

# Phishing by data URI

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October 22, 2012

## 1 Abstract

Historically, phishing web pages have been hosted by web servers that are either compromised or owned by the attacker. This paper introduces a new approach to creating working phishing web pages without the direct need of a host. The contents of the phishing web page is simply contained its own URI (link). We present the appropriate steps to do this, and show a working example of such a phishing page.

## 2 Introduction

Using the data URI scheme it is possible to present media content in a web browser without hosting the actual data on the internet. Data URIs follow this scheme:

```
data:[<mediatype>] [;base64] ,<data>
```

Here, `<mediatype>` are one of the MIME media types described in RFC 2046[1]. The MIME media types were originally intended for use with emailing, but are also used to describe all content on the Internet as well. This means that you can represent any content type (e.g. `image/jpeg`, `text/html`, etc.) from the specification that is supported by the web browser.

Base64 encoding is optional. Using it ensures that any representation of data can be correctly transferred over the internet, by using a manageable alphabet to represent the data rather than raw bytes. Base64 splits the data into pieces of six bits (yielding  $2^6 = 64$ ) different characters to choose from.

To exemplify,

```
data:text/plain;,hello
```

shows the text *hello* without the use of Base64 encoding, and

```
data:text/plain;base64,aGVsbG8=
```

shows the same *hello*, and the `data` field now encoded.

Data URI technology has been available as RFC 2397[2] since 1998 – described as a way to easily embed text, pictures and other data in HTML pages, and for such it may be more efficient and hassle-free than hosting a possibly large number of small files.

However, with the ability to host arbitrary data within a URI, the possibility of doing the same with malicious web content springs to mind. Phishing web pages are minimally modified copies of original web pages, usually hosted at a compromised or malicious web server. Creating a phishing site from PayPal, Inc., for example, usually implies hosting at least a copy of PayPal’s login site, credit card information site, or other web page dealing with sensitive data. All content on the web page can be linked from PayPal’s own content servers. However, using the data URI scheme to contain the entire web page’s contents is also possible. Pictures, JavaScript, style sheets etc. can either be translated into their own data URI embedded in the file, or be linked from their respective sources. In the last case, all content, such as a JavaScript in the `head` tag, must be referenced in an absolute manner to work, i.e.:

```
<script type="text/javascript" src="./javascript.js" />
```

is changed to

```
<script type="text/javascript" src="http://example.org/javascript.js" />
```

or

```
<script type="text/javascript" src="data:text/javascript;contents of javascript.js" />
```

### 3 Creating a phishing site

An easy recipe of creating a phishing site is shown below:

1. Download the login web page to be copied.
2. Change all file paths relative to the domain to absolute ones, or convert them to data URIs.
3. Make the desired modifications to the site’s code. One can, for example, transfer user credentials or private data to another location.
4. (Optional) Encode the text contents of the web page with Base64 encoding to obfuscate the data to the victim. Base64 encoding will extend the overall data size by about 33 %.

5. Append the encoded material or the text contents of the web page into a data URI: Everything from `<!DOCTYPE>` (or `<HTML>`) to `</HTML>` must be moved into the `<data>` field above.

After this, you will end up with something along these lines. Note that we have used `text/html` as the MIME type as this is the appropriate way to present HTML pages.

```
data:text/html;base64,DQo8IURPQ1RZUEUgaHRtbCBQ
VUJMSUMgIi0vL1czQy8vRFREIEhUTUwgNC4wMSBUcmFuc2
10aW9uYWwvL0V0Igc0KImh0dHA6Ly93d3cudzMub3JnL1RS
L2h0bWw0L2xvb3N1LmR0ZCI+DQo8aHRtbD4NCiAgICA8aG
(...)
bnR3ZWlyLndvYS9Db250ZW50cy9XZWJtZXJ2ZXJSZXNvdX
JjZXMvc3dfYmFzZS5jc3MnIHJlbD0ic3R5bGVzaGVldCIg
dHlwZT0idGV4dC9jc3MiPg0KICAgICA8c3R5bGUgdH
1wZT0idGV4dC9jc3MiPg0KCQkJdGQ
```

The length of the final URI is a consequence of the data hidden within. If the original web page is very large, embedding linked material within may not be viable.

