Multimedia Presentation Software Solutions for Internet-Based Courses

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Abstract

The authors discuss multimedia presentation software (MPS) solutions in the context of the growth of Internet-based courses. Representative solutions for creating multimedia course lectures at the desktop and enterprise levels are described and evaluated. The authors suggest criteria to assist in the selection, implementation, and administration of MPS solutions to maximize accessibility and student learning while minimizing expense.

Introduction

Distance education has become a pervasive feature of the U.S. academic landscape (Howell, Williams, & Lindsey, 2003). According to the U.S. Department of Education's National Center for Education Statistics, in the 12-month 2001–2002 academic year, 56 percent of all 2- and 4-year degree-granting institutions offered some form of distance education, and an additional 12 percent expressed an intention to start offering distance education within the next three years. This trend is even stronger in public institutions of higher education, with 90 percent of public 2-year and 89 percent of public 4-year colleges offering distance education courses (Lewis & Waits, 2003). Perhaps a better term than distance learning is "distributed learning." Ron Dunn, the CEO of the Higher Education Academic Group at Thomson Learning notes that "…we are going to see a whole spectrum of learning situations, from the traditional professor in front of the class, through hybrid situations on campus and in corporations, to distance only where professor and student, whether for undergraduate degrees or corporate certification, communicate purely electronically and never meet" (quoted in Lichtenberg, 2001).

A significant driving force behind the current explosion of electronically-based distance learning solutions was the advent of the World Wide Web in the mid-1990s, which changed forever the concept of "distance," making it solely a matter of degree (Lichtenberg, 2001). Although Internet-based education is flourishing in a number of venues including corporate training (Pace, 2001), the authors will restrict themselves in the present case to academic institutions of higher learning, specifically public and private 2-year and 4-year colleges and universities. Of the various approaches to distance education in both public and private institutions of higher learning, asynchronous Internet-based courses are the most frequently used according to the National Center for Education Statistics (Lewis & Waits, 2003). Additionally, eighty-eight percent of the institutions either currently offering distance education or planning to do so within the next three years expressed the intention to begin using or increase the use of asynchronous Internet-based classes. The day seems to be quickly approaching, at least in public higher education in the United States , when synchronous and asynchronous Internet-based courses are seen as completely interchangeable with instructor-led synchronous courses.

The focus of this paper is the development of multimedia presentations for course lecture delivery via the Internet. Specifically, the authors limit themselves to systems that could be used by a non-technical faculty member to develop his or her own lectures for posting on the Internet. Although such products as Authorware and Flash can be used for professional multimedia presentation creation, they will not be considered in this

paper because these products require more training and experience than the typical faculty member would be willing to invest.

Internet-based courses come in two broad varieties. One variety uses an electronic learning management system (LMS), either a proprietary system, such as the Blackboard or WebCT platforms, or open-source, such as Moodle. There are clear advantages to such systems, because the instructor requires minimal training to place multimedia presentations on the LMS platform.

A second variety of Internet-based multimedia presentations is individual course web sites. There are several excellent WYSIWYG programs that make it unnecessary for instructors to learn HTML in order to develop course web sites and place multimedia content on the server, but it is probably safe to assume that using an LMS is easier than developing and administering a dedicated course web site. As a tradeoff, there is more flexibility for the instructor when a dedicated web site is used for course delivery.

Obviously, these two varieties of offering Internet-based courses are not mutually exclusive, and it is entirely possible for an instructor to use both a course Blackboard, for example, and a course or instructor's web site. Regardless of whether an LMS or a dedicated web site is used, course materials must be uploaded to a server to be available to students. The same multimedia presentation solutions could be used to produce multimedia presentations for an LMS or for web-based courses.

Multimedia course materials presented via an Internet-based course come in a dizzying array of choices, including, but not limited to, any combination of the following:

• Archived lectures with full motion video and audio. These could be built from enterprise-level professional systems, or home-grown from inexpensive desktop systems.

• Narrated voice-over screen capture videos using PowerPoint or other programs. These may or may not include transitions, animations, on-screen digital ink annotations or "talking head" video.

