BLACKBOARD EXECUTIVE UPDATE

King, Darin

Interim Vice Chancellor of IT

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Project Background

Historical Perspective

The North Dakota State Board of Higher Education (NDSBHE) first expressed support for a single learning management system (LMS) that would be used by all North Dakota University System (NDUS) institutions in 2011, when it voted to approve a document entitled "Maximizing Results through Efficiencies." At the time, there were three learning management systems supported by six separate installations across the NDUS.

On May 24, 2016 the NDSBHE reiterated its desire to adopt and support a single LMS implementation for the entire University System by passing a vote to proceed with consolidation into a single LMS environment.

NDUS Learning Management Systems prior to 2017

Three different LMS solutions were supported across the NDUS prior to 2017. These solutions were supported by six separate technical instances consisting of four separate instances of Blackboard Learn and single instances of Moodle and eCollege.

The table below represents the LMS solutions at each institution and how they were delivered.

NDUS Institution	Current Instances	LMS Solution
Minot State University North Dakota State University University of North Dakota Valley City State University	Blackboard Managed Hosting Locally Hosted at NDSU Locally Hosted by NDUS Data Center Locally Hosted at VCSU	Blackboard
Dakota College Bottineau Dickinson State University Mayville State University Williston State College North Dakota University System	Software as a Service	Moodle
Bismarck State College Lake Region State College North Dakota State College of Science	Software as a Service	Pearson eCollege

Annual hosting and support costs for Moodle were paid for with appropriated funding through the NDUS Core Technology Services budget while individual campuses were responsible for annual licensing, hosting, and support costs for Blackboard Learn and Pearson eCollege.

Decision to Change

Bismarck State College (BSC), Lake Region State College (LRSC), and North Dakota State College of Science (NDSCS) decided in 2015 to drop Pearson eCollege and implement a different LMS system. This provided an opportunity to develop a solution that would satisfy the 2011 directive of the NDSBHE and create operational and fiscal efficiencies.

Selection of Blackboard

Leading up to 2016, a majority of NDUS students and faculty (70%) were using Blackboard Learn as their campus LMS. A comprehensive needs analysis was done to better understand the needs of the non-Blackboard Learn campuses. The intent was to determine if existing LMS systems (Blackboard or Moodle) would meet the current and future needs. It was determined through this process that either solution would meet the needs of the University System, but since seven of 10 students/faculty were already Blackboard Learn users, it was determined that Learn would be the most efficient and effective solution to adopt.

By selecting Blackboard Learn, the majority of NDUS users would not have to learn a new LMS allowing more functional and technical support resources to be available to the campuses new to Blackboard Learn. In addition, NDUS had a contract in place with Blackboard learn that could be renegotiated to include additional institutions and features.

Delivery Model Options

There were two viable delivery model options available.

Option 1: NDUS Locally Hosted

NDUS would purchase and maintain the infrastructure necessary to host Blackboard Learn for all NDUS institutions. The infrastructure would be housed in the NDUS Data Center and could comprise either a single or multiple instances of purchased Blackboard Learn software.

By hosting Blackboard Learn in the NDUS data center for all NDUS institutions, some efficiency could be achieved. Current Blackboard Learn campuses would no longer have to purchase and maintain campus-based hardware to support Blackboard. There would still be hardware that would have to be purchased and maintained by NDUS, but it would potentially reduce the current operational cost of running campus-based infrastructure. This would also potentially require additional NDUS resources to ensure acceptable performance during peak usage periods.

NDUS would be responsible for all patching and upgrades if self-hosted. This would be done once or twice per year and require significant down time to accomplish.

In this scenario, there would not be access to the newest version of Blackboard Learn, called the Ultra Experience.

Option 2: Software as a Service (SaaS)

Blackboard would deliver the Learning Insight Bundle on a subscription basis and host it for all NDUS Institutions. This subscription service could comprise of either a single or multiple instance of Blackboard Learn.

Blackboard's SaaS offering is powered by a modern cloud-based computing stack via Amazon Web Services. This would provide 99.9% uptime, on demand scalability during peak usage, and near zero downtime for updates and maintenance.

Blackboard hosts and maintains all SaaS environments, including production, stage, test, as well as a reporting environment (Direct Data Access). Blackboard would be responsible for all patching and upgrades. This would allow coordination of updates across all NDUS institutions to ensure a consistent user experience.

