Office for Domestic Preparedness
Learning Content Management Overview

I. Introduction

Recently, ODP and consortium members have expressed interest in Content Management and Learning Content Management Systems (CMS and LCMS products), and their potential role in implementing Blended Learning. The purpose of this paper is to respond to this interest by helping to further explain the learning content landscape, the relationship with Learning Management Systems (LMS products), and the potential value of learning content management to ODP and consortium members.

As mentioned in our earlier paper regarding "LMS Best Practices" (dated February 2003), the similarity in terms and overlap in functional areas often causes confusion regarding CMS, LCMS, and LMS products. Although various products blur these lines, it is important to review the primary distinctions that will be most relevant to ODP and training partners. To focus the learning content discussion, there are four Web-based components that warrant review and comparison:

- **Content Management System (CMS):** Enables organizations to create, automate, and manage most types of electronic content. These functions often include repository and search services, configuration management and version control, publishing services, and workflow automation. These products have applicability beyond learning content management, but can be used as part of a learning solution. From a Blended Learning perspective, however, this class of solution is too broad for most ODP and training partner needs. For completeness, a leading CMS product (Documentum) is detailed in Appendix B as comparative example.
- **Learning Content Management System (LCMS):** Provides a multi-developer environment where learning content developers can create, store, reuse, manage and deliver learning content from a central object repository.[1] From a best practice perspective, important LCMS features also include SCORM conformance, Section 508 compliance, test development and management, and XML support. These products more accurately reflect the needs of ODP and consortium members, and are therefore the primary focus of this paper.
- **Learning Management System (LMS):** Facilitates the delivery, management, and tracking of technology-enabled training.[2] A complicating factor when discussing LMS and LCMS products is that a growing number of vendors are combining these capabilities. In fact, several of the LCMS products discussed below offer integrated LMS functionality as well.

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[1] "LCMS Report: Comparative Analysis of Enterprise Learning Content Management Systems", Bryan Chapman, p. 28 (www.brandon-hall.com, 2003).
[2] See the February 2003 paper entitled "LMS Best Practices" for more information on LMS products and functionality.

- **Learning Portal:** A consolidation point for all education and training materials through which both internal and external users access educational and performance support materials. In fact, ODP is currently planning to employ a learning portal "presentation layer" (the First Responder portal) in front of its future learning management systems.

