

Blackboardlearn⁺

*Blackboard Learn 9.1 Service Pack 10
Release Notes*

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About the Release Notes

The Release Notes provide System Administrators with information about the changes from the previous release, 9.1 Service Pack 9 (9.1 SP9) to this Service Pack, 9.1 Service Pack 10 (9.1 SP10). Always review the entire document and consider how this information affects your specific usage patterns.

If you are upgrading to Release 9.1 from Release 9.0, 8.0, 7.x, or CE8, CE4, Vista 8, ANGEL 7.4, or ANGEL 8.0, please go to the [Upgrade Center](#) for information targeted to your needs.

Help Us Make Release Notes Better

Release Notes plays an important role in helping you plan and implement upgrades. Take this [short survey](#) to give us feedback on ways we can improve our release documentation.

Changes that Impact End Users

These new features or enhancements improve the user experience. They may require communication and some training for teachers and students.

Highlights include:

- [New Content Editor](#)
- [New File Picker](#)
- [Enterprise surveys and course evaluations](#)
- [New assessment reporting](#)
- [Global navigation](#)
- [My Blackboard](#)

Changes that Impact System Administration and Integration

These changes impact the administration of the system, including API integration. A review of Building Blocks, Snapshot or other integrations may be required. We also recommend that you review the security settings of your system and review the new Security section.

Highlights Include:

- [Features and Functions No Longer Supported](#) – Features or functions that are targeted for removal from the system in a future release as well as features or functions no longer supported in SP10.
- [Security](#) – Security enhancements and security vulnerabilities resolved in this release.
- [Supported Technologies Changes](#) – Changes in supported browsers, operating systems and databases.
- [Performance and Scalability](#) – The latest analysis from our Performance Engineering team and how to tune an installation of this release.
- [Installation and Upgrade Information](#) – Changes to the installation, detailed upgrade paths, warnings, and tips for running the installer.

New Features and Enhancements

The Release Notes provide a high-level overview of the new features and enhancements for Release 9.1 SP10.

System Administration

Cloud Settings

Cloud settings control the connection of an individual Blackboard Learn instance to Blackboard cloud services. Cloud settings are available on the System Administration panel under Cloud Management. Settings include:

- **Cloud Connector** – Creates the connection between Blackboard Learn and centrally located cloud services.
- **Cloud Profiles and Tools** – When the Cloud Profile and Tools option is enabled, users have access to create basic profiles and search for users by profile information. The cloud connector must be turned on first.
- **Cloud Settings** – Controls how cloud features display in Blackboard Learn and in third party networks like Twitter and Facebook. Cloud settings only appear if cloud services are enabled.
- **Reported Items** – Displays a queue of profiles that have been reported by users as inappropriate. Administrators can take action to remove items or block users based on school policies and procedures.

New Content Editor

The newly designed content editor vastly improves the user experience for adding text and other forms of digital content to Blackboard Learn. The new content editor is based on the industry standard TinyMCE WYSIWYG editor. The new content editor is delivered as a building block extension for optimal maintenance and integration.

- Collapsed and expanded views help users control screen space.
- A new math equation editor is included mathML (WIRIS).
- The content editor is always on for users so they no longer have to explicitly opt in or opt out.
- Spell check and the math editor options are controlled separately at the administrator level. They can be set at the system, course and organization levels.
- Administrators can control the spell check dictionaries from the Tools page. There are three dictionaries included in Learn. Additional open source dictionaries can be downloaded from the internet and installed.
- Administrators can control the math editor image service settings from the Tools page.
- The create reusable object option has been removed from the content editor but users can still create reusable objects from course files or the Content Collection.
- Administrators can extend the existing font family in the content editor to include non-system fonts such as Hellenistic Greek. Two resource bundles, `font.override`, and

`font.addition`, allow you to override the set of default fonts or include additional fonts in the default set.

- Additional editing capabilities have been added including:
 - For text:
 - Correct copy and paste from Microsoft Word
 - Align Full
 - Find/Replace
 - Blockquote
 - CSS editing
 - Insert non-breaking spaces
 - Symbols
 - Emoticons
 - For tables:
 - Setting row and cell properties
 - Insert and delete rows and cells
 - Splitting and merging cells
 - For media
 - Consolidation of media selections under a single toolbar
 - Automatic HTML validation

File Picker

The file picker is the window that opens when users click Browse Content Collection or Browse Course. The file picker is available everywhere users attach files.

The file picker can

- Display a file or folder's name, last modification date, versions (files only) and size.
- Sort on each column being displayed.
- Change the number of items being displayed, editing the table's paging.
- Search across all folders and files with a single search input.
- Toggle between a list view and a thumbnail view. The interface for thumbnail view does not change.
- Go to the current folder listing's parent folder in one click.
- Quickly switch between the top-level content areas (My Content, Courses, Organizations, Institution, and Library), Bookmarks and the Learning Objects Catalog.
- Navigate the folder hierarchy using breadcrumbs.
- Switch to a more advanced search.
- Upload a file.

Learning Tools and Interoperability (LTI 1.1)

Note: The IMS has merged the Basic LTI and the LTI specifications with the release of LTI 1.1. Use of the term "Basic LTI" refers to Basic LTI 1.0.

Blackboard is certified to support LTI 1.1. This includes support for outcomes (grading of LTI based assignments) and support of additional launch parameters. Blackboard also supports custom parameters that may include Learn template variables that are resolved to Learn data (@X@ variable interpolation).

LTI 1.0 support in 9.1 SP10 has not changed.

LTI 1.0 is supported on 9.1 SP4 and above.

LTI 1.1 is supported on 9.1 SP10 and above.

Security

Blackboard is committed to improving security features and resolving security vulnerabilities quickly and carefully. Such security vulnerability resolutions may lead to the release of a Security Advisory as well as any needed product update for our customers based on the context, severity and timing of confirmed vulnerabilities. Below we have outlined the security enhancements and security vulnerabilities resolved in this release.

For more information on each of the features and improvements, please see the System Administrator documentation in help.blackboard.com.

Input Validation Filter

The Input Validation Filter is the new first line of defense to confirm data coming into Blackboard Learn is safe. It verifies that user requests coming in to the system are safe by sanitizing the data through a default ruleset. Administrators can create a custom ruleset to override a rule in the default ruleset and to decide which building blocks to apply the filter.

The Input Validation Filter is fast, providing cross-site scripting fixes much faster than the traditional patching process. Traditional patches can have various dependency issues or may need to be rolled back. Providing fixes through the Input Validation Filter is a much cleaner and faster way of delivering patches, as they are provided directly through the Software Updates Center.

The Input Validation Filter is installed and enabled by default for Blackboard Learn Release 9.1 Service Pack 10 and later. Access the Input Validation Filter feature on the Administrator Panel.

Alternate File Domain Settings for Serving Content

This security control forces files uploaded by users to open from another web domain. It is a defense-in-depth compensating control against potentially malicious files. It helps protect from Cross-site Scripting attacks performed through malicious files by leveraging the internet browser's existing security control, the "same-origin policy."

For example, your institution's main Blackboard site is "https://blackboard.myinstitution.com" and content is served from "https://blackboard-content.myinstitution.com". By using an alternate domain, the user's cookies and session information is further protected from potentially malicious scripts in uploaded HTML files.

This security control is not enabled by default since it requires administrators to configure an alternate domain and its corresponding SSL certificate. Blackboard strongly recommends all customers enable this setting.

Security API

Blackboard now is integrated with a best practices open source security library from the [Open Web Application Project's \(OWASP\) Enterprise Security API \(ESAPI\)](#). This security library is installed on Blackboard Learn through a building block called "ESAPI Security Module" and is required for system operation. Blackboard strongly recommends all building block developers leverage this new Security API based on OWASP ESAPI. These Security API changes include best practice implementations, and consistent nomenclature.

Input influenced by users, whether trusted or not, needs to be validated on the server-side before processing (input validation). It also needs to be validated prior to display (output validation or escaping). Validation helps ensure system resiliency and prevents security issues such as cross-site scripting.

