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Robust networked e-Exams with Moodle

Mathew Hillier[1][0000-0001-9990-0479] and Andrew Fluck[2][0000-0003-1301-4615]
[1]Monash University, Australia, Mathew.Hillier@monash.edu
[2]University of Tasmania, Australia, andrew.fluck@utas.edu.au

Abstract. This session will present our latest research into the development of a resilient e-Exam system that is capable of working without a network for most of the exam session, including the conclusion of an exam, without loss of data. We have adapted open source software such as Linux, Safe Exam Browser and Moodle to provide an electronic workflow for assessments. Live Linux USB sticks are used to leverage a variety of student bring-your-own laptops to provide a consistent full desktop and application suite to each candidate. A range of software applications is provided to enable rich, constructed assessment responses alongside a Moodle quiz e-workflow. Applications include a full office suite (word processor, spreadsheet etc), multimedia players, drawing tools and discipline specific software, such as Mathematics (e.g. Sage, GeoGerba) and programming environments for Python and Scratch. The presentation will also include advice; tips and traps, procedures and equipment requirements for running this type of e-exam based on our experience of live trials conducted during 2017 and 2018 at Australian universities.

Keywords. e-Exams, networking, resilience, offline, authentic assessment

1 Background

This session presents work being carried out under an Australian nationally funded project [1, 2, 3] looking at modernising supervised examinations within the Australian higher education context.

We use the term 'e-Exam' (eExam) in our work to specifically refer to a “timed, supervised, summative assessment conducted using each candidate’s own computer running a standardised operating system” [4]. This differentiates what we are doing from other systems that employ purely 'online' testing tools that are reliant on a high degree of network up time. Such online testing can take on the format of a digital data collection form (e.g. online quiz in Moodle or Blackboard, web apps such as TCExam and QuestionMark Perception or software such as ExamSoft). In our case we include the use of 'authentic' software applications fit for the purpose of the assessment task e.g. a fully functional office suite is provided to write reports or essays, mathematical tools such as GeoGebra to address complex math problems and computer aided design tools for engineering or design.

2 Our e-Exam platform

The e-Exam platform uses customised Live Linux USB sticks to leverage a variety student bring-your-own laptops to provide a consistent full desktop and application suite to each candidate in controlled manner. A range of authentic software applications can be provided, including a full office suite, multimedia players, drawing tools and discipline specific tools, for example, Mathematics software (Sage, Maxima, R, Octave, Scilab, GeoGebra, Gummi (LaTeX editor), NetLogo). Connecting to a learning management system such as Moodle via the integrated Safe Exam Browser is also possible.

The e-Exam platform can be used in a variety of configurations including:

a) Fully offline: No network is used during the exam and all material is pre-loaded on the USB prior to the exam session. A full suite of applications are made available on the USB with all work conducted in local working space. A fully automatic document save feature is available when the office suite is used as the response composition environment.
b) Cached online: The e-Exam USB provides a secure client that connects to a Moodle server. Exam content is downloaded or cached (such as from a Moodle quiz) at the start of the exam. The network is then optional and serves as an administrative convenience from then onwards. A full suite of applications can be optionally provided.
c) Fully online: The USB acts as a secure gateway to a learning management system server or virtual desktop environment. A full suite of applications can be optionally provided via the USB

as local working space. A highly reliable network and server infrastructure is required. The trade off between administrative convenience and in-room reliability is that a network outage will result in a halt to the exam.

3 Session focus

This session will focus on the next phase in the evolution of the Australian developed bring-your-own laptop Live Linux USB based e-Exam platform previously presented at the 2017 World conference on computers in Education 'eExam Symposium' held in Dublin.

This demonstration will feature a new 'cached online' feature set showcasing the capabilities and flexibility of this approach. The demonstration will include use of authentic Mathematical software (GeoGebra and Octave) for constructed responses in conjunction with a Moodle quiz based e-Exam. The presentation will also include advice on running this type of e-exam based our experience of live trials that will include tips and traps, procedures and equipment requirements.

Use of this approach would typically involve:

1. Exams materials are prepared as a Moodle quiz, including any file attachments.
2. Exam rooms set up with e-Exam USB sticks placed on desks instead of paper.
3. After students enter the exam room they boot their laptop using the USB stick.
4. The e-Exam USB will connect to a Moodle server via Safe Exam Browser (SEB) where the student will log-in with their credentials.
5. A link to the exam for this student (Moodle quiz) will be shown.
6. At the appointed start time the student clicks the 'attempt quiz now' button. The action will only be permitted with matching SEB 'keys'. At this point all question content will be cached to the web browser cache (SEB). The network becomes optional from then onwards (i.e. as an administrative convenience). A full suite of applications can be made available on the USB stick with complex constructed responses possible using the USB as local working space. Such responses can then be submitted via the Moodle file upload question type.
   - Moodle quiz responses are autosaved every minute with synchronisation to the Moodle server.
   - In the event of a temporary network outage the auto-save events are redirected to an encrypted file in local storage. The student is able to continue working. A return of network connectivity will see the next auto-save sync to the server again.
7. The end of the exam the session is finalised using a standard Moodle 'submit all and save' button.
   - In the event of a permanent network outage the 'submit all and save' event will be redirected to an encrypted file on local storage.
8. Students conclude by shutting down and returning the e-Exam USBs.
   - If required (i.e. network outage), the locally saved response files will be retrieved from USBs via a large hub and then transferred to the Moodle server.
9. Grading occurs within Moodle.

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References

1. TEAA (2015) Transforming exams across Australia, Australian Government Office for Learning and Teaching, Grant, ID15-4747 http://transformingexams.com
2. Fluck A. & Hillier, M. (2016): Innovative assessment with eExams. Australian Council for Computers in Education Conference, Brisbane, 29 Sep to 2 Oct. http://conference.acce.edu.au/index.php/acce/acce2016/paper/view/34/27
3. Hillier, M. & Fluck, A. (2017). Transforming Exams - How IT works for BYOD e-Exams. Australasian Society for Computers in Learning in Tertiary Education conference (pp. 100-105). Toowoomba, 4-6 December. http://2017conference.ascilite.org/wp-content/uploads/2017/11/Concise-HILLIER.pdf
4. Fluck, A. & Hillier, M. (2017). eExams: Strength in Diversity. In A. Tatnall & M. Webb (Eds.), *Tomorrow's Learning: Involving Everyone. Learning with and about Technologies and Computing* (Vol. 515, pp. 409–417). Cham: Springer. https://doi.org/10.1007/978-3-319-74310-3_42