II. Putting it Together – An Example

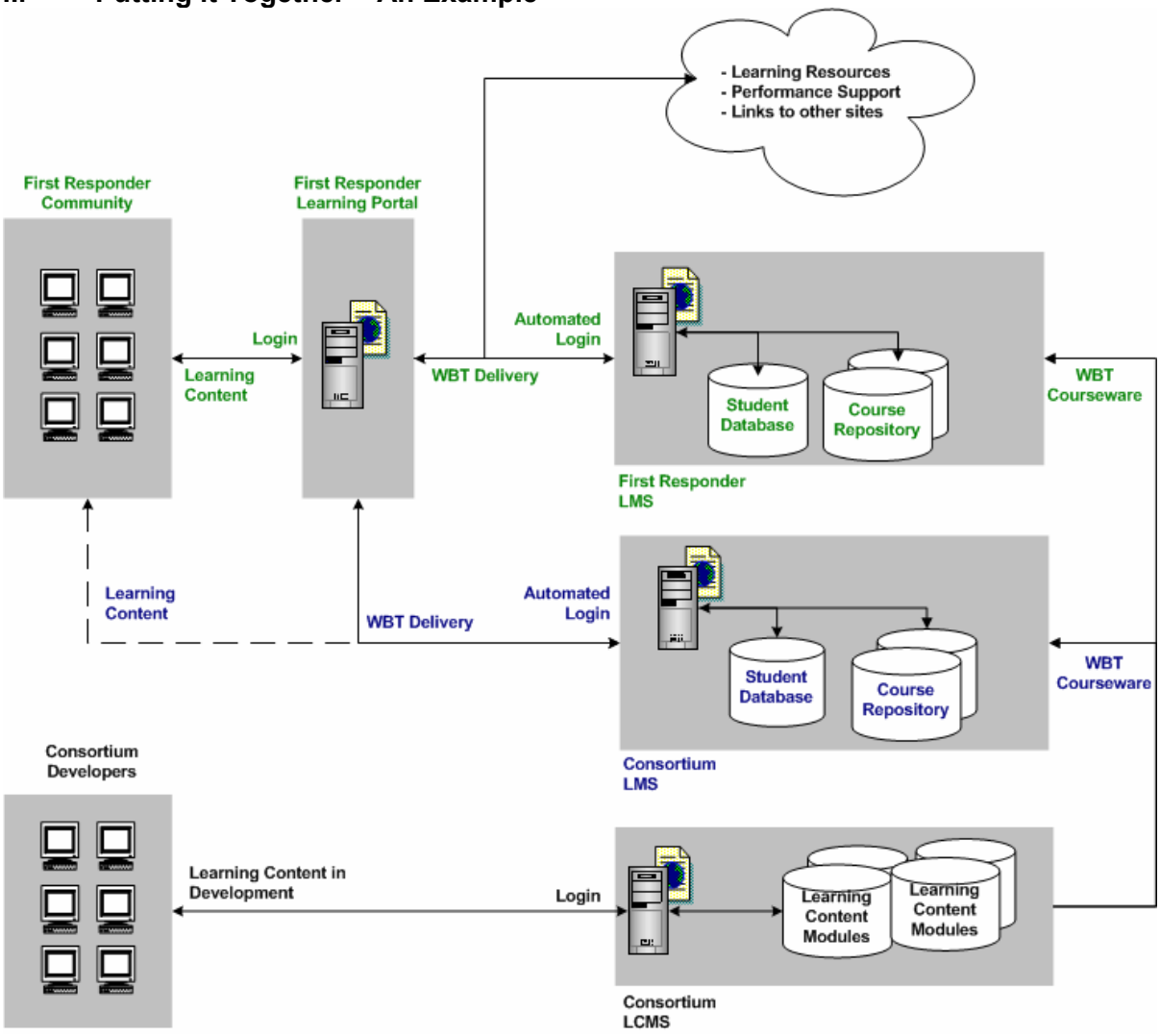

Figure 1: Example Configuration

Figure 1 (page 2) shows an example configuration composed of a First Responder Portal and LMS, a Consortium LMS, and a Consortium LCMS. In this example, First Responders login to a single portal and are then routed to either the First Responder or consortium member LMS to take a Web-based course, or routed to various other Web-based resources. The dotted line shows that First Responders could also have the option of accessing a consortium member LMS directly without first coming through the portal. Figure 1 also shows consortium developers logging into an LCMS to develop learning content collaboratively, and then loading this completed content into either the consortium or First Responder LMS for delivery.

Depending upon individual requirements, of course, the example configuration could be modified in many ways for specific implementations. For example, a consortium member may

have a single product (such as Aspen, discussed later) that performs both LMS and LCMS services. Other consortium members may only wish to develop Web content locally and have it delivered elsewhere. To make such a determination, however, it is important to explore the various aspects and strengths of currently available, commercial-off-the-shelf (COTS) LCMS packages.

III. Learning Content Management Systems

LCMS products provide collaborative content development and the ability to interact with LMS services to deliver content to the LMS that permits the LMS to track student progress. The LMS then orchestrates student scheduling, tracks student progress, and evaluates student performance through the materials. LCMS products achieve this through the integration of SCORM-conformant calls directed to the LMS.

Some LCMS products are able to interact directly with a subset of the commercially-available LMS products to provide additional capabilities. In some cases this connectivity allows for more dynamic editing of the course materials, in others the LCMS provides courseware that better tracks student usage and content. Furthermore, some LCMS solutions include integrated LMS functionality. An LCMS is characterized by the following functions:

- Template-driven, Collaborative Content Development
- Facilitated Content Management (i.e., indexing and reuse)
- Publishing
- Workflow Integration
- Develops materials with an Automated Interface with an LMS through application of SCORM templates

In addition to these functions, some LCMS products provide version control features development teams may find useful. Version control refers to the ability to store and retrieve older versions of course materials, and the ability to permit developers to use external applications to maintain the courseware.

While not considered a “defining” characteristic, some LCMS products support different types of testing and assessment mechanisms within the developed courseware. Course developers incorporate knowledge checks within courseware to reinforce critical points and to assess completion of the stated learning objectives. The ease with which a system allows developers to add these assessment components to a course may be a defining element in the selection process.

One component of some LCMS products that may be less critical is the inclusion of interaction mechanisms directly in the LCMS itself (such as threaded discussion boards, and instant messaging). While interactions are a key part of the e-Learning experience, many LMS products already provide this function to the student. In situations where an LMS does provide this functionality, or one already exists outside of the LMS/LCMS environment (such as an external application or a threaded discussion board), it would be more useful for an LCMS to provide the ability to link to existing interaction mechanisms through the use of templates.

IV. Candidate LCMS profiling

In this section, we describe five example LCMS products that typify the industry. The vendors and products examined are:

- Outstart's Evolution
- Viewpoint's Vuepoint Learning System
- Click2Learn's Aspen
- Docent's Enterprise LCMS
- Avaltus' Jupiter

The following section highlights the salient elements of the LCMS products to show the possible functions and combinations available on the market today. The information was collected from a variety of first-hand sources (including actual product experience and vendor-supplied information), as well as the 2003 Brandon-Hall Report on LCMS products.[3] The specific characteristics addressed for each LCMS are:

- Operating Environments – operating systems and databases supported by the tool.
- Development – development methodologies recommended or supported by the product.
- Output Formats – output formats supported by the tools, including information relative to SCORM conformance and Section 508 compliance.
- Assessments – the supported assessment methods available to developers.
- Interactions – the means of interaction available between instructors and students, and amongst the students.
- Cost – this reflects the estimated cost over time of acquiring, installing and maintaining the LCMS system.
- Company Details – this can be used to determine the stability of the company, and the overall support behind the product.
- Federal Government Customers – indicates whether the vendor of the product has current or prior customers in the Federal Government community.

