Redirect2Own: Protecting the Intellectual Property of User-uploaded Content through Off-site Indirect Access

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Abstract. Social networking services have attracted millions of users, including individuals, professionals, and companies, that upload massive amounts of content, such as text, pictures, and video, every day. Content creators retain the intellectual property (IP) rights on the content they share with these networks, however, very frequently they implicitly grant them, a sometimes, overly broad license to use that content, which enables the services to use it in possibly undesirable ways. For instance, Facebook claims a transferable, sub-licensable, royalty-free, worldwide license on all user-provided content. Professional content creators, like photographers, are particularly affected. In this paper we propose a design for decoupling user data from social networking services without any loss of functionality for the users. Our design suggests that user data are kept off the social networking service, in third parties that enable the hosting of user-generated content under terms of service and overall environment (e.g., a different location) that better suit the user’s needs and wishes. At the same time, indirection schemata are seamlessly integrated in the social networking service, without any cooperation from the server side necessary, so that users can transparently access the off-site data just as they would if hosted in-site. We have implemented our design as an extension for the Chrome Web browser, called Redirect2Own, and show that it incurs negligible overhead on accessing “redirected” content. We offer the extension as free software and its code as an open-source project.

1 Introduction

Internet users generate massive amounts of data. Every minute of the day, smartphones and personal computers are used to share 684,478 pieces of content on Facebook, add 3,125 photos on Flickr, and upload 48 hours of video on YouTube [5]. Social networking services (SNS) have only further intensified content creation and dissemination, and maybe more importantly, they have pushed the number of content creators to new levels. Facebook, probably the largest such network, reports 1 billion active users as of October 2012 [7]. Content creators using such services retain the intellectual property (IP) rights on
the content they share, however very frequently they implicitly grant the service, a sometimes, overly broad license to use that content. For instance, according to Facebook’s terms of service (ToS) [8], the social network gains a “transferable, sub-licensable, royalty-free, worldwide license” on all content the user uploads or shares with the service. Similarly, Google’s ToS informs its 425 million users [21] that “When you upload or otherwise submit content to our Services, you give Google (and those we work with) worldwide license to use, host, store, reproduce, modify, create derivative works, communicate, publish, publicly perform, public display and distribute such content” [13].

Arguably, the license requested by the various service providers may only serve the purpose of providing legal support to operations related with data backups and distributed content delivery. Nonetheless, it does include uses that can be in conflict with the IP owner’s best interest. For example, photos or text shared by a user could be used in an undesired way such as being part of an advertisement campaign targeting their friends or contacts in general. SNS are also increasingly used by professional artists (e.g., photographers) and businesses for marketing purposes [12], and to promote their intellectual property [4]. Such professional content creators are affected even more profoundly by such ToS. To make things worse, even if a user removes content from the network, something that invalidates the granted license, the data is not necessarily immediately deleted from the server [2]. Note that Facebook actually took steps to remedy this situation [3], but not all services have done so.

At the same time, there are alternative user-content hosting and exchange services that feature more favorable terms of service to users. For example, Flickr [9], Fotki [10], and Shareapic [20] are only a few of the online services that enable the uploading and sharing of photos under a well-defined license [25], which is limited to the specific functions necessary to run the offered services (e.g., data backup operations). Dropbox offers similarly favorable ToS [6] to users for hosting any type of file, while untrusting users can also utilize their own personal storage device, like FreedomBox [11].

In this paper, we propose a design that decouples content from social networking services, while still enabling users to share their content through the social network as before. In other words, our proposal facilitates the hosting of user content in third-party, intellectual-property-friendly hosting services, at the same time allowing its seamless integration in first-party sites, so that its users can view, like, tag, comment, and generally interact with it as they normally would. Our approach employs an indirection scheme, based on replacing the actual content being shared on the SNS with pseudo-content, containing encoded meta-information that points to the actual off-site data. This level of indirection places the original content outside the social network, thereby enabling the IP owner to share content without relinquishing any rights to the network.

