

# *Blackboard Building Blocks*

2003 Overview White Paper

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## Document Purpose

This white paper explores how Blackboard Building Blocks™ enable institutions to accomplish their strategic goals through an open, flexible and supported technology for integrating external tools, systems and content into the Blackboard e-Education Suite (*Blackboard Learning System™*, *Blackboard Portal System™*, *Blackboard Transaction System™*). Using this Building Blocks, institutions can build on top of the Blackboard Suite to enhance the education experience for all. Institutions can meet the needs of the classroom through advanced tools and content delivery; build strong communities to unite the institution towards common goals; and provide Administrators with the tools and services to more easily manage the e-Education infrastructure.

Blackboard Building Blocks technology is available today in the industry's leading e-Education infrastructure Suite:

- *Blackboard Learning System* (Release 6, ML)
- *Blackboard Portal System™* (Release 6)
- *Blackboard Transaction System™* (Windows, Unix)

## Introduction

Each institution has a unique collection of requirements for IT infrastructure, e-Education, and end user support. As institutions begin to evaluate and explore how technologies can best benefit them, they learn that there is no “one size fits all” approach when it comes to a technology investment. Most concluded that it is ideal to invest in technology that is flexible and extensible. The Building Blocks architecture is designed to allow institutions to extend the Blackboard e-Education Suite to integrate both custom developed and best-of-breed commercial tools, services, hardware and content to meet their institution's needs.

Through extensive feedback from educators, students, and instructional technologists, the Blackboard Product Advisory Board, and Beta testing partners, the Building Blocks technology has been developed to deliver on four core client success pillars:

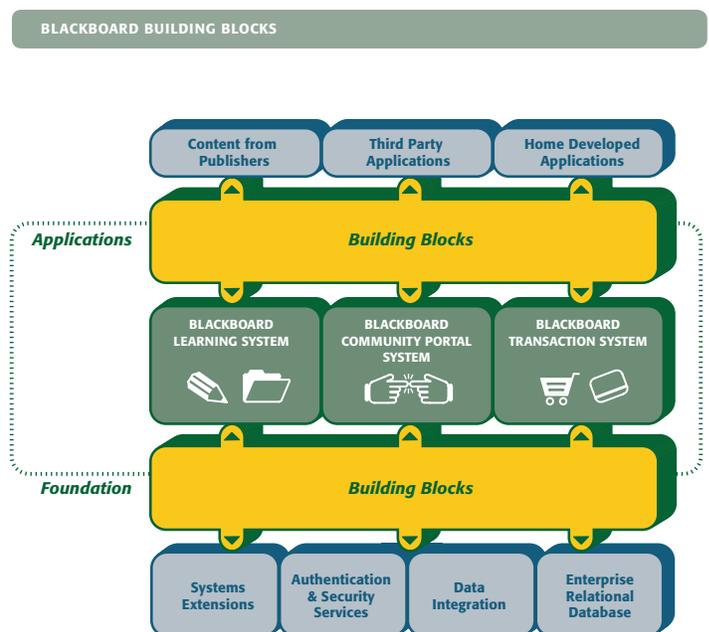
- **Ease of Use and Simplicity:** Intuitive and comprehensive feature set to support institution's education and community-building goals.

- **Open Architecture:** Flexibility to achieve institution's unique strategic objectives.
- **Proven Enterprise Technology:** Reliable, scalable, secure, e-Education operating environment that is easy to implement and maintain.
- **Ability to maximize returns and optimize cost of ownership:** Cost-effective and efficient architecture and functionality to reduce the administrative overhead required to manage growth and maintenance.

## Overview of the Building Blocks Technology

Stemming from a commitment to promote an open environment for Suite customization, flexibility, and interoperability, the Blackboard Building Blocks architecture provides clients with an e-Education system that can be customized to meet unique pedagogical, administrative, and transaction processing needs. Throughout the Blackboard Suite, administrators and end users may leverage Building Blocks technology to seamlessly integrate homegrown, open source, or commercially licensed applications, and system services.

At the heart of Building Blocks is the Building Blocks Manager that exposes the core of Blackboard to enable data exchange, interoperability, and transaction processing with, technologies including:



- Authentication and Security Protocols (e.g., LDAP, Kerberos, Active Directory)
- Enterprise Resource Planning (ERP) systems such as Student Information Systems (SIS),
- Third party applications and hardware (e.g., Point of Sale registers, instant messengers, wireless network protocols), and
- XML-based Web Services

Using the Building Blocks Manager, institutions can customize their Blackboard implementation to meet institution-specific needs for teaching and learning, community building and transaction processing. Through a comprehensive developers program and a freely available Software Developers Kit (SDK), and published integration specifications, Building Blocks is designed to readily allow data exchange – through the use of *Integration Agents* – among systems and various software products and thus enhance the daily experience of administrators, students, and faculty.

