Blackboard Advisory Committee: Status Report, spring 2011
JQ Johnson, 12 May 2011 (for meeting scheduled 17 May 2011)

General
More membership change in our committee. Anne van den Nouweland will be on sabbatical for the rest of this year, and Katie Dwyer has let me know that due to schedule conflicts she will be unable to participate.

Reminder: We archive these quarterly status reports, and other information about the BAC, at http://libweb.uoregon.edu/scis/blackboard/advisory.html.

This report is somewhat abbreviated, since Tim and I have been putting most of our time into troubleshooting a persistent system problem (see below).

System status update
The major issues for this term have revolved around increasingly frequent crashes of the blackboard system, plus a series of less serious problems. Although steps have been taken to address some of the issues that are implicated in the crashes, we do not at this time know if the crashes have finally been resolved, and have theoretical reasons to believe that they have not.

Spring term usage
As usual, blackboard usage continues to increase:

<table>
<thead>
<tr>
<th></th>
<th>spring 2010</th>
<th>spring 2011</th>
<th>growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active CRN coursesites</td>
<td>1876</td>
<td>2043</td>
<td>9%</td>
</tr>
<tr>
<td>Users in at least one coursesite</td>
<td>20214</td>
<td>21850</td>
<td>8%</td>
</tr>
<tr>
<td>Student enrollments in active coursesites</td>
<td>69997</td>
<td>86529</td>
<td>23%</td>
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Note the very large increase in number of course enrollments. I am quite suspicious of this number, since it isn’t consistent with patterns from other years in which spring has always been about the same usage as winter term (which this year was 78612).

As part of a management presentation to senior administrators last month we collected some statistics comparing different UO computing resources. Although we have limited comparison data, it is very clear that blackboard is far busier by almost any measure than, for example, the UO home site or DuckWeb, and is comparable by most measures to UO Webmail (based on data collected 18 Feb-20 Mar).

Software upgrades
Since our last meeting, we have made a number of minor software changes plus one major upgrade: during spring break we upgraded the database servers from 10G to Oracle 11Gr2 Enterprise Edition, the current version of Oracle certified for use with the Blackboard Learn
software. Running 11Gr2 on our 3 Oracle servers (“ebony1” and “ebony3” in the Computing Center sharing a single filesystem on the Computing Center SAN, with one of these always our primary server, plus “ebony2” in Oregon Hall with a separate copy of the database files) means that if ebony1 crashes we can fail over to ebony3 in under a half hour, though a failover to ebony2 would still require several hours of downtime.

In the “minor” category, the only significant user-visible changes related to the handling of email “notification” – email sent to users, typically when new announcements were posted in coursesites. As of our last meeting, an annoying user interface bug was producing garbled html email messages for all such notifications, with possibly hundreds of lines of “Click here to view and edit your Notification Settings” lines appended. Given large numbers of user complaints, we temporarily disabled all email notifications in 25 March, but that produced even more complaints so we re-enabled notifications on 6 April. We finally received a fix from Blackboard which eliminated the bogus lines and installed it on 23 April. However, starting 8 May users began reporting email notifications for announcements that had been posting up to a month earlier. As of 9 May we have once again disabled notifications and are investigating.

In the larger environment, a major change has been the recent release of new versions of browsers, including Firefox 4, Internet Explorer 9, and Chrome 10. Based on our testing, Firefox 4 seems to work well with Blackboard and continues to be our preferred browser. We are actively testing IE 9 and Chrome 10, and believe that one or both may be usable with Blackboard this summer. However, Blackboard Inc. does not plan to certify either Firefox 4 or IE 9 until Service Pack 6, and has no announced plans for certifying Chrome. Although there have been minor version releases of Safari, we have no new problems with it on a Mac platform; we do not currently recommend using Safari for Blackboard access on either Windows or iPad.

Per discussions at our last meeting, we continue to see a problem with faculty struggling to make their coursesites available at the beginning of the term. Based on committee recommendations, we do not plan for fall term to take the simple approach of changing the default to “available.” Due to the problems we identified we will not be including announcements in coursesites to remind faculty of the process, but will send an email message to all faculty in September reminding them of how to do it. Meanwhile, it’s worth noting that Blackboard has taken our recommendations and put the instructions in yet one more highly visible location – in a prominent place on the page that is accessed from Control Panel > Help > On Demand.

