Lecture Capture Deployment Models

Tracking Costs for Scalability

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Executive Summary
One of the single most transformative technologies to arrive in higher education – and one of the most popular among learners – lecture capture nonetheless is following the adoption curve seen by many other enterprise technologies. Departments or colleges or entire universities pilot, trial, adopt, expand, find new pedagogical applications, and expand again. Considering the nature of this cycle, and the varying skill sets and levels of resources available within institutions, it is critical that effort is taken to determine the most suitable deployment model for each particular college or university. While there are likely variations, for the purpose of this paper we’ve narrowed the deployment models covered to what we see as the three primary models.

On-premise deployment (also known as “customer premise equipment” or CPE) is the most traditional approach, which involves placing all of the software and hardware required to deliver the solution on the customer’s premises – which, in the case of lecture capture, is on the institution’s campus. The pluses of on premise deployments have to do with control and with operational considerations. Disadvantages have to do with the fact that an institution is paying for its own capital expenditures on technology and management of that technology. It becomes incumbent upon IT to stay on top of usage and operational factors – and ensure that some excess capacities exist to support peak usage.

Cloud-based (also known as Software as a Service, or SaaS) delivery is a newer approach which involves purchasing the application as a service from a vendor that delivers it via the “Cloud,” where it is then accessed over the Internet. The vendor takes care of the significant costs of providing “bullet-proof” uptime by delivering the service through a robust, purpose-built infrastructure. The pluses of a cloud-based approach typically relate to a combination of scalability, management/operational efficiencies and predictable costs. Disadvantages may relate to security concerns, as well as lack of overall control over the delivery of the service.

A third, “hybrid” model combines elements of both the premises-based and Cloud-based models. Typically, the hybrid model has a portion of the service delivered via the cloud, and another portion handled locally. For instance, the service itself may be delivered via the cloud, while content is stored locally. Or there may be equipment such as recording appliances locally that send content to the cloud. The advantages and disadvantages of a hybrid model depend largely on how each portion of the service is delivered, and who is responsible for keeping each portion of the service operational.

Each deployment model has its pros and cons, and every institution of higher education will want to investigate cost of ownership as well as other non-financial considerations in order to determine their best options. A cost of ownership worksheet, designed to consider a three-year ownership cycle, is included in this paper and available online in Excel format as a guideline for assessing the true costs of deployment across the three different models.
The Importance of Lecture Capture to Education

Lecture capture is the first new technology since the notebook and pencil and textbook to allow a learner to be able to review what he or she has been taught. And learners are responding in droves. In a Fall 2010 Tegrity Student Survey of 6,883 college age and adult higher education students, a total of 85% stated that having access to recorded lectures made study somewhat or much more effective than normal. About a third indicated that lecture capture significantly increased their success in the course, and almost 46% indicated that it increased somewhat their success in the course. Finally, almost three quarters (73%) indicated that lecture capture significantly or somewhat improved their grade in the course. Survey results can be downloaded directly from Tegrity at http://tegr.it/y/f2010sur.

The beauty of lecture capture is that it allows learners to revisit and review material and creates a feedback mechanism between instructor and learner. Yet it also turns learners into content creators, in the sense that it can be used for learners to comment on existing content, or to create their own content. Some instructors in fact are beginning to have their students demonstrate how they would solve problems – perhaps putting them in teaching mode – yet another form of content creation. The many capabilities and benefits of lecture capture have progressed and emerged such that it now commands a much larger role – a role which is re-defining how the traditional lecture is becoming virtualized in a way that has much greater relevance to both students and lecturers than the original “one-time” event of the lecture. This makes lecture capture truly transformative, and a tool that will impact the field of education significantly in coming years.

From a dry technology perspective, lecture capture consists of an aggregation of a number of technologies -- such as software systems, storage devices, encoding/transcoding capabilities, microphones, audio systems, and webcams or classroom digital cameras. Many of these have been around individually for a long time – but their combination and integration creates a much larger solution. The net result: the ability to digitally capture, store, and make available the content of a classroom or individual user-generated “event.” Those events can be an entire class session, portions of a session, or an instructor or learner producing their own supplementary learning content – such as tutorials and study guides – in small or large “chunks.” A lecture capture solution offers a platform for capturing audio, video, in-class and after-class and outside-of-class asynchronous interactions, and data such as curricular content and delivering it real-time and (more typically) on demand. Additional features include security as desired by the institution, single sign-on, scheduling, indexing, review capabilities, threaded discussions, and media management (accomplished with varying levels of learning management system integration).