• PowerPoint slides or presentations in a variety of formats, with or without digital ink annotations and hyperlinks.

For the purposes of this paper, solutions making use of audio, computer screen capture, and optional video will collectively be called multimedia presentation software (MPS) solutions. The authors' main focus is the production and distribution of presentations that to some extent mimic the dynamic qualities of classroom presentations by including presentation slides or other computer screen capture, the instructor's voice synchronized with the presentation materials, and in some cases, the inclusion of video of the instructor or other video content.

Research indicates that the use of voice-over narration adds substantial interest and instructional value to asynchronous presentations (Talley, 2005). Limited research evidence indicates that the presence of a video component, particularly a "talking head" instructor, adds incremental costs, but perhaps little incremental instructional value to multimedia presentations. In a controlled study, Berner and Adams (2004) found that adding video to an audio slide presentation did not improve learning or learner satisfaction. The larger instructional impact apparently comes from the students' ability to see what the instructor is presenting rather than to see the instructor present it, and to hear what the instructor is saying. The authors' experiences and those of others indicate that the human voice does in fact bring a level of personalization and humanization to online learning (Woods & Keeler, 2001; Mark, 2004).

In the remainder of this paper, the authors provide examples of MPS solutions specifically used for Internet-based lectures. Although real-time streaming media can also be incorporated in synchronous course delivery, such media would be examined in this paper only to the extent that the presentations are archived for on-demand delivery at some later point in time. The MPS solutions discussed next allow the incorporation of audio and screen-capture video (usually from PowerPoint presentations), along with optional elements

including screen annotations and "talking head" video. MPS solutions range from free to extremely costly, and may be invoked at the desktop or enterprise levels. Our purpose is not to provide an exhaustive list, as whatever list we provide will quickly become outdated, but rather to provide a set of reasonable criteria to assist the administrator in making an effective choice or choices from the array of possibilities. In order to develop these criteria, we review several popular and representative solutions and then provide a suggested checklist for evaluating both the solutions reviewed and other ones the administrator may consider.

The Beginnings of MPS Lectures

Many readers will remember the long-standing low-tech approach to narrated slide shows in a bygone era: carousels with 35-mm slides, a slide projector, and a screen. The presenter spoke, narrating the projected slides. PowerPoint automated the slides, but not the narration, and was essentially pointless and powerless until the lecturer began to speak. However, with the advent of the World Wide Web in the mid 1990s, the delivery of streaming multimedia presentations to a personal computer via a web browser moved from fantasy to reality. Problems of bandwidth, operating systems, cross-browser compatibility, and server and client software were faced and addressed, and soon PCs were regularly receiving streaming media presentations including, at first, audio and then video.

The use of this technology was not lost on educators, and one of the very first multimedia presentation solutions adapted to distributing course lectures was provided by Real Networks' RealSlideshow and RealPresenter programs. These products were fully functional and operational by the late 1990s. Although both of these programs have been discontinued, they established the basic format including a timeline, audio synchronized with screen output, optional slide transitions, background music, or other embellishments. A slide show (or a series of PowerPoint slides) could be stored and delivered as streaming media synchronized with narration. Legacy versions of these products and support documentation can still be found (RealNetworks, 2006). Today, many MPS solutions exist that follow in the basic footsteps of RealSlideshow. These vary widely in expense, ease of use, and degree of integration with Microsoft PowerPoint, the ubiquitous presentation software program.

Definitions

The authors distinguish between two levels of MPS : desktop and enterprise. Others have made a distinction among desktop, production, and enterprise levels (see Rhyne, et al., 2005), but two levels are sufficient for our present purposes. The desktop level is characterized by an instructor or even a student using a program or programs that are free or relatively inexpensive. This level involves a single computer with the software installed, even if the computer is part of a larger intranet. We specifically avoid discussing production-level solutions that would require expertise, training, or resources not generally available to or of interest to the typical faculty member. Enterprise level solutions involve server-based programs available via either an application service provider (APS) or a dedicated server solution.

