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How to ensure a successful HbbTV Operator Application platform roll-out

Eurofins Digital Testing has been active in HbbTV since 2010; Eurofins frequently support interoperability plug-fest events and are on the HbbTV Association Steering Board as well as being active contributors in many of the sub-groups like the Testing Group and the Marketing and Education Work Group. Most recently Eurofins has been appointed to develop some of the official Operator Applications tests and has recently announced support of the Operator Applications test suite in the Ligada iSuite for HbbTV test harness.

In this white paper, we look at what considerations should be taken into when launching a new HbbTV Operator Application platform and explore the importance of ensuring the correct test program is put in place to ensure a smooth roll-out and the ultimate success of the platform and its services offered to consumer.

Introduction

Next generation TV platforms based on HbbTV are gaining huge ground as roll-outs of a rich selection of services sweep across the globe.

A new exciting addition to the HbbTV technology framework recently has been the Operator Applications (OpApps) specification. OpApps was designed to let TV platform operators offer a fully branded and consistent user experience directly, without any dependencies on proprietary operator-specific devices.

The open standard enables operators to create a "virtual Set Top Box (STB)" experience for any type of network supported by connected TVs or even white-label STBs and serves as a foundation that can be used by any operator. OpApps are independent of the TV channel being watched, device, remote control keys, etc; they will have access to the system beyond regular HbbTV apps but can coexist and interact with regular broadcasters' HbbTV apps gracefully.

Operators can therefore implement a fully immersive branded experience based on HTML5 HbbTV applications more easily and cost efficiently, whilst greatly reducing the costs of producing and maintaining proprietary hardware and software rollouts and subsequent updates.

Just imagine being able to manage the platform UX remotely and deploy software updates over broadcast or broadband without the complex and potentially problematic middleware upgrades!

To achieve the full potential of HbbTV Operator Applications, operators can make use of an existing and mature device certification ecosystem, including a new Operator Application Test Suite. Operators also need to ensure their new Operator Applications deliver the desired experience across the range of target hardware, which can be challenging compared to dealing with proprietary STB hardware, but with the right tools and QA approach potential pitfalls can be avoided. This paper aims to help explain how to achieve a successful OpApps platform roll-out.

What is an Operator Application?

OpApps come in three "flavours":

Standard – the most basic OpApps implementation. A regular HbbTV 2.0 application that is launched by the press of a button. It does not replace any UI elements of the TV/STB. E.g. red button launches the platform branded OpApp.

Privileged – it will replace some, if not most, of the TV/STB's UI when activated. The OpApp will appear as a "source" on the TV, in addition to the usual HDMI input, Live TV, etc.

Operator-specific – intended for STBs. The application will be the UI for the platform branded STB, replacing the need for an actual STB UI entirely.

In this document, we will mainly be focusing on the Privileged and Operator-specific OpApps as these are most relevant to platform operators and broadcasters, but the principals apply equally to any kind of OpApps.

In an Operator-specific OpApps implementation, the operator branded STB should require no explicit discovery / installation, bar a few user customisation steps at first boot up to personalise the user experience.

In standard / privileged implementations, when an OpApp is discovered in the signalling, the viewer will be presented with options to select which to install and subsequently unzip and install it. Discovery can be via a DNS lookup, from a Common Interface module or in the broadcast AIT.

A typical OpApp install process would be as follows:

OpApps are distributed as encrypted packages (signed and encrypted zip), with a "bilateral agreement" in place between the operator and each of the manufacturers. The decryption process is then carried out by public-private key authentication. This ensures only genuine OpApps are installed and only on pre-approved devices. OpApps should also have no impact on regular HbbTV apps but should allow a certain level of interaction with them on the same device. An OpApp could also be allowed to start another OpApp in some scenarios.

