Benchmark**XPRT**

BenchmarkXPRT Development Community

Exploring WebXPRT 2015

WebXPRT 2015 uses scenarios created to mirror the tasks you do every day to compare the performance of almost any Web-enabled device.

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WebXPRT

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INTRODUCTION

This paper explains the concepts behind WebXPRT 2015. WebXPRT 2015 is a tool created to evaluate the performance of web-connected devices. Like the other XPRT family benchmarks, it is easy to use, runs relatable workloads, and delivers easy-to-understand results. WebXPRT can complete a performance test in about 15 minutes.

We explain the development guidelines common to all BenchmarkXPRT tools in general, as well as the specific goals and assumptions of WebXPRT 2015. Finally, we discuss how we have structured the tests, how WebXPRT calculates results, how to share results, and how to participate in the BenchmarkXPRT community.

DEVELOPMENT PROCESS

We use a unique design methodology. Instead of the closed, bottom-up approach used by many benchmarking efforts, we use an open, top-down approach that includes the Development Community. Our approach starts by taking input from the community and examining the most common use cases. We then write a Request for Comment (RFC), proposing use cases to incorporate into the application. Once we have written the RFC, we publish it to the community.

The community's input on the RFC guides the drafting of a design document. The design document then drives the implementation of the community preview, which we release to the community for input. We make changes based on community input from the preview period and finalize the code to create a general release.

WEBXPRT 2015: THE DETAILS

WebXPRT is a tool for evaluating the performance and HTML5 capabilities of web-connected devices. It uses HTML5, JavaScript, and other web technologies to implement representative web-user scenarios. It runs on almost any web-enabled device, from phones to tablets to PCs.

WebXPRT 2015 improves on WebXPRT 2013 in a number of ways. WebXPRT 2015 includes updates to the original WebXPRT 2013 tests and adds two new tests, Sales Graphs and Explore DNA Sequencing, to test additional capabilities. WebXPRT 2015 provides much more on-screen feedback during the test, including progress indicators and descriptions of the tests as they run. It also supports UIs in both Simplified Chinese and English, and provides a syntax for automating the tests.
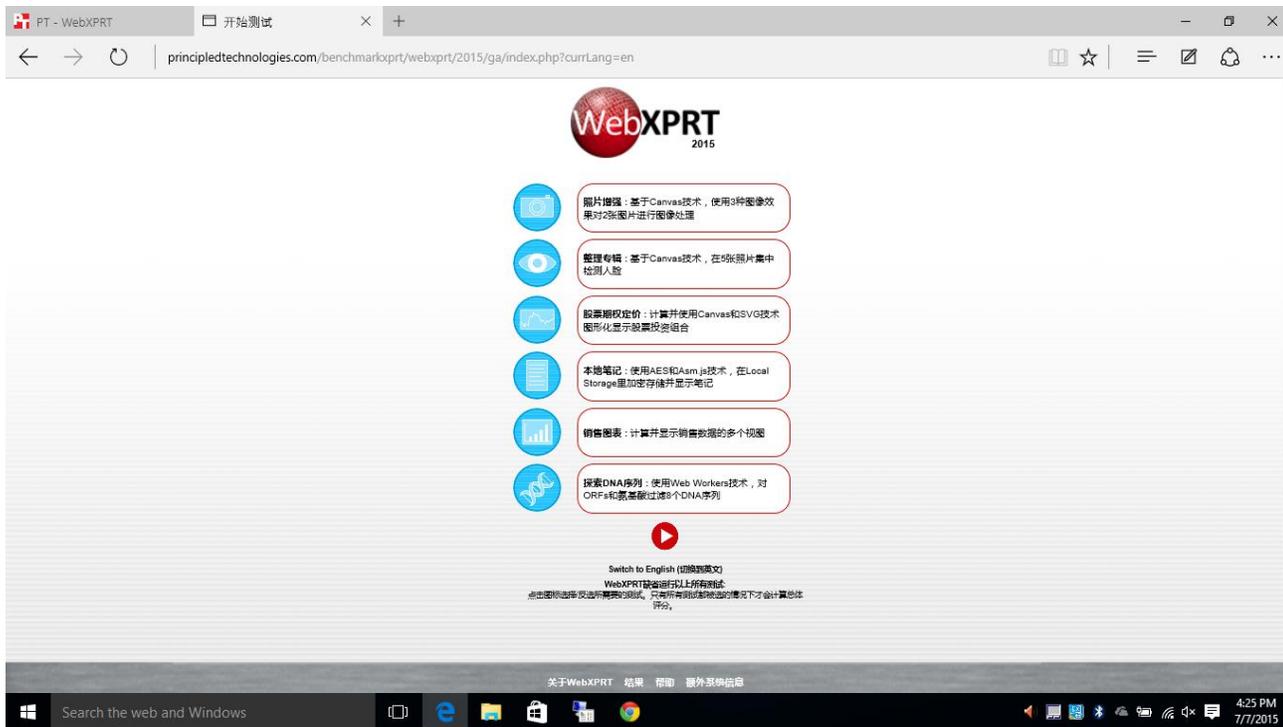
Figure 1: WebXPRT 2015's Simplified Chinese UI.