An example is provided below (Appendix A), which because of its size has been appended at the end.

## 4 Spreading the phishing web page

Remembering that the web page is contained within the URI, “only”<sup>1</sup> the URI must be passed on to a potential victim. Historically, phishing URIs are transferred by email, but in recent years, social media phishing has exploded. The use of URL shortening services has provided an additional layer of uncertainty in abstracting the original URL from the user<sup>2</sup>. (At least) One URL shortening services, TinyURL.com<sup>3</sup>, also provides the possibility of shortening data URIs into short URLs. *Whether or not TinyURL does this unwittingly is not known.*

## 5 Applicability and limitations

Being a rather old RFC specification, data URIs are supported by all major contemporary web browsers. A possible problem of this approach is rather

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<sup>1</sup>The URI could easily reach hundreds of kilobytes

<sup>2</sup>However, as the user reaches the target URL, it will be shown in the address bar.

<sup>3</sup><http://TinyURL.com>

the web browsers' memory management. The address field is simply not created for containing the enormous amount of bytes contained in the data URI.

In Google Chrome in particular, a control for unsafe redirection is implemented, disabling the user direct access to a data URI if that URI is the target of a redirection, such as from a URL shortening service. The user is presented with an alert that "This webpage is not available", together with the entire URI. Appended below is the error code `Error 311 (net::ERR_UNSAFE_REDIRECT): Unknown error.` indicating that the request was denied due to an unsafe state. However, the target URI is still present in the address field, and a push of the enter button successfully renders the web page. Note that Google Chrome does not produce an error when the user clicks directly on the data URI, without the redirection.

As of 22.10.2012, these limitations apply to the current web browsers:

Opera	12.02.1578	$x > 16777216$
Chrome		$1572864 < x < 3145728$
Internet Explorer	9.0.8112.16421	unsupported
Firefox		$x > 16777216$
Safari	5.34.57.2	$x > 16777216$

All values  $x > 16777216$  are probably unlimited.

## 6 Legal issues

In addition to the obvious issues with phishing, a discussion is appropriate as to whether a web host that keeps malicious data URIs is liable for hosting the malicious content they represent. In the above scenario, it can be argued that the URL shortening service is the host, as it provides and keeps the actual content.

## 7 Future Work

We may see more of so called "spear phishing", attempts focused on individuals, as phishing pages now can be created more easily. A personalised phishing web page can be created automatically, based on gathered information, and transmitted to one victim only. There is reason to believe that the

data URI scheme can provide other unknown attack vectors, so research on this topic and further scrutiny of the scheme is a prudent choice.

## 8 Conclusion

In this paper we have introduced a new way of presenting phishing web pages using a rather old, seldom used way to present web content. Using this procedure, there is no clear source of the phishing page and its content, which makes it difficult to trace, monitor the movement or establish the origin of the web page. Also, we conclude that phishing no longer requires web hosting of the page<sup>4</sup>, so phishing web pages may be more elusive passed around the Internet. They have no established anchor point in the Internet.

There is no way to *shut down* or remove a data URI web page, besides removing all instances of its link.

**The example presented in this document contains no harmful code. The example, and anything learned from this document should NEVER be used to perform any malicious activity. We do not with this example try to point out any vulnerability or weakness specific to Wikipedia, which was selected because of its international reputation and simple login page.**

## References

- [1] N. Freed and N. Borenstein. *Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types*. RFC 2046 (Draft Standard). Updated by RFCs 2646, 3798, 5147. Internet Engineering Task Force, Nov. 1996. URL: <http://www.ietf.org/RFC/RFC2046.txt>.
- [2] L. Masinter. *The “data” URL scheme*. RFC 2397 (Proposed Standard). Internet Engineering Task Force, Aug. 1998. URL: <http://www.ietf.org/RFC/RFC2397.txt>.

