App Transport Security: What, Why, How?

About Me

→ Chris Dzombak

→ iOS @ NY Times

→ @cdzombak on Twitter

Don’t take notes.

App Transport Security

→ WWDC 2015

→ iOS 9

→ OS X 10.11

App Transport Security

...is just a few rules about network connections.

App Transport Security

...is just a few rules about network connections.

...for apps built against the iOS 9 or OS X 10.11 SDKs.

The rules

No HTTP

TLS 1.2

Good TLS cipher suite, that provides forward secrecy

SSL certificate issued by a trusted certificate authority

Safe lengths for encryption keys

→ RSA keys: 2048 bits or longer

→ ECC keys: 256 bits or longer

Server certificate uses SHA-256 or better

ATS Rules

→ HTTPS

→ TLS 1.2

→ TLS cipher suite with forward secrecy

→ Trusted certificate authority

→ Safe encryption key size

→ Certificate using SHA-256 or better

HTTPS Best Practices

Certificate pinning?

Almost nobody uses certificate pinning 😢

Frederic Jacobs
@FredericJacobs

Following

It's 2016 & apps like YouTube, Peach, Instagram or Slack don't do certificate pinning. Rogue CAs anyone?

ATS is implemented somewhere in Core Foundation territory

App Transport Security rules apply to `NSURLSession`, `NSURLConnection`, `libcurl`, …

ATS: On the server

ATS: On the server

→ Use Mozilla's server-side TLS guide and configuration generator

→ Get a free certificate from Let's Encrypt

→ Or an inexpensive one from Namecheap

→ Test with SSLLabs SSL Tester

Adopting ATS

Build against the iOS 9/ OS X 10.11 SDK

ATS Exceptions

→ Configure exceptions per-domain

→ `NSAppTransportSecurity` key in `Info.plist`

```
NSAppTransportSecurity : Dictionary {
    NSExceptionDomains : Dictionary {
        <domain-name-string> : Dictionary {
            NSIncludesSubdomains : Boolean
            NSExceptionAllowsInsecureHTTPLoads : Boolean
            NSExceptionRequiresForwardSecrecy : Boolean
            NSExceptionMinimumTLSVersion : String
        }
    }
    NSAllowsArbitraryLoads : Boolean
}
```

`NSExceptionDomains`

→ Optional.

→ Dictionary. Keys are domain names; values are dictionaries.

`NSIncludesSubdomains`

→ Optional; defaults to `NO`.

→ Whether this domain's exceptions apply to its subdomains, too.

`NSExceptionMinimumTLSVersion`

→ Optional; defaults to `TLSv1.2`.

→ The minimum TLS version that will be accepted for connections to this domain.

→ Valid values: `TLSv1.0`, `TLSv1.1`, `TLSv1.2`

NSExceptionRequiresForwardSecrecy

→ Optional; defaults to YES.

→ Setting to NO allows for using TLS cipher suites that don’t provide forward secrecy for connections to this domain.

NSExceptionAllowsInsecureHTTPLoads

→ Optional; defaults to NO.

→ If YES, your app can connect insecurely to this domain with no certificate, or a self-signed, expired, or hostname-mismatched certificate.

Third-party exceptions

- `NSThirdPartyExceptionAllowsInsecureHTTPLoads`
- `NSThirdPartyExceptionRequiresForwardSecrecy`
- `NSThirdPartyExceptionMinimumTLSVersion`

```
NSAppTransportSecurity : Dictionary {
    NSExceptionDomains : Dictionary {
        <domain-name-string> : Dictionary {
            NSIncludesSubdomains : Boolean
            NSExceptionAllowsInsecureHTTPLoads : Boolean
            NSExceptionRequiresForwardSecrecy : Boolean
            NSExceptionMinimumTLSVersion : String
        }
    }

    // let's talk about this…
    NSAllowsArbitraryLoads : Boolean
}
```

NSAllowsArbitraryLoads

→ Optional; defaults to NO.

→ When YES, disables ATS for all domains, except those you configure via exceptions.

Exceptions can opt domains out of ATS...

...