Input validation examples:

```
ValidationUtility.isValidDirectoryPath( String )
ValidationUtility.isValidGuid( String )
ValidationUtility.isValidEnumeratedType( Enum, String )
```

Output Validation examples:

Java Methods

```
EscapeUtility.escapeForHTML ( String )
EscapeUtility.escapeForHTMLAttribute ( String )
EscapeUtility.escapeForJavascript ( String )
EscapeUtility.escapeForUrl ( String )
EscapeUtility.escapeForCSS ( String )
EscapeUtility.escapeForXML ( String )
EscapeUtility.escapeForXMLAttribute ( String )
```

JSP Methods

```
${bbNG:EscapeForHTML( String )}
${bbNG:EscapeForHTMLAttribute( String )}
${bbNG:EscapeForJavascript( String )}
${bbNG:EscapeForURL( String )}
${bbNG:EscapeForCSS( String )}
${bbNG:EscapeForXML( String )}
${bbNG:EscapeForXMLAttribute( String )}
```

Cookie Security

Cookies for session management are hardened based on the persistence of cookie values, their associated IP addresses/relationships and lifecycle. Improvements include:

- Session cookies contain a “secure” flag set if SSL is enabled.
- Cookie values are reset on-expire, on-load, and on-login. For example, session management-related cookies are explicitly expired when the browser session is terminated or the session expires.
- Session cookie contains a “httpOnly” flag.

Cookie Disclosure Building Block

Blackboard is committed to ensuring that the collection, protection, use and storage of private information follows all legal and industry best practices by proactively supporting European Union regulations that help ensure privacy and security on the web. Blackboard is providing all Blackboard Learn clients with the Blackboard Security Management Cookie Disclosure building block. This building block allows schools to comply with the European Union’s e-Privacy Directive. The building block can be downloaded and installed easily into Blackboard Learn instances.

The Blackboard Security Management Cookie Disclosure building block is intended to support the European Union Privacy Data Directive and laws implemented in the United Kingdom and other member states related to this directive. Specifically, this building block implements features that require users to provide consent prior to data collection and provides information about the nature and extent of data collection within Blackboard software and services to end users.

Related Security Advisories

Many of the security fixes related to the following security advisory are available in this release.

- Authorization Vulnerabilities in User Directory and Assignments of Blackboard Learn Could Allow Information Exposure
- Cross-site Scripting Vulnerabilities Course Delivery and Content Collection in Blackboard Learn Could Allow Elevation of Privilege
- Cross-site Scripting Vulnerability in Visual Text Box Editor of Blackboard Learn Could Allow Elevation of Privilege
- Cross-site Scripting Vulnerability in Spell Checker Could Allow Elevation of Privilege
- Cross-site Scripting Vulnerabilities in Blackboard Learn Could Allow Phishing
- Invalid Session Management in Legacy Content Upgraded to 9.1 Could Allow Session Hijacking

Security Fixes in this Release

There are over 100 client reported security fixes in this release. For details see the following KB articles available Behind the Blackboard:

[Cross-site Request Forgery](#)

[Cross-site Scripting Fixes Requiring Global Safe HTML Filter Security Control](#) (previously known as the "Global Cross-site Scripting Security Control")

The "Global Safe HTML Filter Security Control" was previous called the "Global Cross-site Scripting Security Control". This is a pre-existing filter in the system and has been renamed to prepare for other security improvements. The security vulnerabilities described in the KB article are resolved in this release when the "Global Safe HTML Filter" is properly configured and set to the strictest setting. As a reminder, Blackboard recommends customers ensure the "Global Safe HTML Filter" Security Control is enabled and set to the appropriate settings. These controls are properly configured by default in SP10 and designed to neutralize user-controllable input before it is placed in output used by the application.

[Other Security Fixes](#)

Course Delivery

Assessment Item Analysis

Item analysis provides statistics on overall test performance and on individual test questions. This data helps you recognize questions that might not adequately discriminate between students who understand the material and those who do not. You can use this information to improve questions for future tests or to adjust credit on current attempts. Ineffective or misleading question are identified easily, corrected in the Test Canvas, and are re-graded automatically.

Assessment Fill-in-the-Blank Question Enhancement

Fill in the Blank and Fill in Multiple Blanks questions now offer **contains** and **pattern match** (using regular expressions) as grading options for answers. Instructors no longer have to rely only on exact match for grading and manually enter every possible correct answer. Instructors can also make the answers case sensitive.

Delete Course Files with Course Delete

Users are now allowed to delete all course files when they delete their courses. This option eliminates orphaned content for courses. Without orphaned content in the course's home folder, reusing courseIDs is more efficient since you don't first have to use the orphaned content report to delete the course's home folder.

360° View Report Enhancement

A new column indicating if a file or subfolder is linked to course content, and if a subfolder contains files that are linked to course content has been added to the 360° View Report.

Enterprise Surveys and Course Evaluations

Enterprise surveys and course evaluations are integrated in Blackboard Learn making it easy to send surveys to courses, departments, institutions or the public. This does not replace the course surveys tool available to teachers inside their course to poll their students. Rather this tool is made available to survey administrator and survey manager accounts to create, send, and analyze surveys on an institutional level.

Survey reports can display aggregate results, analyzing data across courses and business units. Survey reports can display longitudinal results, analyzing data across time periods such as terms or years.

Important Note: If you are a current Outcomes Engagement client, all of your existing data will be available for reporting as long as all Blackboard Learn courses are linked to the appropriate Outcomes sections *prior to upgrade*. To understand and prepare for transition from Outcomes to Course Delivery, read [Transition of the Course Evaluation and Survey tool from Outcomes to Enterprise Surveys](#) in Course Delivery available Behind the Blackboard.

Global Navigation

Global navigating refers to the set of links that appears at the very top of Blackboard Learn. This set of links has been streamlined and becomes the entry point to My Blackboard and social learning tools. Access points to critical academic information is organized in one place to provide a consistent quick and easy way to find information.

When users first log in to SP10, they see an overlay that highlights the new features. After the first login, when users click on the global navigation link, a drop-down menu appears. The items that populate the menu are dependent on whether the cloud is turned on or off and if community engagement capabilities are licensed.

New components of global navigation include:

- The user menu – Provides access to settings that previously were accessed through My Places. My Places has been eliminated. Home and Help links reside here. Clients who license community engagement capabilities will find global links here as well.
- My Blackboard – Provides icons and links to various areas of Blackboard. The icons signal the presence of new information, such as new messages and new posts.

My Blackboard

My Blackboard aggregates information from across the Blackboard Learn system for users. Access My Blackboard using Global Navigation at the top of the screen.

My Blackboard has a navigation panel that quickly connects to different tools in the system. The tools you have access to depend on whether the cloud is turned on and if your school licenses community engagement capabilities. These features are available in My Blackboard:

- **My Blackboard Profile** – Users have access to view and edit their profiles as well as to post to their profile wall.
- **Profile Cards** – Information in profiles is shared when users post to blogs, journals, wikis, and the discussion board. Profile cards are shared in the roster tool and people tool.

- **My Blackboard Posts** – Aggregates posts and comments from blogs, journals, wikis, and discussion boards in courses.
- **My Blackboard Updates** –Aggregates all notifications that users have elected to receive.
- **My Blackboard Grades** – Displays recent grades for all courses users are enrolled in.
- **My Blackboard People** – Provides access to a person's academic network.

Feature	Course Delivery only Cloud off	Any license Cloud on
Login Overlay	Available	Enhanced. Includes prompting to create profile from the overlay. Options to link Facebook and Twitter accounts.
Global Navigation	Available	Enhanced. Includes Profile and People in the menu.
My Blackboard	Available	Enhanced. Includes Profile and People in the menu.
My Blackboard Profile	N/A	Available. Profile shows avatar, name, what I'm studying, about me, and primary email address.
Profile Cards	N/A	Available. Profile Cards limited to showing avatar, name, What I'm studying, About Me, and report.
My Blackboard Posts	Available	Enhanced. Includes avatar and profile cards in posts.
My Blackboard Grades	Available	Available
My Blackboard People	N/A	Available. Basic profiles of my academic network and search within the institution.
My Blackboard Updates	Available	Available

Content Management

Set Default Course Files Properties for Course Copy, Export, and Archive

Administrators can now control the default setting for copying course files or linking to course files during a course copy, export, or archive. This setting only affects courses created after upgrading to SP10.

Copy Course File Attachments

To cut down the number of file attachments that are duplicated during a course copy, a new option has been added to the course copy function for course files. Previously the entire course files directory was included in the package when users elected to include copies of course files. With this new option, users can decide to take the entire folder of files or only those files that are actually linked to course content.

