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& interoperability standards

JISC CETIS
2011 Informal
Horizon Scan

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Produced by various members of JISC CETIS in March 2011.

This report outlines some technology trends and issues of interest and relevance to CETIS. It should be seen as a set of un-processed perceptions rather than the product of a formal process; a great deal of ground is not scanned in this paper and it should be understood that no formal prioritisation process was undertaken. The CETIS Horizon Scan should be seen as a set of potentially-idiosyncratic "takes", material on which discourse and disputation may occur to make possible futures more clear.

1.   MOBILE AS WEB "FIRST CITIZEN"

There has been a strong trend in recent web development events towards putting the mobile browsing experience as being the future "first citizen" of web applications. Up until now, sites have been designed principally for the desktop browser, with specialized mobile sites with reduced functionality, or more recently a separate installable mobile app. However there is a clear trend towards incorporating design for mobile devices into web applications as the "default" and using progressive enhancement for larger devices - which now also includes multi-touch tablets in various sizes as well as laptops and desktops. This is prompting a new wave of software libraries and design techniques for the web that follow patterns established in mobile web applications.

We predict that within five years the majority of new websites will be designed using this "mobile first"/"device agnostic" perspective as users accessing the web using a range of portable devices with different form factors becomes the majority.

For the education sector this poses a transition problem, as not only corporate websites but also learning materials, VLEs, administration systems and third-party content is principally designed for desktop browser access today. While we are currently seeing institutions invest in native mobile applications alongside a traditional website, in the near future we should see middleware solutions such as Molly and other mobile website frameworks having greater take-up, with an eventual transition to full redesigns taking place of both in-house sites and third-party applications.

A particular problem will be transitioning legacy content including packaged learning materials; we may see new solutions needed for re-rendering this content in a mobile-friendly manner.

2.   DEVICES: FORM FACTORS PROLIFERATING, CAPABILITIES CONVERGING

As noted elsewhere, the we are seeing an evolution of technology form factors into a wide spectrum of device capabilities - from ever larger interactive whiteboards at one extreme, to very small mobile devices at the other, and perhaps more importantly a much more diverse middle ground. 2011 is the "year of the tablet", and smartphones have evolved into largely indistinguishable black rectangles, but this only hints at the range of form factors and device types that are being developed. For example, we also have the Galaxy Tab and the Kindle occupying a middle ground between smartphones and full-size tablets.

In contrast to form factors, the capabilities of devices are merging - "laptops" and "desktops" are acquiring smartphone device capabilities such as location awareness, cameras, 3G connectivity, accelerometer, and touch gestures. The gap in

browser capability between devices has also narrowed thanks to advanced mobile browser technologies from Opera and Webkit.

Future applications will need to accommodate this variety of form, while at the same time exploiting the ubiquity of advanced capabilities.

The key standards to watch in this space are those produced by the W3C Device APIs group.

3. MOTION CAPTURE CONTROLLERS FOR GESTURAL INTERFACES

The Microsoft Kinect has been a big hit this year with consumers, but also fired the imagination of researchers as a low-cost action capture and recognition system with a wide range of applications.

While it directly builds on previous console control systems such as the Wii remote and especially the Sony EyeToy, it should properly be seen as representing the continuation of a trend towards gestural computing but moves it out of the track-pad and capacitative screens and into the open environment.

So far, in the research community we've seen some novel tele-operation applications (e.g. controlling robots) and we should see some more developments in this space - for example low-cost laboratory tele-operation.

Continued improvements in recognition could also stimulate interest in capturing data for analysis and assessment, for example in the performance of skills, not just by individuals but also of teams (Kinect's software currently can track up to six people, but only employs feature extraction for the two active players).

If the applications are compelling, and the hardware that enables Kinect-type technology (an infrared laser combined with a webcam and two depth-sensitive cameras) continues to come down in cost, then this type of functionality may spread to other types of devices as a built-in capability.

4. CROSS-PLATFORM APPLICATIONS

There was a time when the only sensible choice for cross-platform non-web applications was Java. This state of affairs began to be broken a few years ago but shows signs of increasing in importance as well as increasing diversity. On the one hand we have Adobe Air for "rich internet applications" while on the other hand, cross platform GUI libraries such as wxWidgets/wxPython and GTK are supporting more desktop-like applications. Although, for example, using Mono and GTK to write a cross-platform application in "Microsoft .Net" is not yet widespread and Mono lags behind Microsoft's capabilities, it represents an increasingly attractive option for developers experienced with the Microsoft .Net platform in particular.

