

NATIONAL UNIVERSITY OF SINGAPORE'S CAMPUS-WIDE E-LEARNING WEEK

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This article provides an overview of the rationale for conducting a large scale University-wide e-learning week, the preparations done by the National University of Singapore (NUS) to get its staff and students ready, the key IT tools used; the usage statistics of the University's information and communications technology (ICT) infrastructure during e-learning week, and the lessons learnt from successfully implementing this campus-wide exercise.

Introduction

Campus closure became a real possibility after SARs first surfaced in Singapore in 2003. During the outbreak, schools in Singapore were closed for a week to prevent the disease from spreading. When the outbreak was brought under control in 2003, many institutes of higher learning (IHLs) began looking into the possibility of implementing business continuity measures in teaching if another major disease outbreak happens in future. This was a very distinct possibility as many experts feared the influenza or bird-flu virus could resurface and mutate into a more lethal strain.

By late 2003, many IHLs have installed commercial or home grown learning management systems, content management systems, content development tools and a high bandwidth campus network. Wireless bandwidths were still in its infancy then, but most students had access to computers. The closure of a campus was never considered a real possibility until the SARs outbreak. In 2006, Singapore Polytechnic launched a project called "e-Learning Week", where the assumption was that the campus would be closed for one week and all teaching had to be done online. The aim of the project was to test the readiness of Singapore Polytechnic's IT infrastructure to cope with

the expected spike in IT resource use. Following Singapore Polytechnic's "e-Learning Week", many IHLs in Singapore began organising and implementing their own e-learning week exercises. For example, e-learning weeks were conducted in the National Institute of Education, Nanyang Polytechnic, Ngee Ann Polytechnic and Nanyang Technological University. Secondary schools and junior colleges also joined in the fray.

These IHLs implemented variations of e-learning week. For example, some like Singapore Polytechnic implemented a campus-wide exercise while others took a more measured approach, selecting only one faculty or college to close for the e-learning week. This meant only some students in certain courses were affected, or students will only be online for one day during the exercise. Whatever the variation of e-learning week, the reasons for implementing the exercise were the same, which were to (a) stress test the organisation's IT infrastructure and (b) get faculty staff (and students) to be better acquainted with the IHL's IT tools. The feedback received from the many e-learning week exercises conducted were mixed. While there were many teething problems, like the sluggishness of the IT infrastructure and the lack of preparation or readiness of faculty staff in terms of preparing their online content, most IHLs generally felt that this exercise was important in focusing the minds of their faculty staff and students in being better prepared and acquainted with their institution's IT tools to help in their teaching and learning.

The ICT Infrastructure at NUS

The NUS (founded in 1905) is a comprehensive University with a student population of around 30,000. The University has its own self-developed course management system called the Integrated Virtual Learning Environment (IVLE) and campus-wide licenses for rapid content development tools like Adobe Presenter (Breeze), which supports content development with PowerPoint, and Camtasia Relay, a screen recording software. Lectures are regularly recorded and streamed over the campus intranet. It has a robust and high bandwidth campus network, with an Internet bandwidth connection of over 400 Mbps and over 1,000 wireless points. It also has a comprehensive notebook ownership scheme. Launched in 1997, this scheme has resulted in about 90% of NUS students having at least a computer. In short, NUS has a robust and well managed ICT and e-learning infrastructure.

Implementing a University-Wide e-Learning Week

2009 saw the emergence of the H1N1 strain of influenza in Singapore. In May that year, the University was contemplating campus closure if the situation deteriorated further. Closing the campus for even one day would throw into disarray the final examinations, graduation ceremonies and the start of the new academic year. Luckily the H1N1 situation abated, infections went down and it was business as usual.

Although the prospect of campus closure was averted, the University realised that this might be a distinct possibility should similar situations occur in future. In fact, medical experts whom the University administration consulted had indicated that to really stop the infections from spreading within the campus, the University had to close for at least two weeks. Prior to the implementation of a University-wide e-learning week, the University had suggested to the respective Faculties that they at least consider identifying faculty staff willing to do their modules online for the coming semester. The University decided to take this 'bottom-up' approach to get faculty staff to volunteer to do their teaching online. Faculties were requested to identify faculty staff willing to take up this challenge.

