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Hype Cycle for Education, 2013

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The education ecosystem is changing as the digitalization trend gets a firmer grip on learning technologies, enabling new business models. This forces CIOs to make tough choices about technologies, and improve flexibility and the speed of change by developing the infrastructure into an exostructure.

Table of Contents

Analysis....3
- What You Need to Know....3
- The Hype Cycle....4
- The Priority Matrix....8
- Off the Hype Cycle....9
- On the Rise....10
  - Mashware....10
  - Quantum Computing....11
  - Education Tablet....14
  - Open Microcredentials....15
  - Campus App Store....17
  - Affective Computing....19
  - SIS International Data Interoperability Standards....21
  - BPO....22
  - Open-Source SIS....24
  - Student Retention CRM....26
  - Citizen Developers....27
- At the Peak....29
  - Learning Stack....29
  - Adaptive E-Textbooks....30
  - Big Data....31

Gamification..... 33
MOOC..... 35
Social Software Standards..... 37
Wireless aaS..... 39
COBIT..... 40
Adaptive Learning..... 43
Sliding Into the Trough..... 45
Digital Preservation of Research Data..... 45
BYOD Strategy..... 46
Mobile-Learning Low-Range/Midrange Handsets..... 48
Open-Source Financials..... 50
EA Frameworks..... 51
Web-Based Office Productivity Suites..... 54
ITIL..... 56
Social Learning Platform for Education..... 59
Cloud HPC/CaaS..... 60
Mobile-Learning Smartphones..... 62
Open-Source Middleware Suites..... 64
E-Textbook..... 66
Cloud Email for Staff and Faculty..... 67
Virtual Environments/Virtual Worlds..... 68
Climbing the Slope..... 69
Emergency/Mass Notification Services..... 69
Hosted Virtual Desktops..... 72
Open-Source Learning Repositories..... 74
SaaS Administration Applications..... 75
Enterprise Architecture..... 77
IT Infrastructure Utility..... 79
Intellectual Property Rights and Royalties Management Software..... 83
Lecture Capture and Retrieval Tools..... 85
802.11n..... 86
Unified Communications and Collaboration..... 87
Tablets..... 89
Game Consoles as Media Hubs..... 92
Entering the Plateau..... 93
E-Book Readers..... 93

Self-Publishing....95
Mashups....98
Appendixes....99
Hype Cycle Phases, Benefit Ratings and Maturity Levels....101
Recommended Reading....103

List of Tables

Table 1. Hype Cycle Phases....101
Table 2. Benefit Ratings....102
Table 3. Maturity Levels....102

List of Figures

Figure 1. Hype Cycle for Education, 2013....7
Figure 2. Priority Matrix for Education, 2013....9
Figure 3. Hype Cycle for Education, 2012....100

Analysis

What You Need to Know

Technology is driving disruption, as outlined in "The Gartner Higher Education Business Model Scenarios: Digitalization Drives Disruptive Innovation and Changes the Balance." New education ecosystem players have already established technology-enabled business models, such as StraighterLine's offering of courses with transferable college credits at very affordable prices ($99 a month and a per-course fee of $49). Potentially even more disrupting is the teaming up of Georgia Tech and Udacity to produce a "massive online course (MOC) format" master of science in computer science degree program for less than $7,000, compared with the traditional on-campus program for $40,000 for non-Georgia residents. In this case, traditional high-quality curriculum and content meet technology-enabled pedagogy to produce scalable, affordable quality education. The key to gaining competitive advantage in this age of disruption is to identify emerging technologies, connect the dots and innovate better than your competitors. The Gartner Hype Cycle for Education aims to equip the education CIO with a toolbox of emerging technologies that have a real impact on how the institution can optimize or change, as well as execute the institutional business (operational) model.

The key trend of "moving from mere digitization to digitalization" that was introduced last year is picking up strength and accelerating technology, pedagogy and educational business model

innovation. The continued development and deployment of massive open online courses (MOOCs) are producing the expected data and improved technologies that make Georgia Tech's affordable online master's degree program in computer science possible. Digital learning in many forms is expanding and producing data that is used to improve grades and retention through technologies such as the Hype Cycle entries Adaptive Learning and Big Data. The increased available volume and variety of learning data increase the value gained from learning data, and this is driving innovation of even more digitalized learning. As an example, The Education Hype Cycle entries Adaptive E-Textbooks and Mashware, which produce "mashbooks," are evolutions of the traditional e-textbook that add new dimensions to learning through technologies such as social annotation and open microcredentials.

One interesting thing in common among the majority of these new institutional-mission-enhancing technologies is that they require the institution's CIO to implement a considerably higher level of interoperability to achieve the full value of the technology. These technologies require integration of data and services from internal sources as well as increasingly from external sources. This is the traditional job of the CIO, but the unprecedented scale of these changes will require the IT organization to move from an infrastructure mindset to an exostructure mindset (see "Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure"). This necessary change is demonstrated by CIOs ranking "improving IT applications, infrastructure, legacy" No. 3 among the top 10 higher education business strategies in the 2013 CIO Agenda survey. IT continues to be perceived as a bottleneck inhibiting change, and needs to develop the flexibility and ability to increase the speed of change that is part of the exostructure mindset.

To find a competitive advantage, "one size does *not* fit all," and CIOs need to find a way to improve their ability to communicate with the institution's leadership and stress the impact of technology early in the strategic planning process. Technology is both expanding and changing the competitive balance in the education ecosystem.

The Hype Cycle for Education, 2013 identifies several emerging technologies that the CIO can use to put together an institution-specific toolbox that enhances personal and organizational productivity. The trick is to have the right balance of tools and timing for the implementation of technology to create an ecosystem of technical capabilities that enable synergies of cost-effective flexibility for the infrastructure, exostructure and the end user. The sheer number of technologies affecting the education ecosystem also requires CIOs to make tough choices regarding which technology sets to bet on, as well as whether to seek help in sourcing from peer institutions, community organizations such as national research and education networks (NRENs), and vendors.

The Hype Cycle

The 2013 Education Hype Cycle's core point of view is that of public K-12 and higher education institutions. However, with the expanding education ecosystem, there are an increasing number of players that impact the traditional way of executing the core common mission: to educate. We see an increase in the crossover of technologies, services and methodologies between the two levels of education, as well as integration/leverage of new education formats such as MOOCs for traditional as well as nontraditional learning. We see a surge of entrepreneurs entering the educational ecosystem who are not necessarily tied to the traditional K-12, higher education and further

education categorizations. Innovators and venture capitalists are trying out many different business models that are aimed at K-12, higher education and the general consumer. We note the increasing need to define standards, such as grades and learning metadata, in the whole education ecosystem to enable the seamless mobility of students and their achievements. We also see an increasing need for higher education institutions to understand which skills and expectations the prospective students bring with them to their institutions, as well as what future employers expect of graduates entering the workforce.

In the 2013 Hype Cycle for Education, the digitalization trend introduced last year is reinforced with new entries such as Mashware and Education Tablet, alongside the steady progress of entries such as MOOC and Adaptive Learning. The important trends of sourcing and standards that underpin delivery have evolved into a single trend — the "exostructure" — that emphasizes the increasing dependencies on external (consumerized) services and (automated) information exchange. The Hype Cycle entries Open Microcredentials and SIS International Data Interoperability Standards are good examples of the integration of IT infrastructure and education information exchange into a single inseparable "institution exostructure."

This complicates the picture for the education CIO even further, as all these truly digitalized capabilities are heavily intertwined with the core missions of the institution: to educate and to research. These digitalized capabilities cannot be implemented without "the business side" driving the change, yet they often are enabled by a digitized and flexible exostructure.

This picture emphasizes the state of technical turmoil in education, which calls for the institution to improve its ability to make choices quickly and correctly. This is admittedly not a strong trait in most education institutions, yet it is crucial that IT governance leverage capabilities represented by more formal frameworks such as enterprise architecture (EA) and COBIT, as well as more lightweight Gartner tools such as the Hype Cycle and the Strategic Technology Map.

The increasing dependence on IT and the opportunity to use IT in all areas of the institution put the CIO in a position to affect the future of the institution. However, CIOs need to develop their ability from merely optimizing alignment (in general) and timing (in particular), to strengthening and demonstrating the value of the IT department to the core business of the institution. Building institutional (business) capabilities based on technology that improves the institution's competitiveness is the goal (see "Connecting the Dots to Gain Competitive Advantage: Articulating a Technology Ecosystem Advantage to Your Board").

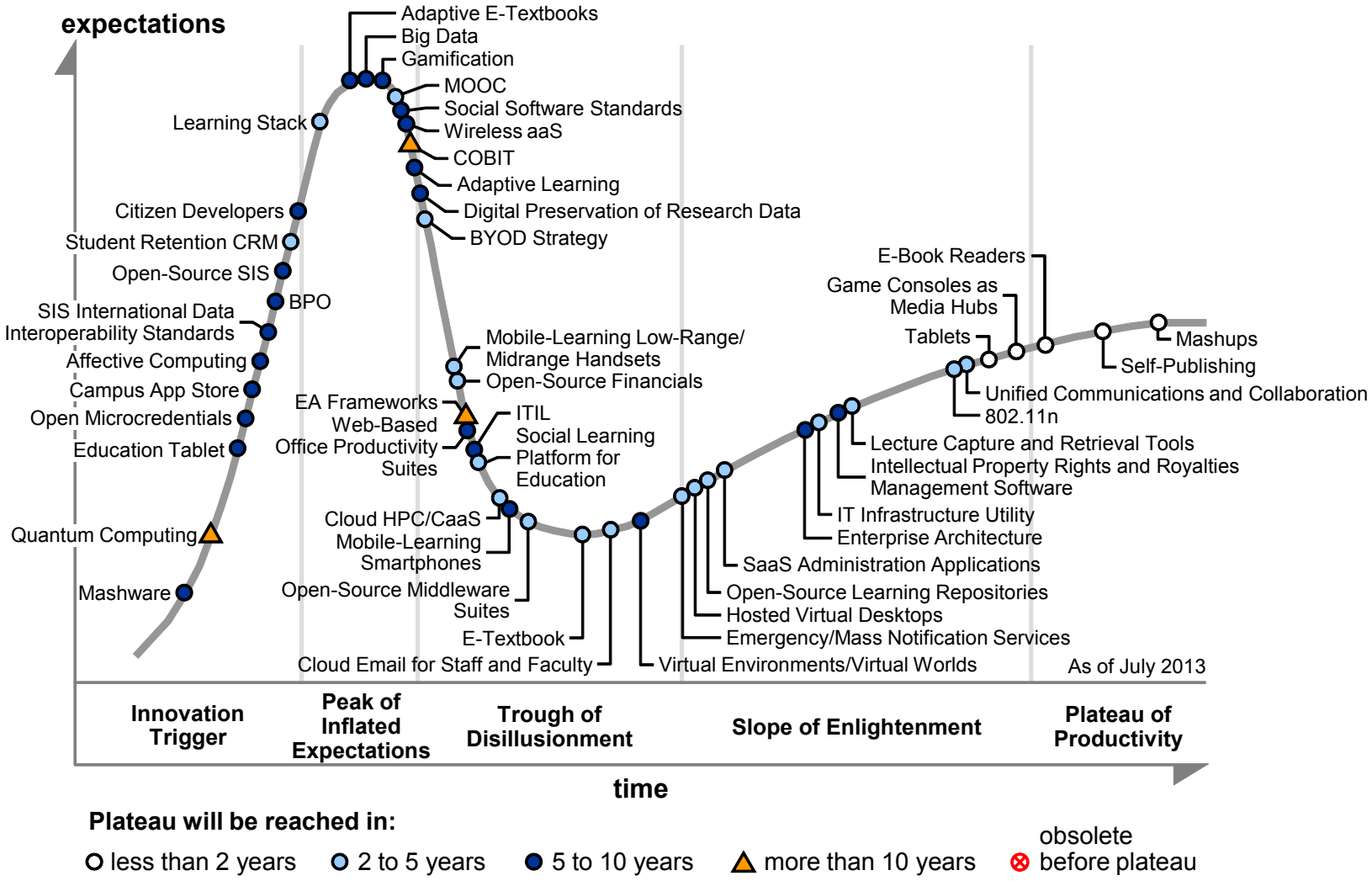
Since the 2012 Hype Cycle, several key technologies have made progress, seven have disappeared, and one has been given a new name. Media Tablets is now referred to as Tablets to acknowledge the broad use of consumer tablets that go well beyond media consumption (especially in education).

There are six new entries:

- Three entries — Mashware, Adaptive E-Textbooks and E-Book Readers — relate to the increasing maturity of e-reading. They represent a minitrend in themselves that is bringing education closer to an e-content-only tipping point.

- The Open Microcredentials entry represents another education-specific standard that is driving the need for an institutional exostructure. Any institution that expects to be a part of the global society will likely be expected to issue open microcredentials in some shape or form.
- The addition of the Education Tablet entry represents the growing hype over these devices, whether they are originally designed for education or specifically customized for education by hardware manufacturers.
- Citizen Developer has been added to emphasize the need to involve students and faculty in the innovation and development of digital tools to support the institution.

Figure 1. Hype Cycle for Education, 2013



Source: Gartner (July 2013)

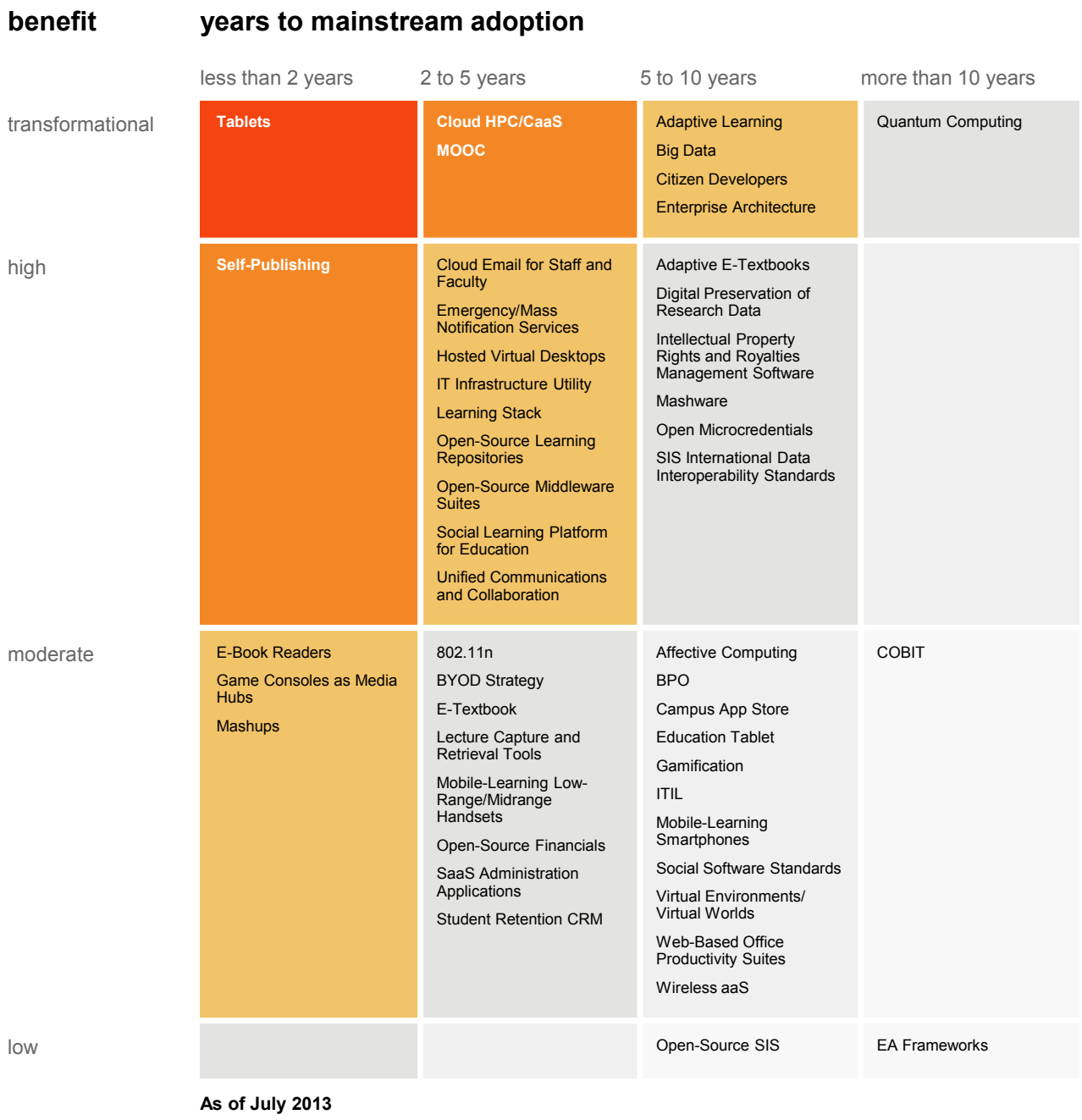
The Priority Matrix

The Priority Matrix for the Hype Cycle for Education is more nuanced and context-dependent than those of most nonindustry Hype Cycles. The reason is that benefit ratings can vary substantially depending on the various types of institutions. Furthermore, we intentionally use some general Hype Cycle entries taken directly from topical Hype Cycles, such as the Hype Cycle for Enterprise Architecture, 2013,to relate to their overall standing in maturity and adoption even outside the education community. The specific institutional context and the general hype/maturity aspect are very important in the assessment of when these technologies are "ubiquitous" enough to build new services or curricula on top of them. This means that the benefit rating is not normalized to any specific type of institution and, more importantly, some technologies have benefit ratings that are relative to their niche technology category. The result can be seen in benefit ratings such as high for Cloud Email for Staff and Faculty, while the rating for the E- Textbook entry is only moderate. In the first case, the rating is due to the relative benefit to an internally managed mail solution. In the second case, the rating is relative to the original expectations for e-textbooks and their importance to the core mission of education.

In this context, Tablets and Citizen Developers are rated transformational because of the way they empower the end user. Cloud HPC/CaaS is rated transformational because of its capability to be a resource equalizer among institutions. MOOC, Adaptive Learning and Big Data are all rated transformational for their ability to bring education in a new form to new learners and collect vast amounts of data that can help improve the education ecosystem. Quantum Computing is rated transformational because it can deliver virtually unlimited computing power, and Enterprise Architecture is rated transformational because of its promise to improve governance and more strategy-aligned IT benefits.

To help clients determine which key investments in IT will be most strategic in positioning their institutions for long-term success, we have developed a complementary tool to the Hype Cycle called the Strategic Technology Map (see "Strategic Direction and Timing in Education: Mashing Up the Strategic Technology Map and the Hype Cycle" and "Toolkit: Speed Up Your Innovation Process; How to Quickly Create Interactive Strategic Technology Prioritization Maps From the Education Hype Cycles"). The Strategic Technology Map makes it clear that achieving success is seldom about individual technologies or even singular chains of dependencies; it is really about an ecosystem of technologies that must be mature enough to support the institution's strategy (service). The Strategic Technology Map can help identify the strategic parts of the ecosystem and its interdependencies, while the Hype Cycle provides crucial information about the weakest link in the ecosystem, leading to better analysis of the timing of the "tipping point." If these tools are also combined with business model scenario planning (see the suite of five documents introduced by "Four 'Business Model' Scenarios for Higher Education: An Introduction to Strategic Planning Through Storytelling"), a sustainable, uniquely adapted and agile technology strategy can be devised for each institution.

Figure 2. Priority Matrix for Education, 2013



Source: Gartner (July 2013)

Off the Hype Cycle

Seven technologies have been removed from the Hype Cycle for Education, 2013:

- Five technologies — Student Enrollment CRM, Organization-Centric IAM, Service-Oriented Architecture, Open-Source Portals and Social Media in Education — are off the Hype Cycle since they are well into the Plateau of Productivity, both in market penetration and in maturity in the education ecosystem.
- User-Centric IAM (identity and access management) has been taken off the Hype Cycle because the original vision of a global claims ecosystem with secure relevant party assertions has been replaced with a self-certified OpenID/OAuth-based approach of limited use to education institutions. Federated IAM is still the most viable approach to secure IAM in the education ecosystem (see "Governments Need to and Can Play a Role in the Online Claims Ecosystem").
- E-Portfolios is off the Hype Cycle a bit early because it has in its current form reached a mature market size, and we do not expect major changes as long as no interoperability standards and cloud offerings are developed. In their current form, e-portfolios are more niche products for singular institutions, rather than the platforms for external exchange and the display of learning outcomes that they were once envisioned to be. Interestingly, open microcredentials might take on some of the original intended functionality of the e-portfolio.

On the Rise

Mashware

Analysis By: Allen Weiner

Definition: Mashware represents the intersection of mashups and courseware. A mashup represents the ability to mix together various content assets from different media and disciplines to create a new asset. The courseware part is the multichannel delivery of "MashBooks," which are the result of mixing together various educational assets (book chapters, video, audio, charts and so forth) into material used for instructional purposes.

Position and Adoption Speed Justification: Mashware allows educators great freedom to create custom content for students by allowing them to "mash together" opens assets and licensed content along with education-oriented tools such as assessments and quizzes. Mashware, which results in MashBooks, is in its infancy and faces issues such a lack of vendors and the need for educators to be adept at using new publishing tools.

User Advice: CIOs will be tasked with the responsibility of maintaining the Mashware platform. Select one that is easy to use, yet produces compelling content.

- Understand that a digital alternative to textbooks should not be solely for cost savings, but rather for the goal of better student outcomes.
- Educational institutions should enforce a policy that recommends students use devices that support open content to allow access to the range of mashware-created e-textbooks and related materials.

Business Impact: Mashware's future is guided by two distinct attributes that must meet to be successful. On one hand, the platform to create Mashware must be easy to use so that educators can be quickly trained on creating new content. At the same time, the resulting MashBooks must be compelling enough for students to remain engaged. At this point, no platform satisfies both values, but leading providers are headed in that direction.

Mashware and resulting MashBooks become more valuable to educators as they become more adaptive. Companies such as Denmark-based Area 9 (working with McGraw-Hill) are developing platforms that allow publishers and developers to build more adaptive functionality into their e-textbooks. The ability to incorporate adaptive learning elements into mashware platforms — which can be accomplished using advanced content tagging techniques — will propel mashware to become an even more vital part of an educator's teaching arsenal.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Embryonic

Sample Vendors: SharedBook; Trunity

Recommended Reading: "The Emergence of 'Mashware' Points to a New Digital Resource for Educators"

Quantum Computing

Analysis By: Jim Tully

Definition: Quantum computers use quantum mechanical states for computation. Data is held in quantum bits (qubits), which have the ability to hold all possible states simultaneously. This property, known as "superposition," gives quantum computers the ability to operate exponentially faster than conventional computers as word length is increased. The data held in qubits is influenced by data held in other qubits, even when physically separated. This effect is known as "entanglement." Achieving both superposition and entanglement is extremely challenging.

Position and Adoption Speed Justification: A large number of technologies are being researched to facilitate quantum computing. These include:

- Optical lasers
- Superconductivity
- Nuclear magnetic resonance
- Quantum dots
- Trapped ions

No particular technology has found favor among a majority of researchers, supporting our position that the technology is in the relatively early research stage.

Some classes of problem would be executed extremely fast with quantum computers, including:

- Optimization
- Code breaking
- DNA and other forms of molecular modeling
- Protein folding
- Large database access
- Encryption
- Stress analysis for mechanical systems
- Pattern matching
- Image analysis

A few of these applications rely on algorithms that have been developed specifically for quantum computers. Many of these algorithms produce an output in a probability form, requiring multiple runs to achieve a more accurate result. One example is Grover's algorithm, designed for searching an unsorted database. Another is Shor's algorithm, for integer factorization. Many of the research efforts in quantum computing use one of these algorithms to demonstrate the effectiveness of their solution. The first execution of Shor's algorithm, for example used nuclear magnetic resonance (NMR) techniques, and took place at IBM's Research Center, Almaden and Stanford University in 2001. Since then the focus has been on increasing the number of qubits available for computation, but this is proving to be very challenging. IBM had demonstrated factorization of the number 15 using five qubits. The latest published achievement is a factorization of the number 21 at the University of Bristol in 2012. The technique used in that case was to reuse and recycle qubits during the computation process in order to minimize the required number of qubits. The practical applications indicated by these examples are clearly very limited in scope.

In February 2007, D-Wave Systems demonstrated a 16-qubit quantum computer, based on a supercooled chip arranged as 4x4 elements. The company followed this with longer qubit demonstrations. Lockheed Martin subsequently purchased a D-Wave One computer where it is in operation at the University of Southern California's facility. Within the past few months a 439-qubit system was demonstrated by the D-Wave Systems.

To date, D-Wave's demonstrations have involved superposition, but have not demonstrated entanglement. Therefore, D-Wave has focused its attention on the use of quantum techniques for adiabatic processing for optimization purposes; a topic known as "quantum annealing." This technique finds the mathematical minimum in a dataset very quickly. There are many types of problems where quantum adiabatic processing will provide a significant improvement in the scale of the problem that needs to be addressed. Google, for example, is collaborating with D-Wave in the area of machine-learning research. However, without quantum entanglement, D-Wave computers

cannot attack the major algorithms demonstrated by the smaller quantum computers that do demonstrate entanglement.

Most of the research we observe in quantum computers relates to specialized and dedicated applications. We are gradually forming the opinion that general-purpose quantum computers will never be realized. They will instead be dedicated to a narrow class of use — such as the optimization engine of D-Wave Systems. This suggests architectures where traditional computers offload specific calculations to dedicated quantum acceleration engines.

Qubits must be held and linked in a closed quantum environment and must not be allowed to interact with the outside world, because they are very susceptible to the effects of noise. Two stages are involved in quantum computation. Stage 1 involves execution of the algorithm, and Stage 2 is the measurement of the resulting data. Measurement is extremely difficult and, typically results in decoherence (destruction of the quantum state) as this involves interaction with the outside world.

Considerable problems exist in increasing the number of linked qubits available for computation, because of noise. The slightest amount of noise or interference will cause the system to drop out of the quantum state and generate random results.

This noise is minimized using two techniques:

- Operating at very low temperatures using superconductors close to absolute zero.
- Enclosing the system within an intense magnetic field (or a comparable shielding scheme) for isolation reasons.

Shielding is probably the biggest single problem in quantum computing. In practical quantum computers, total isolation would not be feasible — so error correction schemes are being developed to compensate for small amounts of interference. Much of the current research on quantum computing is focused on these error correction schemes. Averaging out errors through multiple computations is the most promising approach, because it is not clear that fundamental quantum noise can be reduced. The challenge is to achieve a runtime long enough to facilitate error correction. IBM places this threshold at 10 to 100 microseconds. Some kinds of quantum cryptography actually make use of this difficulty in maintaining the quantum state. In quantum key distribution, for example, unauthorized access to the key can be detected through observation of the destroyed quantum state.

The technology continues to attract significant funding, and a great deal of research is being carried out. However, we have not seen any significant progress on the topic over the past year and we have therefore left the technology's position on the Hype Cycle unchanged.

User Advice: If a quantum computer offering appears, check on the usefulness across the range of applications that you require. It will probably be dedicated to a specific application and this may be too narrow to justify a purchase. Check if access is offered as a service. This may be sufficient, at least for occasional computing requirements. Some user organizations may require internal computing resources, for security or other reasons. In these cases, use of the computer on a

service basis — at least initially — would offer a good foundation on which to evaluate its capabilities.