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<sup>4</sup>While transmission of sensitive data can be handled within the phishing page, receiving and storing the data is not taken into consideration here.

## Appendix A: An example phishing web page

Below we present a phishing edition of the login and registration page of the English Wikipedia, <http://en.wikipedia.org/>. It is a minimal example, in which some relative links have been corrected. Additionally, the functionality of the “Log in” button has been altered, showing the password entered in the password field to the user. The login screen of the English Wikipedia can be found here:

<http://en.wikipedia.org/w/index.php?title=Special:UserLogin>

# The rendered web page

The screenshot shows the Wikipedia 'Log in / create account' page. At the top, there is a navigation bar with the Wikipedia logo and the text 'WIKIPEDIA The Free Encyclopedia'. Below this is a search bar and a 'Log in' button. The main content area is titled 'Log in / create account' and contains a form for logging in. The form has fields for 'Username:' and 'Password:', a checkbox for 'Remember me (up to 180 days)', and a 'Log in' button. A 'Forgot your login' link is also present. Below the form is a section titled 'Secure your account:' with a list of security tips. A JavaScript alert box is overlaid on the form, displaying the message 'Your password is correct horse battery staple' and an 'OK' button. The footer of the page contains links for 'Privacy policy', 'About Wikipedia', and 'Disclaimers'.

Special page

## Log in / create account

### Log in

Don't have an account? [Create one.](#)

Username:

Password:

Remember me (up to 180 days)

[Log in](#) [Forgot your login](#)

### Secure your account:

- Consider logging in on the secure server.
- If your password only contains letters or only numbers, please read our article on password strength and consider changing it (in [Special:Preferences](#) after you log in).
- To avoid becoming a victim of phishing, always verify that you are viewing [Wikipedia's login page](#) when logging in. Wikipedia will never ask for any information other than your username, password and e-mail address.
- Do not give out your password to anyone.
- If your account is compromised, it may be permanently blocked unless you can prove you are its rightful owner.
- As a safeguard you may "commit" to your identity by adding a [cryptographic hash](#) to your user page as explained [here](#). This makes it almost impossible for an impostor to continue impersonating you once you regain control of your account.

[Privacy policy](#) [About Wikipedia](#) [Disclaimers](#)

Powered by [MediaWiki](#)

### **Base64 encoded data URI**

This data URI consists of 24682 characters and can with ease be shrunk to 26 characters with a supported URL shortening service, such as the one mentioned.