A plausible positive driver for this is the increasing volume of linux-based Operating Systems, from "proper" linux distributions to MacOS and on to the likes of Android and webOS. On the other hand, proliferation of Java Virtual Machine runtimes and versions creates a headache - a negative driver - for developers who genuinely want applications to "run anywhere". Recent concerns over Oracle's actions with Java following its adoption of Sun's assets have made this situation worse (e.g. Ubuntu now defaults to OpenJDK).

Although Java is close to the hearts of many in academia, we should be aware of being blind-sided by emerging alternatives, especially if these also support development against a range of form-factors.

Adobe Air- http://www.adobe.com/products/air/
wxWidgets- http://wxwidgets.org/

wxPyython- http://www.wxpython.org/
GTK- http://www.gtk.org
Mono- http://www.mono-project.com
webOS- http://en.wikipedia.org/wiki/WebOS
webOS on desktop - http://www.zdnet.com/blog/open-source/hp-the-linux-desktop-company/8423

5. MACHINE LEARNING ON THE WEB

Several different manifestations of machine learning are emerging on the web, both for-fee Software as a Service (SaaS) offerings and gratis APIs. Four examples follow to illustrate the "different manifestations":

1. Google's translation service has for several years relied on the technique of statistical translation, where bodies of bi- and multi-lingual text (e.g. Canadian government documents in English and French) for the basis for the machine learning.

2. Wolfram Alpha is a much more "supervised" approach in the sense that a very large number of algorithms are created by human beings using the "Mathematica" language in order to realise a "computational knowledge engine". Wolfram Alpha is particularly strong on providing meaningful responses to scientific and mathematical queries such as "molecular weight of aspirin", "differentiate Sin^2(x)" and "distance of moon". The last of these provides the current distance, unit conversions and orbital parameters (it is not a circular orbit). An API is available for free use.

3. The Google Predict API is not yet generally-released but offers classification and prediction features given user-supplied training data. This will be a for-fee service. It is being targetted at examples such as:
"Given a user's past viewing habits, predict what other movies or products a user might like. Analyze posted comments about your product to determine whether they have a positive or negative tone. Guess how much a user might spend on a given day, given his spending history."

4. Whereas Google Predict seems to be aiming for large scale adoption by non-experts, Zementis offers a cloud-based (SaaS) "predictive analytics decision management platform" named ADAPA. ADAPA is aimed at people doing data mining with an understanding of the different applicability of approaches such as Support Vector Machines, Neural Networks, kmeans clustering, etc. It supports the Predictive Modeling Markup Language (PMML), a product of the Data Mining Group. PMML is available under an open licence and is implemented in desktop and service-oriented software used in the data mining community (e.g. SAS, SPSS, KNIME, R, KXEN).

This represents an interesting development from several perspectives:
- the availability of such services presents new opportunities for management (business and educational), research and teaching & learning.
- it reflects a widening of interest in and demand for machine learning and data mining capabilities, a trend that may continue and eventually become a common expectation of what "the web" provides.
- it indicates a maturity in the field and the emergence of a common toolkit of sufficiently-effective methods that can be implemented in a scalable way.

Google Prediction API - http://code.google.com/apis/predict/
Wolfram Alpha - http://www.wolframalpha.com/
Zementis - http://www.zementis.com/

6.   EDUCATIONAL INFORMATICS

In the previous two CETIS Horizon Scans we have signalled "Business Intelligence". The term may, however, be misleading and the text beneath the title alluded to a more flexible and holistic view than the conventional stereotype. This time the idiosyncratic term "educational informatics" has been chosen to avoid associations with existing terms such as "learning analytics" or "academic analytics" (common in North America). Educational Informatics represents an imagined future built upon a number of trends.

The potential affordances of capturing and processing "attention metadata" representing a learner's interactions with resources and other learners have been considered for several years but are now attracting more interest from more people. This is a particular "hot topic" within the Eurpean Technology Enhanced Learning community at present, being the focus of 7th framework projects and proposals to the CEN Workshop on Learning Technologies.

Various articles in the Educause review (and other Educause publications) have signalled "academic analytics" since 2007. The theme of retention is prominent. IMS focussed on this area from 2007-2009, homing in on "targetted retention systems" from a broaded "information analytics" interest.