Yet as much as lecture capture is capturing the imagination of campuses, the range of features and capabilities make it imperative that educators, administrators, and information technology professionals understand their deployment options. Decisions about deployment made today can have a lasting impact on success – and on the ability to scale. And with learners increasingly asking for lecture capture, the ability to scale on demand, rapidly, will be increasingly important as well.
Trends in Lecture Capture
Why is this timely as a topic? Wainhouse Research has stated elsewhere that lecture capture is today – and will remain for the foreseeable future – one of the hottest campus technologies for higher education. We have identified certain trends through conversations with colleges and universities – many of whom are clients wrestling with how to scale – which involve the need to address mobility, data, customized learning, and scalability:

• Mobility -- It should come as no surprise that we live in an anytime, anywhere culture. Students own cell phones (75% of teens in the U.S., slightly lower but similar numbers in other developed nations) and they use them. A full 83% of those with cell phones use them to take pictures; about one third use them to share videos. As smart phones and tablets become increasingly pervasive, educational institutions are increasingly being asked to deliver content to or otherwise harness the power of those devices for mobile learning (m-Learning). An entire generation of learners is coming of age even as the platforms arrive for them to become content creators.

• Data – Institutions of higher education are under relentless pressure to prove themselves and their value and continue to serve (and sometimes grow) their student populations. The good news: retention rates are generally improving in most segments of education (other than some for-profit universities). Yet nonetheless, colleges and universities are under pressure to understand and report on outcomes. And other than student response systems, there is no better way than lecture capture for tracking outcomes of a particular technology. In fact, because lecture capture platforms often allow an organization to see meta-data concerning student review behaviors, they make it easy to track grade improvements.

• Personalization – As Wainhouse Research has reported elsewhere, the ability to personalize the learning experience will be increasingly important. Lecture capture enables custom learning environments that cater to the individual student by offering personal context-sensitivity, the ability to draw on the knowledge of peers and instructors, and democratization of the content creation process as learners themselves contribute to or otherwise use lecture capture tools to learn from or teach others. Capabilities like bookmarking lectures and using presence engines to create discussion or feedback loops go a long way in helping an educator and learner be productive and effective.

• The Need for Scalability – No one size fits all approaches to adopting – or expanding lecture capture – so this is why choice of deployment model is important. Every organization scales differently, as successful deployments are based on a combination of best of breed technologies, campus culture, politics, planning & priorities, resources, competencies, and cultural acceptance. How a campus adds lecture capture may also be driven by business models and approaches to paying for the technology. One thing is for certain: because students

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themselves are asking for lecture capture, organizations need a great amount of flexibility as they plan for deployment.

**How Does Lecture Capture Work?**

The following offers a simplified version of how lecture capture works. The reason it is important to outline the process here is that the choice of deployment model may affect the particulars in terms of where certain things occur and how one manage one’s deployment. The following steps are part of the process of deploying lecture capture:

1. Administration. This includes overall goal setting, as well as selection of courses to be captured and which students should have access to them.
2. Platform configuration and deployment. Creation of credentials: create / import user, course (which may be completely automated or which may require manual intervention), and enrollment data (often through integration with an existing LMS), whether or not lectures are “released for review” or just recorded, and who gets access via authentication, determining whether lecture recording is automated or instructor-activated, as well as what will be the compression/encoding bit rates, how learners access content (again often through integration with a campus LMS).
3. Training. Educating faculty and learners concerning how to use the system.
4. In-room (or office) capture of audio, video, and presentation content. While most lecture capture platforms are classroom-based, some (but not all) offer personal recording capabilities for both instructors and learners.
5. Optional editing by instructor. Some platforms provide editing of lectures to enable an instructor to limit that which will be reviewed or otherwise remove extraneous content; some provide editing only of beginnings and endings, and some do not offer editing. Typically choices can be made based on instructor/departmental preferences and system capabilities.
6. After the capture itself – but still part of the “capture” process – encoding and possibly multi-format rendering of classroom content. Also known as media ingestion in technical circles, this step is important in readying multimedia content for access by various devices. Where it occurs may depend on the deployment model.
7. Delivery. This takes place whether streamed live (while also being recorded) or simply delivered from recording content via on demand streaming.
8. Publishing or notification of content. This occurs via web page, RSS, podcast delivery, email, and/or LMS/CMS.
9. Interactivity and collaboration. The more advanced systems provide mechanisms for students to take notes, bookmark sections and post questions to the instructor, provide additional input to the entire class, and start both asynchronous and real-time discussion with others.
10. Finally, further management and monitoring. Outcomes monitoring is invaluable in letting an IT organization understand usage behaviors; an administration understand strengths and weaknesses in a program and where demand may spike and require additional expansion; and an instructor understand how specific learners are doing in a class.
Each deployment model has its own unique requirements to accomplish these tasks, as described in next section, and corollary costs associated with each model.

