



An automated lecture capture system based on machine vision principles

Matthew Cooper
Flinders University

System Overview

- The Audio Visual Capture System (AVCS) is a fully automated video and audio lecture recording system built upon a combination of IT and AV hardware and software.
- The AVCS uniqueness is its ability to automatically switch between multiple camera and presentation resources as required, capture the resultant output of the switching process and provide professional consistent media content.
- Non invasive to the teaching environment and requires no user intervention.
- Imposes minimal restrictions on current teaching methods.
- Flexible and scaleable dependant upon specific needs of the users and idiosyncrasies of teaching spaces.

Methodology

- The automated system was designed to replace the existing manually recorded lectures, which consisted of camera, video (document camera and playback devices) and computer (PC and Mac) sources.
- Methodology was to develop a system capable of recording consistent lecture material at a quality suitable for conversion into
 - media deliverable online in any video and audio formats
 - lecture video repeats
 - relaying live to remote venues.
- Additional considerations were
 - cost
 - integration into existing teaching room environments
 - minimal user intervention and impact upon existing teaching methods
 - minimal technical support for core scheduling, recording and file transfers
 - remote control and monitoring of key software and hardware components

History

- Initially conceived late 2003 early 2004 as a joint interest project between Jonathan Wheare (software) and Matthew Cooper (hardware and integration)
- Trialled in early 2004 with production model run along side manual recording method in late 2004.
- In early 2005 the system was reviewed by the Universities external commercialisation arm.
- A subsequent report was delivered in late 2005, with the primary outcome recognising the uniqueness of the AVCS technology.
- Recommendations from the report included
 - the University consider a collaborative process to develop the technology for wider campus use.
 - engage their patent attorneys to assess the patentability of the idea
 - if feasible file a provisional patent application.
- Late 2006 our particular Faculty took the decision to provide funding and support for the development of the system we currently use.



Hardware

System 1 - Social Sciences North Lecture Theatre 3 (231 seat)

- Lecture bench linked to recording booth via UTP.
- North 3 linked to AVMU via 400m fibre optic cable - 4 x Video and 2 x Audio
- Fibre used due to costs of infrastructure modifications and quality of service benefits.
- North 3 booth acts as distribution point to permanently hard wired linked venues
- Can additionally be distributed to up to another 3 venues via a web browser in MPEG2 (DVD quality video and audio) anywhere on campus.

Systems 2 & 3 - Social Sciences North Theatre 4 (250 seat) & Theatre 5 (150 seat)

- System 2 located in North 4 recording booth.
- System 3 located in North 5 recording booth.
- System 2 designed to be expandable (16x16 video/audio matrix switching)
- Lecture bench resources transmitted via UTP to recording booth.
- Live relay UTP link to North Theatre 5 projection system from System 2.
- Linked to the North Theatre 5 for redundancy purposes via UTP.



Additional Hardware

- Web browser remote video and audio monitoring.
 - Live quad window view of all resources being fed into an AVCS.
 - One window displays switching of AVCS in real time.
- Web browser control and monitoring of essential AV hardware.
 - These include video switches, power control, scan converters, audio mixers and DSP.
- Additional infrastructure installed into selected smaller teaching spaces.
 - Includes cameras, computer, video and audio feeds.
- Portable AVCS systems used as required to meet additional demand and repeat lectures.
 - Extra venues provide options to do additional recordings due to room bookings in lecture theatres.
 - Lectures that experience problems can rerecord if necessary.
- Redundant automated backup recording systems.
 - These systems are software modified AVCS systems.