To test our proposal, we implemented an extension for the Chrome Web browser that performs our indirection design for sharing content on Facebook, in a transparent way to users. Our implementation is data specific but not service specific. We intercept photos being uploaded to Facebook, and instead upload
them to a more favorable hosting service of the user’s choice (i.e., Flickr). After the upload concludes, we encode the Flickr url pointing to the image in a new pseudo-image, which in turn is uploaded to Facebook. The extension can easily modified to also support other SNS or sites that store the same type of data, i.e., images. We offer our extension, called Redirect2Own, as free software and have made its code open source. Our evaluation of Redirect2Own shows that it has negligible overhead; little more than simply downloading the image directly from the third-party hosting service.

The contributions of this paper can be summarized in the following:

– We discuss the terms of service of social networks in respect to the protection of intellectual property in user-provided content.
– We propose the use of indirection schemata to protect the intellectual property of users in social networks through the off-site hosting of the actual content, thereby placing it outside their legal domain.
– We offer an implementation of our design as a Chrome extension which can be used for Facebook.

The rest of this paper is organized as follows. Section 2 discusses related work. We present the design of our approach in Sec. 3. We provide implementation details in Sec. 4. We evaluate the performance of Redirect2Own in Sec. 5. Section 6 discusses limitations, future extensions, and possible legal implications of our proposal. Finally, conclusions are in Sec. 7.

2 Related Work

FaceCloak [18] shields a user’s personal information from the social networking service by providing fake information to the service itself and storing the actual, sensitive information in an encrypted form on a separate server. The authors of FlyByNight [17] propose the use of public key cryptography among friends in a social networking service setting so as to protect their information from a curious social provider and potential data leaks. NOYB [16] partitions user information in his online profile into atoms and then substitutes each atom with an atom from another user pseudorandomly. The mapping of which atoms belong to whom is encrypted. Encryption keys are distributed among users authorized to de-scramble a user’s profile by placing the correct atoms in their place. The major drawback of such approaches is the key or secret management overhead along with the fact that they hinder the ability of a social network user to reach a large unknown audience in a broadcast fashion to promote himself (e.g., celebrities) or his work (e.g., artists).

In the same spirit of data privacy, a number of approaches propose the separation of environments, such as social networks, where functionality and data

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4 We can request that the Flickr url is not indexed by the service, so that the photo is only accessible to users that know the url. A similar approach is followed by Facebook.
are fused together. Shakimov et al. [19] address user concerns for the privacy of their data in social networks by proposing the use of personal virtual machines, e.g., instances Amazon’s EC2 platform, to hold user data while arbitrating access control. Their approach can be overlayed on top of the existing social graph of a social networking service but having the service store IP address pointers to the virtual machines holding the data, thereby allowing users to remain in their invested platform. Similarly Frenzy [12] is a dropbox-powered social network. FreedomBox [11] is a community project to develop tiny, low-watt computers, also known as “plug servers”, holding all the user’s data, such as e-mail, photos, etc., as opposed to having them on the cloud, and running free software enabling personal privacy.

3 Redirect2Own Design

Here we outline our proposal for an off-site-hosting indirection schema which enables users to protect their intellectual property against social networks and other Web services with restrictive terms of use by placing their content outside their legal domain. We call our design Redirect2Own.

The main pivot of our approach is the decoupling of user data from the platform upon which a Web application is founded. We suggest that while a user interacts with a first-party Web site, e.g., Facebook, his data are hosted by a third party. For instance, Flickr could be used for storing images and Pastebin for text. At the same time, indirection schemata are employed within the first-party site to offer transparent access to the off-site data for this user and others. Creating an abstraction layer between some data-oriented functionality of the first-party site (e.g., tagging or commenting on photos of one’s friends) and the actual storage of the corresponding data (here: uploaded photographs) offers the flexibility of hosting different types of data in different third parties (e.g., Flickr), subject to different terms of service. Thus, Redirect2Own empowers users with better control of their online data without suffering service migration overhead (e.g., move everything to a different social networking service) or any serious loss of functionality.

