Cross-platform AR: The market need and potential solutions

A Position Paper for Mobile AR Summit @MWC 2010

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***Abstract*—** Over the past 30 years people have adapted their behavior with respect to information. The types of tools with which we access digital information have changed from the large mainframe to the desktop PC, to the notebook or laptop, to the mobile device. In this process, people have begun to make assumptions about publishing and searching for digital information.

Augmented Reality has an enormous potential to become the next user interface for information, however, it will not be widely adopted if it breaks with certain key assumptions which users have developed over the past 10 or more years about their relationships with digital content. One of these assumptions is that basic levels of information can be reached through a multipurpose viewer.

It is the responsibility of the leaders of the AR industry to invite representatives of many industries which will be impacted by the expansion of AR and, together, to examine the assumptions of end users, to find ways to meet their needs when possible, or, if this fails, to embark on a very difficult campaign of re-educating users about their relationship to what they consider to be their digital content and the nature of digital content itself.

I. INTRODUCTION

When information was confined to paper (printed) and oral means of transmission, it was highly location dependent. All content was essentially "local" to the user, even if it was about a remote place, but it was in a format (print or spoken words) which was accessible to anyone with vision and/or hearing. Then, content began to be provided in digital formats. At first it remained "local" to the user. Before the widespread adoption of networks, HTML and the Web, digital content was fragmented in several formats, specific to "viewing" software applications and "reading" devices, confined to floppy disks, movable disk drives and, for a short time, Compact Discs. People did not expect digital content to be ubiquitous, flexible, dynamic (changing over time) and multi-dimensional. Further, the computing platform was *not* mobile and digital content could only be consulted where a large box running the correct application. Then came digital networks and the Web.

Now that the penetration of always-on Internet access to the Web in many countries begins to approach that of telephone penetration in homes and businesses, it is natural that people have adapted their behavior with respect to digital information retrieval and publishing. Let us not even speak of the digital native's relationship to content. With the spread of the Mobile Web, connectivity "anywhere, anytime" is a very small shift for those who were perpetually connected to the Internet at home or work, and presents the opportunity for information access to those who lack fixed lined PCs entirely.

By severing the strong link between content and physical media (in the physical world), the ability to consult it (digital content on the Web) means that access to many kinds of information is ubiquitous, utterly independent of place. The same information (from people, or other sources) can be consulted from anywhere there is a network connected device. Information also can spread at a speed unfathomable only a few years ago.

Mobile Augmented Reality has the potential to be a transformational force on the relationships between people, society and information because it is re-creating a profoundly important link between information (now digital) and location (the local context). But, in the current generation of viewers and readers, the digital information available in or "with" Augmented Reality is fragmented.

When a developer prepares an experience involving AR, one of the first steps is to choose a viewing application. It may be a dedicated application compiled with only one dataset, a plug-in or player may need to be added to the PC browser or, on the iPhone or Android and some models of Symbian handsets, one of the "general purpose" mobile AR browsers.

II. MOBILE AR BROWSERS

Mobile AR browsers available today from the suppliers in Figure 1, share many characteristics. In the current generation, they provide the end user with access to digital content from many diverse sources ("publishers") without changing the viewing application. The reverse of this statement is that the AR browser providers have created platforms for publishing content and these platforms, to one degree or another, can be used by third parties to associate the digital content with one or more attributes of the physical world.

Figure 1. Mobile AR browsers

Provider	Name of browser
Mobilizy	Wikitude
Layar	Reality Browser
GeoVector	World Surfer
AcrossAir	AcrossAir AR Browser
metaio	Junaio
Rey Juan Carlos University	LibreGeoSocial
Nokia	Point and Find
Tonchidot	Seika Camera

Many—though not all—of the current generation of Mobile AR browsers also share the fact that they are reliant on geo-location as the attribute to which the digital content is associated. Hence, they are not really appropriate for use with a device which is fixed (immobile) in 3 dimensional space on the Earth (a fixed line PC). Well, we could say that an AR browser which is running on an immobile device would probably have a relatively small set of Points of Interest.