QiIGhyZWY9Imh0dHBzOi8vZW4ud2lraXBlZGh1Lm9yZy93aWtpLlNwZWNPYWw6VXN1ckxvZ2luIj5zZWN1cmUgc2VydmdVY  
PC9hPi4NCjwvbkGk+PGxpPiBjZiB5b3VyIHBhc3N3b3JkIG9ubHkGy29udGFbnMgbGV0dGVycyBvciBvbmh5IG51bW1lcn  
MsIHBsZWZfZSByZWFkIG91ciBhcnRyY2xlIG9uIDxhIGhyZWY9Ii93aWtpLlBhc3N3b3JkX3N0cmVuz3RoIiB0aXRST0i  
UGFz3dvcMqGc3RyZw5ndGgiPnBhc3N3b3JkIHNoemVuz3RoPC9hPiBhbMqGy29uc2lkZXiGy2hhbmdpbcmaGxQgKGLuID  
xhIGhyZWY9Ii93aWtpLlNwZWNPYWw6UHJ1ZmVhZ2V5ZjZkMiIHRpdGx1PSJTCGVjaWFSOlByZWZlcmVuz3VzIj5tZGVjaWFS  
OlByZWZlcmVuz3VzPC9hPiBhZnRlc1B5b3UgbG9nIGluS4NCjwvbkGk+PGxpPiBUbyBhdM9pZCBIzWNvbWluZyBhIHZpY3  
RpbSBVziA8YSBocmVmPSIvd2lras9QaG1zaGluZyIgdG10bGU9IlBoaXNoaW5nIj5waG1zaGluZzwvYT4sIGFsd2F5cyB2  
ZXJpZnkgdGhhdCB5b3UgYXJlIHZpZXdpcGcGPEgY2xhc3M9ImV4dGVybmFsIHRleHQiIGhyZWY9Ii8vZW4ud2lraXBlZG  
h1Lm9yZy93aWtpLlNwZWNPYWw6VXN1ckxvZ2luIj5XaWtpcGVkaWEncyBsb2dpbiBwYwd1PC9hPiB3aGVuIGxvZ2dpbmCG  
aW4uIFdpa2lWZWRpYSB3aWxsIG51dmVYIGFzayBmb3IgyW55IGluZm9ybWFOaW9uIG90aGVyIHRoYW4geW91ciB1c2VybM  
FtZSwgcGFzc3dvcMqGyW5kIGUtbWFPbCBhZGRyZXNzLgOKPC9saT48bGk+IERvIG5vdCBnaXZlIG91dCB5b3VyIHBhc3N3  
b3JkIHRvIGFueW9uzS4NCjwvbkGk+PGxpPiBjZiB5b3VyIGFjY291bnQgaXMGy29tchjvbw1zZWQsIG10IG1heSBiZSBwZX  
JtYw51bnRseSB1bG93ja2VkJHVubGVzcyB5b3UgY2F0IHByb3ZlIH1lvdSBhcmUgaXRzIHJpZ2h0ZnVsIG93bmVYLgOKPC9s  
aT48bGk+IEFzIGEGc2FmZWdlYXJkIH1lvdSBtYXkgImNvbW1pdCIgdG8geW91ciBpZGVudG10eSBieSBhZGRpbmCGYSA8YS  
BocmVmPSIvd2lras9DcnldG9ncmFwaGljX2hhc2hfZnVuz3Rpb24iIHRpdGx1PSJDCnlwdG9ncmFwaGljIGhhc2ggZnVu  
Y3Rpb24iPmNyeXB0b2dyYXB0aWMGaGFzaDwvYT4gdG8geW91ciA8YSBocmVmPSIvd2lras9XaWtpcGVkaWE6VXN1cl9wYW  
dlIiB0aXRST0iV2lraXBlZGh1b0lVzZXIgcGFnZSIgY2xhc3M9Im13LXJlZGlyZWNOIj51c2VYIHBhZ2U8L2E+IGFzIGV4  
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b3IgyW4gaW1wb3N0b3IgdG8gY29udG1udWUgaW1wZXJzb25hdGluZyB5b3Ugb25jZSB5b3UgcGVkaWFSOlByZWZlcmVuz3  