As our case study we consider the Facebook social networking service. The service encourages its members to share a plethora of data, including photos, to improve their online experience which stems from their interaction and the interaction of their friends with that data. In detail, their friends or anyone, depending on their privacy settings, can see the images, comment on them, or place a labeled frame (tag) around certain people in photos. Our design enables users to enjoy the social features offered by Facebook while hosting their data off-site, in third-party services like Flickr and Dropbox, so that Facebook’s restrictive terms of service do not apply to the actual content. This provides users with the flexibility of choosing a third-party content hosting service that features less aggressive terms of service. Note that the principles behind our design can be applied to other scenarios and first-party services as well.
The owner of content (e.g., a photo) uploads it to a third-party user-content hosting service and receives back a URL as the means of accessing that online content in the future. Subsequently, he encodes that URL into a reference object of the same type, e.g., a pseudo-image. In the next step, the owner uploads that indirection object to the first-party site, as he would normally do with the original content. The indirection object will assume the same space that the original content would occupy (e.g., a photo in a Facebook album), if the user chose to upload it directly to the first-party site. That reference object acts as an indirection schema containing the meta-data necessary to retrieve the original content.

In our implementation of Redirect2Own as a browser extension, presented in Section 4, we discuss how the above process can be completely automated to a degree that the user does not have to change his workflow; he can keep uploading content to the first-party site in the same way as before, while our extension will intercept the process and carry out all the steps in the background, without the user realizing that something has changed.

When an indirection object is displayed in the browser, we use the meta-data stored within to fetch the original content, and use it to replace the indirection object. Our aim is that the process is hidden from the user, who does not need to be aware where the displayed content is actually hosted. This way users can still access and interact with the content as they would normally do.

Figures 1 and 2 depict the proposed design when uploading and accessing content respectively. Overall, Redirect2Own is organized around three major components; the encoder/decoder, the core and the indirection provider interface.

The encoder/decoder component carries Web application-specific, e.g., Facebook, modules that handle Redirect2Own’s interaction with the application when a) the user tries to upload content, and b) when the user tries to render a page carrying indirection schemata. When the user tries to upload (write) content, proper indirection schemata (pseudo-data) are presented to the application to take the place of the actual data, which are kept off-site in a third-party content hosting service. At the same time, the actual content is forwarded to...
Fig. 2. Redirect2Own read overview: The process of accessing the original content hosted off-site through its resource locator, obtained by decoding the respective reference object actually hosted by the first-party site.

the core component which hands it off to the appropriate indirection provider module for off-site hosting, in a third party service. Then, when the user tries to render (read) content from the first party application containing indirection schemata, the decoder module is asked by the core component to identify them among different Web page elements, so that the core can pass them along to the appropriate indirection provider (based on their type) for resolution. Afterwards, the decoder module takes care of dynamically replacing the indirections with the actual content on the client-side (Web browser) in a manner which hides the fact that it is not actually retrieved from within the first party application.

The indirection provider carries off-site hosting modules which are content-type specific, e.g., one or more for storing images and another for storing text. These modules handle the hosting of user-generated content and return an indirection schema, which is to take the place of the original content in the first party service, e.g., Facebook. These modules also handle the reverse process of resolving an indirection to a pointer to the actual content, retrieving the content and returning it to the core, which passes it back to the decoder module tasked with dynamically embedding it in the current Web page at the client-side (Web browser) in the place of the indirection object. Examples of indirection provider modules are one using Flickr to upload images while encoding their URLs inside QR codes in the form of images, and one using Pastebin to upload text while encoding the respective URLs using short URLs with a custom fragment identifier (#) at the end to facilitate efficient identification by a decoder module.

3.1 Uploading user-generated content

We will use the scenario of uploading a photo on Facebook and redirecting the content to Flickr instead, as an example that will assist us in describing the process shown in Fig. 1. In step ①, a Facebook-specific encoder module steps in and intercepts the uploading of the photo, so that it never transmitted from the Web browser toward Facebook. Alternatively, the user hands in the photo to the module in a manner similar to what he is used to (i.e., through
a file selection dialog windows or by drag-and-drop). In step 2, the encoder forwards the photo to the core module, which picks the appropriate indirection provider based on the type of the content (here: image). In step 3, the Flickr indirection provider module is invoked to upload the photo on the service. Flickr returns a pointer (usually a URL) to the just-uploaded photo. The indirection module encodes that URL into another image, a QR code in this case, as it needs to be able to take the place of the content the user intended to upload. Had the original content been something else, e.g., text, the indirection pseudo-data object would also be in a text form. This is to ensure compatibility with the respective container the first party service (here: Facebook) utilizes for storing and presenting user content. The indirection object (QR image) is returned to the encoder module in step 4, which uploads it to Facebook in step 5, and acquires a URL reference to it on the Facebook server. This reference is used to populate, in steps 6 and 7, an indirection mappings cache. This cache is used for optimizing indirection object resolution. Parts of the cache can also be sent to friends of the user, either out of band or through some messaging mechanism Facebook provides. Otherwise, users will build their own cache incrementally, as they access the redirection objects. The process of accessing off-site hosted user content is similar and depicted in Figure 2.