File attachment selections are:

- **Copy links to course files** – no copies of linked files are included in the copy. The copied course will have the same set of links and those links will point back to the original location of the link defined in the origin course
- **Copy links and copies of the content** – This will only make copies of linked files. Files within the course's home folder that are not linked to any content within the course are not included in the copy.
- **Copy links and copies of the content (include entire Course home folder)** – This will make copies of all files in the course's home folder whether those files are linked to course content or not.

New User Warnings for Deleting or Moving Linked Folders or Files

Two new warnings help users avoid inadvertently creating broken links to files in their courses.

A warning occurs when a user deletes a folder that is directly linked to course content or that contains files that are linked to course content.

A warning occurs when a user moves a file linked to a course content, a folder that is directly linked to course content or that contains files that are linked to course content, to the recycling bin. This helps prevent broken links because most users are unaware that the recycling bin may be set to automatically purge.

New and Updated Integrations

Blackboard ConnectTxt for Learn

The Send Two-way SMS building block gives instructors the ability to text with students at the course level. With 97% of college students today preferring text, this easy-to-use tool will help improve faculty-student communication and provide important, timely information to today's mobile students. Instructors can send out mass texts to their class and quickly receive replies in Blackboard Learn. Common use cases include class cancellations, exam prep, student questions and support. The purchase of text messaging credits is required.

NBC Learn

The NBC Learn building block will no longer be bundled with Blackboard Learn SP 10. If you have this build block installed on your system, it will continue to function normally. If you would like to install it, visit the [Blackboard extensions catalog](#).

Features and Functions No Longer Supported

As software development evolves and programming languages change, features and functions are replaced with newer and more efficient options. In order for Blackboard to deliver the most modern and effective user experience, we will over time change parts of our applications. This section of release notes lists features and functions that are no longer supported or targeted for end of life. See [Platform Technologies](#) and [Client Technologies](#) for more information on deprecated and unsupported applications.

Themes

Three legacy themes are deprecated in Blackboard Learn SP10.

- Blackboard Classic
- WebCT Classic 1
- WebCT Classic 2

This means that all new features built for SP10 are not styled in these three themes. If you wish to continue using them, you need to include some additional steps in planning your upgrade to SP10.

If you continue using one of these themes with your default brand beyond SP9, or if you have licensed Community Engagement and are using one of these themes with any of your institution brands, it will be converted to a custom theme on your system. If you are not using one of these themes on your system, the theme will be intentionally removed during your upgrade to SP10.

Theme DIFF Tool

To help you address upgrading and custom themes, beginning in SP10 a Theme Diff Tool is available. This tool compares two themes "in place" on your Blackboard Learn server using your theme handles. You can also run the tool on a machine without Blackboard installed, comparing two themes, either zipped or expanded that you have downloaded from your Learn instance. The Theme DIFF Tool is available from [Edugarage](#).

32-bit Environments

With the release of Blackboard Learn Service Pack 8, and going forward, Blackboard only supports operating in a 64-bit environment. You must be operating in a 64-bit environment to use any direct upgrade path to SP9 and SP10. If you are currently running Blackboard Learn in a 32-bit environment, you must migrate to a 64-bit environment first. This is especially relevant to Academic Suite 8.0 SP7 running on Windows. More information on migrating to a 64-bit environment is available at <http://help.blackboard.com>.

SSL Choice

Secure Sockets Layer (SSL) is a protocol for protecting Internet communications. SSL Choice was a feature that allowed administrators to select which areas of Blackboard Learn are secured using SSL and which areas are not using encrypted communications. With the release of Blackboard Learn, Release 9.1 Service Pack 10, SSL Choice is deprecated. This feature has been removed because Blackboard recommends all customers enable SSL system-wide, rather than in select areas, as is consistent with industry best practices. If you are not already running

Blackboard Learn over SSL and wish to use it, start SSL planning with this release. Please contact your Client Support representative for more information if you need additional help.

Application Frameset

To facilitate future user experience changes, Blackboard is beginning the process of replacing the current application frameset. Prior to 9.1 SP10, the application's user interface (UI) elements were presented in a frameset including a top frame for application tabs, institutional branding and other links that persisted across application areas and a bottom frame that contained content pertaining to the activity the user was involved in.

In SP10, the top level frameset, top frame, and bottom frame are replaced by a standard HTML page with two iframes representing the same content elements as the frames prior to SP10. This change does not require any changes to building blocks or customizations that use the frames as the transition to iframes is transparent to any Javascript logic that interacts with the frames. If you have customized your application, Blackboard will provide you with test instances to check any customizations you think may be affected prior to your upgrade to SP10.

Beyond SP10, Blackboard will continue to migrate Learn away from using frames completely. As progress is made towards removing frames from Learn, we will provide additional communication to the developer community.

Basic Licenses

In an effort to provide the best user experience, Blackboard is standardizing on the Enterprise version of Blackboard Learn 9.1 with Service Pack 10. Blackboard Learning System™ - Basic Edition and Blackboard Learn™ - Basic Edition clients must move to an Enterprise version of Learn to upgrade to SP10. A Basic license can only be upgraded as far as 9.1 SP9.

Contact your Blackboard Learn account representative for advice on the paths to transition from the Basic license to an Enterprise version.

Open Standards Content Player

As of SP10, the Rustici SCORM Engine Player is the default SCORM player in Blackboard Learn. The Rustici SCORM player will support Rustici Tin Can packages in addition to supporting all previous SCORM content.

Any content imported with the Open Standards Content Player will continue to be played with that player, but new content will be imported and executed by the Rustici SCORM Engine Player. To convert content that was imported with the Open Standards Content Player to the Rustici SCORM Engine Player, simply re-import the old package and it will default to the new player.

Known and Resolved Issues

The Known Issues list has been redesigned. Each issue now presents as full Knowledge Base (KB) article. This new format allows us to return Known Issues in the regular KB search interface. When you submit cases, you now have greater visibility into the entire issue.

Known and Resolved Issues will now populate in a dynamically generated list on each Release Article and each Service Pack article, available from Behind the Blackboard in the Maintenance Center. They will update in real time as "Target Fix Releases" (the Service Pack where the issue will be fixed) and "Affects Versions" (what Service Packs have the issue occurring).

Performance and Scalability

Blackboard continuously invests in making Blackboard Learn more responsive and capable of handling greater volumes of user traffic with each release. This section of the release notes describes the performance and scalability issues addressed within this release of Blackboard Learn, as well new information about optimizing the configuration.

Performance issues occur when application responsiveness for a system not under load fails to meet user expectations. Scalability issues occur when application responsiveness or stability of a page request for a system under load fails to meet user expectations.

Issues are identified by clients through our traditional support channels and as a result of the performance and scalability exercises performed as part of all Service Pack releases.

Performance Issues and Improvements

As part of the release, performance optimizations are introduced back into the product as a result of a customer issue or internally found problem. The Blackboard Performance Engineering team is responsible for refactoring under-performing areas of the application and verifying regression improvements based on the optimization.

System

High amount of physical reads from disk caused by "where" clause in sync_activity_accumulator stored procedure

A fix was implemented to add a condition that avoids copying of unnecessary records in the procedure.

Need improved search indexes throughout the product

Unnecessary database indexes were removed and appropriate ones have been added.

VTBE symbol font parsing causes high CPU utilization due to inefficient regular expressions

A regular expression pattern has been refactored to optimize the symbol parsing process.

Thousands of "Timer-xxxxx" being leaked causing descriptor exhaustion and server lock-up

A timer thread leak in CAS authentication provider was causing the issue. The timer threads are now properly managed.

CPU spike due to ISAPI_REDIRECT.DLL file

Tomcat connector libraries have been updated to eliminate the CPU spikes when serving large files. The fix addresses the problem on the supported 64-bit platforms only.

Email file attachment uploader can cause high CPU usage. This can be used as a DOS attack.

Cross-site scripting filter's regular expressions were optimized to mitigate the issue.

Updater: Some gradebook post_update_sql scripts repeat unnecessarily

Certain post upgrade scripts within the installer used to run multiple times unnecessarily, causing system upgrades to take longer than they should.

HTTP Compression disabled by default

Web server compression is now enabled by default. However, when you [enable SSL](#) on the default version of Apache 1.3, HTTP compression will no longer work. In order to use both SSL and HTTP compression, you must install [Apache 2.2](#).