Outstart's Evolution is a learning management, development, and media distribution platform. Evolution is part of a scalable integrated product family that permits a variety of solutions to a variety of e-learning needs based on existing capabilities, developer expertise, and the size of the student base. A distinguishing strength is its ability to act as a complete LMS/LCMS solution, and to work in cooperation with external LMS products.

Evolution reportedly works with such LMS systems as Saba, LEAP, Docent, THINQ, Pathlore, and KnowledgePlanet. As SCORM is by definition a portable standard, the courseware as presented can be easily migrated to any number of LMS products for use.

[3] "LCMS Report: Comparative Analysis of Enterprise Learning Content Management Systems", Bryan Chapman (www.brandon-hall.com, 2003). Please note, also, that the pricing information provided is based on figures presented in the Brandon-Hall report. These may not accurately reflect appropriate government discounts, and should be used as estimates.

Operating Environment
Evolution can work on both Windows NT systems and Unix Systems, and uses either SQL Server (2000) or Oracle as its underlying database.

Development
Evolution's approach to courseware development includes the use of template-driven formats (overlaying the content on a variety of standard backdrop and operations). Each template is customized for the intended audience and target media, providing the tool with the ability to propagate one set of courseware to many different audiences through multiple media forms. Content re-use is also supported, to allow for rapid updating and course augmentation as required.

Developers can develop courseware through a variety of external applications, and import them through the interface provided. At present, Evolution can import Word documents, HTML, PowerPoint presentations, and XML. The course materials can be incorporated as a single block, or as distinct entities. Evolution also permits developers to modify the output of the tool to external applications such as Word, and have the tool incorporate those changes back into the system for use in the other supported formats.

Output Formats
Evolution generates output in a variety of formats, including Web-based, CD, print, presentation, wireless devices, various file formats or static HTML for off-line delivery. It allows for the creation of these output types natively without re-versioning or multiple versions of the content. It also supports an offline SCORM viewer that allows SCORM 1.2 content to be viewed without the use of an LMS and have student interactions tracked and later e-mailed, printed or uploaded to the server. Although not presently 508 compliant, the slated 2Q 2003 release will reportedly contain this functionality.

While providing this functionality for the static course materials, such flexibility is not found in the managing of the evaluation questions. The tool employs a separate Excel-based template for pre-populating test questions. Developers modify the questions on this template, and the results are merged back within the system.

Types of Questions
The types of questions supported by the tool include:

- Multiple choice (single and multiple correct answers)
- True/False
- Short Answer
- Fill in the blank
- Matching
- Sequence
- Hot-spot (invisible portion of an image that reacts when the mouse moves over the spot)
- Drag and Drop.

Interactions
Evolution includes built-in threaded discussion support. Students may interact with course instructors to ask questions or provide feedback and may also interact with other students.

Cost
Evolution is the lowest priced application for smaller development environments when compared to the others reviewed in this document, and its large scale pricing is one of the highest. Evolution's pricing is laid out according to the number of total users to be supported.

Application Sizing	1 Year Cost	3 Year Cost (Cumulative)
500 Users	$20,600	$26,950
10,000 Users	$220,660	$287,980
25,000 Users	$436,600	$569,800

Company Details
Outstart employs approximately 110 people, with 40 of those in development and 18 in service.

Federal Government Customers
Outstart has prior experience with federal customers, including FAA, INS, US Navy, USDA, Federal Reserve Bank, and the US Air Force.

Viewpoint Learning System (VLS) is a complete learning solution that incorporates a learning management, development, and media distribution platform, that can function either as a complete package or can work with an external LMS. Its native LMS is fully functional, and can support external as well as internally developed course materials.

In environments where an LMS is already available, the content can be provided to other LMS products. VLS also claims full interoperability with some third-party courseware vendors.

Operating Environment
Its operating environment is limited to Windows NT platforms, and uses SQL Server as its supporting database for course information and tracking.

Development
One of the strengths of VLS is that developers do not require much training in order to use the tool. It is readily learned and easily customizable for the needs of each presentation. VLS is one of the easier tools to use in the industry from the novice's perspective, and provides functionality (such as a course wizard) to walk the developer through the steps of the course creation process.

The look and feel of the courses is controlled through the application of templates (customized output forms into which the course materials are inserted). The templates are easily customized, and as delivered, permit the presentation of the course materials in a variety of different media formats.

VLS also comes with a repository viewer, which permits the developer to retrieve older versions of course materials for modification and use.

