Leveraging mobile network technologies for augmented reality applications

Carl Taylor
+44 7782 229503
tech.100days@gmail.co.uk

ABSTRACT

This position paper presents certain enabling technologies that will bear on the human experience of Augmented Reality from a mobile network perspective, and assesses their convergence. It also briefly explores the necessity for data filtering and looks into more interactive scenarios.

Keywords

Augmented Reality, Design, Human Factors, Mobile, Internet, Sensors.

1. INTRODUCTION

Recent developments in Augmented Reality applications are stirring the imagination of technologists and exciting entrepreneurs. The opportunity to turn travel guides into interactive tools; to turn real life into a virtual gaming experience; or to dynamically overlay digital descriptions onto a local street can have startling value[1] .

We are increasingly living in dense urban conurbations, which bring the benefit of plentiful wired and wireless broadband communication technology. The mobile industry therefore (and operators in particular), possess essential technology to leverage when delivering an Augmented Reality environment; authentication via the USIM, a low latency and high bandwidth IP connection to information sources, a powered platform for camera, display, processing, filtering and the multiple cellular and near-field radio modules. Operators also have the ability to create fixed-mobile services and have the global relationships and infrastructure for service roaming - and the convergence of telecoms with the Internet provides at least two other essential enablers for Augmented Reality: semantic web descriptors and federated identity.

To deliver this vision requires an ecosystem of service providers sharing sufficient commercial opportunities for multiple different business models to bind it all together.

Firstly let's look at the enablers required to put this scenario together, followed by a look at the threat of over-reliance on advertising-based business models and the necessity of data filtering.

The document concludes with a look at extending Augmented Reality to highly interactive scenarios, with greater commercial potential.

2. ENABLING TECHNOLOGY EXAMPLES

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We now consider five technology and service enablers relevant to the creation of a future Augmented Reality technical infrastructure, from a network and data perspective. The device perspective is fast-developing and is not considered here.

2.1 Enablers

LTE and WiMAX networks - current network speeds of 3rd Generation (3G) High Speed Packet Access (HSPA) deliver up to 7.2Mbps, and further migrations to WiMAX and Long Term Evolution (LTE) will bring up to 50Mbps uplink and 100Mbps downlink. The effective use of multiple data sources for mapping and tag recognition requires seamless data transition between Local Area and Wide Area Networks (LAN, WAN). Web-based support of Augmented Reality applications becomes truly ubiquitous when this support is available everywhere, and mobile broadband can now supply this required connectivity in a cost-effective manner to the Augmented Reality environment.

Ubiquitous flat IP networks – wireless operators are turning to flat IP network architecture for lower costs, reduced system latency and IP packet core network functionality. Scalable delivery of environmental data to Augmented Reality applications is now more affordable, manageable and secure, using Deep Packet Inspection techniques. Augmented Reality applications are dynamic, and can require rapid refresh of data. Lower latencies are achieved in flat IP networks, by virtue of fewer nodes in the network - meaning that the near real-time data required by Augmented Reality applications can be delivered faster (notwithstanding radio network congestion).

Sensor networks – can provide local information and interactivity of Augmented Reality applications with digital signage, smart appliances, digital measurement, access control, security and environmental controllers through close-range standardised wireless technologies such as WiFi, BlueTooth[2], and ZigBee[3], along with proprietary systems such as EnOcean and WirelessHART (IEEE 802.15.4)[4]. Not all sensors can/will be connected to the Internet. Not all sensors / tags will be even be powered.

Network-enhanced GPS location / EGPS – can deliver positioning data indoors and in zero GPS signal conditions It can also speed up the time to generate a position fix in poor GPS reception areas by exploiting the data available from cellular networks.

Semantic web descriptors - will help to improve future search and filtering capabilities by providing machine-readable metadata. The impact of this will be in making searching through data more contextually relevant, a potentially important factor in filtering the environmental data by Augmented Reality applications.