Relying heavily on geo-location and the user's pointer or touch (selection) to specify the trigger for retrieving associated information has a number of benefits and drawbacks which are not at the heart of this thesis and therefore will not be expanded here. Let us only note that a Mobile AR browser is, by definition, running on a mobile device. It offers unique functionality because the device on which it runs has a GPS and magnetometer which PCs lack.

In the future, however, mobile AR browser providers and developers who publish content to be viewed within the browser, will certainly also wish to use other natural features of the physical world such as sounds or detection of people and/or objects which are not fixed in 3 dimensional space on the Earth's surface to associate digital content. At such as time when many other sensors can provide the triggers for actions (AR effects and information), browsers will begin to have much more in common with an application which is designed for use on a fixed computer, however, the mobile device will lack a continuous power supply, large screen and the computational power frequently associated with a fixed PC. We believe that a single browser on the PC for all AR content and services would be very useful, in addition to and to complement the mobile AR browser(s).

III. The content publisher's Quandries

Today the owner or developer of unique content suitable for experience via Augmented Reality will need to conduct research before preparing content for end user access. Questions around the user experience, the business model and the technical format of the content are wide open. Is Flash AR an option for both desktop and mobile? How will the content be updated? How will end users discover the content the publisher has to offer? If the owner of the content wishes to control the user experience, to permit interactivity or enable tags to be added by the user, a custom application is required and, frequently, the content is tightly associated with the viewing application in a local data store. This situation is severely limiting the spectrum of mobile AR applications offered to end users.

Alternatively, if the content publisher feels that the user experience provided by the Mobile AR browser is suitable and resources or skills for a developing a dedicated application are insufficient, the publisher will need to choose a content management system specified by the browser provider/publisher. Who remembers when it was necessary to publish the Macintosh-compatible version and Windows-compatible version of a file? To reach the maximum audience, it would appear highly desirable to publish the same content in multiple browser protocols.

Additionally, if the content provider seeks a revenue stream from making the content available in AR format to end users, the mobile AR browser option may not be advantageous due to the lack of support for commercial transactions within the current applications. In essence, the publisher who wishes to make existing data "AR viewable" will need to "regress" to an era when it was necessary to publish separately for different device users.

If a content provider wishes to make the same content available for AR viewing when the user is at their desktop computer and also when mobile, using a mobile device, the options multiply.

IV. End User needs

Early adopters are exploring new Augmented Reality interaction paradigms. Each day more users download and install the technologies necessary for AR experiences. PEREY Research & Consulting estimates that, at the time of the Mobile AR Summit @MWC2010, there are approximately 1 million "instances" of AR applications operational on mobile devices.

A. Experience consistency and purchase portability

Users with previous AR application experience may find some features useful, or find themselves in a new city and want to repeat a use case with a new mobile or fixed device. Must they re-install the application and associated data? It is especially important when the digital AR-ready content has been reached through a commercial agreement or contract with the content's publisher or agent, that the user be able to change devices without losing their valuable purchases.

B. Fresh information and the Real Time Web

As a result of their experiences on the Web, many end users are also increasingly expecting/accustomed to having information updated on a regular basis. While many applications for AR can be based on historical (static) content, and not warrant or require updates, the user will consider the AR user interface to be part of the Real Time Web, with live or near real-time data streams from users, merchants and other sources they trust or nearby.

C. Customization of the user experience

Finally, end users can be expected to have unique needs and to seek (be attracted by and more loyal to) applications for AR experiences which they can adapt (self-configure) or filter content to meet their preferences. Settings for Mobile AR might include topical (thematic) interests, how to manage data storage for frequently requested objects, how to gracefully "fall back" when the network bandwidth is insufficient for optimal experiences, and the preferred input for quick searches (voice/keyword, location or image recognition).