To support this 'bottom-up' approach, the Centre for Instructional Technology (CIT) initiated roadshows at every Faculty to inform faculty staff about the IT technologies and pedagogical approaches available in helping them put their course modules online. A similar presentation was made at the Faculty Deans meeting on 7th August 2009. Following the meeting, NUS Deputy President (Academic Affairs) and Provost Professor Tan Eng Chye mooted the idea of doing a University-wide e-learning week to test the University's readiness in managing a closure of the campus for one week and its ability to recover from such a move. There were initial objections from certain Faculties, who felt the current practice of identifying faculty staff willing to take up this challenge was sufficient. However after explaining the rationale for adopting a campus-wide approach for e-learning week, on 21st August 2009, Provost notified all Deans and Heads of Departments of the decision to institute a University-wide e-learning week. It was suggested that the exercise be conducted from 4th to 10th October 2009 (i.e. week 8 of semester I, AY2009/2010). The University was given only six weeks to prepare for this exercise.

An e-learning week working group was formed to oversee the implementation of this exercise. It was chaired by Vice-Provost (Education) Professor Tan Thiam Soon and comprised the Vice-Deans of both undergraduate and graduate studies (or their representatives) from each

Faculty and School, as well as the Directors of the NUS Computer Centre, CIT, Centre for Development of Teaching and Learning (CDTL), Centre for English Language Communication (CELC), Office of Corporate Relations (OCR), Registrar's Office (RO), the NUS Libraries and the University's Office of Safety & Health Management Division (OSHE).

Moving From a Department to University-Wide e-Learning Week

In February 2008, CIT, OSHE and the Communications and New Media Programme (CNM), a department within the Faculty of Arts and Social Sciences, conducted a departmental e-learning week. Faculty staff in CNM were requested to participate in the exercise on a voluntary basis for one week (18th to 22nd February 2008), where they had to teach all their courses online. About 30 faculty staff, 1,400 students and 30 CNM modules were involved. As this was the first time an e-learning week was conducted in NUS, the post-analysis survey results from faculty staff and students were mixed. However all departments involved felt that this was a good first start and the experience gained from conducting such an exercise could be used in future e-learning week exercises.

Based on the feedback received and on CIT's own internal study of the tools used, CIT began planning for a more extensive e-learning week. The idea was to target a medium-sized Faculty and involve all lectures and tutorials conducted in the Faculty. However, before CIT could begin discussions with the Dean and Vice-Deans of the selected Faculty, the University decided to adopt a more direct approach, that is, to conduct a University-wide e-learning week and involve all Faculties and Schools.

For this University-wide e-learning week, all Faculties with the exception of the Duke-NUS Medical School were involved and all modules—undergraduate and graduate—were involved. After initial consultation with CIT, the University decided that only lectures would participate in this exercise, the reason being that lectures were less resource intensive compared to more interactive modes of teaching like tutorials and seminars. In addition, as this was the first time such a campus-wide exercise was being conducted, the University was uncertain about how well its ICT infrastructure would tolerate a sudden spike in IT resource usage. Another major issue was the cost of securing the software licenses. Although CIT had Centra Symposium, a virtual classroom software installed in 2003, the department only had a license to support 75 concurrent users. This was clearly not enough to support online tutorials and seminars campus-wide. To increase the licenses to 200

concurrent users, the vendor's quoted price was in the region of S\$200,000. In the end, the University identified one Faculty, i.e. the NUS Business School¹ to conduct both lectures and tutorials online for e-learning week, while the rest of the Faculties would conduct only their lectures online. Additionally, the University Scholars Programme (USP) volunteered to conduct all their modules (lecture and tutorials) online for e-learning week. USP felt this was feasible as their class sizes were smaller.

All in all, faculty staff, students and the supporting departments like Computer Centre, CIT and the Provost Office only had six weeks to prepare the entire campus for this exercise. Besides getting faculty staff and students prepared to post and retrieve their lectures online, CIT and the Computer Centre also had to review the hardware and software infrastructure to ensure that they can respond to the expected surge in demand during e-learning week.

Summary of Tools for e-Learning Week

The first thing CIT did when it was informed of the University-wide exercise was to form its own internal e-learning week task force.

CIT reviewed and discussed the proposed platforms and tools that staff could use to prepare for e-learning week. Faculty staff have diverse range of IT skills, with most staff familiar with surfing the web, accessing email and using Microsoft Word or PowerPoint to prepare their course content. A major advantage in the University's favour was that faculty staff and all students are very familiar with the University's course management system (IVLE). CIT decided to set some guidelines for all faculty staff involved to follow during the exercise:

The first basic requirement was to maintain a presence on the IVLE, which would be the main conduit through which faculty staff would collaborate, communicate and transmit their online lectures with their students.

Besides having a basic presence on IVLE, faculty staff were also requested to create and maintain some specified tools on IVLE to give their students further support during the exercise (see Figure 1).

