Keys to Delivery:

Reliability
- 99.9% Availability Guarantee backed up by best in class Tier-4 data centers, multiple Internet (ISP) Connections, and redundant A-side / B-side network infrastructure.

Security
- Physical security (24x7 Security personnel, Biometrics, Closed Circuit Camera System), network security, and 3 levels of data backups provisioned daily, 3rd party testing and certification.

Scalability
- Cost-effective build-as-you-grow business model. Add data storage, bandwidth, and users on demand.

Fully-Managed Service
- True 24x7x365 proactive monitoring, reporting, and maintenance by experienced Blackboard team (250+ people across 4 continents), creating a one-stop shop for all software and infrastructure support.

Lower Cost
- Lower Operational Expenditure and Capital Expenditure costs for clients with a near-zero risk on mission critical service failure.
- Managed Hosting Services utilizes economies of scale for deployment of best in class infrastructure and expertise, allowing for better and more cost effective delivery then any one institution can achieve.
- Fixed Budget – Financial predictability with no unexpected costs related to Personnel or Infrastructure issues and needs. One fixed fee covers the annual delivery costs regardless of hardware failure, increases in storage, Bandwidth, and users.
Cost Considerations for Delivery of the Bb Software:

1. Datacenter and Systems Infrastructure

Datacenter Facilities
A cost estimate to deliver high levels of physical security, multiple active power and cooling distribution paths, redundant components such as multiple levels of power backups, temperature control, fire suppressant systems, battery farms and are fault tolerant in providing 100% power availability.

Blackboard’s Managed Hosting clients are hosted in Tier-4 facilities and provide a minimum 99.9% SLA on the Blackboard environment with credits issued for violations. Blackboard’s client environments are connected to the internet via redundant connections to Tier 1 Internet Service Providers as well as include redundancy in the infrastructure in the network stack, servers and storage. As the Managed Hosting facilities are Tier-4, they include UPS power back up, state-of-the-art fire suppression, redundant on-site diesel generators, controlled access, and 24x7x365 guarded security.

Server Hardware
Costs for hardware related to production and non-production systems including backup/spare HW for failure and scalability.

Blackboard’s Managed Hosting clients are hosted in a dedicated environment utilizing the latest technologies from Dell’s blade servers. Each Blackboard Enterprise client is given their own application (Blackboard) and database server(s) environment based on the active user level and configuration required. Servers are easily added to scale the infrastructure as clients’ usage increase.

Network Hardware
Costs for network hardware which includes switches, hubs, routers, load balancers, intrusion prevention and other network devices wholly or partially allocated to supporting your Blackboard e-Learning environment.

Blackboard’s Managed Hosting Environment was built using a highly available network design. There are various levels of redundancy built in with no single point of failure across the routers, switches, firewalls, intrusion prevention and load balancers. Additional networking devices are easily added in order to support the highest levels of security, performance, and availability. In addition, Blackboard maintains an “A” side and “B” side of the network and connections to multiple ISPs.
Production Storage and Backup Strategy
Costs associated with delivering enterprise class production and non production level storage including redundant hardware, support, regular backups and offsite storage.

Blackboard Managed Hosting implements three levels of data security strategies. First, Blackboard stores all clients’ production data on highly available clustered head units. The second level performs daily snapshots that stores read-only versions of a file system and provides the ability to recover lost or deleted files. Snapshots are stored online on redundant storage systems for 30 days. The third level is that daily backups are created and SnapMirrored to a separate physical Bb datacenter(s).

Operating System Software
A cost estimate for operating system (OS) software. Blackboard’s Managed Hosting Environment standard implementation is on Linux.

Database Software
This is an estimated cost for database server software which also includes the price that your organization pays to acquire database software. Blackboard’s Managed Hosting Environment standard implementation is on Oracle.

Monitoring System Software
Costs for investment in monitoring software and hardware devices, either wholly or partially allocated to maintaining and analyzing the Bb implementation.

Managed Hosting monitors Blackboard software, supporting hardware and software components for performance and availability. Implementing a network monitoring solution often requires extensive analysis and customization, but reaps major returns in server stability, crisis response time, and overall network security.

