Harnessing Android applications for RDK and Linux CPE

Helping Pay TV and broadband service providers become the best super-aggregators in their markets by porting Android applications into RDK or Linux environments quickly and cost-effectively.

// In this White Paper you will learn:

- How to remove the ceiling on new entertainment apps that can be onboarded to an existing RDK/Linux set-top box or connected TV platform.

- How to migrate from Android to RDK/Linux platforms without creating 'apps-gaps' that could trash net promoter scores overnight.

- What an operator-controlled applications implementation and management platform – hosting and running AOSP-based applications – looks like.

// Aggregate More

Consult Red uses the term 'Aggregate More' to articulate the market opportunity for video and broadband service providers to deliver a larger collection of services and applications on their platforms. This is going to become a key strategy for success during the rest of this decade.

In the video UX, Aggregate More could mean offering additional streaming services to strengthen a Pay TV provider's position as a super-aggregator. It could mean making casual gaming part of a wider curated entertainment offer. In the broadband UX, 'Aggregate More' could mean offering owned-and-operated or third-party Smart Home applications, ranging from water leak detectors and security cameras to smart energy.

In both cases, aggregating more services that consumers care about will make service providers more important. It will help to reduce churn and create new revenue-generating possibilities.

Aggregate More builds on established operator strengths like service curation, bundling, discounting, subscription management, billing and advanced user interfaces. It is underpinned by operator expertise in data and content security. It harnesses the operator cloud and existing customer premise equipment, and it uses the power of containerisation to build and manage applications that improve lives.

In a world where there is less content exclusivity (because of studio and sports direct-to-consumer services), super-aggregation becomes mission-critical for video service platform providers. They must provide the best content from across the streaming universe, as well as broadcast TV channels, catch-up TV, start-over TV, DVR and operator VOD where appropriate.

And, in a world where high-speed connectivity no longer sets one broadband provider apart from another, it is the provision of applications and services on top of the broadband connection that increases utility and secures ongoing relevance. This is where the broadband battleground will move next.

This white paper addresses the first part of the Aggregate More future: video services. It explores how a video service provider (like a Pay TV platform) becomes a better super-aggregator by filling gaps in the list of streaming services they onboard, and a better all-round entertainer by offering apps that were simply not realistic before.

It shows how more apps can be offered quickly and cost-effectively, and then maintained without burdening the operations team at the operator, or the apps development team at app publishers.

> " Aggregating more services that consumers care about will make service providers more important. It will help to reduce churn and create new revenue-generating possibilities."

// AndApps runs existing Android applications on operator CPE

AndApps is a key building block for 'Aggregate More: Video'. This innovative solution allows video service providers, in their role as super-aggregators, to offer more entertainment applications in a way that is affordable and scalable for everyone (the operator and the application developer).

AndApps is an advanced application delivery platform that opens access to the vast library of Android applications for use on RDK and Linux middleware-based devices. If an Android app exists, AndApps can run it.

The foundation for AndApps is an AOSP (Android Open Source Project) runtime which can run Android applications (APKs). These applications are found in several places other than Android TV, Android TV Operator Tier and the Google Play Store, like Amazon's Fire TV and other connected TV platforms. The applications are not inherently tied to Android-certified devices, and they are not inherently tied to GMS (Google Managed Services). The same APK as found in Android TV devices can be run via AndApps elsewhere.

A large range of Android apps can be tapped – and, where compatible, the apps can be technically provisioned on a Pay TV platform within hours, literally (although full integration, testing and verification must follow). A contractual arrangement with the app developer may be required, but then AndApps takes care of the rest.

Where an application author has written an app for the Android environment, AndApps takes this same application and makes it work in an operator environment running in AOSP. The app author does not have to write new code or introduce any customisations, if they already have an AOSP compatible APK.

> " **If an Android app exists, AndApps can run it.**"

AndApps is not an application development technology and does not change the source application in any way. AndApps is the application delivery platform that takes the existing application and gives it life on new, operator-controlled devices.

// Apps that operators can onboard using AndApps

AndApps is not designed to replace existing applications or app stores found in the RDK or Linux ecosystems – its purpose is to complement them. In the RDK world, the most likely deployment scenario is as part of a hybrid collection of applications, some of them premium native, some HTML (browser-based), some Lightning, and some AndApps.

AndApps provides the apps that cannot be found already, and which would be either impossible or difficult to source and then onboard economically using other sources.