Tomcat shutdown slow on application servers not running the ActiveMQ broker due to file lock contention

Tomcat shutdown process no longer tries to stop the ActiveMQ broker if it isn't actually running on the current node; trying to do so causes a deadlock.

High reflection overhead while performing database object unmarshalling

A pattern of CPU utilization due to reflection overhead during database column value unmarshalling was detected and fixed.

Course Delivery

UserMsgStateDbLoaderImpl and LoadFromCourseIdQuery have a bug and performance issues

Database index changes were introduced to fix the performance issue.

msg_parent_position() and msg_rating() are not performing well with large forums

New indexes have been added to reduce the database "consistent gets" for improving the performance of msg_rating and msg_parent_position functions.

During course archive, the Content Alignments process takes 23 hours to complete

Underlying API changes have been made to retrieve alignable contents more efficiently.

Overall summary of usage report query expensive across core tables (users, course_users, activity_accumulator tables, navigation_item and application)

The issue has been fixed via database query optimizations.

Reoccurring QTI table deadlocks

Persistence logic of the assessment objects was refactored for efficiency and elimination of deadlock on qti_result_data table.

Content Collection

High Learn session counts due to Mac OS WebDAV client behavior

Finder WebDav client does not send back cookie in the follow-on requests on Mac OS. This prevents maintaining a session and also generates lots of unnecessary sessions on the server side. Session data has been disabled for Mac OS WebDAV until Apple resolves the issue.

Long running XYF_FULL_TEXT_SEARCH_TEMP queries and problematic index hints

Database query optimizations and addition of new indexes have been made to fix the issue.

360 view search results are exhausting heap

Eliminated the Files and Subfolders section of the 360 view for top-level folders only.

Recheck Content process performs poorly

Refactored the implementation logic to reduce fetching, loading, traversing, and committing of data.

Infinite Recursive Loop Detected in DirectoryEntry causing consumption of Java heap while writing to logs

Context release was not being triggered upon exception. Better error handling has been implemented.

Delayed connection release in SlideShareApilmpl

The method for releasing HTTP connection was not getting called explicitly. This was causing the HTTP client to hold on to the connection 100 seconds longer than necessary.

Xythos directory quota lookup executes full table scans and causes DB row lock contention

A database query has been tuned in order to maintain its query plan stability against various data sets.

Community Engagement

Massive number of active DB sessions stuck on slow system_roles_entitlement CONNECT BY PRIOR query

Refactored the UI to eliminate loading of viewable multi-institutions hierarchical nodes unless the user explicitly requests a specific node.

Slow user search against domains in 9.1 SP8

It was caused by an inefficient query that was fixed by the use of EXISTS instead of IN function.

9.1SP8 System Admin courses search results taking 60-500 seconds LRN-51725 to load

The issue has been resolved by index changes and database search query optimizations along with the support for CTE queries in the pagination framework.

DB performance tuning around LAYOUT_FAMILY processing and new index on LAYOUT_FAMILY(PK1,TAB_PK1)

Index optimization change has been implemented to resolve the performance issue.

Notification query (enrollments again) causing massive system load spike

New indexes have been added to reduce the database "consistent gets" for improving the query performance.

Setting System Admin as secondary role in a system with domains results in high heap usage

The node entitlement retrieval code was looking at the default domain when there is no need to consider what's inside the default domain.

Poor performance from LoadInstructorsByUserQuery query

The issue has been fixed via database query optimizations and new indexes.

Portal Modules That Are Dependent On External Services Can Cause Tab Page To Load Slowly

A module that relies on external service can slow down an entire page if it's loaded synchronously. As of SP10, modules are configured to load asynchronously by default. Administrators or B2 developers can change this default behavior.

Outcomes Assessment

No performance improvement for Outcomes Assessment.

Assessment Schema Changes

Enhancements in the assessment feature introduce schema changes upon upgrading from Service Pack 7 and below to Service Pack 8 and above. When Learn starts up after the upgrade, a background process updates assessment data for each course in batches of 100 courses. The assessment upgrade process should take less than an hour for most Learn instances, which have less than 2 million rows in the `qti_result_data` table and an average of 10,000 attempts per course. The assessment upgrade process might take a couple days for extremely large institutions, which have more than 100 million rows in the `qti_result_data` table or have a course with more than 1 million attempts.

When the update begins, you will see the following line in the `bb-services-log.txt` file:

```
Starting bulk upgrade of assessment data (in groups of 100)
```

Once the update ends, you will see the following line in the `bb-services-log.txt` file:

```
Finished bulk upgrade of assessment data
```

Learn instances can be restarted while the bulk upgrade is in progress. The task will simply resume from where it left off once the server starts again.

Users can still use the system while this upgrade is in progress because courses are upgraded immediately when a user enters a course that is not updated, however, users are not permitted to access assessments until the immediate update process is complete.

Based on our performance testing, users who are waiting for their course's assessment data to be updated shouldn't have to wait longer than a minute for most courses, which have less than 10,000 attempts.

The response time estimates stated above can vary depending on hardware capabilities and server configuration. Based on our experiments, performance can improve up to 50% when more memory is allocated to Oracle.

We strongly encourage clients to update database statistics prior to upgrading. We also encourage clients to test on a staging environment prior to upgrading the production environment.

Recommended Deployment Approach

64-Bit Deployments

32-bit deployments are no longer supported starting with Release 9.1 SP8 therefore 64-bit operating systems and sub-components (Java and SQL Server or Oracle) must be used. With this change, Blackboard encourages clients to take advantage of larger Java Virtual Machines (JVMs) that range from 4GB to 32GB in size. Blackboard recommends 4GB to 8GB JVMs, but performance testing has been conducted with acceptable performance as high as 32GB JVMs.

Customers need to migrate away from single server Tomcat cluster deployment. Tomcat clustering on a single server was introduced for scalability purposes when the Blackboard Learn architecture was 32-bit and customers wanted the ability to increase their memory usage beyond the limitation of a single JVM capability. With the option to virtualize, Blackboard's benchmarking efforts have moved away from single server Tomcat cluster deployments. Customers can achieve similar performance in a virtual environment on the same physical server with multiple virtual instances as with a bare metal configuration with many Tomcat cluster nodes. The difference in configurations is a smaller demand on the Apache or IIS web server fronting the Tomcat instance(s). The deployment of 64-bit JVM with larger heap sizes has suppressed the need for customers to run in a single server cluster option.

Blackboard recommends that customers consider distributing their Learn deployment across physical servers with the option to virtualize the hardware to take advantage of the CPU and Memory capacity of these systems.

Database Availability Options

Customers need to consider using database availability options such as Microsoft SQL Server Active/Passive or Oracle RAC One Node, which is a single instance of Oracle RAC running within one node in a cluster. Additional nodes can be added within Oracle RAC to address scalability. In general, both offerings are more around high-availability and will have limited or no capability to improve performance.

For More Information

For more information about the SQL Server Failover capabilities of Blackboard Learn, contact Blackboard Consulting.

For information about running Blackboard Learn with RAC, see [Oracle RAC Support on UNIX in Blackboard Help for Administrators](#).

For more information about deploying Blackboard Learn, see the [Hardware Sizing](#) topics in [Blackboard Help for Administrators](#).

Recommended JVM Tuning Set

For every Service Pack, the Blackboard Performance Engineering team spends many hours studying the transactional and systemic performance of Blackboard Learn and whether particular tuning sets will have a positive or negative impact on performance or scalability.

This section provides the recommended Java Virtual Machine (JVM) tuning set as executed in the Blackboard Performance Engineering laboratory against Release 9.1 Service Pack 10. Customers are strongly encouraged to deploy their application environments in a 64-bit configuration using the recommended 4GB or larger tuning set.