3.2 Indirection mappings cache

The indirection mappings cache maintains the N most frequent mappings created, as a result of the user uploading content, and the M most recently used mappings, as a result of the user rendering indirection schemata that others have created. The existence of this cache allows step 8 shown in Fig. 1 to be skipped, which can result in reduced, or even zero, network requests for fetching an image. A hit in the cache saves the downloading and processing of an indirection schema (e.g., QR-code image) from the first-party site. It does not have any impact on the downloading of the actual off-site content. However, it can be employed in cooperation with the browser’s cache, so that frequently used content will not be fetched from the network, resulting in zero network communication. Moreover, mappings from this cache can be exported and shared with one’s friends in an attempt to facilitate the more efficient sharing of content collections, such as entire photo albums. Rather than having one’s friends decode the indirection schemata for a newly uploaded collection, communication mechanisms offered natively by the first-party service (e.g., Facebook’s messaging service) can be overloaded by Redirect2Own to exchange cache mappings between online friends.

4 Redirect2Own Implementation

We have implemented our proposed design in JavaScript (JS) as a Web browser extension for the latest version of Google Chrome (22.0.1229.94 m) with encoding modules facilitating uploading images on the Facebook social networking service using QR-code images as the indirection schemata and imgur.com as the off-site
content hosting service. We chose Facebook because of its popularity so that our proof of concept implementation supports a representative sample of the user-content uploads in social media. We chose [imgur.com](http://imgur.com) as it proved to be the fastest service in terms of response time, as shown in Section 5. Finally, the decision to adopt QR codes as indirection schemata was based on the fact that they are an open standard and any QR-capable device can resolve these to the content they point to, so that even users who do not have our extension can access such content.

Note that, as described in Section 3, our design is extensible through the addition of modules for a plethora of Web applications, including other social networking services and third-party content-hosting providers.

Here we provide implementation details on the components of Redirect2Own.

### 4.1 Encoder/decoder component

As the modules of this component interact directly with Web applications, we implemented this as a Content Script running immediately after the `window.onload` event. Content scripts are the front-end of a Chrome extension enabling direct interaction with the DOM of a page. The first thing the encoder/decoder does is dynamically load application-specific content script modules. These modules register filters that specify when each one should run (not all modules run for all Web sites) and regular expressions for matching DOM elements that are candidates for carrying indirection schemata (for the decoder).

To upload content, the encoder component implements a container window for the user to drag and drop his image files in. Alternatively, the encoder could intercept the user’s actions in the original upload page within Facebook and carry out the steps under the Redirect2Own model. We utilize the Facebook Graph API (http://developers.facebook.com/docs/reference/api/) to upload photos. We then read back the newly-uploaded photo’s Graph ID and static URL on Facebook, which we add to the mappings cache.

When browsing Facebook pages, the corresponding content scripts are loaded and inspect the DOM once on load and then periodically to catch elements dynamically added to the page. Once one of the registered expressions matches against a DOM element, such as an image, the corresponding content script module is fired. Matching content is forwarded to the core and then possibly, unless the mappings cache lookup returns a hit, to the indirection provider component for resolution.

**Optimizations** Naively, Redirect2Own would attempt to decode every image found in the DOM of a page. Even if restricted to pages of a specific domain (e.g., Facebook) that would waste resources for processing a lot of non-QR images. We optimize the process using a few simple heuristics to filter out images that are not part of our scheme. First, we filter images based on their location on the server (e.g., album photos on Facebook are under `sphotos*.fbcdn.net`, while
profile photos under profile.*.fbcdn.net. By inspecting the dimensions of an image, we can also eliminate images that are too small or too large. At the same time, the QR-code images that we generate have a fixed 1:1 ratio of their width over height, a feature which can help us distinguish them from graphics of similar dimensions. We can also ignore image encodings used for other types content in a particular service (e.g., GIF images). Finally, if the target service supports adding a text caption to photos (Facebook does), we can inject identifiers when uploading pictures to facilitate the distinction between QR and non-QR images.