Business Impact: Quantum computing could have a huge effect, especially in areas such as optimization, code breaking, DNA and other forms of molecular modeling, large database access, encryption, stress analysis for mechanical systems, pattern matching, image analysis and (possibly) weather forecasting. "Big data" analytics is likely to be a primary driver over the next several years.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: D-Wave Systems; Delft University of Technology; IBM; Stanford University; University of Bristol; University of Michigan; University of Southern California; Yale University

Education Tablet

Analysis By: Allen Weiner

Definition: An education tablet is either a purpose-built media tablet that comes preloaded with educational content and applications, or it's customized by the hardware provider of an educational institution for use in educational settings.

Position and Adoption Speed Justification: There are two components to an education tablet: hardware and software. In some cases, as in the new Amplify, the hardware comes preloaded with selected software customized for the device's operating system (in the case of Amplify, a custom flavor of Android). It also has the ability for educators to then customize the content to their particular purpose. Amplify, for example, will act as a clearinghouse for applications and content that can be used on its tablet.

Another educational tablet model that is used by Apple (iPad), Amazon (Kindle family) and Barnes & Noble (Nook family) focuses initially on the sale of the device and then allows educators and students to select applications from a marketplace operated by the hardware provider. Each marketplace has its own rules, and given the conflicting operating systems (even the Nook and Kindle, which both use Android, are not interoperable), applications for one device cannot be used on others. The amount of customization of marketplace content is limited, but each device supports cross-platform HTML5, so content and applications built using HTML5 can be used on any tablet with a Web browser.

Yet another model used by Google (Chromebooks) and Windows OEMs, such as Dell and Samsung, is primarily hardware-focused, with each vendor offering a basic framework for K-12 and higher education, driven by vertical efforts within their companies. In the case of Google, the company highlights its YouTube, Maps and Google+ services and illustrates how they can be used in educational settings. By and large, these hardware providers do not offer much in the way of e-textbooks or related content.

Issues surrounding interoperability, building and maintaining a business case of educational-specific devices, and technology readiness at educational institutions, as well as burden of cost, are big headwinds that may trap this technology in the early stages of the Hype Cycle for many years.

User Advice: For practical purposes, CIOs must deal with hardware and software separately. Hardware issues such as compatibility with existing infrastructure, governance and cost are top priorities at the moment, and technology leaders are far from the point of making decisions about devices that united hardware and software in one neat package. Managing a new set of devices will be a major issue for already overworked CIOs.

Software is a different issue, given that it is driven in bottom-up fashion. Educators and students are making content decisions outside the office of the CIO, even further complicating decisions over educational devices, For unified hardware-software strategies to see daylight, CIOS must demand a seat at the decision-making table when it comes to issues related to content.

Business Impact: Far too many issues stand in the way of understanding the business impact of educational tablets. As the field of devices narrows, or if a major, trusted player in the education space such as Microsoft with its Surface tablet enters the picture, it will take several years for the impact to be measured.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Amplify; Apple; Dell; Google

Recommended Reading: "The Nook Reaches Beyond Reading"

"SXSWedu Puts Educational Technology Issues in the Spotlight"

"Predicts 2013: Digitalization Powers Education"

"Apple's Next Target: Reimagining the Educational Ecosystem"

Open Microcredentials

Analysis By: Jan-Martin Lowendahl

Definition: Open microcredentials are about creating ecosystems of open digital "signs" or "badges" of accomplishments that can be used by an individual to indicate skills learned, no matter the circumstance (for example, in a university or in the workplace). The ideal situation is if a claim represented by an "open credential" is verified by a relevant trusted party and attached to a secure digital identity.

Position and Adoption Speed Justification: Microcredentials in the form of various badges or "points" have existed for some time in digital social environments in general and in learning

environments in particular. The phenomenon is closely related to gamification, and has won acclaim for its use by education ecosystem players such as Khan Academy. A key problem is that these environments are proprietary and closed, which makes it difficult to display achievements outside them. The aim of open microcredentials is to remedy that problem and allow anyone to issue credentials that can be portably collected and displayed by an earner, and have a built-in a verification mechanism back to the issuers. Creating a truly open and trusted microcredential ecosystem is a challenging task, but we believe that the Mozilla Open Badge Infrastructure (OBI) project can accomplish it. Its decision to go live with Open Badges 1.0 in March 2013 is the reason we finally have chosen to introduce open microcredentials to the Education Hype Cycle. Open Badges already has more than 600 organizations issuing over 62,000 badges to more than 23,000 learners.

This merits a relatively high entry point. We expect a relatively quick uptake of open microcredentials, with closer to five than 10 years to the Plateau of Productivity. However, that speed could be hampered by issues related to identity management of individual earners and trust in issuers, as well as potentially competing ecosystems provided by players such as LinkedIn.

User Advice: For education institutions, issuing open microcredentials is a great new technology-based capability that will provide more value and motivation to students. It is a low-cost, high-value option to improve student experience. If designed properly, it can give the institution more data about its student population. Furthermore, it can build the institution's brand and help market it.

For institutions, it is crucial to set a clear policy about when it is appropriate to issue a microcredential in the name of the institution. The institution should also make sure that the verification mechanism is clear and that the graphical design of the microcredential is aligned with the brand. If possible, the institution should encourage the earner to tie the microcredential to digital identities that are not self-certified.

If the institution plans to accept microcredentials for any kind of application, staff and faculty need to be educated about how to verify microcredentials.

Business Impact: At the very least, open microcredentials bring a promise to do what the e-portfolio never quite managed. That is to create portable recognition for achievements on a global scale. This is a very good impact in itself and can improve the mobility in the workforce, leading to better fit between skills and employment. At the other end, this is another potential threat to the traditional education institutions that rely on the value of government accredited degrees. If Open Badges is a success, it will make the many emerging business models in the "All About U" scenario stronger in their competition with the "Everybody's U" scenario for the students (see "The Gartner Higher Education Business Model Scenarios: Digitalization Drives Disruptive Innovation and Changes the Balance").

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Mozilla Open Badges

Recommended Reading: "Governments Need to and Can Play a Role in the Online Claims Ecosystem"

"Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure"

Campus App Store

Analysis By: Jan-Martin Lowendahl

Definition: The campus app store is a concept modeled on the iOS App Store or the Mac App Store, but is intended only for one specific institution or school district, or a shared-service environment. The idea is that a new student or employee connects his or her own device ("bring your own device" [BYOD]) and downloads the apps relevant to his or her role. The campus app store is intended to support more than one platform.

Position and Adoption Speed Justification: Educational institutions in particular have to meet varied demand and high expectations from their users. Of the three main user groups (faculty, students and staff) in institutions, only staff can still be expected to accept a standardized workplace environment in which the institution provides both the hardware and software. However, even among the members of this group, there is grumbling in the ranks. For researchers and students, many institutions have had to accept a BYOD reality for some years, leading to various strategies for subsidizing platforms and providing software through images, DVDs or "portal" downloads to simplify the technical environment and reduce support costs.

This is especially relevant for new students bred on consumerized cloud services who each year bring with them a varied assortment of devices: All of these incoming students expect the institution's services to be at least on a par with the likes of Google and Microsoft.

In this context, several organizations, not only educational institutions, are taking the app store model to heart as a vision for achieving at least one part of a more flexible workplace for their knowledge workforces. To date, there is still no mature campus app store, but the €3 million Learning App Store project led by Universitat Oberta de Catalunya (UOC) has delivered an app store (www.learningappsstore.org) that provides a sense of what a campus app store can look like. However, the pitfalls are many if the campus app store is to enable the vision of a truly BYOD environment. In particular, several choices for device-independent standards have to be made, and several standards, such as HTML5, have to mature. A potential step forward in this regard has been taken by the IMS Global Learning Consortium — well-known for its work on education-related standards — which has launched the Educational App Store Project. The initial designs, developed by institutions such as Framingham State University in Massachusetts, UCLA and the University of Michigan, was presented in May 2013.

An alternative to the open standards approach so culturally aligned with the education community is to buy app store functionality from a vendor. Mobile device management (MDM) vendors, such as AirWatch, MobileIron, Citrix, Good Technology, SAP, Fiberlink, Symantec and BoxTone, offer app store capabilities enriched with management and security. Private or enterprise application store

capabilities can also be found in offerings from: (1) mobile application management vendors, such as Partnerpedia and Apperian; and (2) mobile application development platform vendors, such as SAP, Antenna Software and Kony. A higher-education-specific vendor example that has the capability to provide a channel for campus apps (although not campus app stores) is Ellucian, with its Ellucian Go. However, even in more-defined enterprise settings, these solutions are still in the initial stages, and additional testing is needed to apply them to a campus setting.

Although the hype concerning this technology is building quickly, the campus app store still merits a relatively early position on the Hype Cycle and a possibly bumpy five- to 10-year road on the way to the Plateau of Productivity. However, this could change quickly if standards mature, and if National Research and Education Networks (NRENs) decide that this is a worthy project for their communities.

User Advice: Although a very simple idea in theory, a true device-independent campus app store will be hard to achieve. Initially, tough choices must be made on the standards applied and the devices supported. However, it is important to strive for device independence to enable cross-platform collaboration. A service-oriented architecture (SOA) or enterprise service bus (ESB) implementation, such as that demonstrated by UOC, will most likely be fundamental for a successful campus app store. Standardization approaches, such as Macquarie University's use of HTML5-based spreadsheets for business intelligence, will probably be crucial as well.

Because of the relatively complicated requirements for a true device-independent app store, this might be a suitable community software project hosted by an NREN, such as SURFnet or Internet2 in several countries. Such a development could also help with the often-complicated procurement or legal negotiations of more popular "consumer-grade" apps or services, such as Internet2 has done with the Box storage service. The latter is a good example of how an important feature of the app store vision is to stay as close as possible to user experience of the most common consumer app stores, so that consumers' know-how can be exploited to drive down support costs.

Business Impact: Some of the initial business impact will simply come from the flexibility in meeting the demands from the increasing proliferation of consumer devices — thus, increasing user productivity and satisfaction. However, the real opportunity for business impact resides in the personalization of the set of apps used and the apps themselves. There is real promise in having a simple process for adapting the apps to the institutional context (for example, student information system data and HR data) or for providing coders and programmers, including students and faculty, with a process to easily distribute institution-specific apps.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: AirWatch; AppCentral; VMware

Recommended Reading: "Case Study: Approaching the Learning Stack: The Third-Generation LMS at Universitat Oberta de Catalunya"

"Enterprise App Stores Reduce Risk and Improve Business Results"

"The Impact of App Stores on your Application Strategy"

"Enterprises Can Apply an App Store Approach to Support Employees' Smartphones and Tablets"

"Best Practice for Software Asset Management: Take an App Store Approach to Help Manage and Chargeback Software Costs"

"Two Foundations of a Successful App Store"

"There's an App for That: The Growth of Enterprise Application Stores"

Affective Computing

Analysis By: Jan-Martin Lowendahl

Definition: Affective computing technologies sense the emotional state of a user (via sensors, microphone, cameras and/or software logic) and respond by performing specific, predefined product/service features, such as changing a quiz or recommending a set of videos to fit the mood of the learner. Affective computing tries to address one of the major drawbacks of online learning versus in-classroom learning — the teacher's capability to immediately adapt the pedagogical situation to the emotional state of the student in the classroom.

Position and Adoption Speed Justification: True affective computing technology, with multiple sensor input, is still mainly at the proof-of-concept stage in education, but it is gaining more interest as online learning expands and seeks means to scale with retained or increased quality. For example, originally pure research-oriented interest, such as the University of Memphis' Institute for Intelligent Systems with its AutoTutor, has now spawned several more practical tools, such as the open-source software (OSS) GnuTutor or Operation Aries. The latter is even commercialized through Pearson Education (as Operation ARA [Acquiring Research Acumen] http://operationara.com). A major hindrance in its uptake is the lack of consumerization of the needed hardware and software involved. It has to be inexpensively available for students, as they use their personal devices. However, products such as Affectiva's Affdex or ThirdSight's EmoVision are promising, as they enable relatively low-cost, packaged access to affective computing functionality, even if these particular products are geared toward testing media/advertising impact on consumers. Another industry that is more advanced is the automotive industry. Here, the technology has not yet found its way into mainstream vehicle production, but lightweight emotion detection — for example, being tired behind the wheel — is an option in trucks on the market today. Addressing issues such as driver distraction and driving while tired creates more awareness for mood sensing in a very practical and ubiquitous product — the car. Other research labs, such as MIT's Affective Computing Research Group, are working on sensors, such as wristband electrodermal activity sensors connected by Bluetooth to a smartphone, and software, such as the MIT Mood Meter, that assess the mood on campus based on frequency of smiles as captured by ordinary webcams. Developments like these promise to speed up the application of affective computing.

Successful affective computing will most likely involve a complex architecture in order to combine sensor input and provide an accurate response in real time. Mobile learning via cloud services and handheld devices, such as smartphones and tablets, is likely to play a key role in the first generations, with a larger market penetration due to the relatively controlled ecosystem it provides (high-capacity computing, combined with a discrete device with many sensors). As learning content (for example, textbooks) gets more digitized and is expected to be consumed on devices that have several additional sensors (for example, tablets with cameras and accelerometers), interesting opportunities arise to mash up the capabilities of, for example, Knewton's Adaptive Learning Platform and ThirdSight's EmoVision, making affective computing for untutored learning more accessible. This could potentially increase the number of data points available for statistically based adaptive learning.

This merits a small jump on the Hype Cycle, although affective computing is still in the trigger phase, with about 10 years until it reaches the Plateau of Productivity.

User Advice: Most institutions should only continue to follow the research and development of affective computing in education and other industries. However, in order to be prepared for the strategic tipping point of implementation, institutions should start estimating the potential impact in terms of possible pedagogical gains and financial impact, such as increased retention for online learning. Institutions with a large online presence, or ones that want to exploit the hype for brand recognition, should get involved now. Partner with automotive suppliers, consumer electronics companies and universities (particularly online) to further explore this field.

Business Impact: Affective computing is an exciting area with the potential to bring back a bit of the lost pedagogical aspect of in-classroom learning and increase the personalization of online learning. One important advantage of this technology is that, even if it always will be inferior to a face-to-face student-teacher interaction, it scales well beyond the more than 100 student lectures that today offer limited individual pedagogical adaptivity. A potential complement or competition to remedy the scalability problem is the social-media-based peer mentoring approach as exemplified by Livemocha and, more lately, by massive open online courses (MOOCs). In the Livemocha example, it has been shown that a sufficient scale of the community of quality subject matter mentors can be reached by tapping the full Internet community of more than 2.7 billion users.

In general, affective computing is part of a larger set of approaches to further personalize the educational experience online. Another example is adaptive learning that depends on the statistical data of learners in the same pedagogical situation. It is also related to context-aware computing in general.

The ultimate aim of affective computing in education is to enhance the learning experience of the student, which should result in tangible results like higher grades, faster throughput and higher retention. These results will benefit students, institutions and society.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Affectiva; Affective Media; IBM; Pearson Education; ThirdSight

Recommended Reading: "Business Model Innovation Examples in Education"

SIS International Data Interoperability Standards

Analysis By: Jan-Martin Lowendahl

Definition: Student information system (SIS) international data interoperability standards are the data formats needed to facilitate and even automate global student mobility.

Position and Adoption Speed Justification: Increasing political pressure, such as the Bologna Process, generally focuses on recruiting international students, and awareness of the costs associated with processing international applications has sparked activity in standardization. Earlier work, such as the eduCourse schema supported by the Shibboleth Project, has been followed by several others standards, such as Metadata for Learning Opportunities. Now, momentum is building through the vendor community's involvement. This can be seen in the actions of the IMS Global Learning Consortium and the Rome Student Systems and Standards Group (RS3G), which have initiated activities focused on international SIS interoperability. RS3G continues to work with existing EU efforts to advance needed standards, as well as raise awareness in political/ administrative circles for this important standards-related issue for improving student mobility. Most of the latest activities have been political rather than technical in nature, but actions such as the Groningen Declaration (http://groningendeclaration.net) continue to show the global interest in student data mobility. In the U.S., the Postsecondary Electronic Standards Council (PESC) is succeeding in establishing standardization efforts in several areas. The latest national activity involving PESC and Internet2/InCommon is called the Common Identity and Trust Collaborative (CommIT) project. Its aim is to "address and resolve the many challenges associated with authentication in the admissions process." Since this project is associated with the global higher education community "standard" for federated identity and access management (Shibboleth), it is likely to play a role in international student mobility. However, these activities are still at too early a stage to establish true international interoperability. As a result, SIS international data interoperability standards still merit a relatively early position on the Hype Cycle and at least a five- to 10-year road to the Plateau of Productivity.

User Advice: Institutions that expect to recruit extensively from abroad must monitor developments closely to be ready to adopt as soon as possible. Work through your vendor or consortium to establish a road map for adoption. The window during which this can be a competitive advantage is likely to be relatively small, and institutions should anticipate that not having the capability of a streamlined application process enabled by SIS standards can quickly turn into a competitive disadvantage. However, when considering this capability, it should be noted that standards usually take longer than technologies to mature and be accepted on the Hype Cycle.

Business Impact: SIS international data interoperability standards have a direct impact on the ability to recruit the right students to the right courses, as well as on costs for handling applications. The visibility and scrutiny of institutional course offerings will increase with the PriceRunner-type comparison sites that will likely develop, and it will be important to master the factors that lead to

applications from the "right" student profiles. In particular, interoperability of student data will enable a higher degree of process optimization, driving down both cost and risk. Standardization at this level will also facilitate economies of scale of administration through shared services, which will benefit the national or state education system. In addition, it will facilitate big data projects that, because of SIS international data interoperability standards, will have to spend far less time on data normalization and data cleaning. Experience from big data projects could also be fed back into the SIS standards to improve the predictability of big data.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Recommended Reading: "Findings: Bologna Process Demands True International Student and Course Data Standards in Higher Education Throughout the EU"

"Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure"

BPO

Analysis By: Jan-Martin Lowendahl; Terri-Lynn B. Thayer

Definition: Gartner defines business process outsourcing (BPO) as "the delegation of one or more IT-intensive business processes to an external provider that, in turn, owns, administrates and manages the selected processes based on defined and measurable performance metrics." BPO offerings are categorized in two major categories: horizontal offerings (those that can be leveraged across specific industries) and vertical-specific offerings (those that demand specific industry vertical process knowledge).

Position and Adoption Speed Justification: Horizontal BPO is an established service in areas such as payroll and benefits management. Although it is used by education institutions, it still has not penetrated the education market to the same degree that it has the commercial market. Gartner's most recent survey shows that about one-quarter of respondents use traditional BPO.

There exists some confusion in institutions regarding the criteria and crossover between BPO, outsourcing, software as a service (SaaS) and cloud offerings. In BPO, operational decisions are made by the vendor, with the desired ultimate outcome/results specified by the institution via the contract. Here, we discuss vertical-specific education BPO. Education BPO includes offerings such as admissions, grant management, institutional research (aka business intelligence) and online academic programs.

Vertical-specific BPO is still a relatively new phenomenon, at least as a commercial offering. Few institutions have had the chance to try this new service, but the interest is increasing among clients. Because process maturity is generally low, and due to the caution traditionally found among education institutions, this is a slow mover on the Hype Cycle. However, financial pressure and early successes can change this prediction. One of the areas in which BPO in education is gaining

ground is financial aid processing in the U.S. This process requires a high degree of automation, a "bubble" of staff at specific times in the academic year, and integration with the basic student information systems (SISs) of the institutions. There appears to be no overwhelming leader, but there are numerous local/metropolitan area vendors. Two fairly high-profile examples of BPO by the University of Canberra in Australia and the University of Middlesex in London have demonstrated good results, especially in the area of student administration. In both cases, the BPO vendor, without previous higher education knowledge, achieved process improvements as well as cost savings. BPO is still relatively early in the Hype Cycle, and we still expect it to take five to 10 years to reach the Plateau of Productivity, but with the above examples in mind, BPO takes a longer jump on the 2013 Education Hype Cycle than on previous ones. Furthermore, if the disruption of the education ecosystem outlined in "The Gartner Higher Education Business Model Scenarios: Digitalization Drives Disruptive Innovation and Changes the Balance" plays out as envisioned, then BPO will be a strategic capability in the Everybody's U scenario and the speed of uptake will be increased.

In education, K-12 lags behind with regard to BPO. A "not invented here" syndrome persists, and concerns about privacy holds BPO back. The growth of BPO has been impeded by the slow economy, which has meant that school agencies continue with legacy solutions and depend on existing staff to meet business needs, even when those needs change.

User Advice: Education BPO is an interesting offering that is well worth investigating for reasons of quality, cost and focus of core resources. However, institutions considering it need a good understanding of their processes in general and process interfaces in particular, and should do a phased transition. In addition, CIOs should have a comprehensive understanding of their service portfolios before they consider outsourcing business processes (understanding, of course, that the impetus for many of these initiatives begins with the business side, not the professional IT organization). Established skilled resources for vendor management are a must. A clear understanding of privacy legislation and intellectual property rights (especially their safeguarding), as well as basic metrics, must be in place before a contract can be signed. One interesting lesson learned from the cases discussed above is that the BPO vendor brought expertise in process design that considerably improved university processes. Such a change could not have been done from within due to resource constraints and an inability to think "outside the box."

Business Impact: The effect on the institution depends on the process chosen for BPO and the reasons for it. It is likely to assume that the effect will be mostly in the areas of efficiency and quality improvement. However, for areas such as institutional research (aka business intelligence), the effect can be strategic if it leads to more timely access to higher-quality data.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: 2U; Ellucian; QuScient Technologies; Wipro

Recommended Reading: "Gartner Higher Education Sourcing Survey 2009: What, How, How Much and Attitudes?"

"Higher Education 'Business Model' Scenarios: 'Everybody's U': Scale of Market"

"Higher Education 'Business Model' Scenarios: 'All About U': Speed to Market"

"Case Study: University of Canberra Achieves a Step Change With Offshore Outsourcing"

"The Gartner Higher Education Business Model Scenarios: Digitalization Drives Disruptive Innovation and Changes the Balance"

Open-Source SIS

Analysis By: Terri-Lynn B. Thayer

Definition: Open-source higher education student information systems (SISs) are developed via open-source or community source models.

Position and Adoption Speed Justification: Open-source SIS has the potential to be part of a nonproprietary and highly customizable, higher education administrative application suite or a best-of-breed solution. However, features, functionality, processes, integration and support issues are still largely undefined. A promising, but complex, offering is the Kuali Foundation's open-source SIS, Kuali Student (KS). The first module developed was curriculum management; the foundation released the 2.0 version in January 2013. Internationalization of the curriculum management module is also underway. Several schools are in production with this module and several more are in varying stages of implementation. The system is modular in design and is intended to be implemented using a phased approach. The next modules on the road map include academic planning, course offering, student registration and student accounts, with anticipated availability in 2014. Financial aid functionality is planned for 2014-2015; however, admission functionality is not yet on the road map.

Kuali Student and the Kuali Foundation have faced previous setbacks related to partner institutions dropping out and the exhaustion of grant funding. Despite these uncertainties, the Kuali Foundation now appears to be stable, as shown through progress in developing systems, as well as an active user community. However, development of modules has been slow and the development of the fuller suite of student functions is expected to take several years. As with any community source project, adding partners would shorten the timeline, and losing partners would lengthen the timeline.

Note, however, that the Kuali Foundation's successes in forging partnerships with an ecosystem of commercial vendors to contribute to and support the Kuali offerings are extremely important positive steps. This strategic move has provided institutions that wish to adopt a Kuali offering with a method of consistent and professional support — something that, when lacking, has negatively impacted the adoption of some previous open-source initiatives. Another positive development is the Kuali mobility initiative, which continues a commitment to foundational infrastructure components intended to support the broader set of Kuali modules.

The growing success of other Kuali systems, for instance, the Kuali Coeus research administration system, coupled with the recent Indiana University success with its Kuali Financial System implementation and the resulting announcement attributing significant cost savings to the university, has given a boost to Kuali's acceptance. However, despite these successes, the impact rating is low at this point, pending the ultimate creation of a full system with all relevant modules. Adoption will, of necessity, be only incremental as modules are released and until a full system is available.

Other positive trends include the moves of several European national SIS consortia toward open-source software (OSS) or community source licensing, even if there is hardly a community of a critical mass of skills. However, there is the potential for collaboration among the different initiatives if the momentum builds for interoperability components, such as OSS higher education middleware suites and SIS international data interoperability standards. Also of note is the growing international user base, particularly in K-12, of openSIS from OS4Ed.

User Advice: OSS for SIS is in its early stages and should be monitored for future development. This part of Kuali Student should probably have fewer issues with national regulations, and internationalization is planned and likely will be more easily achievable than the Kuali Financial System for this reason.

Unless users fully intend to develop the staff resources necessary to implement and support their own versions of a Kuali system, they should make sure that there is a viable commercial support partner in their locales for implementation and long-term support of KS. It is also notable that there is at least one commercial partner who is offering hosting options.

Business Impact: Student administration, and possibly integration with e-learning platforms and administrative back-end systems (for example, finance and human resources/payroll), are areas that will be affected. Although lower licensing costs are an advantage of commercially supported open-source offerings, additional benefits include user control of the code and lack of vendor lock-in. As vendors continue to open their systems and commercial bolt-on products become available, the entire ecosystem of administrative applications will be positioned to be more cost-effective and contribute a more positive ROI to institutions.

Benefit Rating: Low

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Kuali Foundation; OS4Ed

Recommended Reading: "Student Information Systems in the North American Higher Education Market"

"Overview of Kuali Administrative OSS Offerings for Higher Education"

"Student Information Systems in the North American Higher Education Market"

Student Retention CRM

Analysis By: Terri-Lynn B. Thayer; Marti Harris

Definition: Student retention CRM is defined as applications used by higher education institutions to identify and engage at-risk students, assess their progress as their risk is noted, create and track engagement plans, and enable successful intervention strategies. Some of these applications are mainstream CRM, and others were not originally designed as CRM applications but evolved from other education sector applications.

Position and Adoption Speed Justification: Student retention CRM is the centerpiece of the three CRM types in higher education, bounded on either side by the student enrollment CRM at the beginning of the student life cycle, and alumni development CRM at the end of the student life cycle. Student retention CRM applications are relatively new. Their functionality is a combination of analytics for assessing the risk of withdrawing, combined with the workflow tools for helping students so that they maintain registration and academic progression. These applications make increased use of social software to engage the students and are employing techniques used in alumni development. These CRM systems are embryonic but are developing rapidly due to the increased emphasis on retention rates and the increased scrutiny of costs and outcomes of postsecondary education. It is expected that the more sophisticated techniques used to engage prospective students at the beginning of the student life cycle and those techniques to engage alumni at the end of the student life cycle will move into the matriculation phase of the life cycle at an increasing rate. The previous tendency in higher education to let students sink or swim is changing. The emphasis on retention began at for-profit institutions, but is moving into the state-sponsored and private not-for-profit institutions due to this increased oversight and attention. Institutions are also increasingly taking an institutional view of the student life cycle and bringing together campus stakeholders to unify or limit CRM solutions across the academy. Administrators are interested in a mounting array of analytics to track reasons why students leave the institution, including those that are not related to academic achievement. These systems may interface with big data initiatives for increased retention and student outcomes through improved curriculum design.

Although the adoption rate of student retention CRM is low, it is growing and should continue to do so as a result of this increased focus.

User Advice: It is often easier and more cost-effective to retain a student than to recruit a replacement.

Users should consider the increases in student retention functionality in this area by the student information system vendors and learning management system vendors, but they should also watch the continued development and sophistication of the independent third-party systems in the education ecosystem. Additionally, established CRM vendors are increasingly licensing their platforms as the foundation for higher-education-specific products. Buyers should carefully assess not only the functions provided in this area by learning system vendors in measuring academic engagement and success, but should determine how these retention systems address nonacademic factors, such as student financial pressures, student behavioral problems, and student adjustment and maturity issues — all of which can have a significant effect on retention rates.

