

Privacy Flag Project Enabling Crowd-sourcing based
privacy protection for smartphone applications, websites
and Internet of Things deployments

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Abstract

Privacy Flag combines crowd sourcing, ICT technology and legal expertise to protect citizen privacy when visiting websites, using smart-phone applications, or living in a smart city leveraging user-friendly solutions provided as a smart phone application, a web browser add-on and a public website. It will:

1. Develop a highly scalable privacy monitoring and protection solution with:

- Crowd sourcing mechanisms to identify, monitor and assess privacy-related risks;
- Privacy monitoring agents to identify suspicious activities and applications;
- Universal Privacy Risk Area Assessment tool and Methodology (UPRAAM) tailored to European norms on personal data protection;
- Personal Data Valuation mechanism;
- Privacy enablers against traffic monitoring and finger printing;
- User friendly interface informing about the privacy risks when using an application or website.

2. Develop a global knowledge database of identified privacy risks, together with online services to support companies and other stakeholders in becoming privacy-friendly, including:

- In-depth privacy risk analytical tool and services;
- Voluntary legally binding mechanism for companies located outside of Europe to align with and abide to European standards in terms of personal data protection;
- Services for companies interested in being privacy friendly;
- Labelling and certification process.

3. Collaborate with standardization bodies and actively disseminate towards the public and specialized communities, such as ICT lawyers, policy makers and academics. Eleven (-11-) European partners, including SMEs and a large telco operator (OTE), bring their complementary technical, legal, societal and business expertise; Privacy-Flag intends to establish strong links with standardization bodies and international fora and it also intends to assess and incorporate outcomes from over 20 related research projects. It will build and ensure long-term sustainability and growth.

Executive Summary

This “short” deliverable provides an overview of the work performed within the task *T5.3: Initial knowledge base of 100 assessed key applications*, scheduled within the period M25-M36 (*Task Leader: CTI*).

The task’s main goals has been to test the applicability of the Privacy Flag (PF) tools and evaluation framework to 100 popular sites and applications (50 from each category). The resulting evaluations would initialize the knowledge database of the Privacy Flag platform with useful online evaluations, based on the Privacy Flag tools.

A mixture of volunteers has been gathered, composed of simple users and experts who were asked to submit their evaluations based on the tools they downloaded from the Privacy Flag repository. The users focused upon privacy and security issues they encountered, for popular applications they use and for sites they visit, based on the evaluation tools of the Privacy Flag project.

The goals of the task have been completely “met” and the 100 performed evaluations are stored and made available, as an initial privacy assessment pool of applications and sites, in the Privacy Flag Platform Database. This initial pool is expected to be incrementally enhanced during the subsequent operation of the platform, based on crowdsourced user inputs.

Version History

Table 0.1: Version History

Version	Date	Comments, changes, status	Authors, contributors, reviewers
0.1	02.05.2018	First Draft	CTI
0.2	15.05.2018	Second Draft	CTI
1.0	18.05.2018	Full editorial and conceptual review by the Project Coordinator - Final version ready for submission	OTE

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Table 0.2: Contributors

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Glossary

Acronym

app

DB, Db

ICT

DS

FM

GA

GSam

H2020

HTTP

IMDb

LAN

LED

PF

RAR

SME

SW

TV

UPRAAM

URL

VLC

Wi-Fi

WP

Meaning

Application

Data Base

information and Communication Technologies

Digital Security

Frequency Modulation

Grant Agreement

Goldman Sachs Asset Management

Horizon 2020

Hypertext Transfer Protocol

Internet Movie Database

Local Area Network

Light Emitting Diode

Privacy Flag

Roshal Archive

Small- and Medium-sized Enterprise

Software

Television

Universal Privacy Risk Assessment Methodology

Uniform Resource Locator

VideoLAN Client

Wireless Fidelity

Work Package

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1. Introduction

The main objective of Task 5.3 has been to test and assess the tools that have been made available to the public, by the Privacy Flag (PF) project. In particular, the PrivacyFlag WebAddOn and the PrivacyFlag Smartphone Application were applied -and evaluated as well- to over a hundred of mainstreams applications and websites, with fifty (-50-) from each category.