Within the business world the move away from old-school BI to a much more iterative and enquiry-based approach is clear. Rather than a mental image of standardised management reports from unwieldly IT systems we should imagine a rather less constrained and more unspecified approach. The Wikipedia entry for "Business Analytics" makes a useful distinction, although common usage is not expected to discriminate:
"Business analytics makes extensive use of data, statistical and quantitative analysis, explanatory and predictive modeling, and fact-based management to drive decision making. Analytics may be used as input for human decisions or may drive fully automated decisions. Business intelligence is querying, reporting, OLAP, and 'alerts'."

Our previous use of the term "business intelligence" did not mean the restricted one given in Wikipedia.

That there is increasing interest in the topic is signalled by the recent conference entitled "1st International Conference on Learning Analytics and Knowledge" (LAK11). While it is clear that this is not really the "1st" in this area, it has brought the topic onto the radar of a wider group of people and, by their responses, it appears to be very much of the moment.

Although there is currently a JISC programme concerning Business Intelligence, which we should follow closely, we should also be asking the question: what next? Maturing and accessible techniques for machine learning and data mining generally combined with interest in adopting these techniques to answer more than business questions should yield benefits in the coming 2-3 years.

If we take "business questions" to be those that a business person would ask and understand, we should also be thinking of questions that educators and educationalists would ask and understand. The topic of retention may be a good bridge as it has clear business as well as educational perspectives. A conceptualisation of "digital literacy" suited to staff in 21st century H/FEIs should include space for Educational Informatics (or what you will).

Educause articles on "academic analytics" - http://www.educause.edu/node/645/tid/16930
LAK11 - https://tekri.athabascau.ca/analytics/
International WG on Educational Data Mining - http://www.educationaldatamining.org/

7. CONTENT MANAGEMENT AND APPLICATION FRAMEWORK CONVERGENCE

Web application development frameworks abound, from the very light-weight to rather more fully featured. Their promise is to give developers a head start, an opportunity to work at a higher level and there are a growing number of well supported and battle-hardened offerings (e.g, Zend is one of many for PHP alone). While they have been maturing, content management systems (CMS) - from the humble Wordpress upwards in complexity - have progressively increased the degree to which add-ins and contributed modules can extend their capabilities. This trend seems set to continue to a point of convergence, although it might be more accurate to talk of a "continuum" instead of "convergence". Some of the most widely-used CMSs, such as Drupal, now offer impressive levels of support for application development alongside out-of-the box support for structured and unstructured information and its management. The phrase Content Management Framework (CMF) is sometimes used but does not fully reflect the capabilities offered beyond customised "content management".

While offerings such as Microsoft Sharepoint appears quite widely in the 2009 UCISA corporate information systems survey, and is anecdotally increasing in occurrence, Drupal or an equivalent gets no mention as the CMS or portal software. This appears to be out of step with a wider pattern of adoption outside our sector. An increasingly strong array of support, custom-development and hosting offerings for these "CMFs", several of them also being good examples of the virtuous circle of Open Source Software, makes them potentially viable as enterprise-level platforms.

Zend- http://framework.zend.com/
PHP frameworks generally - http://www.phpframeworks.com/
Drupal- http://drupal.org
IBM and Drupal (2006)- http://www.ibm.com/developerworks/ibm/library/i-osource1/

8. DEVELOPMENT OF BETTER TOOLS FOR USING, EMBEDDING AND DISCOVERING OPEN LICENCES

There are number of domains which have had recent successful initiatives to increase the volume of available openly licensed content - these include Open Data, Open Access, and Open Educational Resources. Within a general picture of this trend to openly license material (for a wide-ranging number of reasons, such as: goodwill, public responsibility, promoting creativity, and advertising a brand), there is increasing use of and support for Creative Commons Licences.

One area of development we anticipate in the coming months is the development of better tools to embed licences, use licensed content, and discover openly licensed material. Some of these tools already exist but we expect others to be developed and their use to become more mainstream. Existing tools include the Plugin to embed CC Licences in MS Office products. Some examples of work which has recently been released (at least in early or beta versions)include:
- Open Attribute - a plugin to help properly cite and attribute CC licensed content
- Creative Commons: DiscoverEd - CC are continuing to develop their discovery tool and we expect the growth of related tools.

Through supporting JISC interest in this work, liaison with Creative Commons, the upcoming OER Hackday we anticipate continuing developments in this area in the near term.