...or, if ATS is disabled via `NSAllowsArbitraryLoads`, exceptions can opt domains back *into* ATS.

Domain only accessible via HTTP

```
NSAppTransportSecurity
    NSExceptionDomains
      "media-server.example.com"
        NSExceptionAllowsInsecureHTTPLoads = YES
```

Domain running an old TLS configuration

```
NSAppTransportSecurity
    NSExceptionDomains
        "less-secure.example.com"
            NSExceptionRequiresForwardSecrecy = NO
            NSExceptionMinimumTLSVersion = "TLSv1.0"
```

Connecting to user-provided URLs, but using ATS for your own domain

```
NSAppTransportSecurity
    NSAllowsArbitraryLoads = YES
    NSExceptionDomains
        "api.example.com"
            NSExceptionAllowsInsecureHTTPLoads = NO
            NSExceptionRequiresForwardSecrecy = YES
            NSExceptionMinimumTLSVersion = "TLSv1.2"
```

`SFSafariViewController` ==

no ATS configuration needed

NSA-friendly mode

```
NSAppTransportSecurity
    NSAllowsArbitraryLoads = YES
```

Best practice: make the narrowest exceptions you can

Connecting to IP addresses over standard HTTP

```
NSAppTransportSecurity
    NSAllowsArbitraryLoads = YES
    NSExceptionDomains
        "api.example.com"
            NSExceptionAllowsInsecureHTTPLoads = NO
            NSExceptionRequiresForwardSecrecy = YES
            NSExceptionMinimumTLSVersion = "TLSv1.2"
```

Connecting to domains with SHA-1 certificates or small key sizes

```
NSAppTransportSecurity
    NSExceptionDomains
        "i-need-a-new-certificate.example.com"
            NSExceptionAllowsInsecureHTTPLoads = YES
```

Debugging

-98xx

Disable ATS (temporarily)

Disable ATS (temporarily)...

...

...then narrow down the issue with exception domains

CFNETWORK_DIAGNOSTICS=1

CFNetwork Diagnostic Logging (Technical Q&A 1887)

https://developer.apple.com/library/ios/qa/qa1887/_index.html

```
nscurl --ats-diagnostics
```

```
nscurl --ats-diagnostics
--verbose https://
www.dzombak.com
```

`nscurl --ats-diagnostics`

→ Can I connect to this server with ATS?

→ Why not?

→ What exceptions do I need to configure?

Working with Charles Proxy: (temporarily) disable ATS

Additional ATS reference/debugging resources

Remember, these slides will be posted online shortly.

https://gist.github.com/cdzombak/3d2ff091b9038fde27bb

Who’s actually using ATS?