Some of the most popular websites and applications have been selected to perform the risk evaluation to them, in order to “bootstrap” the evaluations knowledge database (DB). In addition to this, the task also bootstrapped the crowdsourcing platform by organizing a small-scale pilot that involved volunteer users.

As part of Task 5.3, 100 volunteer users have been gathered and guided into participating in the privacy risk reporting scenarios of the PF project. In order to optimize the quality of the achieved results, two distinct groups of evaluators have been formed. One group was composed by “average” users and the other group was composed by computer experts and privacy/security specialists. Both groups have been asked to report their privacy assessments of software (SW) they use with their devices and websites that they have recently visited.

The large number of dissemination events which have been organized during the Privacy Flag project assisted to achieve a large number of volunteers and participants, outperforming the initially set goals of the project and, *thus*, increasing significantly the size and the contents of the initial knowledge base. The evaluation targets, the methodology of the assessment process and the results of this procedure are, *briefly*, described in the following sections.

2. Evaluation targets

The evaluation has been performed both by experts and average user volunteers. Initially, the first sites and applications have been assessed by security experts with a very strong technical and/or legal ICT background.

The experts first had the opportunity to go through the Privacy Policy and the Terms of Use of each site and application, in order to provide consent and perform the evaluation. The goal of this approach was to create a strong set of accurate evaluations and help other users to feel “more comfortable” about the Privacy Flag tools.

The experts had at their disposal as much time as they needed, in order collect the information that was required to assist their evaluation judgment. All experts were experienced professionals and senior researchers with practical and theoretical knowledge in the security and privacy landscape. To achieve the maximum commitment and their continued involvement in all phases of the Privacy Flag project development, the evaluators have been chosen among the members of the consortium. In particular, effort was expended to include as many experts as necessary to achieve the best mix of evaluators that combine different skills, based on the scientific and professional expertise of each member of the consortium.

The web sites and the smartphone applications have been chosen due to their popularity. Therefore, despite the limited size of the initial knowledge base, the top 50 sites and the top 50 applications represent the majority of users’ preferences. Hence, it was of outmost importance to ensure that these web sites and applications were properly analyzed and assessed. The chosen web sites and applications appear in Table 1.

Initial Knowledge base (Evaluation by Experts)					
	URL	Partner		Application	Partner
1	https://wordpress.org/	DNET	1	Google Maps	OTE
2	https://plus.google.com/	OTE	2	Google Drive	OTE
3	https://twitter.com/	DNET	3	Google News & Weather	IIP
4	https://www.facebook.com/	DNET	4	Instagram	OTE
5	https://www.google.gr/	CTI	5	Yelp	IIP
6	https://www.cloudflare.com/	LTU	6	Clue	

7	https://vimeo.com/	OTE	7	Fitbit	UL
8	http://www.foxnews.com/	LTU	8	MyFitnessPal	
9	https://www.bluehost.com/	LTU	9	Runtastic PRO	IIP
10	https://www.blogger.com	CTI	10	Bandcamp	LTU
11	https://www.ikea.com/	CTI	11	BlackPlayer	LTU
12	https://www.instagram.com/	CTI	12	Spotify	OTE
13	https://www.youtube.com/	DNET	13	Todoist	LTU
14	https://qr.qodaddy.com/	CTI	14	WhatsApp messenger	OTE
15	statcounter.com/	LTU	15	Skype	OTE
16	https://www.elegantthemes.com/	LTU	16	MX Player	LTU
17	http://www.bbc.com/	OTE	17	Pulse News	
18	https://cpanel.com/	DNET	18	Dolphin Browser	
19	https://www.linkedin.com/	DNET	19	Firefox Browser fast & private	UL
20	https://blog.crazydomains.com/	LTU	20	Google Chrome	OTE
21	https://www.booking.com	DNET	21	Opera	IIP
22	https://www.trivago.com/	CTI	22	Find My Device	UL
23	https://undeveloped.com/	CTI	23	CamScanner -Phone PDF Creator	IIP
24	https://qr.yahoo.com/	CTI	24	My Tracks	LTU
25	https://www.joomla.org/	CTI	25	Mint: Budget, Bills, Finance	LTU
26	https://www.plesk.com/	CTI	26	Expense Manager	LTU
27	https://qr.pinterest.com/	CTI	27	360 Security – Antivirus FREE	LTU
28	https://www.visma.com/	LTU	28	Tiny Flashlight + LED	LTU