YgeW91ciBhY2NvdW50LgOKPC9saT48L3VsPgOKPC9kaXY+DQo8L2Rpdj4NCjwvZG12PgkjcQk8IS0tIC9ib2R5Y29udGVu  
dCATLT4NCgkjcQkjcQkjcPCEtLSBwcm1udGZvb3R1ciAtLT4NCgkjcQk8ZG12IGNsYXNzPSJwcm1udGZvb3R1ciI+DQoJCQ  
kJU0cm1ldmVkJGZyb20giJxhIGhyZWY9Imh0dHA6Ly91bi53aWtpcGVkaWEub3JnL3da2kvU3BlY2lhbDpVc2VYTG9n  
aW4iPmhoDA6Ly91bi53aWtpcGVkaWEub3JnL3da2kvU3BlY2lhbDpVc2VYTG9naW48L2E+IGkjcQk8L2Rpdj4NCgkjcQ  
k8IS0tIC9wcm1udGZvb3R1ciAtLT4NCgkjcQkjcQkjcQkjcTwhLS0gy2F0bG1ua3MgLS0+DQoJCQkjcPGRpdipBpZD0nY2F0  
bGlua3MnIGNsYXNzPSdjYXRsaW5rcyBjYXRsaW5rcylhbGxoaWRkZW4nPiJwvZG12PgkjcQk8IS0tIC9jYXRsaW5rcyAtLT  
4NCgkjcQkjcQkjcQkjcTxxaXyGy2xhc3M9InZpc3VhbENsZWfYIj48L2Rpdj4NCgkjcQk8IS0tIGRlYnVnaHRtbCATLT4N  
CGkjcQkjcQkjcPCEtLSAvZGVidWodG1sIC0tPgOKPC9kaXY+DQoJCQk8IS0tIC9ib2R5Y29udGVudCATLT4NCgkjcP  
9kaXY+DQoJCtwhLS0g2NbnRlbnQgLS0+DQoJCtwhLS0gaGVhZGVyIC0tPgOKCQk8ZG12IGlkPSJtdyloZWfkiIibjbfz  
cz0ibm9wcm1udCI+DQoNCjwhLS0gMCAAtLT4NCjxkaXYgaWQ9InAtcGVyc29uYwWiIGNsYXNzPSIiPgOKTzoNT5QZXXzb2  
5hbCB0b29sczwwaDU+DQoJPHVsPgOKCQk8bGkgaWQ9InB0LWNyZWf0ZWFjY291bnQiPjxhIGhyZWY9Imh0dHA6Ly9odHRW  
Oi8vZW4ud2lraXBlZGh1Lm9yZy93L2luZGV4LnBocD90aXRST1TCGVjaWFSOlVzZXJmb2dpbiZhbXA7cmV0dXJudG89V2  
lraXBlZGh1JmFtcD0eXB1PXNpZ251cCI+Q3JlYXRlIGFjY291bnQ8L2E+PC9saT4NCgkjcPxpIGlkPSJwdCl1sb2dpbiIgy  
Y2xhc3M9ImFjdG12ZSI+PEgaHJlZj0iaHR0cDovL2h0dHA6Ly91bi53aWtpcGVkaWEub3JnL3cvaW5kZXgucG9mP3RpdG  
xlPWNwZWNPYWw6VXN1ckxvZ2luJmFtcDtyZXRlcm50bz1XaWtpcGVkaWEiIHRpdGx1PSJZb3UgYXJlIGVuz291cmFnZwQg  
dG8gbG9nIGluOyBob3dlmVYLCBpdCBpcyBub3UgbWfuzGF0b3J5L1Bbb10iIGFjY2Vzc2tleT0ibyI+TG9nIGluPC9hPj  
wvbkGk+DQoJPC91bD4NCjwvZG12PgOKDQo8IS0tIC8wIC0tPgOKCQkjcPGRpdipBpZD0ibGVmdCl1YXZpZ2F0aW9uIj4NCgOK  
PCEtLSAwIC0tPgOKPGRpdipBpZD0ic1uYw1lc3BhY2VzIiBjbfzycz0idmVjdG9yVGFicyI+DQoJPGg1Pk5hbWVzcGFjZ  
M8L2g1PgOKCTx1bD4NCgkjcQkjcPxpICBpZD0iY2EtbmN0YWIte3BlY2lhbCIgy2xhc3M9InNlbGVjdGvkIj48c3Bhb3j48  