WebXPRT is a hosted service that you can run from WebXPRT.com, or from the mirror site in Singapore at http://webxprteast.principledtechnologies.com/webxprt/2015/v1998.

Note: Like many applications, WebXPRT uses a number of third-party functions and libraries. The dependencies for each test are included in the test descriptions below. WebXPRT also uses the jQuery library[1] and MooTools utilities.[2]

About the HTML 5 capability tests

The WebXPRT results screen reports on the HTML5 capabilities of your device by displaying check marks to indicate the capabilities present in your browser and x's to indicate capabilities your browser lacks.[3] We use the Modernizr library to detect HTML5 capabilities.[4] To perform the check, we create the element and check to see if the element exists. Table 1 lists the HTML5 capabilities that WebXPRT checks.

Capability	Description
Canvas	Draws graphics on a web page.
Canvas Text	Draws text on a canvas.
Canvas 2D Context	Draws text, lines, boxes, circles, and other 2D figures on a canvas.

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[1] https://jquery.com/

[2] http://mootools.net/

[3] The HTML5 specification is available at http://www.w3.org/TR/html5/

[4] http://modernizr.com/

Capability	Description
WebGL	Renders interactive 3D computer graphics and 2D graphics within any compatible web browser without the use of plug-ins.
Audio	Embeds audio in a web page.
Video	Embeds a video in a web page.
Video Ogg	Container for the Theora video codec and the Vorbis audio.
Video H264	Container for the H.264 video codec and the AAC audio codec
Video WebM	The WebM format is based on a restricted version of the Matroska container format. It always uses the VP8 or VP9 video CODEC and the Vorbis or Opus audio CODEC.
Geolocation API	Used to get the geographical position of a user.
Local Storage	Allows web applications to store data locally within the user's browser without using cookies.
SVG	Container for Scalable Vector Graphics (SVG). SVG has several methods for drawing paths, boxes, circles, text, and graphic images.
Web Workers	Allows a JavaScript to run in the background, independently of other scripts.

Table 1: WebXPRT HTML5 capability tests.

About the performance test

The performance test measures the speed of web-connected devices. These workloads mirror the kinds of things you do on the Internet every day and include the following HTML5- and JavaScript-based workloads: Photo Enhancement, Organize Album, Stock Option Pricing, Local Notes, Sales Graphs, and Explore DNA Sequencing.

Each workload needs at least one HTML5 capability. The benchmark launches a workload only if the test device supports all of the capabilities required for that workload. The result screen indicates any workloads that did not run. The overall result displays only if all workloads run.

WebXPRT runs the six-workload performance suite seven times before calculating the overall score. WebXPRT also reports the individual workload scores. The test takes about 15 minutes to run.

Test workloads

We describe the tests below. Included in the descriptions are the components that test emphasizes, along with any third-party libraries of functions it uses.

- **Photo Effects.** Measures the time to apply three effects (Sharpen, Emboss, and Glow) to two photos each, a set of six photos total. WebXPRT 2015 increases the dimensions of the photos to 1024x768 pixels. Photo Effects exercises HTML5 Canvas, Canvas 2D, and JavaScript performance. It uses the Pixastic JavaScript Image Processing Library.[5]

- **Organize Album.** Measures the time it takes to check for human faces in a set of five photos. The dimensions of the photos are variously 720x480 pixels, 720x504 pixels, and 693x504 pixels. Organize Album exercises HTML5 Canvas, Canvas 2D, and JavaScript performance. It uses the Core Computer Vision JavaScript library.[6]

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[5] https://github.com/jseidelin/pixastic