Like other LCMSs, VLS is able to import files of various formats in order to generate course materials. Microsoft Word and PowerPoint documents are imported and immediately converted to HTML. Once within the system, these can be modified through VLS's client-side application installed on the developer's machine.

Types of Questions

The types of questions supported by the tool include:

- Multiple choice (single and multiple correct answers)
- True/False
- Short Answer
- Fill in the blank
- Free Form (essays requiring instructor review)
- Matching
- Sequence
- Hot-spot (invisible portion of an image)
- Drag and Drop
- Shredder (drag items to the shredder)
- Hotword (click on words/phrases out of paragraph).

Output Formats

VLS provides a variety of output formats for presentation/course materials including Web-based, CD, print, presentation, wireless devices, various file formats or static HTML for off-line delivery. While not as rich a set of outputs as some other LCMS products, the output type supported provide the most commonly used output formats. VLS produces materials that are SCORM conformant with both version 1.1 and 1.2 of the standard. Although not presently Section 508 compliant, the scheduled 2Q 2003 release will reportedly contain this functionality.

Interactions

There are many interaction capabilities within VLS that allow the students to interact both with other students and with the instructor. It supports threaded discussions, email interactions, instant messaging, live chat, Virtual Whiteboard, and Application sharing. An additional feature that is useful in the early stages of course development is the integration of a commenting feature where students can add comments to each of the learning objects.

Cost

VLS is a highest priced application reviewed in the larger environments, but its smaller environment pricing is one of the lowest. VLS's pricing structure is laid out according to the number of users to be supported.

Application Sizing	1 Year Cost	3 Year Cost (Cumulative)
500 Users	$50,000	$120,000
10,000 Users	$280,000	$672,000
25,000 Users	$580,000	$1,392,000

Company Details

Viewpoint employs approximately 50 people, with 16 of those in development and 13 in service.

Federal Government Customers

Vuepoint has no prior experience with federal customers, but has done business with some of the larger commercial organizations, such as America Online, Inc., 3Com, Lexus USA, and Sun Microsystems.

Click2Learn's Aspen product is structured for the larger scale implementations of LCMS products. Its learning content is completely Web-based, and its authoring environment is likewise web based. Aspen has the ability to function both as an LCMS and an LMS, but can operate well with external LMS solutions such as Docent and Saba, and can produce SCORM conformant (Version 1.2) materials for integration with other LMS products.

Operating Environment
Aspen can be configured to run on either Windows NT or Solaris Unix-based servers. It uses either SQL Server (7.0 or 2000) or Oracle (8i).

Development
The developer can create and modify content either through the web-based client, or through the incorporation of a variety of external document formats – (Microsoft Word, Microsoft PowerPoint, and HTML). One of the key features of Aspen is the ability to use its story-boarding application. Storyboarding is the outlining of a course or presentation at a high level, to portray overall topic flow. The tool permits the developers to map things out at an outline level, then to detail the screens as feedback is obtained.

Types of Questions
The types of questions supported by the tool include:

- Multiple choice (single and multiple correct answers)
- True/False
- Short Answer
- Fill in the blank
- Free Form (essays requiring instructor review)
- Matching
- Sequence
- Hot-spot (invisible portion of an image)
- Drag and Drop.

Output Formats
Aspen supports a variety of output formats of presentation/course materials including Web-based, CD, print, presentation, various file formats or static HTML for off-line delivery. It also supports XML export of the presentation materials for incorporation in other tools. Aspen also provides template-based output generation, and provides the means for developers to customize the templates applied based on their requirements. While not as rich a set of output formats as some other LCMS products, most required/optional formats are provided. Aspen produces materials that are SCORM conformant (Version 1.2 of the standard). The current version is 508 compliant, passing tests from both Bobby and Jaws.

Interactions
There are many interaction capabilities within Aspen that allow the students to interact both with other students and with the instructor. It supports threaded discussions, email interactions, instant messaging, live chat, voice-over-IP, Webcasting, Virtual Whiteboard, Application sharing, and the ability to cluster groups of student into workgroups for group study sessions. An additional feature that is useful in the early stages of course development is the integration of a commenting feature where students can add comments to each of the learning objects.

Cost
Aspen is an average priced application when compared with others reviewed in this document in smaller environments, and is one of the cheapest in the larger scaled environments. Aspen's pricing is laid out according to the number of servers and core components to be supported.

Application Sizing	1 Year Cost	3 Year Cost (Cumulative)
500 Users (1 Server, 10 Authors)	$60,000	$80,000
10,000 Users (2 Server, 50 Authors)	$150,000	$200,000
25,000 Users (3 Server, 100 Authors)	$240,000	$320,000

Company Details
Click2Learn employs approximately 232 people, with 55 of those in development and 76 in service.

Federal Government Customers
Click2Learn has prior experience with federal customers, including Army National Guard, Defense Information Systems Agency, Defense Finance and Accounting Service, Defense Security Service, DSHS (WA), Franchise Tax Board, GSA Federal Technology Service, Military Training Services, National Security Agency, Navy & Marine Corp. Intelligence Training Center, US Army Recruiting, US Air Force, US Navy, USDA, US Agency for International Development.