**Options for Deployment**
Three options for deploying lecture capture solutions have emerged over the past decade, each of which has their own particular set of pros and cons. All three options are illustrated and compared in Figure 1.

**On Premise**
On-premise deployment (also known as “customer premise equipment” or CPE) represents the traditional approach, which involves placing all of the software and hardware required to deliver the solution on the customer’s premises – which, in the case of lecture capture, is on the institution’s campus. This approach typically requires absorbing the capital expense of the equipment and software up front (which requires predicting the required capacity up front), and budgeting for the on-going cost of software maintenance, server administration, and support.
Lecture Capture Deployment Models

Depending on the CPE solution, dedicated hardware appliances may be required in order to capture the content. These appliances are typically installed in each classroom, and they provide flexible connectivity options to capture content, which the appliance then sends to a server located on-premise for encoding. Once the encoding is complete, the fully encoded content is typically sent to a media server for storage and delivery over the campus LAN.

Classroom-based appliances have advantages and disadvantages, and these should be examined as they relate to the specific philosophy and requirements within an institution. Recording appliances offer the advantage of being easy to configure - with a wide variety of connectivity options - since they are dedicated to the task. The fact that they are purpose built typically leads to high reliability, since the OS and hardware are designed to work together to capture content. Disadvantages are that they represent a piece of hardware in each classroom that IT needs to manage, monitor and maintain. Furthermore, as technology advances, they will likely need to be replaced within 3 to 5 years, and that should be taken into consideration when looking at the TCO for a solution. Lastly, placing a recording appliance in every classroom can get expensive, especially for larger schools. If the plan is to scale campus-wide, this should be taken into consideration as well.

Most CPE solutions are server intensive. Servers are used to both encode the recorded content, and store and deliver that content to students. While a few solutions combine these functions in one server, they too require the tasks to be separated once usage scales beyond a certain point in order for performance not to suffer. While CPE solutions offer a high level of control for institutions deploying lecture capture, this is one area where costs should be considered. Especially important are costs related to ongoing management and monitoring of the servers, as these represent a significant percentage of costs over a 3 or 5 year period, depending upon the solution. Lecture capture is a demanding application in terms of the technology infrastructure, since it is dealing with video. As usage grows, it is imperative that the processing and storage resources within the technology infrastructure grow as well. Otherwise, performance will suffer.

For CPE solutions, the servers that encode and store content reside on the institution’s LAN, and keep the network traffic generated by capturing on-campus lectures and by students viewing content on-campus confined to the campus LAN. Therefore, Internet bandwidth is consumed primarily by off-campus students viewing content residing on the server located on-premise. This can be an advantage or disadvantage, depending on the environment. Since data traffic generated by viewing activity is often 50 times higher than the amount of traffic generated by recording activity, bandwidth availability and the location of students become central to the argument here. For a school with excess Internet bandwidth, it isn’t a concern either way. For schools with limited bandwidth, a student population doing most of their viewing on-campus will generate less Internet traffic. For schools with a high percentage of students who are viewing off campus, or that access content on their mobile devices while on the go, having the content reside locally can be a disadvantage, since that content is accessed from the local server over the campus Internet connection.
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The advantages of on premise deployments have to do with control and with operational considerations. From a control perspective:

- With a premises-based deployment, you can “have it your way.” Many of the on-premise solutions offer greater control over how they are deployed.
  - In the lecture capture space, with on premise deployment comes the option of in-class, purpose-built lecture capture appliances. Appliances may be simpler to deploy than PC’s, simply because they are purpose-built and don’t require as much configuration, and are less susceptible to the slings and arrows (viruses and malware) that PC’s face.
- Though most service providers use industry-standard encryption methods, these may not be sufficient for those heavily concerned with data security. Some campuses that must comply with U.S. HIPPAA or other regulatory issues may feel more secure with an on campus deployment.
- Depending on how certain vendors approach the classroom, it is possible that integration with room controllers, podiums, may be more straightforward. (This has nothing to do with CPE per se, but in the lecture capture space, those vendors who do CPE with appliances or integrated podium software may have more out-of-the-box A/V capabilities in the lecture room than are available in a PC configuration.)
- If the majority of local viewing takes place over the campus LAN, the impact on Internet bandwidth is lessened because your students are not accessing a Cloud-based service while on campus.
- You are not as vulnerable to ISP service disruptions and maintain access for your local learners. Similarly, you are less reliant on external Internet connections as recordings can be recorded locally (though most hosted providers offer some way to store recordings locally and upload them later once Internet restored)

The disadvantages of on premise deployments have to do with hardware needs and the need to manage and scale your own infrastructure:

- On-premise deployments are server intensive. With the majority of costs of owning a server being attributed to ongoing management and monitoring, it takes IT resources to keep them operational 24/7/365.
- With an adoption cycle that typically results in continued usage growth, IT must continually monitor available infrastructure resources and bolster them in order to maintain peak performance – especially processing and storage resources.
- If appliances or dedicated hardware is required in each classroom, scaling campus-wide may not be financially viable. Also, additional IT resources must be allocated to managing and maintaining the classroom-based equipment.
- If the campus network goes down, the service is unavailable to off-campus learners in addition to campus-based learners.
- If the campus itself is shut down and there are no off-campus recording capabilities, then the lecture capture service cannot be used for disaster recovery.
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- Off campus bandwidth used for remote/off campus learners; this can drive up your bandwidth requirements if your remote learners are accessing local hosting servers.
- You may need to pay for separate licenses for capture software, media server, and encoding server(s).
- Ongoing software maintenance fees (which are not a factor typically with hosted services providers, though some do charge annual software license fees that include some maintenance costs).

Cloud-Based
Cloud-based (or Software as a Service, aka SaaS) delivery is a newer approach which involves purchasing the application as a service from a vendor that delivers it via the “Cloud,” where it is then accessed over the Internet. The vendor takes care of the significant costs of providing “bullet-proof” uptime by delivering the service through a robust, purpose-built infrastructure that typically includes: carrier-class servers, the redundancy necessary to ensure uptime and data integrity (redundant application servers as well as storage servers) and capabilities such as diesel backup generation in case of power failure. The vendor then sells access to the application as a service, typically charging in a manner that “flattens” out costs as up-front capital investment and other associated deployment costs are eliminated. Cloud-based deployment also eliminates the ongoing costs of software maintenance (typically 15% to 20% of initial software license cost), server administration, and support as the service provider absorbs these costs (or put differently, amortizes them across multiple customer accounts).

Cloud-based lecture capture can be deployed very rapidly, since the infrastructure is already built by the vendor. Furthermore, this infrastructure is purpose-built to deliver high-performance, high-reliability and high-availability, taking tremendous strain off an institution’s IT group to build a comparable infrastructure. Furthermore, the vendor’s cloud-based infrastructure is typically very robust, with built-in application, storage and power redundancies. Building an infrastructure that matches this level of robustness can be an expensive proposition for many institutions that don’t have comparable infrastructures already in place. Furthermore, as technology advances, and new features are offered, the institution benefits without having to perform upgrades to its own servers and associated hardware.

As previously mentioned, the infrastructure to support increased usage must be bolstered to maintain performance. In the case of cloud-based deployment models, that added capacity is usually baked in to the vendor’s cloud-based infrastructure, and is available on-demand. In other words, as usage grows, there isn’t anything the institutions IT organization needs to do from a technology perspective to support the increased usage.

It can be argued that one of the primary advantages of a cloud-based model is that the institutions IT organization can shift the focus to supporting the use of the application in order to drive adoption versus supporting the technology to enable it. The greater the adoption within the institution by instructors and students, the greater the return on investment (ROI), so it stands to reason that shifting resources to activities that drive adoption will increase the overall return that a school receives on their technology investment.
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Whereas many of the CPE-based solutions utilize dedicated appliances, cloud-based solutions rely on computers that are either carried by instructors, or installed in the classroom. There are advantages and disadvantages here, depending on the circumstances. If computers already exist in the classroom, or are already carried by instructors, then the cost of buying dedicated hardware or appliances dedicated to supporting lecture capture is eliminated. Furthermore, dedicated hardware or appliances in CPE-based deployments are often swapped out for new units after 3 to 5 years of use, with 100% of the cost of the replacements attributed to lecture capture. If the lecture capture client is being handled by software running on a computer that is already being used to support classroom presentation and other tasks, then when those units are replaced, only a small percentage of the replacement cost is attributed to lecture capture. It is also a sunk cost, since the computers would likely be replaced anyway, regardless of whether it was supporting lecture capture content recording or not.

Cloud-based solutions are, by nature, very portable. In other words, cloud-based solutions typically have tremendous flexibility in allowing the recording to happen from just about anywhere. Since some of the cloud-based solutions don’t require an Internet connection to capture the recording, we’ve even heard about instructors taking their laptops out in the field and making recordings in remote locations.

A pure cloud-based deployment calls for all network traffic needed to service all users to be routed via the Internet, which may or may not increase the Internet bandwidth required to serve the campus depending on the location of the student population. Also note that the application becomes dependent on the ISP (Internet service provider) that services the campus – if the Internet connection goes down, the access to the application is lost. These days that is less of a concern. On the other hand, because the majority of bandwidth consumption is a result of viewing captured content, campuses with large numbers of off-campus, commuting, or distance learners often find that they save LAN bandwidth and save on their Internet expenses – because the data is trafficked between the cloud-based provider and the off campus learner.