OpApps can run in a number of "states":

1. Foreground / Overlaid Foreground
    a. e.g. EPG, PVR, VOD interfaces
2. Transient / Overlaid Transient
    a. e.g. banners, notifications, reminders, calls to action, etc.
    b. For a limited time only if no user interaction
3. Background – not visible to user at all

Depending on the state, the OpApps might have different level of access to the device's components including the ability to override certain remote control buttons. Certain keys can be designated to start the OpApps, e.g. Guide or PVR, depending on previous agreements between the operator and manufacturers, and the OpApps could appear as an input source on the TV / STB in a privileged OpApps implementation. If the device is powered off or put on standby, the OpApp should spring back to life as the active input when the device wakes or is powered on again.

More details about HbbTV Operator Applications can be found at the HbbTV website, the Operator Applications section. The "OpApps Explained" document would be a good starting point.

Why test Operator Applications?

While the OpApps specification is a standardised part of HbbTV, there is still considerable scope for variation in the implementation across different platforms and devices:

- Features and functionality defined in the HbbTV and OpApps Specifications may be altered for the target platform concerned; e.g. based on the bilateral agreements between manufacturer and operator.
- Additional operator-specific features may be added; e.g. specifying which DRM and/or CAS to be used.
- The population of target devices may vary in their support for optional features and in performance.

Without intimate knowledge of these details, and expertise in the referenced HbbTV specifications, operators run the risk of applications failing to meet standards and platform requirements.

In the case of OpApps, there are many parameters and options that need to be tested to ensure compliance to the specification. These include validating the decryption and authentication process between the OpApps and the device is implemented correctly, checking that access restrictions of viewers' data and privacy by the installed OpApps are being imposed correctly, unzip and install processes are failsafe, and so on. These are all elements that can be tested against the target device hardware, using the core HbbTV Test Suite and HbbTV Operator Applications Test Suite.

In addition, the OpApps platform (application, content and transmission infrastructure to target devices) should also be tested in an end-to-end manner to ensure performance, stability and usability. Rather than rely on lengthy and costly manual testing, automating system level testing is key to maintaining an ongoing service and delivering the expected consumer and commercial benefits of the investment in the platform.

Without good test coverage, what could go wrong?

Often, application developers and QA engineers manually test the broadcast application during development on a handful of reference devices to try to gain confidence of quality. This cannot deliver confidence to the platform operator of the application's wider support on the field, even when multiple reference receivers are used. The following are typical problems faced by platform operators:

Non-conformant applications

App developers may face a situation where some of the app platform's functionality is incorrect, but the errors are masked or 'corrected' by a (fault tolerant, or even incorrect) receiver. Alternatively, applications may implement workarounds for incorrect receiver behaviour that make the application fragile to other receivers' different implementation(s), or even fixes to the current reference receiver. The resulting application codebase can become unwieldy, difficult to manage, and ultimately costly to maintain and develop.

Non-conformant receivers

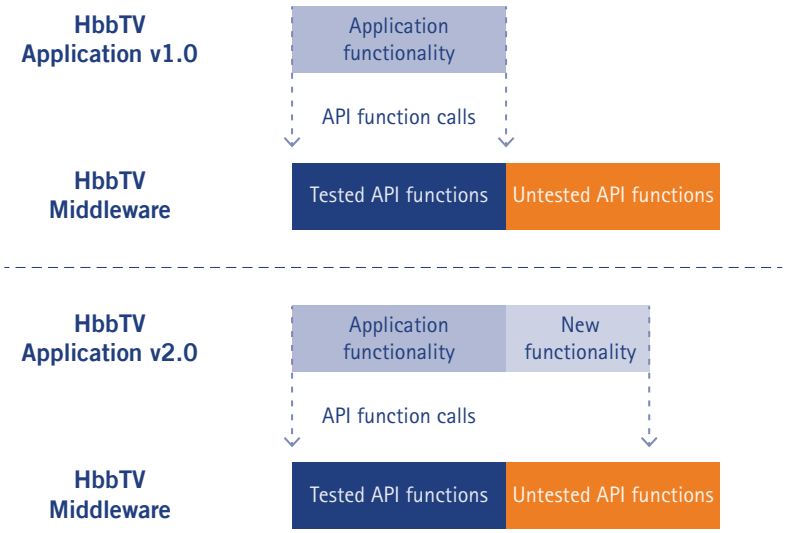
HbbTVs specifications are designed to improve interoperability across the market, however there is still the potential for some manufacturers to not fully implement all the requirements, or not to verify the correct implementation against a validated test suite.