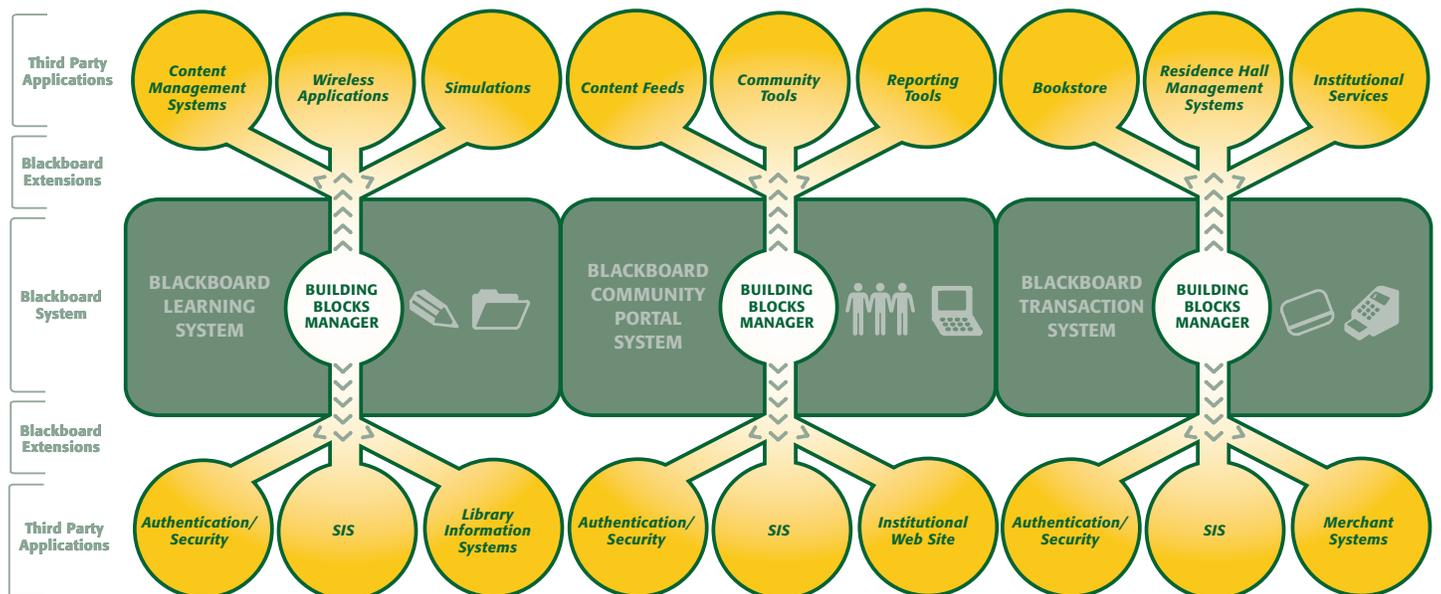
The diagram below illustrates the key components of the Building Block technology. The Building Blocks Manager is the heart of the Blackboard Suite, be it *Blackboard Learning System*, *Blackboard Portal System*, or *Blackboard Transaction*

*System*. Using the Building Blocks Manager components (e.g., APIs, SDK, specifications) an Integration Agent is developed to link the Blackboard Suite to an external system, application, hardware device or learning object. Using the Building Blocks Manager Software, the Blackboard Administrator installs the Integration Agent in the Blackboard Suite. Once it is configured, it exchanges data (e.g., user data, authentication information, transaction records) with the external or third party system. The combination of the Integration Agent and the external system is referred to as a *Building Block*. Each installation of the Blackboard Suite can have an infinite number and kind of Building Block so that each institution can customize Blackboard to meet their needs.