The pluses of the cloud for the most part relate to a combination of scalability, management and operational efficiencies, and predictable costs.

• At the top of the list are high on-demand scalability and the ability to instantly add capacity as usage grows. When utilizing the cloud, one obtains the ability to increase capacity without going through a major hardware/software deployment exercise. Should additional services be needed, e.g., a higher number of learners accommodated, or greater number of lectures captured, the cloud-based vendor is in a position to scale with your organization dynamically.
• Because it is “closer” to its platform, a cloud-based provider can deliver new features more quickly, which removes the need to update premises-based servers or appliances on a regular basis. Often new releases are delivered more frequently, and the cloud-based provider typically has tested out the service prior to opening it up to its users.
• Because it may not utilize local appliances, a hosted provider may be in a position to add classrooms quickly (with the caveat that some A/V equipment is necessary for any lecture capture installation).
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- Similarly, the ability to load manage is important. A cloud-based provider can monitor peak usage, adding capacity as needed far more quickly than can a campus IT organization.
- Cloud-based providers offer fail safe operations, typically creating redundant systems that get triggered in case of system issues, automated backups, etc. Content resides within the provider’s data center – all storage handled off campus with redundant backups.
- Because they have total control over their infrastructure – and the customer’s application is totally dependent on the provider’s reliability – cloud-based providers typically back their uptime performance with guaranteed SLA’s or on a historical basis. Potential customers have the advantage of talking to existing customers about their experiences in terms of uptime, performance, etc.
- Reduced management and maintenance of premises-based servers or classroom-based appliances. While not all management of equipment is eliminated, management tasks are handled by the cloud-based provider, leaving the local IT organization free to focus on other priorities.
- Maintaining a local infrastructure to support the delivery of end-to-end lecture capture requires a high-touch IT group that can handle the mechanics of such a system - which can cost significantly. If no such group exists, or they exist but are resource constrained, then a cloud-based solution eliminates the need.
- No monitoring and upgrading servers, processing resources, storage, etc. as usage scales. Some CPE and hybrid deployments require monitoring to ensure that server processing cores and/or storage are not at capacity – it is the job of the cloud-based provider to handle these issues.
- Security that may be significantly better than some customer-owned data centers. That is a complex question that only your organization and security experts can answer.
- Bandwidth being consumed from provider’s data centers, not the university’s data center. This can be especially important if the organization supports a large number of off-campus learners or expects mobile access, as many organizations might prefer that remote learners not utilize the bandwidth supporting the campus.
- Lower capital expense / overhead costs related to on campus data centers. If a university does have its own data center, it nonetheless reduces costs if it shifts some computing resources offsite.
- Business continuity in case of natural disaster, or campus-based obstacles
- The ability to draw upon hosting provider’s expertise for growing usage– the fact that the hosted provider has access to reports on instructor and learner behaviors means they can easily bring best practices to the fore.

Among the potential downsides of cloud-based deployments are the following:

- Some large university systems are very much under mandate to keep all security within their own hands, in which case cloud-based computing may not be an option.
- Though most service providers use industry-standard encryption methods, these may not be sufficient for those concerned with data security. In addition, some campuses that must comply with U.S. HIPPA or other regulatory issues may require on campus deployment.
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- The cloud requires that you trust your hosted services and Internet services providers to maintain uptime and availability. Many hosted providers can and do store some content locally, which enables you to be sure that captured lectures are properly archived. But in the case of a wide-scale internet outage, access may be limited until the outage is addressed.
- Using a service provider results in the need to manage storage space efficiently. Some providers place limits on the numbers of lectures that remain available, or on the amount of archive space allowed.

Hybrid

A hybrid model attempts to combine the advantages of both models by keeping a (sometimes exclusive, sometimes redundant) local copy of the lecture content on a server located on-campus. Depending on the vendor, the campus-based server is either managed by the customer, or by the vendor (which may or may not also cover the initial expense of the server). If managed by the vendor, then as with the cloud-based model, the on-going cost of software maintenance, server administration, and support of the local server is absorbed by the vendor itself. If the server(s) is managed by the customer, then as with the premise-based model, they bear the responsibility and cost of on-going software maintenance, server administration, and support of that server. In a hybrid model, the application itself, including user administration, typically stays on the ASP’s Cloud-based servers—thus the primary purpose of the on-campus server is to provide local content storage. A hybrid model offers the same potential Internet bandwidth consumption advantages as on-premise deployment—as capturing on-campus lectures and supporting on-campus students are served by the local server on the campus LAN.

