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 [1]
- 71% of websites host at least one tracker [1]

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
CrowdSurf
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
- Regular Expression Matching
- Action
  - Block
  - Redirect
  - Allow
  - Modify
  - Log and Report

- Anonymization
- Corporate Controller
- Open Controller

CrowdSurf Layer

Rule Processor

Layer

Redirect

Modify

Log and Report

Anonymization
CrowdSurf in a picture

Web Services

Opinions
+ Traffic samples

Suggestions

Ruled Interaction

Open Controller

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


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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
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** 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

- [Image of a graph showing the relationship between service rank and number of visits, with a blue curve and red starred data points.]

- **Number of Visits**
  - 1e6
  - 1e5
  - 1e4
  - 1000

- **Service Rank**
  - 1
  - 10
  - 100
  - 1000
  - 1e4

- **T_c**
  - 100
  - 10
  - 1
  - 0.1
  - 0.01
  - 0.001

- **googleanalytics**

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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
CrowdSurf in a picture

Open controller

Third-party controller

Corporate controller

Web Services

Data Analyzer

Corporate Device

Private User Device

Suggestions

Corporate Rules

Web Browsing

Traffic samples

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