This offering also includes a single point of contact within Blackboard (Service Delivery Manager) for all technical support, escalation, documentation and event management. The Service Delivery Manager will also lead the migration efforts for institutions moving to a single or multiple instance.

Delivery Model Selection

The Software as a Service (SaaS) delivery model was selected for the following reasons.
- Operational Efficiencies
  - No local hardware to support. Allows existing staff resources to be reallocated to other tasks.
  - All patching and upgrades done by Blackboard with near zero downtime. Allows for existing staff resources to be reallocated to other tasks.
  - All institutions will be on the same version of Blackboard. Creates efficiencies in training and support of users.
  - Increased ability to provide advanced features and integrations to all institutions by having a single development process.
- Fiscal Efficiencies
  - Annual expenditures become more predictable and stable during the life of the contract. No hardware to purchase, install, and replace.
  - Decreased licensing costs by leveraging the entire NDUS environment.
  - Potential for shared services in the area of instructional design, training, and end user support.

Implementation

Contract

A five-year contract was negotiated for the Blackboard Learning Essentials Bundle using the SaaS Advantage deployment and hosting model. The new contract would save the NDUS over $400,000 per year in licensing costs during the life of the contract, as compared to the cumulative costs associated with the five separate LMS licensing costs across North Dakota.

Governance

Implementation governance for the Blackboard Project was established the summer of 2016 and continues to guide the project. The governance membership includes representatives from research, four-year and two-year institutions and also includes institutional representation based on the LMS platform (Blackboard, Moodle, eCollege).

The governance structure includes an Executive Steering Committee, Technical Committee and Functional Committee. Current governance membership is included in Appendix A.

Implementation Schedule

The initial implementation schedule was based on institutional need and willingness to move forward during an implementation window. The table below summarizes the implementation schedule as of January 1, 2018.

Institution	Date	Scope
BSC, LRSC, NDSCS	March 2017	Pilot courses
BSC, LRSC, NDSCS	May 2017	Full Implementation
UND, VCSU, WSC	August 2017	Full Implementation
DCB, DSU	January 2018	Pilot Implementation
DCB, DSU, MaSU, MiSU, NDSU,	May – August 2018	Full Implementation

Fall Semester 2017 Implementation

After extensive migration and planning efforts, six institutions (BSC, LRSC, NDSCS, UND, VCSU, WSC) went live in the single NDUS instance of Blackboard in the Fall 2017 semester. Blackboard experienced significant and unacceptable operational incidents throughout the first half of the semester that adversely affected faculty, staff and students. These incidents included two prolonged outages and a number of days of degraded performance.

These outages and performance issues conflicted with Blackboard's contractual obligation and were recognized as unacceptable by both NDUS and Blackboard.

Outages and Performance Incidents

The Blackboard SaaS system experienced two significant outages that were very disruptive to faculty, staff and students at the six current Blackboard Learn campuses. These events are unusual, but not unheard of, across any of the various types of Blackboard environments (software as a service, managed hosting or on premises).

DATE	START TIME	DESCRIPTION	RESOLUTION	TOTAL OUTAGE TIME
9/22/17	8:00 AM	Software defect in course copy process.	Software modified and updated in production to eliminate defect.	8.5 hours
10/2/17	9:00 AM	Defect in database connection pool	Defect in core architecture of Blackboard. Mitigated to reduce risk of reoccurrence.	2.5 hours

Performance issues are generally intermittent, of a short duration (5-60 minutes) and affect a subset of active users. Symptoms include slow loading pages, timeouts and/or certain modules not loading. The issues listed below represent reported issues that could be replicated by CTS and/or identified in Blackboard performance monitoring systems.

DATE	START TIME	DESCRIPTION	ESTIMATED IMPACT TIME
8/21/17	11:00 AM	Slow loading, pages timing out, modules not loading	<60 Minutes
8/22/17	7:30 AM	Slow loading, pages timing out, modules not loading	<60 Minutes
8/24/17	11:00 AM	Slow loading, pages timing out, modules not loading	<60 Minutes
8/28/17	10:00 AM	Slow loading, pages timing out, modules not loading	<60 Minutes
8/29/17	2:30 PM	Slow loading, pages timing out, modules not loading	<60 Minutes
8/31/17	8:15 PM	Slow loading, pages timing out, modules not loading	<60 Minutes
10/5/17	9:30 AM	Slow loading, pages timing out, modules not loading	<60 Minutes
10/11/17	11:00 AM	Slow loading, pages timing out, modules not loading	<60 Minutes
10/12/17	2:30 PM	Slow loading, pages timing out, modules not loading	<60 Minutes
10/19/17	11:00 AM	Slow loading, pages timing out, modules not loading	<60 Minutes
10/23/17	7:00 PM	Inability to upload files in courses	<90 Minutes