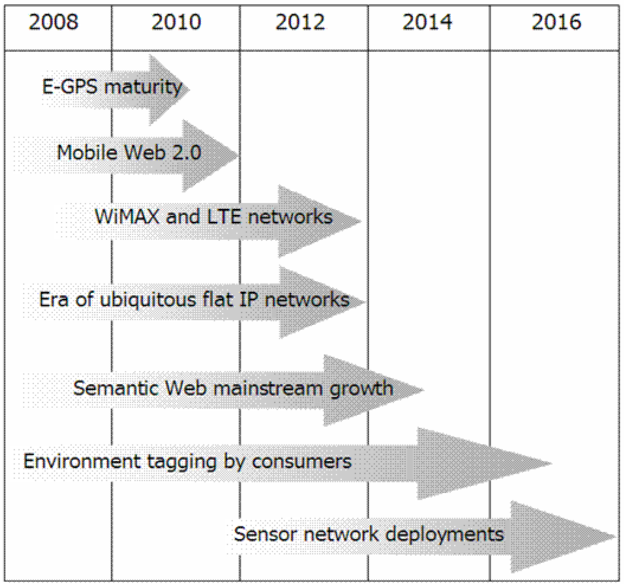

Figure 1 - Network and service enabling technologies for widespread Augmented Reality deployments.

It can be seen from Figure 1 that by 2015/16 the five enabling technologies will be mature, but this does not necessarily mean that they are on a convergent path.

There's evidence of the first applications appearing that demonstrate some of these features. But in this rosy picture there may be a few thorns. Let's examine them:

3. Data filtering requirements

3.1 Spam and clutter

The author has heard Augmented Reality business models based solely on advertising and re-directing people; encouraging them into physical stores via digital signposts, digital coupons and location-based ads. 'Hey!' says the ad-man 'Augmented Reality is just an opportunity for an advertising overlay! Every street in an Augmented Reality world can be lit in 10 foot high neon!'

Whoa. Back up. Maybe users will need some of this stuff filtered out, to remove unwanted clutter – the visual spam, outdated/expired data and digital graffiti (equivalent of physical tagging) – while at the same time ensuring recognition of relevant permanent data, beacons and signposts.

Machines must learn to either take notice, or discard this stuff; the data describing the immediate environment must be filtered by user requirements, by preferences or by predefined tasks.

3.2 Proximity

It may also be sensible to filter input data by proximity. After all, when you look through a video viewer, you only notice things as far as the eye can see, unless objects present themselves as transparencies. There may be new ways to design an effective human interface: If we ask 'Does a user only need information as far as they could normally see?' the answer is clearly 'No' (we all use maps and other navigation tools to navigate and know what is around the next corner).

Sensors may be limited by their radio power and frequency of operation, and so automatically self-filter by proximity, unless connected via a mesh, ad-hoc or other relay network.

3.3 Filtering tools

Contextual reasoning models can be used to filter environmental data based on interpretation of semantic tags.

4. Future developments: Augmented Reality as a real-world tool

The bigger picture is perhaps about using Augmented Reality to change reality, to become an everyday useful tool – something much more than the novelty of squinting into a 2 inch screen pointed at a likely target -

First let's add interactivity to Augmented Reality; These are things that causes changes in the real world – actuators that may be a simple as a bipolar switch or as complex as a programme or instruction set. Result: this could hold my room reservation, change the room smell, temperature lighting and colour to my favorites, it may make proactive/pre-emptive decisions for me, the possibilities are vast.

This brings choice, preference and personalization to the fore: it has the capability to deliver my world, the way I want to experience it.

Secondly, let's consider what we can do with location in Augmented Reality: There's no reason to limit Augmented Reality to the location I am currently in. Although I may physically be in London, if I set my virtual location to a street in Shinjuku, Tokyo then I should see what's there - this blurs the boundaries between Virtual Reality and Augmented Reality. The really interesting idea is whether Augmented Reality users in Shinjuku could see my Virtual presence, presenting as anything from a minimal tag to perhaps a full blown avatar.

5. CONCLUSION

The social impact of widely-available Augmented Reality environments is yet to be determined, but the author is of the view that such sophisticated, complex environments will appeal to humans because of their *usefulness*.

Large scale Augmented Reality environments are only possible through significant integration multiple data sources across the Internet, combined with low cost, high speed mobile networks. This philosophy aligns well with the general model for the Ubiquitous Web.

6. REFERENCES

[1] Cascio, J. et al. 2007. The Metaverse Roadmap – Pathways to the 3D Web. www.metaverseroadmap.org

[2] Bluetooth Consortium. 2008. www.bluetooth.com

[3] ZigBee Alliance, 2008. ZigBee Alliance continues expanding the Internet of things. www.zigbee.org

[4] EnOcean website 2010. www.enocean.com

[5] WirelessHART website 2010. www.hartcomm.org

Carl Taylor +44 7782 229503 tech.100days@gmail.com