If multiple QR-codes are encountered on a single page the can be processed in parallel using Web Workers [24] in JavaScript. Consequently, those images that are indeed valid QR codes containing image URLs, can be also fetched in a parallel and asynchronous manner diminishing the network overhead to that of a single roundtrip to the off-site content-hosting service.

4.2 Core component

The core component coordinates between the front-end components (encoder/decoder) and back-end (indirection provider). It is implemented as a Background Page [14]. It dynamically loads the available indirection provider components and multiplexes towards them requests, coming from the encoder/decoder base, based on the specific Web application and type of content being handled. It also manages the indirection mappings cache.

4.3 Indirection Mappings Cache

As an optimization to resolving indirection schemata to actual content each and every time they are requested by the user, we employ a mappings cache for speeding up frequently used content. This cache takes as input the URL of a indirection schema (before it is processed to reveal the URL it holds to off-site content – in our example case the URL of the QR-code image hosted on Facebook) and returns as output the URL to off-site-hosted content. As soon as the decoder component forwards to the core as a list of URLs of potential direction schemata, the core does a lookup in the mappings cache. On hit, it immediately returns the URL to the external content. On miss, it forwards the URLs to the indirection provider component. Please note that this caching is orthogonal to the Web browser’s content cache. For frequently-used content, the mappings cache will cause the analysis of indirection-candidate objects to be skipped and the Web browser’s cache will fetch the off-site content from the disk rather than the network.

4.4 Indirection provider component

We have employed QR codes to implement indirection schemata for images and URLs to do the same for text. As our off-site hosting providers, we utilize imgur and Pastebin respectively. Both services expose a REST HTTP API while its
users have to acquire a free registration key. This might be an inconvenience for
users as it adds one more step in the installation process of the Redirect2Own
browser extension. However, other services offer OAuth-based mechanisms which
smoothen the process.

At the moment QR codes only contain the URL towards the actual resource
while we append the \texttt{r2o} suffix in the fragment identifier of pastebin URLs so
that they can be identified by our extension. Both indirection schemata can carry
more meta-data if necessary. QR codes can encode up to 4,296 alphanumeric
characters including common symbols and there is no pre-defined limit on the
length of a URL or its fragment identifier.

5 Evaluation

Redirect2Own intercepts content upload and display to transparently implement
the proposed redirection schemes. Here, we evaluate the overhead in terms of net-
work latency and processing time for displaying Web pages containing image-
based (i.e., QR-code images) and text-based redirection schemata. Our evalu-
ation focuses on the impact of Redirect2Own when accessing content through
redirection, rather than the upload process. We believe that the overhead intro-
duced in content display is more crucial for the adoption of our approach, as any
piece of data is accessed frequently, and generated only once.

First, we measured the time required for decoding QR-code images. We up-
loaded 500 QR codes in a photo album on Facebook, and then browsed the
albums using Chrome (version 22.0.1229.94 m) with Redirect2Own enabled. We
instrumented our extension to record the duration of the decoding process. In
particular, we used the \texttt{getTime()} method of the JavaScript \texttt{Date} class to make
a note of the time before and after decoding a QR code. Because the decoding
process exhibited a very short duration and our confidence in JS’s time reporting
was low, we modified Redirect2Own to decode each QR-code image it encounters 10,000 times, so that the process lasts 5 orders of magnitude more than normal. We then divided the obtained results by the number of runs to get the average decoding time for each QR code. Figure 3 presents the cumulative distribution function (CDF) for the time it takes to complete a decoding operation. Overall, the process of decoding a QR-code image takes on average 4 ms. Bear in mind that this overhead is only incurred for images that have not already been filtered out by the decoder (see optimizations in Sec. 4.1).