The power and flexibility of Building Blocks is evident in each component of the Blackboard e-Education Suite:

*Blackboard Learning System:* Administrators can seamlessly install and configure integration agents to a suite of advanced data population, integration, and management tools designed to interact with leading student information systems – including Datatel Colleague™, PeopleSoft SIS™, SCT Banner™, and SCT Plus™. End-users can customize their end-user environment by integrating tools, content, and commercially licensed, open source, or

**BLACKBOARD BUILDING BLOCKS**



homegrown interfaces and extensions. Among the many pedagogical and administrative benefits of Building Blocks Application infrastructure:

- Plan and develop freely distributed or commercially supported applications as extensions to the Blackboard Suite
- Leverage the Blackboard Developers Network, providing access to documentation and a community of Blackboard Building Blocks developers
- Dynamically extend and enhance the Blackboard teaching and learning environment
- Support an institution's multiple language requirements by leveraging the locale functionality of *Blackboard Learning System ML*

*Blackboard Portal System:* Users and administrators will benefit from the various portal modules and news feeds that are accessed through the Building Blocks program. Collaboration tools, instant messengers, and institutional services among others, can be integrated with the *Blackboard Portal System* using documented APIs in the Building Blocks Manager. The *Building Blocks Manager* ensures that users can view, modify, or manage portal modules as appropriate to the portal role and other system permissions the user has been given. Examples include the ability to integrate JA-SIG and RSS portal modules.

*Blackboard Transaction System:* Users can take advantage of a variety of integration agents that allow account portability across campus systems and hardware via their student ID account. The Building Blocks architecture enables institutions to take advantage of Integration Agents to:

- Credit and debit accounts
- Send and receive transaction data
- Develop sophisticated reports to monitor system use
- Increase the portability and use of the user account through integration with a variety of hardware devices and applications

For example, as the ID card or other authentication device is presented at a Point of Sale (POS) System in the dining hall, the POS communicates with the *Blackboard Transaction System*, which verifies the user has a valid meal plan or sufficient credit in their account to pay for the transaction. This same account can be used by the student to check out

books at the library or pay their library fines. At the end of the day this card is the key that grants the student access to their residence hall. To enable this type of account portability on campus, the System Administrator configures the Building Blocks Manager to share student and transaction data between Blackboard and the external systems on campus using a simple graphical user interface.

## Building Blocks Manager

The Building Blocks Manager is a powerful collection of application programming interfaces (APIs), a software development kit (SDK), specification standards and the Manager application software. The following sections provide more detail about the Building Blocks Manager.

### Application Programming Interfaces (APIs) and Software Developer Kit (SDK)

Blackboard's e-Education Suite is made open and extensible by the availability of documented and supported Java-based APIs. Documents for the APIs including the Blackboard application framework, instructions for developing Integration Agents, and the API Javadocs are available in the SDK. The SDK is freely available for download at <http://buildingblocks.blackboard.com>

The APIs available with the *Blackboard Learning System* (Release 6) enable integration within:

- Administrative Control Panel
- Instructor Control Panel
- Course Content areas
- Course Tool areas
- Announcements and Calendar
- Gradebook

Within the *Blackboard Portal System* (Release 6) integration can be made to APIs in the following areas:

- Portal Modules
- Organization Control Panel
- Organization Content areas
- Organization Tool areas
- Announcements and Calendar

Also included in the SDK are advanced APIs to enable user authentication and the ability to create user, course and enrollment records within the *Blackboard Learning System* and *Blackboard Portal System*. These APIs are especially powerful and enable institutions to integrate their Blackboard e-Education Suite with their Student Information System, central user authentication system (e.g., LDAP), and develop single sign-on integration from Blackboard to third party systems.

Additional APIs available within the Building Blocks SDK for *Blackboard Learning System ML* allow developers to take advantage of the multiple language capability called locales. The locale feature enables institutions to support multiple languages within *Blackboard Learning System ML* by installing Language Packs. The APIs allow the Building Block to detect and display the user interface appropriate to the selected language of the system, a specific course, or an individual's default language preference. To illustrate the use of locales...

... an institution elects to set the *Blackboard Learning System ML* default locale to Spanish. An instructor using this system set the locale in his course on German History to German. A Japanese exchange student using this same system sets her default view of the system to be Japanese. However, her view of the German History course continues to display a German user interface – but only if the Instructor sets the course locale to override the individual user locale. Building Blocks installed on this system can detect which locale has been selected and display the appropriate German, Spanish or Japanese user interface.

APIs to the *Blackboard Transaction System* are available but because of the sensitive nature of transaction data, are not available through a public SDK. These APIs enable institutions to use data stored within the Student Information System to populate multiple administrative systems on campus including the housing management system, library systems, card office systems, to name a few. Integrations such as these ensure that data are stored centrally, updates can be made centrally and easily propagated throughout the institution, and through these efficiencies, overall administrative costs are lowered. For more information about the Blackboard Transaction System APIs please contact Blackboard at [b2-info@blackboard.com](mailto:b2-info@blackboard.com).