Operators should ensure that their target devices, or supply chain, make use of HbbTV Test Suites for the core and Operator Applications specification to achieve a good foundation level of device conformance.

Over-reliance on a generic test suite

A generic test suite, or one that provides only general coverage, which does not target the specific platform's functionality can give an improvement in confidence but can still allow problematic situations to arise.

A basic application such as might be conceived at launch might only make use of a few core features of the specification that may be well tested. However, as new services and further features of such applications are launched, making use of new areas of HbbTV functionality less thoroughly tested during receiver development, gaps in test coverage can quickly be exposed.



The HbbTV test suites cannot provide 100% coverage of the specifications, and may require augmenting with platform specific tests, or greater density of coverage in mission critical areas on which the service depends. For example, in respect of CAS and DRM systems, HbbTV remains agnostic to the technology deployed and yet explicit testing of the actual chosen CAS/DRM is critical to achieving confidence, security and compliance. An Operator must carefully assess the scope and depth of testing available against their specific platform requirements and may need to add to the broad cover provided by HbbTV Association test suites.

Poor performance, stability and usability

Another important but not always obvious factor that can have a huge impact on the platform's reputation is issues with performance, stability and usability of the application AND the devices. This area is largely left beyond the scope of HbbTVs specifications, which focus more on conformance, leaving manufacturers free to compete on quality and user experience. However, in an operator application eco-system the platform brand is affected more directly by these issues than a general HbbTV application, and so the operator must also test:

1. General hardware / software performance;
2. Video playback performance;
3. UI design and user friendliness;
4. Stress testing over extended periods of time;
5. End-to-end testing for the app platform and related services;

What test solutions are available?

Eurofins Digital Testing has been the authority in offering HbbTV testing and conformance consultancy solutions to HbbTV operators around the world and has enabled numerous successful HbbTV platform launches. Our range of test tools and services will equip TV operators with the capability to achieve a good test coverage from HbbTV device conformance, application performance and functional testing, to E2E testing and automation.

Device Conformance Testing

Eurofins has recently added an extension to provide full test coverage for the HbbTV OpApps specification to the widely adopted Ligada iSuite for HbbTV. Ligada also offers the ability to extend test coverage to specific TV platform requirements, as custom test suites in the Ligada test framework. For example, it offers a DRM test suite covering PlayReady and Marlin DRMs and various regional platform test suites covering local requirements. Ligada iSuite comprises a test harness and several test suites that can be exercised against a receiver as complete test environment, to comprehensively test its application middleware API implementation. By verifying the receiver's HbbTV and OpApps conformance in various functionality areas using Ligada iSuite, manufacturers can ensure conformance through self-testing, within their own QA cycle, and produce a comprehensive test report for platform operators to review. Application developers can also gain valuable insights into which features of HbbTV functionality work correctly on the receiver under test.

They can then focus on genuine applications issues, without fragile workarounds, and even build a collection of trusted receivers to test their application on. Platform operators can also use Ligada iSuite as a validation tool within their own supply chain QA and acceptance processes.

Benefits of using Ligada iSuite:

