



Build hybrid mobile apps like a security pro!

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About me

- Consultant turned Researcher at Synopsys
- Master's degree in Computer Science
- Violin, dance, hiking
- Current interest - vegetable gardening



Agenda

- Mobile applications 101
- Characteristics of a mobile app
- Threats and threat agents
- Hybrid mobile applications 101
- Following principles of application security
- Exercise - Spot the bad apple
- Summary
- QA

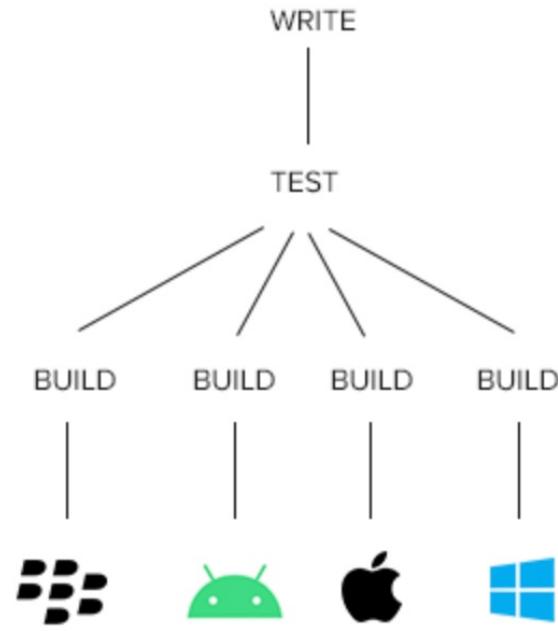
Mobile applications 101

Back to basics

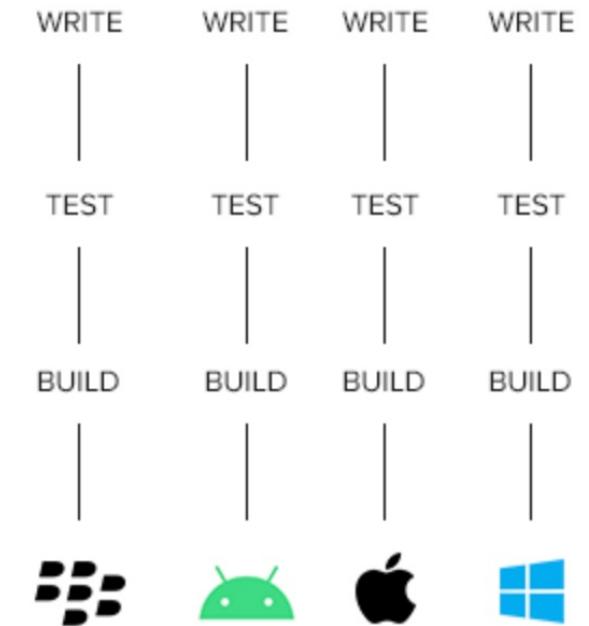
Mobile applications 101

- Apps to use "on the go"
- Not just for productivity
- Android and iOS – 99% of the market
- 800 iOS, 2k Android apps released per week
- SDKs for development
- Native and hybrid apps

HYBRID APPS



NATIVE APPS



Mobile apps - characteristics

- Apps are “contained” for isolation
- Apps use inter process communication
- Code is located on the device
- Data is stored on the device – persistently
- Apps still communicate with server
- Authentication could be client-side
- iOS Apps are vetted before release
- Jailbreaking and rooting



Assets and threats: Mobile apps

- Typical assets
 - user data – client side, long term storage
 - application data – code and assets live client side
 - Functionality – compiled code lives on client side
 - Credentials – handled client-side
- Typical threat agents
 - Malicious apps
 - Non-owner of device – stolen phone
 - MitM – network attacks
 - Malicious user – hacker
- Overall, low likelihood

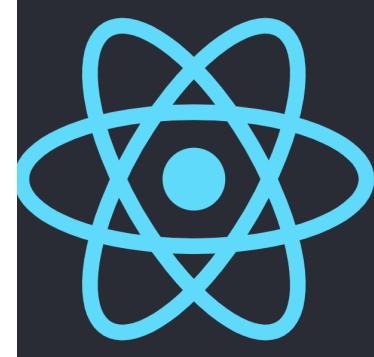


Hybrid mobile applications

What are they made of?

