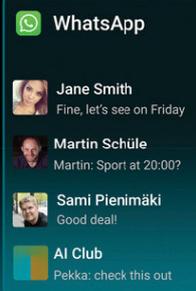
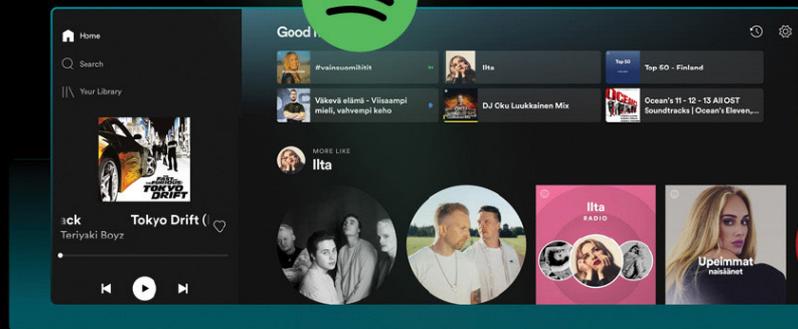


AppSupport

For Linux Platforms



November
2022

jolla

Table of contents

AppSupport for Linux Platforms	3
Executive Summary	4
Validated and Productized Solution	5
Seamless User Experience	6
A Solution for Various Industries	8
Functionality and Architecture	9
Highly Optimized	10
About Jolla	12

AppSupport for Linux Platforms

AppSupport for Linux Platforms is a solution developed by Jolla Ltd., offering a strategic differentiation option for companies developing smartphones, tablets, automotive solutions, wearables and all kinds of smart embedded devices. With the solution, an independent Operating System can be extended to use the vast ecosystem of applications developed for the Android™ platform.

One of the most important requirements to enter the Operating System market is the access or capability to develop competitive end user applications. The current mobile operating system market is dominated by iOS and Android. A clear majority of applications are created for these two operating systems. Jolla's solution enables the access to the operating system market, so that applications created for Android can be run on custom operating systems without changes (binary compatibility).

The Android application performance on Jolla's solution is on par with the native Android OS and available for any embedded Linux-compatible platform.

Android™ is a trademark of Google Inc.

	Linux Platform	Jolla's AppSupport for Linux platforms	Android Open Source Project (AOSP)	Google Android
Customizable for customer needs	Yes	Yes	Yes	No
Full source code access	Yes	Yes	Yes	No
Support for Android apps	No	Yes	Yes	Yes
Integrates seamlessly to customer's brand & user experience	Yes	Yes	No	No
Possibility to innovate and control the feature roadmap	Yes	Yes	No*	No
Possibility to transfer existing Android apps users to new platform	No	Yes	N/A	N/A
Maintain control of the user data	Yes	Yes	No **	No

AppSupport - Key Facts

Opens up excellent new business opportunities for native Linux platforms.

Solution is compatible with Android apps (apks) without any modifications.

Works on existing Linux distributions. Lean architecture, simply integrate to the existing OS as a window or directly to a framebuffer.

Possibility to integrate on wanted and selected hardware features, without forgetting security.

Runs inside a Linux container (LXC), giving the platform full control of data that is exposed to the Android apps

Can run on lower resources than AOSP.

Shares and dynamically allocates memory resources, no need to reserve static resources.

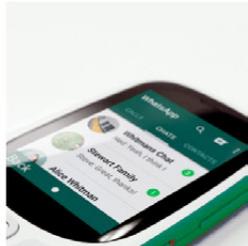
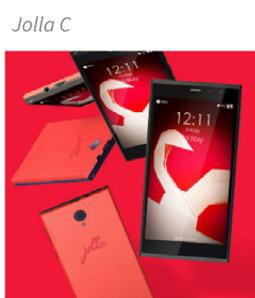
Validated and Productized Solution

Proven commercial compatibility, in market since 2013.

Jolla Ltd. is recognized worldwide as a provider and licensor of alternative mobile operating system Sailfish OS. Sailfish OS offers an independent and customizable alternative to Android OS with full source code access. Sailfish OS is based on MeeGo, developed originally by Nokia and Intel.

While the primary focus of Sailfish OS is to enable the development of native Linux applications, it has been deemed necessary to support also existing key apps, such as WhatsApp, WeChat, Slack and Office. The AppSupport for Linux Platforms software enables applications natively developed for Android OS to run on non-Android-based systems like Sailfish OS.

The support for Android Apps has been available on most of the devices Jolla Ltd. or its partners have made available since 2013.