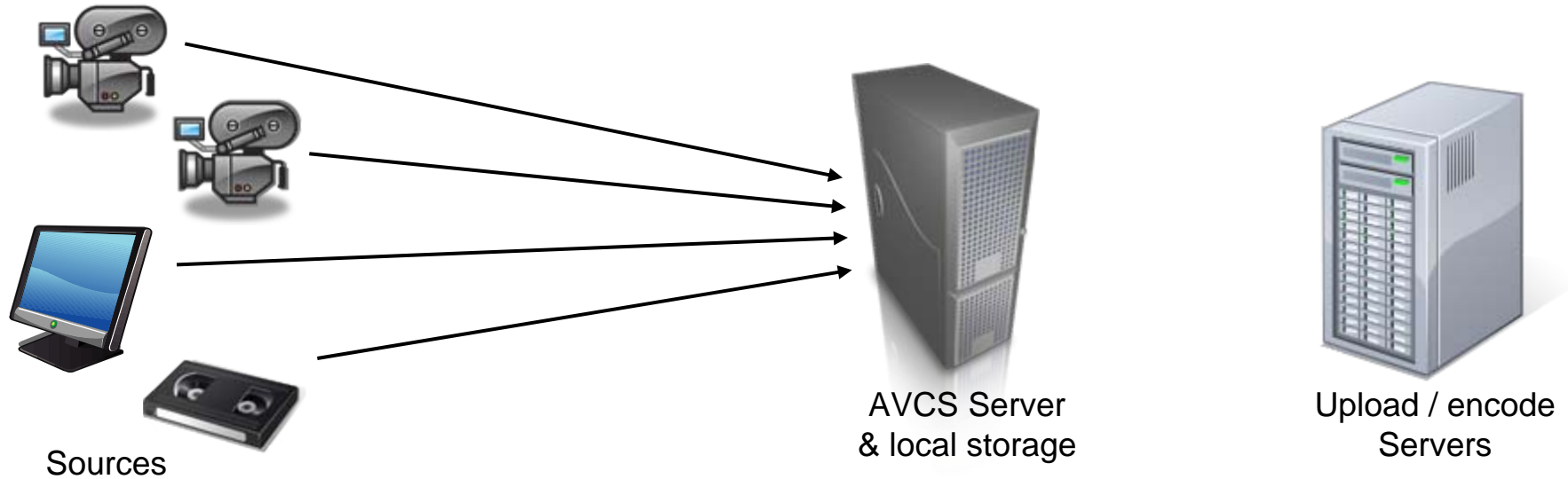
Software

Software can be divided into two main areas

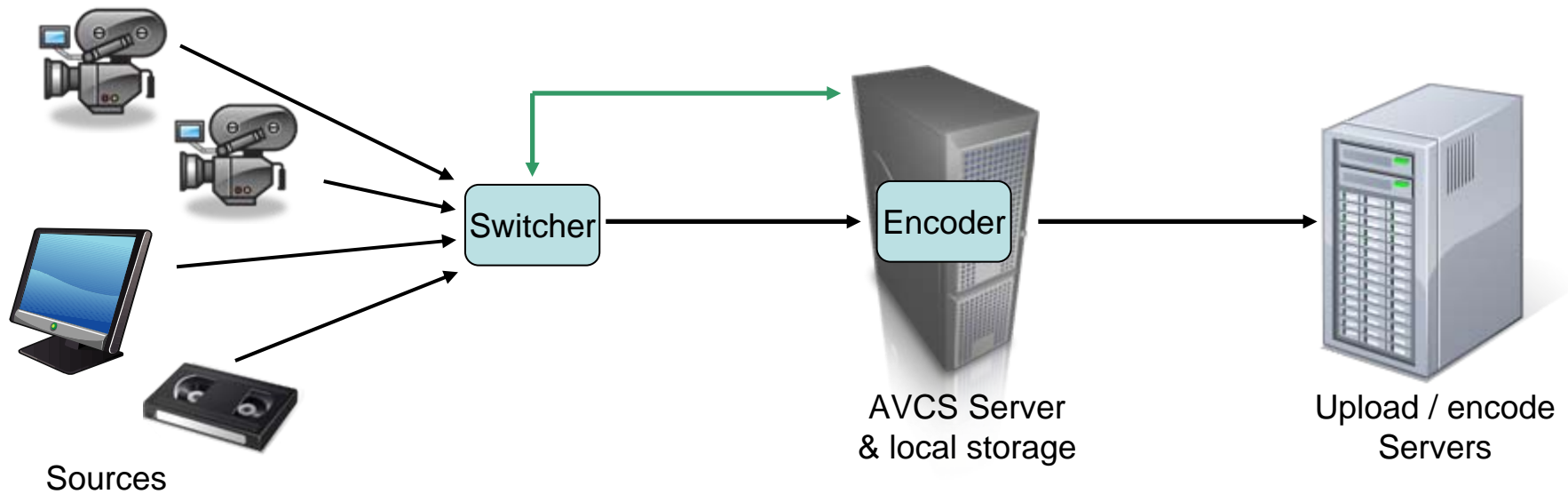
1. AVCS core operating software – switching, capture, file and system management
2. Web based administration interface