29	https://www.amazon.com/	CTI	29	Snapseed	LTU
30	https://www.wikipedia.org/	OTE	30	Pulsar Music Player	UL
31	https://www.flickr.com/	LTU	31	AlarmDroid	UL
32	https://www.paypal.com	OTE	32	IMDb Movies & TV	OTE
33	https://www.bing.com/	OTE	33	TuneIn Radio	UL
34	https://www.ebay.com/	DNET	34	X-plore File Manager	LTU
35	https://www.coursera.org/	CTI	35	Wikipedia	OTE
36	https://www.mysql.com/	CTI	36	Go Launcher EX	
37	https://edition.cnn.com/	LTU	37	Blue Mail – Email & Calendar App	IIP
38	https://www.adobe.com/	OTE	38	All-In-One Toolbox: Cleaner, Booster, App Manager	
39	https://www.yelp.com/	CTI	39	Easy Uninstaller	IIP
40	https://stackoverflow.com/	DNET	40	GSam Battery Monitor	UL
41	https://www.nytimes.com/	OTE	41	AirDroid: Remote access & File	
42	https://www.expedia.com/	CTI	42	SHAREit – Transfer & Share	
43	https://www.urbandictionary.com/	CTI	43	Evernote	IIP
44	https://www.theguardian.com/	OTE	44	KeePassDroid	UL
45	https://www.healthyway.com/	OTE	45	Where’s My Droid	UL
46	https://www.tripadvisor.com/	CTI	46	Cookpad Recipes	IIP
47	https://www.spotify.com/	CTI	47	Flipboard	IIP
48	https://www.nbcnews.com/	LTU	48	Battery Dr saver+a task killer	

49	https://www.airbnb.com/	DNET	49	GO Weather EX	UL
50	https://github.com/	CTI	50	Wi-Fi Analyser	OTE
			51	Amazon Kindle	MI
			52	EasyJet	MI
			53	Booking.com	MI
			54	Vueling.com	MI
			55	The Fork	MI
			56	Lufthansa	MI
			57	MyTaxi	MI
			58	TinyScanner	MI
			59	ItaloTreno	MI
			60	Radio 24	MI

Table 1: Targeted applications and sites with respective contributors

3. Evaluation process

All objectives which were set for Task 5.3 have been met and, *even*, outperformed. The volunteers who participated in the assessment process have provided evaluations for more than 50 websites and smartphone applications. The security and privacy experts also contributed, *timely*, their evaluations which were thorough and quite detailed. Also, of outmost importance have been the simple users that had been reached through the project’s dissemination activities and helped by downloading and installing the Privacy Flag tools. Acting in a crowdsourcing-*oriented* way, they provided the necessary information to increase the accuracy of the evaluation process.

Due to the fully anonymized architecture of the Privacy Flag platform is not possible to identify -or correlate- users with the input provided on specific websites or applications. Therefore, all inputs have been treated “equally”, which is also a fundamental principle in any crowdsourcing system. Only for the group of experts it was possible to “address” them personally and “instruct” them so that to evaluate specific websites and smartphone applications. Simple users, *on the other hand*, were granted a degree of freedom in choosing and assessing preferred targets that were close to their personal interests.

The following evaluation statistics, in Table 2, have been collected during the creation of the knowledge database.

PrivacyFlag WebAddon	PrivacyFlag SmartPhone App
179 total evaluations	187 total evaluations
115 distinct websites	140 distinct applications
50 distinct users	50 distinct users

Table 2: Usage of evaluation tools

A preliminary analysis of the results indicates that many users evaluated more than one application or website and, *therefore*, many websites and applications received multiple evaluations as depicted in Table 4. Due to the anonymity provided by the Privacy Flag platform, it was only possible to monitor the addition of new websites and smartphone apps during their evaluation and insertion into Privacy Flag DataBase. It was not possible (and desirable) to know the users that performed the evaluations. A typical update snapshot in the Privacy Flag DataBase during the evaluation and training period of its operation can be seen in the DataBase dump files, shown in the tables below.