September 2015

→ 1Password (6.0): ❌ opts out

→ Dropbox (4.0): ❌ opts out

→ Facebook (39.1): ❌ opts out

→ Google Maps (4.10.1): ❌ opts out

→ …

September 2015

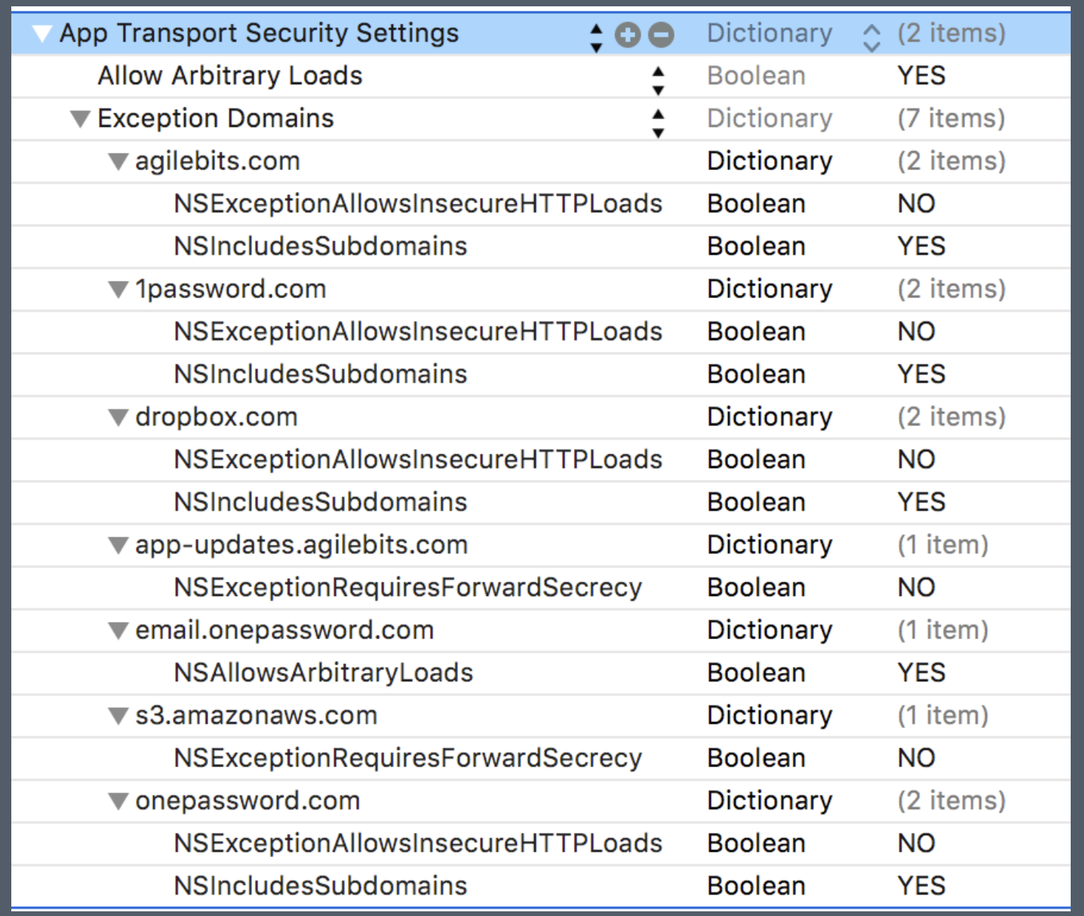
→ …

→ Instagram (7.6.0): ❓

→ Microsoft OneNote (2.16.1): ❌ opts out

→ Tumblr (4.5): ✅ uses ATS properly

Jan. 2016: 1Password (6.2) ✅



App Transport Security Settings	Dictionary	(2 items)
Allow Arbitrary Loads	Boolean	YES
Exception Domains	Dictionary	(7 items)
agilebits.com	Dictionary	(2 items)
NSExceptionAllowsInsecureHTTPLoads	Boolean	NO
NSIncludesSubdomains	Boolean	YES
1password.com	Dictionary	(2 items)
NSExceptionAllowsInsecureHTTPLoads	Boolean	NO
NSIncludesSubdomains	Boolean	YES
dropbox.com	Dictionary	(2 items)
NSExceptionAllowsInsecureHTTPLoads	Boolean	NO
NSIncludesSubdomains	Boolean	YES
app-updates.agilebits.com	Dictionary	(1 item)
NSExceptionRequiresForwardSecrecy	Boolean	NO
email.onepassword.com	Dictionary	(1 item)
NSAllowsArbitraryLoads	Boolean	YES
s3.amazonaws.com	Dictionary	(1 item)
NSExceptionRequiresForwardSecrecy	Boolean	NO
onepassword.com	Dictionary	(2 items)
NSExceptionAllowsInsecureHTTPLoads	Boolean	NO
NSIncludesSubdomains	Boolean	YES

January 2016

→ Dropbox (4.2.2): ❌ opts out

→ Facebook (46.0): ❌ opts out

→ Facebook Messenger (53.0): ❌ opts out

→ Flickr (4.0.7): ✅

→ Gmail (4.3): ❌ old SDK

Jan. 2016: Evernote (7.9.2) ❌

▼ App Transport Security Settings	Dictionary	(2 items)
Allow Arbitrary Loads	Boolean	YES
▼ Exception Domains	Dictionary	(5 items)
▼ evernote.com	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES
▼ akamaihd.net	Dictionary	(2 items)
NSIncludesSubdomains	Boolean	YES
NSThirdPartyExceptionRequiresForwardSecrecy	Boolean	NO
▼ fbcdn.net	Dictionary	(2 items)
NSIncludesSubdomains	Boolean	YES
NSThirdPartyExceptionRequiresForwardSecrecy	Boolean	NO
▼ facebook.com	Dictionary	(2 items)
NSIncludesSubdomains	Boolean	YES
NSThirdPartyExceptionRequiresForwardSecrecy	Boolean	NO
▼ yinxiang.com	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES

