Summary of Sakai Issues, Fall 2014 term
updated 9/24/2014

Sakai users experienced significant difficulties with performance degradation, and actual outages, in the starting two weeks of fall 2014 term, and then again on Thursday, 9/18/2014. These were induced by (1) operating system configuration, (2) an aberrant use, (3) significantly increased concurrent usage, (4) learning curve for scaling MySQL database.

1. Operating System Configuration

The operating systems on which Sakai runs (it is a multi-tier, and multi-server, architecture) depend upon something called a "filehandle". Roughly: a filehandle is what the operating system uses to keep up with files that are in-use. On the operating system, various activities are represented as filehandles in order for the operating system to keep track of them—in this case, enough filehandles to accommodate activities associated with concurrent usage in the database that supports Sakai. The filehandle limit on the operating system hosting Sakai was too low for the level of usage. It had to be increased.

2. Aberrant Use

By analyzing query demand against the database, it became clear that there was one activity that was accounting for at least one-third of the total request demand on the database subsystem. The use case was an image sourced from Sakai that was presented on a very high traffic login page. Thus, it induced significant impact on access logging, and also on demand to render that individual image object. We eliminated that.

3. Significantly increased concurrent usage

The total concurrent number of sessions in Sakai has in the fall 2014 topped 7000, which in past terms had been approximately 5000. This is the number of users active on the system at the same moment. This demand, in turn, increased activity on the "events" tracking component of Sakai: Sakai keeps track of most clicks, actions, etc., per user, per application module. This increased demand, together with the aberrant impact outlined in (#2) above, induced extreme locking issues in the Sakai database. These locks were "deadlocks" where one process is waiting on a second process to complete, but that second process is itself waiting on the first process to complete. This issue was exacerbated by inefficiences in the capabilities of the MySQL database kernel. Addressing (#2) helped the situation. But we further relieved this stressor by moving events logging to an "out of band" process that updates daily rather than a real-time, on-event, process. The net effect was to reduce contention on the "hot" areas of the database subsystem.

4. MySQL Database

For years, ITS's standard/go-to enterprise database has been Oracle RDBMS. Sakai is implemented on MySQL (with commercial support from the vendor, of course). Sakai uses MySQL largely because the original Sakai pilot was outsourced with a provider that utilized MySQL. The implementation timetable to transition from Blackboard to Sakai was accelerated by a calendar year, which eliminated any opportunity to convert the UNC-Chapel Hill database from MySQL to Oracle. Our most recent challenges were centered on contention in the "buffer pools" for memory regions. This appears to have been a different behavior from the kernel inefficiencies mentioned in (#3). The vendor has provided

several database tuning recommendations from an expert MySQL Senior Performance Engineer that the ITS team has been reviewing and load-testing in non-production environments. While at the date of this summary (9/24/2014) those changes have not been applied to the production environments, they are staged and ready to be applied at the next appropriate maintenance window (following completing the full suite of testing activities) or at the next occurrence of database contention.

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It should be noted, too, that these issues were unanticipated and emergent. The representation of outages as "PLANNED" was an artifact of the change-management system ITS uses, not an indication that ITS planned to have maintenance or outages in the first two weeks of classes. All of outages and maintenance activities were a direct result of ITS working expeditiously to relieve the crisis.

Also, we are currently investigating enhancements to the "Forums" functionality to improve efficiency and performance. As of 25 September 2014, 5am-7am, we will have implemented recommended code changes to improve the Forums functions.