Table 3 depicts the smartphone applications that have been evaluated and stored in the Privacy Flag DataBase. On the other hand, Table 4 shows the evaluated websites. Some of them are in the lists that

have been reviewed by the security and privacy professionals, while the rest of them have been selected by the volunteers, based on their own personal interests.

count(*)	app_name
2	<i>Booking.com Hotel</i>
1	<i>Keep</i>
2	<i>Dropbox</i>
1	<i>Discord</i>
1	<i>Alien Shooter</i>
2	<i>e-FOOD.gr</i>
2	<i>IMDb</i>
4	<i>WhatsApp</i>
2	<i>Wikipedia</i>
1	<i>GWPA Finder</i>
11	<i>Instagram</i>
2	<i>Reddit</i>
1	<i>Chain Reaction</i>
3	<i>Viber</i>
4	<i>Skype</i>
1	<i>Snapchat</i>
7	<i>Messenger</i>
1	<i>MX Player</i>
1	<i>BlackPlayer</i>
1	<i>Bandcamp</i>
1	<i>X-plore</i>
2	<i>Todoist</i>
5	<i>Spotify</i>
1	<i>Ryanair</i>
1	<i>Πληκτρολόγιο SwiftKey</i>
1	<i>my_device2</i>

1	<i>Luleå Lokaltrafik</i>
3	<i>BankID</i>
1	<i>3D-katalog</i>
1	<i>Ραδιόφωνο FM</i>
1	<i>Ecster</i>
1	<i>9GAG</i>
1	<i>CamScanner</i>
1	<i>CityGR</i>
1	<i>VLC</i>
2	<i>Swish</i>
1	<i>Έγγραφα</i>
2	<i>RAR</i>
1	<i>Flashlight</i>
1	<i>FindShip</i>
1	<i>LinkedIn</i>
1	<i>Subway Surf</i>
1	<i>Bacteria</i>
1	<i>Δήμος Περιστερίου</i>
1	<i>apergia.gr</i>
1	<i>Ring</i>
1	<i>My Tracks</i>
1	<i>CPU-Z</i>
1	<i>indaHash</i>
1	<i>Earth</i>
1	<i>ionic-maps</i>
1	<i>YouTube</i>
1	<i>Clean Master</i>
2	<i>Evernote</i>
1	<i>Netflix</i>

2	<i>Shazam</i>
1	<i>Slack</i>
1	<i>Expense Manager</i>
1	<i>Ionic DevApp</i>
1	<i>Wallet</i>
2	<i>BlueMail</i>
1	<i>Facebook</i>
1	<i>Champions</i>
1	<i>Skroutz</i>
1	<i>Whats Up</i>
2	<i>Tumblr</i>
1	<i>Khan Academy</i>
1	<i>Lite</i>
1	<i>eduroamCAT</i>
1	<i>Hearing</i>
1	<i>Four-stroke Otto Engine</i>
1	<i>ElectroDroid</i>
1	<i>Cipher tools</i>
1	<i>Physicists who changed the world</i>
1	<i>Pocket Physics</i>
1	<i>Human body (male)</i>
1	<i>Solar System 3D</i>
1	<i>Google Play Musique</i>
1	<i>3D Wallpapers</i>
1	<i>Tichu Counter</i>
1	<i>ATHENA CARD</i>
1	<i>Quizdom</i>
1	<i>Skype Lite</i>
1	<i>DB Navigator</i>

1	<i>DB Navigator</i>
1	<i>OASA Telematics</i>
1	<i>Goggles</i>
1	<i>Download Accelerator Plus</i>
1	<i>Signal</i>
1	<i>Cake</i>
1	<i>Το Επόμενο Λεωφορείο</i>
1	<i>LinkedIn Job Search</i>
1	<i>Födelsedagar</i>
1	<i>Followers Assistant</i>
1	<i>TFA</i>
1	<i>ADM</i>
1	<i>Twitch</i>
1	<i>Firefox Focus</i>
1	<i>Telegram</i>
2	<i>Uber</i>
1	<i>Telegram X</i>
1	<i>File Manager</i>
1	<i>Microsoft Remote Desktop</i>
1	<i>Chess</i>
1	<i>Eurocard</i>
1	<i>GSam Battery Monitor</i>
1	<i>Firefox</i>
1	<i>Pulsar</i>
1	<i>Mein Gerät finden</i>
1	<i>AlarmDroid</i>
1	<i>Tuneln Radio</i>
2	<i>KeePassDroid</i>
1	<i>Wheres My Droid</i>

