA1	cf8bd9dfddff007f75adf4c2be48005cea317c62
SHA224	a2e3aa5b0d6b05643f99e619c2d16deef927d171861477696be5b4c0
SHA256	131f95c51cc819465fa1797f6ccacf9d494aaaff46fa3eac73ae63ffbdfd8267
SHA384	10cc0011d21012867900a17757c239025dac46589f8e08ef93916d773a1dcc62 57b357e408112d0d09fc9d3401d25700
SHA512	5581f85b25f0d80fa84c69e7ca24d98344f5fbaec45b7707dccf139a8c065961 391d6e762516ee1db3137c4d82eca7fbc67c348c37ea0d615bb88161cf3b3008

Not recommended:

```
cat eicar.txt >> ~/.signature
```

Cf: Chrome

Chrome does 3x random HEAD requests. See
`master/chrome/browser/intranet_redirect_detector.cc`



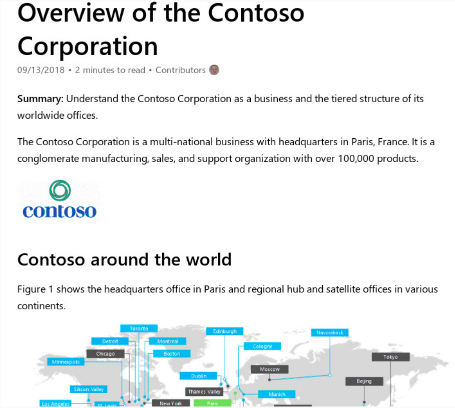
```
// Start three loaders on random hostnames.
for (size_t i = 0; i < 3; ++i) {
  std::string url_string("http://");
  // We generate a random hostname with between 7 and 15 characters.
  const int num_chars = base::RandInt(7, 15);
  for (int j = 0; j < num_chars; ++j)
    url_string += ('a' + base::RandInt(0, 'z' - 'a'));
  GURL random_url(url_string + '/');

  auto resource_request = std::make_unique<network::ResourceRequest>();
  resource_request->url = random_url;
  resource_request->method = "HEAD";
```

Often confused as malicious (by design)

Cf: Contoso

Microsoft's testing company.

`https://docs.microsoft.com/en-us/\`
`    microsoft-365/enterprise/contoso-overview`



Overview of the Contoso Corporation

09/13/2018 • 2 minutes to read • Contributors

Summary: Understand the Contoso Corporation as a business and the tiered structure of its worldwide offices.

The Contoso Corporation is a multi-national business with headquarters in Paris, France. It is a conglomerate manufacturing, sales, and support organization with over 100,000 products.

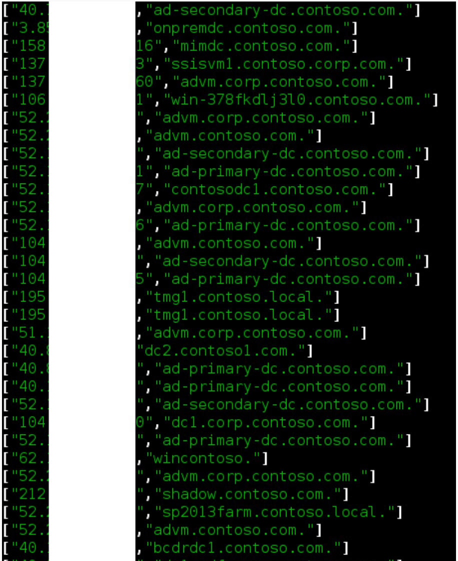
contoso

Contoso around the world

Figure 1 shows the headquarters office in Paris and regional hub and satellite offices in various continents.

Cf: Contoso

Reminder: DOH will amplify what is today merely a few leaks

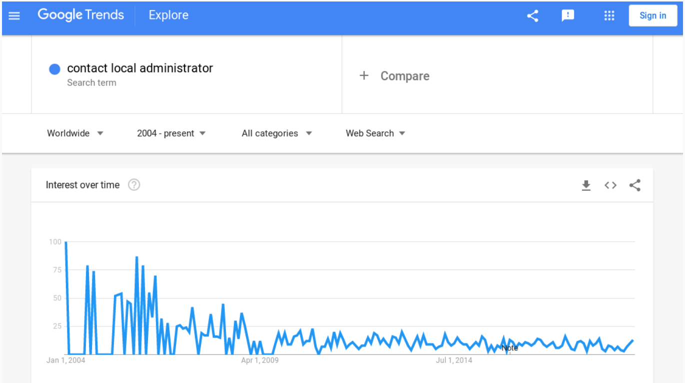


```
["40.[redacted],"ad-secondary-dc.contoso.com."]
["3.8[redacted],"onpremdc.contoso.com."]
["158[redacted]16","mimdc.contoso.com."]
["137[redacted]3","ssisvm1.contoso.corp.com."]
["137[redacted]60","advm.corp.contoso.com."]
["106[redacted]1","win-378fkdlj3l0.contoso.com."]
["52.[redacted]","advm.corp.contoso.com."]
["52.[redacted],"advm.contoso.com."]
["52.[redacted]","ad-secondary-dc.contoso.com."]
["52.[redacted]1","ad-primary-dc.contoso.com."]
["52.[redacted]7","contosodc1.contoso.com."]
["52.[redacted],"advm.corp.contoso.com."]
["52.[redacted]6","ad-primary-dc.contoso.com."]
["104[redacted],"advm.contoso.com."]
["104[redacted]","ad-secondary-dc.contoso.com."]
["104[redacted]5","ad-primary-dc.contoso.com."]
["195[redacted],"tmg1.contoso.local."]
["195[redacted],"tmg1.contoso.local."]
["51.[redacted],"advm.corp.contoso.com."]
["40.[redacted]"dc2.contoso1.com."]
["40.[redacted]","ad-primary-dc.contoso.com."]
["40.[redacted]","ad-primary-dc.contoso.com."]
["52.[redacted]","ad-secondary-dc.contoso.com."]
["104[redacted]0","dc1.corp.contoso.com."]
["52.[redacted]","ad-primary-dc.contoso.com."]
["62.[redacted],"wincontoso."]
["52.[redacted]","advm.corp.contoso.com."]
["212[redacted]","shadow.contoso.com."]
["52.[redacted]","sp2013farm.contoso.local."]
["52.[redacted],"advm.contoso.com."]
["40.[redacted],"bcdrdc1.contoso.com."]
```