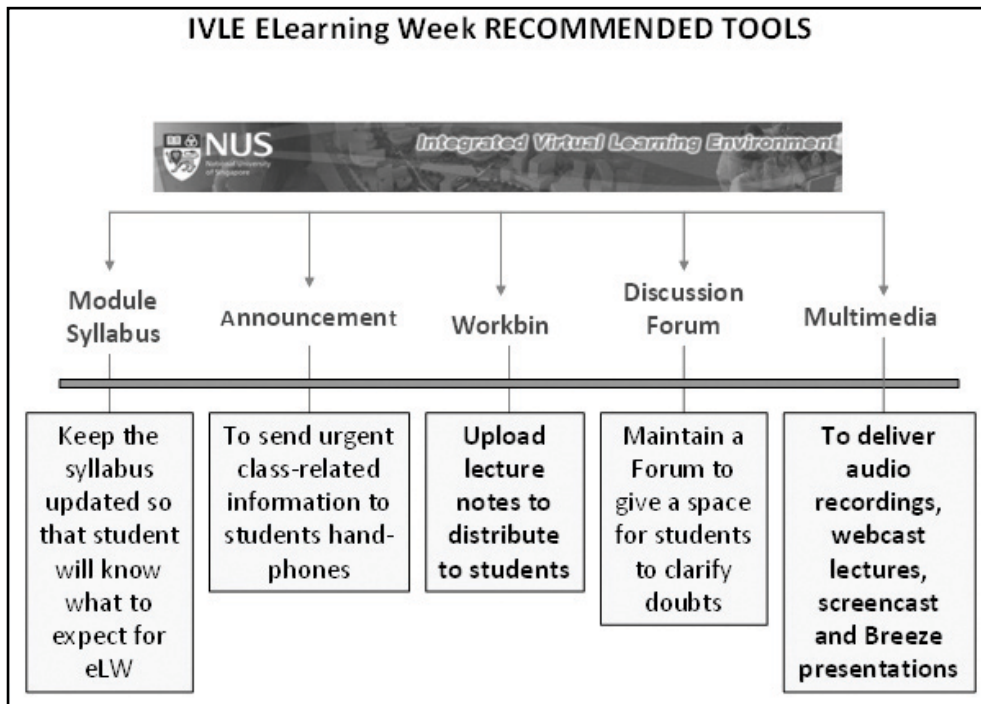


Figure 1. List of recommended tools on IVLE for e-Learning Week.

To encourage faculty staff to go beyond merely uploading their PowerPoint presentation slides on IVLE for their students to download and view during e-learning week, CIT conducted numerous roadshows on the rapid content development tools available for faculty staff (see Table 1, page 8).

They focused on tools that:

- had practically little or no learning curve and provided quick and easy installation
- could be installed in multiple devices
- could be used to develop and publish content from faculty staff's home or office
- did not need sophisticated recording equipment, and
- did not require extensive post-production or intervention from technical staff.

Table 1. Description of recommended tools for e-Learning Week.

Self-service					
Tools	Output	Requirements	Advantages	Disadvantages	Ideal For
Presentation slides & lecture notes	Slides & notes uploaded to IVLE.	<ul style="list-style-type: none"> • Presentation slides & lecture notes 	No additional skills required.	Slides & notes must be comprehensive.	Faculty staff who are pressed for time.
Presentation slides & audio recording	Slides & audio recording (MP3) uploaded to IVLE.	<ul style="list-style-type: none"> • Presentation slides • PC audio recorder & PC microphone 	The simplest e-learning lecture solution.	None	Situation(s) where the presentation contains only text & images.
Breeze <ul style="list-style-type: none"> • Software known as Adobe Presenter 	Flash-based web page linked to IVLE.	<ul style="list-style-type: none"> • Windows only • Microphone • PowerPoint • Breeze account with PowerPoint plug-in 	Works from within PowerPoint.	Breeze authoring is for PowerPoint on Windows only.	Faculty staff who only use PowerPoint in their presentations.
Screen Recordings <ul style="list-style-type: none"> • Software used is Camtasia Relay 	Video of screen recording linked to IVLE.	<ul style="list-style-type: none"> • Windows or Mac • Microphone • Relay account & recorder 	Windows or Mac authoring, displays anything on the screen.	Planning is necessary as Camtasia Relay records in one continuous take.	Faculty staff who display slides, websites & conduct software demos during their lectures.
Recorded for you					
Previously recorded webcast	Video of lecturer & coordinated lecture slides.	<ul style="list-style-type: none"> • Webcast from previous semester(s) 	Only need to inform CIT about which lecture to relay.	Lecture content may have changed from the previous semester(s).	Faculty staff who have done webcast lectures before.
Pre-recorded webcast	Video of lecturer & coordinated lecture slides.	<ul style="list-style-type: none"> • None 	Normal lecture preparation.	Time has to be scheduled to do the recording, which might not be viable in an emergency.	Faculty staff who have not used webcast but want video & slides format. Faculty staff who are pressed for time.