1	<i>GOWeatherEX</i>
1	<i>Fitbit</i>
1	<i>Whatsup</i>
1	<i>Flipboard</i>
1	<i>Cookpad</i>
1	<i>Easy Uninstaller</i>
1	<i>Yelp</i>
1	<i>Opera</i>
1	<i>Ειδήσεις και καιρός</i>
1	<i>GoToMeeting</i>
1	<i>IoT Lab</i>
1	<i>Privacy App</i>
1	<i>CrontoSign Swiss</i>
1	<i>Amazon Kindle</i>
1	<i>EasyJet</i>
1	<i>Vueling</i>
1	<i>Runtastic</i>
1	<i>TheFork</i>
1	<i>Lufthansa</i>
1	<i>Mytaxi</i>
1	<i>TinyScanner</i>
1	<i>Italo Treno</i>
1	<i>Radio24</i>
1	<i>Météo</i>
3	<i>Privacy Flag</i>
1	<i>AlcoDroid</i>
1	<i>Chess</i>
1	<i>Foursquare</i>

Table 3: Received evaluations for targeted apps

count(*)	url
3	https://mail.google.com
1	https://www.theguardian.com
1	http://www.utu.fi
2	http://www.umu.se
1	https://doodle.com
1	http://www2.hm.com
1	https://ltu-talk.slack.com
1	https://www.cuantarazon.com
2	https://www.norwegian.com
1	https://www.newyorker.com
1	http://se.farnll.com
10	https://www.facebook.com
1	https://www.cyberciti.biz
1	https://www.tecmint.com
1	https://www.samkear.com
1	https://www.webhostface.com
1	https://ss64.com
1	https://about.9qag.com
1	https://wordpress.org
1	https://response.questback.com
1	https://www.google.co.uk
1	http://store.steampowered.com
1	http://cdon.se
1	https://www.netflix.com
1	http://www.proquest.com
1	https://en.wikipedia.org
1	https://www.surveymonkey.com

1	https://www.ltu.se
1	https://cpanel.com
1	https://www.rj.se
1	https://prisma.research.se
1	https://twitter.com
1	http://masajo.suomalainenverkkokauppa.fi
1	https://www.linkedin.com
19	https://www.youtube.com
1	https://www.booking.com
1	https://www.ebay.com
1	https://www.eflorist.co.uk
2	https://stackoverflow.com
1	https://www.airbnb.com
1	https://www.paypal.com
1	https://www.sas.se
1	https://link.springer.com
1	https://www.learntechlib.org
1	https://mail.ltu.se
1	https://www.sciencedirect.com
12	http://privacyflag.eu
1	http://www.foxnews.com
1	https://www.cloudflare.com
3	https://www.instagram.com
1	https://core.telegram.org
6	https://chrome.google.com
1	https://ekonomi.ltu.se
1	https://www.nbcnews.com
1	https://edition.cnn.com
1	https://www.hs.fi

1	http://www.sbi.kb.se
1	https://www.vr.se
2	https://www.svt.se
3	http://www.bbc.com
1	https://www.bluehost.com
1	https://www.elegantthemes.com
1	https://www.msn.com
1	https://www.microsoft.com
1	https://www.reddit.com
1	https://www.alexa.com
1	http://dibamoviez.ws
1	https://www.starbucks.com
1	https://el-gr.facebook.com
1	https://www.dropbox.com
2	http://www.cnn.gr
1	https://admin.city.scanlab.gr
1	http://www.sport24.gr
1	https://www.momondo.se
1	https://ltu.instructure.com
1	https://www.ikea.com
1	https://www.blogger.com
1	https://www.google.gr
1	https://gr.godaddy.com
1	https://undeveloped.com
1	https://policy.pinterest.com
1	https://www.amazon.com
1	https://www.coursera.org
1	https://www.mysql.com
1	https://www.urbandictionary.com

