

# Blackboardlearn<sup>+</sup>

*Release 9.1*  
*Release Notes*  
*9.1.407.2*



**Blackboard**



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# Introduction

## About the Release Notes

The Release Notes includes the following sections:

- [New Features and Enhancements](#) – Describes the new features and important enhancements that have been made to the system in this release.
- [Removed Features](#) – Lists the features removed as of this release.
- [Technical Changes](#) – Describes the technical changes that have been made to the system in this release.
- [Resolved Issues](#) – Provides a link to the list of issues resolved in this release.
- [Known Issues](#) – Provides a link to the list of known issues in this release.
- [Performance and Scalability](#) – Details the latest analysis from our Performance Engineering team and how to tune an installation of this release.
- [Supported Technologies](#) – Gives an overview of the changes to supported platform technologies and client technologies in this release.
- [Installation and Upgrade Information](#) – Provides the supported upgrade paths to this release as well as where to go for more information.

## Guides Renamed

The *Blackboard Learn Setup Guide* has been renamed the *Blackboard Learn Installation Guide*.

The *Optimizing Blackboard Learn Deployments Guide* has been renamed the *Blackboard Learn Performance Optimization Guide*.

The *Blackboard Learn Backup and Restore Guides* have been renamed *the Blackboard Learn Moving Blackboard Learn in a SQL Environment* and *Blackboard Learn Moving Blackboard Learn in an Oracle Environment*.

## New Features and Enhancements

Blackboard Learn Release 9.1 includes new features and enhancements in the following capabilities:

- [Course Delivery](#)
- [Content Management](#)
- [Outcomes Assessment](#)

### Course Delivery

Blackboard Learn Release 9.1 introduces many new features and enhancements to the existing features in response to user feedback. This release includes several innovations that are grouped in the following categories:

- Blackboard Connect Integration
- Building Content
- Course Files
- Course/Organization Role Customization
- Grade Center
- Learning Modules
- Lesson Plans for HigherEd and ProEd Clients
- Lesson Plans for K-12 Clients
- Mashups
- Standards Alignment for K-12 Clients
- Tests, Surveys, and Question Pools
- Textbook
- Web Services and Building Blocks
- Wikis

Innovations in each of these areas represent the confluence of best-of-breed features and functions from earlier Blackboard products.

### Content Management

All users who have licensed the content management capabilities of Blackboard Learn will enjoy a more powerful experience when managing their content in Release 9.1.

The following content management features have been enhanced:

- Building Content
- Passes and Permissions

- Recycle Bins
- Search Content
- Views

## Outcomes Assessment

All users who have licensed the outcomes assessment capabilities of Blackboard Learn will enjoy a more powerful assessments experience in Release 9.1.

The following outcomes assessment features have been enhanced or added to Release 9.1:

- Artifacts
- Batch Operations
- Criteria List Operators
- Deployments
- Gradable Content Alignment

## For More Information

For more information about these features and enhancements:

- For those who are upgrading from a previous product release or from a legacy product such as CE 8, the Upgrade Kits for each product release available on the [Blackboard Upgrade Center](#) or [Behind the Blackboard](#) contain an “Understanding the Change” document for each product. These documents give users a comprehensive look at the features and functions of this release and how they compare to the user’s current product release.
- For those who are new to Blackboard Learn, see “Understanding the Change from Blackboard Learn 9.0 to 9.1.”

## Removed Features

The following features are no longer available.

### **eCommerce**

This add-on product line is no longer available with Blackboard Learn.

### **Offline Content**

Offline Content can no longer be added to a Course. The Offline content type will no longer be available when uploading content.

# Technical Changes

Blackboard Learn Release 9.1 includes technical changes in the following areas:

- [Database Changes](#)
- [Application Server Changes](#)
- [Session Fingerprinting](#)

## Database Changes

### Database Schema Names

The default identifier used to name all Blackboard database schemas has changed from BB\_BB60 to BBLEARN. When installing Blackboard Learn, if the Database Identifier parameter is left blank, it will default to BBLEARN. To use a different identifier in all Blackboard database schema names, type the value in the Database Identifier parameter.

**Note** Database identifiers must be unique within the database server.

The Database Identifier parameter is not available in the Installer when upgrading Blackboard Learn. If you are upgrading your environment and want to change your database identifier, contact Blackboard Support.

When creating a test environment in a legacy environment, use the legacy schema identifier, BB\_BB60, in the Database Identifier field in the Installer.

The following table maps the legacy schema names to the new default schema names.

Legacy Schema Name	New Default Schema Name
BB_BB60	BBLEARN
BB_BB60_ADMIN	BBLEARN_ADMIN
BB_BB60_STATS	BBLEARN_STATS
CMS_FILES_*	CMS_DOC

Manual database schema name changes to an existing schema should be done only with the help of Blackboard Support.