Building hybrid mobile apps

- Select framework – Flutter, React Native etc.
- Implement authentication - Store auth tokens, incorporate biometrics
- Handle API calls, user inputs, data storage –
 - UI Components or WebViews for user inputs
 - Make GET/POST requests to app server using library APIs, ex. `fetch()`
- Google play, BMW, eBay, Skype, Tesla, Walmart



What are these libraries?

- Reusable packages or modules
- Maintained by community, 3rd party or open source
- Pre-built components, tools and utilities
- Easy integration into an app -> fast development
- Framework bridges gap, library defines the set of desired native capabilities
- Flutter 36k, React Native 46k



Example

Flutter library

```
import 'package:local_auth/local_auth.dart';
final LocalAuthentication auth =
LocalAuthentication();

final bool didAuthenticate = await auth.authenticate(
localizedReason: 'Please authenticate to show
account balance');
```

The screenshot shows the pub.dev website interface. At the top, there is a dark header with the pub.dev logo, a search icon, 'Sign in', and 'Help'. Below the header, the package page for 'local_auth 2.1.6' is displayed. The page includes the package name, version, a 'Dart 3 compatible' badge, and a '2.1K' like count. A navigation bar below the title has tabs for 'Readme' (which is active), 'Changelog', 'Example', 'Installing', 'Versions', and 'Scores'. The main content area features the title 'local_auth', a brief description of the plugin's purpose, and support information for 'Android', 'iOS', and 'Windows'. At the bottom, it lists supported platforms: 'SDK 16+*', '11.0+', and 'Windows 10+'. To the right of the main content, there are sections for 'Likes' (2127), 'Pub Points' (140), and 'Popularity' (99%). Below these are links for 'Publisher' (flutter.dev) and 'Metadata', which describes the plugin as a Flutter plugin for Android and iOS devices. There is also a link to the 'Repository (GitHub)'.