Sailfish Watch Prototype

Jolla Tablet

R7 by INOI

Accione by Jala

Jolla C

Sony Xperia X

Sony Xperia 10

Turing Phone

Accione P by Jala

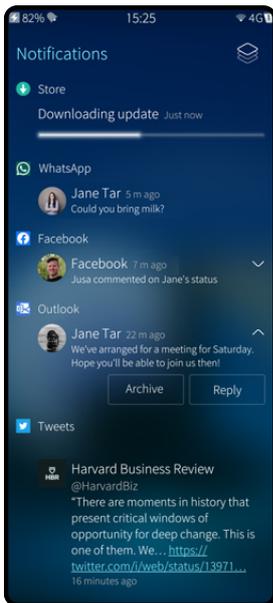
Intex Aquafish

Jolla Smartphone

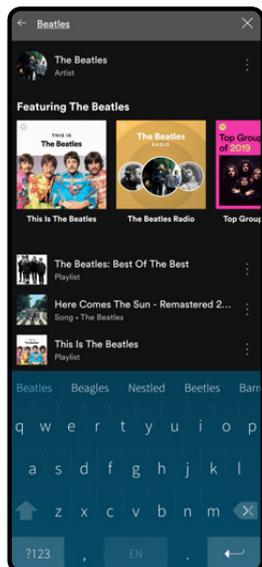
Sailfish Feature Phone

Seamless User Experience

With the solution by Jolla, Android apps can be run as a natural part of the user experience on a Linux platform. The Android applications' look and feel as well as the functionality is integrated so that the behavior matches that of native apps. The navigation model of the native operating system can be used for handling the Android applications.



Rich Android notifications can be integrated to the native home screen.



Native keyboard and Android app communicating together.

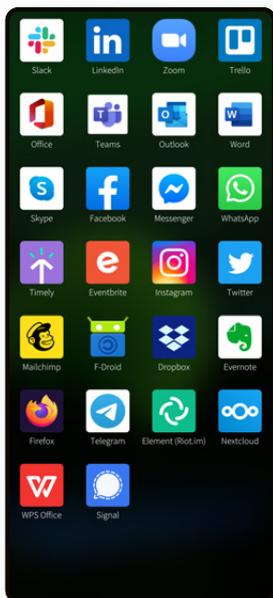


Run native Linux apps and Android™ apps side-by-side.

Hardware accelerated graphics is supported and used with Jolla's App Support solution. Similarly, Android apps have been integrated with native input methods, touch, keyboard and other integrated or external (Bluetooth, USB-OTG) input devices from the Linux-based OS. The integration can be tailored to the capabilities of the platform.

Other hardware integration points include network connectivity, display, power, multimedia, camera, vibra, positioning and sensors. On the application level, user can give permission for Android apps to access user's contacts on the native side. Audio playback on Android apps can integrate with the native Linux audio controls exposed on e.g. MPRIS. On the native side, audio can be controlled by the system interface e.g. home screen audio controls and hardware devices like Bluetooth and wired headsets.

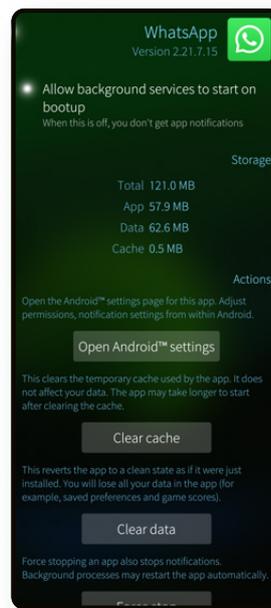
Android apps on the selected platform can also access (with user's permission) the documents, images, videos and other files from the native side, and share the files via native sharing methods. Android notifications can have the same look and feel as other native notifications on the selected Linux-based OS. Notification integration is comprehensive, Android apps can display progress, embed different actions, show avatars or other graphics, play tones, customize text layouts, etc. on the notifications shown on the native OS home screen.



Users can install their favorite apps on the target Linux OS.



Android apps can (when allowed) access files from the native OS



Both Android™ system and app settings can be integrated to the native Settings flows.

Access to 3rd party applications

The system can be deployed with the application set optimized for the purpose. Selected applications can either be pre-installed or downloaded from online sources (3rd party app stores, limited corporate app catalogue, OS-specific repositories, etc.) depending on the customer needs and security requirements. The software and the experience can be fully customized and optimized as preferred.

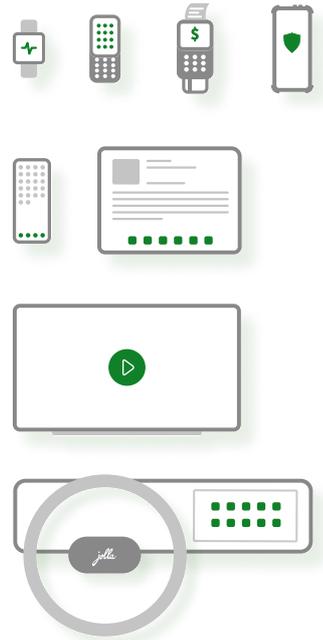
A Solution for Various Industries

Jolla's AppSupport for Linux Platforms lets Linux-based platforms keep full control of their internal feature development and innovation roadmaps. With this, the innovation and user experience can differentiate and exceed the performance and efficiency of competing solutions. Jolla's solution is not using Android Homescreen UI, but integrates with the native system UX.