Current Desktop Level MPS Solutions

Microsoft PowerPoint Narrations

Microsoft PowerPoint is available as part of Micros oft Office, and is installed on the majority of instructors' computers. The simplest approach to record voice-over narration of a PowerPoint presentation is to use the built-in features of Microsoft PowerPoint. To access the slide narration feature, one selects Slide Show, Narration. The presenter advances through the presentation, speaking into an external or internal microphone. The program records the voice narration along with slide timings . An advantage of this approach is that the narrations are automatically saved with the slide show rather than in separate files. Slide shows with narrations can be saved as self-launching PowerPoint presentations or as regular PowerPoint files and can be stored on an LMS or course web page.

Many other programs may be used to enhance the effectiveness of narrated PowerPoint presentations by changing file formats, improving compression, or adding other features. However, for the simplest purpose of

adding voice to PowerPoint, the program itself provides this capability. Many of the other MPS solutions discussed in this article can make use of PowerPoint and other computer programs such as web browsers or Microsoft Excel for screen capture, so PowerPoint will not be further discussed or evaluated separately from these programs.

Microsoft Windows Media Encoder

Microsoft Windows Media Encoder (Microsoft, 2006a) is a free, downloadable, general-purpose program for capturing screen video and audio and saving the resulting output in a Windows Media (WMV) file format which is viewed or heard using the Windows Media Player. The program limits post-production editing capabilities to general properties of the file such as its title and other attributes. It also provides the capacity to convert file formats such as AVI (Audio-Video Interleaved) to Windows Media files, which are more compact. Media Encoder can also be used to broadcast live events from installed audio and video devices. Windows Media Encoder is very useful for converting the output from other programs such as HyperCam into a more compact form.

Media Encoder comes in both 32-bit and 64-bit versions. System requirements for the basic 32-bit implementation are minimal, including 64 MB of RAM , a 266 megahertz (MHz) processor, and Windows XP or 2000. Limited technical support is available from Microsoft via a frequently asked questions (FAQ) page, and an online "How-To-Center" and Windows Media Workshops. Help through email or by phone is also available for a fee.

Microsoft Producer for PowerPoint

This free and easy-to-use program from Microsoft is described as an add-in for Microsoft PowerPoint, but it can be used to produce narrated slideshows from PowerPoint and other sources, as a screen-capture program, and optionally as a screen-capture program with synchronized video and audio elements. The program provides the capability to integrate audio, video, slides, and images to create media-rich presentations (Microsoft, 2006b).

System requirements include Microsoft Windows 2000 or higher; Microsoft PowerPoint 2002 or later; 128 MB of RAM ; 2 GB of available hard disk space; and a 400 MHz processor. Although the creation of Producer files is currently limited to the Windows platform, content created by the program can be viewed on both Windows and Macintosh machines via the free Windows Media Player. Limited support is available via an FAQ page, support articles, tutorial, and newsgroups (Microsoft, 2006b).

HyperCam

Hyperionics HyperCam is an inexpensive software program that can produce screen-capture videos including audio and save them to AVI movie files (Joyce, 2004; Hyperionics, 2006). The AVI files can be easily converted to a more compressed WMV format using the freely-available Windows Media Encoder discussed earlier. HyperCam captures whatever is displayed on the computer screen, or within a selected region or window . The software allows the user to capture anything that can be seen on the computer screen, including cursor movements and menu selections, video elements, screen annotations, and the sound from the system microphone. It will also allow the user to add text captions to recorded movies. HyperCam does not support the re-recording of video clips from the screen using Media Player, RealVideo or QuickTime. HyperCam offers no post-production editing capability for previously recorded projects.

System requirements include a Pentium III or faster processor; Windows 2000 or higher; and microphone for audio (Hyperionics, 2006). A dual-processor system is a plus for recording large areas in fast frame rates (15 fps or higher). HyperCam does not record image from the camera directly, but rather from a selected area of Windows desktop and programs running within it. It is, however, possible to put a webcam window in the corner of such recorded area so that students can see the instructor if that is needed.