local_auth 2.1.6

Published 4 months ago • ⚡ flutter.dev Dart 3 compatible

SDK FLUTTER PLATFORM ANDROID IOS WINDOWS

2.1K

2127 LIKES 140 PUB POINTS 99% POPULARITY

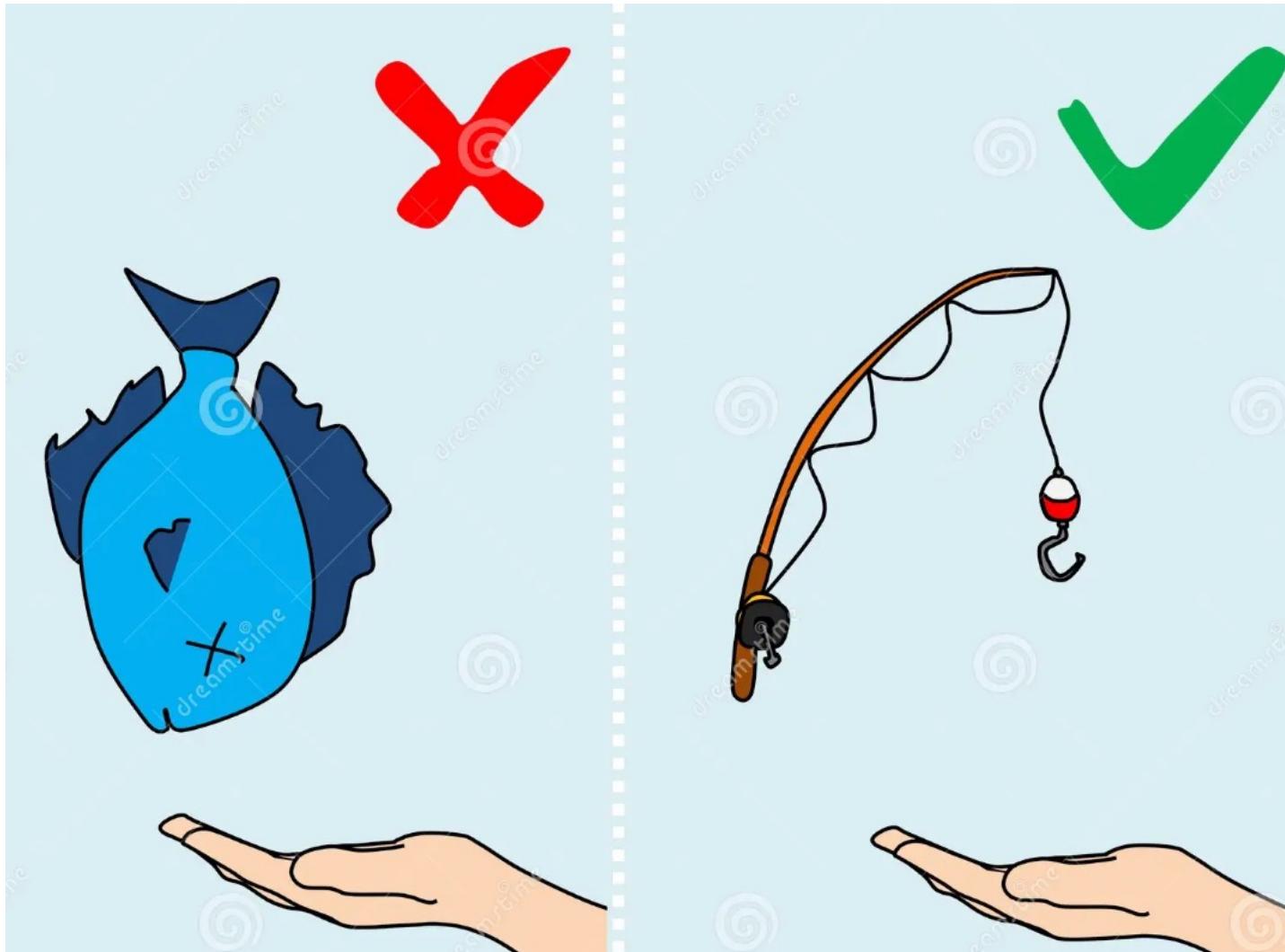
Publisher ⚡ flutter.dev

Metadata

Flutter plugin for Android and iOS devices to allow local authentication via fingerprint, touch ID, face ID, passcode, pin, or pattern.

Repository (GitHub)