Core Operating Software features

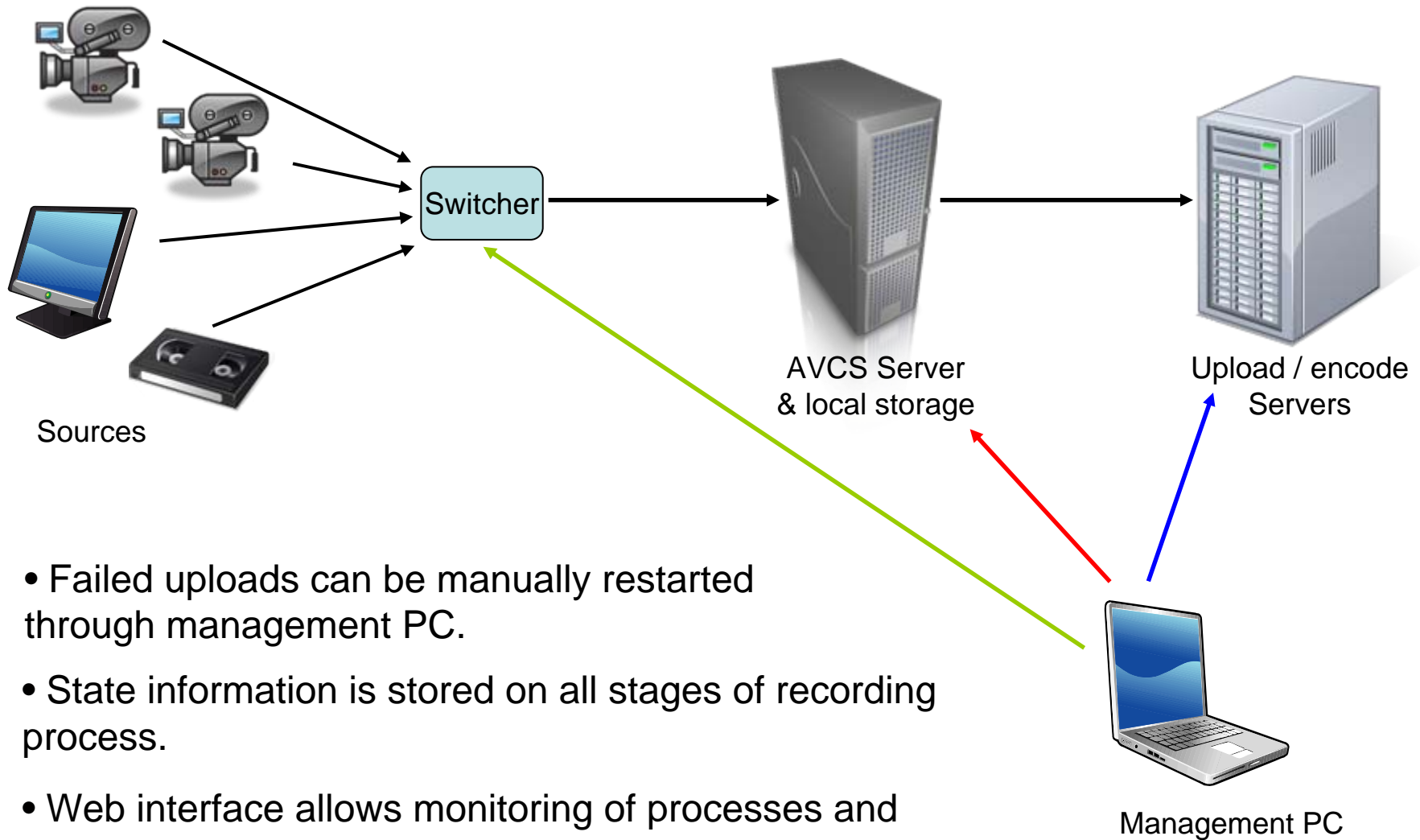
- All AVCS are fully independent, designed to operate irrespective of staffing and other associated external computing resources.
- As the system model is modular it lends itself to individual upgrades to both hardware and software as requirements change.
- Expandable for up to eight video channels if required – current systems are four channels only.
- Can be applied to a wide range of PC hardware.
- Administrative tools to simplify the creation of new systems.