The pluses of the hybrid model are, as stated earlier, in its combinational nature, borrowing aspects of both the premises-based and cloud-based worlds—though it is closer overall to the cloud-based world.

When investigating a hybrid solution, the advantages and disadvantages are similar to CPE and cloud-based models for the aspects that are shared. Therefore, it is best to break down the individual aspects of a specific hybrid solution in order to determine its pluses and minuses.

In general, a hybrid deployment model has the following advantages:

- A lecture recording typically uploads to a local storage server or appliance, making local viewing faster, while reducing the impact / dependence on ISP bandwidth when serving campus-based learners.
- The security of placing content within the firewall, essential on some campuses and in fields like healthcare. Some large university systems are very much under mandate to keep all security within their own hands.
- If the local server is managed by the vendor, IT is less involved in management, so it can be on top of other concerns and spend more user-facing time if campus-based servers are being managed by a hosted services provider

In a hybrid deployment model, disadvantages include:
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- As with on-premise based models, any equipment, including capture appliances or servers, must be managed and maintained by the IT organization. Depending on the size and scope of the IT organization, this could also be an advantage.
- If a high percentage of learners are accessing content off campus, or on the go with a mobile device, having the content reside locally can increase Internet bandwidth usage rather than eliminate this by having that traffic route directly to the content in provider’s cloud.

Comparing Costs across Different Models
While the calculator offered later in this paper attempts to put into the reader’s hands the ability to calculate the true costs of deployment across the different models – at the end of the day a decision on what and how to deploy rests on a combination of evaluating the tradeoffs of each deployment model and true costs. Each deployment model has its own pluses and minuses. Historically CPE has been the rule of thumb in IT because technologies were built for local deployment and organizations often chose to be completely in charge of their IT destinies. In recent years – almost in lockstep with bandwidth improvements and faster processor speeds – the attractiveness of letting someone else manage your technology for you – and the notion of cloud-based computing – have grown in popularity. Budget constraints and the resulting IT resource constraints have magnified the attractiveness of the SaaS or cloud-based approach.

The concept of the cloud, popularized by companies like WebEx, Salesforce.com and increasingly Microsoft, is gaining traction in higher education. While heavy adoption of cloud-based services is well documented in the corporate world, higher education has lagged. A decade ago, CPE was the primary model for deploying technology in higher education, but cloud-based applications and cloud-based computing has come on strong in the past few years based on a) the rate of technological change campuses are experiencing; b) the adoption of Google’s Gmail and Google Apps cloud-based applications in education; c) increased availability and adoption of cloud-based LMS platforms in education, as well as accounting and performance management platforms; and d) the acceptance of cloud-based Facebook, Twitter, and other social media platforms.

Some organizations will prefer or have a requirement to manage their own technologies, some to have them managed for them in a “hybrid” fashion with more on-campus physical presence but significant resources placed in the cloud, and some will prefer to shift the management burden fully to the cloud. This section describes the pluses of each deployment model. Note that often the pluses of one become the minuses of the other models.

Pricing Methods
Most vendors only communicate their pricing via custom quotes, as pricing can depend on a variety of complex factors; others are very clear based on specifics that related to their deployment model(s). Often several factors may be at play, which makes pricing much more than a back of the napkin exercise. Following are the most common pricing models.
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Learner full-time equivalency (FTE)-based pricing

When usage is expected across a defined base of users, such as within a school (as in the School of Business), institution or entire system, the FTE-based approach is sometimes the simplest. It is often the most affordable when the institution is expecting to ramp usage quickly across this defined group. It also has the advantage of predictability, since it is a fixed cost. Department, college, or university site license are also typically based on FTE.

Hourly-based pricing

Hourly options, primarily offered via the cloud-based solutions, can be cost-effective – especially if the FTE is high but the institution is planning on ramping up usage over time. Hours-based pricing can be convenient for pilots or other limited rollouts. These plans also offer a great deal of flexibility when the user population does not fit into specific silos, such as within a specific department or school. For example, if an institution has instructors across different departments or schools that wish to use lecture capture in their classes, an hourly plan would allow the institution to easily accommodate this fragmented use, without bearing the cost of a plan that would allow every single user in those departments or schools to access the technology.

Classroom-based pricing

Classroom-based pricing is a good option for an institution that has a specific group of classrooms identified in which they want to install lecture capture. Classroom-based pricing is more common with CPE-based deployment models.

Mix of appliances and software server licenses

This is the most common CPE-based pricing model, with licenses being required for each server doing the encoding, and each appliance deployed in a classroom. It is then up to the institution to continue to scale technology resources, and associated licenses, as usage grows.