CIT set up five studio-style recording stations on campus to allow faculty staff to walk in before and during e-learning week to have their lectures recorded “live” in a studio setting and uploaded to IVLE for students to playback the recordings.

Preparation for e-Learning Week

To prepare for this exercise, CIT identified one staff to respond to all queries regarding e-learning week. All faculty staff were given this CIT staff's contact information (name and email address) in case they had any queries and support issues that had to be addressed before and during e-learning week. This staff member was required to respond, redirect and conduct the necessary follow-up on all queries raised during this period. An e-learning week website was created to provide information on the recommended tools faculty staff can use, with detailed user guides and best practices. An e-learning week preparation guide was also e-mailed to all faculty staff.

In addition, CIT conducted roadshows and training sessions to all the Faculties and Schools. For some of the tools that needed hands-on training like Breeze (Adobe Presenter), CIT worked with CDTL to conduct hands-on training. These roadshows allowed CIT to receive first-hand feedback from faculty staff about any concerns and issues they had.

CIT also briefed other key stakeholders on the preparation details and their respective roles and responsibilities before and during this exercise. Meetings were set up between CIT staff and Faculty IT Unit managers, as well as staff from the NUS Computer Centre and NUS IT Care. The Office of the Provost also met with the Student Union to find out and to address any concerns and issues students might have about e-learning week. All key stakeholders were regularly updated on the progress.

A specialised application to track the lecturer's preference on the kinds of tools they will be using for e-learning week was also developed. Faculty staff were invited to provide updates on their preferences in this web-based application. A summary of the lecturer's e-learning week tools preferences is given in Table 2.

Table 2. Faculty staff's e-Learning Week content preferences.

Faculty	IVLE Workbin	Pre-recorded Lectures	Breeze Adobe Presenter	Audio Recordings	Screen Recordings
Arts & Social Sciences	33%	8%	13%	4%	4%
Dentistry	94%	-	47%	-	-
Engineering	77%	11%	12%	2%	6%
Law	26%	-	4%	3%	-
Business	32%	21%	29%	21%	25%
Computing	12%	22%	12%	2%	28%
Design & Environment	83%	26%	21%	8%	12%
Science	99%	7%	2%	-	-
University Scholars Programme	11%	3%	-	-	-
Medicine	69%	15%	54%	-	-

Finally, a 24-hour e-learning week support roster was also created, indicating which CIT staff would need to be online after office hours and on weekends during this period.

ICT Infrastructure for e-Learning Week

All IHLs that have conducted e-learning week took a measured and incremental approach in supporting such an exercise because they were very concerned of a potential complete meltdown of their ICT infrastructure. For the NUS' University-wide e-learning week, one of the objectives for conducting the exercise was to stress test the University's existing ICT teaching and learning infrastructure. As such, only minor improvements were made to the existing infrastructure before e-learning week.

Figure 2 shows the existing ICT teaching and learning infrastructure that supports the IVLE. The following changes were made to it:

1. To improve the performance and responsiveness of the IVLE, the team increased the number of web application servers supporting IVLE from 4 to 6 servers (see Figure 3).
2. As IVLE use was made mandatory for this exercise, we expected more faculty staff to opt for the basic approach and upload their lecture notes and presentation slides to the IVLE workbins where their students can download them.