Business Impact: In addition to the obvious social good of helping students to be successful and to receive value for their tuition and fees, it is often a good financial decision to implement a system that helps to retain students and to stop the "bleeding" of revenue from student-based tuition and fees. These systems will assist the institution in maximizing the student lifetime value to the institution.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Ellucian; GradesFirst; Oracle PeopleSoft Enterprise Campus Solutions; Starfish Retention Solutions

Citizen Developers

Analysis By: Ian Finley

Definition: A citizen developer is a user who creates new business applications for consumption by others using development and runtime environments sanctioned by corporate IT. In the past, end-user application development (AD) has typically been limited to single-user or workgroup solutions built with tools like Microsoft Excel and Access. However, today, end users can build departmental, enterprise and even public applications using shared services, end-user-oriented development platforms and cloud computing services.

Position and Adoption Speed Justification: In an era of shoestring IT budgets, businesspeople are increasingly looking outside the IT organization for AD and building an increasing number of applications themselves. Today's rapidly changing business climate demands greater application agility and IT's timelines for AD are often too long to meet business needs. Although agile development methodologies can help IT respond to business needs more rapidly, a lack of resources often prevents a rapid IT response. Furthermore, resource constraints force IT AD groups to focus on only a few high-priority applications. Consequently, the long tail of applications needing development grows still longer. Finally, the tacit knowledge of businesspeople is often difficult to translate into project requirements, making IT AD projects slow and time-consuming for business end users. Sometimes it is faster, less expensive and better for end users to build the applications they need, rather than engage the IT AD group to do it.

These issues have existed for some time, but end-user developers are empowered by new forces, including the evolution of developer tools, the industrialization of infrastructure through cloud computing and changing workforce demographics. Many smaller vendors, and some very large ones, like Microsoft and salesforce.com, now provide powerful developer platforms that make it easier for end users to develop their own applications, even applications that used to require IT AD skills. Often cloud-based, some of these tools can operate completely outside IT's view, requiring only a browser and credit card to build, deploy and run an application available to anyone with access to the Internet. Finally, the growth of consumer computing has taught many in the workforce they don't have to wait for IT to provide the hardware or software needed to do their jobs. By one

estimate, in 2012, there were three times as many workers that "program as part of their work" as professional programmers. The result of these combined forces is more end-user developers creating more applications of greater scope.

Citizen development is end-user AD with IT's blessing and support. In the past few years, we've seen an increasing number of IT organizations looking to address the challenges and harness the opportunities of end-user development by implementing citizen developer programs. We have also seen an increasing level of interest from vendors looking to provide platforms that can help IT organizations transform uncontrolled end-user development into managed citizen development. Although not yet at the Peak of Inflated Expectations, interest in citizen developers continued to grow during the past year.

User Advice: Although end-user AD has operated under the radar for years, IT now needs to engage with end-user developers more actively to enable them to be good citizen developers. The new, more powerful applications that end users are building have the same risks and rewards as some professionally developed applications, and they need an appropriate level of quality, security, performance and availability. Ignoring or attempting to prevent end-user development carries high risks and limits enterprise innovation. Instead, IT should implement a citizen developer program to help end users be safe and innovative developers. Specifically, IT should:

- Embrace AD outside IT — Actively challenge and dismantle negative IT attitudes toward end-user AD. "Shadow development," away from IT oversight, generally occurs when working with IT is too slow, restrictive or expensive to meet business needs, not because end users are capricious or malicious.
- Set clear boundaries — Be proactive and engage with the business to design a citizen developer program that meets both business and IT needs. Make sure the rights and responsibilities of IT, the citizen developer and the business are clearly defined.
- Enable safe and effective end-user AD — Don't just roll out IT's tools to businesspeople. Instead, offer sanctioned development platforms that are end-user-friendly and allow IT staff to manage and monitor citizen development. Extend user support to include citizen development, and measure progress in the volume and sophistication of citizen-developed applications.
- Trust but verify — Provide just enough governance so that IT can review the quality, security, performance and availability of major end-user applications before they are deployed. Implement monitoring to detect end-user applications that could create risks for the enterprise, and develop procedures to handle them. Create a protocol for transferring responsibility for risky and problematic applications to IT.

Business Impact: A citizen developer program that includes IT guidance; IT-supported, end-user-oriented AD platforms; and just enough governance can create a safe environment for end users to unleash their innovative potential. By engaging with end users and helping them help themselves, IT can accelerate the exploitation of new technology, help end users create competitive advantage and new business innovations, and reduce the risks of modern end-user development.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: LongJump; Microsoft; Oracle; salesforce.com; TrackVia; VMware; Zoho.com

Recommended Reading: "Citizen Developers Are Poised to Grow, 2011"

"Case Study: Citizen Developers Can Help Business Keep Pace"

"New Developers Can Help Deliver More"

At the Peak

Learning Stack

Analysis By: Marti Harris

Definition: A learning stack as an architectural construct is a collection of elements, such as applications, personal productively tools, Web 2.0 applications, content repositories and data sources, that, for example, can be accessed through a social learning platform. The learning stack is dynamic. Elements can be added, updated, removed and replaced in the open structure of the social learning platform.

Position and Adoption Speed Justification: The development and adoption of the learning stack concept will follow the adoption of the open structure of social learning platforms. As the learning platform becomes more generic, the learning stack and the elements in the learning stack can become more specialized to academic subjects, in addition to including general-purpose elements. An element in the stack that is subject-specific may be accessed through the learning platform by a specific group of users. General-purpose elements in the stack could include Web 2.0 applications and collaboration tools available to all users of the learning platform. The uptake of the use of the learning stack is dependent on the move away from point solution learning systems and toward a social learning platform.

User Advice: When looking to replace learning systems with next-generation social learning platforms, continue to examine the open structure of learning platforms and its ability to support the learning stack concept. This will ensure strategic decisions can be made regarding the choice of platform and elements in the learning stack. Institutions that have introduced applications suites, such as Office 365 and Google Docs, should consider their placement within the learning stack.

Business Impact: Providers of learning platforms need to offer an open structure to meet user expectations for easy access to collaboration, communications and content within their learning environment. Publishers of educational digital content will find new opportunities to present subject-specific applications as elements in the learning stack. Students will have more access to elements within the learning stack to allow for bottom-up use of learning platforms without requiring faculty members to direct learning activities. If the use of massive open online courses (MOOCs) becomes

a part of the students' profile of learning content, then inclusion in the learning stack should be considered.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Adaptive E-Textbooks

Analysis By: Allen Weiner

Definition: An adaptive e-textbook offers a reading experience that personalizes the learning process in higher education. Powered by technology such as that from McGraw Hill's SmartBook, an adaptive e-textbook draws from personal and aggregated learning data to customize student interactions with the digital content.

Position and Adoption Speed Justification: The concept of adaptive learning dates back to the 1950s with the introduction of artificial intelligence and computers playing a role in education. As IT has evolved, computers have become smaller, more powerful and less expensive. With this evolution, adaptive learning is being implemented in classroom learning, distance learning and tutoring scenarios. Such companies as Sherston Software, Carnegie Learning, Knewton and Pearson (SuccessMaker) offer adaptive learning systems and applications, making this form of personalized learning relatively mainstream.

E-textbooks are a recent newcomer to the world of adaptive learning. Only a few entrants, most notably Kno (KnoMe) and McGraw-Hill (SmartBook), have ventured into this application of adaptive learning. Both use data gathered from individual student behavior, as well as the aggregate behavior of others who have used the same material to offer a student a personalized learning path based on his or her interactions with the digital e-textbooks. SmartBooks was created in partnership with Area9 (which McGraw-Hill now owns a 20% stake in), a Danish software developer focused on adaptive learning solutions.

Adaptive textbooks show great promise, but this technology has a considerable way to go to become mainstream: Issues around the amount of data and privacy remain, as well as the cost of customized development required to build adaptive e-textbooks at scale.

User Advice: Adaptive e-textbooks pose an interesting issue for CIOs in education related to the data needed to bring out the full capabilities of these new digital learning tools. Some of the data — as in the case of a student's interaction with a given e-textbook, can be gathered in the cloud by the e-book publisher, but other data streams (longitudinal data) must be provided by the educational institution and then incorporated into the e-textbook. This challenge is a nontrivial matter for IT departments. Such data integration may become easier over time, with the advancement of such services as InBloom. For now, proceed with great caution.

Business Impact: For publishers, adaptive e-textbooks show a great deal of promise. Most of the larger educational publishers have the resources to invest in building adaptive e-textbooks (case in

point, McGraw Hill). These rich digital textbooks could allow educational publishers to halt the erosion of existing revenue, as well as show value against lower-cost and free resources.

Benefit Rating: High

Market Penetration: Less than 1% of target audience

Maturity: Embryonic

Sample Vendors: Kno; McGraw-Hill

Recommended Reading: "The Emergence of 'Mashware' Points to a New Digital Resource for Educators"

"SXSWedu Puts Educational Technology Issues in the Spotlight"

"Cool Vendors in Education, 2013"

"CIOs Should Clarify Roles and Responsibilities of IT for Cloud Applications in Higher Education"

Big Data

Analysis By: Jan-Martin Lowendahl; Bill Rust

Definition: "Big data" in general is defined as high-volume, high-velocity and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making. Big data in education is associated with collecting vast amounts of data from students' digitized activities and transforming that into information and producing or recommending actions aimed at improving learning outcomes.

Position and Adoption Speed Justification: Big data in higher education, in general, has been around for decades, mainly focused on research. It started with large datasets in empirical and field research and subsequently added huge datasets from fields such as astronomy, and computational and bioinformatics research. However, big data in education is more recent, and has been enabled by more and more of our lives being lived and recorded online. Examples include student information systems (SISs) for grades and demographics, and learning management systems (LMSs) for learning and Facebook for social interaction.

Harvesting this data in sufficient volume and detail can enable the vision of new correlations and, above all, establish the statistical significance between actions and outcomes. CRM systems can go from providing just early warning to optimal fit (which and how many courses in which type of institution), and learning platforms can go from "one size fits all" to adaptive learning. Herein resides the promise of a more intelligent evolution of the education ecosystem that can remedy the failure of Industrial Age education to address differences between and among students' learning characteristics.

The Predictive Analytics Reporting (PAR) Framework project run by the Western Interstate Commission for Higher Education (WICHE) Cooperative for Educational Technologies and the

adaptive learning tools created by Knewton and Carnegie Learning are examples of capabilities based on proprietary big data. In addition, MyFit (acquired by Naviance — see "Cool Vendors in Social Software and Collaboration, 2010") offers an innovative way of harvesting self-reported data on Facebook and, for example, turning it into advice when choosing a college. The big data trend will introduce particularly interesting dynamics in the education ecosystem, since in order for big data to be really effective, the dataset must be bigger than most institutions can collect on their own. Already, the PAR Framework project combining data from big traditional universities, community colleges and for-profit organizations is an interesting example. It now has more than 1.7 million student records from 16 institutions and is looking for more participants (up from six institutions and 600,000 students records only a year ago). The PAR Framework project's release of the data definitions as a Creative Commons license is a major step forward and a possible competitive advantage over commercial competitors such as Civitas Learning (see "Cool Vendors in Education, 2013"). Will that collaborative trend gain traction, or will competition kill this initiative? Will similar collaborative efforts such as exemplified by inBloom take root in big, national K-12 systems, where data ownership is clearer? What are the implications for privacy laws? Where should the line for anonymization be drawn to be useful for good statistical correlation, as well as for personalized feedback, while allowing for privacy?

A clear endorsement that national governments expect much from big data has come from the U.S. Department of Education. There, multimillion-dollar grants are given to individual states to develop Statewide Longitudinal Data Systems. Moreover, the Department of Education's draft issue brief, "Enhancing Teaching and Learning Through Educational Data Mining and Learning Analytics," is intended to inform education stakeholders about how big data can be applied within online learning systems to support educational decision making.

Big data is at the Peak of Inflated Expectations, and first-generation experience is starting to emerge. There is a possibly bumpy five- to 10-year road on the way to the Plateau of Productivity and mainstream adoption. However, that can change quickly if standards mature, and if there is sufficient interest and funding from national and state governments.

User Advice: Many higher education institutions can draw on previous experience with big data in the research community. Meeting the computational needs for handling big data should not be a problem, based on experience with high-performance computing, grid computing and, now, cloud computing. The bigger challenge resides in categorizing the data; making sense of the data, based on plausible theories or hypotheses; and avoiding pseudocorrelation, which is always a problem in these kinds of statistical analyses. However, again, this is not new to the higher education community, and research methodologies exist. There is less experience with large datasets in K-12 education, and an additional impediment in the fear, uncertainty and doubt expressed by stakeholders — especially parents — regarding the possible use of the data by those outside their immediate educational community.

From a practical standpoint, international collaboration would be immensely facilitated if there were more open standards developed for big data. Examples include SIS International Data Interoperability Standards, Metadata for Learning Opportunities and the opening up of the proprietary standards behind, for example, Knewton's knowledge graphs. The PAR Framework published under a Creative Commons license is a particularly good example of how collaboration

can be facilitated using simple established open-source licenses. A caveat in this context is that ownership and privacy issues are potentially huge and must be taken seriously.

Business Impact: Big data is another piece of the puzzle in solving the biggest problem that faces education today: cost-effective scalability with retained and, preferably, improved quality. Being able to offer the right courses and programs (learning opportunities), as well as testing pedagogical approaches to increase grades and examination pass rates (improving learning outcomes), based on statistically valid big data, would be invaluable to students and society as a whole. Using big data to finally break the logjam of student progress created by the archaic (if not arcane) seat time requirements in K-12 education will pay immediate returns in the efficient and effective delivery of instruction.

Benefit Rating: Transformational

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Civitas Learning

Recommended Reading: "The Expanding Education Ecosystem: A World of Choice"

"Cool Vendors in Social Software and Collaboration, 2010"

"Cool Vendors in Education, 2012"

"Cool Vendors in Education, 2013"

"The Importance of 'Big Data': A Definition"

"A Quick Look at Big Data in Education, 2012"

Gamification

Analysis By: Brian Blau; Brian Burke

Definition: Gamification is the use of game mechanics and design to drive engagement in a target audience for nongame purposes to achieve a target business outcome. Many types of games include game mechanics, such as points, challenges, leader boards and incentives, that make playing games enjoyable. Gamification applies these game mechanics to motivate the audience to higher and more meaningful levels of engagement. Humans are "hard-wired" to enjoy games and have a natural tendency to interact more deeply in activities framed in a game construct.

Position and Adoption Speed Justification: Gamification is used to change behavior, develop skills or drive innovation. Some examples of gamification's many uses include customer engagement, education, employee performance, innovation management and healthcare. While the concepts behind gamification are not new, its first use in 2007 coalesced specifically around using game mechanics derived from video games. Today, gamification is gaining traction in the

enterprise. But its current "sweet spot" is the consumer market, which has the most deployments and gamification is integrated into marketing campaigns, customer loyalty programs, product design of mobile apps and services, and is intended to increase customer interaction and engagement. The fastest-growing segment of gamification is internal-facing enterprise uses, in which it is deployed to increase employee engagement in areas like training, innovation management, collaboration and employee performance. This trend is set to accelerate as larger vendors, such as salesforce.com, begin to integrate game mechanics and analytics into their software offerings.

Early adopters, such as consumer brands and services, and mobile apps, show that gamification has had significant positive impact on user engagement rates when applied in a suitable context. However, gamification also has significant challenges to overcome before widespread adoption occurs. Designing games is no easy task — during four decades of video game development, many games have failed despite developers' best intentions. A basic level of game mechanics (points system, leader board, achievements, awards or basic challenges) is often not enough to sustain increased engagement, as incentives and rewards must be aligned to motivate the target audience. Gamifying activities represent another challenge, one that requires careful planning, execution and iteration. Overcoming these challenges will require successive integration of gamification in a wide variety of consumer and enterprise scenarios.

User Advice: Gamification can increase user interactivity and change behaviors, resulting in greater user engagement. When fun is built into the interaction model, users are more likely to continue to engage. Gamification has many uses that target consumers, customers, employees or any other defined audience, and it impacts many areas of business and society.

Organizations planning to leverage gamification must clearly understand the target audience they intend to engage, what behaviors they want to change, what motivates the audience and maintains their engagement, and how success will be measured.

Gamification technology comes in three forms;

- General-purpose gamification platforms delivered as software as a service that integrate with custom-developed and vendor-supplied applications
- Purpose-built solutions supplied by a vendor to support a specific usage (for example, innovation management or service desk performance)
- Purely custom implementations

Organizations must recognize that simply including game mechanics is not enough to realize the core benefits of gamification. Making gamified solutions sufficiently rewarding requires careful planning, design and implementation, with ongoing adjustments to keep users interested. Designing gamified solutions is unlike designing any other IT solution, and it requires a different design approach. Few people have gamification design skills, which remains a huge barrier to success in gamified solutions.

Enterprises trying to encourage new employee behaviors can use gamification as motivation. Organizations are beginning to use gamification as a mechanism to inspire and reward new

initiatives, and to recognize contribution and participation that augments and furthers the purpose of their businesses and their customer communities. Implementing gamification means matching player goals to target business outcomes to attract and sustain a deeper level of interactivity, relationship or engagement with users.

Business Impact: Gamification techniques can be used in a wide range of scenarios to enhance product and service strategies. Its use is relevant, for example, to marketing managers, product designers, customer service managers, financial managers and HR staff, whose aim is to bring about longer-lasting and more-meaningful interactions with customers, employees or the public.

Although gamification can be beneficial, it's important to design, plan and iterate on its use to avoid the negative business impacts of unintended consequences, such as behavioral side effects or gamification fatigue.

User engagement is at the heart of today's "always connected" culture. Incorporating game mechanics encourages desirable behaviors, which can, with the help of carefully planned scenarios and product strategies, increase user participation, improve product and brand loyalty, advance learning and understanding of a complex process, accelerate change adoption, and build lasting and valuable relationships with target audiences.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Badgeville; BigDoor; Bunchball

Recommended Reading: "Technology Overview for Gamification Platforms"

"Business Model Games: Driving Business Model Innovation With Gamification"

"Gamification: Engagement Strategies for Business and IT"

"Best Practices for Harnessing Gamification's Potential in the Workplace"

"Gamification: The Serious Side of Games Can Make Work More Interesting"

MOOC

Analysis By: Marti Harris

Definition: The massive open online course (MOOC) is an online phenomenon made possible by: (1) social networking facilitation of acknowledged experts in a field of study, (2) freely accessible online resources, and (3) hundreds to thousands of registered students. MOOCs have free (no fee) open enrollment to anyone anywhere with network access. Students self-organize their participation in a MOOC.

Position and Adoption Speed Justification: The marketing or knowledge of a MOOC spreads through social networking. Usually, a central Web address is used to consolidate registration, to post a suggested schedule, and to provide support and communications spinoff activity, such as blogs or Twitter feeds. The resulting networks of students and the spinoff discussions become as important as the MOOC topic covered.

MOOCs share some traditional course conventions, such as predefined course timelines and weekly topics. Speed replaces traditional hierarchical structures and associated pedagogical relationships. What we thought we knew about sequence in teaching and learning is being challenged. New findings are being collected as MOOCs continue to develop and evolve. The year 2013 has seen an increase in university MOOC participation globally. However, 2013 has also brought evolving business models, fees and credit discussions, leading MOOCs toward more traditional higher education online offerings. We expect MOOC business models to continue to evolve to become more sustainable.

Although MOOCs will challenge traditional universities' business models, one reason for institutions to offer MOOCs is the potential big data about teaching and learning they can gather. Much remains unknown about MOOC students, such as age, location and even financial need, which will require additional research beyond the usual demographic categorization. Flipped classroom discussions and experiences are on the increase due to MOOCs' content availability.

Examples of MOOCs include Coursera, Udacity, Khan Academy, edX and Udemy. It is reasonable to assume there are additional MOOCs yet to gain full awareness within social networks.

User Advice: To educators, MOOCs present challenges:

- View MOOCs as three opportunities: product (content), process (marketing, organizations) and platform (social collaborative learning platform)
- "Where's the money?" — Everything has a cost and a price tag. Will institutions of higher education support (pay) their faculty and in-house experts to offer MOOCs?
- Do MOOCs offer sustainable teaching or learning opportunity?

IT decision makers should:

- Enroll in a MOOC to gain insight into the phenomenon so they can join faculty and administrative MOOC discussions.
- Begin to assess the IT cost to provide technical support in areas that may impact their institutions, especially in light of the lack of tuition and fees that are not collected for MOOC offerings.
- Determine if their current learning management system (LMS) provider is offering a MOOC model for pricing- and cloud-based single-course offerings. Most are making positive movement toward matching MOOC opportunity and, in some cases, also meeting the non-fee-based models.

It is too early to know the skills needed to survive and succeed as a MOOC student or faculty expert, but a MOOC provides the social ecosystem to explore what these skills will be. The long-

term success of MOOCs cannot yet be determined, since the MOOC phenomenon has just passed the Peak of Inflated Expectations. The next two years should deliver a more sustainable learning offering with or without the MOOC acronym.

Business Impact: The business impact of MOOCs is changing just as MOOC organizations strive to address the cost of authentication and potential credit offerings. Economic and social drivers speed the increased acceptance of MOOCs. The financial impact on higher education institutions with traditional budgeting sources will be significant. Established learning platform providers must address how to complete with a model not based on full-time equivalents, head counts, and traditional license business models if they plan to complete in the MOOC market.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Coursera; EdX; Khan Academy; Udacity; Udemy

Recommended Reading: "Higher Education Must Prepare for the Growing Influence of MOOCs"

Social Software Standards

Analysis By: Nikos Drakos

Definition: Social software standards are protocols and data formats that have been agreed on by industry bodies or are, in practice, used by several products or services to support interoperability and for data/service access between social software environments.

Position and Adoption Speed Justification: There are many formally agreed-on or existing social software standards, but none have been universally adopted. Some of the most notable are:

- **OpenSocial.** This API is managed by the OpenSocial Foundation (see www.opensocial.org) and enables websites and applications to access profile, relationship, activity and other social network data in any social networking environment that supports it. Apache Shindig is an open-source reference implementation of OpenSocial. The latest version is OpenSocial v.2.5, published in August 2012, which introduced support for a common set of services (Common Container), enhanced control over the user interface, and a more complete metadata API.
- **ActivityStrea.ms.** This provides serialized access to social events, using the JavaScript Object Notation (JSON) format or an XML Atom syndication format.
- **OpenID.** This decentralized authentication standard enables users to log in to multiple websites or online services using the same identity. Other single sign-on mechanisms supported by many online services include Facebook Connect and Google Accounts.
- **OAuth.** This is a mechanism for authorizing access to secure RESTful APIs (see Recommended Reading section for more on OAuth and OpenID).

- **Service-specific APIs and protocols.** Dominant social networking platform providers each have different ways to access, embed, or inject content and services into other applications. For example, Facebook offers its Graph API, plug-ins, markup and the Open Graph protocol, which enables the integration of external objects (for example, websites) into Facebook, or into other social applications that support this protocol (see facebook.com (api), facebook.com (opengraph) and ogm.me). Similarly, Google offers its Google+ APIs (see google.com). Given the prominence of some providers, their proprietary integration APIs and protocols are likely to have a more significant impact on the market than agreed standards.

In addition to these standards, which deal with authentication, profiles, connections and activity, other standards are commonly found alongside them in implementations of social applications and platforms. These include common Web-related standards and protocols — such as HTTP and JSON — as well as other infrastructure and transport protocols (such as XMPP). A more comprehensive list of social Web standards is maintained by the World Wide Web Consortium (W3C) as part of its overall stewardship of Web standards (see WC3).

In general terms, available standards typically define lower-level functions, which certainly help with a degree of interoperability and data exchange between an external application and a social media platform. However, further ambitions of seamless migration or service federation between social media platforms remain elusive.

User Advice: Users should monitor agreed-on industry standards and de facto standards, and use them where available and appropriate. They should also encourage their vendors to support these standards in their products. OpenSocial and ActivityStrea.ms support is becoming more noticeable in business social software suites, but due to selective implementations, vendor support for these social specifications and standards should be treated as "nice to have" and not a "must have" capability.

To boost interoperability, users should also become familiar with foundation technologies such as JSON, which will underlie future interoperability standards in social platforms.

Business Impact: Standards can be used to design more flexible, open and user-friendly services for customers or employees, as well as to reduce dependence on a single software or service vendor. However, the impact of these standards will be limited, as vendors of enterprise social software implement them selectively in their products, making them relevant to a small number of specialized scenarios.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Facebook; Google; IBM; Jive Software; OpenID Foundation; OpenSocial Foundation

Recommended Reading: "Hype Cycle for Identity and Access Management Technologies, 2012"

Wireless aaS

Analysis By: Jan-Martin Lowendahl

Definition: Wireless as a service (WaaS) in the education context is when an institution buys wireless services from an external service provider to complement or replace its own network access.

Position and Adoption Speed Justification: As more and more education, research and administrative services are delivered as IT services, reliable network access has become not only fundamental, but also critical. Furthermore, we see several clients struggling with infrastructure upgrades just to keep up with demand in both bandwidth and access as a result of changes in user patterns, such as bandwidth-hungry lecture capture and retrieval services and IP address, as well as access-point-hungry mobile devices. However, the real challenge is not campus access; it is mobile learning, which brings with it another dimension in scale. Both researchers and students have come to expect a seamless "anytime, anywhere" access to institutional IT services, much like telcos' subscription packages and Web consumer services. With the increasing dependence on hybrid and online learning, the institution faces the challenge of how to ensure scalable quality access and support for students beyond the confines of the campus.

WaaS has existed for some time, predominantly as a consumer-grade service based on 3G, and many institutions have negotiated deals with telcos to provide or subsidize network access as a part of a mobile phone subscription. 3G networks have not had enough capacity and coverage area to be a real alternative to Wi-Fi. However, the recent launch of 4G, together with corporate subscription services from a few telcos, provides new opportunities to offer students and researchers the cost-effective ubiquitous bandwidth access they expect. Some telcos even offer platform as a service (PaaS) as an alternative to run institution-specific applications, which further spreads the risks and increases the options for load balancing and business continuity. Further developments in which National Research and Education Networks (NRENs) act as "trusted brokers" and introduce services like Janet 3G, are expected to accelerate WaaS adoption. When an NREN acts a trusted broker to sort out legal, contractual and education-specific security issues and build on established authentication services, such as eduroam (educational roaming), the barrier to adoption is lowered considerably.

It is still relatively early in terms of 4G infrastructure rollout and the maturity of contract conditions globally, but we expect a fast-maturing service as students represent an interesting and important market segment. We see increased interest among CIOs to adopt WaaS as a backup to campus Wi-Fi as WaaS becomes accepted as an alternative.

Altogether, this means a position just past the peak on the Hype Cycle as more options become available. We expect a rather quick journey, closer to five years than 10, to the Plateau of Productivity, and possibly even a move in two to five years if more NRENs follow suit in acting as trusted brokers, and as 4G networks spread.

User Advice: Even if the adoption of WaaS is triggered by a need to provide large groups of students with cost-effective access to institution services, several other benefits can be achieved if the right contract is negotiated. They include ensuring increased bandwidth at the campus by

allowing/requesting the telco to set up access points. If designed in the right way, this will have very positive impact on business continuity, as it introduces another network completely independent of the campus network. (If this is combined with any other cloud services such as email or PaaS/SaaS for administrative systems, it further spreads the risk for total service breakdown.) A key issue for very mobile researchers and students is roaming cost. If the institution has remote or international locations or affiliates that are expected to travel a lot, a roaming tariff has to be included in the contract. Furthermore, as some services will still require high bandwidth not allowed or provided through mobile networks, the option of consolidation of both home and mobile Internet connections should be included in contract negotiations.

