CALL FOR SPONSORS
COMMUNITY APP STORE ARCHITECTURE (CASA) AND OPEN SOURCE COMMUNITY INITIATIVE

EXECUTIVE SUMMARY: OPEN SOURCE COLLABORATION TO SUPPORT A MARKET-BASED APPROACH TO INTEROPERABLE EDUCATIONAL APPS AND CONTENT

IMS Global is seeking sponsors to initiate an open source community (CASA) to develop and support code libraries and APIs that will take the next step beyond IMS’s successful open standards to further reduce the time and effort required to enable interoperable educational resources in seamless, agile and information-rich enterprise.

The members of the IMS Global Learning Consortium have been leading a revolution that is making interoperable applications and digital content a reality in the education segments. Institutions and suppliers are seeing 10-100x improvement in the time and effort required to enable seamless integration. There have been over 180 IMS conformance certifications issued to date, and the 10-100x improvement will continue to get better as the IMS specifications evolve.

Despite the unparalleled success of the IMS standards in the educational segment, there is unparalleled competition for mindshare in today’s world in which literally any organization can claim they have developed a “standard.” In fact, there is a wide and fierce competition for mind share in the educational segment where there has been a proliferation of software that is advertised as providing open standards or APIs for application or data integration.

The IMS members are industry leaders that realize that this sea change in the ease with which educational software and content can be combined will challenge existing business models and barriers, but that vendor-neutral interoperability that reduces cost while enabling greater innovation is the best road to be on to enable growth of the market. However, interoperability standards by themselves are at a disadvantage in terms of competing with free software and APIs because the later provide implementers with a shorter road to implementation. IMS has answered this challenge by investing in a wide range of development resources and support over the last 7 years.

It is time for the IMS community of 220 member organizations, including the most technically advanced educational market participants on the planet, to answer this challenge by establishing an open source community that provides reference implementations of key software components that will help all IMS members proliferate open standards-based resources. CASA will focus on the common components identified during the design phase of the recent IMS Educational App Store project. CASA goes right to the heart of enabling the next generation of widespread interoperability by fostering collaboration on a peer-to-peer “app store architecture.” Thus, taking a very successful commercial model for encouraging a vibrant marketplace for “apps” but removing the major hurdle to enterprise adoption and collaboration by basing it on open standards.

Sponsors will contribute initial funding to bootstrap the open source community and provide representation to serve on the governing steering committee of CASA, and thus make decisions effecting the deliverables. Sponsors must be current IMS Contributing Members or new IMS Contributing Members that wish to join IMS for the purpose of supporting CASA. To become a sponsor, please contact Rob Abel, CEO of IMS at rabel@imsglobal.org.
THE OBJECTIVES: MAKING ADOPTION OF DIGITAL RESOURCES IN EDUCATION EASY

The CASA open source community will create and maintain open source reference implementations that will enable the following key market objectives:

- **Accelerate adoption** of learning tools and content through standards-based marketplaces
- **Facilitate instructor search and consumption** of learning tools and content within online course environments
- **Facilitate institutional management and presentation** of learning tools and content services to instructors and students
- **Provide an alternative distribution channel** to learning tool and content providers, reducing the market power of proprietary app stores
- **Give universities easy access to existing catalogs**, both open and proprietary, **as well as to actionable data** on use of digital resources.

THE CASA CONCEPT: ADDING AN APP STORE ON TOP OF THE BROWSER

For the IMS community to succeed with interoperability of educational resources the “solution” must fully embrace a wide range of alternatives represented by larger trends. The World Wide Web is a vast, mildly curated repository of information. While search engines fairly accurately filter the Internet based on content, they are less effective at filtering based on functionality. For example, they lack options to identify mobile-capable sites, sites that provide certain interoperability mechanisms, or sites related to certain industries or with certain content rating levels. There is a space where such a model already exists: the “app stores” that pervade the native mobile app landscape. In addition to the app itself, these hubs have deep awareness of application metadata, such as mobile and/or tablet support. Another deficit of search engines is their inability to allow organization-based configuration, defining a worldview with trust relationships, filters and transformations to curate the results they present to end users. Native app stores use a star (hub-and-spoke) topology with a central hub for publishing, which lacks this fine-grain customizability, but an alternative peer-to-peer topology, as is used for autonomous systems across the Internet, restores this freedom.

Based on these considerations, the Community App Store Architecture (CASA) provides a model for publishing and sharing web applications with metadata about features and functions; further, it includes mechanisms for filtering and transforming this data during the publishing and sharing processes. This enables the construction of affinity-focused environments that may connect with peers to which it may share apps and publishers from which it may receive apps. Use cases for CASA include an LTI Tools store, a K-12 website or an organization’s mobile dashboard, such as [http://m.ucla.edu](http://m.ucla.edu).