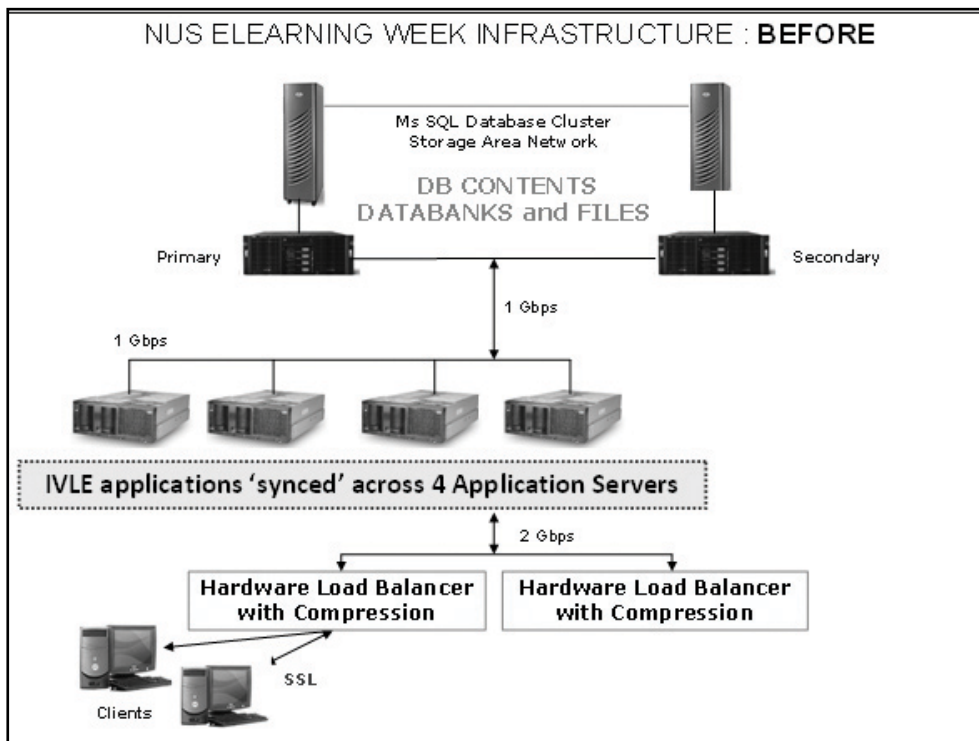


Figure 2. Existing ICT teaching and learning infrastructure at NUS.

To ensure a fast uploading and downloading process, the team moved the databanks and data files from the storage area network (SAN) to the 6 web application servers. The databanks and data files were replicated in each of the servers and CIT staff ran special software to ensure all files are 'synced' across all 6 servers. In this way, users can retrieve their data files more quickly as the transfer now does not need to go through the MS SQL database server as it had previously (Figure 3).

3. This option of moving the databanks and data files to the servers ensured that the IVLE's MS SQL 2005 database and database server focused on supporting only key database functions for IVLE.
4. To support more multimedia content being streamed and viewed, the University increased the capacity of its video streaming servers from its current 500 streaming capacity to being able to support 4,000 concurrent streams. CIT also had additional servers on stand-by in case there was a need to further increase the streaming capacity (Figure 4).

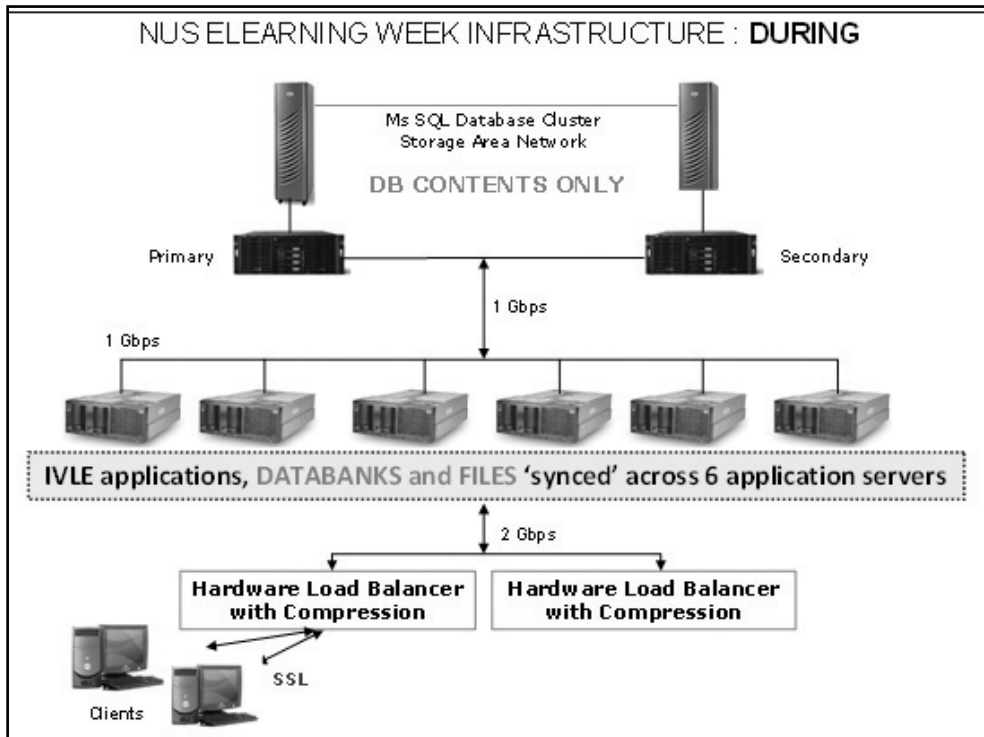


Figure 3. The NUS ICT teaching and learning infrastructure during e-Learning Week.