Blackboard Mitigation and Remediation

A detailed Root Cause Analysis (RCA) was done by Blackboard after each incident and provided to NDUS for additional analysis. Throughout the semester, NDUS executive, technical and functional staff worked extensively with their counterparts at Blackboard to put changes in place to both mitigate and remediate the issues identified by the RCA's.

These changes included:
- Adding more application server instances to improve performance. Blackboard increased the number from 6 to 12 during the first few weeks of the semester.
- Rapidly developing and deploying a patch to remediate a software defect to ensure it didn't happen again.
- Develop changes to operational practices to mitigate specific types of performance issues documented in the RCA's.
- Implemented improvements in their ability to more closely monitor the performance of the NDUS system to proactively mitigate issues.
- Initiated the planning and testing of a different, more robust Amazon database tier.
- Initiated the planning and testing of a different, more robust Amazon file service.

Spring Semester 2018

The semester break was an opportunity for Blackboard to implement required security patches and additional improvements to the NDUS system, as well as a scheduled Bb Learn application upgrade. These changes caused two incidents during the first two weeks of the semester.

Outage and Performance Incidents

During the first two weeks of the semester, the NDUS Blackboard system experienced two significant incidents that adversely affected faculty and students.

DATE	START TIME	DESCRIPTION	RESOLUTION	TOTAL IMPACT TIME
1/8/18	9:00 am	Slow loading, pages timing out, modules not loading	Implemented Robots.txt, Increased PIOPS, and tweaked a DB stored procedure schedule	10 hrs
1/9/18	9:00 am	Slow loading, pages timing out, modules not loading	Implemented Robots.txt, Increased PIOPS, and tweaked a DB stored procedure schedule	10 hrs
1/10/18	12:45 PM	Slow loading, pages timing out, modules not loading	Implemented Robots.txt, Increased PIOPS, and tweaked a DB stored procedure schedule	90 mins
1/11/18	2:00 pm	SSL Cert warning to users	Wrong Cert was installed during scheduled install, rolled back.	10 mins
1/15/18	7am	Users being logged off while working	REDIS security policy Session Change, adjusted	24 hrs
1/16/18	7am	Users being logged off while working	REDIS security policy Session Change, adjusted	24 hrs
1/26/18	9:00 AM	Software defect in course copy process.	Software modified and updated in production to eliminate defect.	70 mins

A detailed Root Cause Analysis (RCA) was done by Blackboard after each incident and provided to NDUS for additional analysis. A number of changes were implemented to remediate the incidents.

These changes include:

- Blackboard increased the number of application servers from 12 to 18 during the first week of the semester to account for the performance reduction due to the Meltdown/Spectre patching done by Amazon.
- Additional tuning of the higher tier database to maximize performance based on our usage patterns.
- Reapplication of a fix to a software defect that was over written by a previous patch.
- Changed configuration to better align with new Amazon caching system.
- Implementation of new performance monitoring tools.

Blackboard Campus Visits

Blackboard was onsite January 29-31 with a goal of visiting Stakeholders including faculty, staff and students. Their purpose was to build relationships with end users while understanding and listening to issues, struggles and challenges faced by campuses over the previous two semesters. Blackboard Executives participated in a scheduled Governance meeting, walking through changes put in place to address outages and performance issues. They also took time to hear comments voiced from the eleven campuses and CTS staff. Blackboard and CTS visited four institutions: LRSC, NDSU, UND and VCSU; all geographically located on the eastern side of the state, with plans to visit all remaining campuses tentatively scheduled for the second week of April, 9-13.

Common themes identified in various meeting and campus visits include:
- System performance
    - Reliable delivery of SaaS environment
- Training
    - Professional development
    - Tools/Functionality/Adoption
    - Grading
    - Portfolios
    - Attendance
    - Product Roadmap
- Additional capabilities
    - Analytics
    - Accessibility
    - Mobile
    - Web Conferencing

Blackboard has made a commitment to follow up and provide NDUS with an update on the areas listed above.