Docent's Enterprise LCMS is an enterprise level LCMS that can operate either with Docent's LMS product, or any other AICC or SCORM conformant LMS. The Docent LCMS is focused primarily on creating, managing, and delivering online content, although a variety of output formats are supported.

Operating Environment
Docent LCMS can be installed in Windows NT platforms (NT 4.0, 2000, XP), as well as a variety of UNIX platforms, including Solaris, AIX, and HPUX. It can function using a wide selection of database servers, including SQL Server, Microsoft Access, IBM DB2, and Oracle as its supporting database for document storage and tracking.

Development
Docent LCMS supports a variety of document formats, including Microsoft Word, Microsoft PowerPoint, and standard HTML documents. The application also provides tool add-ins for such applications as PowerPoint and Dreamweaver to allow developers to access the stored data from within those applications. Docent LCMS also comes with an editor (Docent Outliner) that provides developers the ability to create and structure courseware and assessments for publishing, working in conjunction with any tool that exports HTML.

Look and feel of courseware is controlled through templates, which can be easily customized. It comes also with a repository viewer, which permits the developer to retrieve older versions of course materials for modification and use.

Types of Questions
The types of questions supported by the tool include:
- Multiple choice (single and multiple correct answers)
- True/False
- Short Answer

- Fill in the blank
- Matching
- Sequence
- Hot-spot (invisible portion of an image)
- Drag and Drop.

Output Formats
Docent LCMS supports a wide variety of output formats, including Web content, XML, Microsoft Word and Palm-style computer output for portable viewing. Docent LCMS produces materials that are SCORM conformant (Versions 1.0, 1.1, and 1.2) and AICC compliant without modifications to the templates that come with the application. Docent LCMS is also Section 508 compliant, and has been tested with Bobby and JAWS to confirm compliance.

Interactions
There are no embedded interaction mechanisms built into the Docent LCMS, as they have made these features part of their LMS product.

Cost
Docent's LCMS is the highest priced LCMS at the smaller configurations reviewed in this document, and still in the higher bracket in the larger environments. The costs for Docent LCMS are in the table below:

Application Sizing	1 Year Cost	3 Year Cost (Cumulative)
500 Users	$100,000	$160,000
10,000 Users	$350,000	$560,000
25,000 Users	$400,000	$840,000

Company Details
Docent employs approximately 175 people, including 50 in development and 85 in service for their entire product line.

Federal Government Customers
Docent has worked with federal agencies before, including the US Army, US Mint, US Senate, FBI, FDA, FDIC, Federal Trade Commission, GSA, IRS, and the Library of Congress.

Avaltus' Jupiter is a full-featured LCMS that also requires an external LMS for the management of student registration and tracking. It actively supports integration with such LMS systems as Saba, Sun ELP, Plateau, PeopleSoft, KnowledgePlanet, and Docent. It has also demonstrated an ability to interoperate with other CMS systems, such as Interwoven, Documentum, Artesia, and Convera.
Operating Environment
Jupiter can be installed on a variety of server configurations. Not only does it support Microsoft NT and 2000 Operating Systems, but also a variety of UNIX installations, including Solaris, Linux, and HPUX. It can operate using both SQL Server (7.0) and Oracle (8i) as its supporting database platform.

Development
One thing that distinguishes Jupiter from other packages is the emphasis placed on the representation of course materials in XML. It does accept and interact with other formats, but at

its core Jupiter is an XML based application. The preferred mechanism for adding and modifying materials is through their internal XML-based editor. External documents (e.g. Microsoft Word and PowerPoint) can be imported at the creation phase of a course, but Jupiter only supports "Round trip" editing of Word documents using its XML transformation engine.

Types of Questions

The types of questions supported by the tool include:

- Multiple choice (single and multiple correct answers)
- True/False
- Short Answer
- Fill in the blank
- Matching
- Sequence
- Hot-spot (invisible portion of an image)
- Drag and Drop
- RWD Infopak Software Simulations (third party product)
- E-Sim Rapid Builder Hardware Simulations (third party product).

Output Formats

As with other tools described earlier, Jupiter supports a variety of output formats of the presentation/course materials including Web-based, CD, print (enhanced printed materials), and static presentations. It also supports XML export of the presentation materials for incorporation in other tools. Jupiter also provides template-based output generation, and provides the means for developers to customize the templates to be applied according to their requirements. Jupiter produces materials that are SCORM conformant (Versions 1.1, and 1.2 of the standard). The current version is reported to be Section 508 compliant, although no documentation was available at this writing to indicate what tests were used.

Interactions

Unlike most other LCMSs that have been discussed, Jupiter provides no native interaction ability for student to student and student to teacher interactions. They do however provide the ability to incorporate external interaction mechanisms through the use of Skins or interface template customizations. The skins can point to any number of external communication types.