Early use cases for AndApps include:

- Casual games, including games found on phones

- Regional BVOD (broadcaster VOD) apps that are found in Google Play but not available in native form

- Video-centric social media apps like TikTok • Niche VOD services like anime

- Sports streaming apps – including special interest and lower-tier sports.

- Provision of FAST (free ad-supported linear TV channel) apps

> " Application publishers do not have to write or develop a new app - AndApps instead uses the application they developed for the Android environment."

// App publishers can extend device reach without additional effort

As previously noted, application publishers do not have to write or develop a new app – AndApps instead uses the application they developed for the Android environment. As a publisher makes changes to their application for the benefit of Android and Google Play, the operator application can also be updated, since AndApps runs the same underlying application.

For app publishers, the effect is 'publish-once-and-use-elsewhere'. They only have to maintain their application APK in order for their application across the operator RDK/Linux landscape to be maintained simultaneously.

This has important implications for operators using RDK/Linux. Once the application is tested and deployed, it can be viewed by the publisher as a bonus device endpoint that gives a publisher more reach without additional maintenance burden or cost. Even if the publisher does

not release its application to an RDK-centric app store, or agree to onboarding on a one-to-one basis (for economic reasons), their app can be made available to the RDK/Linux community.

We expect many application developers to be happy to have their apps used in an AndApps environment. Free apps that seek reach to monetise their content via advertising or, in the future, in-game purchases are strong contenders for agreeing to AndApps opera tor onboarding.

Apps running in the AndApps runtime have noticeably superior performance compared to HTML apps. Performance is only marginally less than the Android version of the app, so any operator looking to migrate its CPE (customer premise equipment) from an Android OS environment to RDK or Linux can keep offering the applications they want, and avoid any meaningful performance degradation.

// Operator hardware where AndApps can be used

AndApps has optimised resource utilisation for constrained devices and can be installed on existing operator CPE using a software download. This solution will work with most devices shipped after 2020. It can be used with classic gateway-style set-top boxes with hybrid broadcast/streaming support, or with streaming-only 'puck' STBs. It can also be used with private-label Smart TVs that are developed and retailed by operators.

AndApps is hardware agnostic: the common denominator for its use is the presence of an RDK or Linux OS that is controlled by the operator. This also means that where an operator ports its OS/UX to a television OEM for use under the OEM retail brand, AndApps can be used, too.

> " AndApps has optimised resource utilisation for constrained devices and can be installed on existing operator CPE using a software download."

// Why operators may want to run Android apps on RDK or Linux

There are several use cases where an operator may want to choose applications they have seen in the Android environment (including in Google Play) and run them on their RDK or Linux devices. They fall into two broad categories: operators who already use RDK or Linux, and operators who want to migrate away from an Android OS environment to RDK or Linux.

Operators who already use RDK or Linux

Operators who already use RDK or Linux would typically use AndApps because they need more apps than they have today, to ensure a competitive super-aggregator customer experience. This is the 'apps top-up' scenario.

The apps they want may not be available in RDK-centric app stores. Perhaps the apps can be sourced without a one-to-one onboard – but only in HTML, which does not provide the app performance desired. Maybe the app provider is unwilling to enter an onboarding relationship on a one-to-one basis (typically for economic reasons), or it could be non-economic for the operator to consider a one-to-one custom onboarding.

Operators who want to migrate from Android to RDK/Linux

Android TV and Android TV Operator Tier provide a powerful OS/UX for television services and super- aggregation. However, there are trade-offs for operators relating to how much control they have over the UI and data – and operators must accept competitive apps on their devices.

An operator's ability to differentiate is limited if rivals in the same territory are also Android TV or Operator Tier customers. Operators must also be aligned with Google's roadmap developments and long-term ambitions. For operators who believe the negatives outweigh the positives, migration from Android to RDK/Linux is a consideration.

One immediate challenge presented by an Android-to-RDK or Android-to-Linux migration is the potentially dramatic loss of apps (because the Google Play store is sacrificed). Consumers who are used to having direct-to-consumer studio apps or favourite FAST channels or game applications will immediately notice if they disappear – or there is a noticeable downgrade in performance. There is the potential to trash a net promoter score.

Once again, options for app replacement include an RDK-centric app store if the application exists there, but they may not. They could agree with the app author to develop for the RDK environment, e.g., in Lightning if a one-to-one onboard is realistic, but this comes with development and ongoing maintenance costs.

