Webizing MAR contents

WXR Library
(Webized X Reality)

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XR

XR
X = Variable

VR
Virtual Reality

MR
Mixed Reality

AR
Augmented Reality

Oculus
Oculus Go
Facebook
October 11, 2017

Windows Mixed Reality
Headsets
Microsoft
October 17, 2017

Hololens
Microsoft
March 30, 2016

ARKit iOS 11
Apple
September 19, 2017

ARCore
Google
August 29, 2017

What Are All These Realities? VR, MR, AR and XR 101, December 15, 2017,
https://www.achao.design/inspire/what-are-all-these-realities-vr-mr-ar-xr-101
Milgram-Weiser continuum

Motivation

- Experience XR in your browser
- No matter what kind of device you have
Immersive Web Working Group Charter

The **mission** of the [Immersive Web Working Group](https://www.w3.org/2018/09/immersive-web-wg-charter) is to help bring high-performance Virtual Reality (VR) and Augmented Reality (AR) (collectively known as XR) to the open Web via APIs to interact with XR devices and sensors in browsers.


<table>
<thead>
<tr>
<th>Start date</th>
<th>24 September 2018</th>
</tr>
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<tbody>
<tr>
<td>End date</td>
<td>1 March 2020</td>
</tr>
<tr>
<td>Chairs</td>
<td>Ada Rose Cannon (Samsung), Chris Wilson (Google)</td>
</tr>
<tr>
<td>Team Contacts</td>
<td>Dominique Hazael-Massieux (0.2 FTE)</td>
</tr>
</tbody>
</table>
| Meeting Schedule | **Teleconferences**: topic-specific calls may be held  
**Face-to-face**: we will meet during the W3C's annual Technical Plenary week; additional face-to-face meetings may be scheduled by consent of the participants, usually no more than 3 per year. |

1. **Background**

A new generation of head-mounted displays and environment sensing capabilities on mobile devices are enabling augmented and virtual reality (collectively known as XR) to emerge as a critical field of evolution for human-machine interactions.

Due to its inherent low friction and support for ephemeral experiences, the Web provides a promising ecosystem for the creation, distribution, and experiencing of XR content, applications, and services.
The October 2016 W3C Workshop explored that potential, relying on browsers to display and interact with content using available head-mounted displays and handheld devices providing a window into virtual space. The Community-Group incubated WebXR Device API has already gained interest from a number of implementors. This Working Group will build on that momentum to standardize the WebXR Device API as part of the Open Web Platform.

2. Scope

The Immersive Web Working Group will develop standardized APIs to provide access to input and output capabilities commonly associated with XR hardware such as Google’s Daydream, the Oculus Rift, the Samsung GearVR, the HTC Vive, and Windows Mixed Reality headsets and sensors as well as mobile handheld devices and standalone headsets such as the Oculus Go. The WG will develop APIs to enable the creation of XR web experiences that are embeddable in the Web of today, enabling progressive enhancement of existing sites.

The **scope** of the Immersive Web Working Group charter is to define APIs which:

- Detect available XR devices and sensors.
- Query XR devices for device-specific capabilities.
- Receive updated information about the device's position and orientation over time.
- Receive updated information about the device's environment.
- Present imagery to the device at the device's native frame rate, using the device's position and orientation over time to provide an immersive experience.
- Provide information about XR-specific input, including tracked controller state and hand gesture.
- For augmenting reality on devices which support AR, enable XR sessions that provide real-world display, and provide the ability to hit-test surfaces in the real world.

**Out of scope:**

- Defining browser user experience inside virtual or augmented reality, aside from navigating between XR sites.
- Defining mechanisms for global-scale AR browsing.