**Hardware (?) problems**

The major issue during the past 3 months has been escalating hardware problems and system crashes. During 2011 we have had 13 incidents during which unscheduled downtime caused a significant period when no one could access the blackboard service:

- 1/11/2011 switch failure 2 1/2 hours
- 1/17/2011 ulimit problems 45 minutes
- 1/18/2011 ulimit problems 10 minutes
- 1/24/2011 unable to reach database 10 minutes
- 2/3/2011 unable to reach database 20 minutes
- 3/1/2011 unable to reach database 10 minutes
- 3/8/2011 unable to reach database 15 minutes
- 3/29/2011 unable to reach database 10 minutes
- 4/3/2011 DNS problems 2 hours 10 minutes
- 4/12/2011 unable to reach database 40 minutes
- 4/26/2011 database server hung 20 minutes
- 4/27/2011 database server crash 1 hour 5 minutes
5/3/2011 database server crash 2 hours 40 minutes
5/9/2011 database server crash 2 hours 11 minutes

In addition, we experienced a fairly large number of other incidents when problems caused a partial outage or significant slowdown. Combined with a single very long (10 hour) outage in August due to DNS problems, we have experienced more unscheduled downtime in the past year than in the previous 10 years combined.

A few of the problems were attributable to specific identifiable issues. For example, the first 3 problems listed were due to hardware then software configuration issues, and the downtime on 3 April was definitely related to network problems with the UO DNS servers. The outage of 1/24 may also have been due to intermittent network failure. However, the rest of the problems have appeared mysterious and very difficult to debug. Although it is clear that the problems began in late January or possibly early February and escalated in late April, we have not even been sure if they had a single cause.

Most of the incidents had a proximate cause of application servers all restarting when they believed that the database server had stopped responding. Many incidents occurred Tuesday evenings at about 6:20pm, suggesting that there might be some scheduled task causing particular problems. We explored numerous theories including bad code ostensibly introduced in the Bb 9.1 upgrade in December causing deadlocks in the database, cascade failures as the front end load balancer moved processes from one server to another, errors in tuning either the application servers or database servers, etc. It appears that part of the problem was caused by changes in system configuration around the beginning of the year; for example, we changed configuration of load balancing, doubled the number of application servers to provide greater capacity plus increase redundancy and ability to survive single-system failures, and changed the database servers to use linux hugepages.

During the first week of May we explored a load-related theory, that a combination of factors including the 9.1 upgrade, increased overall usage of the blackboard system, additional application servers, introduction of hugepages, and possibly some other ill-advised turning changes all increased the load – specifically memory usage -- on the blackboard database server. Then some undetermined trigger event (perhaps an as yet unidentified scheduled Tuesday-afternoon task) would push the server to start swapping, causing massive slowdowns to the point where the application servers would see the system as down and would themselves fail. To address the problem, Information Services on May 10 upgraded the memory in both the primary database server and the two backup servers from 8GB to 32GB each.

We are watching to see if this change eliminates the symptom. Time will tell. Meanwhile, we are planning more major changes to address database reliability, but they probably cannot be implemented until winter break.

As of the second week of May, our theories are very much in flux. JQ’s version of the story as of afternoon of 12 May is that an occasional event (having to do with xythos file processing hence introduced in BB 9.1) triggers a number of failed or delayed database queries and a temporary slowdown of the database server. A few seconds later the load balancing front ends notice a delay of perhaps 20 seconds in app server response, and start moving users between application servers, triggering a massive overload in the database server and a system crash. At this point we do not know how serious the trigger event actually is, or whether the front ends are being too aggressive in detecting server down. We don’t even know how the front ends are configured or whether it is per Blackboard recommendations. We also don’t know whether having increased the capacity of the database will reduce the delay that the trigger event introduces to below the current load balancer panic point.
We are beginning to collect some lessons learned. One is that we had problems and still don’t have confidence that we understand them well enough to know if they are fixed. This is in part a reflection on the now (partially a result of the move of blackboard hardware to IS a year ago) quite complex blackboard system architecture, with no one who understands all of the components. Tim and I, for example, don’t even know what the software and hardware configurations are on most of the servers. It also appears to be a reflection on organizational dynamics; there are at least 4 different teams involved in blackboard support: the library, which manages the blackboard software on the application servers plus overall blackboard planning and interaction with the user community; the IS database group, which manages the database for the library and contracts with IS Systems for hardware support; IS Systems, which manages the servers and is responsible for operating system software; IS Network Services, which manages connectivity. It became apparent that communications among these groups was not always as good as it could be due to differences in approach and organizational culture. For example, all of the groups have their own independent trouble ticketing systems, and most have a wiki for sharing information within the group but do not allow outsiders to access it. In some of the groups there is not a tradition of keeping the user community informed. From the library end, we have had numerous cases where someone in IS made clear that they thought they had provided us information that we in fact hadn’t received. The library in the past had a single point of contact in IS Systems, but the sudden departure of that staff member in March exacerbated communications difficulties. Simple steps to make sure that at least the first 3 of these affected groups are all copied on all relevant correspondence seems to have improved the situation. I also hope to get consensus on the creation of a shared database of all configuration changes affecting the blackboard system.