Cost

Jupiter is about average in cost when compared to the other LCMS products reviewed in this document when in smaller environments, but is one of the highest in the larger scales. The pricing is laid out according to the number of users and developer seats to be supported.

Application Sizing	1 Year Cost	3 Year Cost (Cumulative)
500 Users, 10 developers	$70,500	$90,000
10,000 Users, 50 developers	$235,800	$314,400
25,000 Users, 100 developers	$416,250	$555,000

Company Details
Avaltus employs approximately 10,000 people, with 24 of those in development of Jupiter and 400 in services overall.

Federal Government Customers
Avaltus has worked with federal agencies before, including the Defense Commissary Agency (DeCA), and the U.S. Department of Defense.

V. Comparison of Characteristics

The LCMS applications presented in the previous section are a small sampling of the many on the market today. These were selected for the variety of options they presented, both in function and external systems with which they interact. Below is a table which summarizes the characteristics of each LCMS according to the characteristics described in the prior sections. Note that the selected LCMS products are a representative sample of the available products on the market today. While the selected products are considered some of the market leaders, others may be worthy of consideration in special environments.

Feature	Outstart's Evolution	Vuepoint Learning System	Click2Learn's Aspen	Docent Enterprise LCMS	Avaltus' Jupiter
Operating Environment	NT, Unix SQL Server, Oracle	NT, SQL Server	NT, Solaris UNIX SQL Server, Oracle	NT 4.0, 2000, XP, UNIX Solaris, AIX, HPUX SQL Server, Access, IBM DB2, Oracle	NT 4.0, 2000, UNIX Solaris, Linux, HP/UX SQL Server, Oracle
Development Methods	Importing Word and PowerPoint, Thick Client Internal XML editor	Thick Client editor, Word, PowerPoint Import	Web-based Storyboard development environment, Import of Word, PowerPoint, and HTML	Word, PowerPoint, and HTML Import, Plug-in support for PowerPoint and Dreamweaver, Thick client	Round trip Word, PowerPoint, XML, Import. Editing through internal XML editor
Output Formats	Web-based, CD, print, presentation, wireless devices, static HTML, Word and PowerPoint	Web-based, CD, print, presentation, wireless, static HTML	Web-based, CD, print, presentation, output file, static HTML, XML export	Web-based, XML, Word, static HTML, Word, PowerPoint, AICC	Web-based, CD, print (enhanced)
508 Compliant	Scheduled 2Q 2003	Scheduled 2Q 2003	Compliant	Compliant	Compliant
SCORM Conformant	1.2	1.1, 1.2	1.2	1.0, 1.1, 1.2	1.1,1.2
Assessments	Multiple Choice, True/False, Short Answer, Fill in the Blank, Matching, Sequence, Hot-Spot, Drag and Drop	Multiple Choice, True/False, Short Answer, Fill in the Blank, Free Form, Matching, Sequence, Hot-Spot, Drag and Drop, Shredder, Hotword	Multiple Choice, True/False, Short Answer, Fill in the Blank, Free Form, Matching, Sequence, Hot-Spot, Drag and Drop	Multiple Choice, True/False, Fill in the Blank, Matching, Sequence, Hot-Spot, Drag and Drop	Multiple Choice, True/False, Short Answer, Fill in the Blank, Matching, Sequence, Hot-Spot, Drag and Drop, RWD Infopak Software Simulations, E-Sim, Rapid Builder Hardware Simulations
Interactions	Built in thread support	Threaded Discussion, email, instant messaging, live chat, Virtual Whiteboard, and Application Sharing, Commenting Tool	Threaded Discussion, email, instant messaging, live chat, voice-over-IP, Web casting, Virtual Whiteboard,	None	None

			Application sharing, clusters		
Cost[4] **500: 1yr/3yr** **25K: 1yr/3yr** **100K: 1yr/3yr**	$20,600/26,950 $220,660/$287,980 $436,600/$569,800	$50,000/120,000 $280,000/$672,000 $580,000/$1,392,000	$60,000/$80,000 $150,000/$200,000 $240,000/$320,000	$100,000/$160,000 $350,000/$560,000 $400,000/$840,000	$70,500/$90,000 $235,800/$314,400 $416,250/$555,000
Company Details	110 employees, 40 in development and 18 in service	50 employees, 16 in development, 13 in service	232 employees, 55 in development and 76 in service	175 employees, 50 developers, 85 in service	10000 employees, 24 developers, 400 in service
Federal Customers	FAA, INS, US Navy, USDA, FRB, US Air Force	N/A	National Guard, DISA, DFAS, DSS, DHSH(WA), Franchise Tax Board, GSA, Military Training Services, NSA, Navy & Marine Corp Intelligence Training Center, US Army, US Air Force, US Navy, USDA	US Army, US Mint, US Senate, FBI, FDA, FDIC, FTC, GSA, IRS, Library of Congress	DeCA, US DoD

VI. LCMS Self-Evaluation Questions

With the variety of products and capabilities listed earlier, it is important for organizations to stay focused on their areas of greatest need when considering an LCMS. The following self-evaluation questions are intended to help organizations concentrate on these critical areas:

Do we need an LCMS?