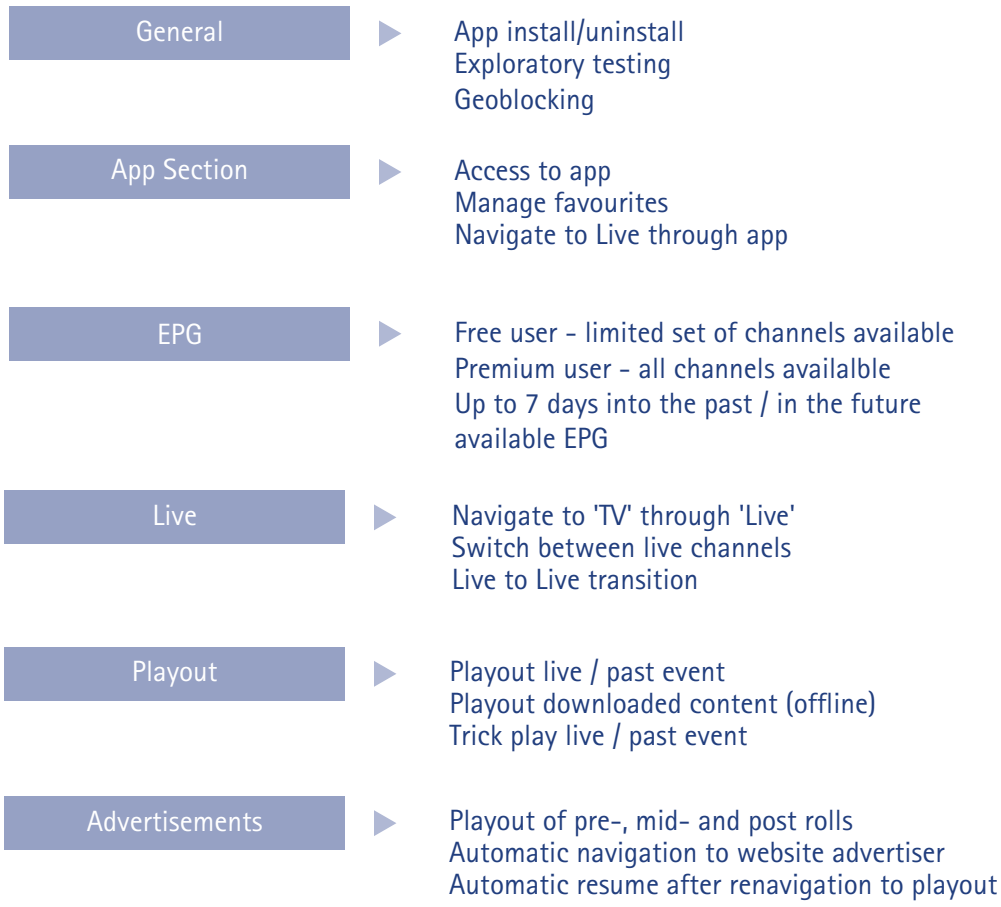
- Widely adopted de facto test tool that is well tested and trusted by the industry and used by the majority of the biggest TV and STB manufacturers
- Full conformance with official HbbTV Test Spec; Ligada's generated reports are accepted for logo certification by major HbbTV platforms, regulators and standard organisations
- Automation – IR blaster, power cycling, image and video capture for post run analysis; A standard test cycle can take 10 days or more even with automation offered by Ligada, imagine the manual alternative
- Dynamic test stream and DSMCC generation and playout
- Media sync testing
- Full test coverage for HbbTV and OpApps including:
    - Launcher-based OpApp tests
    - Discovery and Installation tests
      (DNS SRV Discovery, HTTP and ZIP app packages)
    - Full support for new HbbTV Test APIs and OpApps tests in the HbbTV repository
- Add / edit tests to create your own platform's "test suite"
- Allows targeting of API functions not just in use by current applications but also those that are intended to be used in the future
- Allows for simple testing of API functions by simplifying the test setup and removing the need for customised test streams for each test case
- Ability to paint a map of the entire HbbTV and OpApps API support in receivers, not just for the current application.
  This is useful for future application creation.
- Built-in support and optimised for OpApps testing, in that encrypted and digitally signed OpApps packages can be integrated into Ligada to facilitate out of the box testing. More details of how this works can be found in a separate document titled Decryption and Authentication in OpApps testing, please get in touch with Eurofins to obtain a copy.