### Schema Change Summary

- 671 tables, 137 views, 16 columns, 3 packages, 2 constraints and 5 indexes changed
- 91 new tables
- 21 new views
- 141 new columns
- 5 new constraints
- 3 new indexes
- 14 new sequences

**BBLEARN (formerly bb\_bb60)**

- 669 tables
- 127 views
- 1 package across 5 schemas
- 37 new tables
- 107 columns added to existing tables
- 1 new view

**BBLEARN\_ADMIN (formerly bb\_bb60\_admin)**

- 1 new column added to existing tables
- 1 package changed
- 5 views, 8 columns, and 1 package changed
- 7 new tables
- 10 new views
- 7 new columns
- 7 new sequences

**CMS**

- 46 new tables
- 14 new columns

**CMS\_DOC (formerly cms\_files\_xxx)**

- 1 tables, 2 columns, 2 constraints, and 5 indexes changed
- 1 new table
- 10 new views
- 5 new columns
- 5 constraints
- 3 new indexes
- 7 new sequences

**BBLEARN\_STATS (formerly bb\_bb60\_stats)**

- 5 views changed
- 8 columns changed
- 1 package changed
- 7 new tables
- 10 new views

- 7 new columns
- 7 new sequences

## Database Size Changes from Learn 9.0 to 9.1

### Installer

- Total: -36% (reduced)
- BB\_BB60 / BBLEARN: 22%(increased)
- CMS: -64%
- Others: <+1%

### Updater

- Total: 26% (increased)
- BB\_BB60 / BBLEARN: 16% (increased)
- CMS: 29% (increased)
- Others: <+1%

## The Database Statistics Schema

The `activity_accumulator_cr` procedure has been modified to insert new records into the new table `activity_accumulator_queue` instead of directly into the `activity_accumulator` table. The new table will be smaller in size, which reduces the performance impact of `activity_accumulator_cr`, which runs for every user action. Use of indexes on `activity_accumulator_queue` table should be avoided in the interest of application performance.

A job has been scheduled via the `DBMS_JOB` interface to run a stored procedure `activity_accumulator_update` which flushes the queue table every 10 minutes into the actual `activity_accumulator`. The `activity_accumulator_update` copies data from the queue table to `activity_accumulator`, which is the production table that holds the data permanently. This job inserts data in 2000-record batches to the `activity_accumulator` (though it leaves between 500-2000 records behind each time). Between the hours of 23:00 and 00:00 each night, database time, the job moves a higher volume of data in order to clean up any missed records from previously.

**Note** If the Oracle parameter `job_queue_processes` is set to zero, the `activity_accumulator_update` job will not run. As a symptom, the system tracking pages would start showing zeros and course activity reports would show no activity.

## Statistics Schema Configuration

The statistics schema (`BBLEARN_admin`) configuration is no longer explicitly tied to the configuration for the core transitional schema (`BBLEARN`). The values required to access the statistics schema, stored in `BBLEARN_admin.BB_INSTANCE`, are populated from `bbconfig.database.stats.server.name` in the `bb-config.properties` file. A consequence of this change is that the statistics schema `BBLEARN_STATS` can be moved to a

separate database or physical system, and the settings will be preserved when running `PushConfigUpdates`.

## Oracle RAC Support

Blackboard offers support for RAC with all versions of Oracle supported by Blackboard. For support information, see [Supported Technologies](#). For information about running Blackboard Learn with RAC, see the *Blackboard Learn Server Administrator Guide* available on [Behind the Blackboard](#).

## Updated Oracle JDBC Driver

The Oracle driver was updated to build 11.1.0.7. This fixes many critical Oracle bugs at the JDBC layer, such as AS-143785 - Protocol violation exceptions.

**Note** Blackboard Learn is Compatible with Oracle 11gR1, but Oracle 10gR2 is the only version of Oracle Certified for Blackboard Learn. For more information, see [Supported Technologies](#).

## New Critical Database Error Handling

Code was added to respond to fatal database errors by ensuring that the corrupted connection is closed. For example, JDBC errors resulting in OALL8 protocol violations previously would result in corrupt connections filling up the connection pool. With this change, corrupt connections are recognized and removed from the pool.

## New 64-Bit Database Support

64-bit versions of both SQL Server and Oracle are supported. For more information, see [Supported Technologies](#).

## Query Enhancements

### Paged Searches

Blackboard Learn is now 5–25 times faster when conducting user and course searches. The idea is to load only one page of necessary data records at a time using highly tuned SQL queries. This is enormously beneficial for those pages where a very large amount of data needs to be displayed. The old architecture retrieved all of the data and stored it in memory. Subsequent navigation across pages happened in memory. When the data volume is extremely large, so is the amount of memory consumed to store the data. With the new paged searching method, the consumption of memory is significantly reduced and is instead available for other transactions or processes. Because the new pagination architecture consumes a much smaller amount of memory, the resultant Garbage Collection (GC) pause time is much smaller.

### Hierarchical Queries

Hierarchical data no longer uses the `x_` pattern, which relied on a separate table to maintain all graph edges. Instead, native database syntax (CONNECT BY statements in Oracle and recursive Common Table Expressions in SQL Server) is used to load hierarchical data.