[6] https://github.com/liuliu/ccv

- **Stock Option Pricing.** Calculates and displays graphic views of a stock portfolio. WebXPRT 2015 increases the number of stocks to 500. Stock Option Pricing exercises HTML5 Canvas, SVG, and JavaScript performance. It uses the dygraphs JavaScript charting library.[7]
- **Local Notes.** Measures the time it takes to encrypt, store, and display notes from local storage. WebXPRT 2015 incorporates asm.js technology in this workload.[8] Local Notes measures HTML5 Local Storage, JavaScript, AES encryption, and asm.js performance. It uses the localStorageDB.js database layer for localStorage and sessionStorage[9], the Emscripten LLVM-to-JavaScript Compiler,[10] and aes.c for AES encryption.[11]
- **Sales Graphs.** Provides a web-based application displaying multiple views of sales data. This test is new for WebXPRT 2015. Sales graphs exercises HTML5 Canvas and SVG performance. It uses the D3.js JavaScript library for manipulating documents based on data.[12]
- **DNA Sequence Analysis.** Measures the time it takes to process eight DNA sequences for open reading frames (ORFs) and amino acids. This test is new for WebXPRT 2015. DNA Sequence Analysis exercises HTML5 Web Worker and JavaScript (String, regexp and array) performance. It uses the functions findPotentialStartsAndStops and findORFsinSeq,[13] and the Sequence Manipulation Suite.[14]

SCORING

The primary performance result is the overall score that the benchmark calculates. For that score, higher results are better. WebXPRT also reports individual results for the six performance workloads. These results report the average time (in milliseconds) that it took to run the workload. Because those results are times, lower scores indicate faster performance and are better. As with the other BenchmarkXPRT benchmarks, the overall score is relative to a calibration device. For WebXPRT 2015, the calibration device is an iPad Air1 running iOS 7.1.1.

WebXPRT includes a confidence interval, a measure of the uncertainty of the score or result, with each individual score and the overall result. An example is 122 +-3%. The percentage expresses a confidence interval at a 95% confidence level, a common level for this type calculation.[15] You can interpret the results as saying that if you were to repeat the test on the same system using the same test procedures, 95 percent of the time you could expect the results to fall within the confidence interval WebXPRT reports. For example, the results would mostly fall within the range of 118 to 125 for the 122 +-3% example.

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[7] http://dygraphs.com/

[8] http://asmjs.org/spec/latest/

[9] https://github.com/knadh/localStorageDB

[10] https://github.com/kripken/emscripten

[11] https://chromium.googlesource.com/native_client/pnacl-llvm-testsuite/+/087bc24fe42977223eb264d09fa8d3ab944a45eb/MultiSource/Benchmarks/7zip/C/Aes.c

[12] http://d3js.org/

[13] http://a-little-book-of-r-for-bioinformatics.readthedocs.org/en/latest/ (These functions were ported from R code to JavaScript.)

[14] http://imed.med.ucm.es/Tools/SMS/d_load.html

[15] http://en.wikipedia.org/wiki/Confidence_interval
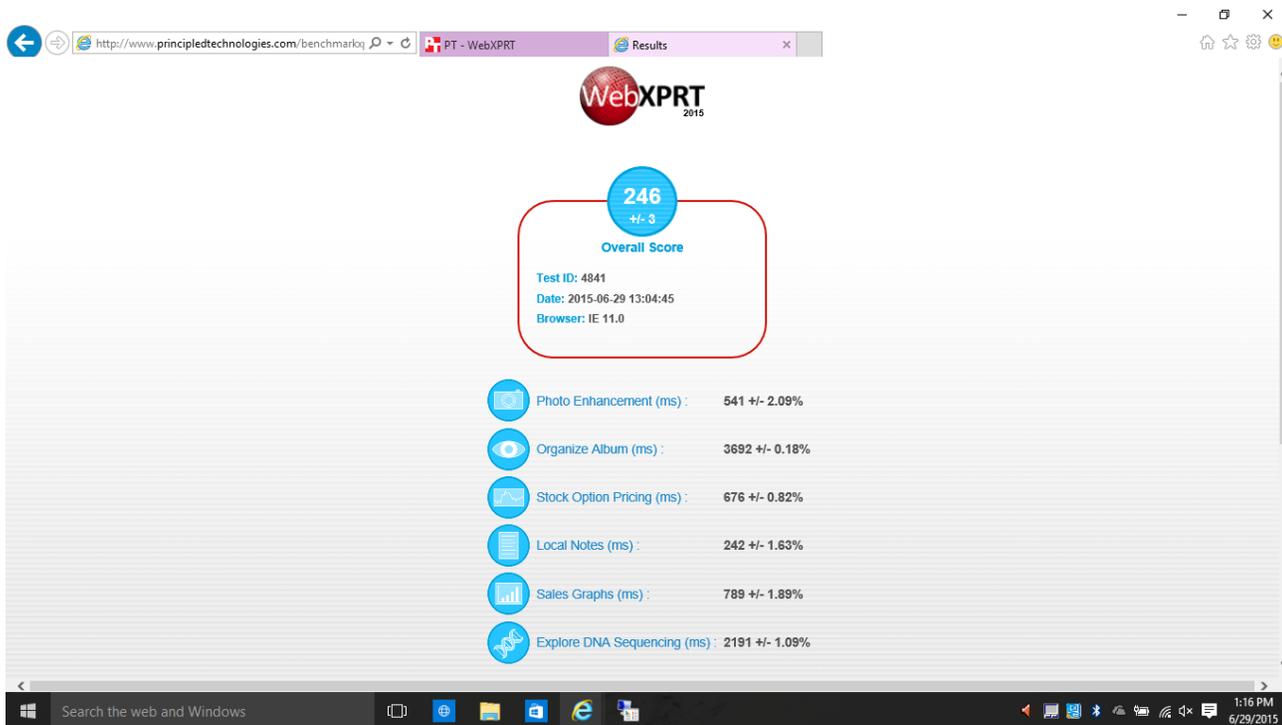
Figure 2: The WebXPRT 2015 results page