- Scheduler software module starts recording process on AVCS server.
- Checks and frees necessary disk space on local storage.
- AVCS server monitors input channels.
- AVCS server uses machine vision techniques to analyze activity.
- Key machine vision software components are as follows.



- Video sources selected and switched by AVCS server based on customised switching profiles.
- Switched output encoded to DV video file format.
- Stored for future upload on local storage.
- Locally stored recordings are uploaded to upload / encode server.
- Uploads can occur immediately, manually or at a predetermined time.
- Locally stored file are removed when upload confirmed.



- Failed uploads can be manually restarted through management PC.
- State information is stored on all stages of recording process.
- Web interface allows monitoring of processes and the reconfiguration of jobs.

Web browser administrative GUI

- Ability to customise recording profiles, for example
 - PowerPoint and audio only
 - Camera and audio only
 - Or any combination of selected resources as predetermined and scheduled prior to recording
- Administrative option to automatically or manually upload to network location.
- Uploads may also be delayed to minimise impact upon network bandwidth.
- Can upload a recorded lecture to a remote location and record at the same time.
- Global online index displaying the current status of each system.
- Manual recording option using remote IP based video / audio monitoring and control of video switching hardware.







Global AVCS Index

> Index

AVCS Boxes

- > AVCS1
- > AVCS3
- > AVCS4
- > AVCS5
- > AVCS6
- > AVCS7
- > AVCS8

AVCS Index

	Scheduler	Uploader	Recording	Uploading
North 3	Running	Running	Idle	 Uploading
North 3 BU	Operating		Idle	
North 4	Running	Running	 Recording	Idle
North 4 BU	Running	Running	Idle	Idle
North 5	Running	Running	Idle	Idle
236n	Not Responding 		Unknown 	
114n	Not Responding 		Unknown 	