User support for HyperCam includes a Tech Support Message Board that has a search feature that allows the

user to search previously posted messages (Hyperionics, 2006). Hyperionics claims that posts to the tech support message board are answered by tech support within the same or next day. In addition, there is an FAQ section on the Hyperionics web site along with downloadable documentation in PDF and MS Word formats.

This software is a bargain at the current price of $39.95 for a new license (Hyperionics, 2006). Hyperionics provides volume discounts and an educational discount. HyperCam can be purchased and downloaded from the Hyperionics website. A free trial version of HyperCam is available to download from the Hyperionics website. HyperCam is available in several foreign language versions (e.g. Hungarian, Italian, Polish).

Camtasia Studio

Camtasia Studio is relatively sophisticated but intuitive software program that allows users to produce narrated and annotated presentations from PowerPoint or other programs for web and CD-ROM delivery (Techsmith, 2006). Camtasia Studio captures and records all multimedia elements including slides, transitions such as mouse movements, keystrokes, annotations, clicks, animations and video and audio. The program can then produce output files in a variety of multimedia formats including QuickTime (MOV), RealMedia, WMV, AVI, Executable, Animated GIF, Macromedia Flash and Macromedia Flash Video (Mark, 2004). Camtasia Producer allows users to edit the video including movies and image files in BMP, GIF, or JPEG format (Dalziel, 2004). Camtasia Studio provides many special effects to add interest to the presentation. If instructors want students to pay special attention to something, they can highlight or underline the text, draw boxes, ellipses or use arrows that point to specific places on the presentation. An optional PowerPoint add-in can be installed, making the operation of Camtasia Studio point-and-click. In addition to the software, all that is required is a microphone, speakers and an optional webcam. System requirements include Microsoft Windows 2000 or later versions; Microsoft DirectX 9 or later; 1.0 GHz processor, however 2.5 GHz is recommended; a minimum of 256 MB RAM , however 1 GB is recommended; a Windows-compatible sound card; and 40 MB of hard-disk space for installation (TechSmith, 2006).

Online support is available through the TechSmith web site. The site provides a Support Center that allows users to search for answers using a keyword search feature. In addition, users can take advantage of the Online Learning Center which provides a library of training resources including product manuals, tutorials, videos, and instructor-led workshops for a fee. Users can also email questions to TechSmith Support.

Currently, a single-user license can be purchased for $299. A multi-user license (5 users) can be purchased for $995 (TechSmith, 2006). TechSmith provides educational discounts to accredited non-profit K-12 schools and colleges and universities. Current single user educational pricing is quite reasonable and ranges from $149– $169. Users can purchase and download the software or can download a 30-day trial from the TechSmith website.

authorPOINT

authorPOINT is a PowerPoint plug-in that instantly captures PowerPoint presentations along with audio and/or video, resulting in a fully synchronized presentation (authorGEN, 2006). Speaker notes can be added to the presentation. Once authorPoint has been installed it is accessed through PowerPoint simply by opening the PowerPoint presentation and clicking the capture button. The presentation can be stored in Flash, Real Media or Windows Media format.

System requirements include Microsoft Windows 2000 or later; Microsoft PowerPoint 2000 or later; Windows Media Player 8.0 or higher, Real Player, or Flash Player 8; and a supporting browser (Internet explorer 5.5 or higher for Windows Media and Real Media outputs). Virtually all current browsers support Flash Player. Hardware requirements are Pentium III or later microprocessor; 128 MB RAM ; a sound card; microphone for audio; and webcam or digital camcorder for video.

Presently, support is available through electronic mail. An FAQ page, tutorial, and a user's manual are available on the authorGEN website. In addition, downloadable sample outputs using Flash Player, Windows

Media Player, Real One Player, and Flash Player for Pocket PC are available on the authorGEN website. A single user license currently costs $299.00 and a kiosk license is $999.00. A 30-day free trial version is available on the authorGEN website.

authorLIVE

This product allows the user to deliver live lectures using PowerPoint along with audio and video (AuthorGEN, 2006). Students can view the lecture live from anywhere in the world, and can instant message the instructor during the lecture to carry on a two way conversation. An interactive whiteboard is available to enhance the lecture and students' understanding of the material being presented. Live presentations created using authorLIVE can be archived for later viewing.