## Application Server Changes

### New Background Tasks

The following background tasks are new in Blackboard Learn Release 9.1. They are all implemented as `SingletonTimerTasks`, which means that they will not conflict if run on multiple application servers. However, all of the tasks depend on database state. As a result, they only need to run on a single node.

Task ID	Description	Default Period
<code>bb.fulltextsearch.indexprocessor</code>	Processes events out of the <code>FT_INDEX_UPDATE_EVENT</code> table.	Once an hour
<code>bb.connect.usersync</code>	Sends contact updates to an integrated Connect SMS server when pertinent user information changes.	Once an hour
<code>bb.userlifecycleevent.dispatcher</code>	Periodically sends user lifecycle event notifications (that is, user added/deleted/modified) to all registered listeners.	Every 5 seconds
<code>bb.cms.admin.search</code>	Polls the CS repository to find course directories with no corresponding course and flags the folders with a property identifying them as orphaned.	Every 24 hours
<code>bb.deployment.scheduling</code>	Polls the database and activate/deactivate Outcomes deployments based on dates.	Once a minute
<code>bb.deployment.reminders</code>	Polls the database and send out reminders to participants for pending deployments.	Once a minute

### File System Changes

As a result of changes to support multiple database instances, shared data goes into a `BBLEARN` sub-directory in the `./blackboard/content/vi` directory instead of the previous `bb_bb60` directory. However, this does not change the overall file system layout for clients who are upgrading from a previous version of Blackboard Learn.

New default installations will have the following directory to support Lucene indexes for data received from the `BBLEARN` schema:

```
./blackboard/content/vi/BBLEARN/lucene
```

## Notable Logs

Log	Description
bb-schema-log.txt	Records DDL activity initiated using the Outcomes user-defined attributes or Building Block schema definition.
bb-session-log.txt	Records suspicious session fingerprint activity.
bb-sms-log.txt	Records attempts to send messages to Blackboard Connect as well as automatic sync attempts.

## HTTP Compression Support

Blackboard Learn now supports HTTP GZip compression using the IIS and Apache native compression capabilities. GZip compression typically compresses a 100 KB file to about 10 KB.

Configure compression in the `bb-config.properties` configuration file. For more information, see the *Blackboard Learn Server Administrator Guide* for Release 9.1.

## Optional Clustered Tomcat Setup

An option for new installations is that they can be configured to use a clustered Tomcat environment. In Tomcat clustered environments, cross-server communication is needed to synchronize caches across multiple application servers. All Blackboard Learn systems spanning multiple application servers must be part of the same ServerGroup and communicate using the port specified in that ServerGroup. Each node requires its own unique ServerGroup and associated port number.

Recommendations for clustered Tomcat environments are discussed in the section 64-Bit Deployments in this document. For more information, see the appropriate “Optional Clustered Tomcat Setup” section of the *Blackboard Learn Installation Guide* for Release 9.1.

## Session Fingerprinting

Session fingerprinting can help detect when a user’s session has been hijacked by a malicious attacker based on changes in the IP address or User-Agent HTTP headers. A fingerprint helps uniquely identify users, for example, by using their computer’s IP address or the type of browser (User Agent) that they are using. The system can be configured to respond by doing nothing, forcing re-login, or forcing logout.

Session Fingerprinting is not available with Blackboard Learn - Basic Edition.

For more information, see the *Blackboard Learn Administrator Guide*.

## Resolved Issues

The list of issues resolved in Blackboard Learn Release 9.1 is available on the [Resolved Issues Page](#) of the Maintenance Center.

## Known Issues

The list of known issues in Blackboard Learn Release 9.1 is available on the [Known Issues Page](#) of the Maintenance Center.

# Performance and Scalability

Blackboard continuously invests in making Blackboard Learn more responsive and able to handle greater volumes of user traffic. This section describes the performance and scalability issues in this release of Blackboard Learn.

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

In general, Blackboard Learn Release 9.1 is more responsive and scalable than both Release 9.0 Service Pack 3 and Release 8 Service Pack 6 across all supported platform configurations. Blackboard completed more than 2000 hours of performance tests on Release 9.1, and this number will continue to increase as Blackboard produces Service Packs against the Release 9.1 code line.

When comparing Release 9.1 against any previous Service Pack using regression performance settings, no degradation of performance was reported during performance tests or benchmarks. Performance improvements have been confirmed on both SQL Server and Oracle configurations.

### Performance Issues

#### Accessing Existing Courses

When upgrading from a previous version, the first user to access the home page for each existing Course may experience some latency while the system updates the keywords used within Assessments. This latency should occur only the first time that a user accesses the page and should last no more than 5–10 seconds. Blackboard removed this operation from the Installer and Updater to reduce the amount of down time needed to upgrade to Release 9.1. Users accessing new courses created in Release 9.1 will not experience this latency.