Blackboard Managed Hosting maintains a software monitoring system to provide real-time information about the Managed Hosting environment to the Blackboard Network Operations Center (NOC). This ensures that Blackboard system administrators are made aware of system failures as soon as they arise.

Below is a just sampling of services and resources that Blackboard monitors through a variety of proprietary, open source, and commercially available monitoring software:

- Connectivity Ping - Check performed periodically
- CPU Monitors - CPU utilization
- Disk Monitors - Disk utilization
- HTTP - HTTP request for the hosted server
- H-Check - Monitors web page content
- Memory Checks - System memory utilization
- MSGS Checks - System log files for instances of Warning, Fatal, and Notice
- Procs Checks - Critical processes to ensure they are running
- Ports - Monitors for the use of unnecessary system ports
- E2E Latency – Monitors total user end to end latency
- Login Response – Monitors Blackboard application login and time to respond
2. Implementation Costs

Initial Staffing: Implementation Personnel
An estimate of the total labor cost for personnel involved in the initial implementation of the Blackboard application would include costs for any of the following activities: project management, software installation, hardware installation, changes to security policies, installation/customization of monitoring systems, and backup hardware, etc.

Staff Training Costs
A cost estimate for training would include the cost of training in-house administrators on the Blackboard platform, as well as any other staff and user instruction deemed necessary to ensure a professionally deployed Blackboard infrastructure.

Blackboard’s Managed Hosting staff is comprised of leading engineers and administrators who hold numerous certifications. Some of these certifications include Red Hat Certified Engineers, Project Management Professionals (PMO), Microsoft Certified Professionals, Oracle Certified Professionals, ITIL Practitioner, ISC2 Certified Information Systems Security Professional (CISSP) and others. Additionally, the Managed Hosting staff is regularly trained on new releases of the Blackboard software. This training, coupled with the experience of interacting with over 900 installs of the Bb software, gives our staff the unique expertise to proactively head off problems before they occur.

3. Ongoing Staffing

IT Management
This is an estimated cost for personnel planning and managing the Blackboard infrastructure. Activities and projects associated with ongoing Blackboard infrastructure deployment and operations may include managing third-party software and hardware related to Blackboard infrastructure, maintaining security policies, disaster recovery responsibility and asset management, as well as maintaining, troubleshooting and tuning IT infrastructure as related to Blackboard.

Applications and Systems Administration
Estimated personnel costs associated with maintaining, troubleshooting, and tuning as related to the Blackboard application such as networking devices, backup systems and monitoring systems. Associated projects may include administrating the Blackboard application, applying upgrades (application packs) released by Blackboard, installing or updating third-party software to the Blackboard infrastructure, backing up and restoring Blackboard content files, monitoring and troubleshooting systems associated with Blackboard, implementing and managing network security policies and actively managing Blackboard application’s performance and stability.
Blackboard’s Managed Hosting NOC Engineers monitor each Managed Hosting client’s dedicated environment 24 hours a day, seven days week, year round. In the case of an alert, the application and infrastructure is proactively managed in order to avoid any potential maintenance issues. The Managed Hosting Operations team also continuously plans and implements updated and new software and hardware to enhance the capability and capacity of Blackboard network.

Database Administration
Estimated personnel costs associated with managing, troubleshooting and tuning the database system that supports the Blackboard application. Projects may include backing up and restoring database, maintaining and troubleshooting the database daily, generating statistics and reports against the database, upgrading and updating the database, etc.

Hardware Administration
Estimated personnel costs associated with maintaining, troubleshooting, and tuning the Blackboard infrastructure. Projects include installing and maintaining third-party hardware that supports the Blackboard application, managing physical network environment, troubleshooting problems associated with the hardware infrastructure, etc.

4. Other Factors to Consider
The intangibles of having the expertise that comes with 15 years of hosting Blackboard, for now 1,500+ clients, positions us to deliver the most reliable and consistent experience for our partner institutions. The below are examples of value add proactive services our team provides:

› **Back to School Review:** MH proactively reviews each client’s Production System leading up to the fall (or as needed) season to prepare them for the next year. We review system audit, patch set audit, trends in system performance history, application version, hardware and software.