Current webserver time: 10:59:36

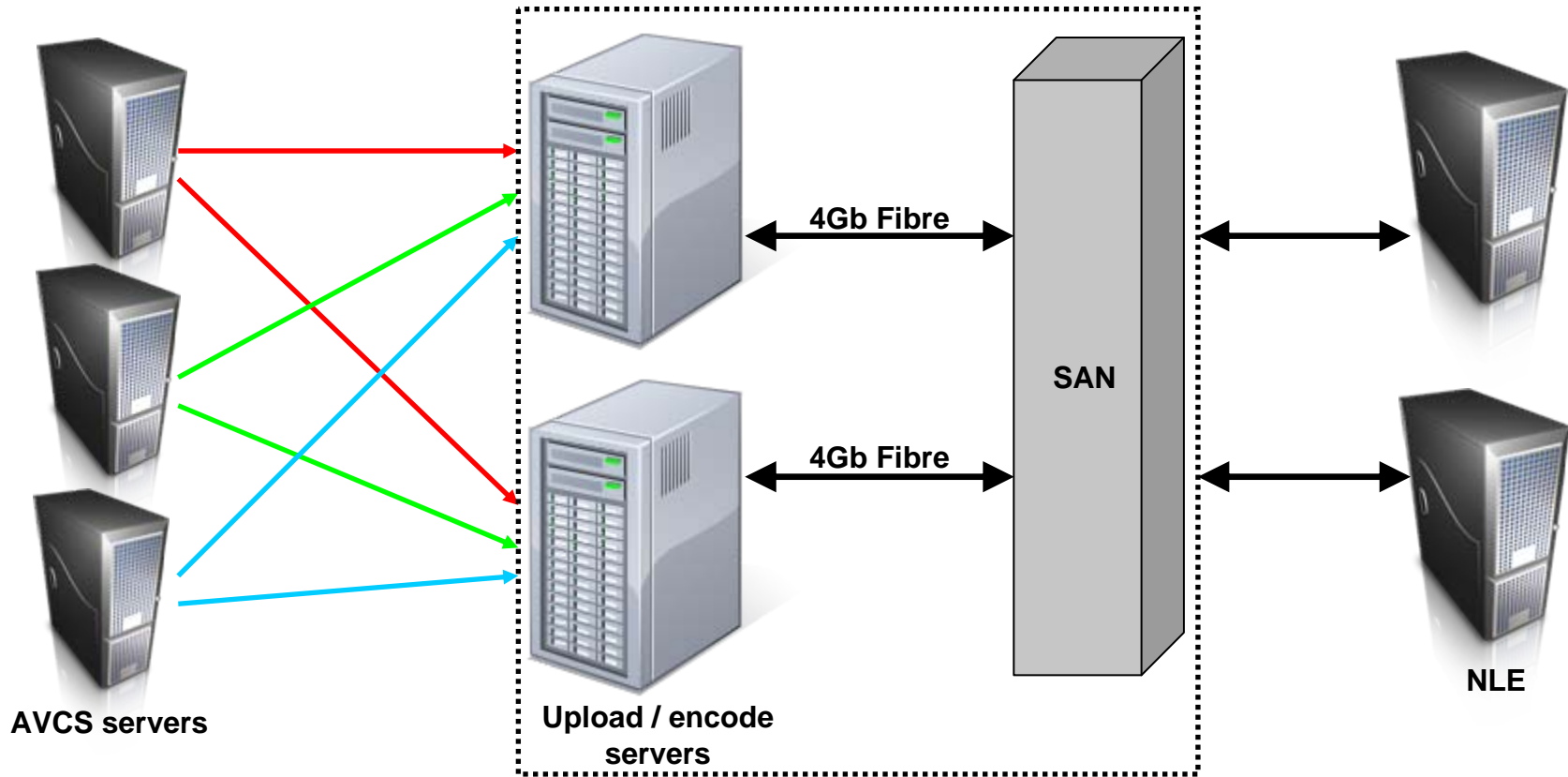


Add Lecture Recording schedule

- > Main index
-
- avcs3 - 129.96.145.90
-
- > Index
- > **Add lecture**
- > Add lecture immediate
-
- > Edit lectures
-
- > Statistics
-

Name	Year	Month	Day	Hour	Minute	Duration	Repeats	Record profile	Upload profile
test_recording	2008	8	25	14	0	55	0	default	ssh to webservice
	2008	1	1	1	0	5	0	default	ssh to webservice
	2009	2	2	2	5	15	1	present	smb to encoder2
	2010	3	3	3	10	30	2	longcomp	smb to encoder1
		4	4	4	15	45	3	lowsense	
		5	5	5	20	55	4		
		6	6	6	25	120	5		
		7	7	7	30		6		
		8	8	8	35		7		
		9	9	9	40		8		
		10	10	10	45		9		
		11	11	11	50		10		
		12	12	12	55		11		
		13	13	13			12		
		14	14	14			13		
		15	15	15			14		
		16	16	16			15		
		17	17	17					
		18	18	18					
		19	19	19					
		20	20	20					

Editing and Encoding



1. Files uploaded to SAN via encode servers – Intranet and dedicated Gb links
2. Files edited on NLE systems – across dedicated Gb links
3. Encode servers process files and upload to multiple locations automatically

Publishing

- A standard open source DV codec is used for capture (replay and relay quality concerns) a lecture is 13GB in size and takes approximately 5 - 10 minutes to upload over gigabit intranet connections to SAN.
- NLE workstations used to top and tail lecture, fix any audio problems, flag omissions and errors.
- A lecture can be edited, encoded and published onto WebCT in approximately 1.5 hours.
- Media added to WebCT using a purpose designed media management tool.
- Three files including an automatically determined 'oncampus' and 'offcampus' streaming video file are available, and a downloadable audio MP3 file.