Business Impact: The key business benefit is to provide real, ubiquitous access to institution services "anytime, anywhere" and, in particular, increase student transparency regarding the real cost for their education (required by law in some countries). Nontraditional students in particular (who are increasing in numbers), who need to combine work and family with studies, need true mobile network access to be able to exploit all "dead time" (for example, commuting) to be more productive. But this type of infrastructure as a service (IaaS) has an impact on the IT organization's ability to address business continuity and, ultimately, provide the IT organization with more sourcing options that allow them to focus their resources and skills on the services that require specific institutional knowledge.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Janet 3G; Sprint

Recommended Reading: "Is Your WLAN Ready for the K-12 One-to-One Student Computer Initiative?"

COBIT

Analysis By: Simon Mingay

Definition: COBIT, owned by ISACA, originated as an IT control framework, and COBIT 5 has evolved into a broader IT governance and management framework for the purpose of ensuring that the organization's investment in IT will enable the achievement of its goals. COBIT 4.1 was, and remains, used by many midsize to large organizations across a wide range of industries — and is more selectively used in education — to implement controls to manage key risks or meet an audit or compliance requirement.

Position and Adoption Speed Justification: COBIT 5 is a major initiative by ISACA to bring together many of its frameworks into a single governance and management framework. There is very limited mapping between COBIT 4.1 and COBIT 5 and, most notably, COBIT 5 uses the concepts of governance and management practices, rather than control objectives. No longer is COBIT an acronym for Control Objectives for Information and Related Technologies, but is simply a brand name for the ISACA product. Organizations are being very cautious in their adoption of the

new COBIT 5 released in April 2012, preferring to make use of the more established 4.1 until 5 has proven itself.

COBIT is having a very slow, but steadily increasing, effect on IT in education. This occurs particularly where a more centralized approach to IT governance is being attempted, the style of governance is changing due to greater competition, where institutions are being influenced by best practices outside of the sector or where external auditors have been involved in reviewing IT activities. But absent of relevant compliance or external reporting issues and external auditors pressuring organizations to adopt COBIT, and considering the challenges of enforcing standard processes and controls within an educational environment, COBIT is unlikely to be widely adopted. Those that do use COBIT, use 4.1 in a very selective and tactical way to implement controls that manage key risks and security issues. Few use it as a broad framework to manage and govern the creation of value.

COBIT 5 has the potential to act as a unifying force in the management and governance of the IT organization and the wider business. As a control framework, COBIT is well-established, especially among auditors. COBIT is relevant to education, but frequently culturally mismatched, and a catalyst to spark interest is missing. We see relatively few inquiries related to COBIT from educational organizations.

User Advice: Even with the COBIT 5 update and its integration of ISACA's many frameworks, the focus of this high-level framework is on what must be done, not how to do it. Therefore, IT operations management has typically used COBIT 4.1 as part of a mandated program in the IT organization and to provide guidance regarding the kind of controls needed to meet the program's requirements. Process engineers can, in turn, leverage other standards, such as ITIL, for additional design details to use pragmatically. Despite v.5's expansion, it still complements, rather than replaces, ITIL, and COBIT 5 has the potential to be the tool used by leaders to identify business and IT needs. It is the most appropriate framework or standard to address those needs.

Because COBIT 5 has adopted the ISO 15504 process maturity model and also incorporates COBIT 4.1, Val IT 2.0, Risk IT, Business Model for Information Security (BMIS) and the Information Technology Assurance Framework (ITAF), COBIT 4.1 expertise will have limited applicability to COBIT 5. Consequently, a major training and familiarization exercise needs to be undertaken by organizations adopting COBIT 5 as a successor to COBIT 4.1, and is part of the reason for the slow adoption of 5.

IT managers that want to assess their management and governance to better mitigate risks and reduce variations, and are aiming toward clearer business alignment of IT services, should use COBIT in conjunction with other frameworks, including ITIL and ISO 20000. Those IT managers that want to gain insight into what auditors will look for, or into the potential implications for compliance programs, should also take a closer look at COBIT. But, adoption of COBIT 5 can only be successful if the wider enterprise embraces the framework. Any IT organization facing a demand for wholesale implementation should push back and focus its application in areas where there are specific risks in the context of its activities.

In particular, IT leaders should know if a specific audit is being conducted against the COBIT 4.1 or COBIT 5 framework, because there will be significant differences in approach. Successful adoption of COBIT 5 requires a concerted program of effort involving the audit team, IT and the other stakeholders to ensure all efforts are headed in the same direction.

COBIT 4.1 is still better-positioned than ITIL in terms of managing IT operations' governance and high-level risks; enterprises that wish to put their IT service management program in the broader context of a management and governance framework should use COBIT. COBIT 5 extends its scope to the business drivers and stakeholder needs that cascade ultimately to the IT-related goals. The mappings and weightings of the needs to the IT goals are essential to the COBIT 5 view of the questions that IT must address if it is to be successful.

COBIT's scope is the entire organization; therefore, IT managers can refer to this source if they believe the goals of the enterprise are not clearly communicated and cascaded to their own functional teams. Services and processes and their associated capabilities must now be focused on addressing the explicit goals of the enterprise and not simply to implement a complete set of controls, unless each relates to meeting a specific goal.

If an organization were to be audited using COBIT 5, this may also highlight where business goals are not well articulated or the goal's implications are not cascaded down into IT goals.

These cascading goals can serve as audit trails to justify the IT activities, processes and services, and can help build business cases around each of them at the different levels of detail as required. Each COBIT 5 process is part of a cascade that links directly to business goals to justify what it focuses on, how it plans to achieve the targets and how it can be measured (metrics).

An additional consideration is that service improvement programs that seek to leverage ITIL all too frequently set themselves up as bottom-up, tactical, process engineering exercises, lacking a strategic or business context. While ITIL encourages and provides guidance for a more strategic approach, COBIT can help in achieving that, particularly by drawing business stakeholders into the organizational change.

Business Impact: While COBIT 5 moves COBIT toward a broader management and governance framework, it is seen by most users as a framework for effective governance and reducing risk. It affects all areas of managing the IT organization, including aspects of IT operations. Management should review how COBIT 5 can be used to enhance governance practices and help better manage risks and, thus, result in improved performance. COBIT's usefulness has moved a long way beyond a simple audit tool. But note that COBIT 5 will necessitate an extensive training program for all those currently using 4.1.

Large or complex institutions will likely find greater financial and performance benefits through improved governance, especially if COBIT is used as one of several tools to identify and rectify weak links between demand governance and supply governance of IT services (see "Defining IT Governance: The Gartner IT Governance Demand/Supply Model").

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Adaptive Learning

Analysis By: Jan-Martin Lowendahl

Definition: Adaptive learning in its fundamental form is a methodology that changes the pedagogical approach toward a student based on the student's input and a predefined response. Adaptive learning more recently is being associated with a large-scale collection of learning data and statistically based pedagogical responses, and can be seen as a subset of personalized learning that includes such approaches as affective and somatic computing.

Position and Adoption Speed Justification: Adaptive learning is finally coming of age. The concept is not new and can trace its roots back to at least the 1950s, but the increasing abilities of capturing learner data through online learning has meant a breakthrough. Companies such as Carnegie Learning and Knewton have been working for several years to prove adaptive learning's viability. Knewton's approach to start its own online SAT training has especially proved valuable in collecting the empirical data needed to prove the value of this approach to learning. But the real breakthrough that merits a position near the top of the Peak of Inflated Expectations is Knewton's "productification" of the concept into an "adaptive learning platform," because it represents a major step toward making "personalized learning" accessible. Knewton's adaptive learning platform is a product that anyone can buy, and the adoption by large players such as Pearson's, will likely ensure big enough datasets for enough topics for personalized learning to break the critical-mass barrier.

The real value of adaptive learning lies in the metadata attached to each learning "morsel." That is why we see open tools for tagging so that anyone can tag educational content, even open educational resources (OER), to the fine-grained level that is needed for true adaptive learning (a type of crowdsourcing and big data collection). That learning morsel must then be combined with enough empirical data of students trying to master the topic to give statistically valid "personalized learning." This capture and reuse of metadata is something that has to be managed by license agreements that allow vendors and OSS products to continuously improve their topic-based metadata so that it can feed directly back into adaptive learning. This is also one of the reasons we see projects like edX from MIT and Harvard. Empirically captured and statistically valid learning metadata is extremely valuable in designing the pedagogy of the future.

We are hitting the knee in the s-curve that could spell exponential growth over the next decade of adaptive learning. The more educational institutions that sign up, the better adaptive learning becomes. The signs for adoption are good. The 2013 Inside Higher Education and Gallup poll of 831 U.S. college and university presidents shows that 66% of the respondents agree (answer 4 or 5 on a 5-point scale where 5 is strongly agree) that "Adaptive testing and learning have great potential to make a positive impact on higher education." The corresponding response for massive open online courses (MOOCs) is 42%.

The hype is still strong, and several new vendors are getting into the game with their own twists on adaptive learning. This proliferation of vendors creates some confusion and brings up the issue of metadata standards for collecting the large datasets needed and providing the student with a

seamless transition between different adaptive learning platforms and content. A "portability-problem" that is similar to what we have seen in the e-portfolio case. We will now enter a phase where usage of adaptive learning will give real-world experience on a broader scale that will give invaluable data and provide many lessons learned on the way to an optimized adaptive learning ecosystem.

Altogether, this merits a position still within the Peak of Inflated Expectations, but also a clear move toward the Trough of Disillusionment. Even though the benefits are obvious and the road map promising, with a potential snag of legal issues, we still believe that there will be another five to 10 years to the Plateau of Productivity and mainstream adoption in the best case.

User Advice: CIOs will play a major role in helping increase the degree of digitization (from infrastructure to textbook) to reach the level where all appropriate learning can be done digitally and connected, allowing the adaptive learning tools to be applicable. But, the key stakeholder will be faculty responsible for online learning because this tool can tip the scale in competitive advantage for online programs — perhaps even so much that pure brick-and-mortar programs need to care. A very practical advice is that CIOs, in collaboration with faculty, need to make sure that adaptive learning requirements begin to be included in learning environment RFPs.

The key challenge for adaptive learning is to get large enough datasets that allow statistically valid personalized learning advice to the student. The question that looms is if current license constructions for Knewton, for example, will hold up when institutions realize they are helping potential competitors to benefit from their student data. It is easy to see a walled garden system where only the biggest institutions get real benefit from adaptive learning because they are the only ones that can reach a critical mass of data. Another related potential challenge is to which degree privacy regulation (laws) and student rejection of this tracking will impact the datasets that can be collected. Finally, it remains to be proven that the adaptive learning platform works with any topic, not just the relatively structured topics such as SAT and college math readiness programs, which are behind its current success.

Business Impact: Adaptive learning has the potential to solve at least part of the biggest problem that faces education today: "cost-effective scalability with retained and preferably improved quality."

In general, adaptive learning is part of a larger set of approaches to further personalize the online educational experience. Another example is affective computing that aims to achieve personalized learning based on, in particular, emotional sensory input. It is also related to context-aware computing in general.

The ultimate aim of adaptive learning in education is to enhance the learning experience of the student, which should result in tangible results such as higher grades, faster throughput and higher retention, preferably at lower cost to the student. A key accomplishment would be if adaptive learning enabled outcomes based on "any paced" learning. These results will benefit students, institutions and society.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Blackboard; Carnegie Learning; Desire2Learn; Instructure; Knewton

Sliding Into the Trough

Digital Preservation of Research Data

Analysis By: Jan-Martin Lowendahl

Definition: Digital preservation in the higher education community context refers to the issue of dealing with very long-term storage and retrieval of primarily research data. The objective of digital preservation is to attain or surpass the standard of archiving and retrieval that was set by handling paper archives for hundreds of years in some countries.

Position and Adoption Speed Justification: Although the problem has been around for some time, progress in this field has been rather slow due to the pace of change in IT, as well as the perceived high total cost of ownership (TCO) and a lack of monetary ROI. The strategies for addressing the problem are well-developed in theory, but the practical solutions have not been as strong. This has now changed, thanks to the cloud.

A breakthrough is the "trusted broker" approach that is the result of two major open-source software repository communities, Fedora Commons and DSpace Foundation, joining forces to create the DuraSpace organization and DuraCloud service. DuraCloud was officially launched in 2011. Its price list for its services shows costs based on options of storage capacity and underlying choice of public cloud provider. The increasing maturity of the underlying cloud storage services, such as Amazon Web Services, Rackspace and SDSC Storage, makes it highly likely that this service will deliver on its promise to overcome the TCO argument that previously haunted the issue. But the real long-term benefits lie elsewhere. The important death-of-distance effect helps research communities to come together in an unprecedented way to create critical mass for even small topic areas. The cloud delivery model also brings a disintermediation of the IT departments that, more often than not, speeds up the implementation. Finally, the retrieval of the data is greatly enhanced with the "de facto" user interface that software as a service (SaaS) inherently brings with it. DuraSpace is maturing into a "preservation stack" enabling and integrating more services related to preservation. An example includes the development of the DSpaceDirect service, which is a hosted version sprung out of the experience of DuraCloud. The key issue is long-term sustainable funding to keep development going while the business model is fine-tuned. Sponsorship funds are still the major source of revenue. We foresee that similar government-funded cloud-based preservation/ open access efforts will run into similar problems.

Altogether, this technology merits a position just past the Peak of Inflated Expectations this year. We still stick to the estimate of five to 10 years until the Plateau of Productivity because of the remaining main issues that will drive digital preservation into the Trough of Disillusionment — privacy, intellectual property rights and metadata. The latter will always be deeply embedded in the

respective research areas, and likely a perpetual issue related to digital provenance and re-creation of data. To this we add what we think is a short-term funding issue that is related to scaling up the services provided from a development and governance point of view. However, we believe this issue will be overcome over time as business/funding models for these basically open-source efforts are developed.

User Advice: Digital preservation is starting to get the attention it deserves. With increased dependence on digital data and more focus on "open access" policies from funders, the principal relevance to research is increasing and even mandated in some cases. The increasing volumes of data and potential cost-benefits in tiered storage will force institutions to adopt information storage and retrieval strategies that include the digital preservation of research data. The basic strategies now have to include cloud storage options. However, it is important to conduct proper due diligence of external providers, including not only operational procedures and exit strategies, but also privacy and legal matters. This area is well-suited for shared services or cloud computing solutions due to the obvious economies of scale, even in due diligence. The cloud option in particular means setting up or finding a broker that is within the academic sphere of trust, such as DuraCloud.

Business Impact: Success in handling the digital preservation problem in higher education is crucial for future research, because more and more data exists only in the digital realm. In the long term, it has the potential to be transformational for research, especially for its ability to revisit raw data for new interpretations and to access very long series of data.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: DSpace; Fedora

BYOD Strategy

Analysis By: Jan-Martin Lowendahl; Bill Rust

Definition: BYOD, which means "bring your own device," is set to become the dominant practice in higher education in the First World, and is growing worldwide. BYOD in this context means BYOD as a deliberate strategy, as opposed to the "provide a standard device strategy" that has been popular in the past. A BYOD strategy is *not* a "laissez-faire" approach, but a thought-out, defined strategy. BYOD presents IT organizations in education with multiple challenges, but also provides multiple benefits.

Position and Adoption Speed Justification: CIOs in higher education or K-12 can no longer stop the wave of different consumer devices (not even among administrators). Moreover, the solution is not handing out "monocultures" (such as iPhones and iPads) — students revolt against that practice, preferring to use devices that they personally select. There is a need in education to formally adopt BYOD as a full strategy, and to willingly support and advocate the BYOD approach as a benefit for the students and the institution. More institutions have seen the light and are moving

toward this approach; others have still not yet adopted it, but almost all institutions are discussing how to handle it. Educators in K-12 must address equity as an issue, especially where the electronic delivery of instruction is required — not optional. In higher education, the BYOD discussion is widening to include "bring your own everything" (BYOE), which includes devices as well as services. This relates closely to the Gartner term "consumerization" and puts even greater strain on the IT department. BYOD is here to stay. Real-world experience starts to accumulate and CIOs are scrambling to keep up as the BYOD strategy is starting to slide toward the Trough of Disillusionment. However, we anticipate rapid advancement through the Hype Cycle as pressure from students and faculty builds.

User Advice: For IT organizations to take advantage of the BYOD trend, the security of the network and applications must be first-rate. Moreover, the systems that the customers interface with must be capable of transacting business in all of the major devices and OSs, *or* the mobility strategy must be built around a common denominator protocol like HTML5. The situation is similar to that of SMS or texting: Texting is ubiquitous because it is device-, network- and OS-neutral. It works virtually everywhere on most phones, smartphones and many handheld devices. It may not be "pretty," but it is effective.

A mobility strategy for BYOD must be the same. It must work with almost any device that has a browser in order to be acceptable. The alternative is to program the front end of many systems in iOS, Android or other mobile OSs, which is an expensive proposition and a losing battle. Accommodating at least each major handheld OS would allow for the maximization of the user experience, but using a browser-based technology, while not the "prettiest" option for each device, is ubiquitous and allows generalized mobility. The multi-OS problem is accentuated in education, as students can be expected to bring a much more varied set of devices compared with a corporate environment, and at the same time guiding by policy is more difficult. Still, it is becoming common for an institution to offer a few OS-specific and optimized apps for specific purposes — for example, GPS-enabled campus maps. However, these are commonly purchased through vendors such as Blackboard, Sourcebits and Modo Labs, instead of being built.

With such approaches as a virtualized desktop (cloud desktop), as well as the use of the functionality of server-based computing, such as Citrix, even devices of relatively limited native functionality can be effectively utilized by various constituencies. However, it may be necessary, in the case of some specific applications, to maintain a relatively small application group to build campus- and institution-specific applications that are offered through the campus's own app store — for free or for a price. This approach could be used to effectively provide optional but desired services via a self-supporting financial model.

Business Impact: With the acceptance of the consumerization of technology and the near-universal acceptance of the use of personal devices to access and interact with enterprise systems, IT directors are embracing the trend of pushing transaction processing to the users — to their delight (thereby making a virtue out of a necessity). It is a reversal of a 40-year trend of IT organizations having to maintain all tools for collecting and processing data, but it is a key step in embracing an exostructure strategy (see "Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure").

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Blackboard; Modo Labs; Sourcebits

Recommended Reading: "BYOD in Education by Design, Not Default"

"Gartner's View on 'Bring Your Own' in Client Computing"

"Best Practices for Supporting 'Bring Your Own' Mobile Devices"

"The Impact of BYOC on Management and Support"

"Creating a Bring Your Own Device (BYOD) Policy"

Mobile-Learning Low-Range/Midrange Handsets

Analysis By: Jan-Martin Lowendahl; Nick Jones

Definition: Mobile-learning (m-learning) or learning administration applications use basic and enhanced phones. Such handsets range from ultra-low-cost devices capable only of voice and SMS, selling for less than $20, to more-capable handsets supporting Web browsing and Java Platform, Micro Edition (Java ME), retailing for as much as $150.

We separate m-learning on basic and enhanced handsets from m-learning on high-end smartphones, such as iPhones, because these will tend to be used in different ways by different students and in different markets.

Position and Adoption Speed Justification: M-learning encompasses a very broad range of applications, including, but not limited to, media delivery (for example, audio and video), exploratory learning using augmented reality, educational games, collaboration and project work, e-books, surveys, tests, data gathering, real-time feedback, and simulations.

Technologically, low-end handsets can deliver m-learning in several ways. For example, this could be by using: (1) very simple technologies, such as SMS — for example, for health education; (2) server-side technologies — for example, the mobile Web or, in some cases, using the handset just as a voice channel to listen to lessons broadcast from a server; (3) more-capable handsets that support stored media, such as podcasts or video; (4) native m-learning applications specially developed for low-end handsets and preloaded by the manufacturer — for example, Nokia Life Tools; and (5) simple applications developed using widely available tools, such as Java ME. One of the challenges that determines m-learning application architecture in emerging markets is that data communications to a handset are often weak (for example, general packet radio service [GPRS] or SMS) and sometimes unavailable.

Examples of low-end m-learning deployed include simple tests and exams (for example, vocabulary tests for students learning a new language) and health education. Some low-end m-learning is

delivered as a service predominantly for markets in developing countries — for example, Nokia Life Tools in India and China, and Urban Planet Mobile's ringtone-based language learning in Indonesia. There are increasing examples of services for more-mature markets, such as the U.S., where more-innovative companies have developed SMS-based SAT-prep-as-a-subscription service by exploiting the ubiquity of SMS functionality. Vendors such as Urban Planet keep adding markets, especially in developing countries. For example, Urban Planet won a USAID grant together with 32 other companies to deliver literacy education to Uganda in Rutooro (a local language).

Some K-12 institutions prefer low-end devices, as they provide access to learning objects while minimizing the exposure to the "full-featured" Internet that smartphones offer. However, the latter point might not hold up, as Moore's Law will benefit low-end m-learning during the next five years, and the handset capability available at a given price point will continue to rise, enabling low-end and midrange handsets to deliver more-sophisticated m-learning. Larger screens and the falling price of color screens will particularly benefit low-end m-learning.

Low-end m-learning is quickly maturing and finding real learning applications in the education ecosystem. Altogether, this merits another jump on the Hype Cycle closer to the Trough of Disillusionment, and we expect a quick run through the trough due to more-focused applications and more-defined markets. We also expect the time to the Plateau of Productivity to diminish, which is why we have set it at two to five years at this point.

User Advice: A real change to a curriculum must be based on a near 100% availability of a tool for the students. Educational organizations in which students own primarily low-end and midrange handsets should experiment with m-learning technologies and systems that match these devices. M-learning on lower-capability devices will be particularly important in emerging markets, but can also be a stepping stone in developed markets, as there is not yet 100% penetration of smartphones.

Business Impact: Organizations such as network operators and handset manufacturers in emerging markets, where relatively few devices are smartphones, should explore the potential of educational services and applications delivered on low-range to midrange handsets. Organizations such as agricultural cooperatives that need to distribute information to large numbers of individuals owning low-end handsets should also explore m-learning techniques. Subscription m-learning services are a potentially interesting model for network operators and others in emerging markets, because the low price points are outweighed by the large potential number of learners. The latest examples show that mobile-learning companies can use low-end m-learning as a disruptive innovation to establish themselves and make inroads even in more-mature markets.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Bharti Airtel; McGraw-Hill; Nokia; Urban Planet Mobile

Recommended Reading: "M-Learning Opportunities and Applications"

"Cool Vendors in Education, 2011"

"Cool Vendors in Collaboration, 2009"

Open-Source Financials

Analysis By: Terri-Lynn B. Thayer

Definition: Open-source higher education financial applications are developed via open-source or community source models.

Position and Adoption Speed Justification: Open-source solution financial projects have the potential to be part of a nonproprietary and highly customizable, higher education administrative application suite or a best-of-breed financial solution. The Kuali Financial System (KFS) is continuing to execute well on its road map, and is implemented at more than a dozen institutions. The traditional strong points of open-source software (OSS) with readily available support (provided there is critical mass of skill in the community) has proved to be true. The Kuali Foundation has moved beyond the initial hype and scaling to a critical mass is well underway with a half dozen more planned implementations. Process, integration and support issues are coalescing. The foundation's initiative to partner and grow an ecosystem of for-profit vendors that can offer support to the development effort, as well as provide sustainable and professional support services and even hosting options, has been key to the success to date.

Major milestones and credibility were achieved with the successful implementations at Cornell University and Indiana University (IU). The recent experiences of these prestigious institutions has been closely watched. IU has attributed a $20 million savings to the implementation of KFS. There are also benchmark examples of very low-cost implementations and vendor-hosted successes.

The community source software movement keeps maturing, and the commercial-support ecosystem is expanding. Interest in OSS, in general, continues to be high, and successful marketing from the Kuali Foundation, in particular, continues to draw interest and results in the overall expansion of the modules in the Kuali suite. All are good indicators of continued progress toward a sustainable community. We are waiting for the inevitable implementation and/or maintenance failure that will bring a frustrating experience to the Kuali Foundation, but such an event will be crucial for maturing the OSS project and moving it past the Trough of Disillusionment. The exact number of KFS implementations is difficult to track because the nature of open source is such that institutions can install it without any formal notification to the foundation. However, while the interest is growing, the total number of implementations is still very small, so open-source financials advances only minimally in this year's Hype Cycle.

User Advice: Open-source solutions for financials are still in an early stage, and should be monitored as a possible fit only for institutions that are capable of supporting in-house application development, as well as those that have no pressing need to change their solutions. When this is the case, and the institutions have homegrown systems, they might consider joining the open-source community to see if they can contribute and prolong the lives of their current systems or replace them altogether with the OSS version. Institutions outside the U.S. should observe how national regulation and local accounting best practices affect the need for customization and

maintenance. Smaller institutions and institutions outside the U.S., in particular, should watch for signs of a sustainable market for commercial-support providers if they contemplate an OSS financial solution.

With this large and complex OSS undertaking, it is critical that institutions have a developing OSS culture, software development and maintenance experience to draw on to keep risk levels under control. Although OSS can be an economical alternative, it is decidedly not "free."

Business Impact: The area of financial administration and the areas of financial integration with other administrative applications will be affected, but, as a whole, they will have a limited effect on the core mission of the institution's education and research. However, the benefit may increase as the Kuali Foundation continues to offer functionality that is specific to higher education, such as Kuali Coeus for grants management, Kuali Ready for business continuity and the library management project, Open Library Environment. The main factor in KFS adoption to date has been the reduced total cost of ownership (TCO) vis-a-vis a commercial offering.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Emerging

Sample Vendors: Kuali Foundation

Recommended Reading: "Open Source in Higher Education, 2008"

"Gartner Higher Education Sourcing Survey 2009: What, How, How Much and Attitudes?"

EA Frameworks

Analysis By: Cathleen E. Blanton; Philip Allega

Definition: Enterprise architecture (EA) frameworks generally refer to a catalog of artifact types and the taxonomical structure for EA artifacts, and also infer a process for creating, using and governing those artifacts. This Hype Cycle entry focuses on the aggregation of hype concerning all EA frameworks that are offered in the marketplace for use by EA practitioners and EA programs. It does not focus on a single EA framework or the concept of an EA framework.

Position and Adoption Speed Justification: Gartner has observed some decreased interest in evaluating EA frameworks from clients, as most clients have settled on a framework and are working on it and refining it, but a fair amount of confusion persists. In the past three years, Gartner has received more than 1,200 inquiries on frameworks used for architecture. The number of inquiries on specific frameworks has also increased. For example, in 2011, Gartner received 122 TOGAF inquiries (see "Taming Your EA Framework With Business Outcomes"). In our 2011 global survey, 55% of EA programs recognized their use of an EA framework. Of those, 37% named "homemade" or "blended" as their primary frameworks, with no other public framework indicating greater than 10% adoption.

We caution that the variability in content and advice within the body of knowledge in any EA framework indicates that this technology's maturity is deemed as adolescent because:

- Marketplace participants have not yet commoditized.
- New entrants to the EA framework market will find it harder to differentiate their customized frameworks from a smaller set of iconic all-purpose frameworks and those that are industry- or vendor-specific.
- Many EA consultancies and tool vendors will strive for framework agnosticism and convergence as a way to maintain market relevance, while supporting a smaller set of EA frameworks.

We have advanced this closer to the trough to reflect the fact that most clients have passed the "pick a framework" panic and are evolving a personalized framework that allows them to focus on delivering business outcomes. Clients will continue to evolve and customize their frameworks indefinitely as business challenges and EA methodologies evolve, and as this evolution becomes accepted, the hype around the "one right framework" myth will dissolve over the next 10 years or more.