- Are the materials to be used to instruct students?
- Is there a need to add and support questions?
- Is there a need to track the location and status of a user of the materials?
- Is there content that needs to be changed on a frequent basis?
- Do we need to propagate the content to a variety of different formats (print, Web sites, PDAs)?

In most cases, if the answer is yes for at least 2 of the above questions, then an LCMS is probably a suitable fit for the situation. When considering candidate LCMS products, the following questions should help to start the selection process.

LCMS functional considerations:

- Do we need to interact with an existing LMS?
- Do we need the LCMS to provide LMS functionality?
- Are there other LCMS products or CMS products currently installed with which the system needs to integrate?
- How many developers and students do we need to support with this system?
- What content authoring abilities do I need to have within the system?
- What external authoring applications do I need to support?
- Does the system need to be able to track and archive different versions of the materials?

[4] "LCMS Report: Comparative Analysis of Enterprise Learning Content Management Systems", Bryan Chapman (www.brandon-hall.com, 2003). Please note, also, that the pricing information provided is based on figures presented in the Brandon-Hall report. These may not accurately reflect appropriate government discounts, and should be used as estimates.

Architectural considerations:

- Do we need a centralized server, where all assets are maintained at one location?
- Do we need a distributed architecture?
- If a distributed architecture is required, will a single entity control the all the assets and applications?

Environmental Factors:

- What platforms, operating systems, and computing capacity are currently in place within the server environment?
- What databases are presently within the current operational environment?
- What security considerations are there with regard to user logins, trusted domains, and privacy concerns?

Lifecycle Factors:

- How long is the application likely to be used within the organization?
- What kind of support should be expected from the LCMS vendor?

VII. Interpreting the Self-Evaluation

Organizations often have a variety of motivations for acquiring an LCMS:

- Reduce cost of maintenance of training materials
- Reduce the amount of time in producing training materials
- Provide consistent and reusable content
- Provide version control and archiving of many versions of content
- Orchestrating and controlling development from a variety of developers
- Some combination of the above

Based on your responses to the self-evaluation questions, please consider the following guidelines when selecting and implementing an LCMS:

- Similar to an LMS, organizations with technical infrastructure challenges should consider a hosted solution for their LCMS. All of the LCMS products reviewed in this paper are also offered as hosted/ASP (Application Service Provider) solutions.
- Organizations without any e-Learning infrastructure should consider LCMS products that offer LMS capabilities. This may simplify the implementation and operation of the e-Learning infrastructure.
- Check to see that the information provided by your organization's technical representative is supported by the LCMS you select (e.g., server operating system and database).
- Ensure that your organization's courseware development workstations can support the requirements of your selected LCMS. Some require local installation of client/server or "thick clients" that require significant workstation computing power.
- Depending on the complexity and requirements of your organization's technical representative, it may be necessary to maintain their continued support and cooperation throughout the acquisition and implementation process. Your organization's LCMS

solution should be consistent with the architectural, security, and privacy guidelines defined for the enterprise.

VIII. Next Steps

Organizations interested in acquiring an LCMS can use the following steps to guide them through the acquisition process:

1	Identify an internal "champion" for the LCMS effort – an individual responsible for advocating and leading the acquisition and implementation process.
2	Identify interested "stakeholders" of the proposed system and illicit comments and requirements from this group. Such stakeholder communities normally include groups such as instructors, training coordinators, training developers, students, and management.
3	Clearly document organizational requirements and expectations of the new LCMS, and prioritize these elements into "must have" and "nice to have" features.
4	From a business perspective, determine the budget and implementation time frame for the new LCMS.[5] LCMS products range widely in price from roughly $20,000 to $2,000,000 for initial implementation and licensing, with an additional 10% per year for ongoing support and maintenance. Depending upon the product and the size of the project, implementation time frames range from several weeks to several months. During this time, internal staff will be necessary to map business processes, identify user permissions, test, and participate in other configuration tasks. Finally, consider the internal labor that will be necessary to administer the system – anywhere from .5 to roughly 8 full-time equivalents (FTE) annually depending on the size of the project.
5	Work with representative(s) from the IT organization to identify computing platform considerations (e.g., available processing power, supported server and database software, etc.), available connectivity, and all applicable security, accessibility, and privacy requirements.
6	Depending on the results of 1-3 above, the requirements, time frame, and scale of the acquisition may need to be revised. In most instances, this will cause the organization to focus on a smaller, phased implementation that focuses on the truly critical items. For example, the organization may choose to focus solely on WBT delivery and development, and shift competency management and multi-rater assessment to a later time. These revised criteria should be documented and used to develop a "Statement of Work" (SOW) or "Request for Proposal" (RFP) outlining the acquisition requirements. The considerations and "best practices" listed earlier should be used as a basis for developing the SOW/RFP.
7	The SOW/RFP will be used to solicit bids both from product vendors and integrators to address organizational needs. This competitive process will allow the organization to consider various solutions, and may include both COTS and custom products, along with installed or hosted (i.e., ASP) solutions.
8	Use the requirements of the SOW/RFP to score each proposed solution (e.g., based on some combination of completeness, technical accuracy, and cost), and select the best approach. In addition to the products suggested earlier (see page 2), new and alternate