## Specification Standards

Interoperability between systems is made easier by adherence to industry standards. The Building Blocks technology embraces standards-based integration for data exchange, user authentication and content packaging.

### Content Packaging and Data Exchange

Since its inception, Blackboard has helped develop and now supports through the Building Blocks APIs the IMS data exchange and content packaging standards as well as JA-SIG and RSS channel modules for the Blackboard Portal System. Content standards, such as SCORM, are being given greater focus at many institutions. As standards gain adherents within the user community, Blackboard explores ways in which to incorporate them into the Blackboard core code and API framework.

### Authentication

The APIs enable integration between Blackboard and central authentication systems using standard authentication protocols such as LDAP, Kerberos, and Active Directory.

### Financial Reporting Standards

*Blackboard Transaction System* supports financial reporting requirements (Regulation E), financial data exchange standards, and transaction security standards used by the banking and credit industries. Transaction encryption includes the Advanced Encryption Standard (AES) recently approved by the Secretary of Commerce and National Institute of Standards and Technology (NIST).

Blackboard is a leader in development and support of the IMS standards, and a strong supporter of many others. As such, Blackboard enjoys working closely with a variety of standards bodies and standards movements around the world to ensure that the *Blackboard Learning System*, *Blackboard Portal System* and *Blackboard Transaction System* can meet our clients' integration needs efficiently and effectively.

## Manager Software

Rounding out the Building Blocks Manager is the application itself. The Building Blocks Manager gives Blackboard Administrators a graphical user interface (GUI) by which they can easily install and configure the Building Blocks that link the Blackboard Suite with an external service, system, hardware device or application. Within the Blackboard Learning System and Blackboard Portal System the Building Blocks Manager resides within the Administrator Control Panel.

Blackboard Transaction System Administrators access the Manager through an interface installed on their local client machines. The Manager application allows them to install and configure data Integration Agents, and – on one screen – configure field mapping, stop/start communications, or view the status of all external systems and hardware with which their Transaction System is integrated.

## Integration Agents (a.k.a. System Extensions)

Integration Agents are the software or data exchange specification that connects the Building Blocks Manager to an external application, system or content. The Integration Agent plus the external application, system, hardware or content is referred to as a Building Block. Integration Agents have been known by a few different names in the past depending upon the type of data exchanged or Blackboard application:

- *Blackboard Learning System* – System Extension
- *Blackboard Portal System* – System Extension
- *Blackboard Transaction System* – Transaction Interface or System Interface

As Blackboard has developed integration points among each application in the Blackboard e-Education Suite it made sense to unify the integration terminology across the Blackboard Suite. Future releases of the Blackboard applications will contain the new terminology within the user interface.

From a technology perspective the Integration Agents for *Blackboard Learning System* and *Blackboard Portal System* are Java-based but that does not preclude them from integrating with systems, applications or content built using different technology. The Integration Agent installed in Blackboard

Name	Vendor	Version	Status	Components	Permissions	
Astrology	<a href="#">Astrology.com</a>	1.1.0	Available	Components	Permissions	Remove
CNNModules	<a href="#">CNN</a>	1.0.0	Available	Components	Permissions	Remove
GoogleModule	<a href="#">Google</a>	1.0.0	Available	Components	Permissions	Remove
HETemplateModules	<a href="#">Blackboard Inc.</a>	1.0.0	Available	Components	Permissions	Remove
Maps	<a href="#">Mapquest</a>	1.0.0	Available	Components	Permissions	Remove
New York Times	<a href="#">New York Times</a>	1.1.0	Available	Components	Permissions	Remove
Time	<a href="#">Time</a>	1.1.0	Available	Components	Permissions	Remove
Travel	<a href="#">Expedia</a>	1.0.0	Available	Components	Permissions	Remove
WeatherModule	<a href="#">Weather.com</a>	1.0.0	Available	Components	Permissions	Remove
Zap2itModules	<a href="#">Zap2it</a>	1.0.0	Available	Components	Permissions	Remove
Sample Plugin	<a href="#">Sample Plugin Vendor</a>	1.0.1	Available	Components	Permissions	Properties Remove

must conform to the XML-based package standard defined in the SDK, and call any Building Blocks APIs with the appropriate Java commands.