Our reasoning for this position and adoption speed is as follows:

- The belief that there can be one EA framework to solve all the needs of an EA program has only recently been exposed as false. Use of multiple EA frameworks by our clients indicates that EA practitioners are weary of the hype associated with individual EA framework claims of being *the one* that will deliver EA value.
- While the hype on the proliferation of EA frameworks persists — one practitioner has counted over 900 frameworks that can support EA efforts — many enterprises have already moved beyond this, as a sizable number of enterprises report being satisfied, very satisfied or extremely satisfied with their framework choices. Mature EA practitioners will continue to customize their EA frameworks to resonate with their business cultures and industries.
- The speed of universal consolidation to a smaller, more orthogonal set of industry EA frameworks remains slow, given that barriers to entry remain low, and market participants are rewarded commercially. Market participants that monetize the use of particular EA frameworks in the marketplace have little or no incentive to change their perspective. Conceivably, larger consultancies and tool vendors could view framework agnosticism as an advantage that avoids limiting their markets. As they advise and encourage clients to customize their frameworks (thus monetizing their experience with their clients' and customers' frameworks), consultancies that cannot adapt will be disadvantaged, and the market will converge on a smaller set of mainstream framework options, while continuing to customize or adapt those options for their own use.
- Market forces of commoditization have yet to shake out the universal elements of EA frameworks, yet commoditization is inevitable. The distinctions between many mainstream frameworks reflect the variety of needs that EA must meet; they do not necessarily imply competitive differentiation. As enterprises accept that they must blend and customize frameworks for their particular needs and cultures, the market will eventually converge on fewer

frameworks across key categories, each of which has its own valid raison d'etre: consortia-developed, open-source, industry-specific and tool communities.

User Advice: Our research indicates that EA frameworks are best viewed as inspirations to EA programs, rather than aspirations to be followed in exacting detail. We find that more organizations leverage components from multiple frameworks to develop a customized one that meets their business, IT and cultural needs, and resonates with their stakeholders.

Gartner recognizes that, while all EA functions need an EA framework, the proliferation of EA frameworks and the claims of their vociferous supporters have distracted EA from focusing on business outcomes (see "Enterprise Architecture Leaders Focus on Business Impact").

Our advice continues to be the following:

- Realize that any particular EA framework should provide a consistent organizing structure for architectural concepts, and should not simply be followed as a rigid process or set of rules.
- Review framework choices early in the EA process, and select characteristics that match the priorities of your enterprise, resonate with your stakeholders and facilitate decisions that deliver business outcomes.
- Assemble a quick, simple, expansible composite framework that can support high-priority EA activities — that is, those that will generate the most value and the best outcomes.
- Review and modify your framework periodically to ensure that it continues to meet your needs.

EA frameworks are a tool that complements intentional EA value planning, but cannot substitute for it. EA practitioners still must do the following:

- Focus the EA discipline first on delivering business outcomes that are based on business direction and future-state vision, as articulated in an enterprise context.
- Leverage multiple EA-related frameworks as inspiration and guidance for organizing, structuring and communicating architectural concepts specific to the organization.

Business Impact: The ongoing proliferation of EA frameworks and their surrounding hype reflect the desires of new consultancies and educational institutions to make a proprietary mark on the practice of EA throughout the marketplace. EA programs that are seeking a recognizable common language, process and artifact structure can refer to new frameworks, but should maintain focus on keeping their framework focused on outcomes and resonant with their industry and corporate culture. The market's tendency to introduce new frameworks is exacerbated by EA certification efforts that seem to equate an understanding or demonstrated prowess in a particular body of knowledge with proficiency in using one or more EA frameworks. It is in the best commercial interests of those making money from certifying a particular framework, or delivering services based on a particular framework, to continue their claims that their particular EA framework is best. Market participants are not yet rewarded by adhering to a commonly accepted language, process or artifact to support EA, although the most successful are capable of supporting business outcomes in a framework-agnostic environment.

Our observations and research indicate that the hype surrounding the term "EA frameworks" is more prevalent than the actual market adoption and penetration of specific EA frameworks. EA programs should continue to use caution in the selection and use of any one particular EA framework, seeking those aspects of EA frameworks that support the scope and focus for their EA program today.

Business leaders must focus their EA programs and their practitioners on pragmatic practices and outcome-driven deliverables that leverage the EA discipline to run, grow and transform their businesses.

Benefit Rating: Low

Market Penetration: More than 50% of target audience

Maturity: Early mainstream

Sample Vendors: Accenture; Atos; Capgemini; Enterprise Architecture Center of Excellence (EACOE); Logica; MIT; Sogeti; The Open Group; Zachman International

Recommended Reading: "Taming Your EA Framework With Business Outcomes"

"Enterprise Architecture Process and Framework; CIO Desk Reference Chapter 9, Updated Q4 2011"

"Gartner's 2011 Global Enterprise Architecture Survey: EA Frameworks Are Still Homemade and Hybrid"

"Understand How Methodologies Evolve Into Standards to Achieve Service Excellence"

Web-Based Office Productivity Suites

Analysis By: Michael A. Silver

Definition: Office productivity suites are generally collections of basic productivity applications for tasks such as word processing, spreadsheet creation and presentation graphics. Traditionally, suites such as Microsoft Office and OpenOffice are thick-client applications that require significant maintenance on users' PCs. The Web paradigm enables personal content creation and editing support services to be provided, using a rich-client experience that does not require explicit delivery and maintenance of the software on individual PCs by the enterprise.

Position and Adoption Speed Justification: Although some products in this market also offer hosted email, here we consider only the productivity functions, such as word processing and spreadsheets. Office productivity products have been available on the Web for more than five years. These applications generally do not approach the level of functionality of full-function, fat-client suites (such as Microsoft Office); however, they usually provide a useful, but smaller, function set. Google Apps for Business (GAB) is being adopted, largely for Gmail, but customers usually experiment with Google Docs for certain users. Microsoft's Office 2013 includes a new version of Office Web Apps that maintains good compatibility with Microsoft Office, but with a much smaller

feature set than the installed fat-client version. Also, Apple just announced iWork for iCloud (June 2013), though few details are available. Online products can be free for consumers, but organizations usually need to license a larger offering that includes their use.

Individual users have been using free, consumer-grade versions to augment, rather than replace, functionality in traditional office suites (such as for real-time collaboration) for years. Offline functionality has been limited, but features continue to be added by all vendors, sometimes on a weekly basis. Many vendors offer some type of Web-based productivity suite, with IBM Docs (finally released, but with a relatively small but growing feature set), and Zoho as additional examples. As functionality improves, Web-based office productivity applications may make the traditional versions of Microsoft Office relatively less important, as users rely on the fat-client products for less time each week. However, mobile applications for smartphones and tablets have also started to emerge and users today seem to prefer a richer app experience and need the offline functionality. In many cases, the Web-based applications are used in addition to traditional products like Microsoft Office and few, if any, organizations have been able to eliminate Microsoft Office entirely. Customer interest in mobile applications may slow the growth of Web-based products.

User Advice: Web-based products are not an adequate replacement for Microsoft Office for all users, and will not be anytime soon. However, some users do not need the richness of Microsoft Office (or other full function thick-client suites), and for them a Web-based product may suffice. The critical issue is determining who can survive with Web-based tools, who requires installed Microsoft Office, and whether the complexities involved in supporting Web-based suites and locally installed versions of Microsoft Office simultaneously are worthwhile. The biggest problem for every non-Microsoft office suite is compatibility, and specifically visual fidelity with Office. Alternative products often change the way documents look and users may have to go back and reformat documents to repair any problems that were introduced. Google Docs will challenge installed versions of Microsoft Office in organizations that select Google to host email and where a substantial proportion of users can get their jobs done without Microsoft Office and don't need perfect visual fidelity. Additional features of Web-based products, including ease of co-authoring (a major feature of IBM Docs, but not discussed for iWork), could help attract users away from traditional suites.

There are four areas to test regarding user segmentation. Web-based suites may suffer compared with installed versions of Microsoft Office in feature richness, roundtrip fidelity, extensibility and offline operation:

- **Feature richness —** Users that require a large number of features or the more advanced features of Microsoft Office may not be able to run an alternative product.
- **Roundtrip fidelity —** With any alternative product, every time a document is edited with a product other than the one in which it was created, visual inconsistencies will be introduced.
- **Extensibility —** Many organizations run multiple applications that integrate with Microsoft Office. Office is a development platform, and few independent software vendors integrate with alternative office solutions.

- **Offline operation —** Web-based products offer varying degrees of offline capability. Users that are not deskbound will require offline capability (or ubiquitous network access) before a Web-based product can replace Microsoft Office.

Audit the degree to which other applications (such as CRM and ERP) provide Microsoft Office macros or integrate with Office to facilitate interacting or integrating with those applications via an Office tool. Determine what Office application user segments do not require the use of those functions.

In many instances, use of Web-based office suites by organizations is closely tied to moving email to the cloud, because vendors that supply one usually provide the other, often in a packaged bundle. Organizations with access to these products should consider if they can suffice for some users. However, it is not likely that all users can be moved from Microsoft Office, so organizations that try to run Web-based office products will likely run a mixed-product environment.

Whether or not there is organizational interest in Web-based office products, realize that end-user experimentation with these tools is taking place. Give your users guidelines on practicing safe experimentation (whether at work or not) with Web-based and mobile applications. Encourage them to share their findings with you, including their best and worst practices. Appoint a champion of freeware (and software as a service) to track these trends, and ensure that the enterprise experiments with and implements such software where appropriate.

Business Impact: A new generation of productivity applications could significantly change how users collaborate on projects, and how organizations pay for, deploy and manage office productivity services. Web-based products provide access from a greater variety of devices, and organizations may be able to offload the maintenance of these applications.

Benefit Rating: Moderate

Market Penetration: Less than 1% of target audience

Maturity: Adolescent

Sample Vendors: Apple; Google; IBM; Microsoft; Zoho

Recommended Reading: "Toolkit: Segmenting Users for Alternative Office Productivity Software"

"Microsoft Office: Buy It or Use It From Office 365 'in the Cloud?'"

"When to Consider Alternatives to Microsoft Office"

"Google Upsetting Microsoft's Cloud-Office System Ambitions"

ITIL

Analysis By: Simon Mingay

Definition: ITIL is an IT service management framework that provides guidance on the full life cycle of IT services. ITIL is part of a joint venture between the U.K. government and Capita. ITIL is

structured as five core books: service strategy, service design, service transition, service operation and continual service improvement. Specific implementation guidance is not provided; the focus is a set of good practices that an organization should adapt to its needs.

Position and Adoption Speed Justification: ITIL has been evolving for more than 20 years. It is well-established as the de facto standard in service management. It shares many concepts and principles with the formal service management standard ISO/IEC 20000, although the alignment is not perfect, with differences reflecting the different origins and goals of the two bodies of work.

The current release, ITIL 2011, was the first update to the major version 3 (v.3) release in 2007. ITIL has the highest adoption rate of the related frameworks used within IT operations (e.g., COBIT, CMMI, MOF) across all sectors, including education, and is mainstream today. Based on our polls, most organizations worldwide use the ITIL framework, but the number of organizations using additional approaches, such as continuous delivery and DevOps, is growing. Also, even after the significant improvement to service strategy in the 2011 update, ITIL is primarily used for guidance in service operation and transition. The unbalanced adoption is the reason penetration is shown as 20% to 50%.

The current version of ITIL covers the entire IT service life cycle. This includes service strategy, business relationship management, transition planning and support, and design coordination as well as the essential operational processes such as incident management and change management. ITIL advises on IT strategies to enable the business, processes for the design of IT services, their transition into production, ongoing operational support and continual service improvement. In general, service transition and service operation are the most commonly used books, and could arguably justify a position higher on the Plateau of Productivity. In contrast, service strategy has not gained momentum since the 2011 rewrite, and could be placed much earlier in the Hype Cycle.

Integration, defined as the exchange of information, is a key focus, and ITIL 2011 provides much clearer guidance with respect to integration and the scope of different processes, such as change management and transition planning.

For nearly all IT organizations, ITIL can play a major role in operational process design, even where cloud, hybrid and Pace-Layered Application Strategy are embraced. ITIL will continue to serve as a source of guidance for those responsible for delivering IT services through their process and organization design and tool selection and implementation.

Overall, we continue to see a tremendous span of adoption and maturity levels. Some organizations are just embarking or have stalled on their journey for a variety of reasons, whereas others are well on their way and pursuing continual improvement. Leaders are integrating ITIL with other approaches to improve service — lean and DevOps being notable examples. In fact, a combination of process guidance from various sources tends to do a better job of addressing requirements than any framework in isolation.

ITIL is widely adopted within educational institutions, even if the maturity of those implementations is often relatively low and the speed of progress similarly slower than we see in other sectors. This

relative slowness is a result of the cultural and behavioral challenges of the changes involved. ITIL skills are much sought after in the hiring process. Most early adopters in educational institutions have focused on implementing a basic level of "service desk" and "service support" capability, with processes such as change, incident and problem management in the first round. In this, they have gained valuable insight and a more realistic view of what ITIL can do for a higher education IT organization. More recently, we have seen educational institutes implementing service catalogs and portfolios, but struggling to create something meaningful for the three very different constituents (faculty, administration and students). ITIL is now seen as an established quality stamp, especially for centralized IT services. Still, full implementation of all ITIL processes in an institution is rare. Most educational bodies continue to treat ITIL as a bottom-up process engineering exercise and fail to put it in a more strategic and transformational context. We have positioned ITIL further back on the Hype Cycle for Education than we have for other sectors because it is applied in a less mature way. Expectations for ITSM in education have moved on from a basic approach to ITIL, and now demand a much more strategic approach to transitioning to a true service-based organization. As the education sector increasingly looks at the exploitation of shared service approaches, this lack of service management maturity will prove a stumbling block for many.

User Advice: Leverage ITIL as guidance to accelerate adoption of industry best practices, refined to meet the needs of your specific business goals. Some recent developments, such as the rise in agile methods and Pace-Layered Application Strategy (see Gartner's ValueOps research), have yet to be explicitly reflected in the ITIL body of knowledge. While the core practices are sound, users currently need to look for additional inspiration in sources such as ValueOps, lean, DevOps and continuous integration if they are to keep with changing operational needs.

ITIL is helpful in putting IT service management into a strategic context and providing high-level guidance on reference processes and other factors in the service life cycle. To optimize service improvements, IT organizations must first define objectives and then pragmatically leverage ITIL during the design of their own unique processes. There is a large pool of ITIL trained staff available, so this requirement should be a part of the development and recruitment process.

Education institutions that are unfamiliar with ITIL should begin by examining the standard process framework used by ITIL. However, it is critical they understand the true nature of the transformation to a service-based organization, and develop a program in that context, rather than simply doing a bit of bottom-up process engineering.

It is also important to recognize that most higher education institutions neither have, nor need to have, the cultural prerequisites for attaining the highest levels of service management maturity. But for any educational institutions embarking on the creation of a shared service organization, it is critical to develop the service management capability and tackle some of the underlying behavioral issues.

Business Impact: ITIL provides a framework for the strategy, design, transition, operation and continual improvement of IT services, including the organization, processes, technology and management practices that underpin them. Most IT organizations need to start or continue the transition from their traditional technology and asset focus to a focus on services and service outcomes as described in this framework. IT service management is a critical discipline in achieving that change, and ITIL provides useful reference guidance for IT management. Service management

professionals must also accept that ITIL is not a standard and, therefore, precise implementation instruction is not provided.

Large and/or complex institutions will likely find greater ROI because of: (1) the relative need for transparency through agreed-on processes and nomenclature due to many/different stakeholders and (2) the relative return on the "administrative" overhead that ITIL introduces. ITIL is particularly relevant to central IT operational services groups (running service desks, data centers, campuswide networks and so on). ITIL also has a positive impact on multisourcing, where institutions and external service providers work according to ITIL.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Recommended Reading: "ITIL 2011 Service Strategy: An Important Missing Link Between IT and Business"

"Five Ways to Manage IT Service Transitions to Cloud, Leveraging ITIL Processes and ITOM Tools"

"Use Six Sigma With ITIL 2011 to Improve IT Operations Processes and Effectively Leverage the Cloud"

"How to Leverage ITIL 2011 and Avoid Three Common Cost Traps"

"Increase I&O Effectiveness With the ValueOps Perspective"

"Running IT Like a Business 2.0: The Service-Optimizing IT Delivery Model"

Social Learning Platform for Education

Analysis By: Marti Harris

Definition: A social learning platform is an extension of traditional systems for learning management and learning content management that incorporates social software features to support structured social and informal, as well as formal, learning activities. The platform supports learners' desire to receive learning as needed. Newer models include massive open online course (MOOC) platforms.

Position and Adoption Speed Justification: As awareness of the impact of informal and structured social situations on learning grows, students, faculty members and researchers are expecting social software features to support collaborative learning environments. Vendors are adopting product development strategies that are social-learner-centric, while educational institutions are exploring how best to use new social software options. Social learning platforms are emerging, and expectations are high. Educational institutions are reviewing their current learning environments to tap into the collective knowledge of all members of their communities and to increase their organization's capacity to learn formally and informally. They also acknowledge the

importance of social networks and the requirement to access the expertise of colleagues inside and outside the institutions. A social learning platform is particularly useful and engaging for students in hybrid or distance learning classes.

The advancement of MOOCs shows the importance of "social" in learning platforms, and will influence the acceptance of social learning platforms.

User Advice: Institutions that have a single-purpose learning system installed should engage with their current vendors to understand the product development road map for enhancing systems with social software features. If their current vendors do not have plans for adding these features, or if the time frame for development is too long, then institutions should look for solutions that can be easily integrated into their learning architectures. Solutions already in place, such as content management, collaboration and communication, should be considered for use, as well as solutions procured specifically for learning purposes. Educational institutions that do not have systems for learning and content management, or that are looking to consolidate multiple learning applications, should add support for a social learning platform as an important evaluation criterion.

Business Impact: The social learning platform gives learners the ability to establish a presence or social profile that reflects their expertise and interest; to create, discuss, share and capture learning content as learning objects; to organize and find learning objects from a variety of sources, such as search or peer ratings; to interact with peers in their social networks and be able to reach beyond their networks to other trusted sources of information; to engage in experience-based learning exercises; and to receive real-time online coaching and support.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Emerging

Sample Vendors: Blackboard; Coursera; Desire2Learn; edX; Google; Instructure; Microsoft; Moodle; Pearson (LearningStudio); Sakai

Recommended Reading: "Gartner Higher Education E-Learning Survey 2008-2009: Poised for the Next Step?"

"Gartner Higher Education E-Learning Survey, 2008-2009: OSS Momentum Continues, but Is Not Alone in Changing the Market"

Cloud HPC/CaaS

Analysis By: Jan-Martin Lowendahl

Definition: Computing as a service (CaaS) or cloud high-performance computing (HPC) in higher education deals primarily with on-demand delivery of moderate to massive computing power for education and/or research purposes.

Position and Adoption Speed Justification: CaaS or cloud HPC is a natural extension of grid computing for many higher education institutions, and some grid computing implementations border on the concept of the "private cloud" even today. Many institutions also collaborate in the HPC area and have already established "shared-service clouds." This means that cultural acceptance of CaaS is likely to be high. Further advantages include the classic "cloudonomics," such as electricity and cooling savings, pay as you go, and rightsizing, countered by the usual drawbacks regarding intellectual property (IP) protection, privacy, backup and so on. The most interesting effect is how CaaS/cloud HPC is increasing the availability of HPC to smaller institutions and even to students. The interest is at a high level, and several institutions are including cloud HPC in particular in their sourcing strategies.

CaaS/cloud HPC has moved beyond proof of concept and entered the next phase, focusing on establishing practical processes and services on a larger scale. For example, established grid organizations, such as the European Grid Infrastructure (EGI), are transforming existing grids into "cloud computing" through the EGI Federated Clouds Task Force. Even more interesting, the Helix Nebula initiative is a preliminary step toward a European cloud-based scientific "e-infrastructure," which aims to bring together several providers — commercial and public — to create a viable competitive market of cloud services. Several well-known organizations and vendors are involved, such as CERN (the European Organization for Nuclear Research), the European Space Agency, BT Global Services, Atos and Capgemini.

These events show that CaaS/cloud HPC is nearing the Trough of Disillusionment, where practical problems are ironed out and practical experience separates hype from reality.

User Advice: To move to CaaS, institutions need to understand their current total cost of ownership and risk level, and they must conduct due diligence to check up on the intended provider (regardless of whether it is a nonprofit shared-service consortium or a commercial vendor) on issues such as IP, privacy, security, storage and backup. CaaS options are most valuable for institutions that face special circumstances, such as short-term projects, variable computing demands and limitations in power grids (as in downtown London). Institutions that are involved in CaaS often, but not always, need to combine it with storage as a service. One capability that is likely to rise in importance with CaaS is network technology, which reduces latency and improves security. Another change for some institutions is that they have to factor in the bandwidth costs explicitly because many commercial services charge directly for that component, which has been "no fee" at the end-user level in most countries with an established national research and education network.

Business Impact: The impact on higher education is potentially transformational because it puts more computing power in the hands of more students and researchers. The convenience factor is high and will probably lead to increased collaboration regarding computing-intensive research and education. If CaaS can also be combined with subject-specific services, such as Gaussian as a service (for molecular calculations), and support from parallelization expertise for optimizing the code for the cloud, then it has the potential to speed up research cycles and tremendously increase accessible data volumes.

Benefit Rating: Transformational

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Amazon; Dell; Google; IBM; Microsoft; Obsidian Strategies

Recommended Reading: CERN, "Strategic Plan for a Scientific Cloud Computing Infrastructure for Europe," August 2011 (http://cdsweb.cern.ch/record/1374172/files/CERN-OPEN-2011-036.pdf).

Mobile-Learning Smartphones

Analysis By: Jan-Martin Lowendahl; Nick Jones

Definition: We address mobile-learning (m-learning) or a learning administration application using smartphones (that is, handsets with an identifiable OS capable of supporting installable applications). M-learning encompasses a very broad range of applications, including, but not limited to, media delivery (for example, audio and video), exploratory learning using augmented reality, educational games, collaboration and project work, e-books, surveys, tests, data gathering, real-time feedback, and simulations.

Position and Adoption Speed Justification: Users bought 425.8 million mobile phones in 1Q13. Smartphones now account for 49.3% of mobile phones sold in the quarter, at 210.1 million units. This was up from 44.0% in 4Q12 and 34.8% in 1Q12. Advanced smartphones, such as the iPhone, have already been used for educational purposes. As smartphones become more capable and more numerous, their ubiquity, sophisticated features and flexibility will make them preferred m-learning tools in mature markets, even if media tablets in different formats are gaining ground. There is a form factor versus function competition that will segment the m-learning market in the near future. For example, some K-12 teachers simply reject smaller screen size phones for reading, while other institutions embrace smartphones as replacements for "clickers" (classroom response systems) just because of their size.

Although a wide range of m-learning applications has been demonstrated, the domain is still the subject of pilot testing to understand what type of education is best delivered on mobile devices and how to integrate m-learning with traditional education. Smartphone mobile learning has had a hard time taking off and is still seeking its killer application. In fact, mobile learning on low-range/midrange handsets has a much clearer trajectory of growth with its low-end but ubiquitous feature set that includes SMS and ringtone language lessons. Through 2014, emerging smartphone applications, such as augmented reality viewers, smartphone e-book reader applications and scriptable mapping tools, will offer new delivery platforms for educational content. In the long term, technologies such as flexible screens will enable a wider range of portable m-learning devices.

Inhibitors in 2012 still include the immaturity of the domain, smartphone cost, device limitations, development of m-learning course materials, lack of skills and the wide diversity of mobile devices. Educause student data from 2011 indicates that, although 99% of students in developed countries had a mobile phone, only about 62% had a smartphone. A major inhibitor for any large curriculum changes as well as programs looking at leveraging smartphones is that schools still have to include a strategy for providing smartphones to students.

Through 2014, we expect that platform differences will impact m-learning delivery technologies on smartphones. For example, technology-neutral content delivery tools, such as HTML5, may not have matured enough. Certain types of innovative applications may evolve more quickly on more-open platforms, such as Android, which impose fewer technical and commercial restrictions on developers.

Higher education system providers for administrative and learning systems are increasingly offering mobile applications, which is evidence of a financial commitment from these providers to meet the requirements of end users in higher education institutions. Android, iPhone and iPad applications from higher education providers are increasingly expected to be the norm.

The lack of full ubiquity among students and the increasing understanding of the problems of supporting a diversity of OSs, together with different form factors, lead Gartner to position m-learning on smartphones on a steady trajectory toward the Trough of Disillusionment and to retain a five- to 10-year time to the Plateau of Productivity.

User Advice: Many educational institutions have experimented successfully with some form of m-learning. Educators should look for simple applications that can deliver educational materials or assist staff and students with administrative tasks, such as sending assignment reminders and booking resources. Educational institutions have the opportunity to increase the accessibility of learning content that not only better supports problem-based pedagogy, but also leads to better usage of "dead time" (for example, while commuting). The latter convenience is greatly appreciated by part-time learners, which tends to increase student satisfaction and retention.

The growing body of experiences has shown that, in some cases, the m-learning experiment initiatives have not been properly structured to truly assess the impact of such devices. Failing to structure the experiments in m-learning leaves open the questions of the value and effectiveness of specific approaches to m-learning. Any institution attempting to experiment with m-learning should, therefore, carefully design the assessment phase to confirm or disprove the assumed advantages to specific applications of m-learning.

Business Impact: Corporations and governments should explore the potential of m-learning for just-in-time training. Organizations and educational institutions creating or selling training and reference materials should explore the potential of mobile devices as delivery channels.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Apple; Blackboard; Desire2Learn; Instructure; OutStart; Tribal Software

Recommended Reading: "M-Learning Opportunities and Applications"

"Market Insight: Worldwide Opportunities for Consumer Mobile Applications in Education and Learning"

"Forecast: Mobile Phones, Worldwide, 2011-2017, 1Q13 Update"

"Market Share Analysis: Mobile Phones, Worldwide, 1Q13"

"Best Practices for Mobile Device Learning Initiatives in Higher Education"

Open-Source Middleware Suites

Analysis By: Jan-Martin Lowendahl

Definition: Open-source higher education middleware suites are collections of middleware needed to integrate software solutions on campus. They include functionality such as identity and access management, enterprise service bus, and workflow.

Position and Adoption Speed Justification: A "plug and play" software integration foundation is something that institutions have strived for decades to achieve, leading to many more-or-less trendy approaches, of which service-oriented architecture (SOA) is the current dominant incarnation. Alongside commercial "closed source" options for the components of an SOA platform, the higher education community has run several high-profile open-source software (OSS) projects, of which the Jasig uPortal and the National Science Foundation (NSF) middleware project have been among the most visible. Both projects have affected the market in a positive way. The Jasig uPortal did it mainly through "pushing" the adoption of Web services standards, and by providing a neutral service delivery platform for vendors such as SunGard Higher Education (now Ellucian). The NSF middleware project produced the Federated Identity and Access Management (FIAM) solution, Shibboleth, which is used by the majority of identity federations in the academic world.

These single-purpose middleware OSS projects have now been complemented by an OSS middleware suite approach that has its roots in the community source foundation models represented by Sakai and Kuali. Both foundations decided early on to have an SOA design approach, and, consequently, a number of middleware components have become crucial to their success — especially in the case of Kuali, where the seamless integration of a number of administrative applications is a major goal. It is, therefore, only a natural consequence of these needs, together with the Kuali Foundation's knack for marketing, that we saw the first release of the OSS higher education middleware package named Kuali Rice in 2009. Kuali Rice is composed of identity management, enterprise workflow, enterprise service bus, enterprise notification and an application development framework (Kuali Nervous System). The aggregation approach of several existing components, together with the community source model, merits a rather a fast time to plateau on the Hype Cycle. However, the complexity of middleware in itself adds a certain level of uncertainty to the project as well. A recent example is that the Kuali Rice project early on betted on the object-relational mapping (ORM) framework Apache ObJectRelationalBridge (OJB), rather than Hibernate. OJB was retired in 2011, while Hibernate has been folded under JBoss and is the thriving community for ORM functionality. This has resulted in a relatively extensive redesign and rewrite of some parts of Kuali Rice. Nevertheless, these problems are solvable and the project has made steady progress; a sign of its relative maturity is that a few institutions have adopted Kuali Rice without any plans to use any other Kuali components. The 2.4 version of Kuali Rice is due for its final release in November 2013.