Number of concurrent users

Some vendors price based on the amount of concurrent viewing takes place – which may seem clear cut but which may in fact be one of the most limiting approaches to pricing. This is because if you don’t plan properly – and under provision – you may be challenged by your user community if streams become bottlenecked or quality impaired. Yet if you over provision, you may be over paying.

Number of simultaneous encodings

This approach is typically associated with CPE-based deployments and is based on how many simultaneous recordings can take place. As with the number of concurrent users, this can be limiting because if you don’t plan properly – and under provision – you may be challenged by your user community if recordings become bottlenecked in the encoding queue. This would cause delays in the
availability of the content for students. For some solutions, each different format being encoded is counted as a unique encoding. Take the case of a server with four processing cores with associated lecture capture encoding licenses, and three different formats of the same recording being encoded (MPEG-4, MP3 and M4V for example) to support viewing on different platforms and devices. In such a scenario, that one single recording consumes three of the encoding licenses, causing other recordings to quickly backup in the queue.

Other pricing considerations

Some solutions include a license for the media server, while other solutions build the media server function into the service itself. However, some require that the institution provide the media server, which typically adds licensing costs to the overall solution. Keep this in mind when calculating TCO.

Calculating the True Costs of each Deployment Model

Vendors vary in their pricing models, as described above. To accomplish comparisons between apples and oranges, you may need to be certain you have captured every potential cost between vendors who deploy in the same ways (all CPE or all hybrid, for instance) as well as vendors who offer different deployment models. Some of these values may be zero depending on the specific vendor. We recommend calculating total cost of ownership over a three or five-year period using the calculator contained in Table 1 on the next page, which also can be downloaded in Microsoft XLS format at http://www.wainhouse.com/files/papers/wr-lc-tco.xlsx:
## TCO WORKSHEET

<table>
<thead>
<tr>
<th></th>
<th>Cloud</th>
<th>Hybrid</th>
<th>CPE</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Classroom capture</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appliances</td>
<td>$___</td>
<td>$___</td>
<td></td>
<td>Number of rooms / refresh every 3-5 years</td>
</tr>
<tr>
<td>Capture software</td>
<td>$___</td>
<td>$___</td>
<td>$___</td>
<td>Software license fees plus PCs if needed</td>
</tr>
<tr>
<td><strong>Encode/Catalog/Storage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per stream/core encoding license</td>
<td>$___</td>
<td>$___</td>
<td></td>
<td>Only some vendors charge this</td>
</tr>
<tr>
<td>Encoding Server hardware</td>
<td>$___</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Media Server hardware</td>
<td>$___</td>
<td>$___</td>
<td></td>
<td>Fixed cost; watch minimum hardware requirements / refresh every 3-5 years</td>
</tr>
<tr>
<td>Media Server license(s)</td>
<td>$___</td>
<td>$___</td>
<td></td>
<td>(If required; sometimes vendor-included at no charge)</td>
</tr>
<tr>
<td>Disk Space</td>
<td>$___</td>
<td>$___</td>
<td></td>
<td>Length of storage may determine long-term needs</td>
</tr>
<tr>
<td>Storage or Usage Overage</td>
<td>$___</td>
<td></td>
<td>$___</td>
<td>Any charge for exceeding recording and viewing hours</td>
</tr>
<tr>
<td><strong>Distribute/Play</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concurrent viewers</td>
<td>$___</td>
<td>$___</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTEs</td>
<td>$___</td>
<td>$___</td>
<td>$___</td>
<td></td>
</tr>
<tr>
<td>Hourly recording / viewing fees</td>
<td>$___</td>
<td>$___</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bandwidth</td>
<td>$___</td>
<td>$___</td>
<td>$___</td>
<td>Calculate based on where most viewing will take place</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Software Maintenance</td>
<td>$___</td>
<td>$___</td>
<td></td>
<td>Mandatory charge from some vendors</td>
</tr>
<tr>
<td>Solution management</td>
<td>$___</td>
<td>$___</td>
<td>$___</td>
<td></td>
</tr>
<tr>
<td>Internal management / support personnel</td>
<td>$___</td>
<td>$___</td>
<td>$___</td>
<td>CPE and Hybrid may require more IT staff</td>
</tr>
<tr>
<td>Facilities</td>
<td>$___</td>
<td>$___</td>
<td></td>
<td>Data center space, power, power backup systems, cooling, networking equipment, etc</td>
</tr>
<tr>
<td>Vendor-provided Training and Support</td>
<td>$___</td>
<td>$___</td>
<td>$___</td>
<td>Training may be provided for free or online; support may not</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>$___</td>
<td>$___</td>
<td>$___</td>
<td></td>
</tr>
</tbody>
</table>
Lecture Capture Deployment Models

Non-Financial Considerations

Other factors should also be taken into account when considering how to deploy and what it will cost. Broad questions to ask include:

1. Your organization’s character, size, and scope – What is the student population? Are you supporting on campus vs. off campus learners. Are they commuters? What is the geographic area you are trying to serve? How likely are you to need to scale over time? What is the likely pace of change you expect to see over the next few years?

