(somewhat) breaking the same-origin policy by undermining dns-pinning

(somewhat) breaking the same-origin policy by undermining dns-pinning - Martin Johns, It's a shampoo world anyway.

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Content

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Maddin, Montag, 14. August 2006, 17:42

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A small contribution to the current "hacking the intranet with JavaScript" meme:

Introduction

J. Grossman, RSnake, SPI Dynamics, pdp and others have demonstrated lately that it is possible for a malicious JavaScript a) to obtain the (internal) IP address of the hosting web browser, b) to portscan the lan to locate intranet http servers, c) to fingerprint these http servers using well known URLs d) and (sometimes) to exploiting them via CSRF.

During my research on that topic I discovered, that with some tweaking, it is also possible for the script to obtain read access, allowing the leakage of internal information and more precise fingerprinting.

Technical background

The basis of the attack is rather old. It was described by the Princeton University in 1996 [1] and was recently brought to my attention by Amit Klein [3]. For the attack to succeed the attacker needs to control the DNS entry for his web server (www.attacker.org in the following example).

Attacking an intranet host located at 10.10.10.10 would roughly work like this:

- The victim downloads a malicious script from www.attacker.org

- After the script has been downloaded, the attacker modifies the DNS answer for www.attacker.org to 10.10.10.10
- The malicious script requests a web page from www.attacker.org (e.g via loading it into an iframe)
- The web browser again does a DNS lookup request for www.attacker.org, now resolving to the intranet host at 10.10.10.10
- The web browser assumes that the domain values of the malicious script and the intranet server match, at therefore grants the script unlimited access to the intranet server.

To prevent this type of attack, modern web browsers implement “DNS Pinning” - DNS lookup results are kept unchanged for the entire browser session, even though the DNS entry’s lifetime may be shorter. Mohammad A. Haque describes in [2] how the attack method still can work, providing that the malicious script survives in the browser cache. The described scenario requires the victim to quit his web browser and to access the malicious script a second time, which renders the attack to be somewhat unlikely.

The refined attack: Undermining DNS pinning by rejecting connections

As it turns out, it is also possible to force the browser to renew the DNS entry for a given domain “on the fly”. The following sequence of events worked for me (tested on IE6 xpsp2 and Firefox 1.5.0.6):

1. The victim loads the script from www.attacker.org.
2. The attacker changes the DNS entry of www.attacker.org to 10.10.10.10
3. Further more the attacker quits the web server that was running on www.attacker.org’s original IP
4. The script uses a timed event (setIntervall or setTimeout) to load a web page from www.attacker.org
5. The web browser tries to connect to the IP which is bound to www.attacker.org from the previous request. As the web server there is shut down now, this connection attempt is rejected.
6. Because of this (and probably because of the DNS entry’s short lifetime), the browser drops the DNS pinning and does a new DNS lookup request, resulting in 10.10.10.10 (sometimes it takes more than one loading attempt to trigger the lookup request).
7. The script is now able to access the intranet server’s content and to leak it to the outside.

Some (crude) PoC code is available at http://polyboy.net/xss/dnsslurp.html

I successfully tested the described approach on two different computers in two different networks. Still the result is purely experimental. As I have not read the web browser’s source code, I can only guess why the attack works. For this reason it may be possible, that the attack fails on different setups.

Outlook

This technique obviously can be automated. Instead of quitting the web server on attacker.org completely, dynamic firewall rules could be used to reject further connections from the victim’s IP after the initial script was delivered.

The attack only woks, if the attacked server does not check the http host property, as this property would still be “www.attacker.org”. For the same reasons all virtual hosts are out of the attacker’s reach.

Update (12/2006): Kanatoko Anvil from jumperz.net found out that it is not necessary to shut down the web server. It is sufficient for the malicious script to access a closed port on the intranet server (e.g. attacker.org:81) to cause the web browser to initiate a new DNS query. See here for a demo. Wow.

References

[1] DNS Attack Scenario, http://www.cs.princeton.edu/sip/news/dns-scenario.html [2] Josh Soref: DNS: Spoofing and Pinning, http://viper.haque.net/~timeless/blog/11/ [3] Amit Klein: Re: Detecting, Analyzing, and Exploiting Intranet Applications using JavaScript (Posting to the WebAppSec-Mailinglist), http://www.webappsec.org/lists/websecurity/archive/2006-07/msg00090.html

Comments

slow_reader, Samstag, 16. Dezember 2006, 02:54

viper.haque.net/~timeless/ credit wrong

Your second reference is incorrect: "timeless" is Josh Soref, a well-known contributor to the Mozilla project.

Maddin, Dienstag, 26. Dezember 2006, 16:16

It's now corrected.

Thank you for this information.