[5] For most government organizations, depending on the size of the procurement, a business justification (i.e., 8a "Cost/Benefit" or "Return on Investment" analysis) is necessary before proceeding further.

	solutions may be available that better fit the organization's specific functional, technical, and budgetary requirements.
9	Work collaboratively with the selected bidder to develop a work plan and implementation schedule to meet the organization's goals and requirements. These plans normally include some period of analysis and configuration, data migration, testing, training, and maintenance and support. Develop a "roll back" plan if the new solution fails to meet the organization's needs.
10	Maintain a release schedule for updates, patches, and other improvements for the system. It is important to revisit and re-prioritize requirements throughout the useful life of the system.

While not a comprehensive and exhaustive list, these steps should form the basis of an organization's LCMS acquisition process.

APPENDIX A – CMS Product Example

The Glossary contains definitions for terms used throughout the document.

Term	Definition
CMS	Content Management System
LCMS	Learning Content Management System
Natively	Included as part of the standard package or application.
SCORM	Shareable Content Object Reference Model (SCORM) is a suite of technical standards that enable web-based learning systems to find, import, share, reuse, and export learning content in a standardized way.
SCORM Template	A template applied by an LCMS when generating output. In this case, a SCORM Template is a template that contains the calls to a LMS indicating the progress of the student within the course materials
XML	Extensible Markup Language (XML) is a simple, very flexible text format derived from SGML (ISO 8879). Originally designed to meet the challenges of large-scale electronic publishing, XML is also playing an increasingly important role in the exchange of a wide variety of data on the Web and elsewhere.
508 Compliant	In 1998, Congress amended the Rehabilitation Act to require Federal agencies to make their electronic and information technology accessible to people with disabilities. Inaccessible technology interferes with an individual's ability to obtain and use information quickly and easily. Section 508 was part of an amendment to the Rehabilitation Act requiring Federal Agencies to eliminate barriers in information technology, to make available new opportunities for people with disabilities, and to encourage development of technologies that will help achieve these goals. The law applies to all Federal agencies when they develop, procure, maintain, or use electronic and information technology. Under Section 508 (29 U.S.C. ‘ 794d), agencies must give disabled employees and members of the public access to information that is comparable to the access available to others.

APPENDIX B – CMS Product Example

This section contains a review of the Documentum 5 enterprise CMS application. The application is a "best of breed" in the CMS world, and has been implemented as part of larger e-Learning solutions in many environments.

Documentum is an enterprise level CMS that supports a broad range of document and information formats. As a CMS, it does not have an internal LMS, nor does it natively interact with them. However most LCMS products have the ability to exchange information with these servers, and there are some initiatives to connect this application to industry standard LMS products (such as Plateau).

Operating Environment
Documentum can be installed in both Windows NT platforms, as well as a variety of Unix platforms, including Solaris, AIX, and HPUX. It can function using a wide selection of database servers, including SQL Server, Sybase, IBM DB2, and Oracle as its supporting database for document storage and tracking.

Development
Documentum supports a variety of document formats, including Microsoft Word, Microsoft PowerPoint, Macromedia Dreamweaver and Homesite, Ektron eWebEditPro, Corel XMetaL, and Arbortext Epic. There is also an internal XML based editor included with the tool that allows both developers and educational professionals the ability to modify the presentations.

Look and feel of the courses is controlled through templates, and these templates can be easily customized.[6] It comes also with a repository viewer, which permits the developer to retrieve older versions of course materials for modification and use.

Types of Questions
Documentum does not support question presentation and resolution in its current form

Output Formats
Documentum supports a wide variety of output formats, including Web content, XML, and rich media such as audio, video, and images. Documentum is not able to produce materials that are SCORM conformant without modifications to the templates that come with the application. Documentum 5 is Section 508 compliant.

Interactions
There are many interaction capabilities within VLS that allow the students to interact both with other students and with the instructor. It supports threaded discussions, email interactions, instant messaging, live chat, Virtual Whiteboard, and Application sharing. An additional feature that is useful in the early stages of course development is the integration of a commenting feature where students can add comments to each of the learning objects.

Company Details
Documentum employs approximately 1100 people.

[6] It is possible that portions of the SCORM functionality can be incorporated through the use of templates.

Government Customers

US Army, US Mint, US Senate, FBI, FDA, FDIC, Federal Trade Commission, GSA, IRS, Library of Congress