2.1 Success Criteria

In order to advance to Proposed Recommendation, each specification is expected to have at least two independent implementations of each feature defined in the specification.
XR Device
XR Content

- VR
  - X3D 4.0
  - X3DOM
  - XML3D
  - Mozilla A-Frame and WebVR
  - W3C Declarative 3D for the Web Architecture Community Group
  - W3C WebVR Community Group

- AR
  - Chromium WebAR Prototype
  - Argon – Georgia Tech
  - AWE.io
  - AR.js – jeromeetienne

- MAR / XR
Advantage of Webizing MAR Contents

- Desktop 3D
- Virtual Reality
- Augmented Reality
- VR Training
- Remote 3D Collaboration
- Collaborative AR
- Collaborative XR (VR, AR, MR)
WebXR Example 1
WebXR Example II

AR – 3D Interaction

AR to 3D Collaboration
WebXR Example III

VR – VR Interaction

Expert

WXR Workspace

Worker
AR – VR Interaction
1. WXR Library Development Status
2. How to Authoring Contents & Example
3. Issues & Plans
WXR Library Development Status
WXR Library Development Status

Concept

Virtual Reality

Desktop 3D

Augmented Reality

A Chamber
WXR Library Development Status

Concept

Virtual Reality

WebVR

Desktop 3D

WXR Library

WebGL

WebGL + Vuforia

Augmented Reality
1. Load WXR Library

```html
<wxr-camera>
  
  <wxr-transform>translate3d(0,1.5,0.6)rotate3d(0,0,0);</wxr-transform>

  <wxr-light-ambient>
    <wxr-transform>translate3d(0,0,5,0);</wxr-transform>

  <wxr-light-directional>
    <wxr-transform>translate3d(0,0,0.5);</wxr-transform>

  <hhandle_arrow>
    <wxr-transform>translate3d(-0.15,-0.033,0.02)rotate3d(-1.5708,0,0)scale3d(2,2,2);</hhandle_arrow>

  <hhandle>
    <wxr-transform>translate3d(-0.14314130320526366,0.00118852780006789,-0.025979195634580843) rotate3d(1.5708,0,0) scale3d(1.4,1.4,1.4);</hhandle>

  <annotation01>
    <wxr-transform>translate3d(-0.215,-0.1,0)rotate3d(0,0,3.14)scale3d(0.08,0.08,0.08);</annotation01>

  <STEP01>
    <wxr-transform>translate3d(-0.2,1.04,0)rotate3d(-1.5708,0,3.14)scale3d(1,1,1);</STEP01>

  ...
</wxr-camera>
```

2. Define Transformation

3. Define Scene Tree
WXR Library Development Status

Concept

```xml
<wxr-user user-id="jungmin.ha@wrl.or
<wxr-description title="Ballvalve VP
<wxr-view default="3D" current="3D"
<wxr-ar engine="vuforia">
<wxr-camera fovy="61" near="0.050000"
<wxr-space src="http://content.wxr.v
<wxr-light-ambient color="#f0f0f0"
<wxr-light-directional color="#f0f0f0"
<wxr-target id="STEP01" src="ht
<wxr-obj id="handle" mtl="#06"
<wxr-obj id="handle_arrow"
<wxr-plane id="annotation01"
</wxr-target>

...</wxr-space>
```
WXR Library Development Status

Configuration Management

Group

Repository

- wxr.js
- wxr-three.js
- polymer-elements
- wxr-www
- wxr-element
- wxr-example

- wxr-android-browser
- wxr-ios-browser

- wxr-space-server

- wxr-webizing-device-manager
- wxr-dummy-device-adaptor
- wxr-hand-leapmotion-adaptor
- wxr-hand-steamvrcontroller-adaptor
- wxr-tracker-optitrack-adaptor
- socket.io-client-cpp