### Performance Improvements

#### Notifications

Customers reported issues with Notifications in Release 9.0 including high CPU utilization and possible database deadlocks. These issues have been addressed through query optimization and the addition of database indexes.

#### Database Index Changes

Release 9.1 includes many new indices to address outstanding query performance issues. Customers now will see indexes on all Foreign Keys in the database. Additional indexes were added to address sub-optimal query execution path performance.

## Grade Center

To optimize the responsiveness of the Grade Center grid view and other functions within the Grade Center, a variety of queries to return a Grade Center item and attempt information were refactored and several indices were added.

The Grade Center history has been optimized to eliminate latency caused by JavaScript blocking, which was occurring in a loop function. This issue caused large Grade Center history records to take minutes to return. The same data set now takes seconds to return.

The process of downloading a full Grade Center offline has been optimized. Large data sets were taking upwards of 10 to 15 seconds to download. The same data set now can be downloaded in approximately 4 seconds.

## Unnecessary 404 Errors

Internal testing identified several JSPs reporting 404 HTTP messages in which the HTTP object was not found. A minor change fixed the appropriate path of the JSPs to eliminate the unnecessary messages. Clients should report 404 errors because they lead to additional logging in the application and may uncover possible issues with the user interface experience.

## Discussion Board Search

Internal testing identified poor performance when users search at a thread level within a Discussion Forum. Response times varied from 10 seconds to as high as 120 seconds. The associated query was refactored to reduce the response time to less than 3 seconds.

## Unqualified Searches

Customers reported issues with unqualified searches performed from the Administrator Panel, Course Control Panel, and Course Catalog. These unqualified searches had the potential to consume all of the memory in a Java Virtual Machine (JVM). Several of these searches were refactored to push the demand of resources into the database from the application server. These changes improved responsiveness when returning, sorting, and paging results, and reduced the overall memory footprint in the JVM.

## Tomcat Server Crashes

The default configuration of Tomcat allows page buffers to grow to fit the largest page served to date without scaling them back again to the default size. This assumes that this much space will likely be needed again. However, this is not realistic in an application where most requests are rather small, but some requests create very large output pages.

The problem is particularly obvious when users launch specific requests that produce extra large output sets, such as listing all users in a very large class or on the system, or all/most courses on the system (in other words, when executing an “unqualified search”). This not only creates many short-lived objects in Java memory (which can be garbage-collected quickly) and introduces short-term memory pressure on the heap, but it also makes the page buffer for this thread grow very large, and stay that size. As a result, this memory is never used, but it is not made available. Additional parameters for avoiding this condition were added to the JVM arguments.

## Recommended Deployment Approach

### 64-Bit Deployments

Release 9.1 is the first release to offer an entire application and database footprint using 64-bit addressable memory. To take advantage of more addressable memory, Blackboard strongly encourages clients to deploy using 64-bit operating systems (OSs) and sub-components (Java and SQL Server or Oracle). As part of the 64-bit deployment, Blackboard encourages clients to take advantage of larger Java Virtual Machines (JVMs) that range from 2GB to 16GB in size. The preferred size is 4GB, but performance testing has been conducted with acceptable performance as high as 16GB.

Customers should begin migrating from Tomcat clusters. Tomcat clustering was introduced for scalability purposes when the Blackboard Learn architecture was 32-bit and customers wanted the ability to increase their memory usage on a single server. With the option to virtualize on both 32-bit and 64-bit, Blackboard's benchmarking efforts have moved away from 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 instances. The difference in configurations is a smaller demand on the Apache or IIS web server fronting the Tomcat instance(s). The option to deploy a 64-bit JVM with larger heap sizes has suppressed the need for customers to run in a cluster option.

Blackboard recommends that customers consider a deployment approach consisting of larger 64-bit JVMs that are distributed 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 should also consider 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 the *Blackboard Learn Server Administrator Guide* available on [Behind the Blackboard](#).

For more information about deploying Blackboard Learn, see the *Blackboard Learn Hardware Sizing Guides* for Dell and Sun Deployments in the Upgrade Kit available on [Behind the Blackboard](#).

## Recommended JVM Tuning Set

For every release, 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. For Release 9.1, Blackboard conducted more than 2000 hours of system testing and benchmarking across all certified and supported configurations.

This section provides the recommended Java Virtual Machine (JVM) tuning set as executed in the Blackboard Performance Engineering laboratory against Release 9.1.

JVM sizing varies from platform to platform. 32-bit Windows and Linux deployments are limited to JVM sizes no greater than 1.7GB of addressable memory. This consists of the main heap area (Old and New Space) plus the permanent space. 64-bit Windows, Linux, and Solaris configurations are not impeded by this limitation of addressable memory.