List of secure libraries

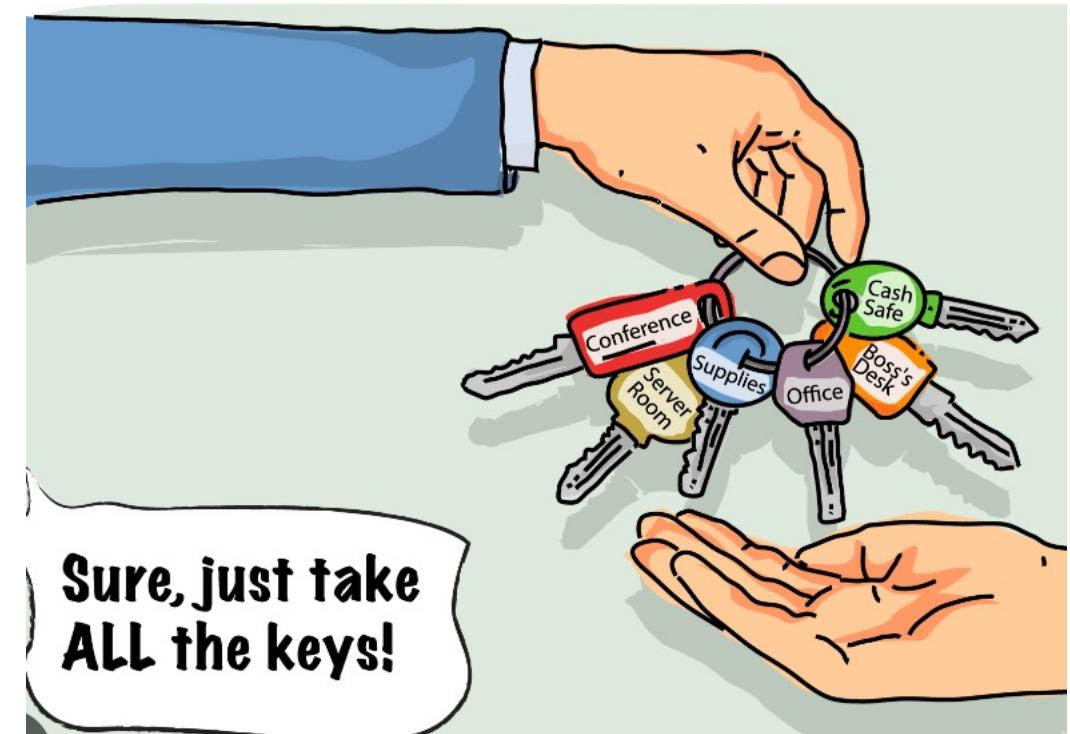


Principles of application security

And how to apply them in hybrid mobile apps

Principles of application security: Least Privilege

- Principle: Less is more
- Permissions in a mobile app such as camera, location, mic
- Minimum set of permissions
- Set permissions in configuration files
- Caution - Runtime permission requests
- Evaluate the library
 - Does not request unnecessary permissions
 - Allows configuration
 - No strict defaults
 - Supports authz controls for ex. data storage



Principles of application security: Security by obscurity

- Principle: Secrecy for security
- Debunked, but useful for mobile apps
- Secure all parts:
 - Code – use obfuscation, code splitting
 - data – use encryption
 - network – use HTTPS
- Evaluate the library
 - encryption and key generation algorithms are secure, check defaults
 - Code obfuscation for all code, not just JS
 - Sensitive UI components can be masked



Principles of application security: Minimize attack surface

- Principle: limit the number of entry points into your app
- Mobile OS sandboxing is not enough
- Secure data stored on device and in transit
- Clipboard, Keyboard, Logs, WebViews
- Evaluate the library
 - Forms should support validation of inputs
 - Avoids excessive logging
 - No debug code
 - JavaScript in WebViews
- Deep links – Apply the ‘KISS’ principle

```
handleWebViewLoad = () => {
  const { userInput } = this.state;
  const webView = this.webview.ref;

  webView.injectJavaScript(`document.getElementById('userInput').innerHTML = '${userInput}';`);
}
```

Principles of application security: Client trust

- Principle: Selectively trust
- Trusted or busted
- Avoid blindly trusting the
 - device, user, library, network
- 3rd party risks are inherent, consider SCA
- Sketchy package managers
- Evaluate the library
 - Verify the publisher and CVEs for libraries
 - Employ controls to secure the network, for ex. ATS
 - Use a safety net for bad user choices, ex. Keyboards, masking



#	CVE ID	CWE ID	# of Exploits	Vulnerabi
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1 [CVE-2018-16202](#) 22 Dir. Trav.

Directory traversal vulnerability in cordova-plugin-ionic-webview unspecified vectors.



Principles of application security: Defense in depth

- Principle: set of best practices for holistic security
- Ex. JB detection, latest OS version, auth controls on keychain, debuggers, business logic
- Anti-reverse engineering controls
- Evaluate the library –
 - Deprecated methods,
 - Works same as native code
 - insecure defaults
 - Verify ease of a bypass i.e. event based vs result based APIs



Spot the bad apple
Let's apply our learning

Exercise – evaluate these library APIs

Constructors

`HashCryptRaw(HashAlgo type)`

Construct with type of algorithm

`Sha3_384 → const HashAlgo`

`Sha3_512 → const HashAlgo`

`Keccak_224 → const HashAlgo`

`Keccak_256 → const HashAlgo`

`Keccak_384 → const HashAlgo`

`Keccak_512 → const HashAlgo`

`Sha1 → const HashAlgo`

`RipeMD_128 → const HashAlgo`

`RipeMD_160 → const HashAlgo`

`RipeMD_256 → const HashAlgo`

`RipeMD_320 → const HashAlgo`

`Blake2b → const HashAlgo`

`MD2 → const HashAlgo`

`MD4 → const HashAlgo`

`MD5 → const HashAlgo`

`Tiger → const HashAlgo`

`Whirlpool → const HashAlgo`

Exercise – evaluate these library APIs

```
 10     export type Options = {
 11         body?: string | {},
 12         credentials?: string,
 13         headers?: Header,
 14         method?: 'DELETE' | 'GET' | 'POST' | 'PUT',
 15         sslPinning: {
 16             certs: Array<string>
 17         },
 18         timeoutInterval?: number,
 19         disableAllSecurity?: boolean
 20     }
 21 }
```