2. How does your organization incorporate / handle new developments in technology?

3. What are your resources in terms of staffing, facilities, and IT competencies?

4. What is the “tenor” or set of attitudes on your campus towards technology, and the impact of the consumerization of education technology? In other words, what are your instructors and learners asking for or expecting?

5. What are your funding mechanisms for lecture capture and how can you appropriately and sensibly plan for today’s and tomorrow’s costs?

6. How “strategic” is lecture capture to your organization? Is it mission critical? Do you want to invest IT staff time to maintaining your lecture capture solution (vs. using IT time for other initiatives)?

Other non-financial considerations to ask relate to your ultimate selection of a deployment model:

- How do instructors in my organization today make content (off-line or online) available to their learners?
- Have we been doing lecture capture via other methods (videotapes, audiotapes) and if so, what did we learn that might apply here?
- Do different instructors have different attitudes about lecture capture – how many different approaches should we offer to accommodate all user needs?
- How much automation do I need to seek?

Answers to these two sets of questions should be viewed in tandem with the calculator and your organization’s strategic plan in determining which deployment model best suits you. Wainhouse Research believes that to truly understand the cost of ownership of lecture capture – and even more important, to truly position your organization for rapid deployment growth – requires nothing more than doing your homework pre-deployment, while still in the planning stages. It is best to do this work up front to save yourself headaches later.

Conclusion

Today’s higher education CIO / CTO understands the need to be forward thinking while watching the bottom line. One way is to focus on adoption and let others handle the heavy lifting. Obviously no one size fits all so the goal is for the calculators to help those considering deployment to gather their own data and go from there.
About the Authors

**Alan D. Greenberg** is Senior Analyst & Partner at Wainhouse Research. He is distance education and e-Learning practice manager at Wainhouse Research, and co-lead analyst on WR's WebMetrics web conferencing survey program. He has conducted research into dozens of distance learning networks and e-learning users, was product marketing manager for a set of turnkey classroom packages, and has led a number of educational and training initiatives. Most recently he authored the three-volume segment report *The Distance Education and e-Learning Landscape* and authored numerous white papers and reports on lecture capture, web conferencing, videoconferencing, and interactive whiteboards as applied for education and e-Learning. He also has consulted to many states, universities, and regional educational consortia on distance education strategies, and received the 2010 Outstanding Leadership by an Individual in the Field of Distance Learning award from the U.S. Distance Learning Association. Alan holds an M.A. from the University of Texas at Austin and a B.A. from Hampshire College. He can be reached at agreenberg@wainhouse.com.

**Andrew H. Nilssen** is a Senior Analyst & Partner at Wainhouse Research, where he is a consultant to rich media conferencing vendors, network infrastructure vendors, end users, government agencies, end users, and venture capitalists. Andy is a co-author of WR's annual three volume series Rich Media Conferencing, the firm's thorough analysis of the conferencing industry and leads the WR web conferencing and IM & Presence practice. Earlier in his career, Andy managed the planning and launching of PictureTel's Venue and Concorde group videoconferencing systems. Andy has 25 years of experience in high-technology product marketing and market research, earned his MBA and BSEE degrees from the University of New Hampshire, and holds two ease-of-use related patents. Andy can be reached at andyn@wainhouse.com.

About Wainhouse Research

Wainhouse Research, [www.wainhouse.com](http://www.wainhouse.com), is an independent market research firm that focuses on critical issues in the Unified Communications and rich media conferencing fields, including applications like distance education. The company conducts multi-client and custom research studies, consults with end users on key implementation issues, publishes white papers and market statistics, and delivers public and private seminars as well as speaker presentations at industry group meetings. Wainhouse Research publishes a variety of reports that cover all aspects of rich media conferencing, and the free newsletter, *The Wainhouse Research Bulletin*.

About Tegrity

**Tegrity Campus** is the only cloud-based Lecture Capture solution proven to improve student achievement, satisfaction, retention and recruitment across an institution. It makes class time available all the time by automatically recording, storing and indexing every class on campus – without the need to install any special hardware or software in classrooms. The company’s patent-pending Search Anything™ and Smart Bookmarks™ features then let students instantly review key class moments online using a PC, Mac, iPod, iPad or other mobile device. For more information, visit [http://www.tegrity.com](http://www.tegrity.com).