Blackboard recommends using the following tuning set for 8GB JVMs on Windows, Linux, and Solaris systems with 4 CPUs using the latest version of Java 7. These recommended settings are managed in the `bb-config.properties` file.

```
bbconfig.min.heapsize.tomcat=8192m
bbconfig.max.heapsize.tomcat=8192m
bbconfig.max.permsize.tomcat=384m
bbconfig.max.stacksize.tomcat=384k (Windows)
bbconfig.max.stacksize.tomcat=400k (Linux, Solaris 32-bit)
bbconfig.max.stacksize.tomcat=800k (Solaris 64-bit)
bbconfig.jvm.options.platform=-XX:StackShadowPages=20 (Linux only)
bbconfig.jvm.options.platform=-XX:StackShadowPages=10 (Solaris only)

bbconfig.jvm.options.extra.tomcat=-XX:NewSize=2048m
-XX:MaxNewSize=2048m -XX:+UseTLAB -XX:SurvivorRatio=4
-XX:+AggressiveOpts -XX:+UseCompressedStrings -XX:+OptimizeStringConcat
-XX:+UseStringCache -XX:+UseCompressedOops -XX:+PrintVMOptions
-XX:+PrintGCDetails -XX:+PrintGCTimeStamps -XX:+PrintGCTaskTimeStamps
-XX:+PrintCommandLineFlags -XX:+PrintGCApplicationStoppedTime
-XX:+PrintGCApplicationConcurrentTime

bbconfig.jvm.options.gc=-XX:+UseConcMarkSweepGC
-XX:+ExplicitGCInvokesConcurrent -XX:+UseParNewGC
-XX:ParallelCMSThreads=2 -XX:ParallelGCThreads=4
```

The below formulas are applied to derive the suggested tuning set. Please note that `NewSize` and `MaxNewSize` can take a range of values for optimal performance by dividing `bbconfig.max.heapsize.tomcat` property value by either 4 or 3.

```
-XX:NewSize = (bbconfig.max.heapsize.tomcat) / 4
-XX:MaxNewSize = (bbconfig.max.heapsize.tomcat) / 4
-XX:ParallelGCThreads = <#cpus < 8 ? #cpus : 3 + ((5 * #cpus) / 8) >
-XX:ParallelCMSThreads = (ParallelGCThreads + 3) / 4
```

A stack overflow in Java normally results in the offending thread throwing a `java.lang.StackOverflowError`. However, a limitation in Java implementation causes JVM to crash upon stack overflow error on some Unix servers running 64-bit JVM. Configuring the size of shadow pages in `bb-config.properties` addresses this issue. Please refer to Java's [Bug 7059899](#) for more detail.

```
bbconfig.jvm.options.platform=-XX:StackShadowPages=20 (Linux only)
bbconfig.jvm.options.platform=-XX:StackShadowPages=10 (Solaris only)
```

Release 9.1 Service Pack 10 requires Java 7. This brings the opportunity to leverage Garbage-First (G1) garbage collector in Java 7 Update 4 and later. The G1 collector is a server-style garbage collector, targeted for multi-processor machines with large memories. Tests conducted

by Blackboard Performance team indicated no significant performance gain on Release 9.1 Service Pack 10. Additional experiments will be conducted G1 collector in the future releases.

Apache 2.2 HTTP server

Starting with Release 9.1 SP8, Blackboard Learn recommends swapping out the shipped Apache 1.3 Web server for an external Apache 2.2 distribution. The instructions can be found in `config/apache2/README.txt` file under the Blackboard Learn install. Apache 2.2 is required under one of the following circumstances:

- Shibboleth authentication provider is used
- SSL and Compression are used together

Process Model in Apache

Apache 1.3 serves requests using preforked processes. When the server's parent process is started, it forks a number of child processes that are responsible for accepting connections on the listening sockets. When a connection is received, the system wakes up one of the processes to handle the connection.

Apache 2.x supports pluggable concurrency models called Multi-Processing Modules (MPMs). When building Apache, you must choose MPM. Two of the important MPMs are Worker MPM and Prefork MPM. Worker MPM uses multiple child processes, each with multiple threads. Each thread handles one connection at a time. Worker is generally a good choice for high-traffic servers because it has smaller memory footprint than Prefork MPM. Prefork MPM uses multiple child processes with one thread each. Each process handles one connection at a time. Prefork is comparable in speed to worker, but it uses more memory. Prefork's threadless design can be used with non-thread-safe third-party modules and it is easier to debug on platforms with poor thread debugging support.

Apache 2.2 runs with Prefork MPM as the default. Follow the below instructions to switch to Worker MPM. Blackboard recommends using the Worker MPM.

```
To determine which MPM is running:
```

```
/usr/sbin/apachectl -l
```

```
To determine if Apache has Worker MPM compiled in:
```

```
/usr/sbin/httpd.worker -l
```

```
Uncomment HTTPD=/usr/sbin/httpd.worker in /etc/sysconfig/httpd
```

```
Restart Apache
```

KeepAlive

The Keep-Alive extension to HTTP/1.0 and the persistent connection feature of HTTP/1.1 provide long-lived HTTP sessions. They allow same TCP connections to be used by multiple requests. Performance tests have shown reduced latency times. As a result, Blackboard recommends leaving the default setting, `KeepAlive On` in `httpd.conf`.

`KeepAliveTimeout` specifies the amount of time the server waits for subsequent requests on a persistent connection. This directive is set to 5 by default. Blackboard's internal tests suggest increasing the value to 15 for optimal performance.

Estimating MaxClients for Optimal Performance

`MaxClients` sets the limit on simultaneous requests so connection attempts beyond the configured number of `MaxClients` are queued. `MaxClients` defaults to 256 with the Prefork MPM and 400 (`ServerLimit` multiplied by the value of `ThreadsPerChild`) for the Worker MPM. Blackboard recommends setting `MaxClients` to 200 as a starting point. When using the Prefork MPM, `ServerLimit` must always be the same as `MaxClients`.

Use the formula below to achieve a more precise calculation of `MaxClients`. The formula aligns to the tunable capacity of Tomcat application server. `MaxClients` must not exceed the `MaxThreads` configured by `bbconfig.appserver.maxthreads`.

```
MaxClients = minimum(
"RAM Memory allocated to Apache Web server" /
"Max child process size",
bbconfig.appserver.maxthreads)
```

To calculate the `Max child process size`, use the following command during a server busy time.

```
ps -ylC httpd --sort:rss
```

It is also important to ensure that you have enough RAM memory on the server for Apache by using the below formula:

```
"RAM Memory dedicated to Apache Web server" =
MaxClients * "Max child process size"
```

An example configuration for the Worker MPM:

```
<IfModule worker.c>
  StartServers          2
  MaxClients            200
  MinSpareThreads      25
  MaxSpareThreads      75
  ThreadsPerChild      25
  MaxRequestsPerChild  0
</IfModule>
```

An example configuration for the Prefork MPM:

```
<IfModule prefork.c>
  StartServers          8
  MinSpareServers      5
  MaxSpareServers      20
```

```
ServerLimit      200
MaxClients       200
MaxRequestsPerChild 4000
</IfModule>
```

Compression

`mod_deflate` compresses content before it is delivered to the client. Blackboard recommends enabling the extension by following the Apache 2.2 documentation.

http://httpd.apache.org/docs/2.2/mod/mod_deflate.html

SIS Logging

SIS Logging verbosity is set to `Errors Only` by default. Several clients have reported performance issues when this setting is configured to `All Diagnostic and Debug Messages`. Processing thousands of records using `All Diagnostic and Debug Messages` can cause problems due to large increase in database memory usage.

If `All Diagnostic and Debug Messages` must be turned on, clients should increase the log cleanup frequency from the default value of 30 days to 10 or less. This configuration is exposed in `config/internal/data-integration.properties`:

```
# How much days worth of entries should be saved during automatic purges
data.integration.purge.length=30
```

Supported Technologies

In every release, Blackboard devotes time and resources to make Blackboard Learn run on the latest operating systems, databases, and browsers available, with the goal of creating a system that is more manageable, more stable, and more user friendly.

This section highlights the major changes to the Supported Technologies and Browsers for this release. For the most up-to-date information, see Blackboard Learn Release 9.1 SP10 Supported Technologies and Browsers and Supported Technologies End User available on the [Behind the Blackboard](#).

The following sections highlight the new Platform and Client configurations tested for this release using the following support terms:

- **Certified:** Fully supported technology with highest level of testing before release.
- **Compatible:** Fully supported technology with minimal level of testing before release.
- **Unsupported:** Unsupported technology because it is either impossible or not tested.

