[Proceeding] CrowdSurf: Empowering Informed Choices in the Web

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(Article begins on next page)
CrowdSurf
Empowering Transparency in the Web

25 Aug 2016, ACM SIGCOMM, Florianopolis

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Mario Baldi
Introduction
Do you know what you HTTP?
Example
Web tracking

Thousands of Web trackers collect our data:
- Browsing histories
- Religious, sexual, and political preferences
- On average, the first tracker is met as soon as the browser starts
- Some trackers reach 96% of users
- 71% of websites host at least one tracker

The Open Question

How to know and choose which services our data is exchanged with and how?
Partial solutions

In-network devices
- Firewalls and proxies
  - Fail in case of encrypted traffic (HTTPS)
  - Lack scalability
  - Managed by third parties

On-client
- Browser plugins
  - Limited scope
  - No control on device traffic
  - Not transparent

Google, Microsoft, and Amazon are paying Adblock Plus huge fees to get their ads unblocked

Lara O'Reilly
Feb. 3, 2015, 6:57 AM
60,452 views
22 comments
A New System

Goal
Let **users** re-gain visibility and **control** on the **information** they exchange with **Web services**

Design Principles
- **Holistic**
  - working in any scenario
- **Client-centric**
  - available on any kind of device
- **Practical**, not revolutionary
  - use existing technology
- **Crowd-sourced**
  - knowledge built on a community of users
- **Automatic**
  - little engagement of the user
- **Privacy-safe**
  - never compromise users’ privacy
Cloud

- A controller collects information about the services users visit
  - Explicit -> their opinion
  - Implicit -> traffic samples
- Users’ contributions processed by data-analyzers and the advising community
- Results = suggestions about the reputation of services

Client

- Users download the suggestions they like
- the CrowdSurf Layer translates them into rules
- Rules = actions on users’ traffic
  - Regexp + action
CrowdSurf Controllers

Open Controller
- Collaborative approach
- Users improve the wisdom of the system
  - Traffic samples and opinions
  - Build data analyzers and suggestions

Corporate Controller
- Builds directly rules for employees
- Employees cannot customize rules
- All devices follow the same rules
The CrowdSurf Layer

- HTTP
- Regular Expression Matching
  - Action: Block, Redirect, Allow, Modify, Log and Report
  - Suggestions to Rules
- Anonymization
- Open Controller
- Corporate Controller

CrowdSurf Layer: Rule Processor

TLS
TCP
CrowdSurf in a picture

Opinions + Traffic samples → Open Controller

Suggestions

Rules

Traffic samples

Corporative Controller

Web Services

Ruled Interaction

26 August 2016

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Proof of Concept
Prototype

Controller
- Java-based web service
- Communicates with CrowdSurf devices
- Hosts a data analyzer for identification of tracking sites
- Collects traffic samples
- Distributes suggestions

Client
- Implemented as a Firefox plugin
- Supports block, redirect, log&report
Example of Data Analyzer: Automatic Tracker Detector

Unsupervised methodology to identify third-party trackers [2]

- Observation:
  - trackers usually embed UIDs as URL parameters

- Procedure:
  1. Input: HTTP traffic samples provided by CS users
  2. Take all HTTP queries to third-party services
     http://acmetrack.com/query?key1=X&key2=Y
  3. Extract keys (key1, key2) and their values
  4. Check the presence of key values uniquely associated to the users

Example of Data Analyzer: Automatic Tracker Detector


34 new third-party trackers found
Performance Implications of running CrowdSurf

Different user profiles

Paranoid Profile
- Blocks
  - adv/tracking
  - JS code
- Does not report traffic samples

Kid Profile
- Activates child protection rules
- Reports traffic to trackers

Corporate Profile
- Redirects search.google.com to search.bing.com
- Blocks social networks, e-commerce sites, trackers
- Reports activity on DropBox
Impact on Web site loading time

Paranoid is 1.07 times faster than baseline
Kid is 1.08 times slower
Corporate is 1.18 time slower
Conclusion
Open Problems

- Lot of details to consider
- Design/develop/stardardize a new network layer
- Protecting users’ privacy
  - Anonymizing HTTP/S traffic
- Usability
- Involve users to join
- Protection from malicious biases
CrowdSurf

Holistic, crowd-sourced system for the auditing of the information we expose in the Web

https://www.myermes.com
Thank you!
Need a new model that...

- Enables transparency and visibility
- Takes actions
- Under user’s control

- Monitor the HTTP traffic before encryption takes place
- Block/manipulate/report transactions to undesired services
- Automatic, but configurable
### Example of Data Analyzer: Automatic Tracker Detector

#### Automatic Tracker Detector

#### Dataset
- HTTP trace from ISP running Tstat
  - 10 days of October 2014
  - ~19k monitored users
  - ~240k HTTP transactions per day

#### 34 new third-party trackers found

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Example
A growing business around our data

Loss of visibility and control

- HTTPS protects our privacy, but...
- ...prevents third parties to check what’s going on under the hood of encryption
- ...and severely limits network functions

“Child protection through the use of Internet Watch Foundation blacklists has become ineffective, with just 5% of entries still being blocked when HTTPS is deployed” [2]

Time to collect a dataset

![Graph showing the relationship between service rank and number of visits.](image-url)
Monitoring the Web

CrowdSurf Controllers

Open Controller
- Collaborative approach
- Users improve the wisdom of the system
  - Traffic samples and opinions
  - Build data analyzers and suggestions

Third party Controller
- Suggestions for commercial purposes
- Opens to a market of suggestions

Corporate Controller
- Builds directly rules for employees
- Employees can not customize rules
- All devices follow the same rules