Blackboard recommends using the following tuning set for 1.4GB JVMs (32-bit) on Windows, Linux, and Solaris systems using Java 1.6. These recommended settings can be managed within the `bb-config.properties` file or `wrapper.conf` file:

```
-Xms1400m -Xmx1400m -XX:NewSize=350m -XX:MaxNewSize=350m
-XX:SurvivorRatio=4 -XX:+UseConcMarkSweepGC -XX:+UseParNewGC
-XX:+UseTLAB -XX:PermSize=256m -XX:ParallelCMSThreads=2
-XX:ParallelGCThreads=4 -XX:+PrintVMOptions -XX:+PrintGCDetails
-XX:+PrintGCTimeStamps -XX:+PrintGCTaskTimeStamps
-XX:+PrintCommandLineFlags -XX:+PrintGCApplicationStoppedTime
-XX:+PrintGCApplicationConcurrentTime
-Xloggc:<blackboard_directory>/logs/tomcat/gc.log
```

Clients who are unable to leverage more than 4GB of memory per OS can take advantage of 64-bit as long as their Intel or AMD CPU models support x64 on Windows or Linux. The Solaris CPU models should provide 64-bit support. In this scenario, customers unable to upgrade beyond 4GB can still take advantage of larger heap spaces.

When using a 2GB heap size, change the following parameter values in the recommended tuning set:

```
-Xms2048m -Xmx2048m -XX:NewSize=512m -XX:MaxNewSize=512m
```

For 64-bit JVMs on Windows, Red Hat Enterprise Linux and Solaris platforms, Blackboard recommends that 64-bit clients take advantage of large heap sizes, such as 4GB and 8GB. As noted above, Blackboard strongly encourages clients to leverage a 64-bit JVM for more addressable memory.

When using a 4GB heap size, change the following parameter values in the recommended tuning set:

```
-Xms4096m -Xmx4096m -XX:NewSize=1024m -XX:MaxNewSize=1024m
```

When using an 8GB heap size, change the following parameter values in the recommended tuning set:

```
-Xms8192m -Xmx8192m -XX:NewSize=4096m -XX:MaxNewSize=4096m
```

## Understanding the Settings

### Concurrent Mark Sweep Collector

With the certification of Java 6, Blackboard recommends using the Concurrent Mark Sweep Collector (`-XX:+UseConcMarkSweepGC`) instead of the Parallel Collector (`-XX:+UseParallelGC`).

### Local Allocation Buffer (TLAB)

The `-XX:+UseTLAB` parameter forces the JVM to use thread-local object allocation. A Thread Local Allocation Buffer (TLAB) is a region of Eden that is used for object allocation by a single thread, which is faster than performing an atomic operation on a top pointer shared across threads. Using a TLAB improves concurrency by reducing contention on the shared heap lock. Administrators can specify TLAB initial size and disable the resizing through the `-XX:TLABSize=<size in kb>` `-XX:-ResizeTLAB` parameter. The default setting of 256KB provides adequate performance. Blackboard's tests do not show increased performance when changing the TLAB size from the default value 256KB to 128KB or to 512KB. To discover which settings have a positive, negative, or neutral effect on performance, trace all TLAB operations, using the `-XX:+PrintTLAB` parameter.

### Survivor Spaces

The `-XX:SurvivorRatio` parameter controls the size of the two survivor spaces. If survivor spaces are too small, the JVM will copy collection overflows directly into the old generation. If survivor spaces are too large, they will be empty. At each garbage collection, the JVM determines the number of times that an object can be copied before it is tenured, which is called the tenure threshold (`-XX:MaxTenuringThreshold`). After experimenting with setting `-XX:SurvivorRatio` to 4, 8, 16, and 4096 with `-XX:MaxTenuringThreshold` set to 0, Blackboard's tests have found that customers who use our heap setting recommendations can improve Eden space memory management by changing the `-XX:SurvivorRatio` parameter to 4 or lower. Configurations that use JVM heap sizes larger than 8GB require different settings.

### New Space Region

Use the `-XX:NewSize` and `-XX:MaxNewSize` parameters instead of the previously recommended `-XX:NewRatio` parameter to determine the memory needs in the New Space region of the JVM. During performance tests, the `-XX:NewRatio` parameter did not size and resize the new generation space of the JVM correctly. Size the `-XX:NewSize` and `-XX:MaxNewSize` parameters to roughly 1/4 or 1/3 the size of the JVM.

## 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 Supported Technologies and Browsers](#) available on the [Maintenance Center](#) on [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

### 32-bit Server Configurations

	Application Server/JDK 1.6	SQL Server 2005 (32-bit)	SQL Server 2008 (32-bit)	Oracle 10gR2 (32-bit)
<b>Windows Server 2003 SP1 (32-bit)</b>	Compatible (32-bit JDK)	Compatible	Compatible	Unsupported
<b>Red Hat Enterprise Linux Server 4 (32-bit)</b>	Compatible (32-bit JDK)	Unsupported	Unsupported	Compatible
<b>Red Hat Enterprise Linux Server 5 (32-bit)</b>	Compatible (32-bit JDK)	Unsupported	Unsupported	Compatible