Platform Technologies

64-bit Server Configurations

	Application Server/ JDK 7u7	SQL Server 2012 (64-bit)	SQL Server 2008 R2 (64-bit)	SQL Server 2008 (64-bit)	Oracle 11gR2 (64-bit)	Oracle 11gR1 (64-bit)	Oracle 10gR2 (64-bit)
Windows Server 2008 (64-bit)	Certified (64-bit JDK)	Certified	Certified	Certified	Unsupported	Unsupported	Unsupported
Windows Server 2008 R2 (64-bit)	Certified (64-bit JDK)	Certified	Certified	Certified	Unsupported	Unsupported	Unsupported
Red Hat Enterprise Linux Server 5 (64-bit)	Certified (64-bit JDK)	Unsupported	Unsupported	Unsupported	Certified	Compatible	Compatible
Red Hat Enterprise Linux Server 6 (64-bit)	Certified (64-bit JDK)	Unsupported	Unsupported	Unsupported	Certified	Compatible	Unsupported
Sun Solaris 10 (64-bit SPARC)	Certified (64-bit JDK)	Unsupported	Unsupported	Unsupported	Certified	Compatible	Compatible
Sun Solaris 11 (64-bit SPARC)	Certified (64-bit JDK)	Unsupported	Unsupported	Unsupported	Certified	Compatible	Compatible

Configuration Notes:

- Microsoft Windows Server 2003 is not supported. Please see this [announcement](#) from February 2011 for more details.
- Microsoft SQL Server 2005 is not supported in SP9. SQL Server 2005 requires a 32-bit application server, which is no longer supported. All clients must upgrade to Microsoft Server 2008 R2 64-bit and SQL Server 2008 64-bit.
- Microsoft SQL Server 2008(R1) will not be supported past SP11.

Non-English Operating Systems and Databases

Non-English operating systems and databases, such as a Chinese-language version of Oracle, are considered compatible with Blackboard Learn.

Oracle RAC

Blackboard offers support for RAC with all versions of Oracle supported by Blackboard. For information about running Blackboard Learn with RAC, see [Oracle RAC Support on UNIX](#) in [Blackboard Help for Administrators](#).

Hybrid Configurations

Red Hat/Solaris hybrid configurations have not been tested and are not supported.

SSL Configuration

Blackboard strongly recommends running the Secure Sockets Layer (SSL) protocol to secure communication between a Blackboard Learn Web/App server and a client machine. If SSL is not used, authentication may be compromised. For more information, see [About SSL and SSL Choice](#) in [Blackboard Help for Administrators](#).

Java Platform (JDK) Support

JDK 7u7 is supported for SP10. JDK 6 is *not* supported.

Virtualization

VMware® ESX Server 4 (Linux® and Windows®) is the only configuration Certified by Blackboard for Release 9.1.

Blackboard supports other virtualization solutions as long as Blackboard and the hypervisor support the guest operating system.

In addition to VMware, Blackboard has experience with Citrix XenServer 5.5, Solaris 10 Zones and Red Hat® Enterprise Linux® 4 & 5 Xen

Client Technologies

Blackboard's support of Google Chrome and Mozilla Firefox differs from the other supported browsers. Chrome and Firefox are following a rapid release strategy and releasing updates every 6 or so weeks. Chrome requires an automatic upgrade for end users, whereas Firefox offers the option to turn off the automatic upgrade. Blackboard has decided to support Chrome and Firefox in the broad sense meaning we will accept issues on both browsers and strive to resolve issues on Blackboard Learn as appropriate.

Blackboard has conducted testing using the version Stable Channel of Chrome and the Final Release Channel of Firefox that were available during testing of this release. We resolved browser related issues at the time of releases, but cannot guarantee the compatibility of future versions. We will conduct testing on the latest browsers and Blackboard Learn releases to provide timely information on browser compatibility.

Note: The latest operating system and browser versions, if not listed here, are always considered compatible if the vendor supports them. apache 2.2

Windows Client Configurations

	Internet Explorer 9	Internet Explorer 8	Firefox (ESR) ¹	Firefox (Final Release Channel) ²	Google Chrome (Stable Channel) ³
Windows XP (32-bit)	Unsupported by Microsoft	Compatible	Certified	Compatible	Compatible
Windows Vista (32-bit)	Certified	Compatible	Certified	Certified	Compatible
Windows Vista (64-bit)	Compatible	Compatible	Certified	Compatible	Compatible
Windows 7 (32-bit)	Certified	Compatible	Certified	Certified	Certified
Windows 7 (64-bit)	Certified	Compatible	Certified	Certified	Certified

Mac OSX Client Configurations

	Safari 5.1	Safari 5.0	Safari 4.0	Firefox (ESR) ¹	Firefox ⁴ (Final Release Channel) ²	Google Chrome (Stable Channel) ³
Mac OSX 10.6 "Snow Leopard"	Certified	Certified	Compatible	Certified	Certified	Certified
Mac OSX 10.7 "Lion"	Certified	Unsupported by Apple	Unsupported by Apple	Certified	Certified	Certified

¹ Firefox ESR is a release of Firefox intended for groups who install and maintain the desktop environment in large institutions. More information is available at <http://www.mozilla.org/en-US/firefox/organizations/>

² The Firefox Release Channel is the fully tested version by Mozilla and intended to be the most stable. This channel is updated roughly every 6 weeks. More information is available at <http://blog.mozilla.com/blog/2011/04/13/new-channels-for-firefox-rapid-releases/>.

³The Chrome Stable Channel is the fully tested version by Google and intended to be the most stable as the name implies. This channel is updated roughly every 2-3 weeks for minor releases and 6 weeks for major releases. More information is available at www.chromium.org.

⁴ Firefox 8 and Mac OS are not compatible with the drag and drop functions on Blackboard Learn.

Accessibility and JAWS

Blackboard strives to make all its products as accessible as possible. JAWS for Windows 11 and 12 were used during accessibility testing for SP10.

JRE Support

Blackboard Learn supports the latest version of Sun JRE 7. JRE 6 will continue to work with SP10. The JRE can be downloaded from <http://www.oracle.com/technetwork/java/javase/downloads/index.html>. Windows System Administrators who want to provide auto-download for users can find the .cab file link for the appropriate JRE at <http://www.oracle.com/technetwork/java/javase/autodownload-140472.html>.

Java Applet Code Signing

Java applets bundled with Blackboard Learn 9.1 SP10 are now signed with a timestamping authority, <https://timestamp.geotrust.com>, which certifies that the Blackboard code signing certificate was valid at the point in time when the applet was signed. Web browser client JDKs that trust the timestamping authority will run the applets without error, even after the Blackboard code signing certificate expires. All JDKs since version 1.5 trust this timestamping authority by default.

Technologies Not Supported

The following technologies are not supported:

- Internet Explorer 6, 7
- Firefox 1.x, 2.0, 3.0, 3.5, and 3.6
- Safari 2.0, 3.x and any version on Windows
- Mac OSX 10.3, 10.4, 10.5
- Java 5, although it may continue to work

Installation and Upgrade Information

For information about fresh installations of Blackboard Learn 9.1 SP10, see [Installing Blackboard Learn in Blackboard Help for Administrators](#).

For information about upgrading to Blackboard Learn Release 9.1 SP10, see the [Upgrade Center](#) and see [Upgrading to Blackboard Learn 9.1](#) in [Blackboard Help for Administrators](#).

Direct Upgrade Paths

The following releases have been tested and can be upgraded directly to Blackboard Learn 9.1 SP10.

- Blackboard Learn Release 9.1 Service Pack 9 (Build 9.1.90132.0)
- Blackboard Learn Release 9.1 Service Pack 8 (Build: 9.1.82223.0)
- Blackboard Learn Release 9.1 Service Pack 7 Hotfix1 (Build 9.1.70081.25)

Blackboard Learn 9.1 SP10 only supports an Enterprise license. If you are running Blackboard Learning System™ - Basic Edition or Blackboard Learn™ - Basic Edition you must move to an Enterprise version of Learn to upgrade to SP10. A Basic license can only be upgraded as far as 9.1 SP9. Contact your Blackboard Learn account representative for advice on the paths to transition from the Basic license to an Enterprise version.

Indirect Upgrade Paths

Blackboard Learn 9.1 SP10 only supports a 64-bit environment. You must be operating in a 64-bit environment to use any direct upgrade path to SP10. If you are currently running any of these service packs in a 32-bit environment, you must migrate to a 64-bit environment first. This is especially relevant to Academic Suite 8.0 SP7 running on Windows. More information on migrating to a 64-bit environment is available in help.blackboard.com.

Blackboard Learn 9.1 SP10 only supports an Enterprise license. You will not be able to upgrade to SP10 if you have a Blackboard Learning System™ - Basic Edition or Blackboard Learn™ - Basic Edition license.