The scope of end user needs for AR-enhanced applications, on mobile or desktop, must receive further attention from experience designers but for the moment it is already clear that users will be frustrated and not adopt applications which are "static," self-contained and lack the level of intelligence to which are accustomed on the Web.

V. Leveraging existing infrastructure

In addition to considering the needs of content providers and end users, all those in the Augmented Reality ecosystem must examine how they can reduce costs and risks by leveraging existing providers of infrastructure services. Instead of re-inventing (re-engineering) infrastructure for the management of client log-in, content object and trigger storage and transactions (m-commerce), partnerships with proven providers will accelerate the time-to-market and, likely, produce positive results for end users.

To accelerate the time to market and decrease investment in custom engineering, standard APIs should be used, and where absent, should be established for both AR application developers and the partners (providers of infrastructure modules).

VI. Solutions to explore

Proprietary silos or platforms controlled by a single technology provider are unsuitable for the development of Augmented Reality as a ubiquitous and easy to use interface for digital content from a variety of publishers and sources. For developers and content publishers to invest in and reap the rewards [1] of Augmented Reality-enhanced solutions, there will need to be one or more widely-accepted approaches for meeting the needs of content providers, end users and the providers of AR applications to control costs and maximize ROI.

In the 1990s, when many applications were not network connected or aware, there were transcoding applications available for converting digital content. As network access became more prevalent, the transcoding algorithms evolved to software as a service and were hosted in the network to manage compression and other conversions of media content to ensure access regardless of the terminal the user has. This is still the approach used to address an array of multimedia file management tasks for mobile and stationary computing devices. A "bridge" which provides conversion from one format to another suitable for the application or device is one approach which could address some needs of the community and approach cross platform AR. In mobile this is a service which is tightly associated with device identification and is usually hosted by the mobile network operator or a trusted third party.

The partnerships with existing infrastructure services, such as authentication, security/account management and for dedicated services such as image recognition, are unlikely to be possible with a bridge. In these cases, it is most likely incumbent upon those who are creating AR applications to ensure that they are compatible with widely-accepted APIs of other infrastructure segments which can be accessed in a modular manner and are already built to be highly scalable.

Public and private content repositories also have APIs. Companies who wish to use geo-location for AR should examine geo-location databases such as Google Local Pages and CitySearch. CitySearch has just published its API, permitting developers to access information on over 3 million local businesses.

The Web has demonstrated that a client-server architecture is highly advantageous to meeting the digital content expectations of end users. It will be beneficial for the entire digital ecosystem for there to be new standard tags and metadata identifiers available specifically for AR. Providers of Web-based experiences with an optional AR enhancement as a user interface will need to adapt their code when they introduce AR-ready objects. What needs to be added to the desktop browser such as Safari, Firefox or Internet Explorer to immediately support AR interfaces? Similarly, the developers of applications, such as mobile AR browsers, will need to be able to "read" the tags in any AR-ready database or Content Management System.

VII. Conclusion

While the future is rosy for Mobile AR, one of the possible barriers to expansion is the development of "silos" of software and content, and user experiences which are not readily adapted to the user's context or failing to meet the needs of ecosystem partners. These islands of content are likely to deter the content publishers with the most valuable content as well as to discourage users who want to be able to freely "browse" their world without being loyal to one browser application.

The participants of the Mobile AR Summit must initiate a cross-industry (*not just AR industry*) project or activity group to evaluate the alternatives and develop acceptable, open systems which can easily expand in modular fashion while still meeting the needs of content publishers, end users and the other partners in the Augmented Reality ecosystem.

Acknowledgement

The author wishes to thank Pedro de las Heras Quirós of Rey Juan Carlos University for carefully reviewing and providing helpful comments in response to this position paper.

References

[1] Perey, C., *Where's the money? Mobile AR Revenue Streams.*