There is one cloud on the horizon, though, and it is the strong interest in cloud computing by the higher education community. Going to the cloud requires partly different sets of technologies and skills that are more outward-facing (see "Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure"). This means that the focus might be shifted to efforts such as OpenStack (www.openstack.org) if the Kuali Rice project fails to include cloud integration functionality.

This merits a position in the Trough of Disillusionment; we expect a rather steady exit in the next year and a firm trajectory to maturity.

User Advice: Middleware can be a complex business that requires careful design consideration. The simple fact that it sits in the middle of a lot of information streams makes it hard to exchange, and these solutions tend to be long-lived. Therefore, it is crucial to choose solutions that are as flexible as possible by adhering to standards (open as well as de facto) that are as future-safe as they can be. OSS projects have a good track record in implementing open standards, and, as demonstrated, they can even drive standards adoption. Therefore, open-source higher education middleware suites should at least be on shortlists when compared with commercial options to test vendor openness. However, Kuali Rice is not the only OSS project with an SOA aim. There are a few less-marketed alternatives (see "Case Study: Approaching the Learning Stack: The Third-Generation LMS at Universitat Oberta de Catalunya").

Business Impact: Kuali Rice is still in its early days compared with older and more complete suites from vendors such as Oracle and IBM. However, the characteristics in terms of more-general functionality and global need for middleware relative to, for example, learning management systems or enterprise resource planning platforms, make it a good candidate for the sustainable global OSS community. At the very least, this OSS project can help push open standards, which can be a foundation for a plug-and-play Web services approach that will promote the coexistence of many delivery modes, as well as business models, with an open and objective platform.

There is already a precedent for creating a common platform, or at least a reference platform, the way Shibboleth did in working together with the Liberty Alliance to influence the development of the SAML 2.0 standard.

An added benefit of the OSS middleware suite is its relatively lightweight approach to middleware compared with commercial options. The lightweight nature, combined with the lack of upfront investments, allows institutions to start implementing more quickly and gain maturity in a crucial institutional capability.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Kuali Foundation

Recommended Reading: "Open Source in Higher Education, 2008"

"OSS Administrative Solutions in Higher Education Are Becoming More Viable"

"Overview of Kuali Administrative OSS Offerings for Higher Education"

"Case Study: Approaching the Learning Stack: The Third-Generation LMS at Universitat Oberta de Catalunya"

"Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure"

E-Textbook

Analysis By: Bill Rust; Allen Weiner

Definition: E-textbooks are defined as content that is delivered electronically on user devices. Unlike traditional print materials, e-textbooks can be edited to include up-to-date information, be assembled or disassembled to rearrange the sequence or to include content from other sources, offer multimedia representation of information and instructional exercises, and allow users to insert personal notes or diagrams as study aids.

Position and Adoption Speed Justification: The momentum toward the adoption of e-textbooks comes from: (1) educators' view of digital content as a means of staying current in content areas and of keeping students engaged in learning activities; (2) an increasing number of relatively inexpensive, small form-factor devices (personally or institutionally owned) that are available for deployment in educational settings; (3) competition among traditional self-publishers; and (4) a new breed of rivals for anticipated e-textbook revenue.

State education agencies, such as in California and Florida, have mandated or are considering requirements to replace print with digital content, and publishers are racing to get to market first.

The migration from print to digital content is viewed as a question of "when, not if," but not all education agencies are truly ready for the transition. The availability (or the will) of primary and secondary schools to provision or otherwise ensure access to user devices for all learners stands in the way. Recent developments, with several large universities striking deals with publishers to bring down total cost and ensure availability of e-textbooks, is accelerating adoption, but, overall, e-textbooks have yet to climb past the Trough of Disillusionment. Publishers have not yet found or settled on the right business model, and the proliferation of general-purpose tablets and other mobile user devices need to increase — at least in the K-12 space. Single-purpose devices that serve as content readers for digitized text were in the vanguard and are still being promoted, but e-textbooks on multipurpose devices (that is, with productivity and communication/collaboration tools) are more attractive options in the eyes of many education technology leaders.

User Advice: The business case for e-textbooks becomes stronger as the capital cost of user devices decreases, support and infrastructure resources are put in place, and current content providers either offer economic licensing agreements or get pushed aside by content providers willing to do so. Primary and secondary technology leaders should partner with curriculum planners to develop a business case that includes replacing print with e-content deployed to personally owned or assigned student devices. Institutions of higher education are likely to see wider adoption

first in the use of e-textbooks that are electronic forms of print versions because of the wider availability of applications for user devices and because the content selection process will not require change.

Business Impact: E-textbooks will become the preferred content delivery mechanism throughout public and private education agencies and institutions. School organizations that provide digital content resources to students will be relieved of the liabilities of physical inventory, storage, distribution, repair (rebinding) and replacement because of loss. The conflux of decreases in device cost, the availability of multiple device form factors that can put e-textbooks in the hands of users, and consumer adoption of similar technologies are driving adoption.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Amazon; Houghton Mifflin Harcourt; McGraw-Hill

Cloud Email for Staff and Faculty

Analysis By: Matthew W. Cain

Definition: Many institutions use no-fee cloud email services for students, and more schools are beginning to use the same service for staff and faculty.

Position and Adoption Speed Justification: As more institutions have good experiences with cloud email services for students, they are increasingly considering the same service for staff and faculty. If we were simply considering cloud email for students we could conclude that it has passed through the Hype Cycle and is fully mature. But when we consider cloud email for staff and faculty *only*, we place it just after the Trough of Disillusionment because adoption lags for non-students — mainly due to privacy and security concerns. Vendors are getting better at addressing control, security and legal concerns by, for example, making archive and discovery services available and offering support and management services. As a result of these investments, and a growing comfort with the cloud email model, we believe that the time to the Plateau of Productivity for all academic constituencies will be within two to five years.

User Advice: Institutions contemplating no-fee cloud email services for staff and faculty should evaluate the services using six core criteria:

- Economics
- Infrastructure alignment
- Features
- Migration effort
- Support/SLAs

- Security/legal/privacy

Regarding the last point, institutions (working with internal security personnel) should assemble a checklist of the most critical security concerns to review with the vendors. The ability to access logs and mailboxes in case of an emergency should be understood. Support for Statement for Auditing Standards No. 70 (SAS 70) Type II and other certification should be compared. Privacy statements should be scrutinized side-by-side and passed by legal personnel for added input. Legal review should scrutinize accommodations for local regulations, such as the Family Educational Rights and Privacy Act (FERPA) in the U.S., and support for U.S.-EU Safe Harbor for non-U.S. institutions; support for e-discovery and hold requests should be part of the comparison. Legal personnel should also decide if scrutiny of data location and domestic hosting provisions are important.

Business Impact:

- The cost of internally run email can be anywhere from $1 to $10 per user per month, so there can be significant savings for an institution moving to a no-fee cloud email service.
- Other advantages of cloud email deployments include vendor-supplied upgrades, redeployment of IT staff, very large mailboxes and built-in disaster recovery services.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Google; Microsoft

Recommended Reading: "Cloud E-Mail Decision-Making Criteria for Educational Organizations"

Virtual Environments/Virtual Worlds

Analysis By: Marti Harris

Definition: Virtual environments or virtual worlds are online platforms in which participants are immersed in a three-dimensional representation of a virtual space.

Position and Adoption Speed Justification: The topic of virtual worlds has diminished in higher education circles. General-purpose use of environments like Second Life has not proved to be interesting enough to hold the attention of most educators. However, real successes continue in virtual worlds, not for the purpose of creating virtual recreations of real environments, but rather for the purpose of creating experiences that can take place only in virtual environments.

Second Life, although still used, has given way to other virtual platforms that have proved more functional for simulations and experimentation. Projects such as Duke University's Open Cobalt (funded in part with National Science Foundation grants) represent continued interest in and development of virtual worlds. The future successes of virtual environments will benefit from advances in gaming and simulation. In these two areas, faculty members have high hopes.

The interest in gaming platforms appears to move early virtual environments into the gamification products (such as Air University for training games).

User Advice: Use the "try before buying" strategy when available, experimenting with proven virtual environment platforms where other institutions have a measure of success. Organizations such as the New Media Consortium (www.nmc.org) provide real application developments and uses. Expect continued growth of educational gaming and simulation. Encourage faculty and students to sample and explore. Expect simulation and gaming to find a place in the learning stack as subject-specific elements.

Business Impact: There will be effects on analysis, student performance, productivity and agility for knowledge transfer processes, teaching/learning and research support, decision support, training, R&D, intellectual capital management, and innovation.

Benefit Rating: Moderate

Market Penetration: 1% to 5% of target audience

Maturity: Emerging

Sample Vendors: Entropia Universe; Linden Lab; Multiverse; Open Cobalt; OpenSimulator; SAIC

Climbing the Slope

Emergency/Mass Notification Services

Analysis By: Roberta J. Witty; John Girard

Definition: Emergency/mass notification services (EMNSs) automate the distribution and management of notification messages to multiple endpoints. Secure message distribution can be done via a Web portal, a mobile device app or browser, or the vendor's call center. Use cases include emergency/crisis events, business operations notifications, business-context-based alerting, IT service alerting, reverse/enhanced public emergency calls, and public safety.

Position and Adoption Speed Justification: Critical incidents today range from localized events, such as a fire or power outage, to regional and catastrophic disasters, such as earthquakes (as in Chile, Haiti and Japan), hurricanes/tsunamis (as in Metro NYC, Indonesia and Japan) and terrorist attacks (as in Mumbai, London and the U.S. on Sept. 11). They don't have to cause major physical damage to have a major business interruption — for example, the 2010 Iceland volcanic ash event, and the 2009 to 2010 H1N1 virus. As a result, organizations are increasingly implementing EMNS, thereby building a stronger crisis management program. The EMNS market is price-competitive at the basic capabilities level. As customer needs and use cases change and expand, so, too, will this market. The majority of implementations are hosted by the vendor (97.6%), and are priced using a per-contact model.

EMNS products have attracted many specialty audiences, resulting in a large field of many small vendors and a few large, multiproduct vendors. Gartner's current vendor list contains more than 60

vendors, and it keeps growing. Consolidation is expected and needed over the next five years. Potential mergers and acquisitions of EMNSs include vendors in the following markets: facilities management; physical security; fire safety; crisis management; environmental, health and safety; disaster event information analytics/situational awareness; and business continuity management (BCM) planning.

No vendor has an offering that supports all use cases. There is some vendor overlap between the EMNS and communications-enabled business process markets (see "Hype Cycle for Enterprise Communication Applications, 2010") through an EMNS product application programming interface (API) for integration to a triggering business application. We are also seeing purpose-built offerings such as customer communications management (see "Hype Cycle for P&C Insurance, 2012") and multichannel marketing communications (see "Magic Quadrant for CRM Multichannel Campaign Management"). We expect that organizations will continue to need multiple tools to achieve all use cases.

Many enterprises initially bought an EMNS without doing an in-depth analysis of their needs, within one use case or across all those in the enterprise. Therefore, some have been disappointed with their current vendor, and are looking to switch to one that supports their future needs. Currently, this switch is not terribly difficult because there is minimal integration with in-house applications — for example, enterprise directories and human resources applications. Therefore, the switching costs are low. However, as enterprises integrate the EMNS tool with more applications in support of additional use cases, take on a stronger crisis/incident management focus within their overall BCM programs, and implement a BCM software suite, the reason, ability and cost to switch to another vendor will become much less attractive.

The position for 2013 remains the same as in 2012 for the following reasons:

- The number of vendors is still expanding.
- The direction of new features is still open to interpretation — a few vendors are moving into the situational awareness market but the adoption of these tools for that purpose has barely been embraced by the customer base.
- The use cases within the organization are expanding. However, if these tools expand, their capabilities to embrace nonemergency messaging are uncertain (see "Magic Quadrant for U.S. Emergency/Mass Notification Services" and "Market Analysis in Depth: EMNS Magic Quadrant").

User Advice: Understand all the notification use cases needed by your organization to ensure that you are making the best use of your investment.

To do a valid pricing comparison, require all vendors on your shortlist to use the same pricing model, or require them to convert theirs to yours.

Choose a vendor that has experience in your vertical industry to better align their offering to your business operations.

Choose an EMNS vendor that has customer support services located in the same or adjacent time zones as your firm's, as well as language support for your operating locations, and review operating locations as well as language alignment.

Choose an EMNS vendor that has data center operations located in different geographic locations from yours to prevent the same event from impacting you and the EMNS vendor, as well as for privacy protection considerations.

Select an EMNS vendor that supports your organization's mobile technology and social media integration strategy, and has device-specific applications that align with that strategy.

Service interruptions can happen to any organization, including EMNS vendors. If you want 24/7 availability of a service, then validate your needs against the EMNS vendor's capability and delivery of that capability via a documented SLA. Know that 100% uptime guarantees typically only mean a reimbursement of fees paid by the customer to the vendor, if the vendor does not maintain that uptime guarantee.

Carefully plan your enrollment procedure to ensure that all people who need to be contacted are included in the service, and that their contact information is current and complete.

Carefully plan the type, number and content of notification messages, because:

Recipients of notification messages may ignore notices if too many are sent about the same event.

Carrier-based character restrictions on text messaging make the formation of a meaningful message challenging.

During a regional disaster, don't overload the telecommunications infrastructure with needless messages.

Business Impact: The interest in and need for EMNSs — which are critical for managing and improving an organization's crisis communications capability — continue to grow among governments, public and private enterprises (regulated or not), educational institutions, and operators of critical infrastructures, because crisis communications are becoming a best practice and a requirement for some industries (for example, higher education and part of U.S. fire code NFPA 72). The business benefits of using an EMNS tool include:

- Key personnel can be notified in minutes, and large numbers of nonkey, but affected, personnel can receive critical information about the event.
- Management can focus on critical decision making and exception handling, instead of message delivery.
- Human error, misinformation, rumors, emotions and distractions — which are so often found during a crisis — can be better managed and corrected.
- A documented notification audit log can be provided for real-time and postevent management.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Amcom Software; AtHoc; Blackboard; Cassidian Communications; Cooper Industries; Emergency Communications Network; Enera; ERMS; Everbridge; Federal Signal; FirstCall; Global AlertLink; MIR3; NY-Alert; Omnilert; Rave Mobile Safety; Send Word Now; SunGard Availability Services; West Communication Services

Recommended Reading: "Magic Quadrant for U.S. Emergency/Mass Notification Services"

"Market Analysis in Depth: EMNS Magic Quadrant"

"The Emergency or Mass Notification Service Market: Now and for the Next Five Years"

"Toolkit: Emergency and Mass Notification RFP Template, 2011"

"Spam Filters Could Cripple Your Emergency Notification System"

Hosted Virtual Desktops

Analysis By: Mark A. Margevicius; Ronni J. Colville; Terrence Cosgrove

Definition: A hosted virtual desktop (HVD) is a full, thick-client user environment run as a virtual machine (VM) on a server and accessed remotely. HVD implementations comprise server virtualization software to host desktop software (as a server workload), brokering/session management software to connect users to their desktop environments, and tools for managing the provisioning and maintenance (e.g., updates and patches) of the virtual desktop software stack.

Position and Adoption Speed Justification: An HVD involves the use of server virtualization to support the disaggregation of a thick-client desktop stack that can be accessed remotely by its user. By combining server virtualization software with a brokering/session manager that connects users to their desktop instances (that is, the OS, applications and data), enterprises can centralize and secure user data and applications, and manage personalized desktop instances centrally. Because only the presentation layer is sent to the accessing device, a thin-client terminal can be used. For most early adopters, the appeal of HVDs has been the ability to thin the accessing device without significant re-engineering at the application level (usually required for server-based computing).

While customers implementing HVDs cite many reasons for deployments, three important factors have contributed to the increased focus on HVD: the desire to implement new client computing capabilities in conjunction with Windows 7 migrations, the desire for bring your own device (BYOD) and device choice (particularly iPads), and the uptick in customers focused on security and compliance issues. During the past few years, the adoption of virtual infrastructures in enterprise data centers has increased, making HVDs easier to deploy. With this increase comes a level of maturity and an understanding of how to better utilize the technology. This awareness aids HVD implementations where desktop engineers and data center administrators work together.

Early adoption of this technology has been hindered by several factors, including licensing compliance issues for the Windows client OS. This has since been resolved through Microsoft Windows Virtual Desktop Access (VDA) licensing offerings; however, the cost still inhibits adoption. This was only one aspect of the higher total cost of ownership (TCO) associated with implementing HVD on a broad scale. While many IT organizations made significant progress in virtualizing their data center server infrastructures, HVD implementations required additional virtual capacity for server and storage (above and beyond what was in place for physical to virtual migrations). Even with Microsoft's reduced license costs for the Windows OS, which enables an HVD image to be accessed from a primary and secondary device with one license, there are still other technical issues that hinder mainstream adoption.

Since late 2007, HVD deployments have grown steadily, reaching around 18 million users by the end of 1Q13. Because of the constraints, the broad applicability of HVDs has been limited to specific scenarios, primarily structured-task workers in call centers, and kiosks, trading floors and secure remote access. About 50 million endpoints remain the target population of the total 700 million desktops. Throughout the second half of 2013 and into 2014, we expect general deployments to continue, albeit at a slower pace than in 2012. Inhibitors to general adoption involve the cost of the data center infrastructure required to host the desktop images (servers and storage in particular) and network constraints. Even with the increased adoption of virtual infrastructures, cost-justifying HVD implementations remains a challenge because of HVD and PC cost comparisons. Some advancements in leveraging application virtualization make HVD less cumbersome by introducing the ability to layer applications. This makes managing the image and maintaining the HVD easier. Availability of the skills necessary to manage virtual desktops remains a challenge, as is deploying HVDs to mobile/offline users, despite the promises of offline VMs and advanced synchronization technologies.

The virtual graphics processing units (GPUs) introduced in 2012 will eventually allow a broader audience, but will not have much impact until the end of 2013 and into 2014.

HVD marketing has promised to deliver diminishing marginal, per-user costs, due to the high level of standardization and automation required for successful implementations. However, this is currently only achievable for persistent users where images remain intact — a small use case of the overall user population. As other virtualization technologies mature (e.g., brokers and persistent personalization), this restraint will decrease. This will create a business case for organizations that adopt HVDs to expand their deployments, once the technology permits more users to be viably addressed. Enterprises that adopt HVDs aggressively will see later adopters achieve superior results for lower costs. However, these enterprises will need to migrate to new broker and complementary management software as products mature and standards emerge.

User Advice: Unless your organization has an urgent requirement to deploy HVDs immediately for securing the environment or centralizing data management, wait until late 2013 before initiating deployments for broader (mainstream) desktop user scenarios. Through 2013 and 2014, all organizations should carefully assess the user types for which this technology is best-suited. Clients that make strategic HVD investments will gradually build institutional knowledge. These investments will allow them to refine technical architecture and organizational processes, and to grow internal IT staff expertise before IT is expected to support the technology on a larger scale through 2016.

Balance the benefits of centralized management with the additional overhead of infrastructure and resource costs. Customers should recognize that HVDs may resolve some management issues, but will not become panaceas for unmanaged desktops. In most cases, the promised TCO reductions will not be significant, and will require initial capital expenditures to achieve. The best-case scenario for HVDs remains securing and centralizing data management, and structured-task users.

Organizations must optimize desktop processes, IT staff responsibilities and best practices to fit HVDs, just as organizations did with traditional PCs. Leverage desktop management processes for the lessons learned. The range of users and applications that can be viably addressed through HVDs will grow steadily through 2013. Although the user population is narrow, it will eventually include mobile/offline users. Organizations that deploy HVDs should plan for growing viability across their user populations, but should be wary of rolling out deployments too quickly. Employ diligence in testing to ensure a good fit of HVD capabilities with management infrastructure and processes, and integration with newer management techniques (such as application virtualization and software streaming). Visibility into future product road maps from suppliers is essential.

Business Impact: HVDs provide mechanisms for centralizing a thick-client desktop PC without re-engineering each application for centralized execution. This appeals to enterprises on the basis of manageability and data security.

Benefit Rating: High

Market Penetration: 1% to 5% of target audience

Maturity: Adolescent

Sample Vendors: Citrix; Dell; Desktone; Microsoft; Red Hat; Virtual Bridges; VMware

Open-Source Learning Repositories

Analysis By: Marti Harris

Definition: Open-source repositories are digital repositories built on open-source software for sharing of digital media and content. They include multiple formats of digital types and are available by institutional ownership, subscription or institutional membership in a consortium. Faculty and students can use the repositories for peer review content and to submit content for consideration.

Position and Adoption Speed Justification: A number of the open-source repositories connect to the most prevalent learning platforms and can be referenced by users when building course content or learning/studying materials. Open-source repositories can allow for the exchange of content and experiences in the larger education community. Progress on standards will cause the pace of adoption to pick up, but faculty culture is still not attuned to reusable, object-level content. Even sharing traditional course content within a department is not as prevalent as it could be. Perhaps the competitiveness of the tenure process leads to, in effect, the copyrighting of the learning content within an institution. In institutions, learning repositories will give way to digital content repositories that are not for the sole purpose of holding learning content as more and various types of content will be incorporated into learning. However, open-access repositories allow for the acceptable use of shared digital content between members of academic communities globally who

are not directly competing against each other. Both intellectual property and identity management are still important issues, but the simple solution of Creative Commons licensing is now spreading rapidly. In the global context, the Open Educational Resources movement is picking up speed in conjunction with the e-textbook trend, and we are almost seeing a second peak of hype. Altogether, this merits a successful exit from the Trough of Disillusionment and a relatively quick ride to the plateau.

User Advice: Consider open-source repositories to increase the performance of content access within a learning platform. Look for repositories with a track record of higher education integration with learning platforms. An open-source e-learning solution interfaced with a consortium-driven e-learning repository would be a powerful and economical solution for higher education institutions. Invest in some education regarding the Creative Commons licensing model.

Assess the willingness of faculty members and researchers to participate in open-source repositories, and identify barriers that may be removed early in these types of projects.

Business Impact: Affected areas include instruction, learning space, research and library management. With the continued rising cost of higher education, shared resources that are available through open-source repositories may provide improved ROI by making content and collaboration more accessible.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Alfresco; DSpace; EPrints; Fedora; MERLOT

SaaS Administration Applications

Analysis By: Terri-Lynn B. Thayer; Bill Rust

Definition: Software as a service (SaaS) for administration applications in education is software that is owned, delivered and managed remotely by one or more providers, based on a single set of common code and consumed in a one-to-many model by all contracted customers at any time, on a pay-for-use basis or as a subscription. Application service provider (ASP — aka "hosting") models differ from SaaS in that the solutions are owned by the customers, but hosted and managed by vendors using their experience and expertise.

Position and Adoption Speed Justification: Educational administrative applications that may be delivered through SaaS include major solutions, such as student information systems (SISs), finance, HR software, CRM, learning management, federal financial aid calculations and point solutions, such as substitute teacher notification and assignment systems. SaaS architectures are single-tenant, which support one customer per instance of the application, or multitenant, which accommodate multiple customers on a given instance of the application.

Over the past year, the interest in SaaS has increased dramatically for education at all levels. Primary and secondary school agencies are attracted to the model by its economies of scale and speed of deployment, as well as the growing recognition that the business requirements that schools once thought were unique to their particular organizations can be met without a custom (or customized) solution.

In the higher education environment, SaaS is gaining ground, along with business process outsourcing (BPO), particularly in the area of financial aid processing. SaaS offerings for the federal financial aid calculations — formulas that change yearly — are very practical and play to SaaS's strong suit: There's a single instance of regulations to update, with many users paying by the application to have the approved and validated calculations performed, relieving them of the yearly update to that portion of their higher education ERP systems.

Interest in broader SaaS offerings is increasing across the entire spectrum of higher education institutions, from the community college sector to major universities. Research-intensive institutions have demonstrated considerable interest in SaaS solutions for HR, payroll and finance systems, with Workday experiencing significant interest among this group. Some less complicated institutions are seeking SaaS offerings for their SIS requirements, although there is still not a viable SaaS SIS for more complex schools. Higher education institutions are driven to consider SaaS for a variety of reasons, including avoidance of high capital costs and disruption related to major upgrades, staff relief from maintaining a growing portfolio of customizations, and a desire for the consequent standardization of business processes inherent in adopting a SaaS solution. Multitenant solutions are by design often free of customization, and the institution benefits from frequent introduction of new functionality. However, the institution typically has limited control over the schedule of these upgrades.

Barriers to adoption include cultural proclivities and legal and security concerns. The culture of education, especially K-12 education, shows a demonstrated preference for customized and/or self-built solutions. Legally, state, local and federal requirements for locating stored data or for the public disclosure of business practices that SaaS providers consider a competitive advantage can delay, if not stop, the implementation of a SaaS solution. However, adoption is expected to accelerate, especially in primary and secondary education, where common business requirements will be driven by accountability mandates from federal levels of government, as will be the case in higher education in the very regulated area of financial aid. The recognition of SaaS as a form of cloud computing also brings attention and a degree of acceptance to SaaS solutions in this market.

User Advice: Best practices for considering administrative application requirements are re-examining needs, and considering process and technology changes to meet business requirements. Build business cases to satisfy these business requirements that comprise the ongoing total cost of ownership for the range of solution models, including SaaS. The key decision will often be reduced to balancing calls for customized, highly enterprise-specific requirements — and the costs that accompany them — versus the opportunities that may be offered through SaaS or other shared deployment models. Keep in mind that SaaS applications are a form of cloud computing, and that the true test of deploying SaaS is the capacity to deliver your established performance indicators. Flexibility, control, customizability, and scalability should all be carefully considered when adopting a SaaS solution.

Business Impact: SaaS offers school organizations the opportunity to identify and concentrate on analyzing and using essential data without saddling them with the hardware, software and staffing requirements that accompany enterprise-hosted solutions. Educational agencies and institutions that don't view their data requirements as unique will adopt SaaS. Those that do not see a common solution — and are willing to pay for the perceived critical differences between themselves and similar organizations — will not adopt SaaS.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Ellucian; TopSchool; Workday

Recommended Reading: "CIOs Should Clarify Roles and Responsibilities of IT for Cloud Applications in Higher Education"

Enterprise Architecture

Analysis By: Brian Burke; Philip Allega

Definition: Enterprise architecture (EA) is a discipline for proactively and holistically leading enterprise responses to disruptive forces by identifying and analyzing the execution of change toward desired business vision and outcomes. EA delivers value by presenting business and IT leaders with signature-ready recommendations for adjusting policies and projects to achieve target business outcomes that capitalize on relevant business disruptions. EA is used to steer decision making toward the evolution of the future-state architecture.

Position and Adoption Speed Justification: Leading EA programs continue to push the overall EA discipline further toward the Plateau of Productivity in the next two to five years. The overall maturity of EA by practitioners is improving, continuing to progress on the Slope of Enlightenment through 2013. Leading EA teams balance focus on transformational change while maintaining existing services.

Leading EA practitioners are business-outcome-driven, and evolve their EA programs with a focus on EA value realization rather than on the creation of artifacts for their own sake. EA programs have clearly shifted their positioning away from an inward view of IT systems alone to a broader vision of EA that guides their organizations to realizing their enterprise strategies and goals.