YSBocmVmPSJodHRW0i8vaHR0cDovL2Vulndpa2lWZWRpYS5vcmevdy9pbmRleC5waHA/dG10bGU9U3BlY2lhbDpVc2VYTG  
9naW4mYw1wO3JldHvbnRvPvdp2lWZWRpYSIgIHRpdGx1PSJUAglzIG1zIGEGc3BlY2lhbCBwYwdlIHdoawNoIH1lvdSBj  
Yw5ub3QgZWRpdCI+U3BlY2lhbCBwYwdlPC9hPjwvc3Bhb3j48L2xpGOKCQkjcP91bD4NCjwvZG12PgOKDQo8IS0tIC8wIC  
0tPgOKDQo8IS0tIDEgLS0+DQo8ZG12IGlkPSJwLXZhcmlhbnRzIiBjbfzycz0idmVjdG9yVGFicyI+DQoJPC9hPjwvZG12PgOK  
PgOKTzoND4NCgkjcP9oND4NCgk8aDU+PHNwYw4+VmFyaWfudHM8L3NwYw4+PEgaHJlZj0iIyI+PC9hPjwvZG12PgOKPGRpdipB  
pZD0ibjbfzycz0ibWVudSI+DQoJCtX1bD4NCgkjcQkjcP91bD4NCgk8L2Rpdj4NCjwvZG12PgOKDQo8IS0tIC8xIC0tPgOK  
CQkjcP9kaXY+DQoJCQk8ZG12IGlkPSJyaWdodCl1YXZpZ2F0aW9uIj4NCgOKPCEtLSAwIC0tPgOKPGRpdipBpZD0ic12aW  
V3cyIgy2xhc3M9InZlY3Rvc1RhYnMgZW1wdHlQb3J0bGV0Ij4NCgk8aDU+Vm1ld3M8L2g1PgOKCTx1bD4NCgkjcTwdWw+  
DQo8L2Rpdj4NCgOKPCEtLSAvMCAAtLT4NCgOKPCEtLSAxIC0tPgOKPGRpdipBpZD0ic1jYWN0aW9ucyIgy2xhc3M9InZlY3  
Rvck1lbnUgZW1wdHlQb3J0bGV0Ij4NCgk8aDU+PHNwYw4+QWN0aW9uczwvc3Bhb3j48YSBocmVmPSIiIj48L2E+PC9oNT4N  
CGk8ZG12IGNsYXNzPSJtZW51Ij4NCgkjcP9sPc9kQk8L3VsPgOKCTwvZG12PgOKPC9kaXY+DQoNCjwhLS0gLeGLeGLeG  
0+DQoNCjwhLS0gMiAtLT4NCjxkaXYgaWQ9InAtc2VhcmNoIj4NCgk8aDU+PGxhYmVsIGZvcj0ic2VhcmNoSW5wdXQiP1Nl  
YXJjaDwvbkGFIzWw+PC9oNT4NCgk8Zm9ybSBhY3Rpb249Imh0dHA6Ly9odHRW0i8vZW4ud2lraXBlZGh1Lm9yZy93L2luZG  
V4LnBocCIgaWQ9InNlYXJjaGZvcmevdy9pbmRleC5waHA/dG10bGU9U3BlY2lhbDpVc2VYTG9naW4mYw1wO3JldHvbnRvPvdp2  
lWZWRpYSIgIHRpdGx1PSJUAglzIG1zIGEGc3BlY2lhbCBwYwdlIHdoawNoIH1lvdSBjYw5ub3QgZWRpdCI+U3BlY2lhbCBwYwdlPC9hPjwvc3Bhb3j48L2xpGOKCQkjcP91bD4NCjwvZG12PgOKDQo8IS0tIG5hdm1nYXRpb2  
4gLS0+DQo8ZG12IGNsYXNzPSJw3j0YwWiIGlkPSdWlW5hdGluZyB5b3Ugb24nPgOKCTzoNT5QZXXzb2F0aW9uPc9oNT4NCgk8  
ZG12IGNsYXNzPSJib2R5Ij4NCgkjcP9sPc9kQk8L2Rpdj4NCgkjcPxpIGlkPSJULW1haW5wYwdlLWR1c2NyaXB0aW9uIj48YSBocmVmPS  
Ivd2lras9NYwluX1BhZ2UiIHRpdGx1PSJWaxNpdCB0aGUgbWfufbiBwYwdlIFt6XSIGyYWNzZXNza2V5PSJ6Ij5NYWluIHh