NETWORK TOPOLOGY

Traditional app stores employ a star topology whereby publishers add apps to a central hub and the hub makes these apps available to end-users. This approach requires a homogeneous worldview, a centralized trust model and an agreeable aggregator, none of which have been shown to exist on the World Wide Web. The alternative is a distributed model, the very model of the Internet architecture itself. In the same way that autonomous systems in the Border Gateway Protocol share routes they’re willing to serve and select routes they’re willing to use, CASA presents a model for accepting and sharing applications in a consistent way based on their metadata; further, as the peer-to-peer model is a superset of hub-and-spoke and complete configurations, it supports sub-graph composition best described as a small-world network. When surveying organizations about how they manually ascertain and curate environments such as the ones CASA seeks to enable, it is this small-world topology that most adequately models their publishing and sharing relationships. From an efficiency standpoint, where a star topology requires a central aggregator which can support $N$ connections, and a complete topology requires $\frac{N(N-1)}{2}$ total connections, this approach has reduced
performance footprint based on the number of relationships maintained by every peer in the network, rather than the total size of the network.

LEARNING TOOL AND DIGITAL RESOURCE INTEROPERABILITY
In the last several years, IMS GLOBAL has made progress with tool and resource interoperability, by developing the LTI specification, which was developed to allow instructors to easily and seamlessly leverage third party tools in their LMS’s. To create this integrative layer of code, The IMS community has created and evolved the Learning Tools Interoperability™ standard. LTI™ allows an LMS (Learning Management System) or other learning software to pass authorization and other context information from the learning platform to the tool, which returns information on activities performed. Digital resources exchange, including resources that include links to LTI tools, is achieved using the complementary IMS Common Cartridge specification.

HOW DO I FIND, COMPARE AND EVALUATE AND INSTALL LTI TOOLS OR DIGITAL RESOURCES?
LTI enables a vision of many niche products being pluggable into the LMS; however, without a storefront that is integrated into the learning platform, the acts of publishing, locating and integrating tools or digital resources are key problems. For instance, the IMS Global website provides a list of LTI-compatible tools, but, just as a search engine provides generalized results, this list is rather broad and purely informational. There is no easy way for an learning platform user to research LTI math tools to see which ones are most popular, to review other users’ comments, and to generally peruse software listings the way they do with native app stores. In addition, even if they find the tool they desire, it does not deliver on the promise of interoperability until it is integrated into the learning platform. IMS Global and its constituents should thus present a solution that enables learning platform users and administrators to parse through LTI tools, searching via a tool’s attributes and viewing detailed metadata and product views before making a selection. The Community App Store Architecture (CASA), with its ability to share and propagate apps with their metadata and then enable integration of the application into the learning platform, satisfies this need such that a network of browser-based app stores may peer together to cultivate organization-based or affinity-based app stores of that may contain LTI, as well as other types of tools (e.g. W3C widgets or simple web links).

THE COMPONENTS OF A COMMUNITY APP STORE ARCHITECTURE (CASA)
The Community App Store Architecture (CASA) enables the sharing of web apps and associated metadata (“mi casa es su casa”) through the URI Sharing Environment (USE) Protocol, as described by https://github.com/uShare/protocol.

CASA is comprised of three modules which represent an implementation of the USE Protocol. The first module is the CASA Engine, which queries other CASA Engine publishers that share modules with peers based on its organization-specific configuration. The second module is the CASA Engine Manager which provides an administrative user interface for the management of the engine’s organization-specific configuration, including peering relationships, filters and transformations; and allows the entity to set and manage their preferences and filters for content. The third module is the CASA Storefront, which provides an “app store” user interface for easy user access to apps received by or published into the CASA Engine. The initial CASA storefront reference implementation will be developed to work with open source learning platforms, but given differences in consumer environments, it is expected that eventually numerous versions of the CASA Storefront will exist.

1) The CASA Engine
The CASA Engine has two principal jobs: The first is that of App discovery and the second is that of App publishing. Using App publishing, any provider of content can make their educational applications or digital resources available to any number of app stores, eliminating the need to separately publish their content to the plethora of repositories,
referatories or other centralized catalogs. Thus making app distribution scalable. App discovery content filters will be configured on a per engine basis, while app publishing profiles will be created on a per App basis.

1.1 CASA Engine Job 1: Discovery
This process entails querying other CASA Engines to receive information regarding apps of which these peers have knowledge. This process is supplemented by: (1) a filter layer to drop apps that do not meet organizational requirements, and (2) a transformation layer to curate apps that the Engine has received. These enable each CASA Engine to apply a lens based on preferences of the organization. For example, one might implement an accessibility filter whereby the Engine only accepts apps with ADA and Section 508 compliance.