Jolla's solution can be utilized in various environments, including e.g. the automotive sector and the transportation industry more widely.

3rd party applications are only dependent of the available Android API level. The 3rd party applications commonly support older Android API level versions for several years. This allows to prepare and plan the updates based on the customer's needs.

Jolla delivers updates to the supported Android version on regular basis.



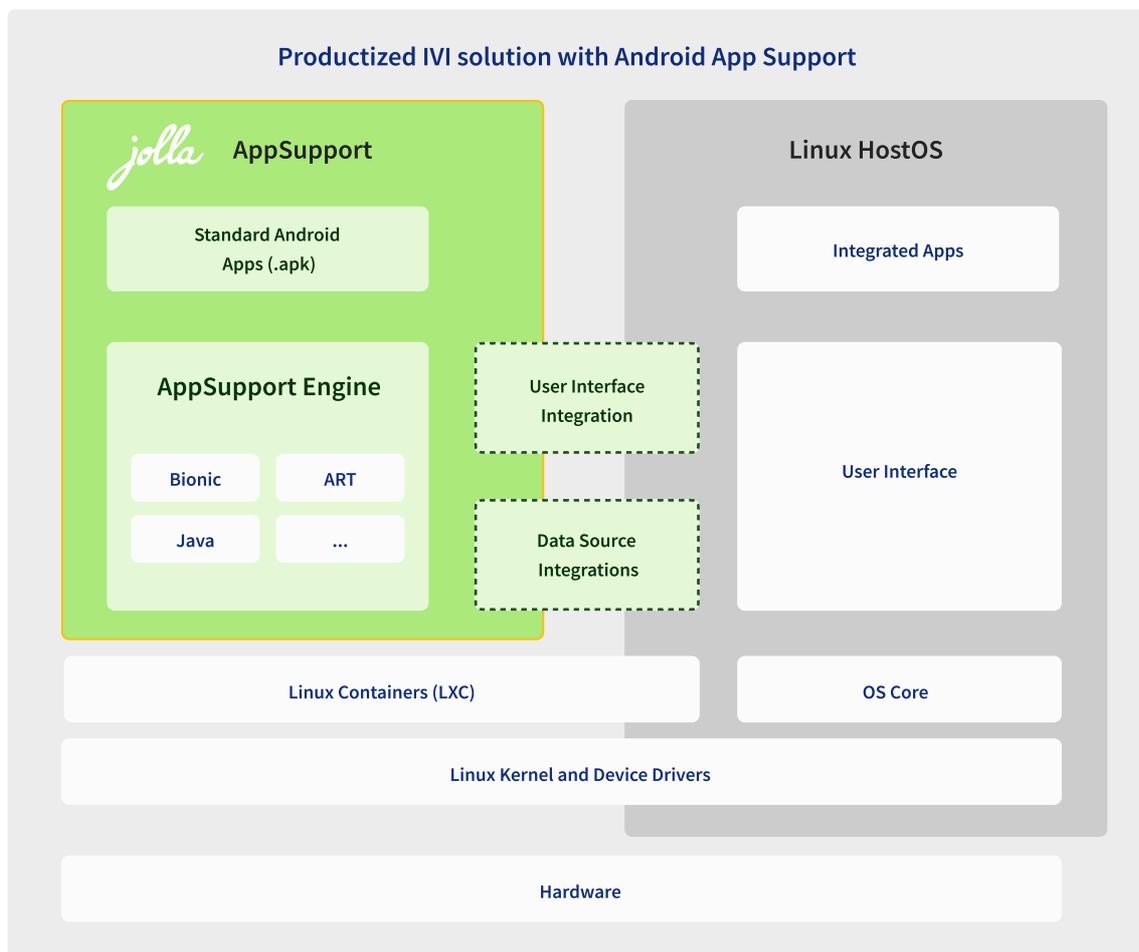
Name	Version numbers(s)	API level	Initial stable release date	Supported security fixes
Lollipop	5.0 – 5.1.1	21 – 22	November 12, 2014	No
Marshmallow	6.0 – 6.0.1	23	October 5, 2015	No
Nougat	7.0 – 7.1.2	24-25	August 22, 2016	No
Oreo	8.0 – 8.1	26 – 27	August 21, 2017	Yes
Pie	9	28	August 6, 2018	Yes
Android 10	10	29	September 3, 2019	Yes
Android 11	11	30	September 8, 2020	Yes

Android version history based on Wikipedia. This chart indicates that Android version 8 is still a feasible and officially supported platform to run 3rd party applications created for Android OS. The solution by Jolla currently supports Android version 10.