In all these scenarios, Android Apps on RDK or Linux – enabled by AndApps – provide a solution. An Android-to RDK or Android-to-Linux migration could be managed in multiple ways, for example:

- New gateway STBs are deployed using RDK/Linux instead of Android and over time replace the 'legacy' set-top box fleet. AndApps is implemented on the new devices.

- New streaming-only set-top boxes, including devices designed for broadband-only customers who are not taking a Pay TV package, can be used to debut RDK/Linux with AndApps.

- RDK/Linux, with AndApps, is introduced via a (private labelled) operator Smart TV, or even via a Smart TV retailed by an existing OEM brand that is now using a Pay TV operator's OS/UX

> " AndApps beneficiaries fall into two broad categories: operators who already use RDK or Linux, and operators who want to migrate away from an Android OS environment to RDK or Linux."

// How AndApps works – the tech deep-dive

AndApps is an advanced application delivery platform for Android apps on operator-controlled RDK or Linux hardware environments. It is an AOSP runtime environment, with similarities (but also important differences) to how a browser works.

AndApps Runtime ensures the application works seamlessly with the middleware and hardware. Correct remote control navigation within the app for example, or support for low-latency wireless gaming controllers. It ensures application features operate smoothly on the device, like start/pause/stop, full-screen or Picture-in-Picture. AndApps Runtime is optimised according to the hardware device profile, ensuring application works with all variants of the operator CPE, and makes sure everything keeps working.

One notable precedent for the AndApps approach is the Windows Subsystem for Android. This enables a Microsoft Windows 11 device to run Android applications that are available in the Amazon Appstore, which is the catalogue of Android apps consumers see and is available on Windows 11 in dozens of countries. The messaging from Microsoft to app publishers is straightforward: "Expand your app's reach".

Its guide to Windows Subsystem for Android highlights app examples like Playrix, which expanded mobile-first games to the PC, and Argon, a retro gaming platform that added desktop compatibility to attract new PC users.

AndApps is optimised to run with minimal overhead, which means operators get more value from their deployed CPE population. There is no requirement for new hardware. It enables hardware acceleration to improve user experiences with graphics and audio acceleration.

Operators benefit from economies of scale because each implementation of AndApps, and the efforts to ensure it is optimised for a given device, builds on the knowledge base that can be used on the next deployment. Over time, the porting of a given application becomes more of a validation than an integration exercise.