## 64-bit Server Configurations

	Application Server/ JDK 1.6	SQL Server 2005 (64-bit)	SQL Server 2008 (64-bit)	Oracle 10gR2 (64-bit)	Oracle 11gR1 (64-bit)
Windows Server 2003 SP1 (64-bit)	DATABASE ONLY	Compatible*	Compatible	Unsupported	Unsupported
Window Server 2008 (64-bit)	<b>Certified**</b> (64-bit JDK)	Unsupported	<b>Certified**</b>	Unsupported	Unsupported
Red Hat Enterprise Linux Server 4 (64-bit)	Compatible (64-bit JDK)	Unsupported	Unsupported	Compatible	Unsupported
Red Hat Enterprise Linux Server 5 (64-bit)	<b>Certified</b> (64-bit JDK)	Unsupported	Unsupported	<b>Certified</b>	Compatible***
Sun Solaris 10 (64-bit SPARC)	<b>Certified</b> (64-bit JDK)	Unsupported	Unsupported	<b>Certified</b>	Compatible***

\* Microsoft® SQL Server 2005 must be installed with SP2 or above.

\*\* Blackboard does not support Windows Server 2008 R2.

\*\*\* Blackboard supports only build 11.1.0.7 of Oracle 11gR1.

## JDK

Sun Java™ SE 5 (JDK™ 1.5.x) is no longer supported. JDK 1.6.x is the only supported version.

## Windows Server 2008 IIS 7 Roles and Features Configuration

Windows Server 2008 uses IIS 7. Before installation of Blackboard Learn 9.1, IIS 7 needs to be configured with specific Role Services and other settings.

1. Install the IIS 7 Role in Windows Server 2008 Server Manager and configure Role Services:
  - A. Click **Start** and select **Administrative Tools** then select **Server Manager**.
  - B. Click **Roles**, and under the **Roles Summary** heading, click **Add Roles**.
  - C. From the list of displayed roles, select **Web Server (IIS)**.
  - D. Click **Next**.

At a minimum, the following five (5) role services must be installed in addition to the default role services:

- Role Services > Web Server > Application Development > ISAPI Extensions
- Role Services > Web Server > Application Development > ISAPI Filters
- Role Services > Management Tools > IIS 6 Management Compatibility > IIS 6 Metabase Compatibility
- Role Services > Management Tools > IIS 6 Management Compatibility > IIS 6 WMI Compatibility
- Role Services > Management Tools > IIS 6 Management Compatibility > IIS 6 Scripting Tools

To enhance performance, troubleshooting, and offer additional web server configuration options, Blackboard recommends that the following role services also be installed:

- Role Services > Web Server > Common HTTP Features > all five (5) role services enabled
- Role Services > Web Server > Application Development > all seven (7) role services enabled
- Role Services > Web Server > Security > all eight (8) role services enabled
- Role Services > Management Tools > all three (3) role services enabled
- Management Tools > IIS 6 Management Capabilities > all four (4) role services enabled.

Of the role services listed in this step, the following are will be of the most interest:

- Role Services > Common HTTP Features > HTTP Redirection (to allow for HTTP redirection, in the event that the site is renamed)
  - Role Services > Security > Windows Authentication (to allow for Active Directory integrated authentication)
  - Role Services > Security > IP and Domain Restrictions (to allow for greater control of web server access)
  - Role Services > Performance > Dynamic Content Compression (to allow for enhanced performance)
- E. Select Windows Process Activation Service (.NET Environment), and then click Add Required Role services.

2. Disable the Default Web Site:
  - A. Click **Start** select **Administrative Tools** then select **Server Manager**.
  - B. From the left menu, click the plus sign next to **Roles** to expand the tree.
  - C. Click the plus sign next to **Web Server IIS**, and then click **Internet Information Services (IIS) Manager**.
  - D. Under the **Connections** heading, click plus sign next to the **%HOSTNAME%**, and then click the plus sign next to **Sites**.
  - E. Right-click **Default Web Site** and from the drop-down menu select **Manage Web Site**, then select **Stop**.
3. Back up the current IIS 7 configuration and verify.
  - A. `%windir%\system32\inetsrv\appcmd.exe add backup "Blackboard Pre-Change"`
  - B. `%windir%\system32\inetsrv\appcmd.exe list backup`
4. Modify the IIS 7 configuration to permit double escaping within URLs (applies to all sites).
  - A. `%windir%\system32\inetsrv\appcmd set config /section:system.webServer/Security/requestFiltering - allowDoubleEscaping:True`
5. Modify the IIS 7 configuration to allow upload files greater than 20MB in size, specified in bytes (applies to all sites).
  - A. `%windir%\system32\inetsrv\appcmd set config - section:requestFiltering - requestLimits.maxAllowedContentLength:104857600`
6. Back up the current IIS 7 configuration and verify.
  - A. `%windir%\system32\inetsrv\appcmd.exe add backup "Blackboard Post-Change Backup"`

- B. %windir%\system32\inetsrv\appcmd.exe list backup
7. Restart the IIS service.
    - A. Click **Start** and select **Administrative Tools** then select **Server Manager**.
    - B. From the left menu, click the plus sign next to **Configuration** and then click **Services**.
    - C. From the list of services, right-click **World Wide Web Publishing Service** and select **Restart**.