System requirements for both instructor and students include Microsoft Windows; Mac or Linux; a browser (Internet explorer 5.5, Mozilla 1.0, Netscape 6, Opera or higher); Flash Player 7.0; microphone for audio; and webcam or digital camcorder for video.

Support for authorLIVE is available through electronic mail. An FAQ page and tutorials are available on the authorGEN website. A user's guide for both presenter and attendee can also be downloaded from the authorGEN web site. An annotated screenshot example is available on the authorGEN website (authorGEN, 2006).

Presently, there are two purchase options for authorLIVE. One may either choose the pay-per-use option (currently 8 cents/user/min) or a concurrent user license. Educational discounts are offered for both purchase options. In addition, a 15-day free trial version is available on the authorGEN website.

Impatica

Impatica is a PowerPoint add-in product that transforms a PowerPoint presentation, including any associated audio and video, into a compressed format (up to a 95% reduction in the base file size) that can be streamed over the internet using a Java applet player (Burcham, 2003; Impatica, 2006). PowerPoint files are relatively large, and when saved as HTML, lose animations that may have been added, making them poorly suited for web-delivery. By converting the PowerPoint presentation into a compressed format, Impatica solves this problem.

System requirements include Microsoft Windows 98 or later versions and for MAC users, a PowerPoint Mac OS X edition is available; Microsoft PowerPoint 97, or later versions; and a supporting Java 1.1 enabled browser (Internet explorer 4 or later; Netscape version 4 or later) (Impatica, 2006). Hardware required includes a Pentium III or later; 128 MB RAM (minimum of 256 is recommended); a sound card; microphone for audio; and webcam or digital camcorder for video. All students need is a Java-enabled web browser and the ability to connect to the internet. No additional software or plug-ins are required.

Support for Impatica is available through electronic mail or by telephone via a toll-free number (Impatica, 2006). Users receive 90 days of free support and maintenance. Beyond the 90 days, support and maintenance are 20% of the purchase total per year. User support resources available on the Impatica website include tutorials and a frequently asked questions section. A user's guide can be downloaded from the website.

A single copy of Impatica for PowerPoint currently costs $499. A "5-pack" license costs $1,495 (Impatica, 2006). Site licenses, educational pricing, and mixed platform packages, are also available. An evaluation copy can be downloaded from the Impatica website.

Current Enterprise-Level MPS

Lectora

Lectora is an authoring and publishing software program that allows the instructor to build e-learning lectures and courses using drag and drop techniques (Travantis, 2006). Instructors can create and deliver interactive multimedia (text, animation, video, and audio) lectures without any knowledge of programming. Instructors can easily convert their PowerPoint presentations into Lectora format. In addition, Lectora has tools that allow instructors to create questions for quizzes and tests. Lectora supports numerous media file types such as JPEG, GIF, WAV, MP3, AVI, MOV , and Flash. The finished product can be published to HTML, CD-ROM or DVD , and single-file EXE. Lectora integrates with any AICC, SCORM or LRN standards-based LMS.

Minimum system requirements include Intel or AMD processor; 32 MB RAM ; 40 MB free hard drive space; Windows 98 or later; PowerPoint 97 or later; and a supporting browser (Internet explorer 4.0 or higher, Netscape 4.7 or higher, Mozilla) (Travantis, 2006).

Support for Lectora is available through electronic mail or live by telephone. User support resources available on the Trivantis website include a quick tour tutorial, pre-recorded demos, an FAQ section, a Service Center that provides downloadable post-release service and maintenance updates, and a community bulletin board. Documentation can also be downloaded from the website. Trivantis offers several training options including in-house ($495 per person), onsite ($3000 per session), or online ($495 per person) training programs

Prices for Lectora Professional Publishing Suite (support included) range from $2,790 – $3,185 per license (Travantis, 2006). Prices for Lectora Publisher (support included) range from $1,790 – $2,185 per license. The software can be purchased and downloaded from the Trivantis website. A 14-day free trial version of Lectora may download from the Trivantis website.

