WIND RIVER SOLUTION ACCELERATOR FOR ANDROID, AUTOMOTIVE

Since its debut in 2007, Android has established its leadership in smartphone sales worldwide. More recently, it has also been proven as a valid operating system choice for any embedded device, not just mobile phones. Its potential for deployment across a wide range of devices and its customizable user interface have created tangible traction within the large community of open source developers, all of whom are creating differentiated products that entail still more Android functionality enhancements. Companies in many industries seeking to offer their own unique user experience embrace Android in order to incorporate this endless creativity into their own products.

ANDROID IN THE CAR
The automotive industry is no exception to this trend. Car manufacturers want to differentiate themselves from their competition by deploying state-of-the-art, cutting-edge in-vehicle infotainment (IVI) systems and electronics, and Android is an ideal choice for aftermarket IVI systems, next-generation personal navigation devices, companion devices, and OEM head units. To fill the gap between the Android Open Source Project and automotive real-market requirements, Wind River® developed the Wind River Solution Accelerator for Android, Automotive, a commercial add-on software module that runs on top of the Android operating system and can help meet the connectivity demands of end customers.

TABLE OF CONTENTS
Android in the Car ........................................................... 1
Components ........................................................................ 2
iPod/iPhone/iPad Docking .................................................. 2
IVI Graphical User Interface ................................................. 4
FM Radio ................................................................ 5
Optional Add-on Products ................................................. 7
Professional Services ........................................................ 7
Partner Ecosystem .............................................................. 8
Customer Support .............................................................. 8
Contact Us ........................................................................ 9
COMPONENTS

Wind River Solution Accelerator for Android, Automotive includes components that provide a seamless integration between Android communication features and automotive requirements.

**iPod/iPhone/iPad Docking**

Wind River Solution Accelerator for Android, Automotive enables Apple iPod, iPhone, and iPad docking for media access through the central unit console, which acts as an accessory to the iOS device.

Devices are connected to accessories through the iPod accessory protocol (iAP). The exchange of commands and data between devices can be done over UART, USB, or Bluetooth transport, depending on the chosen data stream. Changing to a different transport requires re-authentication.

The iPod accessory implementation adheres to the R45 release of the MFi Accessory Firmware Specification.

![Figure 1: iPod accessory protocol architecture](image)

Authentication is required for communication between the accessory controller and the iPod attached to the accessory. The iPod needs the assistance of the Apple authentication coprocessor (CP) to verify that third-party accessories are authorized for use. The CP acts as an I2C slave. When Android starts up the system, it communicates with the CP through I2C and retrieves the CP’s version, ID, and certificate. The certificate is used for authentication with an iPod when connected.
The solution supports the most popular CP, version 2.0B. It contains X.509 v3–based certification and generates a signature using 20 bytes of challenge data from the iPod. The signature from the CP is verified by the iPod and the authentication process is completed.

The iAP commands are structured into different functional catalogs, or “lingos.” The Wind River iPod connectivity solution supports a high number of iAP commands adherent to the following lingos:

- General (0–0x51)
- Simple remote (0, 1, 0x0b)
- Display remote (0x0e, 0x0f, 0x12, 0x14)
- Extended interface (0–0x45)
- Digital audio (0–0x05)
- Storage (0–0x12)
- iPod out

Our engineering team is working continually to support additional lingos, so check with your Wind River representative to get an updated version of the supported iAP commands.

The Android iPod subsystem consists of three main components:

- iPod daemon
- iPod service and library
- Music application

The iPod daemon is the authentication and transport layer used to communicate directly with the iPod and CP. The iPod service is a thin application programming interface (API) and translation layer for access to the daemon. The music application is the user interface (UI) for the iPod when not in out mode. It is effectively the control pane for navigation as well as a music and video player.
The iPod docking component of Wind River Solution Accelerator for Android, Automotive has minor requirements for the hardware platform: The platform must have a connection to the I2C path to the Apple authentication chip and a driver enabled for access.

The connection between accessories and iPods can also be made via Bluetooth transport. iAP over Bluetooth uses the RFCOMM transport protocol APIs. RFCOMM functions resemble the USB human interface device (HID) when using the USB transport. Digital audio signals are transferred via advanced audio distribution profiles (A2DPs), while an audio/visual remote control profile (AVRCP) is used to control playback.

The car’s Android-powered multimedia system can play the media files contained on devices such as the following:

- iPod classic 6G
- iPod nano 4G, 5G, 6G
- iPad 1, 2, and The new iPad
- iPod touch 3G, 4G
- iPhone 3GS, 4, 4S

Devices are continually being tested, so check with your Wind River representative to get the updated list of supported iOS devices.

When in out mode, the iOS device can interact and be controlled by the Android device through the native Apple UI. When a song is played in out mode, the album artwork, the song, band, and album names, a progress bar, and timing data appear on the video screen. The video display is transmitted in analog format at 640x480. The accompanying audio may be transported using either analog or digital audio over USB. The user can navigate intuitively by using the menu options, just like with any iOS device.

**IVI Graphical User Interface**

Wind River Solution Accelerator for Android, Automotive offers a customizable UI. This component affects the appearance of the central display with color scheme, theme, or different location of graphic assets such as button location or size. The IVI UI is designed as a “skin,” so a new look and feel can be easily added on top of the infrastructure. The features included are specifically designed to meet automotive use case requirements.