Previous Version	Suggested Path
9.1 SP8 ERP (Build 9.1.80257.0)	<ol style="list-style-type: none"> 1. Upgrade to 9.1 SP8. 2. Upgrade to 9.1 SP10.
9.1 SP7 (Build 9.1.70081.0)	<ol style="list-style-type: none"> 1. Upgrade to 9.1 SP7 Hot Fix 1. 2. Upgrade to 9.1 SP10.
9.1 SP6 (Build 9.1.60230.0)	<ol style="list-style-type: none"> 1. Upgrade to 9.1 SP8. 2. Upgrade to 9.1 SP10.
9.1 SP5 (Build: 9.1.50119.0)	<ol style="list-style-type: none"> 1. Upgrade to 9.1 SP7 Hot Fix 1. 2. Upgrade to 9.1 SP10.
9.1 SP4 (Build: 9.1.40071.3)	<ol style="list-style-type: none"> 1. Upgrade to 9.1 SP6. 2. Upgrade to 9.1 SP8. 3. Upgrade to 9.1 SP10.

Previous Version	Suggested Path
9.1 SP3 (Build: 9.1.30151.0)	<ol style="list-style-type: none"> 1. Upgrade to 9.1 SP5. 2. Upgrade to 9.1 SP7 Hot Fix 1. 3. Upgrade to 9.1 SP10.
9.1 GA, SP1, SP2	<ol style="list-style-type: none"> 1. Increment through the service packs to 9.1 SP5. 2. Upgrade to 9.1 SP7 Hot Fix 1. 3. Upgrade to 9.1 SP10.

Paths for Importing and Restoring Courses

The following table identifies the supported paths for importing or restoring a course that was exported or archived from Blackboard Academic Suite. Certified paths are fully tested and supported by Blackboard. Compatible paths are not fully tested but should function correctly based on past performance.

Note: Paths for importing and restoring courses are not backward compatible. Courses may be imported or restored to a newer version, but courses from a newer version may not be imported or restored to an earlier version.

Source	Support
Blackboard Learn Release 9.1	Certified
Blackboard Learn Release 9.0	Certified
Blackboard Academic Suite Release 8	Certified
Blackboard Academic Suite Release 7	Certified
Blackboard Academic Suite Release 6	Certified
Blackboard ML	Certified
Blackboard 5.5*	Certified
Blackboard 5.0*	Compatible
CourseInfo 4	Not Supported
Blackboard Vista and CE 8.0.5 or higher	Certified
Blackboard Campus Edition 4.1.7	Certified
ANGEL LMS 7.3	Not Supported
ANGEL LMS 7.4	Certified
ANGEL LMS 8.0	Certified

*Blackboard 5 and Blackboard 5.5 did not include an Archive and Restore function. Courses from these releases may be imported but courses cannot be restored with user data and interactions intact.

Before Running the Updater / Installer

Certain tasks need to be accomplished and settings checked before running the installer / updater. Server software must meet certain requirements in order to run the installer successfully.

For all platforms operating in a load-balanced environment, the Blackboard Application must be shut down on all the Application Servers for all upgrades. Upgrading one Application Server while another is running can cause database corruption on all platforms.

Upgrading Server Software

Windows

- The database is run on a separate server when using two or more servers. In a Windows environment, the appropriate client tools for the database must be installed on the Application server or servers when using a configuration with two or more servers.
- If running on Windows, when installing the Java SE Development Kit (JDK), make sure that both the JDK and the JRE components are installed to different locations. Also, ensure that there are no spaces in the path name to either the JDK or the JRE.
 - Shut down Bb-Services
 - Install JDK 7u7
 - Change the JAVA_Home environment variable
 - Change the `config\bb-config.properties`, both `bbconfig.java.home` and `bbconfig.java.home.win`
- If running on Windows, support for .NET APIs and .NET Building Blocks has been removed from Blackboard Learn in Release 9.1. If you are using .NET APIs and Building Blocks, they will not work in Release 9.1. Replace them with comparable Web Services and Java Building Block APIs. For more information about the available APIs, see the API documentation available on <http://www.edugarage.com>.

Linux and Solaris

- The database is run on a separate server when using two or more servers. For Linux and Solaris configurations, the database client tools are shipped with the application and must not be installed separately.
- If running on Solaris, ensure that the Swap space for the operating system is 0.5 – 1.5 times the amount of physical RAM on the server. For more information, see http://www.sun.com/bigadmin/content/submitted/swap_space_impact.jsp.

Upgrading to Blackboard Learn 9.1 SP10

When You Have a New License

Important Note: If you have a license for Blackboard Learn 9.1 Blackboard Learning System™ - Basic Edition or Blackboard Learn™ - Basic Edition, you must first obtain an Enterprise license to upgrade to SP10. Contact your Blackboard learn account representative to transition to an Enterprise license.

When you have a new license, save the new license file in the same directory as the updater. Be sure not to confuse the new license with the old license file.

During the upgrade, select **Provide new License file** when prompted by the installer.

Warnings and Tips for Upgrading

SQL Server 2008 Settings

If you are running Learn 9.1 in a Windows environment, a successful installation or upgrade to SP10 requires SQL Server 2008. If your database server is upgraded from a previous SQL Server version (2005 or older) to meet this requirement, set the database **Compatibility level** to **SQL Server 2008 (100)** for all databases. The setting is located under **Options** in **Database Properties**.

Content Editor – Math Editor Image Service

To resolve broken math equation images when using a separate Image Service Host over SSL, generate a new self-signed certificate where the CN= matches the FQDN (fully qualified domain name) that appears in the Image Service Host. This new certificate should also be imported into the JDK keystore at `JAVA_HOME/jre/lib/security/cacerts`.

Warning for Customizations and Configuration

Running the Updater on an existing system will reset many back-end and user interface customizations. Examples and warnings describing specific known issues are included here.

Examples of affected back-end settings include:

- `JAVA_HOME` system environment variable
- SSL and custom authentication settings
- Settings in the `bb-config.properties`, `authentication.properties`, and `wrapper.conf` files

Examples of affected user interface settings and other affected areas include:

- Course Settings (which control the Course Menu)
- Building Block availability
- API hosts information
- Module and Tab availability, role settings, and custom layouts

Customizations will need to be reapplied after the upgrade. To make this process easier, create a detailed document outlining all existing customizations.

Note: Any configuration files removed by the upgrade will be placed in the `blackboard_directory>/backups/<upgrade_timestamp>` directory. Use these files as a guide when updating the new configuration files to reapply your previous customizations.

Mashups, Building Blocks, Blackboard Mobile and Firewall Warning

Bidirectional communication to Web Services that control the APIs for Mashups, some Building Blocks, and Blackboard Mobile is required. If you are running Blackboard from behind a firewall as a test server or for security reasons, you will need to open the firewall to use these features. To open bidirectional communication to Web Services, you must configure your firewall to allow responses from the API hosts. Information from the hosts is available at these locations. Known ports are listed.

- Flickr – <http://www.flickr.com/services/api/>
- YouTube – <http://gdata.youtube.com>
- SlideShare – <http://www.slideshare.net>
- Blackboard Mobile – <http://mlrs.medu.com> and <http://mlcs.medu.com> Ports 80 and 443
- SafeAssign for Blackboard Learn – safeassign.blackboard.com IP address: 69.196.241.21 Ports 80 and 443
- SafeAssign for Blackboard Vista – www.safeassign.com IP 69.196.241.20 Ports 8080 and 8443
- McGraw-Hill Connect – 204.8.135.97 and 198.45.24.170
- Blackboard Software Updates and Cloud Profiles – <https://connect.cloud.bb>, <https://softwareupdates.cloud.bb>, <https://api.cloud.bb>, and <https://ui.cloud.bb> Port 443

Echo 360 Warning

The Echo 360 Building Block supporting the free, limited-use access to EchoPersonal capture and publishing capability is no longer be bundled with Blackboard Learn. Those institutions that have downloaded this Echo360 Building Block previously and are actively using it may continue to do so with support from Echo360. However, no new instances will be permitted or supported. Echo360 recordings can still be integrated into a Learn course using links. For clarification, Echo360 will continue to integrate with this and prior Blackboard Learn releases so learning content captured with a paid version of the Echo solution will accessible using Blackboard solutions. To learn more about how your school can work with Echo360's Lecture Capture solutions, visit their website at www.echo360.com.