Macromedia Breeze

Macromedia Breeze, now an Adobe product, can turn Microsoft PowerPoint presentations into interactive multimedia lectures. With Breeze Presenter, an instructor can create PowerPoint presentations with audio, video, animations and simulations and publish it and upload to a Breeze server or course management system (Martinez , 2004). The lectures are converted into Flash format for access via the web. Breeze Live allows instructors to conduct real-time online lectures which are delivered in Macromedia Flash format. Breeze Trainer allows the user to create multimedia training modules using PowerPoint. Breeze Meeting is a web conferencing component that can be used for real-time meetings and seminars. Breeze Events is used to manage user registration, notification and tracking for large online meetings, seminars, or presentations. Breeze integrates with AICC and SCORM standards-based learning management system.

System requirements for the hosted version include Microsoft Windows 98se or later, Mac OS X 10.2 or later, Linux, or Solaris; PowerPoint 2000; a supporting browser (Internet explorer 5.0 or higher, Netscape 7.1, AOL 9, Mozilla); Flash Player 7.0; bandwidth of 56 kb/sec; 600 MHz Intel Pentium III, 128 MB RAM , 100 MB available disk space and screen resolution of 800 x 600 pixels (1024 x 768 or higher is recommended); microphone for audio; and webcam or digital camcorder for video (Macromedia, 2006). Breeze licensed server system requirements include Windows 2000 Server or Windows 2003 Server SP1; Hardware requirements include Pentium 4, 2-GHz processor; 1 GB RAM ; CD-ROM drive; 1 GB of disk space for Breeze installation; a minimum of 80 GB of disk space for content storage; and NTFS file system. Minimum network requirements include 100 MB and port requirements of 1935 (RTMP), 80 or other HTTP port, 443 if SSL is enabled.

Support is available through electronic mail or by telephone using a toll-free number (Macromedia, 2006). User support resources available on the Macromedia Breeze website include online live seminars and tutorials. A Resource and Support Center , located on the website, provides additional support. Users can download Breeze documentation from the website. Annual fees for support and maintenance run 15–20% of the total purchase price.

The starting price range for Macromedia Breeze is $10,000 – $20,000 and is dependent on whether one purchases the hosted version or licenses the enterprise version for hosting on one's own server (Macromedia, 2006). The price is also dependent on the type of software purchased (e.g., Presenter, Meeting, Training,

Events), the number of software licenses purchased, per user fees. In addition, Breeze Meeting can be purchased monthly, or a pay-per-use option is available. Macromedia Breeze offers a free 15-day trial for which one may register on the Macromedia website.

Tegrity Campus

Tegrity Campus allows users to produce full-motion video, audio, and screen-capture lectures, automatically upload them to Blackboard, WebCT or other course management system and archive them for later retrieval (Tegrity, 2006). Every lecture is automatically recorded and posted in the course management system (CMS) or portal. Students can access lectures on-demand through the CMS or download the lectures to their iPods. With Tegrity the instructor can use a tablet PC interface to add dynamic annotations and create interactive lectures that go beyond traditional slideshow presentations (Lindsey, 2003).

Tegrity also markets a digital pen that students can use to write notes that can be retrieved electronically for later review (Roach, 2005). The notes are uploaded to the student's computer using a cradle. This process creates digital notes which are synchronized with the instructor's multimedia presentation. This allows students to the opportunity to replay the lecture while reviewing their synchronized notes. Students can click on any part of their notes and Tegrity will take them to the part of the lecture that corresponds to that section of the notes.

System requirements include minimum 128 MB RAM ; Microsoft Windows 2000 or higher; Microsoft Internet explorer 5.0 or higher; Microsoft Office 2003 or higher; 30 MD available hard disk space; microphone for audio; webcam or digital camcorder for video; and screen resolution of 1024 x 768 pixels.

Support for students, instructors, and administrators is available through electronic mail or by phone using Tegrity's toll-free number. User support resources available on the Tegrity website include numerous tutorials and a frequently asked questions sections for both students and instructors. A user's guide and quick reference guide for students can be downloaded from the Tegrity website.