Open Attribute - http://openattribute.com/
DiscoverEd - http://discovered.labs.creativecommons.org/

9. PUBLIC SECTOR DATA

Previous CETIS Horizon Scans have highlighted Linked Data and this has been a theme at past CETIS conferences (in 2010 and 2009 in particular). A number of events and trends reflect changing headings and progress on public sector data,

whether "linked data", "open" or not. One clear change, which was anticipated in discussions at CETIS Conference 2009, is a strong swing towards public sector bodies being <u>required</u> to provide data. The political significance of this is highlighted by the existence of the Public Sector Transparency Board (chaired by Frances Maude) and the consequential actions in HEFCE and the Information Standards Board, to name but two, have followed on rapidly. A significantly more far reaching set of requirements is likely to emerge from this policy priority and the demands on information systems in H/FEIs and sector agencies to meet the requirements without entailing excessive cost may present serious challenges. There has, for example been a suggestion that sectoral transparency boards should be created. Parliamentary Counsel has also been instructed to draft the clauses on the 'right to data' for inclusion in a Freedom Bill.

The emphasis of this agenda is clearly about Transparency; it is unfortunate that arguments in favour of the open release of data currently used by HMG Trading Funds seem to have fallen on deaf ears. The hopes that were kindled in 2009 consequent to announcements of the release of Ordnance Survey and British Geological Survey data are now dashed. The EU INSPIRE Directive (2007) paved the way for much more coordinated geospatial data management, rationalisation and a set of common data standards. One deliverable arising from INSPIRE is a single UK gazetteer of addresses, which is believed to be Linked-Data-ready by having a URI for each address. Disappointingly, this will only be available freely to selected public sector agencies. Opportunities for systemic efficiency savings across the nation and for the creation of innovative citizen- and business-oriented services on the back of an Open Data gazetteer appear to have been sacrificed. The JISC Geospatial Working Group (JIR) must be disappointed.

At an institutional level, we are now seeing some first-mover activity. This has the appearance of being done in the interest of enhancing reputation and visibility rather than tangible and immediate business benefit. The Open University and Southampton University, both with strong Semantic Web interests, are prominent. These institutions are paving the way for others when it comes to understanding and managing the risks of opening up their data. It remains to be seen how many other institutions will adopt a reputation-oriented approach and how they might attempt to target their data-release, whether associated with Public Sector Transparency or not.

The essence of the moment is clear: there will be more data available and more requirements on H/FEIs to provide their data. This presents risks/threats arising from provision - e.g. burden, security/privacy - and an opportunity arising from consumption - e.g. to make more informed business and educational decisions. Some of these, such as the Key Information Set, are upon us now while we have more time to consider others and to act.

Public Sector Transparency Board- https://www.data.gov.uk/users/transparency-board
HEFCE, public information about HE- http://www.hefce.ac.uk/learning/qual/public/infoset.htm
INSPIRE- http://inspire.jrc.ec.europa.eu/
UK Address Gazeteer- http://www.communities.gov.uk/news/corporate/1786470
OU Data- http://data.open.ac.uk/
Southampton Data-http://data.southampton.ac.uk/

10.   MOBILE APPLICATIONS

A proposal has been put in by the DWP (Department of Work and Pensions) to develop a Mobile Applications Accessibility Standard. It is still at the drawing board stage, so may not be further developed. It will focus on mobile application accessibility (i.e. apps that can be used on mobile devices (such as smartphones)) rather than on simply viewing a website on a mobile device. (Note: there is no current activity by CETIS or the community at this stage as it has only just been announced but it is clearly of interest as it may have an impact on learning resources developed for smartphones, etc.

11.   ETEXTBOOKS

eBooks and eBook readers are rapidly becoming widely available consumer products. It is to be expected that the application of these to teaching and learning will follow, indeed the JISC national eBook observatory project concluded in 2009 that the "time is ripe for a major expansion of library provision" of eBooks. ISO/IEC JTC1 SC36 have already initiated a study period on e-Textbooks to which CETIS have contributed a use case.

There are a number of aspects of this development that would be of significant interest to CETIS. The formats and standards used for eBooks (e.g. ePub) are essentially packaging formats: how do they compare with IMS Content Content Packaging? Do the eBook formats and the eBook reading devices allow for high quality content, with interactivity where appropriate or are they suitable only as a less-bulky replacement for paper? How well do eBook formats and devices support "OpenText books" built from open educational resources?

Final report from JISC national eBook observatory - http://www.jiscebooksproject.org/reports/finalreport
JISC ebooks for FE http://fe.jiscebooksproject.org/
CETIS Open e-Textbook Use Case for ISO/IEC JTC1 SC36 - http://blogs.cetis.ac.uk/lmc/2010/11/25/open-e-textbook-use-case/

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For more information visit our website: http://jisc.cetis.ac.uk/