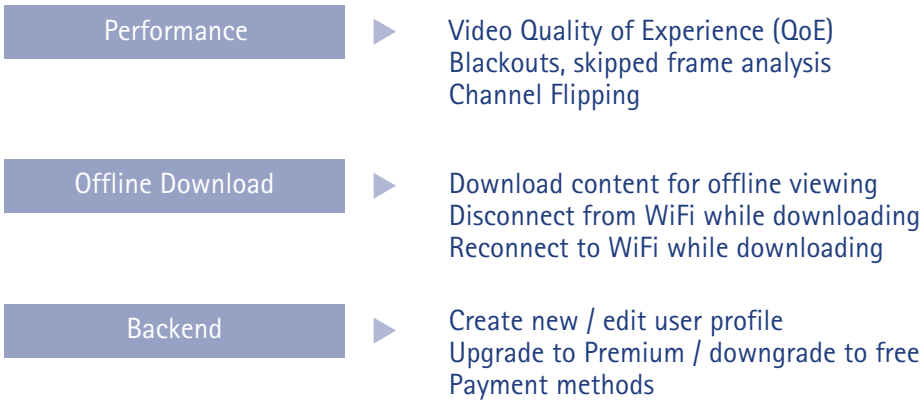
App Platform Testing and Test Augmentation

In addition to device compliance testing, it is vitally important to also have the Operator Applications tested professionally by experts who have had decades of experience in devising test strategies, coverage, planning and execution, by means of (and often a combination of) automated, semi-automated and manual testing.

These can be functional and non-functional testing of the application and integration, security, performance testing of the platform as a whole. For instance, in scenarios where companion devices are used or if the platform is simultaneously deployed over OTT (e.g. mobile devices) it is important to also carry out thorough and comprehensive testing of the actual platform across the range of target devices, and identify any issues with compatibility, interoperability, latency as well as usability such as user experience in general and measuring app / device performance as an end user.

Here is an extract from a test plan for a typical app platform:





These types of testing can be provided at a specialist Eurofins Digital Testing lab and/or at designated customer facilities with staffing or test augmentation resources from any one of Eurofins' operation centres in the UK, Belgium, Sweden, Hong Kong and Poland, and should be carefully integrated into a successful TV platform launch and ongoing operational excellence strategy.

Automation and End-to-end Testing

TV platforms can also employ a test automation platform such as Eurofins' very own TestWizard during development phases as well as after deployment, by defining a (perhaps large) set of test cases across a range of TVs and/or STBs to carry out functional, performance, stress and regression testing on their OpApps.

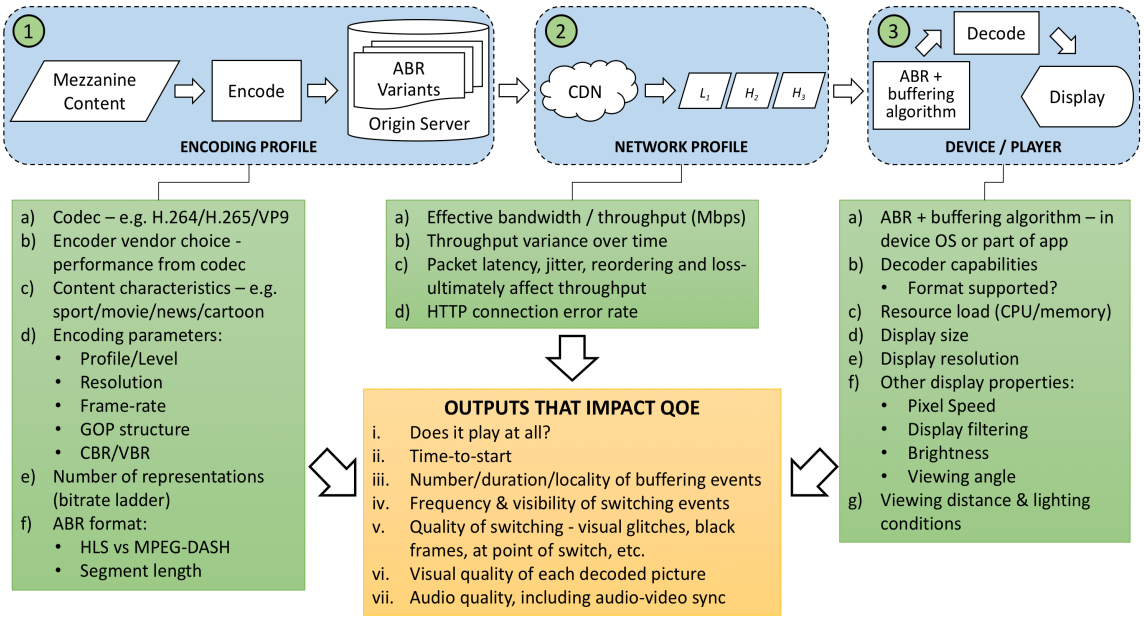
TestWizard is a script-based environment for creating custom test cases and managing test runs all from a web interface. This allows parallel testing using resources in the most efficient way, shortening test execution time and providing quick feedback and reports. With this test platform, time spent on repetitive testing tasks can be highly reduced with no compromise on test coverage and test consistency by enabling automated testing of full end-to-end user scenarios involving multiple device types like STBs, applications, mobile devices and web services.