## IIS Configuration Editing Notes

Blackboard recommends that you do not manually edit the %windir%\system32\inetsrv\config\applicationHost.config file to configure these options. This will result in errors that require a backup and restore of the last known good backup of the IIS 7 configuration that was managed by the IIS.

If you manually backed up the applicationHost.config file, restoring this manual backup and restarting IIS 7 will not fix errors generated by manually editing this file to configure IIS 7.

By default, IIS 7 will check every two minutes for changes to the configuration files and will automatically create backups of them, maintaining a history of ten backups. Use the oldest of these backups to restore IIS 7 to a working state.

```
%windir%\system32\inetsrv\appcmd.exe list
backup%windir%\system32\inetsrv\appcmd.exe restore backup
"CFGHISTORY_0000000021"
```

Once the configuration has been restored and verified through web browser access, then use the appcmd utility to configure the necessary features of IIS 7 as described in the section above.

If this approach does not solve the problem with IIS 7 generating errors, remove and then reinstall the IIS 7 Role.

If you need to reinstall the IIS 7 Role, you can use the %BLACKBOARD%\tools\admin\WebsiteReinstall.bat command to re-establish the Blackboard Web site within IIS. Install the IIS 7 Role in Windows Server 2008 Server Manager and configure Role Services

## 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. These systems have not undergone official Blackboard Product Development testing.

### Oracle RAC

Blackboard offers support for RAC with all versions of Oracle supported by Blackboard. For information about running Blackboard Learn with RAC, see the *Blackboard Learn Server Administrator Guide* available on [Behind the Blackboard](#).

### Oracle 11gR1 Query Error

Oracle 11gR1 contains a bug that displays the following error when attempting a complex query:

```
ORA-00600: internal error code, arguments: [kkocxj : pjpCtx], [], [],
[], [], []
```

To prevent this error, before installation or afterward log on as a system user and run the command:

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

## 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 the *Blackboard Learn Server Administration Guide*.

## Client Technologies

### Windows Client Configurations

	Internet Explorer 8	Internet Explorer 7	Firefox 3.6	Firefox 3.5	Firefox 3.0
Windows XP (32-bit)	Compatible	Compatible	Compatible	Compatible	Compatible
Windows Vista (32-bit)	<b>Certified</b>	Compatible	Compatible	<b>Certified</b>	Compatible
Windows 7 (32-bit)	<b>Certified</b>	Unsupported	Compatible	<b>Certified</b>	Compatible
Windows Vista (64-bit)	Compatible	Compatible	Compatible	Compatible	Compatible
Windows 7 (64-bit)	<b>Certified</b>	Unsupported	Compatible	<b>Certified</b>	Compatible

### Mac OSX Client Configurations

	Safari 4.0	Safari 3.2	Firefox 3.6	Firefox 3.5.x	Firefox 3.0.x
Mac OSX 10.5 "Leopard"	Compatible	Compatible	Compatible	Compatible	Compatible
Mac OSX 10.6 "Snow Leopard"	<b>Certified</b>	Unsupported	Compatible	<b>Certified</b>	Compatible

## Accessibility and JAWS

Blackboard strives to make all its products as accessible as possible. JAWS for Windows 9 and 10 were used during accessibility testing.

## JRE Support

Blackboard Learn requires the latest version of Sun JRE 6. The JRE can be downloaded from <http://java.sun.com/javase/downloads/index.jsp>. Windows System Administrators who want to provide auto-download for users can find the .cab file link for the appropriate JRE at <http://java.sun.com/javase/6/webnotes/install/jre/autodownload.html>.

## No Longer Supported

The following technologies are no longer supported:

- Internet Explorer 6
- Firefox 1.x and 2.0
- Safari 2.0
- Mac OSX 10.4 “Tiger”
- Java 5

## 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™.

# Installation and Upgrade Information

For information about fresh installations of Blackboard Learn 9.1, see the *Blackboard Learn Installation Guide* for Release 9.1.

For information about upgrading to Blackboard Learn Release 9.1, see the following sections and the *Upgrade Guide* for your current version.

## Direct Upgrade Paths

The following releases can be upgraded directly to Blackboard Learn 9.1.