Pricing for the Tegrity system is based on the number of FTE students. For example, a license for 2000 FTEs currently costs $24 per student annually. Per student prices are lower for more FTEs. The cost of the digital note-taking pen and software for the pen is $99 per student.

Evaluation Criteria

Following are ten suggested criteria to evaluate both desktop-level and enterprise-level MPS solutions. The authors use these criteria to summarize their evaluations of the MPS solutions discussed in this article. Additionally, readers may find these criteria helpful in evaluating other solutions that come to their attention. The criteria and the authors' evaluation of each of the reviewed solutions are found in Table 1.

1. *Ease of use* . Some MPS solutions are transparent to the user. He or she simply invokes the solution before starting the narrated presentation, or from within PowerPoint or other presentation program. Other MPS solutions are less transparent and require user orientation or training.

2. *Service model* . Some MPS solutions are desktop-level authoring systems that produce files that can be uploaded to an LMS or course web-site. Others are enterprise-wide systems invoked through an organization's intranet, and still others are invoked through an APS (application service provider) model.

3. *File formats supported* . Some MPS solutions such as HyperCam produce only one output file format. Others such as Tegrity produce a propriety file format. Still other programs, such as Camtasia Studio, can produce files in a variety of output formats.

4. *Operating system(s) supported for content development* . Some MPS solutions can be used to develop multimedia content on more than one operating system, while others are available for only one operating

system. It is important distinguish the content development platform from the platform used for viewing content, as all the multimedia presentations discussed in this paper are viewable via standard web browsers on multiple operating systems.

5. *Initial costs* . These were evaluated as free, moderate ($1 – $500), or high (more than $500).

6. *Recurring costs* . These were evaluated as above.

7. *Simplicity or complexity of output* . Some programs or program options produce a single integrated output file, such as WMV or EXE, while others produce a folder of multiple separate files with HTML, audio, video, and synchronization files. For enterprise systems, such file proliferation is not a problem, but for desktop systems, file proliferation can create difficulties in uploading files to a server.

8. *Ability to perform post-production editing* . Some programs provide little or no post-production editing capabilities, while others permit substantial opportunity to modify or augment post-production content.

9. *Level of the solution* . Some products are invoked primarily at the desktop level, while others are invoked at the enterprise level.

10. *Form of integration* . Some products integrate easily with institutional LMSs such as Blackboard, WebCT, or others, for example as course modules. Other products integrate adequately via the ability to upload files or folders to a server either as part of a hosted solution, an LMS, or a course web site.

Table 1. Evaluation of MPS solutions

MPS Reviewed	1. Ease of Use	2. Service Model	3. Output Formats	4. OS	5. Initial Costs	6. Recurring Costs	7. Output	8. Editing	9. Level	10. Integration
PowerPoint	Very Easy	Desktop	.ppt, .pps	Win Mac	Free	Free	Simple	Non	Desktop	Internet/ LMS
Media Encoder	Easy	Desktop	Windows Media	Win	Free	None	Simple	None	Desktop	Internet/ LMS
Producer	Very Easy	Desktop	Windows Media	Win	Free	None	Complex	Limited	Desktop	Internet/ LMS
HyperCam	Medium	Desktop	AVI	Win	Moderate	Moderate	Simple	None	Desktop	Internet/ LMS
Camtasia Studio	Medium	Desktop	Various	Win	Moderate to High	Moderate	Simple to Complex	Extensive	Desktop	Internet/ LMS

authorPOINT	Very Easy	Mixed	Various	Win	Moderate	Moderate to High	Simple to Complex	Limited	Desktop	Internet/ LMS
authorLIVE	Easy	Mixed	Various	Win Mac Linux	Moderate	Moderate to High	Simple to Complex	Limited	Mixed	Internet/ LMS
Impatica	Easy	Software Only (Java-based)	Proprietary	Win Mac Linux	Moderate to High	Moderate	Simple to Complex	Limited	Desktop	Internet/ LMS
Lectora	Medium	Mixed	Various	Win	High	High	Simple to Complex	Extensive	Enterprise	Internet/ Proprietary/ LMS
Macromedia Breeze	Medium	Mixed ASP LMS	Flash	Win	High	High	Simple to Complex	Extensive	Enterprise	Internet/ Hosted/ LMS
Tegrity Campus	Easy	ASP (Seat license)	Proprietary	Win	High	High	Complex	None	Enterprise	Internet/ LMS