We explained in detail how WebXPRT 2013 calculates its results in the white paper *WebXPRT 2013 results calculation and confidence interval*.[16] WebXPRT 2015 uses identical calculations, adjusted for six workloads and seven iterations. We have also provided a spreadsheet showing the exact calculations for a WebXPRT 2015 result.[17]

To avoid confusion, we rescale the results every time we release a new version of an existing benchmark. By making the results obviously different, we hope to reduce the likelihood that users will inadvertently mix results from two different versions together. If you are familiar with WebXPRT 2013, please be aware that the results for any test platform with WebXPRT 2015 will be quite a bit lower than the same platform with WebXPRT 2013.

ADDITIONAL SYSTEM INFORMATION

WebXPRT collects descriptive information about the test platform. To see the information it collects for your test system, click the Additional system information link at the bottom of the WebXPRT Start test and Results pages.

Because WebXPRT 2015 runs on such a wide range of devices and browsers, obtaining information on the test platforms is difficult. The system information for WebXPRT consists of the user agent string reported by the browser. However, information reported by the user agent string may be incorrect. WebXPRT 2015 reports the user agent string

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[16] http://principledtechnologies.com/benchmarkxprt/whitepapers/2013/WebXPRT-2013_calculation.pdf

[17] You will find the spreadsheet at
http://www.principledtechnologies.com/benchmarkxprt/webxprt/2015/WebXPRT%202015%20results%20calculation.xlsx. The results that the spreadsheet uses are published at
http://www.principledtechnologies.com/benchmarkxprt/webxprt/2015/details.php?resultid=4.

as it receives it. The benchmark does not attempt to verify that the user agent string is correct under the assumption that the user or browser had a reason for setting it the way it is.

In the process of developing WebXPRT 2015, we investigated the JavaScript Navigator object as a possible way to improve the system information that WebXPRT could report. Unfortunately, this information also can be unreliable. We report some of the information from the navigator along with a disclaimer. Here is a sample of the system information that WebXPRT reports, from a Google (HTC) Nexus 9 tablet running Android 5.1.1.

User agent String: Mozilla/5.0 (Linux; U; Android 5.1.1; Nexus 9 Build/LMY47X) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/43.0.2357.93 Safari/537.36

JavaScript Navigator provided the following browser information. However, we have found that this data is not always reliable.

Browser Version: 5.0 (Linux; U; Android 5.1.1; Nexus 9 Build/LMY47X) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/43.0.2357.93 Safari/537.36
Language: en-US
Platform: Linux aarch64
Product: Gecko
OS: NA

Privacy

Upon launch, WebXPRT displays the benchmark's privacy policy. WebXPRT does not gather personally identifying information or display individual results publicly without the tester's permission.