Operators working in multiple territories can use AndApps to deliver the same app experience on all their hardware types, across any network type, in any country. AndApps puts the operator in control of decisions like when to release a new application and whether it appears on all devices or a subset of its CPE population.
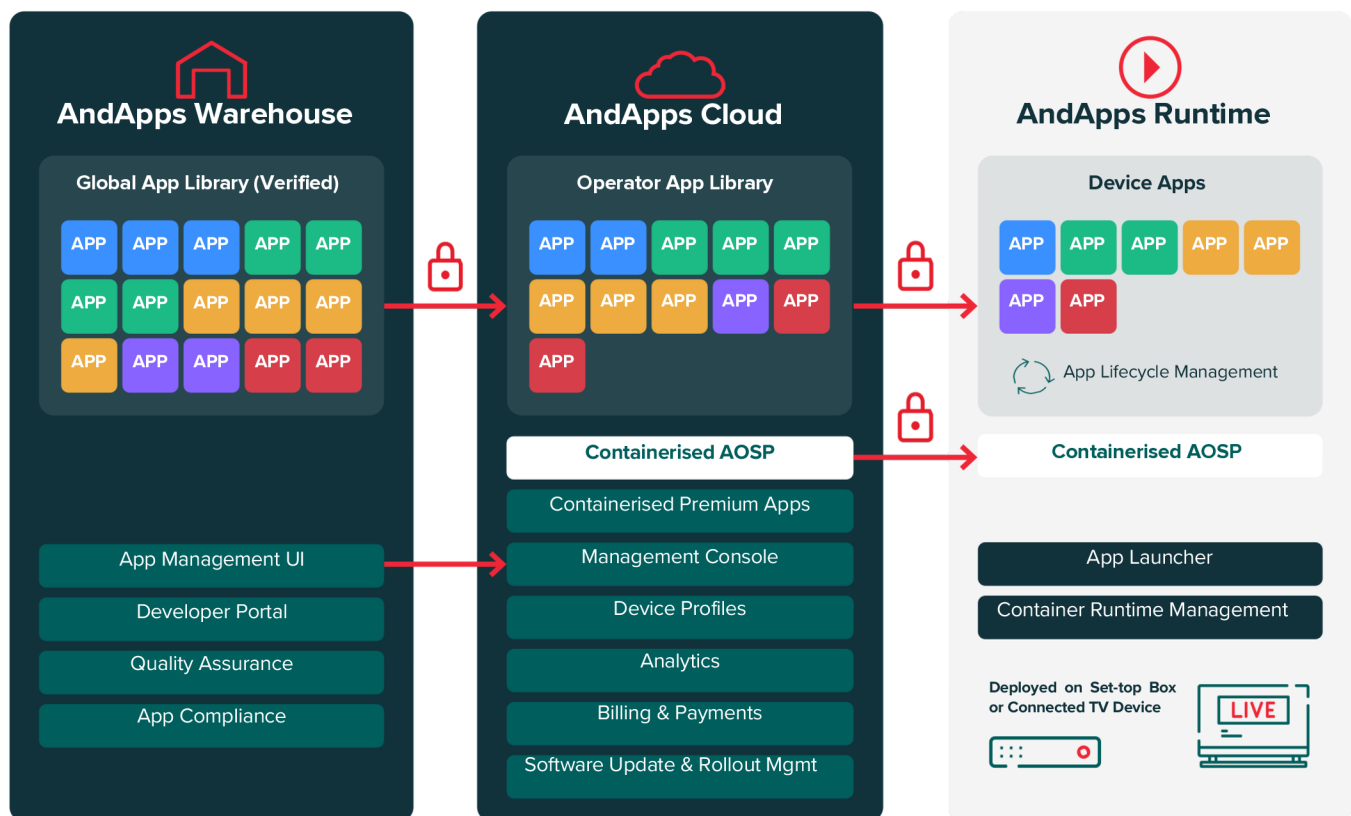
Containerised delivery of additional apps and runtimes can be supported

AndApps Warehouse - A global origin repository of managed applications. AndApps Warehouse takes care of application submission (by the application developers) and associated metadata, providing application testing, verification and status views.

AndApps Cloud - Provides operator-centric management for the platform and enabled devices, including application and runtime lifecycle management.

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// Massive time-and-effort savings using AndApps vs native video applications

It would be difficult for operators to match the efficiencies and cost-effectiveness of re-using Android applications in AndApps implementations. Consult Red estimates significant cost and time-to-market savings when using AndApps compared to other options. The following findings are based on a first-time effort for a complex integration, comparing AndApps vs an equivalent native premium video application (and based on figures from Consult Red historical project data and estimates):

" We successfully launched 6 OTT apps in less than 5 months with AndApps. The ease and speed of implementation was unprecedented."

Alex Glass,
Chief Product and Technology Officer, Fetch TV

fetch

TIME-TO-MARKET COMPARISON - Native App Porting vs. AndApps (first deploy)

Application launch

- An RDK/Linux operator can launch an app in half the time using AndApps.
- The AndApps deployment would be nearer to five months versus approx 12 months.
- These figures include contractual work, porting, integration, pre-certification, bug fixing and certification.
- If you remove contractual work, the deployment time roughly halves (for
- both AndApps and native).
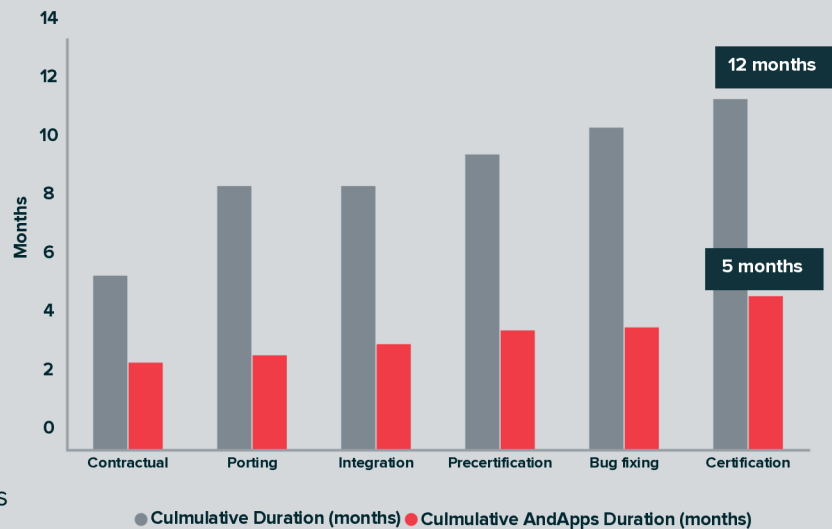
Application update

- An application update is also approx. twice as fast when using AndApps.
- The average update time for AndApps is just over two months versus nearly five months for native.