The solution provides an Android API and can supply APIs for the following:

- Global UI and home screen
- Bluetooth
- iPod docking
- FM radio
- Automatic speech recognition (ASR)/ text-to-speech (TTS)
The IVI UI has two layers. The first is a global view that includes the home display. The second changes according to the feature activated. The IVI home display is similar to the Android launcher but easier to control on an IVI device.

The IVI home display inherited certain functions from the Android launcher, including the following:

- Listing and launching of all applications
- Management of wallpaper settings
- Management of shortcut plug-in
- Management of live folder plug-in
- Management of widget plug-in

The IVI home display also includes categories for applications (e.g., Download, Tools, All) and a default widget for home.

Customers can choose a boot-up logo (animation) and browse through wallpapers and customizable icons for frequently accessed applications. There are also well-categorized application groups including automotive-specific applications, using a layout that is suitable for use in cars.

**FM Radio**

The FM radio component is a framework for radio broadcasting to which customers can easily add new radio technology and features. It offers a wide range of features that are meant to enhance the user experience; for example, access to FM radio is simpler with easy-to-read screen buttons and displays. In addition to the current radio device interface, this component will support many new interface features coming from Android.
The radio component can be divided into two parts: the radio broadcasting path, and the radio audio path. The radio driver for the broadcasting path follows the V4L2 Linux specification that supports some management functions and provides the interface. The audio data uses the ALSA Linux component to deliver the audio stream.

**Figure 4: FM radio service**

The FM radio component offers standard features such as station presets, seek and scan modes, and station frequency, in addition to a set of new features such as signal strength and selected station names.

The radio application calls the radio API for these basic functions: start/stop the radio receiver, adjust the frequency, and auto seek. Users also have the ability to input the channel frequency digitally. Channels can be changed either by scan mode or seek mode, just like on any other normal radio.
Optional Add-on Products

Wind River offers additional Solution Accelerators for Android that include the following features:

- Hyperboot, for reducing the boot time of the IVI system
- Firmware management, for ensuring secure run-time updates wired or over the air to other Android devices
- Bluetooth IVI extensions, for connectivity to various personal phones from the vehicle central unit
- Wind River Media Center, for enhancing connectivity via DLNA standards

For more information on the additional Solution Accelerators for Android, visit www.windriver.com/products/mobile/.

PROFESSIONAL SERVICES

Wind River Solution Accelerator for Android, Automotive is complemented by Wind River Professional Services, a CMMI Level 3-rated organization. Our experienced team of engineers delivers device software expertise that solves key development challenges and directly contributes to our clients' success, enabling them to reduce risk and focus on development activities that add value and differentiate their designs. As part of our comprehensive solution, Wind River offers specialized embedded Android expertise, with focused offerings that help customers meet the demands of end users and speed new products to market while minimizing development costs.

With more than 150 experienced automotive specialists worldwide, in most cases able to communicate in the client's language, Wind River can help implement parts or all of the IVI system. Services include the following:

- **Architectural consulting and planning**: Architectural studies and technology migration planning
- **Platform**: Application and middleware development; integration (open source and proprietary); porting and migration; kernel and OS optimization; BSPs, drivers, and boot loaders; hypervisor customization; and feature and roadmap acceleration
- **Simulation**: Wind River Simics modeling, integration, and consulting
- **Test management**: Integration and methodology consulting
- **Certification**: Software and systems safety and security consulting (IEC 61508, DO-178B, MILS)
- **IP management**: Long-term management (virtual lab, Linux change configuration management, testing as a service [TaaS])
- **Turnkey product development (hardware and software)**: Design and manufacturing insertion
Wind River is committed to assisting its customers with their specific development requirements. Possessing extensive experience with platform design, including navigation/infotainment systems, Wind River Professional Services has implemented hardware and software solutions for the embedded device market and continues to work with standard organizations to establish the next-generation platforms.

Learn more about our professional services packages at www.windriver.com/services/automotive-practice/.

PARTNER ECOSYSTEM
Our well-established, world-class partner ecosystem ensures smooth integration between Wind River technologies and those of premier hardware and software companies. Our customer support team is trained to troubleshoot partner technologies in use with Wind River products, making ours the most comprehensive and best-supported partner ecosystem in the embedded and mobile industries.

Wind River Solution Accelerator for Android, Automotive is supported on Intel® Atom and ARM-based platforms. For demo purposes, the solution has been implemented on a Freescale iMX53 board.

CUSTOMER SUPPORT
Wind River Support, a Service Capability and Performance (SCP)–certified organization, provides support for all Wind River Android products. We provide full maintenance and support, delivered through the Wind River Online Support website and our worldwide technical support team. Visit Online Support at www.windriver.com/support for fast access to product manuals, downloadable software, and other problem-solving resources. Online Support offers a comprehensive knowledge base with a robust search feature for locating product information and manuals by keyword, author, published date, document type, language, and solution category. Additional features, including patches and technical tips for common problems, are available for all customers with a subscription.

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Wind River is a world leader in embedded and mobile software. Wind River has been pioneering computing inside embedded devices since 1981, and its technology is found in more than 1 billion products. Wind River is headquartered in Alameda, California, with offices in more than 20 countries. To learn more, visit Wind River at www.windriver.com.

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