HbbTV Testing – an approach to testing TV receiver middleware based on web standards

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Abstract

HbbTV is a specification that defines an application platform for IP connected broadcast devices, typically "Smart TVs". The specification references several W3C standards. The HbbTV Association distributes a test suite and a test harness to help manufacturers of HbbTV devices validate the compliance of their device. The design and usage of these test tools is significantly different from other well known HTML focussed test suites, including those provided by W3C. This paper considers the requirements for testing TV based devices, the test solution that HbbTV has adopted and how this differs from W3C testing approaches.

Background

Other papers presented at the workshop provide background about the HbbTV specification and its wide deployment. The HbbTV specification is now implemented on the vast majority of all new mid to high end connected TVs sold in Europe. HbbTV applications are very similar technically to any other web application, but the user's experience is very different. The application is typically launched directly from the broadcast channel, often requiring no initial interaction from the user who has little if any notion that he is running something akin to a mobile or PC application on a computer like platform. These applications need to "just work" and if they do not the user will not be able to upgrade the device or the application to make it work. There are many makes of HbbTV receivers with a greater variation in browser and media player integrations than is common in the PC, tablet and mobile spaces. Taken together these factors mean the interoperability of HbbTV devices with HbbTV applications is hugely challenging and important. Ideally interoperability needs to be ensured from when TV devices are first introduced into the market.

HbbTV Testing Requirements

The HbbTV test solution is intended to be used in an environment where organisations – such as a pay TV operators, national regulatory bodies, retailers or the HbbTV Association itself – wish to ensure that certain HbbTV devices comply with their requirements. This might be so that the devices can carry the organisation's logo or be promoted on their website.[2] Typically this will be achieved by requiring the execution of a test suite on the retail device and using a binary pass/fail from the test report to determine whether the device is eligible. In the extreme case, obtaining a "pass report" is the gate to starting a manufacturing line. Consequently manufacturers are extremely sensitive about precisely which tests are run and that if a test is shown to be incorrect it can be rapidly challenged and waived.

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[1] The author is a member of the HbbTV Association Steering Group. This paper is presented on behalf of Digital TV Labs who have contributed towards many aspects of the HbbTV test solution.
[2] More details about HbbTV Certification can be found at "The HbbTV Certification Process", by Simon Waller and Jimin Chung, and also at http://www.hbbtv.org/pages/about_hbbtv/hbbtv_logo.php.

The above factors and other considerations led to the following requirements for the HbbTV test solution.

- Each test case is a "mini web application" with a well defined set of metadata that:
    - includes a unique and persistent test ID (critical to accurately describing different versions of the test suite and which tests are being challenged and/or waived);
    - includes a test assertion that describes the precise atomic test purpose; and
    - includes other metadata, such as pre-conditions and specification references.
- The test suite should be quick to run, preferably using test automation wherever practical.
- The test suite can be run on different implementations of a test harness. The HbbTV Test Specification defines the API and behaviour of the test harness required for it to execute the test suite, meaning that multiple implementers can provide test harnesses with different added-value features, such as test automation.
- The list of test cases in the test suite must be precisely defined and versioned at any point in time so that all devices are tested on the same basis. Within that, it is possible to selectively run a set of tests according to whether the receiver supports a particular optional feature or not.
- The test harness can be run on a local network to isolate the test behaviour from unpredictable public network behaviour. This is particularly important for video streaming testing by manufacturers based in countries where Internet connectivity might be poor or legally restricted.
- Executing the test suite requires no special software to be installed on the receiver under test. I.e. it can be run on an unmodified HbbTV device bought in a shop, without any programmatic access or special configuration.
- The test harness provides a complete, machine readable test report that can be exported and used to provide evidence of the compliance or otherwise of a device. The test report must demonstrate that precisely the right tests for the features supported by the receiver have been run, along with a full log of the test results.

The HbbTV Test Solution

The HbbTV test solution consists of the following elements.

- The test suite is a set of test cases that can be distributed separately from the test harness. The test suite has a well defined directory structure.
- The test suite includes supporting tools, common test assets (such as audio-video streams) and the test cases themselves. Each test case contains an XML file (with a well defined schema) that describes the test case, along with the core HTML, JavaScript and CSS files that make up the test case.
- A broadcast driven launching mechanism for each test case which allows each test case to be automatically run one after the other by the TV receiver, using a launch method that is identical to the way HbbTV applications are launched when deployed.
- A JavaScript API used by the test case web applications to communicate to the test harness (typically, but not necessarily, implemented via XmlHttpRequests).

- A test management system that implements the test harness API, sequentially executes the correct tests, collates the test results and makes them available in a well-defined XML report format.

The test coverage provided by the HbbTV test suite does not typically test basic HTML, DOM and CSS support in the underlying web browser. Instead the focus is on functionality that is TV centric (e.g. media playback and track selection) or vulnerable to being broken as part of the browser being integrated onto the device platform (e.g. related to media player or remote control integration). Where browser centric tests are included they only cover stable and well supported parts of the W3C specifications.

Differences in testing approach between W3C and HbbTV

The following differences between the W3C and HbbTV testing approach can be identified. [Caveat: the author is not familiar with the most recent developments in W3C testing and the distinctions made here may be out of date.]

The W3C test runner relies on filenames to identify test cases with limited test metadata within the HTML. It is not clear how test sets and individual tests can be precisely and persistently identified when filenames can be changed over time and files added and removed.

The W3C test suite is intended to both validate browser implementations and validate the associated W3C specifications. The HbbTV test suite's primary goal is to system test complete CE devices.

W3C assumes all tests should be available on a single publicly accessible server, whereas HbbTV provides a local test server that can be installed at a manufacturer's development site. There are clear pros and cons to both approaches.

The HbbTV test suite is designed to be passed 100% by compliant devices, whereas 100% compliance of W3C tests is rarely a goal of browser vendors who have no strong commercial imperative to achieve it and also may explicitly choose to fail certain tests (e.g. to maintain compatibility with major websites). One consequence of this is that it is not currently practicable for HbbTV to reference all W3C tests as it is not reasonable to expect embedded TV browsers to pass tests that not all desktop browsers pass.

HbbTV has not attempted to provide Digital Rights Management (DRM) tests because its specification is DRM neutral. In practice many HbbTV platforms will utilise a DRM system, and a consistent approach to testing areas such as Encrypted Media Extensions (EME), Content Decryption Module (CDM) integration, as well as use of embedded DRMs would be useful to HbbTV. W3C's work in this area is likely of interest to manufacturers of TV devices containing a browser.

The application life-cycle of each test case and the means by which it is launched are significantly different. HbbTV tests are each launched using of broadcast signalling, whereas the W3C mechanism uses a wholly web based test runner.

Conclusions

HbbTV and many other application platforms for CE devices make extensive use of W3C specifications. There is huge value in providing high quality test material with broad coverage for W3C specifications: it promotes implementation quality, improves user experience and ultimately promotes take up of the technology, while reducing cross-industry costs. By working together more closely on testing approaches and creation of test material there is an opportunity to bring extensive mutual benefit to both W3C and HTML5.

Nevertheless, there are valid differences in test requirements and approaches which make it hard for organisations such as HbbTV to simply refer to W3C tests and it would be useful to address this.