Exercise – evaluate these library APIs

launch method

```
Future<void> launch(  
    String url,  
    {Map<String, String>}? headers,  
    Set<JavascriptChannel> javascriptChannels = const <JavascriptChannel>{},  
    bool withJavascript = true,  
    bool clearCache = false,  
    bool clearCookies = false,  
    bool mediaPlaybackRequiresUserGesture = true,  
    bool hidden = false,  
    bool enableAppScheme = true,  
    Rect? rect,  
    String? userAgent,  
    bool withZoom = false,  
    bool displayZoomControls = false,  
    bool withLocalStorage = true,  
    bool withLocalUrl = false,  
    String? localUrlScope,  
    bool withOverviewMode = false,  
    bool scrollBar = true,  
    bool supportMultipleWindows = false,  
    bool appCacheEnabled = false,  
    bool allowFileURLs = false,
```

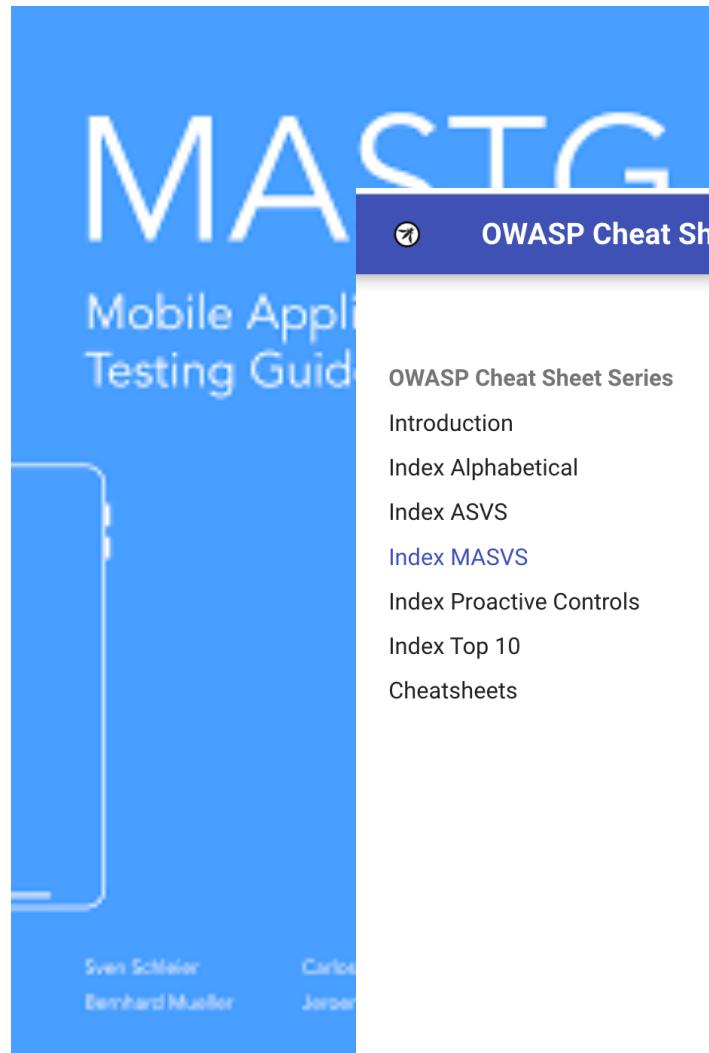
Summary

- Hybrid apps are on the rise
- Dev practices matter more than frameworks & libraries
- Use external libraries, but scrutinize them
 - Verify the library version
 - Disable insecure defaults
 - Verify cross-platform compatibility for the security controls
 - API implementation should be resilient in an untrusted environment
 - Look for CVEs
- Compliment with security controls by the OS



"Skip the blow by blow. Just condense it into a couple of barks."

Resources



PROJECTS CHAPTERS EVENTS ABOUT Member Login

OWASP Mobile Top 10

[Main](#) Acknowledgements Controls



NIST Home > Security Guidance > Mobile Device Security

SECURITY GUIDANCE

MASVS Index

OWASP Cheat Sheet Series

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Device Security

Device security is a critical concern for organizations as mobile devices can add to their employees' productivity and access business resources at any time. Not only has this technology revolutionized the way we work, but organizations are devising strategies to ensure that compromised mobile device may allow access to sensitive data that the user has entrusted to the device. With this in mind, security efforts are dedicated to helping organizations address mobile cybersecurity challenges.

Questions

Thank You