1.2 CASA Engine Job 2: App Publishing:
This process entails allowing other CASA Engines to query the CASA Engine, providing a configurable mechanism for publishing a catalog of web applications and metadata to peers in the network. The CASA Engine publishes apps as individual profiles, and thus each app is made available based on creator’s sharing preferences. Each app may select between “local”, “shared”, and “shared with propagation”.

2) The CASA Engine Manager Module
The CASA Engine Manager module will be a web-based interface and generally set up by the learning platform technical manager. It will allow administrative users to configure the CASA Engine, including defining filters and transformations, configuring peers and managing app publishing profiles.

3) The CASA Storefront Module
The CASA Storefront Module will be a web-based interface that allows the learning platform users to select apps from searchable and orderable properties such as categories, tags, ratings and capabilities, as defined by individual app profiles. CASA Storefront modules will likely be implemented for a wide range of learning platforms, as well as other consumers such as a web portal mobile dashboard, that wish to leverage the app profiles stored within the CASA Engine.

EXAMPLES OF COMMERCIAL APPLICATIONS AND RESOURCES
Large and small publishers of digital educational resources seeking to maximize exposure and improve the user experience are limited by the degree to which their products can be found and easily integrate into the educational enterprise. It does not matter if these resources are contained within a web-hosted application or can be downloaded and tailored inside a learning platform. It is difficult for either type of resource to be adopted by a faculty member that does not have time to deal with a proliferation of logins and content destinations. For the digital experience to become better than the print experience, digital must be made substantially easier. Using the CASA architecture a publisher can work with any number of institutions through the platform that the institution chooses for content alternatives to be exposed to users in the way that the institution desires. Most institutions will have a process for approving digital content alternatives, establishing business relationships and, thus, working with trusted suppliers. CASA enables a scalable process to work with a potentially large number of providers while also making it easier for faculty make use of digital resources that are integrated into the enterprise systems by design. Thus the barriers to adoption of digital resources are greatly reduced.

Providers of a wide range of digital tools, such as e-portfolios, collaboration software, adaptive tutors, assessment tools, classroom capture, grading, authoring, library systems, professional development, etc. will benefit greatly from CASA. They will have a scalable approach to enable their products to be easily found and integrated into the educational enterprise. Users will benefit by applications that are better integrated into their experience. In fact, entirely new approaches to educational applications will be enabled such as tools that might be sold directly to students that can be easily integrated into the educational enterprise. In all cases the usage of such tools can be expected to be significantly higher than it is today because they are easily available in the institutional context.
EXAMPLES OF CROWD SOURCED ACADEMIC RESOURCES

One example of a crowd sourced academic resources is a professor that keeps a robust and ever evolving organic chemistry glossary. This glossary is something that students help with, add to, and even get extra credit in the professor’s course if they contribute to it enough. This mobilized tool is useful to students doing a chemistry lab, and saves them from having to open up a laptop next to their experiments. The professor is willing to share this glossary freely, however, today, without a network of CASA Engines; there is no easy way to find it.

Another example is a school of business that wants to make its homegrown case studies into MBA-focused student simulation games. It makes sense that they would be most interested to share and publish them for simulation exercises with other business schools. This would likely be reciprocal if several other schools were in turn willing to share their case-study simulations with the business school community.

Finally, The CASA Engine will provide universities and other entities a way to publish in new models within a trusted network of web-based apps (with functionality and content intertwined) independently. Examples of apps that might employ a variety of publishing models could include a journal of Egyptology, where subscribers might get a notification when a new article is published. A writer might decide to publish an ePUB3 novel in chapter iterations. If the readers didn't like a chapter, the writer could re-do it, allowing the public to crowd-source the editing process.
PROVIDING CROWD SOURCED RANKINGS
The CASA Engine will also satisfy the need for the learning platform administrators to get their peer’s perspective on how using certain tools worked within their environment. There is currently no place for faculty or instructional technologists to see user’s opinions and ratings, read narratives of what they did with it, or how their students liked using it etc… . The CASA Engine will provide a set of ‘most useful’ ratings for both the CASA Manager and the CASA Storefront modules.

CASA OPEN SOURCE COMMUNITY DELIVERABLES
The CASA project will focus on setting up the open source community and implementing the reference implementation of CASA with at least one, but possibly multiple examples of Storefronts. The CASA governing steering committee will work with the IMS members and additional advisors to provide guidance on the factoring of the components of CASA and their future evolution. Some components will be considered high priority libraries to implement the standards that will be maintained and evolved by the IMS within the CASA community as the specifications evolve.