Jan. 2016: ForeFlight (7.5.1) ✅

▼ App Transport Security Settings	Dictionary	(2 items)
Allow Arbitrary Loads	Boolean	YES
▼ Exception Domains	Dictionary	(5 items)
▼ api.simperium.com	Dictionary	(1 item)
NSExceptionAllowInsecureHTTPLoads	Boolean	NO
▼ splex.foreflight.com	Dictionary	(1 item)
NSExceptionAllowInsecureHTTPLoads	Boolean	NO
▼ charts.foreflight.com	Dictionary	(1 item)
NSExceptionAllowInsecureHTTPLoads	Boolean	NO
▼ api.foreflight.com	Dictionary	(1 item)
NSExceptionAllowInsecureHTTPLoads	Boolean	NO
▼ cloudfront.foreflight.com	Dictionary	(1 item)
NSExceptionAllowInsecureHTTPLoads	Boolean	NO

January 2016

→ Google (11.1.0): ❌ opts out

→ Google Maps (4.14.0): ❌ opts out

→ Microsoft OneNote (2.18.1): ❌ opts out

→ Pages (2.6.1): ✅

→ Peach (1.0.9): ❌ opts out

Jan. 2016: Instagram (7.13.1) ?

▼ App Transport Security Settings	Dictionary	(2 items)
Allow Arbitrary Loads	Boolean	YES
▼ Exception Domains	Dictionary	(6 items)
▼ akamaihd.net	Dictionary	(3 items)
NSIncludesSubdomains	Boolean	YES
NSExceptionAllowsInsecureHTTPLoads	Boolean	YES
NSThirdPartyExceptionRequiresForwardSecrecy	Boolean	NO
▼ instagram.com	Dictionary	(5 items)
NSExceptionAllowsInsecureHTTPLoads	Boolean	YES
NSExceptionRequiresForwardSecrecy	Boolean	YES
NSRequiresCertificateTransparency	Boolean	NO
NSIncludesSubdomains	Boolean	YES
NSExceptionMinimumTLSVersion	String	TLSV1.2
▼ cdninstagram.com	Dictionary	(5 items)
NSExceptionAllowsInsecureHTTPLoads	Boolean	YES
NSExceptionRequiresForwardSecrecy	Boolean	YES
NSRequiresCertificateTransparency	Boolean	NO
NSIncludesSubdomains	Boolean	YES
NSExceptionMinimumTLSVersion	String	TLSV1.2
▼ fbcdn.net	Dictionary	(3 items)
NSIncludesSubdomains	Boolean	YES
NSExceptionAllowsInsecureHTTPLoads	Boolean	YES
NSThirdPartyExceptionRequiresForwardSecrecy	Boolean	NO
▼ facebook.com	Dictionary	(3 items)
NSIncludesSubdomains	Boolean	YES
NSExceptionAllowsInsecureHTTPLoads	Boolean	YES
NSThirdPartyExceptionRequiresForwardSecrecy	Boolean	NO
▼ help.instagram.com	Dictionary	(5 items)
NSExceptionAllowsInsecureHTTPLoads	Boolean	YES
NSExceptionRequiresForwardSecrecy	Boolean	NO
NSRequiresCertificateTransparency	Boolean	NO
NSIncludesSubdomains	Boolean	YES
NSExceptionMinimumTLSVersion	String	TLSV1.2

Jan. 2016: Pinterest (5.7.2) ?