Continued movement up the Slope of Enlightenment in 2013 is driven by EA practitioners that are leading the evolution of EA in five key ways:

1. Focusing on business transformation
2. Integrating EA with business
3. Defining business outcome performance metrics

4. Working closely with business executives
5. Investing in EA (95% of leading programs invest 10% or more of their IT budgets on EA)

While EA is an established discipline in the majority of organizations, there continues to be large numbers of organizations that are either starting or restarting EA programs. Overall, EA maturity on Gartner's ITScore is 2.64 out of 5.00, leaving significant room for improvement. In a recent survey of 134 EA practitioners, we asked how successful their EA program had been over the past year. Only 18% responded above the midpoint, reinforcing the argument that there is room for improvement. We believe a large number of EA practitioners are shifting focus to a more pragmatic business-outcome-driven EA approach, but as a general practice EA remains on the Slope of Enlightenment. As a larger number of EA practitioners become focused on delivering business outcomes, the EA practice will evolve to reach the Plateau of Productivity within the next five to 10 years. While it may seem to be a long transition period, change comes slowly to the practice of EA, demonstrated by the fact that it has taken more than 25 years for EA programs to progress to the level of impact we are seeing today.

User Advice: Enterprise architects must make the switch from process-driven EA approaches to a business-outcome-driven EA. As noted in "Stage Planning a Business Outcome-Driven Enterprise Architecture," EA is a journey, not a destination. Each stage of the journey must be planned pragmatically, and be focused on a limited set of target business outcomes. Each iteration must deliver a highly valuable set of recommendations for business managers to execute.

Thinking in terms of stage planning guides EA practitioners must think strategically to:

- Align EA to the highest-priority business outcomes.
- Streamline EA development to only create the deliverables that directly address the highest-priority business outcomes.
- Define a process to create those deliverables in a resource-efficient way.

Business Impact: EA must focus on the most significant business disruptions and outcomes that the organization faces, and deliver the road maps that will guide the organization through the required change. The scope of EA change includes business, information, solutions and technology, and will:

- Address opportunities for strategic and tactical change to enable the competitive positioning of the business in the future state.
- Identify deficiencies in the current-state portfolio that must be resolved.
- Provide a set of constraints on projects to minimize complexity.

To support these activities and address stakeholder issues, enterprise architects will:

- Engage senior business and IT leadership to understand the goals of the organization.
- Clearly communicate business strategies, and articulate dependencies and requirements, to business leaders.

- Measure and deliver the value of EA, based on enabling business outcomes rather than on the internal tasks of developing EA artifacts.

Benefit Rating: Transformational

Market Penetration: More than 50% of target audience

Maturity: Early mainstream

Recommended Reading: "Stage Planning a Business Outcome-Driven Enterprise Architecture"

"EA Stage Planning: Target Business Outcomes"

"EA Stage Planning: Frame EA Deliverables"

"EA Stage Planning: Plan EA Delivery"

"Define the Business Outcome Statement to Guide Enterprise Architecture Efforts"

IT Infrastructure Utility

Analysis By: Claudio Da Rold; Frank Ridder; Philip Dawson

Definition: Gartner first defined an IT infrastructure utility (IU) as a shared IT infrastructure architecture provided through on-demand services. More broadly, we define infrastructure utility services (IUS) as the provision of outsourced, industrialized, asset-based IT infrastructure managed services (below the business application functional layer). IUS are defined by service outcomes, technical options and interfaces, and are paid for based on resource usage, allocation or number of users served.

Position and Adoption Speed Justification: IUS represent the industrialized version of data center managed services and are integral to the evolution of that market. The data center managed services market is significant in size (more than $120 billion in 2012, not counting network outsourcing) and encompasses several delivery models (see "Toolkit: Price Dynamics on the Data Center Services Market Map; The 3D View"). All types of providers in this space — including vendors, outsourcers, hosting companies, network service providers, offshorers and cloud specialists — are increasingly addressing utility and cloud-based services as well as managed services. This feeds the IUS space with offerings branded as cloud, private cloud, hybrid cloud, utility or industrialized services solutions. In 2012 the Gartner IT service market share structure was modified to include a number of different delivery models (traditional outsourcing, hosting, cloud infrastructure as a service [IaaS], and IUS).

The most basic IUS style is utility hosting, which has evolved from traditional dedicated hosting via virtualization and is now moving rapidly toward cloud IaaS. The most developed IU offerings are currently built on standard infrastructure blocks (such as virtualized computing, storage and networking), to which platform elements designed to support a specific application landscape (such as enterprise resource planning, CRM, communications and collaboration) are added. By far the most mature offerings are those developed since 2005 to support customized SAP environments.

By using IUS, the client is still in full control of the customized applications, while the service provider defines, develops, controls and manages the operating platform up to a level below the logic of the application. The provider tailors the architecture/performance and price of the service to the application requirements. For example, billing per server, per GB or based on the SAP Application Performance Standard.

Leading outsourcers are industrializing their delivery models and virtual data center hosting companies are delivering IUS that increasingly leverage a cloud computing infrastructure that provides the basis of virtualization and low-level automation. Specialized companies, such as ThinkGrid, are also introducing virtualized desktop utility services into their service stack (see "Data Center Services: Regional Differences in the Move Toward the Cloud, 2012"). A whole new set of utility services will be driven by the Nexus of Forces and the requirement to quickly enable mobile, cloud-based and always-connected consumers to use applications and services.

Finally, public cloud compliance issues for regulated industries (such as banking, insurance, pharmaceutical and the public sector) make IUS an attractive model to provide shared and compliant services.

As cloud technology becomes more pervasive, more vendors are offering infrastructure utilities (for example, Accenture, CSC and IBM announced a private cloud for SAP application offering in 2011). Increasing levels of adoption and more competition has advanced the maturity of the IU further and software tool providers and cloud specialists are raising the amount of the managed services work that can be automated to make the service more resilient and less expensive.

Between 2009 and 2012, intensive competition between competing IU for SAP (IU4SAP) solutions brought down the price of this industrialized service significantly showing that, in many cases, the next step in industrialization will be low-cost services (see "Riding the Wave of Industrialized Low-Cost IT Services"). Examples of current industrialized, one-to-many, low-cost IT services include virtualized servers available for $150 or less per server per month, and IU4SAP with entry levels at approximately $7 per user per month for large installations, much lower than traditional client costs (see "Estimated Price Points for Industrialized Low-Cost IT Services").

The move by large IU providers into offering public cloud services (for example, HP launched a public cloud IaaS in April 2012 and IBM just announced the acquisition of SoftLayer), the ongoing price reduction of cloud services by major providers such as Amazon, and the announcement that Microsoft will deliver platform as a services (PaaS) and IaaS within Azure while matching Amazon prices, further increases the potential for ongoing lowering of costs due to higher volume and full automation leverage.

Fueled by the continuing economic challenges, the industrialization trend of the IT services industry is actually accelerating (see "Outsourcing Trends, 2011-2012: Exploit Changes in Infrastructure Services"). The evolution from traditional outsourcing delivery models toward cloud-based models is driving innovation at an increased pace and is leading to significant further investment at different service layers. Many of these investments are being made in the infrastructure layer, because this is an area where virtualization technology is mature, sharing is possible (providing organizations understand the risks and can satisfy their security and compliance requirements), the willingness to outsource is high, the acceptance for standard services is solid and knowledge is widely available

(see "How Key Trends in the Data Center Infrastructure Outsourcing Market Will Affect Your Business").

Finally, the ongoing discussion about cloud delivery models ranging from private to hybrid to public, and the mix of hype and fear, uncertainty and doubt associated with cloud computing, are fueling interest in IUS, which are perceived as more secure and reliable than public cloud (see "The Realities of Cloud Services Downtime: What You Must Know and Do").

For the latest evaluation of providers in this space, refer to the latest Magic Quadrant for Data Center Outsourcing and Infrastructure Utility Services, available with regional versions for Europe, North America, and Asia/Pacific.

User Advice: IUS are managed services delivered through an industrialized delivery model. All client organizations should:

- Improve awareness and understanding of these new IUS offerings to leverage their potential value for their enterprise.
- Include IUS in the set of service options under evaluation as part of their sourcing strategy and enterprise architecture.
- Investigate critical areas, including pricing mechanisms and demand management, architectural specifications and limits, impact on application software licenses, service transition in and out, contract terms and conditions, security, compliance, auditing and risk management.
- Use the Gartner Infrastructure Utility Maturity Model as a road map to follow the evolution of infrastructure toward the real-time infrastructure concept. This evolution will affect most organizations, regardless of their decision to transform and run their infrastructure internally (insourced delivery) or externally (outsourced delivery or IUS).

Organizations delivering their IT infrastructure services in-house should regularly monitor how IUS offerings are advancing in the market. Increasingly, these offerings will become the external benchmark for price, efficiency and flexibility. Some of those will take the form of industrialized low-cost services (see "Industrialized Low-Cost IT Services Drive Value, By Definition").

Organizations considering outsourcing deals, utility or cloud IaaS offerings should:

- Concentrate on pricing units and pricing schema — and on the related tools for service requests, metering, billing, and financial and service reporting — to understand the maturity of offerings. The degree of flexibility must align with client requirements and the maturity of the offerings.
- Request references from other clients using these offerings and pricing units and exercise due diligence in actively checking those references. Discuss transition issues as a key area of concern.
- Ask the provider to carefully describe the processes, automation tools and SLAs underpinning service delivery quality, reliability, compliance and efficiency, because a focus on unit definition and pricing alone is insufficient to achieve the best value for money.

- Request that providers communicate their service/architecture road maps to give an understanding of how their offerings evolve over time and to judge the potential for lock-in into their specific architecture. Ask providers how they are moving from traditional to cloud-based IU services during the next few years.
- Understand how their sourcing life cycle (sourcing strategy, vendor selection, contracting and ongoing management) will change when embracing highly-standardized solutions.
- Start piloting or using IUS as part of their IT value chain and evaluate hidden costs, TCO and transition cost during the pilot phases.
- Request proof regarding statements of regulatory compliance and verification of security and location transparency of data stores.
- Verify the impact of software licensing models when moving from dedicated to shared IU-based hosting solutions.
- Understand the impact of the solution on their three-year and five-year planning cycles, including potential opportunities and risks alike.

Business Impact: IT IUS can:

- Optimize the cost-efficiency and service effectiveness of IT infrastructure around virtualization.
- Increase flexibility in response to business requirements.
- Deliver an open, predefined and automated platform for innovation.

To reap the benefits of IUS, clients must overcome significant cultural, financial and technical issues, such as standardization acceptance, independent software vendor pricing strategies, application portability, virtualization and policy-driven management for heterogeneous environments. Continuing economic uncertainty and the further rise of cloud-enabled services solutions will accelerate the evolution toward the industrialized and low-cost IT services that are expected to provide an ongoing and significant unit price reduction in the coming years.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Accenture; Atos; AT&T; BT Global Services; Capgemini; CSC; Dell; Fujitsu; HCL Technologies; HP; IBM; Logica; Rackspace; Savvis; T-Systems; Telstra; Terremark; Unisys; Verizon Business

Recommended Reading: "IU4SAP Offerings: Accenture's Private Cloud Solution for SAP"

"Infrastructure Utility for SAP Applications: TSystems' Dynamic Services for SAP Solutions"

"Infrastructure Utility for SAP Applications: HP ECS-Utility for SAP Offering"

"Infrastructure Utility for SAP: An Analysis of HCL Technologies' Offerings"

"Infrastructure Utility for SAP Applications: CSC Cloud IU for SAP"

Intellectual Property Rights and Royalties Management Software

Analysis By: Mike McGuire

Definition: Intellectual property rights and royalties (IPRR) systems — a class that includes intellectual property rights management (IPRM) — enable rights holders to index and associate specific business rules (including distribution rights information) with each piece of content under their control.

Position and Adoption Speed Justification: This profile of IPRR management software focuses on the media and content industries. Note that IPRR as a class includes patents, as well as applications in the pharmaceutical, IT and education sectors. Some vendors mentioned herein are expanding into some of these other areas, but their primary focus is on media and entertainment opportunities.

The shift from analog to digital assets has changed the nature of IP in the media industry. IP that used to consist of a single episode, for say a TV series, can be treated as literally hundreds of digital assets. As such, IP management systems — particularly many older, homegrown solutions — are struggling to match the ever-increasing complexity created by a multichannel/multidevice world. Content licensing, image licensing and music licensing agreements cover an already complex set of interlocking contractual arrangements that go into the development and distribution of copyrighted material. IPRR/IPRM platforms often include, run parallel to or tie into royalty tracking and settlement systems, given that each commercial transaction for copyrighted content typically requires a royalty payment. These uses will include distribution to multiple online distribution providers, incorporation with advertising, use in consumer products, or display through traditional and digital means. Typically, the software is a component in a digital distribution value chain at a content company, and it is used in conjunction with digital asset management solutions. The IPRR/IPRM systems provide the content company with a way to track the authorization or "clearance" of the rights-in/rights-out of a given work. To be clear, the solutions covered in this Hype Cycle entry typically do not include content protection or digital rights management technologies (which has its own entry).

Ultimately, solutions must incorporate analytics to determine the relative performance of properties and integrate with finance and accounting systems for calculating royalty payments. There will also be a need to integrate or match up output with systems or services used to monitor compliance with the licenses that have been granted, and to identify the unauthorized use of licensed content. Moreover, media company IT executives and their internal clients — legal, sales, finance and business teams — are demanding that IPRM systems not only provide the capabilities previously mentioned, but also provide timely status reports on all the commercial transactions for a given set of assets. While real-time sales and licensing/transaction reports are not on the immediate horizon, decision makers are increasingly pushing for more than monthly reports. Meeting this particular

demand will give media executives the business information they will need to develop and exploit any new business models that Internet-based delivery might enable.

At the core, the IPRR/IPRM market is about providing content companies with the tools needed to know their inventory — what they have a right to sell and where and when — and to track and monetize it. With the explosion of the online distribution market — from video on demand and over-the-top video, to online distribution via online stores — demand for robust IPRR/IPRM solutions will only increase as content companies scramble to find the tools required to legally and profitably meet this new demand.

This already fraught situation is going only get more complicated and, once again, it's the music industry that will serve as test case. As music distribution moved from unbundling CDs into a set of individual tracks, and those tracks have moved from being sold one at a time through download stores, to being streamed to an application on a PC or connected device, tracking and accounting for all those streams is creating a big data headache for rights holders. As movie and TV businesses face the potential of a similar "time of unbundling" (the signs are starting to point to unbundling of tiered programming bundles that define the economics of the U.S. TV market), it would seem logical that a related big data challenge awaits them.

User Advice: Media companies that are not yet automating their licensing processes — or at least key elements such as rights-in or rights-out overall, or even smaller elements such as clip licensing — must build plans to automate these processes. The growth in online distribution, driven by the huge interest that consumers are showing in devices such as media tablets, smartphones and other connected devices, mandate media companies invest in IPRR/IPRM platforms. Particular attention should be paid to the integration level offered for core business applications and the potential for growth. It's just as important as starting with a solid set of company-standard definitions for rights-in and rights-out systems. In many cases for media companies that own or control large libraries of content, this process will start with an intellectually simple but operationally challenging effort of entering in the information from the contracts of all their owned or controlled movies, TV shows, books, songs, etc.

Media companies must drive for standardization of lower-level issues such as definitions and metadata requirements for tagging content — knowing that a single piece of content can now be distributed or exploited in multiple ways — which are important requirements to fully leveraging these IPRR/IPRM platforms. Active participation is critical, at the appropriate levels, in industry efforts to develop high-level common-content IDs and the development of registries.

Business Impact: IPRR/IPRM affects IP management, sales, contract management and CRM. In contrast to businesses that are trying to protect their IP, media companies are trying to protect their assets while exploiting them across multiple distribution channels, which requires them to track content usage, enforce distribution contracts and calculate royalty payments to myriad stakeholders involved in the creation and distribution of the assets.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Adolescent

Sample Vendors: Counterpoint Systems; Mediamorph; Oracle; Prodagio Software; Real Software Systems; SAP

Recommended Reading: "Amazon, Apple, Facebook, Google, Microsoft and Sony Battle for Supremacy in the Media Clouds"

Lecture Capture and Retrieval Tools

Analysis By: Marti Harris

Definition: Lecture capture and retrieval tools are two sets of complementary tools often presented as a suite. Lecture capture tools perform live recordings, including voice and relevant visual material, in as complete a manner as possible. Lecture retrieval tools aid students in retrieving the whole lecture or the parts of the lecture relevant to their learning needs.

Position and Adoption Speed Justification: Several proven solutions are on the market and more institutions send out RFPs, leading us to believe that the breakthrough in adoption as an enterprise solution is not far away. One driving factor is the successful adoption within discipline-specific programs and departments, which continues to shorten the time to broader adoption. Teacher push-back and system complexity continue to impact the speed of adoption, although systems are improving on several fronts. Desktop editing options for faculty members should help soften push-back. We see lecture capture and retrieval systems passing the Trough of Disillusionment and climbing the Slope of Enlightenment with a quick path to the plateau.

User Advice: User acceptance is key to deployment, in terms of functionality and instructors' acceptance of being recorded. Pilot implementations with thorough evaluation and stakeholder involvement are a must. Evaluation must include: (1) ease of use and convenience; and (2) ease of deployment, as well as search/indexing and "playback" functionality for students. Beware of the social and behavioral issues with these solutions. Initially, faculty are not accustomed to being recorded or the additional preparation time needed to teach with this tool. Faculty support must be addressed seriously. However, it can be expected that younger generations (both faculty and students) will become increasingly accustomed to peer-created content and realize that recorded lectures should not be compared with Hollywood production standards. Expectations will then focus on the learning qualities, rather than the production qualities.

Consider statistical functions that help to monitor student usage coupled to, for example, student success and student retention. Seek a solution that can be integrated with e-learning platforms. Consider software as a service (SaaS) solutions to minimize storage implications.

Business Impact: Lecture capture and retrieval tools have been shown to have some positive effect on student grades and retention, and they promise to be important pedagogical tools. The ability to index lectures and to offer playback of selected passages have proven to be key to these positive results. However, they are just two of many tools that are needed, and they can never replace good teaching. They can only extend its reach. Practical benefits include review, improved

scores, improved retention, convenience, and a new option for students to make up planned or unplanned absences.

Benefit Rating: Moderate

Market Penetration: 5% to 20% of target audience

Maturity: Mature mainstream

Sample Vendors: Accordent Technologies; Cisco; Echo360; Panopto; Sonic Foundry; Tegrity; Winnov

802.11n

Analysis By: Tim Zimmerman

Definition: The 802.11n standard is the latest wireless LAN (WLAN) standard ratified by the IEEE. Improvements have expanded the throughput and range of 2.4GHz or 5GHz. A single spatial stream operating within a 20MHz channel width can achieve 75 Mbps throughput, compared with the 54 Mbps of a similar 802.11a or 802.11g solution. However, most vendors offer two or three stream radios that are capable of a throughput of up to 450 Mbps. Like previous 802.11 standards, 802.11n provides backward-compatibility with 802.11a, 802.11b and 802.11g standards.

Position and Adoption Speed Justification: The market movement to 802.11n has been steady. Many vendors continue to report that more than 90% of new access points purchased are 802.11n. The 802.11n standard is subject to the same considerations as other access points — autonomous versus coordinated, controller-based versus controllerless versus in the cloud, or with one, two or three integrated radios within the access point.

User Advice: IT leaders should consider dual-radio (2.4GHz and 5GHz) 802.11n for all their WLAN requirements. The number of radios within an access point, as well as the number of spatial streams supported and the type of multiple input/multiple output (MIMO) support needed, will be determined by the enterprise WLAN requirements, including capacity and level of service. Vendors will still have points of differentiation that will not only improve wireless network performance in terms of capacity and robustness of communication, but will also create the need for use case testing, because vendor implementation choices will impact data, voice and video applications.

Business Impact: Consider 802.11n for all WLAN scenarios within the enterprise, including small branch, remote office or large enterprise solutions. We believe that 802.11n will enable sufficient bandwidth and support of required capabilities (such as quality of service) for many enterprises to consider for moving their data, voice and video applications to the WLAN.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Aerohive Networks; Aruba Networks; Cisco; HP

Recommended Reading: "Magic Quadrant for the Wired and Wireless LAN Access Infrastructure"

"Use Best Practices to Implement a WLAN"

"Best Practices for WLAN Site Surveys That Save Money"

Unified Communications and Collaboration

Analysis By: Jeffrey Mann

Definition: Unified communications and collaboration (UCC) describes the combination of unified communications and collaboration technologies. Enterprise collaboration vendors were previously fairly distinct from those for enterprise communications, with software companies like Microsoft and IBM dominating the former, and telephony and networking vendors making up the latter. This distinction has blurred because Microsoft and IBM offer voice and telephony features and vendors like Cisco, Avaya and Siemens have made moves toward the collaboration market.

Position and Adoption Speed Justification: Because UCC represents the merging of former, distinct marketplaces, there are significant hurdles to overcome when considering it for enterprise use. Vendors have been jockeying for position to gain influence over end users, leading former partners such as Microsoft and Cisco to become fierce competitors.

Vendors have been aggressively adding functionality to their product suites that overlap or compete directly with other products brought in-house for completely different reasons. For example, Microsoft's Lync is still used primarily as an IM and (secondarily) Web conferencing platform. However, it also includes voice and telephony functionality features that many organizations have already acquired from other vendors. Enterprises must decide whether to accept the overlap, drop the incumbent supplier or live with more than one provider and integrate the different functions. Social technology is the next potential area of unification as activity streams and enterprise social network functionality overlaps with or incorporates IM and other communications capabilities.

Over the past decade, disparate organizational functions have been merged together in a sometimes turbulent mix, with either two disparate IT sub-departments, or an IT department (typically charged with collaboration and end-user productivity) and the communications infrastructure group (responsible for telephony and networking) being restructured into a single operating unit. End-user organizations are coming under pressure as IT sub-departments responsible for communications increasingly conflict with the others that are responsible for collaboration. We regularly hear customers complaining, "Why are they bringing in new voice services when we already have that covered?" or conversely, "Why won't they let us use the cool facilities built into these tools?" These tensions will have to be resolved and new market "norms" established before it becomes clear what the balance will be between UCC and unified communications in the marketplace. Vendors are several years into this effort, so this technology is moving quickly along the Hype Cycle.

Collaboration vendors will have a hard time achieving the required quality and robustness of traditional communications vendors as they add these capabilities to their products. This is similar to how communications vendors are finding it a challenge to understand UI issues and how people work. For the moment, seamless UCC remains an aspiration for most suppliers. However, the potential benefits of UCC make it a worthwhile exercise. Shifting seamlessly between a variety of communications and collaboration modalities increases productivity and end-user satisfaction.

Consumerization is also driving user expectations in this area. Facebook, Google, Apple and Skype can mix communications and collaboration, so why can't enterprise vendors?

User Advice: Ensure that the different IT sub-departments involved are aware of each other's plans and are communicating effectively. Creating a joint task force to develop a UCC strategy made up of communications, network and collaboration people, as well as representatives from management and lines of business, has proven to reduce interdepartmental friction.

Separate the organizational and budget politics from an evaluation of the benefits of enhancing users' communication and collaboration capabilities. Users need some of both. For many users it may generally be better if they are more integrated (unified) than not. A UCC project can produce both benefits and unintended drawbacks. In some cases, it could needlessly disrupt current and effective work practices, add complexity and may be seen as unnecessary, costly and a waste of human and technical resources. In other cases, it can improve communications, augment work performance, increase effectiveness and help disparate virtual teams excel. Some employees may do better with, and some better without, UCC. Do not treat this as an all or nothing proposition for every user — show tolerance. Allow some degree of overlap and redundancy if it provides beneficial or is more convenient. Determine the right capabilities road map for various user segments and work the organizational and budget politics into a separate parallel path.

To become more familiar with the possibilities and prove the value of UCC, first look for groups of users who already understand the potential benefits and business cases that provide the clearest path to a measurable return. These test cases can help build the case for more widespread deployment.

Business Impact: Users expect to be able to employ an integrated set of collaboration tools, escalating to the highest value combination of interactive services — both inside and outside the firewall and including fixed and wireless networks — for the business task at hand. Presence services will be a vital unifying tool, enabling users to right click on a name and invoke a variety of collaboration mechanisms. Shared team spaces will provide temporary and persistent repositories for interactions. These capabilities will be available as a complete stack from some vendors — which currently only provide point solutions — as they expand their offerings. Standards-driven integration will make even more combinations possible, beyond relying on a single vendor's product stack.

The value to organizations will be realized in several ways. First will be the simplified and more effective use of the increasingly broad range of collaboration and communication options. Second will be the improved ability of individuals and groups to accelerate reactions to market events. Third will be efficiency gains from the contextual embedding of communication services into applications at points where, for example, process disconnections occur and human intervention is necessary.

Identifying the potential value of UCC is easy. What organizations will struggle with is quantifying the benefits and calculating ROI. Companies may need to eschew traditional ROI mechanisms and look for alternative, less quantifiable means to justify UCC investments, such as process cycle acceleration, faster problem remediation, increased information awareness and the inclusion of more internal and external resources in planning processes.

Benefit Rating: High

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Avaya; Cisco; Google; Huawei; IBM (Lotus); Microsoft; Siemens Enterprise Communications

Recommended Reading: "What You Need to Know to Succeed in the UCC Market"

"Single-Vendor or Multivendor UCC: Which Approach Is Best for You?"

Tablets

Analysis By: Roberta Cozza; Van L. Baker; Angela McIntyre

Definition: A tablet is a device based on a touchscreen display that facilitates content entry via an on-screen keyboard. It has a screen with a diagonal dimension of a minimum of seven inches. Tablets lack the extensive content creation of ultramobiles or notebook PCs. Tablets are categorized as either premium, basic or utility based on the experience they deliver via hardware specifications and consequent software. Premium tablets are approaching the capabilities of ultramobiles. Examples are: Apple's iPad, Google's Nexus7 and Microsoft's Surface RT.

Position and Adoption Speed Justification: Beyond Apple's iPad, and with the exception of consumer-oriented tablets from Google and Amazon, other tablet vendors have not enjoyed much success to date. Other manufacturers remain committed to this hardware platform and will continue to improve their offerings in 2013. The success of the tablet form factor has been primarily in the consumer market, but it also continues to be increasingly considered within the business segment where the shift toward the bring-your-own-device trend is accelerating tablet adoption. Tablets are mainly used as companion devices, and the use of tablets as primary computing devices remains limited to specific roles, or to support specific enterprise processes at present. Tablets screens are seven inches and larger and may come with a supplementary input device, such as a keyboard or stylus. The primary focus for tablets has been on content consumption, but tablets with screens 10 inches or larger are increasingly used for light content creation.

This device category has disrupted the consumer PC market, with the greatest impact on the notebook segment. Tablets offer an attractive alternative to mini-notebooks, low-end notebooks and thin-and-light notebooks for consumers who are focused on content consumption. Gartner sees a structural shift in the market, in both mature and emerging geographies, in which fewer consumers replace their PCs. Instead, many consumers transfer to tablets and leave their traditional

PCs to age out without replacing them. Once in use, tablets assume a central role in handling consumer consumption tasks, with users finding they spend less and less time on PCs.

The content creation capability of tablets is improving and their instant-on functionality and long battery life give them a convenience that appeals to consumers. Wireless keyboards can easily be added for extended periods of typing, but content creation tasks will still take place predominantly on a shared PC or ultramobile. Ongoing transfer out to tablets from consumer notebooks will be further helped by proliferation of affordable 7-inch and 8-inch tablets from 2013. As prices of tablets decline and capabilities of utility tablets from white-box vendors improve, we will see first-time users in emerging markets considering a tablet as their first computing device to accompany their phone or smartphone. This will strongly threaten PC sales growth opportunities. As a result of these dynamics, Gartner's PC forecasts show a strong drop in both PC units shipped and installed base over the next four years.