12 months

5 months

● Culmulative Duration (months) ● Culmulative AndApps Duration (months)

Launch your next OTT app in half the time with AndApps

EFFORT COMPARISON - Native App Porting vs. AndApps (first deploy)
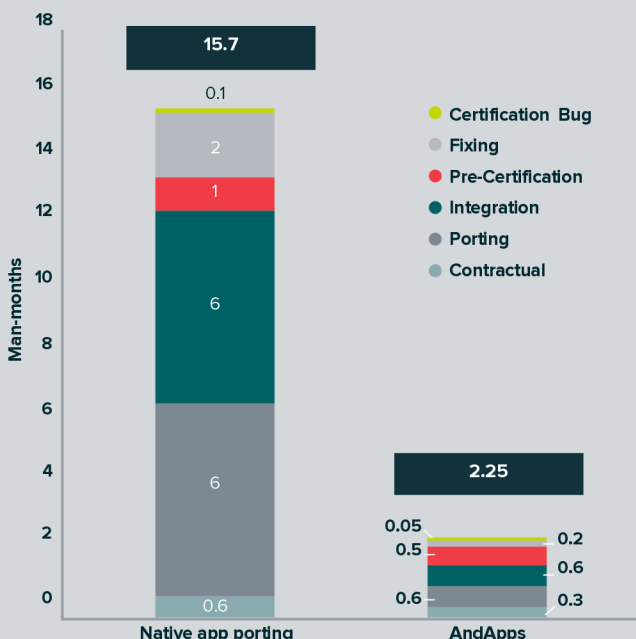
Application launch

- Launching an app with AndApps requires 7x less effort compared to an equivalent native app integration.
- This figure assumes no dependence on GMS but does assume contractual work. Without contractual work,
- AndApps needs 8x less effort than native.
- Consult Red estimates an average of two man-months of time (approx.) for an AndApps application launch (reduced marginally if there is no contractual work).

Application update

- You can update an AndApps premium video application with 6x less effort versus an equivalent native app integration (with contractual work included).
- Consult Red estimates approx. 1.2 man-months of effort (reducing to approx. one month without contractual).

Reduce the effort of launching your next OTT app by 85% with AndApps

// Android apps on RDK and Linux 'as a service'

It is possible to port an application APK to an RDK or Linux environment, ensure the runtime environment is optimised, and then forget it – as a time-limited technology project. However, the best approach to hosting and maintaining apps in these operator environments is to treat it as a service.

> " The best approach to hosting and maintaining apps in these operator environments is to treat it as a service."

Consult Red offers AndApps as a comprehensive service that ensures ongoing maintenance of both the runtime and applications, with security patches implemented and updates optimised. A service level agreement would be a best-practice approach – giving the app authors as well as the operator full confidence in long-term QoE.

// Key relationships/interfaces when using AndApps

Here are some of the important relationships/interfaces involved in this approach to Android apps on RDK/Linux devices:

- AndApps, residing within a containerised application management solution, is a white-label solution, totally hidden from consumers.

- Because the application pre-exists, neither Consult Red, AndApps nor the operator touch the app in any way.

- The application author does not have to rewrite their application – their existing application APK is ported. They only need to maintain the app (as they usually would for the Google Play store) to ensure the AndApps implementation on RDK/Linux is also up-to-date.

- The operator pays a simple integration fee and/or a maintenance fee for AndApps

- Any commercial arrangements between an operator and an app author are organised directly between them. However, Consult Red may provide an interchange where app authors provide standard permission for operators, based on agreed parameters, that can be automatically applied. This will avoid the need for one-to-one agreements.

- The use of AndApps has zero impact on ad tech or advertising sales associated with ad-supported apps – these functions are contained within the application

- Subscription apps can be treated the same way as other paid apps on the operator platform: sign-up and subscription management are via the app provider unless an agreement allows the operator to manage these functions via its platform.