Functionality and Architecture

A Customer can securely extend the available application set on their selected Linux platform with the existing Android™ Application ecosystem.

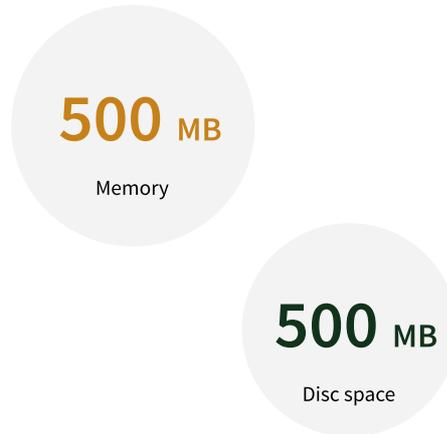
1. Android applications are run in a secure isolated sandbox
2. Solution is compatible with .apk files without any modifications
3. Application performance is on the same level as in native Android
4. It is possible to integrate all hardware features to Android applications, without restrictions
5. The applications can be run on lower resources than when using AOSP



Highly Optimized

Resource usage

Jolla’s AppSupport solution uses less memory compared to running Android in a Virtual Machine. Following values are memory and disk space that are needed by the Android App Support (memory and disk space needed by the applications depend on the installed apps).



Memory consumption measured after starting few applications and using the apps and then forced to stop all the apps. Memory consumptions are reported as difference in proportional set size (PSS). See: https://en.wikipedia.org/wiki/Proportional_set_size

compatibility program

Summary	
Suite / Plan	CTS / cts-dev
Suite / Build	10_r6 / 6958444
Host Info	Resultf@start kopo (Linux - 5.10.21-200.fc33.x86_64)
Start time / End Time	Thu Mar 11 19:17:16 EET 2021 / Thu Mar 11 19:32:20 EET 2021
Tests Passed	587507
Tests Failed	3424
Modules Done	383
Modules Total	386
Fingerprint	Sony/aosp_xqau52/pdx201:10/QP1A.190711.019/eng.abuild.20210223.180722:user/test-keys
Security Patch	2020-10-05
Release (SDK)	10 (29)
ABIs	arm64-v8a,armeabi-v7a,armeabi

Compatibility (CTS)

<https://source.android.com/compatibility/cts>

Android App Support compatibility with CTS test suite is 99.4 %. The value is calculated by comparing the amount of passed tests (587507) to the number of failed tests (see the table on the left). This value displays that there are no need to do changes to the .apk files.

This result is measured with Jolla's own Sailfish OS operating system. The test coverage is subject to the level of feature integration on the target system.

Performance (AnTuTu)

<https://www.antutu.com/en/index.htm>

Antutu (8.2.4)	Android Open Source Project (AOSP)	Android App Support by Jolla	Performance compared to AOSP
CPU	38936	38620	-1%
GPU	15027	15053	0%
UX	20905	19397	-8%
MEM	23788	23055	-3%
Total	98656	96125	-3%

Performance (PCMark)

<https://benchmarks.ul.com/pcmark-android>

PCMark (2.0.3716)	Android Open Source Project (AOSP)	Android App Support by Jolla	Performance compared to AOSP
Work 2.0 performance score	3984	4347	9%
Computer Vision Score	2174	2212	2%
Storage Score	3916	4614	18%

Performance (3DMark)

<https://benchmarks.ul.com/3dmark-android>

3DMark (2.0.4652)	Android Open Source Project (AOSP)	Android App Support by Jolla	Performance compared to AOSP
Ice Storm Extreme	9850	8812	-11%
Sling Shot Extreme – OpenGL ES 3.1	814	812	0%
Sling Shot Extreme - Vulkan	824	835	1%

About Jolla



We Empower the Mobile OS World with Freedom of Choice

Jolla Ltd. is the developer and a licensor of European mobile operating system Sailfish OS, an open Linux mobile operating system targeted for corporate and governmental solutions. As part of Sailfish OS, Jolla has developed a solution that enables running Android™ apps on any Linux-based platform.

Jolla was born in 2011 continuing the heritage of Nokia and MeeGo. The company is based in Tampere, Finland.

Jolla Ltd
Polttimonkatu 3
FI-33210 Tampere
Finland

Business and general inquiries:
info@jolla.com
www.jolla.com
www.sailfishos.com

[linkedin.com/company/jolla](https://www.linkedin.com/company/jolla)
[facebook.com/jollaofficial](https://www.facebook.com/jollaofficial)
twitter.com/JollaHQ
[youtube.com/user/jollaofficial](https://www.youtube.com/user/jollaofficial)