5. Servers that are hosting rapid content development e-learning tools like Breeze (Adobe Presenter), screen recorder (Camtasia Relay) and Flash streaming were also upgraded to ensure higher performance under heavy loads (Figure 4).
6. As a precaution, the Computer Centre also negotiated with the University's Internet bandwidth provider to allow for bust-mode usage of the Internet pipe during e-learning week.
7. CIT also distributed about 400 headsets to faculty staff who were interested in recording their lectures.
8. No other changes were made to the ICT teaching and learning infrastructure. The Computer Centre and CIT also explored having a proxy site outside campus to host some of the online content. This was to ensure that students could enjoy even faster access to the lecture materials.

However, after some discussion this option was not pursued further, since one of the main reasons for doing a University-wide e-learning week was to stress test the University's ICT teaching and learning infrastructure and identify any potential bottlenecks.

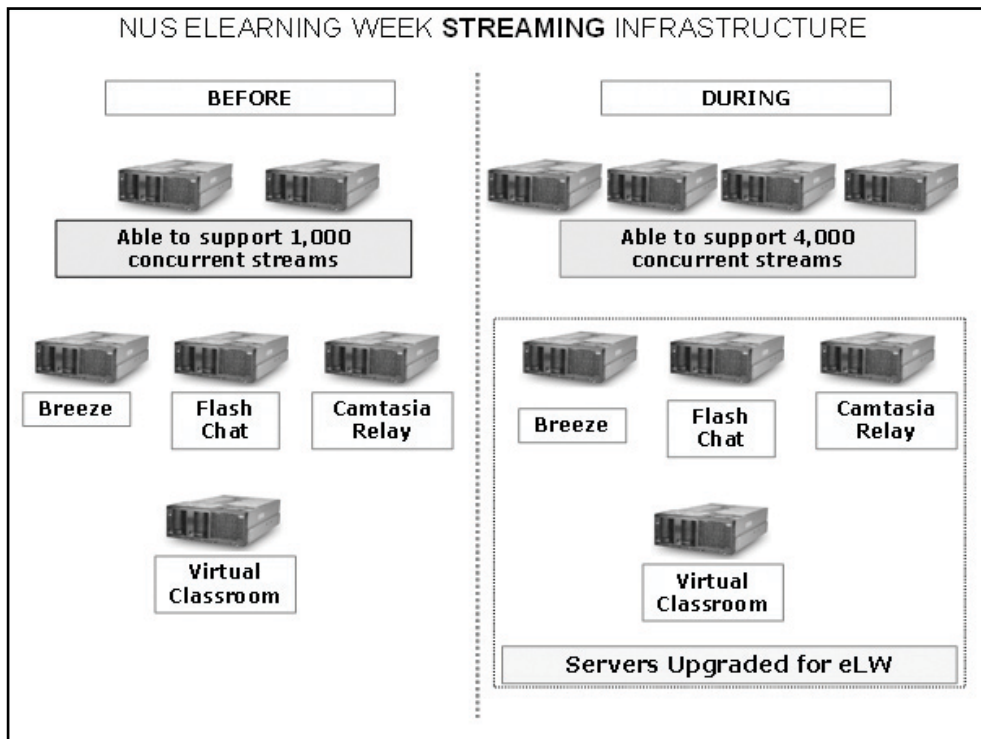


Figure 4. NUS e-Learning Week streaming infrastructure.

- To support faculty staff who will conduct online tutorials, CIT subscribed to a hosted virtual classroom service called WebEx (www.webex.com). Eight modules comprising a total of 100 students took up the challenge of conducting their tutorials online during e-learning week.

Preparing Students for e-Learning Week

Following the decision to go for a University-wide e-learning week, a list of frequently asked question (FAQs) was created specifically for students and posted on the e-learning week website. CIT also created an e-learning week discussion forum on IVLE to answer to any queries students might raise regarding this exercise.