Tablets may have "open-source" OSs, such as Android, under the control of the OS vendor with modifications from the device maker, or an open OS under the control of the OS vendor, such as Apple's iOS 5 or Microsoft's Windows 8. The OSs offer open programming APIs and development environments for third-party developers to create applications that can be downloaded from online stores, such as the Apple App Store, Google Play and the Amazon Appstore. The rapid growth of tablet-optimized applications has contributed to the success of the tablet market, while the success of e-book and magazine reader applications for tablets has significantly altered the e-reader market.

Tablet capabilities for content creation, such as photo and video editing, as well as productivity applications, have improved dramatically in the last year, making these devices more practical as general-purpose tools. This trend is expected to continue.

More than 115 million tablets were sold worldwide in 2012, and Gartner forecasts see global tablet penetration above 5% of target audience in 2013. Tablet global household penetration is expected to reach over 45% by YE17 (assuming one tablet per household). This justifies a faster movement along the Hype Cycle, reaching the pre-plateau position.

User Advice: Enterprise IT architects should prepare for tablets to continue to gain traction in their employee base as the devices increase in popularity with consumers. In many cases, these devices have already entered the enterprise as employees use their own tablets for work. IT managers should apply the managed diversity model for these devices. For tablets with the Android OS, IT managers should select device makers on the strength of their security road maps and adherence to OS updates. Apple iOS 5 has improved security features for iPad. Windows RT tablets need different management and security products than x86-based Windows 8 tablets. IT should decide whether the security features of tablets are sufficient to address the risks associated with the job roles in question and the application needs of mobile users.

Tablets should also be considered for business-to-consumer applications for delivering content, providing high-quality graphics in sales situations and/or driving customer engagement where it is required for navigating through marketing materials. During the next three years, tablets will be used in business for customer-facing roles — for example, by sales (to give presentations to clients), by realtors and by executives. The adoption of tablets by businesses will depend on the development of software that incorporates touch in ways that significantly enhance the user experience or

improve productivity, because there is a lack of multitouch-centric user interfaces in mainstream productivity applications.

Tablet deployment remains strong in vertical segments like transportation, healthcare and education.

Business Impact: The adoption of multitouch technology in both the smartphone and tablet categories has elevated multitouch-use models to mainstream devices that consumers carry every day. Additionally, the availability of instant-on access has driven strong adoption as consumers have come to place a high value on this feature. The proliferation of multitouch and instant-on capabilities in tablets and smartphones has put additional pressure on the PC industry to offer multitouch and instant-on functionality in notebooks. Ultramobile designs (Ultrabooks, for example) incorporate tablet features popular with consumers, such as long battery life and instant-on access. Touch capability has become mandatory for ultramobiles using Intel's Haswell chipset. The disruptive influence of tablets on the market has also put an emphasis on industrial design that was lacking in the market before the arrival of these devices.

Manufacturers of consumer electronics need to broaden their efforts to address the full user experience and avoid focusing on hardware features as they develop tablets for the market. Consumers have shown that they are much more concerned with usability and software that is well designed for use with a multitouch tablet environment than they are with hardware features.

PC manufacturers will increase experimentation with controls, such as gesture and voice, in addition to multitouch. Tablets, in conjunction with smartphones and cloud-based services, are fundamentally changing PC use models today and the impact will accumulate in the longer term as the installed base of traditional PCs shrinks considerably (see "Forecast Analysis: Devices, Worldwide, 1Q13 Update").

Benefit Rating: Transformational

Market Penetration: 5% to 20% of target audience

Maturity: Early mainstream

Sample Vendors: Acer; Amazon; Apple; Asus; Google; Lenovo; Samsung Electronics

Recommended Reading: "Market Definitions and Methodology Guide: Consumer Devices"

"Apple iOS 5 Enterprise Improvements for Tablets and Smartphones"

"iPhone and iPad Security Assessment"

"Android Smartphone and Tablet Security Assessment"

"Quarterly Statistics: Personal Computers, All Countries Forecast Database, 2Q12 Update"

"Windows on ARM May Not Be What Many Enterprises Expect"

Game Consoles as Media Hubs

Analysis By: Mike McGuire

Definition: Game consoles as media hubs describe the proprietary software applications that, along with broadband connectivity, enable game consoles to deliver broadband premium content services, including movie, TV and music offerings (such as Netflix and Hulu). Most content options are delivered on demand, but increasingly live TV programming (authentication required) is also available.

Position and Adoption Speed Justification: Throughout 2012 and into 2013, game console vendors continued to refine and expand the positioning of their consoles as multimedia hubs for consumers. As some of the gamer population has moved online, multiplayer gaming is becoming the norm. Gamers are also avid consumers of nongaming content, and they are not the only users in the household that are interested in its delivery. Microsoft and Sony have been increasing the services they offer to include movies, television shows and other services. Microsoft's Xbox 360, and recently announced but not-yet-shipping Xbox One, and Sony's PlayStation 3 (and the announced but not-yet-shipping PlayStation 4) now offer a robust set of content, ranging from movies via broadband streaming services, such as Netflix and Epix, to the whole slate of TV programming from ESPN. The challenge for the vendors is convincing hard-core gamers — the consumers that put these consoles in a position to expand beyond gaming — that the new platforms are still powerful, engaging gaming devices. With their added online media services capabilities, these consoles compete with over-the-top (OTT) set-top box (STB) vendors such as Roku, Boxee and the Apple TV. However, with the new consoles rumored to be priced in the $400 to $500 range — and in the Xbox's case an additional $100 for the Kinect sensor, these devices are considerably more than the $100 or less than OTT STB manufacturers typically charge. By opening up their platforms for applications from content or service companies, consoles have an expansion capability that OTT STB vendors might be hard-pressed to match.

Throughout 2012 and into 2013, Microsoft and Sony exchanged a series of announcements focused on nongaming content, with Nintendo also enabling users to access streaming video content from online distributors such as Netflix. Microsoft introduction of the Xbox One continued the positioning as a compelling platform for nongaming content. Sony introduced its PlayStation 4 in February and the console is expected to ship to retailers in time for the holidays, according to press reports.

Among the most intriguing examples of this emphasis on nongaming content came at the end of 2012 when Microsoft announced the hiring of a CBS veteran to head up the development of a studio in Los Angeles focused on creating original video properties targeted at the Xbox ecosystem. Beyond that, market leaders Sony and Microsoft are making these moves to defend their positions in the battle against Apple, Google and Amazon, among others, for dominance in the living rooms, studies and bedrooms of consumers. Long-term strategic hedges by multichannel video programming distributors (MVPDs) are also in place, as they extend their programming to these consoles, with perhaps the ultimate goal of creating virtual STB functionality to provide authentication and billing/provisioning capabilities normally handled by a proprietary STB. Verizon FiOS had a similar offering on the Xbox 360 console. However, specifics on which MVPDs or

Internet TV service providers will be offering live linear TV programming through these consoles have not yet been released by the vendors.

User Advice: Movie studios, cable networks and others that develop and distribute original video content should continue to support distribution opportunities with the game-console customer base. Content companies should take advantage of the unique opportunities to create new interactive features and audience-engagement possibilities that the sensor devices such as Xbox Kinect. Not all content will be appropriate for such treatment, but serial content that has an affinity with gaming genres is ideal.

Content companies already licensing content to the console manufacturers through aggregators, such as Netflix or Hulu, should explore more aggressive experiments with release windows — for example, more of the premium rental windows. These one-time rentals usually involve a premium over and above a typical movie rental of titles that are either in the theatrical or initial broadcast (of a TV show) windows. As (relatively) secure terminals in a living room, with an integrated store and billing capability, the consoles are alternatives to Apple and Google hardware hegemony in the battle for the connected living room.

Experienced interactive content application developers will be in demand by content companies and MVPDs looking to differentiate content offerings on the consoles.

Business Impact: The business impacts are mainly in incremental distribution market opportunities for media companies. Advertising opportunities — that is, beyond the in-stream advertisements that could come with the content a la Hulu — are uncertain, but Microsoft is still pursuing advertising on Xbox and in June 2012 announced the NuAds format for the Xbox and Surface ecosystems. However, for pay content services, game consoles represent another (relatively) secure distribution point in the connected-device universe, with unique, at least in the near term, interactive capabilities.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Microsoft; Nintendo; Sony

Entering the Plateau

E-Book Readers

Analysis By: Allen Weiner

Definition: E-book readers are devices that facilitate screen-based reading of books and periodicals. These are devices for which reading is the sole purpose or among the leading uses. E-book readers today primarily include black-and-white e-book readers using e-ink technology; tablet devices, which offer color, allow access to rich media, and support enhanced e-book content as

well as newspapers and magazines; and smartphones, such as the iPhone, and Android- and Windows-based phones.

Position and Adoption Speed Justification: The justifications for current positioning on the Hype Cycle are:

- Pew Research Center's Internet & American Life Project Internet reports in its October 2012 research that 29% of adults in the U.S. own either a tablet or basic e-book reader. That clash, and the move from dedicated e-book readers to all-purpose media tablets, indicates a race to the plateau.
- A rapid increase in the sales of e-books, makes up a significant portion of incumbent publishers' revenue. That is good for the consumer, but not necessarily manufacturers of e-book readers.
- Declining retail costs for black-and-white e-readers show the market is flattening.
- The quality and number of e-book, newspaper and magazine content applications available for tablets are increasing. This allows consumers to read e-books on any device.
- The emergence of enhanced e-books and platforms, such as Vook and Inkling, creates platforms for new e-book apps suited for tablets. This puts a major crimp in the future of dedicated e-book devices.
- The increase in the use of digital screens for educational content is one area that shows potential, as the educational market could use dedicated e-book readers for such courses as literature.

During the next year, a number of developments will impact the placement of e-readers on future Hype Cycles:

- Amazon's deployment of Liquavista, which it purchased from Samsung. Liquavista's color, electrowetting technology offers the possibility of a new class of e-readers with improved reading functionality.
- An increase in the digitization of books, especially backlist and out-of-print titles. An increase in the depth and breadth of content will appeal to the e-reading consumers but not necessarily e-book reader manufacturers.
- Settlement of the legal charges of price-fixing against Apple and major publishers. This will affect e-book efforts of publishers that find it difficult to yield a profit from models such as Amazon's wholesale-retail scheme.
- An increase in the use of tablets in both K-12 and higher-ed scenarios as well as the success of made-for-education tablet/screen-reading devices, such as Amplify. The educational opportunity is interesting but remains unclear for the time being.

All is not well in the e-book reader market. The two recognized leaders of dedicated e-book readers — Amazon and Barnes & Noble — are slowing (if not outright ending) development of new dedicated e-book readers. As more consumers take to all-purpose devices, such as media tablets, to read e-books and other content, the market for dedicated e-book readers is at best plateauing.

Tablets will most likely be the primary driver of e-books from a creation and consumption standpoint.

User Advice: Book publishers must now focus their attention beyond dedicated e-book readers but not totally ignore them. The dual-lens approach will force them to continue to create high-quality versions of books (especially novels) for dedicated e-book readers to appeal to the market that wants to read only trade content. At the same time, publishers must look to the future and develop content suitable for experiences geared toward tablet reading.

In developing content for screens beyond e-book readers, follow the lead of such markets as education, which are moving away from proprietary devices that support only one format and have limited functionality to those that support open standards such as ePub 3 and HTML5.

Business Impact: If you are in the publishing business as a content owner, publisher or distributor, or in an adjacent area such as advertising, you have already felt the impact of e-book readers and are now adapting business models to a world in which digital becomes the primary channel for printed content. The same goes for anyone in the digital value chain supporting content for e-book readers, which include hardware manufacturers, publishing service providers and content/ application developers.

E-book readers have already altered the business model and supply chain for all forms of printed content by eliminating inventory considerations; creating new approaches to the promotion, design and production of published content; and wiping out nearly all brick-and-mortar retail outlets dedicated to the sale of books.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Mature mainstream

Sample Vendors: Amazon.com; Barnes & Noble; Google; Plastic Logic; Sony

Recommended Reading: "Technology's Impact on Self-Publishing Will Forever Change the Book Business"

"The Nook Reaches Beyond Reading"

"SXSWedu Puts Educational Technology Issues in the Spotlight"

Self-Publishing

Analysis By: Allen Weiner

Definition: Self-publishing is the process of an author bypassing the typical channels for book distribution, and handling all aspects of the value chain from editing, physical or digital printing (usually employing a service provider), and distribution.

Position and Adoption Speed Justification: Prior to the popularity of e-books, self-publishing was limited to the physical world in the form of:

- Vanity publishing: Authors contract with a publishing house (generally a company that does little more than physical printing), and are left to handle distribution.
- Subsidiary publishing: Similar to vanity publishers, but, in this case, publishers pay a portion of the cost as it relates to printing and distribution.
- Micropublishing: The specific case in which a title is created by and underwritten by a specific group or vertical for distribution to its members.

Cost-efficient digital workflows have provided the impetus for growth within the e-book portion of the self-publishing business. Amazon and Barnes & Noble (PubIt, now sporting a new interface and tools) have established self-publishing divisions, with pure players such as FastPencil and Lulu among the higher-profile players.

Self-publishing has generated great interest in the world of higher education. Apple's announcement in early 2012 of its new Apple iBooks Author platform and iTunes/iTunes U distribution program opened up the market for new content creators who may range from incumbent educational authors to new, previously unpublished educational writers. Apple and others, such has Inkling and FastPencil, are creating tools and marketplaces geared for self-publishing in the higher education space. The growth and now governmental support of open educational resources is yet another catalyst that will stimulate self-publishing. In 2012, education's thirst for low-cost or free content has been a driver for self-publishing.

The digital revolution has brought new life to self-publishing, providing great access to a broader number of "authors." Using a digitally based self-publisher to publish a book is as easy as uploading a video to your favorite consumer-generated media site. Most self-publishing firms also offer a marketplace that sells works from self-published authors using social media recommendations and reviews as a means to differentiate. Digital self-publishers also have developed relationships with larger book marketplaces; for example, Smashwords distributes some of its more popular titles through Amazon and Barnes & Noble using a revenue-sharing model.

Key to the growth of self-publishing is the ability for recommendation engines (social and otherwise) to provide readers with the ability to sift through millions of titles to find ones that appeal to personal tastes. One move that could cause some stir in the self-publishing community was Amazon's purchase of Goodreads, a leading book recommendation community that was a key place for new authors to showcase and share their work. Self-publishing has also adopted a twist on the "freemium" model, in which many authors give away their works or charge a nominal fee, hoping to build a loyal following.

Amazon, Barnes & Noble and distribution giant Ingram have an advantage in this space, given their distribution power but, in most cases, they also take a larger percentage of author revenue than the pure players.

The self-publishing space is also seeing a new twist that takes the print-on-demand model and uses new technology such as Xerox's electronic book machine (EBM), the Espresso Book Machine,

which offers small print runs for an audience that ranges from authors creating family genealogy books to budding best-selling writers. These EBMs are deployed in retail settings (most often in bookstores) that are positioned to offer ancillary writing support services such as editing, proofing and cover design.

User Advice: Publishers should view emerging self-publishing markets as a means to find new writing talent. Penguin, for example, has created Book Country, a community of aspiring authors, as a place to nurture new writers to feed into its pipeline. In some cases, publishers could consider creating a new imprint for these up-and-coming writers.

Amazon and Barnes & Noble are using self-publishing as a means to create a robust value chain of services that complement their other pipelines. In essence, both book giants are using self-publishing as an imprint to compete with other publishers, as well as create differentiation from other media cloud providers such as Apple and Microsoft.

Self-publishing in any form faces the major challenge of getting titles in front of consumers. To date, recommendation engines and social media have not been uniformly effective in getting the word out. Competing with best-selling authors takes the sort of money and muscle that pure-play publishers lack. On the other hand, Barnes & Noble has done a good job mixing its PubIt titles into its recommendation list. Anyone entering the self-publishing space should come armed with direct marketing and/or social marketing skills to build audiences.

Educational institutions must establish governance that reviews new self-published material to ensure it meets the standards of a given institution.

Business Impact: As with music and over-the-top video, self-publishing represents a shift toward greater consumer and creator control, and disintermediation of traditional distribution schemes. As self-publishing grows, established authors can easily create their own imprints, cutting incumbents out of the mix. The opportunity for support services in the area of social media marketing certainly will take on a greater role, but those talents will likely come from specialists, rather than publishers that have continually decreased their marketing budgets.

Marketplaces such as Amazon and Barnes & Noble are somewhat publisher-neutral and would be glad to work with any publisher — be it a solo practitioner or micropress — for mass digital or even physical distribution.

Benefit Rating: High

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

Sample Vendors: Amazon; Barnes & Noble; Fast Pencil; Smashwords; Yudu

Recommended Reading: "Technology's Impact on Self-Publishing Will Forever Change the Book Business"

Mashups

Analysis By: Jan-Martin Lowendahl

Definition: Mashup software or services in higher education simply bring together functionality and/or data from more than one source.

Position and Adoption Speed Justification: The formal Gartner definition of mashup is a lightweight, tactical presentation layer integration of multisourced applications or content in a single, browser-compatible offering. It is a lightweight variant of the older notion of a composite application and the heavier service-oriented-architecture (SOA) approach to composite applications. The original, general meaning was that mashups are composite applications that are built on enterprise platforms, are internal-facing and are not necessarily Web-based. But for all practical purposes, today the term "mashup" is almost exclusively associated with Web-based applications that leverage consumer-oriented sites for external-facing audiences. However, the different definitions are being blurred as mashups move onto enterprise platforms, and composite applications swivel to face outward. Even within the enterprise, mashups rely partly on data and services from public websites, such as Google Maps, craigslist, eBay and Amazon. Because mashups leverage content and logic from other websites and Web applications, they're lightweight in implementation and are built with minimal code (which can be client-side JavaScript or server-side scripting languages, such as PHP or Python). These are not fixed requirements, but reflect the original implementation of the mashup concept in Web 2.0 startup companies, which typically do not use enterprise-oriented platforms, such as Java or .NET.

Higher education has embraced mashups, and many institutions have some applications and/or projects that use them. Academic and administrative applications are likely to include some form of mashups to link data and functionality to the application. Faculty and students are comfortable with mashups from the public Web, including videos and shared content, and often promote the use of mashups. Social networking software has also increased interest in mashups and their use in higher education. An important enabler for mashups is the increased focus on legal data sharing through the work of organizations like Creative Commons.

This latter trend has meant mashups are leveraged for personal productivity needs, rather than the requirements of a long-standing corporate role. This suits academia perfectly. Mashups bring together many innovations: Web APIs, lightweight client-side scripting, delivery of content via RSS, wikis, Ajax, social networking and the explosion of Web-based communities. For a long time, the closest thing to mashup creation tools for "civilians" (users who do not write code) was an RSS feed reader or podcasting client, which enabled them to "mash" content from multiple sites. This situation has improved greatly with more-powerful tools such as Yahoo Pipes and Microsoft Popfly. More recently, the introduction of learning tools such as Open Tapestry has taken mashups to a whole new level. Open Tapestry allows online course designers to use content where it already resides on the Web, rather than requiring it to be copied into the institution's system. The professor simply "assembles" courses and teaches online by "gluing together" open education resources (OER). Open Tapestry also integrates with many Web 2.0 tools in a way that is close to the mashup concept itself. Such examples show that the mashup concept and technology is established, and that it will drop off the Hype Cycle in 2014.

User Advice: Higher education institutions are naturally being drawn to the use of mashups through student portals, social networking software, mobile apps, and academic content posted from multiple sources to course management and content management systems. Institutions must regularly review policies and practices to ensure that decisions about which institutional data or content should be locked down are made at the institutional — not individual — level, and that institutional digital rights management policies are enforced. Institutions must be prepared to make changes in practices, policies and mindsets, which may take time, or to get people engaged in institutional discussions. It is important to note that mashups add another layer of complexity to data or source validation. This is especially important to highlight when using external data sources and when using mashups for educational purposes.

Business Impact: Mashups can be used effectively to bring content and functionality together with a low level of IT skills, thus improving flexibility and the time of progression from idea to service.

Benefit Rating: Moderate

Market Penetration: 20% to 50% of target audience

Maturity: Early mainstream

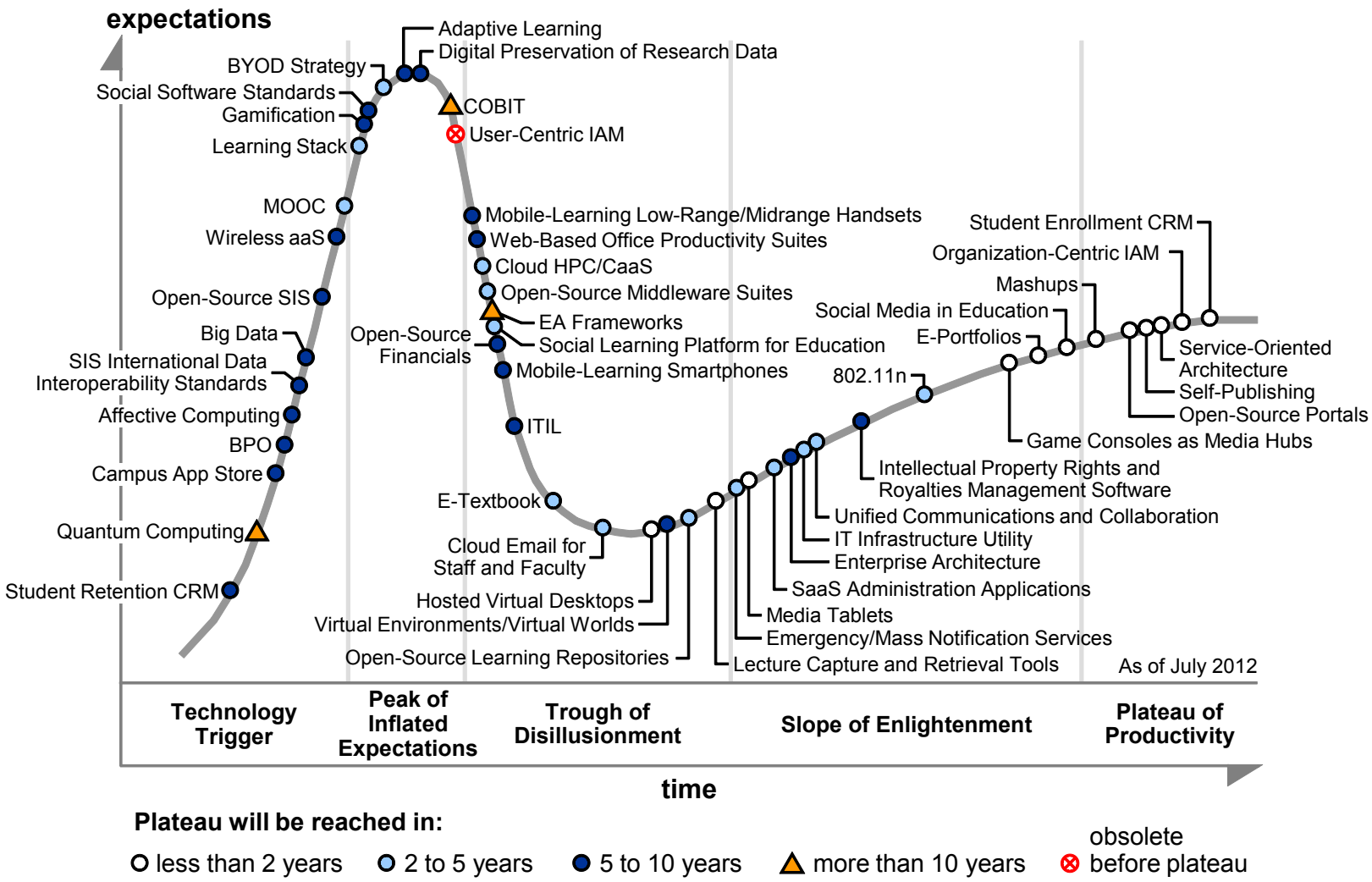
Sample Vendors: Adobe; Google; IBM; Microsoft; Open Tapestry; Oracle; Yahoo; YouTube

Recommended Reading: "Cool Vendors in Education, 2013"

"Gaining Competitive Advantage in the Education Ecosystem Requires Going Beyond Mere Infrastructure to Exostructure"

Appendixes

Figure 3. Hype Cycle for Education, 2012



Source: Gartner (July 2012)

Hype Cycle Phases, Benefit Ratings and Maturity Levels

Table 1. Hype Cycle Phases

Phase	Definition
Innovation Trigger	A breakthrough, public demonstration, product launch or other event generates significant press and industry interest.
Peak of Inflated Expectations	During this phase of overenthusiasm and unrealistic projections, a flurry of well-publicized activity by technology leaders results in some successes, but more failures, as the technology is pushed to its limits. The only enterprises making money are conference organizers and magazine publishers.
Trough of Disillusionment	Because the technology does not live up to its overinflated expectations, it rapidly becomes unfashionable. Media interest wanes, except for a few cautionary tales.
Slope of Enlightenment	Focused experimentation and solid hard work by an increasingly diverse range of organizations lead to a true understanding of the technology's applicability, risks and benefits. Commercial off-the-shelf methodologies and tools ease the development process.
Plateau of Productivity	The real-world benefits of the technology are demonstrated and accepted. Tools and methodologies are increasingly stable as they enter their second and third generations. Growing numbers of organizations feel comfortable with the reduced level of risk; the rapid growth phase of adoption begins. Approximately 20% of the technology's target audience has adopted or is adopting the technology as it enters this phase.
Years to Mainstream Adoption	The time required for the technology to reach the Plateau of Productivity.

Source: Gartner (July 2013)

Table 2. Benefit Ratings

Benefit Rating	Definition
Transformational	Enables new ways of doing business across industries that will result in major shifts in industry dynamics
High	Enables new ways of performing horizontal or vertical processes that will result in significantly increased revenue or cost savings for an enterprise
Moderate	Provides incremental improvements to established processes that will result in increased revenue or cost savings for an enterprise
Low	Slightly improves processes (for example, improved user experience) that will be difficult to translate into increased revenue or cost savings

Source: Gartner (July 2013)

Table 3. Maturity Levels

Maturity Level	Status	Products/Vendors
Embryonic	▪ In labs	▪ None
Emerging	▪ Commercialization by vendors Pilots and deployments by industry leaders	▪ First generation High price Much customization
Adolescent	▪ Maturing technology capabilities and process understanding Uptake beyond early adopters	▪ Second generation Less customization
Early mainstream	▪ Proven technology Vendors, technology and adoption rapidly evolving	▪ Third generation More out of box Methodologies
Mature mainstream	▪ Robust technology Not much evolution in vendors or technology	▪ Several dominant vendors
Legacy	▪ Not appropriate for new developments Cost of migration constrains replacement	▪ Maintenance revenue focus
Obsolete	▪ Rarely used	▪ Used/resale market only

Source: Gartner (July 2013)

Recommended Reading

Some documents may not be available as part of your current Gartner subscription.

"Understanding Gartner's Hype Cycles"

"The Expanding Education Ecosystem: A World of Choice"

"Choose Choice Over Chaos in the Expanding Education Ecosystem"

"Predicts 2013: Digitalization Powers Education"

"Cool Vendors in Education, 2013"

"Agenda Overview for Higher Education, 2013"

"Agenda Overview for K-12 Education, 2013"

More on This Topic

This is part of an in-depth collection of research. See the collection:

- Gartner's Hype Cycle Special Report for 2013

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