To measure the network delay for retrieving the actual (hosted off-site) content after the resolution of an indirection schema, we employed 8 popular image-hosting services. We used the top five results when querying for “image hosting” on Google, plus Flickr, Dropbox, and Facebook’s content distribution network (CDN). For each service, we uploaded a 44KB image once, and then retrieved it 10 sequential times in 60 second intervals for a period of 32 hours on a weekday. Table 1 presents the median values from our measurements. We notice that we can retrieve an image from Facebook’s CDN (where the Facebook-uploaded images are normally stored) in 11 ms, and only one other service, imgur.com, is equally fast. Flickr takes close to 150 ms, while Dropbox requires almost 300 ms to serve the content. We see a significant gap between the first and last four services. We believe that image-hosting services that are more oriented towards interoperability with social networking services, such as Twitter and Facebook, are geared towards offering lower response times than services that advertise ample storage for hosting one’s images on the Cloud.

Overall, to access a single image using our indirection scheme, the browser would have to download that pseudo-content from the server, decode it, and then retrieve the actual content from a third-party server, such as Flickr. Therefore, in the case of Facebook someone would need 162 ms and 321 ms for using Redirect2Own with Flickr and Dropbox respectively, as opposed to 11 ms had the content been posted directly. As we have shown here, that is mainly due to the slower response times of these services, and less an effect of the redirection scheme.

| Service       | Response Time |
|---------------|---------------|
| Facebook CDN  | 11 ms         |
| Imgur         | 12 ms         |
| Photobucket   | 50 ms         |
| PostImage     | 51 ms         |
| Flickr        | 147 ms        |
| Dropbox       | 306 ms        |
| Tinypic       | 310 ms        |
| Imageshack    | 434 ms        |

Table 1. Time needed to retrieve a 44KB image from 8 popular image-hosting services.
Caching Effects Besides the fact that multiple schemata can be processed and retrieved in *in parallel*, Redirect2Own includes a mappings cache for frequently-accessed images or for a collection of images that the owner wants to share with his friends (described in Sec. 4). In the first case, we maintain a mapping between the URL of the indirection schema on the first-party server (here: Facebook) and the URL of the actual content in the third-party server (*e.g.*, Flickr). URLs of indirection schemata found in the cache will *not* be retrieved or decoded, and the off-site content will be immediately fetched. Therefore, a cache hit completely eliminates the cost of downloading and decoding a QR code from Facebook, *i.e.*, 16 ms in total. Please note that this caching method can be used along (*i.e.*, it is orthogonal) with the browser’s own caching mechanism so that if the off-site content is already cached from a previous request, the overall network delay will remain zero. In the second case, the owner of the content can share the mappings with his friends either out of band or using, for instance, Facebook’s messaging system. We imagine this in a scenario, where users would want to share an entire album of photos. This sharing of mappings can be performed transparently to users by Redirect2Own, piggybacking on existing social features.

6 Discussion

6.1 Redirect2Own without a browser extension

We consider the case of users accessing off-site content in a practical way without the use of the Redirect2Own browser extension. Enabling such access to the content in a practical way allows one’s online friends, who cannot or do not want to install this extension, to still be able to access the content from within the first-party site. Such compatibility for non-users of the extension is expected to encourage its adoption. We thus focus on compensating for the *read* functionality of the Redirect2Own extension. On that matter we observe that social networking services, to improve the interaction of their users with external sources, offer remote-content preview features. In other words, when users post links or other references to external content, a preview of the remote resource (*e.g.*, Web page, image or video) is rendered within the social networking service in the form of a thumbnail picture. The external content, along with the preview rendering are not hosted on the social networking service, and when users attempt to interact with them, they are redirected to the original external source. They are therefore not part of the social networking service and are not covered by its terms of service.

By employing the ubiquitous feature of commenting on items featured in a social networking service, we can include links or other references, that the service will generate a content preview for, to all the reference objects. For instance, one can leave a comment in Facebook underneath a QR-image reference object (generated by Redirect2Own) with the URL referencing the original image in the third-party site. Facebook will render a preview thumbnail picture of the original image, based on that URL in the comment, enabling users without the Redirect2Own browser extension to take a glimpse of the content being
referenced, and also provide a link for them to easily navigate to the hosting service. Such functionality is not odd and can be met in other social networking services such as Twitter. Besides the use of comments, other approaches are through social plugins, e.g., Facebook’s Like and Share buttons that have the same result for pages on external sites where the original user content might be hosted.

