CrowdSurf: Empowering Informed Choices in the Web

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CrowdSurf
Empowering
Transparency
in the Web

25 Aug 2016,
ACM SIGCOMM,
Florianopolis

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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

On-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
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.

**Cloud**

**Client**

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

Regular Expression Matching

Action

Block Redirect Allow Modify Log and Report

TLS

TCP

Open Controller

Suggestions to Rules

Corporate Controller

Anonymization
CrowdSurf in a picture

Opinions + Traffic samples

Open Controller

Suggestions

Ruled Interaction

Web Services

Rules

Traffic samples

Corporate Controller
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/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.myeremes.com
Thank you!
Need a new model that...

- Enables transparency and visibility
  - Monitor the HTTP traffic before encryption takes place

- Takes actions
  - Block/manipulate/report transactions to undesired services

- Under user’s control
  - 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

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 number of visits and service rank, with a label for googleanalytics]
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