Conclusion and Recommendations

When deciding between enterprise and desktop solutions, administrators may find the criteria discussed above to be helpful, at least as a starting point. Other factors may be considered as well, including the degree of faculty initiative, the culture of the institution, and the availability or lack of a centralized instructional technology staff. Generally, faculty members who take initiative will experiment with available desktop-level solutions as part of their course preparations. The complexity of having many different desktop solutions makes them difficult to support from an institutional perspective. On the other hand, if the culture of the institution supports it and the faculty members take

less initiative, a centralized enterprise solution may be less complex and easier to administer.

Powerpoint, HyperCam, and Windows Media Encoder are excellent solutions making quick screen-capture videos with audio voice-over for posting on an LMS or a course web site. This is especially true when professional post-production editing can be accomplished by those with the requisite skills and equipment, or when no post-production editing is needed. These programs provide the user the ability to create and easily distribute PowerPoint or screen-capture videos with audio narration. For many instructors, these easy-to-use

and inexpensive (or free) desktop products may be the only MPS solution needed.

For desktop authoring and post-production editing of screen-capture, audio, and video, the moderately-priced Camtasia Studio represents an excellent choice. The audio/video output can be stored in a variety of formats and can be archived via a course web site or an LMS. The post-production editing capabilities are quite impressive for such an inexpensive product, and output files can rival those produced by more expensive solutions. Microsoft Producer is easy to use and free, but unlike Camtasia Studio, produces only limited file output and proliferates output files. Additionally, Producer is heavily tied to the Windows architecture, while Camtasia Studio can easily produce Flash or other cross-platform output files.

Desktop products such as authorPOINT and Impatica offer excellent ease of use, but currently suffer from limited post-production editing capabilities. One significant advantage of Impatica is its ability to perform massive file compression. In addition to the products reviewed in this paper, there are many others available for both the Windows and Mac platforms, and it is hoped that the approach taken by the authors can be extended to evaluating those MPS solutions as well.

In the authors' experience, the functionality of the Tegrity system is fairly limited and the price tag is relatively high compared with less expensive programs. However, the degree of integration with Blackboard, for example, is quite good, and the ease of use is superb. Instructors need to make very few if any adjustments in their teaching approach with Tegrity. The digital notes synchronized with the lecture available through the Tegrity system are an innovation. Thus for administrators seeking a standard enterprise solution requiring minimal investment in training and allowing faculty members considerable flexibility, Tegrity is an excellent choice.

Tegrity and Lectora both integrate well with Blackboard, WebCT, and other LMS, while Macromedia Breeze can also be used as a standalone product with an enterprise-wide hosting solution. As a Flash-based enterprise level system, Macromedia Breeze offers institutions the flexibility of licensing solutions that have limited or no desktop level costs (Rhyne et al., 2005). Breeze supports integration with WebCT and Blackboard, and is a scalable campus-wide solution.

We have described some representative desktop and enterprise MPS solutions for Internet-based courses and have suggested criteria for evaluation of MPS solutions. Neither our list of MPS solutions nor our list of criteria should be considered to be complete, yet it is our belief that these descriptions and criteria will serve as a helpful starting point for administrators considering MPS solutions. Further research would be helpful in determining the relative importance of each criterion and whether additional criteria are needed. Additional research should also be conducted to examine the actual choices made by institutions opting for desktop and enterprise solutions in comparison with our suggested criteria.

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1.Both initial and recurring costs were categorized as free, moderate ($1 – $500), or high (more than $500).

2. PowerPoint is pre-installed on the majority of Windows-based computers.

3. Impatica supports massive file compression (as much as 95%) using its proprietary format.

4. ASP is an abbreviation for application service provider.