On the 9th of September, the Vice-Provost (Education) met with all student leaders to brief them on the reasons for conducting a University-wide e-learning week. Student leaders were also requested to inform their fellow students on the rationale for NUS to conduct such an exercise. Following the meeting, the Provost and Registrar's Office sent an e-mail to all students informing them about e-learning week, its rationale and what to expect. Students were reminded not to come to campus for lectures during e-learning

week but to participate in their lectures online instead. Faculty staff were also reminded to communicate their e-learning week plans to their students before the exercise.

For students without a computer or broadband access at home, computer clusters around campus were kept open for longer hours (well past midnight) during this period and Faculty-specific clusters were requested to allow students from other Faculties to use their cluster if necessary.

Usage Statistics for e-Learning Week

During e-learning week, an average of 2,400 users logged into IVLE every hour (compared to 2,100 users during the regular instructional period). At its peak, there were 4,349 users logged into IVLE between noon and 1 p.m. on the first day of the exercise (Monday) compared to 3,557 users during the semester for the same time. On average, there were about 300 more logins per hour during daylight hours, compared to the week before the exercise.

A total of 1.3 terabytes (TB) of data was downloaded by students over e-learning week. During the exercise, many faculty staff took the opportunity to deliver their lectures online using the recommended rapid content development tools. Table 3 gives the total number of such lectures delivered online during this period.

Table 3. Modules in webcast, screencast and Breeze format for e-Learning Week.

No. of Modules	4th Oct	5th Oct	6th Oct	7th Oct	8th Oct	9th Oct	10th Oct
Webcast	124	88	94	87	74	81	68
Screen Recordings	43	72	79	87	91	88	88
Breeze (PowerPoint)	126	187	205	222	235	233	224

The NUS network also experienced a dramatic increase in its utilisation, from an average of 150 Mbps per day to an average of 412 Mbps per day. Figure 5 indicates the usage of the various tools on IVLE before and during e-learning week. In fact, the usage of these tools was higher before e-learning week. The ‘high’ vertical bar on the 8th of October (Thursday) showed a heavy usage of the IVLE chatroom and its assessments tools.

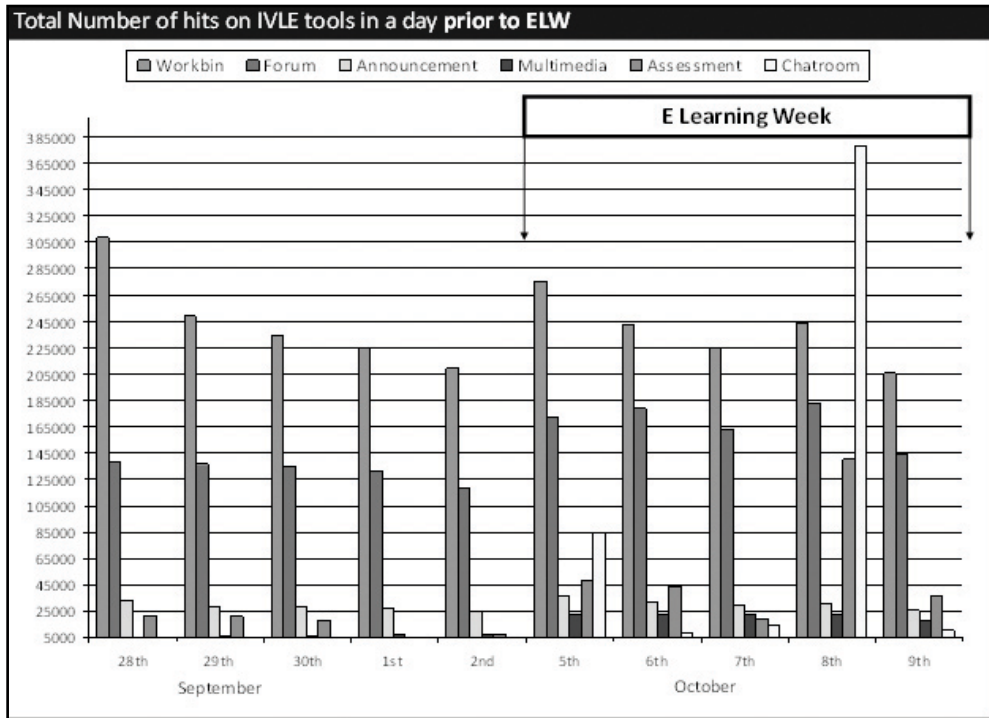


Figure 5. Number of hits on IVLE tools before and during e-Learning Week.

Figure 6 gives the usage of IVLE over a 24-hour period. During e-learning week, IVLE was supporting well over 4,000 users per hour. Usage only dropped after 3 a.m. but picked up from 10.00 a.m. onwards.