When you run WebXPRT, it collects the test results and some data about the browser on the device that produced those results and stores this information in a database.[18] When you run the benchmark, you give permission for this storage, and for Principled Technologies to use the data WebXPRT collects for the purposes of improving the benchmark. In addition, you permit Principled Technologies to quote aggregate results and result ranges, such as high and low, the number of results, or the average, but PT will not make individual WebXPRT results public without your permission. In addition, WebXPRT does not report, and therefore PT cannot make public, identifying personal or corporate data, or any other potentially confidential information.

When you submit results (in a process we describe later), we require your email address. We will keep your email address confidential, and will use it only to contact you regarding the result submission. We will not use it for any other purpose.

TEST AUTOMATION

One major enhancement to WebXPRT 2015 is the ability to run scripts in an automated fashion. You can control the execution of WebXPRT 2015 using parameters and values appended to the WebXPRT URL. The three parameters available are:

testtype: WebXPRT provides two test types:

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[18] You will find a list of the information WebXPRT collects at
http://principledtechnologies.com/benchmarkxprt/webxprt/2015/WebXPRT-2015-data-collection.pdf

- Core tests - 1
- Experimental tests – 2

As we are writing this white paper, WebXPRT 2015 contains no experimental test and we have disabled this option. However, we include it for future use.

tests: This parameter lets you specify the tests to run. To run an individual test, use its code:
- Photo Enhancement: 1
- Organize Album:2
- Stock Option Pricing: 4
- Local Notes: 8
- Sales Graphs: 16
- Explore DNA Sequencing: 32

You can specify multiple tests by summing the codes. For example, to run stocks (4) and notes (8), use the sum of 12. To run all core tests, use 63, which is the sum of all the individual test codes (1 + 2 + 4 + 8 + 16 + 32 = 63).

result: You can select the format of the results:
- Display the result as an HTML table: 1
- Display the result as XML: 2
- Display the result as CSV: 3
- Download the result as CSV: 4

To use the automation feature, start with the URL http://www.principledtechnologies.com/benchmarkxprt/webxprt/2015/v1998/auto.php, then append a question mark (?) and add the parameters and values. For example, to run all the core tests and download the results, you would use the following URL:

http://www.principledtechnologies.com/benchmarkxprt/webxprt/2015/v1998/auto.php?testtype=1&tests=63&result=4

AFTER RUNNING WEBXPRT

Comparing results to the database

You can view public results for WebXPRT 2015 on the WebXPRT 2015 results page.[19] These results are for tests that PT ran, results published by the technology media, or tests that users submitted. To find detailed information on any set of scores, click the link under the Source column.

Submitting results

WebXPRT 2015 allows you to submit results to Principled Technologies for us to display on the results page. Simply click the Submit button on the Results screen. Fill in a contact email, device name, model number, operating system, and browser name and version. You have the option to add additional information. PT will store your email address securely and confidentially, and will only use it to contact you regarding the result submission. PT will not use your email address for any other purpose. After filling in the necessary fields, all you have to do is click Submit.

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[19] http://www.principledtechnologies.com/benchmarkxprt/webxprt/2015/results
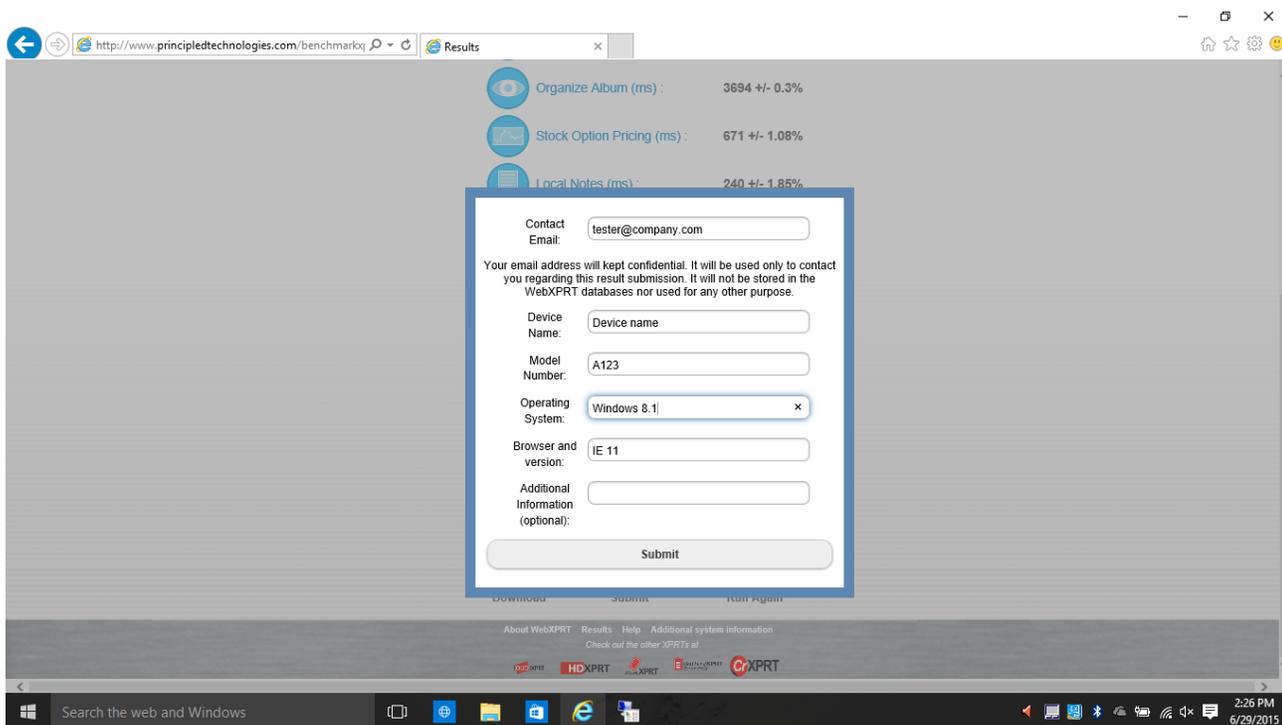
Figure 3: Submitting results after a run.