Benefits of SUDN Policy Domain

- Incentives for policy transparency
- Browsers should accept/believe/report voluntary filter disclosures—but doubt denials.
- Perhaps less “pollution” of nTLDs, assuming Chrome learns enough in initial `*.dnspolicy.arpa` resolutions
    - Less noise in malware detection!
- DNS filtering tools motivated to adopt: Preserves user base post-DOH
- Theory: Censors and malicious DNS editors not rewarded; likely agnostic?
    - Users likely gain a diagnostic tool of limited value
    - User testing likely identical to mere browser starting
    - Consultation needed with domain experts

Policy Discovery



Google Trends | Explore | Sign in

contact local administrator
Search term

+ Compare

Worldwide ▾ | 2004 - present ▾ | All categories ▾ | Web Search ▾

Local policy represents intentional user choice or rules.

UI contexts should reference it, specifically.

Further Considerations

- Verification of `dnspolicy.arpa` site data?
  - How to render policy page? Safety? TLS?
  - Perhaps DNSSEC sign the test zone. (cf. `dnssec.fail`)
  - e2e DNSSEC incentive!
- FP low, FN likely still high
- Localization of policy document to LAN?
- Neutrality of testing zone (cf. ASN 112)
- Likely technologically neutral viz. ad-ware blockers and advertisers?

Credits and Caveats

- Utility of `dnspolicy.arpa`, and hosting of policy content from others. (Thanks!)
- Thanks to several anonymous attendees offering comments
- Idea offered to stimulate debate

Resolver Information Self-Publication

- `https://tools.ietf.org/html/draft-sah-resolver-informat`
    - Sood, Arends and Hoffman
    - Resolvers self-publish if they perform DNSSEC
    - SUDN and RRType: `resolver-info.arpa/IN/RESINFO` and well-known URI
    - I-JSON response (RFC 7493), only from Recursives
    - Json response has `inventory` field, plus TBD
    - `‘‘If the resolver understands the RESINFO RRtype, the RRset in the Answer section MUST have exactly one record’’`
    - Structured
- Thus, “policy filtering awareness” could be a json field

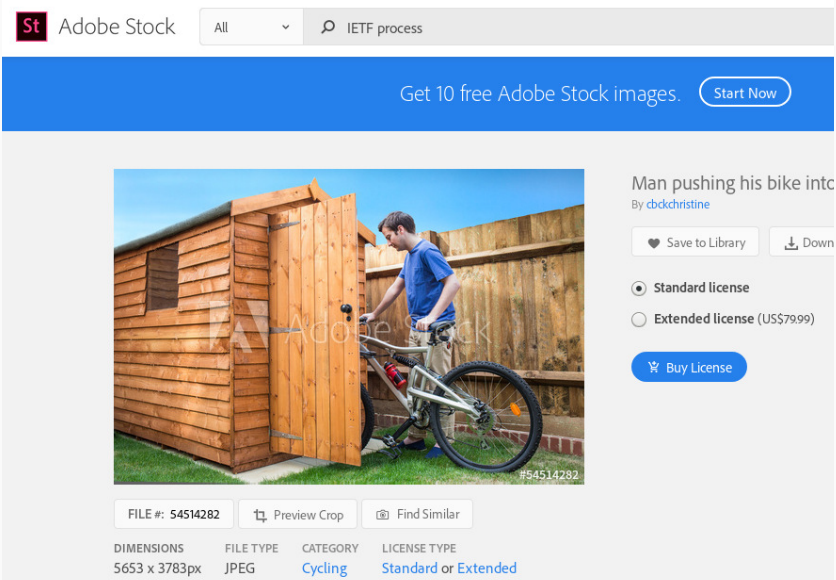
Comparison

	SUDN & A?	SUDN & RESINFO? & .wellknown
policy format	wildwest	I-JSON
adoption	trivial	RRType Tax
scope	RD=1 policy only	RD=1 policy & DNSSEC & ...
paths	multi-path	Unclear
DDoS/Amp	Merely IN A?	Filterable

Open Issues

- Good precedence for “testing/metadata” centric zone
- How to prevent policy transparency devolving into an ad? (Yaml response?)
- What about split policies? (One `/etc/resolv.conf` entry filters, the other is quad 9?)
- Can policy fields be enumerated into categoricals?

Comments Seem Likely



Man pushing his bike intc

By cbckchristine

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