› **System Hardware:** MH both proactively and reactively identifies client systems in need of additional hardware to maintain acceptable performance levels. If downtime is needed this is scheduled with the client in advance (except for emergency situations where repeated crashes can be avoided with immediate action). In most cases prepwork is completed ahead of time so the actual downtime to add new hardware is minimized.

› **Audit Fixes:** MH proactively identifies the client systems with audit failures and contacts the clients to schedule the needed fixes before issues are reported.
› **24/7 Monitoring:** real time proactive monitoring of all client systems for System (URL) and individual server uptime/availability, individual server CPU utilization, disk utilization vs. free space, memory utilization, log-on success, database table-space, host latency, and LDAP server connectivity as examples

› **Maintenance Notification:** MH sends email alerts to clients about upcoming maintenance at the MH datacenters. These notifications are for maintenances that are planned and may or may not have client system impact.

› **Maintenance for security & performance patches:** This work is always tested and QA’d before being place into a client environment. These are typically critical patches that all clients require and are released from Bb Product Development or 3rd party vendors (Ex: Oracle). The Bb Managed Hosting team keeps track of all such patches and will proactively apply them, typically with no downtime.

› **Survey Follow Up:** MH Support Management proactively contacts clients when they submit negative surveys to support cases. We want to understand where we failed them so we can improve as a support team, hosting organization, and company. We also make sure they have the MH escalation document (available on Behind the Blackboard) so they can let us know of urgent issues as they are reported.

› **Webinars:** MH hosts live webinars for clients covering various product features and processes. All of these are recorded and available for viewing at anytime.

› **User Groups:** MH hosts monthly user groups for ASR (Advanced System Reporting). This brings together MH clients so MH can explain information and the client community can share their own experiences, scripts, and lessons learned. We also offer a MH 101 Orientation Web Seminar to proactively educate clients on MH services, processes and escalation contacts.
Blackboard Managed Hosting performs thousands of Production upgrades each year. We have developed best practices to ensure that all upgrades are successful and as transparent to the end users as possible. Our team is proactive is proactive in its approach to determine when an upgrade might be beneficial as well as during the process itself:

- **Patch Audit**: MH reviews all currently installed patches and manually audits them to see if the bug is fixed in the new service pack or if patches for that new SP is available (and if so we proactively apply them during the upgrade window). The idea is to not reintroduce a bug once fixed/patched. If a bug were to be reintroduced because a patch is not available yet for the new SP we inform the client so they can choose to continue with the upgrade while we request a patch, or they can choose to postpone the upgrade until a patch is available.

- **Patch Sets**: MH will apply a Product Development approved Patch Set during the upgrade window. This is a set of patches MH Support believes all clients would benefit from having to prevent exposure to known bugs with existing patches. PD tests the patches together and approves the Patch Set. Patch sets currently exist for 9.1 SP4-SP8. There are 9-13 patches included for the most recent SPs.

- **System Audit**: Perform a system audit of 120+ setting/tuning checks and correct any failures during upgrade window. The MH WebTech & DBA teams developed scripts to check for specific system tuning/settings.

- **ICM Handoff**: If the hosted client has ICM, MH will create an ICM handoff case in advance to schedule ICM engineers. They will review and correct any problems after MH’s portion of the upgrade is completed and before the site is released to the client. Support and the ICM team meet on a weekly basis to review needs for upcoming upgrades.

- **Reminders/Warnings**: MH provides clients reminders & warnings of actions the client will need to complete after the upgrade. This includes reviewing brands & themes and building block settings as they can be modified during the upgrade process.

- **Notifications**: Proactive email notifications when the upgrade process begins and when it is completed.

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**Blackboard Managed Hosting**

- Best in class Tier-4 Datacenters and Infrastructure
- Minimum 99.9% Availability Service Level Guarantee
- True 7x24x365 support, proactive monitoring, upgrades, and maintenance
- Certified IT Professionals with expertise in running Blackboard software
- Peace of mind with the experience of 250+ individuals, thus no disruption in support due to unexpected employee turnover, vacation time, on-call IT staff.
- Instant and incremental scalability – Users, Storage, Bandwidth can increase on-demand
- Reallocation of resources to other projects
- Predictable Budget with fixed annual costs of Hosting with Blackboard, NO unexpected Infrastructure or Personnel costs.