6.2 Absence of user data from server-side computations

Obviously the social networking service is unable to carry out any kind of computations on the off-site data. For instance, Facebook has rolled out a feature enabling labeled frames (tags) of people in photos so that online friends are notified when someone they know is “tagged” in a new photo uploaded in their social graph. If all photos are kept off-site, tagging may not work out of the box.

One may notice that tagging takes place dynamically at the client side through code running in the user’s browser and the service’s back end is employed only as a permanent store for that information. Therefore, a code bridge could be implemented so that user’s tagging actions on the off-site data can be translated to valid information for the social network to store and serve. We have experimented with the simple case of adding a white border around the actual QR-code to create an image of the same size as the one hosted off-site. We found that tagging works as far as the users are concerned.

On the other hand, other features such as social authentication might be more challenging to support. In social authentication, a user is presented with photos of his friends and is prompted by the social network to correctly identify them as an additional authentication feature besides providing his password. Facebook employs facial recognition algorithms to select good-quality photos of people’s faces for the social authentication challenges. Storing indirection schemata instead of the actual photos in the social network, will prevent it from generating social authentication challenges.

In general, storing user-generated content anywhere but the first-party Web site results in any kind of server-side calculation to be infeasible. For instance, when storing text, indexing and search functionalities cannot be supported by the server as the actual text is retrieved by each user on his side and is never available to the server. Same thing applies to photos as a more specific case detailed above. We consider the calculation of content meta-data at the client side, as a means of providing the necessary information for features such as the aforementioned to be provided by the first-party site.

6.3 Legal right to follow links

There is a special mention in the Facebook terms of service for social plugins such as the Like and Share buttons which enable users of third-party sites to post links or content from these sites to Facebook. The terms of service state that when such sites include the plugins in their pages they give permission to Facebook to “use and allow others to use such links and content on Facebook”. It
is not clear what falls under the “use” of the content coming from external sites. Facebook creates an entry in the user’s profile after he has “liked” or shared external content. That entry is called an “activity” and shared with the user’s online friends. For that matter, Facebook employs a crawler to fetch one of the images from the external page to use it as a thumbnail and also inspects the content of the external page to identify keywords, categorize it and extract a subset of the text to use as the description of this entry. The same behavior applies to URLs the user posts in his profile as part of status updates or in his comments to the activity or content of other users.

At the moment there seems to be a technical distinction between content, including text and images, retrieved that way from external sites and content the user directly uploads to Facebook, e.g., images added to his photo albums. The former are stored under the external subdomain of Facebook’s CDN domain (external.ak.fbcdn.net) while the latter are found under the photos or profile subdomains (http://sphotos-e.ak.fbcdn.net, http://profile.ak.fbcdn.net). Furthermore anything under the external subdomain is periodically fetched from its original source, usually after a user’s action to access it inside Facebook.

Overall, we cannot find a clear license claim on external content and it seems for the moment that there is some distinction between that and content uploaded explicitly by users. However, the line gets blurry when users post links or content from external sources which are part of their own intellectual property. Although these sources will be treated as external in the way they are stored, one could argue that legally they fall under clause 2 of the terms of service [8], describing the implicit sub-licensing of such content posted “on or in connection with Facebook”.

7 Conclusions

Massive amounts of content are generated and shared through social networking services every day. Users, be it for leisure or business, upload their content online, many times agreeing to terms of service that grant broad licenses on how services can use their content and may not meet the users’ needs and wishes. We proposed a design that decouples content from such services, enabling users to share their content in the first-party service as they normally would, while actually hosting it in a more suitable third-party hosting provider. For example, services with more favorable terms like Dropbox can facilitate such user needs. We created Redirect2Own, an extension for the Chrome Web browser, that enables users to share photos on Facebook, while hosting the actual content on Flickr, in a transparent and effective way. This extension provides a way for individuals and businesses to keep using social networking sites, without relinquishing any use rights of their intellectual property. Finally, we believe that Redirect2Own can also be perceived as the means to exercise pressure on such services to amend their terms of service in the users’ favor.
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