ABOUT THE BENCHMARKXPRT FAMILY

The BenchmarkXPRT tools are a set of apps that help you test how well devices do the kinds of things you do every day. In addition to WebXPRT 2015, the BenchmarkXPRT suite currently comprises the following tools:

- BatteryXPRT 2014 for Android, an app to measure the battery life and performance of Android-based phones and tablets
- CrXPRT 2015, an app to test the responsiveness and battery life of Chromebooks
- MobileXPRT 2013, an app to test the responsiveness of Android devices
- TouchXPRT 2014, an app to test the responsiveness of Windows 8 and Windows RT devices
- HDXPRT 2014, a program that uses commercial applications to test the capabilities and responsiveness of PCs running Windows 8.1

We designed the apps to test a wide range of devices on a level playing field. When you look at results from XPRTs, you get unbiased, fair product comparison information.

The community model

We built BenchmarkXPRT around a unique community model. Community membership is open to anyone, and there are many different ways to participate.

Members of the BenchmarkXPRT Development Community are involved in every step of the process. They give input on the design of upcoming versions, contribute source code, and help test the resulting implementation. Community members have access to the source code and access to early releases in the form of community previews.

The community helps us avoid the ivory tower syndrome. Diversity of input during the design process makes the tests more representative of real world activity. Giving community members access to the source code both improves the implementation of the design and increases confidence in the code.

The community model differs from the open source model primarily by controlling derivative works. It is important that the BenchmarkXPRT benchmarks return consistent results. If the testing community calls different derivative works by the same name, the result would be that test results would not be comparable. That would limit, if not destroy, the tools' effectiveness.

Where can I get more information?

Visit us at WebXPRT.com or follow us on Twitter and Facebook. We announce breaking news on the BenchmarkXPRT blog (available to everyone) and the BenchmarkXPRT forums (available to members only). If you cannot find the answer to your question, or if you need help with WebXPRT, send an email to our team at BenchmarkXPRTsupport@principledtechnologies.com.

WHAT IS THE BENCHMARKXPRT DEVELOPMENT COMMUNITY?

The BenchmarkXPRT Development Community is a forum where registered members can contribute to the process of creating and improving the BenchmarkXPRT family, including WebXPRT. If you are not currently a community member, we encourage you to join! (Yes, that means you – our community is open to everyone, from software developers to interested consumers.) Not only will you get early releases of future versions of WebXPRT, but you will also be able to download the source code (available to members only) and influence the future of the app. Register now, or for more information, see the BenchmarkXPRT FAQ.

CONCLUSION

We hope this paper has answered any questions you may have about WebXPRT. If you have any other questions, or if you have suggestions on ways to improve WebXPRT, please post them on the community forum or e-mail us at BenchmarkXPRTsupport@principledtechnologies.com. For more information, visit us at BenchmarkXPRT.com and WebXPRT.com.

ABOUT PRINCIPLED TECHNOLOGIES

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We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

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We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.