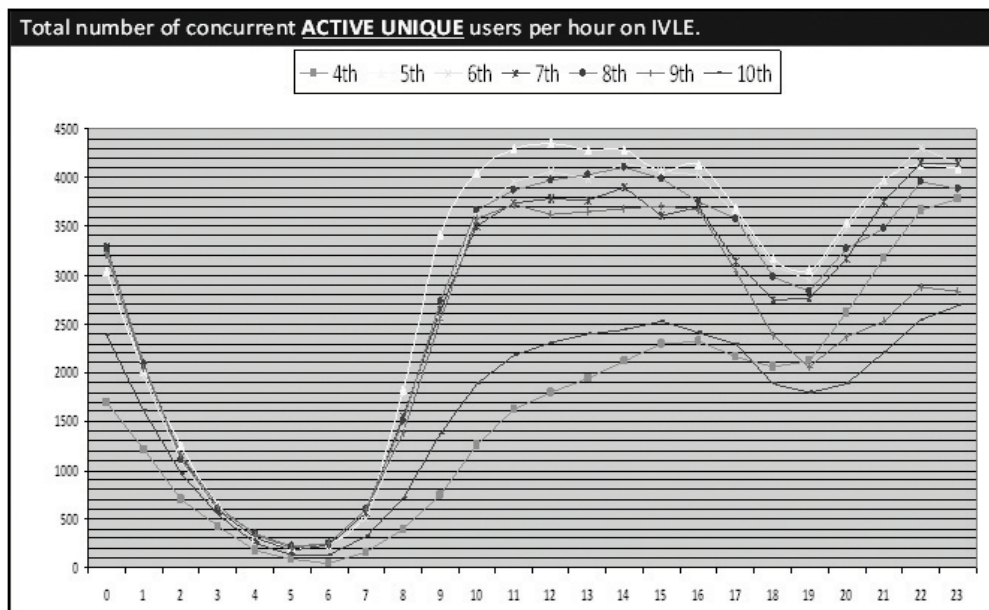


Figure 6. Users on IVLE during e-Learning Week over a 24-hour period.

Lessons Learnt During e-Learning Week

This first campus-wide e-learning week was successful and the objectives stated have been met. The ICT teaching and learning infrastructure performed very well during this period. Faculty staff rose to the challenge by taking time to learn and use the recommended IT tools to replace their lectures during e-learning week. They also became more aware of the capabilities of IVLE and the IT tools available to develop online content. Students should also be commended for accepting this campus closure and agreeing to take their lectures online.

If any organisation or IHL is planning an e-learning week exercise, the following recommendations would help in implementing it successfully:

- Ample notification should be given to the IHL's faculty staff and students, with clearly explained rationale for conducting such an exercise. This should be done preferably six months in advance, with regular reminders to all users to prepare for the e-learning week.
- Inform faculty staff what is expected of them for e-learning week and give them a variety of options that they can choose from, from the basic requirements needed to fulfil their pedagogical needs for e-learning week to more advanced options. Whatever their choice, it should be supported by the IHL's course management system. The course management system is central to e-learning week and should be the main conduit through which faculty staff and students communicate and collaborate during the exercise.
- Faculty staff are usually pressed for time; while some plan weeks in advance on what to teach each week, others only decide following what they have taught in the last lesson. Preparation for their lessons for e-learning week will most likely be done at their office or home. So, the content development IT tools selected for the exercise must be able to be installed in a variety of computers and locations multiple times. It is also important to give faculty staff a variety of software options to develop their content. Most use PowerPoint to deliver their lectures, so a content development tool that works with PowerPoint should be one of the software options. For non-PowerPoint users, a good and professional screen recording software with webcam support would suffice. Software options should work both for PC and Macintosh platforms, and adequate licenses should have been purchased beforehand.

- IHLs should also address faculty staff's concerns about copyright issues and provide options such as preventing students from downloading content and restricting them to only viewing the content online.

An e-learning week exercise enables the University to stress test their ICT teaching and learning infrastructure; at the same time, faculty staff and students become better acquainted with the IT tools. It is for this reason that e-learning week should continue on a regular basis, whether campus-wide or on a smaller scale, with Faculty closure for one week every semester. As software programmes become easier to use, computers and infrastructure platforms get more powerful and the bandwidths of home broadband systems increase, it can only get easier for faculty staff and students to participate in such an exercise.

Endnote

1. The NUS Business School later decided to do their lectures online, but not their tutorials, for e-learning week.

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