▼ App Transport Security Settings	Dictionary	(2 items)
Allow Arbitrary Loads	Boolean	YES
▼ Exception Domains	Dictionary	(5 items)
▼ akamaihd.net	Dictionary	(2 items)
NSExceptionRequiresForwardSecrecy	Boolean	NO
NSIncludesSubdomains	Boolean	YES
▼ api.twitter.com	Dictionary	(1 item)
NSExceptionRequiresForwardSecrecy	Boolean	NO
▼ api.braintreegateway.com	Dictionary	(2 items)
NSExceptionRequiresForwardSecrecy	Boolean	NO
NSExceptionsAllowsInsecureHTTPLoads	Boolean	NO
▼ fbcdn.net	Dictionary	(2 items)
NSExceptionRequiresForwardSecrecy	Boolean	NO
NSIncludesSubdomains	Boolean	YES
▼ graph.facebook.com	Dictionary	(1 item)
NSExceptionRequiresForwardSecrecy	Boolean	NO

Jan. 2016: Tumblr (5.1): ❌

Yahoo Weather (1.9.0) ❌

▼ App Transport Security Settings	Dictionary	(2 items)
Allow Arbitrary Loads	Boolean	YES
▼ Exception Domains	Dictionary	(13 items)
▼ flurry.com	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES
▼ yahoo.net	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES
▼ zenfs.com	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES
▼ yahoofs.com	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES
▼ www.tumblr.com	Dictionary	(0 items)
▼ flickr.com	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES
▼ yahoo.com	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES
▼ yhoo.com	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES
▼ yimg.com	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES
▼ ahoo.it	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES
▼ api.tumblr.com	Dictionary	(0 items)
▼ staticflickr.com	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES
▼ yahoo-inc.com	Dictionary	(1 item)
NSIncludesSubdomains	Boolean	YES

January 2016

→ Slack (2.66): ❌ opts out

→ Snapchat (9.21.1): ✅

→ YouTube (10.50.18): ❌ opts out

5 of those 20 apps use ATS reasonably well.

It’s hard?
(debugging is hard?)

Ad networks

Google | Ads Developer Blog

The official blog for information about the AdWords, AdSense, DoubleClick and AdMob APIs and SDKs.

Handling App Transport Security in iOS 9

Posted: Wednesday, August 26, 2015

“To ensure ads continue to serve on iOS9 devices for developers transitioning to HTTPS, the recommended short term fix is to add an exception that allows HTTP requests to succeed and non-secure content to load successfully.

Publishers can add an exception to their Info.plist to allow any insecure connection...”

```
<key>NSExceptionDomains</key>
<dict>
    <key>facebook.com</key>
    <dict>
        <key>NSIncludesSubdomains</key>
        <true/>
        <key>NSThirdPartyExceptionRequiresForwardSecrecy</key>
        <false/>
    </dict>
    <key>fbcdn.net</key>
    <dict>
        <key>NSIncludesSubdomains</key>
        <true/>
        <key>NSThirdPartyExceptionRequiresForwardSecrecy</key>
        <false/>
    </dict>
    <key>akamaihd.net</key>
    <dict>
        <key>NSIncludesSubdomains</key>
        <true/>
        <key>NSThirdPartyExceptionRequiresForwardSecrecy</key>
        <false/>
    </dict>
</dict>
```

Lack of awareness/unwillingness to learn?

samfriend commented on Jun 9, 2015

Adding the following to your Info.plist will disable ATS

< key>NSAppTransportSecurity< / key>

< dict>

< key>NSAllowsArbitraryLoads< / key>< true/>

< / dict>

Lack of caring?

Lack of clear documentation from Apple?

What’s next?


Available on the
App Store

Start now.

Conclusions (1/2)

→ ATS enforces current security best practices

→ Don’t disable it

→ Configure your servers to support the TLS configuration ATS requires

→ Configure the most narrow exceptions possible to allow your app to talk to domains your company doesn’t control

Conclusions (2/2)

→ Three-quarters of popular apps aren’t using ATS properly 😿

→ You can be one of the few to follow best practices!

→ …and Apple will probably start enforcing this at some point.

Questions/Discussion