> " AndApps, residing within a containerised application management solution, is a white-label solution, totally hidden from consumers"
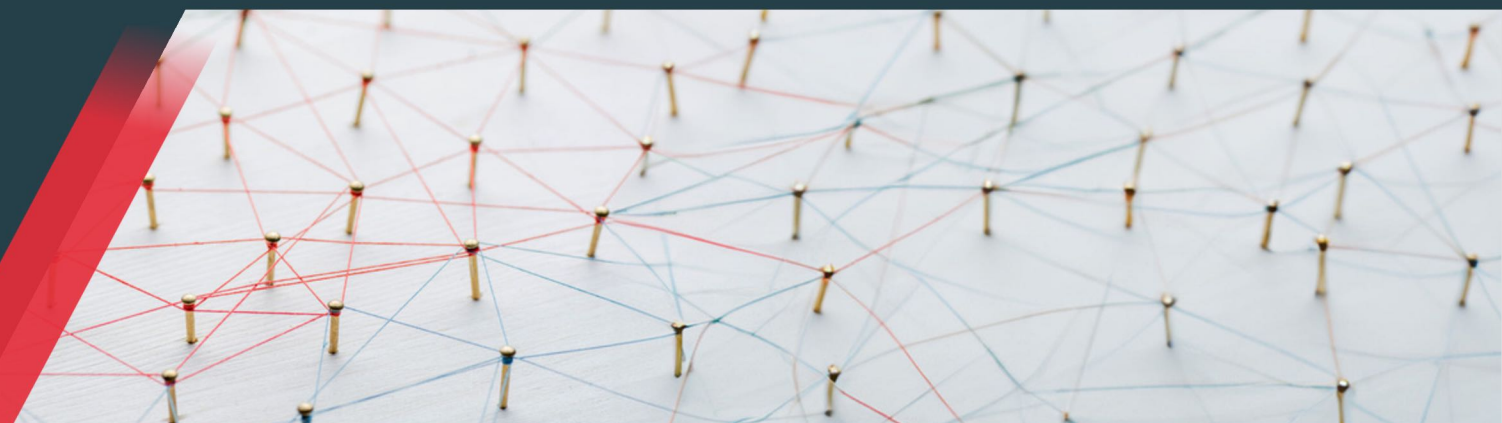
// Benefits of AndApps – a summary

- AndApps enables Android applications to be ported to an operator RDK/Linux environment (with app author permission), removing 'apps-gaps' or expanding the entertainment offer.

- Operators concerned about the degree of control they have over the subscriber experience or data in the Android TV environment can migrate to RDK/Linux without losing apps or apps performance.

- Operators control where apps appear and when (subject to any app author commercial terms).

- AndApps makes app onboarding easy for operators, with no additional app development or maintenance.

- Applications are available very quickly – an RDK/Linux operator can launch an app in half the time needed for a native application.

- Apps perform like they are native, with support for sophisticated features like Picture-in-Picture and app switching.

- AndApps uses open source architecture to enable flexible development, scalability and security operators can trust.

- AndApps is available as a comprehensive, end-to-end, managed solution with security patches and regular bug fixes.

- This solution was developed for the Pay TV and broadband service provider community, with their specific needs in mind, and is field-proven in that environment.

- Simple and transparent commercial arrangements based on implementation and maintenance fees.

> "Apps perform like they are native, with support for sophisticated features like Picture-in-Picture and app switching."

// Conclusion

Pay TV and broadband service providers need to 'Aggregate More' to guarantee their relevance to consumers during the rest of this decade – and as a way to seek new revenue opportunities. This white paper has focused on 'Aggregate More: Video' and the sophisticated end-to-end solution that will help operators to become the best entertainment super-aggregator in their market: AndApps.

AndApps means more premium entertainment applications can be added quickly and cost-effectively to existing RDK/Linux environments. It means painful 'apps-gaps' – which have the potential to reduce net promoter scores overnight -- can be eliminated when migrating from Android to RDK/Linux-based platforms.

AndApps drastically lowers the barriers to app diversification. It removes barriers to OS migration if that is a consideration for a service provider. It levels the app playing field between Android platforms and RDK or Linux-based platforms. AndApps is a significant contribution to the toolkit for the future-facing Pay TV and broadband service provider.

> " AndApps levels the apps playing field between Android platforms and RDK or Linux-based platforms."

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Contact us to find out more

// consult.red   // info@consult.red

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