From an Administrator perspective, Integration Agents are zip files with a .war extension that can be directly installed within the Blackboard Suite. The .war file contains the Integration Agent software as well as all documentation needed to configure it. Information about installing, configuring and using the third party or external software to which the Integration Agent connects is often available separately from the external software vendor.

## Building Blocks Support

Support for Building Blocks is always available for Blackboard clients. Blackboard Administrators can call the Blackboard Support Desk for help with installation of their Building Blocks. Blackboard will troubleshoot problems associated with a Building Block and, if the problem is revealed to be with the third party software, Blackboard Support will point the client to the third party vendor's Support team. If the problem revealed is related to the Building Blocks architecture or Blackboard installation, the Support team will work with the client until the problem is resolved.

## Building Blocks Catalog

Available online at <http://buildingblocks.blackboard.com/catalog> users can explore, learn about, and download Integration Agents for each application in the Blackboard e-Education Suite. The Catalog contains commercially develop Building Blocks as well as open source applications developed by the user community. Many of the Integration Agents and associated Building Blocks are free.

## Building Blocks Developer Network

To support users of the Building Blocks APIs the Building Blocks Developer Network (BbDN) was founded as a network for developers by developers. Containing white papers, knowledge base articles, sample code, getting started tutorials, and online developer forums, the BbDN is a valuable resource for Building Block developers. Access to the BbDN is through <http://behind.blackboard.com>.

Members of the network are encouraged to exchange ideas and collaborate with one another, help one another to troubleshoot problems, and share their experiences using the Building Blocks APIs. Members of the Blackboard Developer Network receive advanced notice of modifications to SDK documentation and APIs, may have access to pre-release Blackboard software, and are invited to participate in members-only opportunities.

For more information about the Building Blocks Developer Network please go to <http://buildingblocks.blackboard.com>.

## Building Blocks Supporting the Four Pillars of Client Success

Building Blocks is more than just technology and documentation; it is a means to support client success. The following sections highlight examples of how clients are reaching their institution goals and user's needs.

### Ease of Use and Simplicity

Ease of use is important to different types of users:

- Instructors want to focus on teaching and interacting with their students – not learning how to program html or re-learning the Blackboard software every time a new tool is integrated.
- Administrators and Faculty don't have time to learn a new user interface each time they have to install, configure or use an Integration Agent.
- Developers are looking for efficient ways to plug their tools, systems or applications into Blackboard so that they're easy to access and the user has a positive experience.
- All users expect their institution to maintain proper up-to-date demographic data about them across all campus

systems, no matter which department is utilizing this information.

The Building Blocks APIs support each of these user needs by making the award-winning *Blackboard Learning System* and *Blackboard Portal System* user interface elements available to developers in what are known as tag libraries. Using the tag libraries, developers can create Integration Agents with the same look and feel as the Blackboard user interface.

Instructors and students benefit from the re-use of Blackboard look and feel by not having to learn a new way to access the tool or system integrated through an Integration Agent. Furthermore, if the institution changes the icons, colors and fonts of their Blackboard installation, the changes percolate to the Integration Agents and no further customization or tweaking by the Blackboard Administrator is required.

Students have similar needs and expect the tools provided to them be ubiquitous across campus. When a student accesses their *Blackboard Transaction System* student ID account at ten, twenty or even fifty places on campus during one day, many of these access points may be third-party or external campus systems enabled by Blackboard Building Blocks. Data on these third party systems is updated in real-time providing a simple way to manage the student ID accounts without having to enter the user data into each system separately, thus creating a seamless student experience.

### Openness and Flexibility

Building Blocks technology makes Blackboard an open Suite and gives institutions the freedom to develop applications in-house as well as take the best-of-breed commercial applications and systems and integrate them with the Blackboard e-Education Suite. In addition, institutions have the flexibility of rolling out new tools and integrated services to their user community on the institution's timeline, not the vendor's. This openness and flexibility creates an environment that encourages innovation and collaboration among institutions the early results of which have been rich and rewarding to the community as a whole.

There are many Building Blocks innovations among *Blackboard Learning System*, *Blackboard Portal System*, and *Blackboard Transaction System* users, some available on the Building Blocks Catalog include:

- Baylor University (Texas) developed a Web-based individual tool called *Online Journal*. The *Online*

*Journal* Building Block provides pedagogical benefits for both students and instructors, as an additional tool for assessment, evaluation and discourse between student and teacher. *Online Journal* allows Baylor to take the successful web-based journaling concept that they began in 1998 and integrate it seamlessly within the Blackboard learning environment.