- Blackboard Learn Release 9.0 Service Pack 3 (Build 9.0.539.0)
- Blackboard Academic Suite 8.0 Service Pack 6 (Build 8.0.475.0)

## Indirect Upgrade Paths

Previous Version	Suggested Path
9.0 GA, SP1, SP2	<ol style="list-style-type: none"> <li>1. Upgrade to 9.0 SP3.</li> <li>2. Upgrade to 9.1.</li> </ol>
8.0 GA, SP1, SP2, SP3, SP4, and SP5	<ol style="list-style-type: none"> <li>1. Increment through the service packs to 8.0 SP6.</li> <li>2. Upgrade to 9.1.</li> </ol>
7.3 SP2	<ol style="list-style-type: none"> <li>1. Upgrade to 8.0 SP6.</li> <li>2. Upgrade to 9.1.</li> </ol>
7.3 SP1	<ol style="list-style-type: none"> <li>1. Upgrade to 7.3 SP2.</li> <li>2. Upgrade to 8.0 SP6.</li> <li>3. Upgrade to 9.1.</li> </ol>
7.3 GA	<ol style="list-style-type: none"> <li>1. Upgrade to 7.3 SP1.</li> <li>2. Upgrade to 7.3 SP2.</li> <li>3. Upgrade to 8.0 SP6.</li> <li>4. Upgrade to 9.1.</li> </ol>
7.2 SP1	<ol style="list-style-type: none"> <li>1. Upgrade to 7.3 SP2.</li> <li>2. Upgrade to 8.0 SP6.</li> <li>3. Upgrade to 9.1.</li> </ol>
7.2 GA	<ol style="list-style-type: none"> <li>1. Upgrade to 7.2 SP1.</li> <li>2. Upgrade to 7.3 SP2.</li> <li>3. Upgrade to 8.0 SP6.</li> <li>4. Upgrade to 9.1.</li> </ol>

Previous Version	Suggested Path
7.1 SP2 or later	<ol style="list-style-type: none"> <li>1. Upgrade to 7.3 GA.</li> <li>2. Upgrade to 7.3 SP1.</li> <li>3. Upgrade to 7.3 SP2.</li> <li>4. Upgrade to 8.0 SP6.</li> <li>5. Upgrade to 9.1.</li> </ol>
7.1 GA and SP1	<ol style="list-style-type: none"> <li>1. Upgrade to 7.1 SP2.</li> <li>2. Upgrade to 7.3 GA.</li> <li>3. Upgrade to 7.3 SP1.</li> <li>4. Upgrade to 7.3 SP2.</li> <li>5. Upgrade to 8.0 SP6.</li> <li>6. Upgrade to 9.1.</li> </ol>
7.0.x	<ol style="list-style-type: none"> <li>1. Upgrade to 7.0 SP1.</li> <li>2. Upgrade to 7.1 SP2.</li> <li>3. Upgrade to 7.3 GA.</li> <li>4. Upgrade to 7.3 SP1.</li> <li>5. Upgrade to 7.3 SP2.</li> <li>6. Upgrade to 8.0 SP6.</li> <li>7. Upgrade to 9.1.</li> </ol>
6.3.x	<ol style="list-style-type: none"> <li>1. Upgrade to 6.3 SP2.</li> <li>2. Upgrade to 7.0 SP1.</li> <li>3. Upgrade to 7.1 SP2.</li> <li>4. Upgrade to 7.3 GA.</li> <li>5. Upgrade to 7.3 SP1.</li> <li>6. Upgrade to 7.3 SP2.</li> <li>7. Upgrade to 8.0 SP6.</li> <li>8. Upgrade to 9.1.</li> </ol>

## 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 9.0	Certified
Blackboard Academic Suite Release 8	Certified

Source	Support
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 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.

## Upgrading Server Software

Server software must meet certain requirements before installing Blackboard Learn. The following items are important to keep in mind when setting up the server software:

- The database is run on a separate server when using two or more servers. Thus, 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.
- 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 [Behind the Blackboard](#).
- 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](http://www.sun.com/bigadmin/content/submitted/swap_space_impact.jsp).

## Upgrading the Operating System or Database

Before upgrading the operating system or database, back up the database and file system and test the restore process.

**Note** Although non-English operating systems and databases (such as a Chinese-language version of Oracle®) are considered compatible with Blackboard Learn Release 9.1, these systems have not undergone official Blackboard Product Development testing.

## Upgrading to Blackboard Learn 9.1

### Upgrade Guides

Blackboard provides separate Upgrade Guides for each of the following products:

- Blackboard Learn Release 9.0
- Blackboard Academic Suite 8.0
- CE 4
- CE 8
- Vista 8

Each Upgrade Guide is available in the appropriate product's Upgrade Kit available on the [Blackboard Upgrade Center](#) or [Behind the Blackboard](#).

### Provide New License

Contact Blackboard Client Operations through the [Upgrade Center](#) to request a new license key file (`bb-license.xml`) for Blackboard Learn Release 9.1. Make sure to do so well in advance of the upgrade. It is important to obtain a new license file to ensure the upgrade includes new features and functions.

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, when the installation prompt presents the following options: Update, Provide new License file, Uninstall Blackboard Learn, and Uninstall appserver, select **Provide new License file**.

### Customizations Warning

Running the Updater on an existing system will reset many back-end and user interface customizations. 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 include:

- Course Settings (which control the Course menu)
- Building Block availability
- 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.