**Downtime and Upgrade Plans, May-December 2011**

Information Services has hinted at – though not finalized plans for – another power shutdown in their Computer Center machine room, somewhat less major than the one on 19 Feb. No date has been announced, but it could happen as early as evening of 27 May and will probably require 2 hours of blackboard downtime. We have indicated that we need to give the blackboard user community more advanced warning than was provided for the 19 Feb event.iii

The discussions that grew out of last year’s faculty blackboard survey were supplemented this spring by meetings Dean Carver had with library faculty departmental liaisons (faculty members responsible for coordinating their departments’ relationships with the UO Libraries). The discussions emphasized the degree to which faculty found the 2009 upgrade to Blackboard 9.0 to be difficult and/or gratuitous, and that many faculty want to see slower change even if change would address acknowledged problems. Based on those discussions, Dean Carver has indicated that she wants the blackboard team to pursue strategies that minimize unnecessary change in the UO’s blackboard user interface.

Taking this guidance to heart, we are moving slowly to adopt new blackboard versions. We do plan to install Blackboard 9.1 SP 5 on 18 June, since that new version (as with most odd numbered service packs) is advertised as a bug fix rather than feature release; SP 5 was released in March, and we have been running it successfully on our test server. SP 6 is scheduled to be released in June, but we do not currently anticipate installing it in production until winter break. When we do install SP 6, we expect to disable many of the new features that it will introduce.

We also are planning for a major hardware and software upgrade to our database servers, building on Oracle 11G Enterprise Edition to run Oracle 11 ASM and RAC. This upgrade is tentatively scheduled for winter break as well. The upgrade will require new server hardware, which is presently on order by Information Services, and we will expect to run RAC on the new hardware for several months in parallel with our existing servers before using it as the back end for our production system.
RAC potentially offers several critically important new features. Most importantly, it means that we will have a fully redundant multiple-database-server configuration. Multiple servers (one in the Computing Center and one in Oregon Hall) can be in operation simultaneously, and if one server fails, the other will simply take over. This will presumably result in greater reliability of our database component, especially since RAC is now the standard configuration in use on other IS-supported large Oracle databases. Oddly, though, RAC would probably not, based on my current analysis, address the problems that have been causing database-related downtime this spring.

**Student Survey Preliminary Results**

As promised, we conducted a survey of student attitudes towards blackboard this spring. I sent invitations to 2311 UO students on 9 April (randomly selected from all students enrolled in courses as of 5 April). We accepted responses through 30 April, and received a total of 556 responses for a response rate of 24.3%. We awarded one Duck Store gift certificate to a randomly chosen respondent, a Junior named Alison Agneray.

Sara Marcott (a student in sociology who volunteered to help with survey design and analysis) and I have just begun to analyze the results. A few observations are worth making immediately though.

Overall, has blackboard enhanced the instruction in courses you have taken?

21% were neutral, and only 7% were dissatisfied or very dissatisfied. When asked about the future, 47% wanted to see it used more, 44% about the same, and 9% less.

When asked what features of blackboard were most useful in contributing to the learning experience in the course, the dominant answers were by far “Course readings,” “Course general information” such as syllabus, “Lecture notes” such as copies of powerpoint slides, and “Grades.” In open ended responses students returned again and again to these themes, noting how important it was to post grades in timely fashion and how beneficial it was to have copies of the instructor’s lecture notes for review. Conversely, many students noted that the ways that blackboard was least useful were related to inability to find materials and inconsistency in the ways different professors used or organized their blackboard sites, with a subtheme that some faculty don’t know how to use blackboard or don’t use it enough.

We asked a number of questions focused on specific issues, and have not yet fully digested the responses. It seems apparent, though, that students do not feel the need for major changes in the training and support provided to them. We also observed that announcements that generate email notifications seem popular, with 58% of respondents saying that they like getting announcements by email; interestingly, students prefer to view course announcements consolidated on the My UO page (52%) rather than on the course home page (24%).

A more complete survey analysis is planned for our summer meeting.
I [update 13 May 2011] We believe that the time for failover between ebony1 and ebony3 is in the best case about 15 minutes if staff are available to respond. Failover to or from ebony2 will after further testing and tuning likely be about 30 to 40 minutes if staff are available.

ii [update 13 May 2011] We have reenabled notifications, and all seems to be well. Notifications for announcements that do not have the “force” box checked sometimes take up to a day to be delivered.

iii [update 13 May 2011] Micah Sardell, IS Assoc Dir for Systems, tells me that there are indeed fairly firm plans for more electrical work in the Computing Center, but that there is a good prospect that it will not require blackboard downtime. He and I agreed that until we know more it would be prudent to announce that there was a possibility of unscheduled downtime during the evening of Friday May 27.