- Arizona State University and The Ohio State University among others have each created a network of off campus vendors (e.g., restaurants, dry cleaners, stationary stores) who accept the Student ID card as a debit card. As a result of this *Town and Gown* partnership each vendor sees additional patronage by being a part of the network and the University gains additional revenue through interest on the value (i.e., float) stored in each student's card account.
- Griffith University (Australia) has developed a number of course tools including – *Search Content* and *Frequently Asked Questions Tool*. Using the Search Content tool, students and instructors can search folders and content items within a course. As the name implies, the Frequently Asked Questions tool allows instructors to easily create and organize a list of frequently asked questions. The searchable tool enables questions to be grouped into categories as well as easily collated for viewing or printing.
- Princeton University (New Jersey) Administrators are focused on user satisfaction - specifically the 500+ instructors who use Blackboard each term. One tool they have built is a *Facebook* tool. Using the *Facebook*, instructors can match names to faces by viewing their course roster online. Within the roster each student's name and email address are paired with a digital photo.
- Seneca College (Ontario) has built a number of tools to make monitoring the Blackboard Learning System easier for System Administrators. Using the tool, administrators can identify which users have logged into Blackboard Learning System within the previous 3 hours. This is especially helpful when trying to troubleshoot periods of slow system response time, or for monitoring system load.

## Enterprise technology

Enterprise technology is the engine that drives the power of Building Blocks integration framework. Building Blocks APIs and specifications are core to the now third generation of Blackboard's enterprise class Suite. This technology

powers integration with student information systems, central authentication systems, and external applications and services at over 800 institutions. For the Administrator and other institution decision-makers this means that the Blackboard e-Education Suite is a platform that is robust, secure and reliable.

Making the decision to invest in mission critical Enterprise technology is a serious one, just as much as the decision to re-commit to it year after year, therefore institutions plan carefully before committing resources. Blackboard has invested significant resources to ensure that the Blackboard Suite meets the needs of users today and is flexible enough to meet the needs of users tomorrow and well into the future.

## Maximizing returns and optimizing costs

As operating budgets become more constrained, institutions realize they need to be able to do more with less. This means being able to support a growing list of technologies, user communities, and institution goals with the same – or fewer resources. One way to gain a higher return on the investments (ROI) already made is to build on top of the existing infrastructure. Blackboard's extensible and scalable *Building Blocks Technology*<sup>SM</sup> is the foundation that allows institutions to do just that.

It is possible through examination of system usage patterns to identify ways to reduce costs, modify user behavior, while meeting user needs and institutional goals. *Blackboard Transaction System* client Marquette University (Wisconsin) had the following success:

- Problem: network printing costs were increasing significantly with each semester. Research showed that depending upon department and printer location, waste was measured at 40-50% of all printouts. Some 10-15% was abuse of printing resources.
- Solution: Integration of the Pharos *Uniprint* print queue management system with *Blackboard Transaction System* enabled a remarkable change on campus.
- Results: By implementing a free allocation per student (value of \$14.00) followed by cost recovery model for printing beyond the free allocation printing costs decreased 66% in year one and 54% in year two. Users developed new printing habits. Cost savings and cost recovery funds invested in technology upgrades and new printers.
- Cost Savings: \$21,500 average annual savings, \$23,000 annual cost recovery.

## The Future

Building Blocks has an exciting future. Blackboard is committed to opening up the Blackboard e-Education Suite to provide additional APIs and controls over the user interface that broaden and deepen the integration potential of the Blackboard Suite. Furthermore, in an effort to lower the barriers to development, Blackboard plans to support the release of the Building Blocks APIs for Microsoft .NET™. This will greatly increase the number of languages available to Building Blocks developers.

As part of the expansion of the API set Blackboard will explore enabling Building Blocks to access native Blackboard tools such that Building Blocks could launch Blackboard tools and vice versa. This level of openness will give institutions the ability to deeply customize the Blackboard tool set by building additional features or creating more sophisticated integrations between custom-built tools and Blackboard tools.

Related to this is the idea that as tools and content evolve, the identity of tools and content will converge. Soon it may not be possible to tell the difference between what is a tool and what is content and the Building Blocks architecture will be open and flexible enough to support this notion.

As institutions explore the Building Blocks technology to create as well as adopt tools, services, and content to meet their unique needs, Blackboard looks forward to championing the innovations that result.

To learn more about the Blackboard Building Blocks Program please call 1.800.424.9299 extension 4 or visit our Web site at <http://buildingblocks.blackboard.com>.



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