

iElement

BUILDING COMPLEX VPN ENABLED PRODUCTS



Customer location**Netherlands****Industry****Communications****Expertise****Security and privacy solutions**

Summary

iElement is a communications company that provides VPN solutions for secure and stable access to internet resources. Their products support multiple platforms. One of their products is a set of native Android applications that offer a VPN with extensive features. These apps lets users configure their connections with numerous settings, using SSH or custom tunnels with dynamic behavior, selecting ports, protocols, server locations, and so on. iElement's Android VPN applications work on an in-app subscription basis and offer billing at one-, three-, six-, and twelve-month intervals after a three-day trial.

iElement contracted with SteelKiwi to build this complex Android app from scratch while helping their backend specialists with debugging and optimization. One of our client's requirements was to use only open-source tools and libraries. To meet our client's marketing needs, we developed and are now supporting three distinct Android VPN applications under different brands.

Technical challenges

1. The Android operating system allows you to implement a VPN using VpnService, but you still need to request permission at the system level and receive the main service events in order to use a VPN connection. Implementing a VPN connection is quite complicated and resource-consuming, as you need to have full control of the data flow, work with connection statuses, and control the service – and this is just the tip of the iceberg.

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2. Since Android is a UNIX-based operating system, we decided to add an SSH connection option. SSH means secure shell, and is a network protocol that allows you to tunnel TCP connections, which makes our VPN connection secure.
3. Integrating and implementing custom solutions for a tunnel with unusual behaviour, which helps to avoid various firewalls and blockings. The idea behind this is to change IP address and port of the tunnel dynamically.

Technical solutions

1. We implemented our VPN based on the well-known open-source library `openvpn` which, generally speaking, provides all the necessary features for standard VPN connections. The `openvpn` library works with Android's VPN service, thread, build configs, and `vpn-profiles`. Even with `openvpn`, however, we still needed to define optimal VPN connection configurations to meet each user's needs and set necessary parameters before we could start the system service itself. Some `openvpn` modules use native C++ code, so we needed to compile native libraries to ensure the correct workflow.
2. We implemented the SSH tunnel for our VPN on the basis of another open-source library, `JSch`. Once the user-specified connection parameters are initialized and a session is created, a tunnel is opened and the VPN connection is forwarded through it.
3. After conducting some research, we realized that we needed to implement dynamic IP and port logics using the Android NDK. We compiled a custom implementation of the tunnel, written in C++, to apply user-specified parameters and achieve strong performance. We also built an intermediate interface between the Java code and C++ code so we could efficiently manage the `openvpn` library to effectively configure and

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initiate TCP tunnel connections. When a tunnel connection is initialized, a new thread is created and our VPN is forwarded to it. This tunnel is particularly complex for one specific reason: it's dynamic and isn't tied to an IP address.

Results

We successfully released the Android applications to the Google Play store and they passed the review process. These application provide flexible VPN connections with a variety of configurations, tunnels, ports, and protocols. The tunnel solutions we developed are stable and battery-efficient, and we're still maintaining and improving them.

Currently, the three VPN applications SteelKiwi developed have more than 500,000 installs, and the audience is still growing.

Technologies

BASE

- Java
- Android SDK
- C++
- Android NDK

LIBRARIES

- openvpn
- libuv
- RxJava
- RxAndroid
- JSch
- Realm
- dnsjava
- Dagger
- Retrofit
- InAppBillings
- Crashlytics

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