For example, a number of test batches can be defined where each consists of a collection of test cases covering items such as those listed in the previous section, and have the automation platform trigger these tests to be run every time there is an update to the software build, or as STB acceptance test platform where a new model of the device can be put through the same test batch for a quick analysis of quality over time during development cycles. The automated tests can also be used as parts of the app and/or device acceptance testing process as well as for on-going monitoring of the trend in changes in quality over subsequent builds or updates in both the software and hardware aspects.

More details and use cases of TestWizard can be found at:
https://www.eurofins-digitaltesting.com/test-tools/testwizard-automation-suite/.

In addition to making sure the software and hardware aspects of the devices at the receiving end, there are also numerous factors that need to be taken into consideration, quantified, and optimised when content streaming plays a key part of your OpApps offering too. In any HbbTV offering with Adaptive Bitrate streaming technologies (e.g. DASH contents and so on), there would be many factors that determine whether the end viewer will consume the content in a manner where it is smooth with minimal disruptions to the delivery and the best picture quality, which can have a significant impact on the Quality of Experience (QoE).

The following diagram summarises all the variables that can affect the QoE in any video streaming ecosystems:



Whether the platform owner employs a CDN provider, or runs their own, the same factors above can drastically affect the QoE. ABR profiles, video encoding platforms (codec's compression ratio, ease of decoding, etc.), and formats must be fully optimised for the target audience's geographic location, network bandwidth and conditions, and the terminals / devices they will be consuming your streaming content on.

The platform operator should also consider how new technologies like CMAF and QUIC will have a positive impact on delivery, save operating costs and still achieve a quality user experience.

Eurofins offers a purpose-built platform for measuring Streaming Video QoE that enables a deep analysis of the complex relationship between factors that affect QoE; such as device type, screen size, encoding technologies and processes, ABR profiles, packaging and transport models, content genre and complexity, and network conditions. The test framework can control all of these factors for repeatable measurements and automate for regression testing at scale on a vast range of TVs, STBs, mobiles and PC/Mac's in Eurofins' vast device zoo of over 400 devices.

Summary

HbbTV Operator Applications open a whole new world of possibilities for TV platform operators to offer their services direct to consumers and can extend the reach to households much more easily and cost effectively like never before, and all done using only open standards.

Today HbbTV platform operators can utilise a mature and comprehensive set of tools to ensure great user experiences and compelling revenue generating services. The OpApps security and privacy features introduce some challenges for testing, however Eurofins industry leading test tools are already able to support these complex requirements and can be deployed by Operators and their suppliers within existing QA processes.

In addition to conformance testing of the HbbTV implementation, it is also vital to the success of the platform to take into careful consideration the testing of the actual app platform, functional as well as testing the user experience as a complete end-to-end workflow including interoperability, stability, usability and so on.

Eurofins Digital Testing is the world leader in HbbTV conformance and digital TV testing, is actively involved in the HbbTV Association and operates globally with leading operators, broadcasters and manufacturers. With its industry leading tools, and out experts' deep knowledge of full end-to-end test strategies, Eurofins continues to help TV platforms succeed in delivering HbbTV based services and content to viewers around the world.

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