CrowdSurf: Empowering Informed Choices in the Web

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CrowdSurf
Empowering Transparency in the Web

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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

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

- **Client**
  - Browser plugins
    - Limited scope
    - No control on device traffic
    - Not transparent
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 can not customize rules
- All devices follow the same rules
The CrowdSurf Layer

- HTTP
- TLS
- TCP

CrowdSurf Layer

- Rule Processor
  - Regular Expression Matching
    - Action: Block, Redirect, Allow, Modify, Log and Report
  - Suggest to Rules

Open Controller

Corporate Controller

Anonymization
CrowdSurf in a picture
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 \(\text{key1} , \text{key2}\) 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
Paranoid is 1.07 times faster than baseline.
Kid is 1.08 times slower.
Corporate is 1.18 times slower.
Conclusion
Open Problems

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

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

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<td>x.bidswitch.net</td>
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<td>rand</td>
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</table>
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

Number of Visits vs. Service Rank

- googleanalytics

- Time to collect a dataset

26 August 2016

CrowdSurf - Stefano Traverso
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