1	https://www.spotify.com
2	https://github.com
1	https://int10.darkorbit.com
1	http://150.140.193.133:2080
1	https://gr.yahoo.com
1	https://www.joomla.org
1	https://www.plesk.com
1	https://www.ngp.com
1	http://www.bvo.com
1	https://www.viber.com
5	https://privacyflag.eu
1	https://news.google.com
1	https://www.trivago.com
1	https://www.udemy.com
3	https://www.trivago.gr
1	https://www.yelp.com
1	https://www.expedia.com
1	https://www.tripadvisor.com
2	http://www.in.gr
1	https://onedrive.live.com
1	https://jsonformatter.curiousconcept.com
2	https://sr-rs.facebook.com
2	https://www.google.rs
1	https://anti-hacker-alliance.com
1	https://www.cosmote.gr
1	https://europa.eu
1	https://wwwen.uni.lu
1	https://wwwfr.uni.lu
1	https://wwwde.uni.lu

1	https://tweetdeck.twitter.com
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Table 4: Received evaluations for targeted sites

The volunteers have been selected in the numerous dissemination events that took place in the last phase of the project (see Table 5 and Table 6 for the contributions of each anonymous volunteer). After a very short training, they were able to download and use the Privacy Flag tools not only in devices where these were preinstalled, but also in their mobile phones and personal computers, laptops, etc. The overall experience was positive and no particular problems have been reported. Some users have performed more than one evaluation, despite that they have been asked to review a given smartphone application -or website- during the dissemination events. Due to the anonymized policy that the Privacy Flag operates within, it is impossible to know whether they downloaded and used the Privacy Flag for their personal computers and mobile devices, but they declared their intention to do so.

count(*)	user_id
23	83
6	84
1	85
5	86
7	87
11	88
2	89
9	90
3	91
8	92
2	93
2	94
1	95
2	96
2	97
2	98
1	99
1	100
1	101
3	102
2	103
1	104
1	105
1	106
20	107
3	108
2	109
6	110

count(*)	user_id
5	111
2	112
3	113
3	116
2	115
2	117
2	114
3	118
3	119
3	120
2	121
3	122
3	123
3	124
1	125
2	126
1	127
1	70
2	129
3	130
1	131
1	132

Table 5: Participation counts for the PrivacyFlag addon

count(*)	user_id
64	100
2	133
2	87
2	88
4	21
1	139
3	86
4	143
1	144
1	146
3	151
2	152
1	147
2	150
2	155
1	149
2	157
1	154
2	158
12	159
2	142
1	161
2	162
1	167
1	174
1	175
1	184
1	193

count(*)	user_id
1	194
9	19
1	201
1	18
1	211
10	214
1	136
1	222
1	227
1	228
3	224
3	223
1	226
1	225
9	230
1	231
1	239
12	241
6	242
1	137

Table 6: Participation counts for the PrivacyFlag app

4. Conclusion

Despite the millions of websites and smartphone applications that exist today, only a very limited subset of them really takes care of the average user's interests and security/privacy concerns. Therefore, it is crucial to guarantee that at least the most popular sites and applications are properly evaluated with respect to their privacy and security features, which is exactly the main goal of the Privacy Flag project and its suite of tools. By mobilizing a relatively small number of technical and legal experts, it was possible to review in detail some of the most popular websites and smartphone applications, providing accurate evaluation results and a first version of the Privacy Flag site and application evaluation database.

More important, the followed procedures and set goals appear to increase the confidence and boost the motivation of average users in participating in the Privacy Flag project. The volunteer users helped, with their broader view, to rectify any possible bias or shortcoming of the initial experts' evaluation. Subsequently, the evaluation framework has further been improved by non-expert users, who downloaded and installed the PrivacyFlag Web Addon and the PrivacyFlag Smartphone applications. The crowdsourcing aspects of the general availability of the Privacy Flag tools via the *Chrome Web Store* and the *Google Play* also contributed to success of the final evaluation of the Top 50 most popular websites and applications in an objective, accurate and reliable way.