AVSS Streaming Admin

[Home](#)

[AVHQ](#)

Lecture Topics Sem2 2008

Business 1002 - Admin,
Internal, External

Business 1005 - Admin,
Internal, External

Business 1008 - Admin,
Internal, External

Business 1009 - Admin,
Internal, External

Business 1010 - Admin,
Internal, External

Business 2004 - Admin,
Internal, External

Business 2007 - [Admin](#),
Internal, External

Business 2010 - Admin,
Internal, External

Business 2013 - Admin,
Internal, External

Business 2015 - Admin.

SOCIAL SCIENCES STREAMING VIDEO PAGE

BUSN2007 - Financial Management



The following lectures can be edited by clicking on the "Edit Details" link at the bottom of each video.
[Student view](#)

VIDEO	VIDEO 1
<p>DATE: Tue 26/08/08</p> <p>LECTURER: Chee Chong</p> <p>DURATION: 49:30</p> <p> MP3 Download Filesize: 11.33MB</p> <p> Quicktime Video Filesize: 932MB</p> <p>Edit details</p>	<p>DATE: Tue 29/07/08</p> <p>LECTURER: Chee Chong</p> <p>DURATION: 43:25</p> <p> MP3 Download Filesize: 9.94MB</p> <p> Quicktime Video Filesize: 818MB</p> <p>Edit details</p>
VIDEO 2	VIDEO 3
<p>DATE: Thu 31/07/08</p> <p>LECTURER: Chee Chong</p> <p>DURATION: 54:00</p>	<p>DATE: Tue 05/08/08</p> <p>LECTURER: Chee Chong</p> <p>DURATION: 50:40</p>



AVSS Streaming Admin

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AVHQ

Lecture Topics Sem2 2008

Business 1002 - Admin, Internal, External

Business 1005 - Admin, Internal, External

Business 1008 - Admin, Internal, External

Business 1009 - Admin, Internal, External

Business 1010 - Admin, Internal, External

Business 2004 - Admin, Internal, External

Business 2007 - Admin, Internal, External

Business 2010 - Admin, Internal, External

Business 2013 - Admin, Internal, External

Business 2015 - Admin.

VIDEO	VIDEO 1	VIDEO 2	VIDEO 3
Add info from nothing form:		DATE: Tue 29/07/08	
		LECTURER: Chee Chong	
		DURATION: 43:25	
Title	1219674600 (Tue 26/08/08)	MP3 Download Filesize: 9.94MB	Quicktime Video Filesize: 818MB
Lecturer	Chee Chong	Edit details	
Topic	Financial Management		
Comments			
Track number			
Bitrate	32000		
Playtime	49:30		
<input type="button" value="Save"/> Cancel			
		DATE: Thu 31/07/08	DATE: Tue 05/08/08

User Comments

‘a product that is very similar to what students experience in the live lecture - something I see as important when these recordings are being used as a supplement to on-campus learning, rather than as a form of external delivery. Students can already see the slides on their handouts, so a video of slides only has little advantage over simple audio recordings in my view.’

Assoc. Prof. Carol A Tilt - Associate Dean (Research) - Flinders Business School

‘I have found the current 'in house' designed and managed technology service to be both consistently flexible and responsive. These more personalised arrangements remain crucial to my delivery (and follow up) of lectures to some 230 undergraduate students who are enrolled in the topics that I currently convene.’

Dr. Maryanne Kelton - Lecturer in International Relations – School of Political and International Studies

‘It is very helpful to have the design team here on campus – Because they know the intimately how the system works and can adjust the settings, we can ask them to make changes in response to student feedback’

Dr. Jane Robbins – Associate Head (Academic) – Faculty of Social Sciences