WXR-Core

WXR-Browser

WXR-Server

WXR-Device

WXR PROJECT
Repository Dependency: WXR-Core

Google Polymer Project

External Projects

polymer-elements

wxr.js
wxr-three.js
wxr-element
wxr-example
wxr.js

Packaging followings as **wxr.html**
Class Hierarchy of wxr-element

<table>
<thead>
<tr>
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<tbody>
<tr>
<td></td>
<td>wxr-target</td>
<td>wxr-html</td>
<td>wxr-peripheral</td>
<td>wxr-hmd</td>
<td>wxr-hmd-mixedreality</td>
<td>wxr-hmd-oculus</td>
<td>wxr-hmd-vive</td>
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<tr>
<td>wxr-peripheral</td>
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<td>wxr-peripheral-ar</td>
<td>wxr-peripheral-ar</td>
<td>wxr-ar-vuforia</td>
<td>wxr-hand-leapmotion</td>
<td>wxr-hand-oculustouch</td>
<td>wxr-hand-steamvrcontroller</td>
<td>wxr-hand-vivecontroller</td>
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<tr>
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<td>wxr-hand-motioncontroller</td>
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<td>wxr-appbar</td>
<td>wxr-debug</td>
<td>wxr-editor</td>
<td>wxr-layerui</td>
<td>wxr-silder</td>
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<tr>
<td>wxr-ar</td>
<td>wxr-description</td>
<td>wxr-animation</td>
<td>wxr-requirement</td>
<td>wxr-user</td>
<td>wxr-view</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
WXR Library Development Status

Repository Dependency: WXR-Browser

- **wxr-android-browser**
- **wxr-ios-browser**

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**WXR-Core**
- **wxr-www**
Communicate with Native Mobile: wxr-ios-browser
Communicate with Native Mobile: wxr-android-browser

NativeEvent Handler

Method Call

loadTargets
donHtmlChange
changeModeAR
changeMode3D
addEventListener
removeEventListener

onProjectionMatrix
onTargetDetected

onCameraReady
onTargetMoved

onTargetLoaded
onTargetMissed

onBeaconResult

WXR Library

ARTracker Engine

WXR Location Manager

WXRAR Tracker Listener

WXR Sensor
Repository Dependency: WXR-Space-Server

wxr-space-server
WXR Library Development Status

Application Flow Chart

Data Access

filesystem

database

wxr-space-server (Express.js)

HTTP Module

Passport.js

interaction-server-socket

Client
WXR Library Development Status

Repository Dependency: WXR-Device

wxr-webizing-device-manager

wxr-dummy-device-adaptor
wxr-hand-leapmotion-adaptor
wxr-hand-steamvrcontroller-adaptor
wxr-tracker-optitrack-adaptor

ValveSoftware
openvr
socket.io-client-cpp

Optitrack
Optitrack SDK
socket.io-client-cpp
Application Flow Chart: Device Connecting, Disconnecting, Event Streaming

XXX-Adaptor

WXRDdeviceInit

WXREvent: XXX Event

disconnect

wxr-webizing-device-manager

WXRUUpdateDeviceProfiles

WXREvent: WXRDdeviceOn

WXREvent: XXX Event

WXREvent: WXRDeviceOff

WXRUUpdateDeviceProfiles

WXRLibrary

WXRWebizingDeviceConfigManager
Application Flow Chart: Configuring Device Profile

XXX-Adaptor

wxr-webizing-device-manager

WXRWebizingDeviceConfigManager

WXRLibrary

WXRUpdateDeviceProfiles

WXRUpdateDeviceProfiles
Demo: Authoring Scene (Source Code)
Demo: Authoring Scene (GUI)
Demo: Collaborating between VR and VR
Demo: Collaborating between AR and VR
How to Authoring Contents & Example

How to Authoring Contents & Authoring Examples
### How to Authoring Contents & Example

**Upload 3D models to use on the Web**

![Image of file explorer interface]

<table>
<thead>
<tr>
<th>Name</th>
<th>Size</th>
<th>Last Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>destroyed.mtl</td>
<td>229 B</td>
<td>2 months ago</td>
</tr>
<tr>
<td>destroyed.obj</td>
<td>165.1 KB</td>
<td>2 months ago</td>
</tr>
<tr>
<td>hexkey.mtl</td>
<td>225 B</td>
<td>2 months ago</td>
</tr>
<tr>
<td>hexkey.obj</td>
<td>14 KB</td>
<td>2 months ago</td>
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</tbody>
</table>