NBC Learn Warning

The NBC Learn Building Block will not longer be bundled with Blackboard Learn in SP10. Upgrading will have no affect on this Build Block if it has already been installed.

SafeAssign Warning

Institutions choosing to archive courses from a legacy production installation and then restore the courses to a new 9.1 instance will lose some of the data associated with SafeAssign, specifically SafeAssignments in restored courses and the student submissions to those SafeAssignments will be inaccessible. In addition, this option could potentially create a privacy issue where some students would be able to see submissions that are not their own.

To avoid these issues, when SafeAssign is heavily used, Blackboard recommends that one of the other two upgrade paths be selected: In-Place Upgrade or Fresh Install – Data Migration.

If your institution chooses the archive/restore option, you will need to have the existing SafeAssign institution database copied from the previous installation to the new installation. Please open a ticket with Client Support to request this copy after the new production installation is complete.

Custom Themes Warning

Significant changes were made to the application markup and CSS in Release 9.1 to support new features and accessibility standards. These changes can cause customized themes and color palette changes created in earlier releases to malfunction as well as fail to apply styles to new features.

Beginning in SP10 a Theme Diff Tool is available that compares two themes "in place" on your Blackboard Learn server using your theme handles. You can also run the tool on a non-blackboard machine comparing two themes, either zipped or expanded that you have downloaded from your Learn instance. The Theme DIFF Tool is available from [Edugarage](#).

Comments have been added to the CSS files to make them easier to read and understand. These comments identify new elements and elements that are no longer used. Extraneous sectors have been removed.

Important Note about Adaptive Release

To ensure that Adaptive Release rules function correctly, additional steps may be required for courses created prior to Blackboard Learn Service Pack 6.

In the majority of cases it's sufficient to remove these permissions manually from the Course Files. Instructors can perform this on a file-by-file basis where adaptive release control is required only on a small number of files, or permissions can be reset for the entire course.

Resetting all permissions to default using the user interface involves briefly permitting all course users access to the files in order that permissions can be revoked on all sub-directories and files in one step. In a course requiring adaptive release control of large numbers of files:

1. In the course Control Panel, go to course **Files**.
2. At the top of a page, access the drop-down menu for the course files directory. It will be labeled '**Files: <courseid>**'
3. Click **Permissions** from the drop-down menu.
4. Click **Add Course User List**.
5. Select **All Course Users**.
6. Select **Read** permission.
7. Check the box to **Overwrite** the existing permissions.
8. Click **Submit**.
9. Find the newly created **All Course Users** list, and click **Delete** from the drop-down menu. Click **OK** to remove permissions from all sub-folders and files.
10. You should be left with three user list permissions (unless you have previously created any custom instructor roles, in which case there will be more than three). Course Builder, Instructor and Teaching Assistant all with full manage permissions.

These instructions will be slightly different if you have licensed the Content Collection.

Note: In rare cases, additional steps may be required. The adaptive release functionality requires file links to exist in a table called `cms_resource_link`. Depending on your Learn version history, in some cases, these rows may not exist and so a course copy or an archive/restore will be required for all content items to function properly with adaptive release.

Previous Content Management Clients Warning

If your institution is planning to upgrade from Blackboard Learn 9.0 or earlier please be aware of possible complications with content management. Clients who have previously licensed the content management capabilities, but no longer have such a license, may encounter problems when upgrading to Release 9.1. This occurs because of lingering schemas in the database that require a content management license. Because of these lingering schemas, the installer is unable to upgrade the database properly and will fail.

If your institution's database has lingering schemas from a previous content management license you must obtain the appropriate uninstaller script from Blackboard Client Support to remove these schemas before upgrading to 9.1.

Load-Balanced Systems Warning

The updater must be run on each application server and the Collaboration server on a load-balanced system. After running the updater the first time, choose the **Update an App Server** for all other application servers and the Collaboration server. This option will upgrade the application files without making any of the database changes.

For all platforms operating in a load-balanced environment, the Blackboard application must be shut down on all the application servers for all upgrades. Upgrading one application server while another is running can cause database corruption on all platforms.

- Upgrades may fail if Port 80 is being used. The installer validates that it can complete installation and start services without conflict by verifying that the ports configured for Blackboard are not in use to avoid startup failures. The ports are checked against the load-balanced hostname `bbconfig.webserver.fullhostname`, where the load-balancer may still be responding during the upgrade. To avoid this error:
 - Make sure no other service is running on the application server and keeping Port 80 open.
 - Make sure the installer is not validating against another server or load-balancer.

See KB article [Upgrade Fails with Port 80 Already in Use](#) for more details.

Oracle 11gR2 Errors

Oracle 11gR2 contains two bugs that cause errors.

The first bug displays errors when importing content or restoring course packages. To prevent this error, as an Oracle user, run the following command:

```
alter system set "_optimizer_push_pred_cost_based"=false scope = both;  
alter system set cursor_sharing=EXACT scope=both;
```

The second bug returns an error that reads:

```
ORA-00918: COLUMN AMBIGUOUSLY DEFINED
```

To prevent this error, apply the Oracle patch bundle 11.2.0.1 number 9259407. This issue is resolved in Oracle 11.2.0.2.

Running the Updater on Windows

Follow these steps to run the Updater on Windows:

1. Make sure that the JAVA_HOME system environment variable points to a full Java Platform (JDK) version 7u7. The path cannot contain spaces. For example: C:\JDK7.
2. Place the Updater file in the desired location, and then double-click the Updater file to launch the Updater.

A welcome message appears with a reminder to read the release notes and the installations instructions completely before updating.

3. Click **Next** to continue.
4. Confirm the installation and content directories for your environment, and then click **Next**. Load-balanced systems should use the correct UNC path for your content directory.

For those clients with content management and the /courses area turned off, a warning appears displaying a message that the /courses content area must be turned on to successfully upgrade. Although not recommended, the /courses area can be disabled again after upgrade, but it must remain on during upgrade.
5. At the next prompt, select **Provide new license file**, and then click **Next**.
6. If the server does not already have a **Server Type** value, the **Server Type** screen appears. Properly categorize the server and click **Next**.
7. When a message appears displaying the changes that will be made when the updater runs, carefully verify the changes. You will not be able to undo the changes after you start the upgrade.
8. Click **Next** to start the upgrade.

 **WARNING!** If you launched the updater from the command line, do not close the command line window or any of the other windows that pop-up during the upgrade as this will cause the upgrade to fail and may leave the database in an indeterminate state.

Running the Updater on UNIX (Red Hat and Solaris)

Follow these steps to run the updater on UNIX.

1. Make sure that the `$JAVA_HOME` system environment variable points to a full Java Platform (JDK) version 7u7. The path cannot contain spaces. For example: `/usr/jdk7`.
2. Place the updater file in the desired location.
3. Open a command-line prompt as the root user and navigate to the directory that holds the Updater.
4. Issue the following command to launch the updater:

```
$JAVA_HOME/bin/java -jar <updater_file>
```

If using the X Windows System (X11) or a similar GUI solution and the `DISPLAY` variable is properly configured, the updater will launch in GUI mode.

Note: The following steps assume that the command-line updater is used.

5. A welcome message appears with a reminder to read the release notes and the installations instructions completely before updating.
6. Press ENTER to continue. Instructions appear for navigating through the updater prompts. The updater, in most cases, will provide a default value in brackets.
7. Press ENTER to accept the default and continue, or enter a different value. Press ENTER to continue after entering a new value.
The first updater prompt asks for the directory where Blackboard will be found.
8. Press ENTER to accept the default, or enter a new value and then press ENTER. If Blackboard Learn is not found in the directory provided, the updater attempts to install at the given location.
9. At the next prompt, type 1 for “1 - Upgrade and Convert” and press ENTER.
For those clients with content management and the `/courses` area turned off, a warning appears displaying a message that the `/courses` content area must be turned on to successfully upgrade. Although not recommended, the `/courses` area can be disabled again after upgrade, but it must remain on during upgrade.
10. If the server does not already have a Server Type value, the Server Type screen appears. Properly categorize the server and press ENTER.
11. When a message appears displaying the changes that will be made when the updater runs, carefully verify the changes. You will not be able to undo the changes after you start the upgrade.
12. Press ENTER to start the upgrade.