Options for Moving Forward

The ability to achieve the NDSBHE's goal of a single Learning Management System (LMS) for the University System is being questioned after the new Blackboard Learn SaaS environment experienced outage and performance issues.

The NDUS has three options for consideration in assessing the direction forward:
1. As currently scheduled, continue migration planning toward a single LMS
2. Pause the migration until system stability has been validated then resume the migration to a single LMS
3. Provide for more than a single instance of the LMS

Within each of the three options, there are correlated impacts:
- Continuing the migration as planned is risky when the technical infrastructure has not demonstrated sustained performance and stability
- The start/stop process of pausing the migration will displace optimum migration windows while stretching staff resources in an elongated environment
- Providing more than a single LMS presents issues related to the Blackboard contract, migration issues, and ongoing technical support.

CTS is working with Blackboard and the institutions to develop detailed information for each option. All angles will be vetted so that decision makers have the most accurate data to make an informed decision. One common goal does continue to unite the 11 institutions of the NDUS and Core Technology Services (CTS): the LMS must work and it must work well for faculty and students.

Appendix A Governance Members

BLACKBOARD GOVERNANCE TEAMS					
Executive Council	**Name**	**Campus**	**Email**	**Phone**	
AA **Academic Affairs**	Carmen Wilson	DSU	Carmen.Wilson@dickinsonstate.edu	701-483-2330	Moodle
	Keith Stenehjem	MaSU	keith.stenehjem@mayvillestate.edu	701-788-4755	Moodle
	Beth Ingram	NDSU	beth.ingram@ndsu.edu	701-231-7131	Blackboard
	Lloyd Halvorson	LRSC	Lloyd.Halvorson@lrsc.edu	701-662-1681	eCollege
CCF **Council of College Faculties**	Greta Paschke	MaSU	greta.paschke@mayvillestate.edu	701-788-4747	Moodle
	Michelle Murphy	LRSC	michelle.murphy@lrsc.edu	618-580-7781	eCollege
	Jenni Lou Russi	VCSU	jennilou.russi@vcsu.edu	701-845-7319	Blackboard
Technical Committee	**Name**	**Campus**	**Email**	**Phone**	
2 - Year					
Moodle	Mike O'Toole	DCB	mike.otoole@dakotacollege.edu	701-228-5601	
eCollege	Karleen Estenson	LRSC	Karleen.Estenson@lrsc.edu	701-662-1527	
4 - Year					
Moodle	Craig Keating	MaSU	craig.keating@mayvillestate.edu	701-788-4793	
Blackboard	Brad Mills	VCSU	brad.mills@vcsu.edu	701-845-7325	CHAIR
Research					
Blackboard	Chad Bushy	UND	chad.bushy@und.edu	701-777-2728	VICE CHAIR
	Suhan Vethanayagam	NDSU	suhan.vethanayagam@ndsu.edu	701-231-6158	
NDUS / CTS					
NDUS / CTS	Kelly Restad	NDUS	kelly.restad@ndus.edu	701-777-2695	
	Corey Quirk	NDUS	corey.quirk@ndus.edu	701-777-0848	
	Janna Kruckenberg	NDUS	janna.kruckenberg@ndus.edu	701-777-5350	
Functional Committee	**Name**	**Campus**	**Email**	**Phone**	
2 - Year					
Moodle	Katie Peterson	WSC	katie.m.peterson.1@willistonstate.edu	701-774-4594	
eCollege	Christine Ahlsten	NDSCS	christine.ahlsten@ndscs.edu	701-671-2238	
	Scott Helphrey	BSC	scott.helphrey@bismarckstate.edu	701-224-5791	
4 - Year					
Moodle	Anthony Willer	DSU	anthony.willer@dickinsonstate.edu	701-483-2166	VICE CHAIR
Blackboard	Sherie Saltveit	MiSU	sherie.saltveit@minotstateu.edu	701-858-3280	
Research					
Blackboard	Lori Swinney	UND	lori.swinney@und.edu	701-777-3569	CHAIR
	Dennis Cooley	NDSU	dennis.cooley@ndsu.edu	701-231-7038	
NDUS / CTS					
NDUS / CTS	Patti Heisler	NDUS	patti.heisler@ndus.edu	701-239-6605	
	Randy Wald	NDUS	randy.wald@ndus.edu	701-239-6623	