**WXR**

https://wxr.nyc3.digitaloceanspaces.com / 321.5 MB / 469 items
How to Authoring Contents & Example

Register markers on Vuforia

AR target marker

### 3Dprinter-nozzle

**Type:** Device

<table>
<thead>
<tr>
<th>Target Name</th>
<th>Type</th>
<th>Rating</th>
<th>Status</th>
<th>Date Modified</th>
</tr>
</thead>
<tbody>
<tr>
<td>plate3</td>
<td>Single Image</td>
<td>★★★★★</td>
<td>Active</td>
<td>Oct 23, 2018 14:31</td>
</tr>
<tr>
<td>new2</td>
<td>Single Image</td>
<td>★★★★★</td>
<td>Active</td>
<td>Oct 23, 2018 14:28</td>
</tr>
<tr>
<td>destroyed2</td>
<td>Single Image</td>
<td>★★★★★</td>
<td>Active</td>
<td>Oct 23, 2018 14:28</td>
</tr>
<tr>
<td>body2</td>
<td>Single Image</td>
<td>★★★★★</td>
<td>Active</td>
<td>Oct 22, 2018 22:55</td>
</tr>
<tr>
<td>body</td>
<td>Single Image</td>
<td>★★★★★</td>
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<td>Oct 22, 2018 22:54</td>
</tr>
<tr>
<td>new1</td>
<td>Single Image</td>
<td>★★★★★</td>
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<td>Sep 19, 2018 17:00</td>
</tr>
<tr>
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<td>Single Image</td>
<td>★★★★★</td>
<td>Active</td>
<td>Sep 19, 2018 17:00</td>
</tr>
<tr>
<td>plate4</td>
<td>Single Image</td>
<td>★★★★★</td>
<td>Active</td>
<td>Sep 19, 2018 16:55</td>
</tr>
<tr>
<td>new</td>
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<td>Sep 19, 2018 03:11</td>
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<td>Active</td>
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<td>printer3</td>
<td>Single Image</td>
<td>★★★★★</td>
<td>Active</td>
<td>Sep 14, 2018 15:18</td>
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<tr>
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<td>★★★★★</td>
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<td>Sep 14, 2018 15:17</td>
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<td>Single Image</td>
<td>★★★★★</td>
<td>Active</td>
<td>Sep 14, 2018 15:17</td>
</tr>
</tbody>
</table>
How to Authoring Contents & Example

Upload marker data on the Web

WXR
https://wxr.nyc3.digitaloceanspaces.com / 321.5 MB / 469 items

Files

Start typing to filter the list of files and folders

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
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<td>index.json</td>
<td>366 B</td>
<td>4 months ago</td>
</tr>
<tr>
<td>pg3.dat</td>
<td>23 KB</td>
<td>4 months ago</td>
</tr>
<tr>
<td>pg3.jpg</td>
<td>8 KB</td>
<td>4 months ago</td>
</tr>
<tr>
<td>pg3.xml</td>
<td>251 B</td>
<td>4 months ago</td>
</tr>
</tbody>
</table>

Download marker data from Vuforia
Use these location at Digital Ocean to add target or object.
Transform the target or object in style tag. (optional)
Additionally add functions or tags to implement the contents.
1. Creating new workspace
Issues & Plans
Issues & Plans

○ Issues
  ○ Unstable connection between Firefox and SteamVR
  ○ Low recognition rate of AR Marker
  ○ Hard to synchronize scene with massive users

○ Plans
  ○ To stable connection between Firefox and SteamVR
  ○ Custom tag hierarchy architecture remodeling
  ○ Extension for more variety of Human Interaction Device
  ○ Extension to using decentralized Web
  ○ Upgrade third party libraries’ version
Decentralized Web

- Killing the server: Redesigning data structures
- From data monarchy to data democracy
- Web 3.0 Technology Stack
Data Synchronization with GunDB
DWXR – AR Interaction

AR Interaction with GunDB
DWXR – VR Interaction

VR Interaction with GunDB
Thank You

Webizing Research Laboratory (WRL)
http://www.wrl.onl

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