Principles of Multimedia News Systems for Business Applications

Ioan I. ANDONE
Alexandru Ioan Cuza University of Iasi,
Faculty of Economics and Business Administration
iandone@uaic.ro

In the past few years considerable demand for business oriented multimedia information systems has developed. A multimedia information system is one that can create, import, integrate, store, retrieve, edit, and delete two or more types of media materials in digital form, such as audio, image, full-motion video, and text information. Multimedia information systems play a central role in many business activities. They represent a very special class complex computing systems. This paper surveys a special type of multimedia information systems: multimedia news systems. Multimedia news systems deal with architectures to manage complex multimedia news databases, online presentation and distribution services or the integration of several existing services to meta-services using intelligent news retrieval engines. The leading presentation platform in multimedia news presentation is news networks providing television services and Internet content distribution. The primary focus is on advanced multimedia news systems infrastructure, document standards, application architecture and principles for multimedia news on the Web that suggest long-term trends in this increasingly important area.
Keywords*: multimedia, information systems, business applications.*

1 Introduction

From business perspective, the demand for networked consumer systems and devices is large and growing rapidly. At home, in a car, at work or at play, Internet users want transparent internetworking and permanent connection to services, providing them entertainment, information, and communication. [3]

News professionals like journalists or opinion leaders in leading roles of companies and organizations request news as essential part of their business life. Digital media as a commonly available data type for news applications brings challenges for computing infrastructure and solution architectures. While many corporate uses of digital media can be handled with current infrastructure, multimedia news systems require more than simple capacity improvements for multimedia contents.

The news community is researching for solutions like high level semantic analysis, management of mixed-type information, and distribution and presentation of multimedia data to satisfy requirements by business scenarios. Modern news networks, news syndication services, and media observation and international news exchange networks are following the customers' needs and provide specific services within the multimedia news application domain. The leading presentation platform in multimedia news presentation is clearly news networks providing Television services and Internet content distribution. Considering the language and geographical restrictions of TV, Internet-based services are in the main focus of multimedia news systems at present and in the future.[3]

The most-used presentation platform for multimedia news herein is the World Wide Web, providing all facets of news aggregation, manipulation, and dissemination. Multimedia news services are facing multiple challenges in storing, providing, and distributing high volume data contents. Competing news providers manage voluminous textual databases, image repositories and multimedia databases. Most appropriate server cluster technology and storage networks handle the data and application management for highly available and scalable multimedia systems. Modern

Internet protocols like HTTP for web-based presentation of text and images, and streaming protocols such as RTSP for audio and video streaming cover the distribution and presentation services of multimedia news systems.

Besides the technical enabling of news presentation and distribution, legal and commercial constraints contribute challenges to the news application area and the main business players within this area. Recently, besides customer oriented access restrictions and modern billing systems, multimedia news are enriched with up-to-date encrypting mechanisms. Especially for audio and video formats, the time constraints in encoding and decoding live streams have introduced challenges which are met by modern approaches such as encryption and watermarking for copyrighted MPEG. [3]

Data security is vital for multimedia commerce and for multimedia applications; light weight encryption algorithms are attractive and appropriate. Common network problems and known issues like bandwidth restrictions at end user sites and peak loads at certain times of the day in news distributions are handled via appropriate network topologies (strategically located service caches) and server side caching of frequently retrieved news data.

We will see in this paper a special type of multimedia information systems: multimedia news systems. The primary focus is on advanced multimedia news systems infrastructure, document standards, application architecture's n-layer approach, and principles for multimedia news that suggest long-term trends in this increasingly important area.

2 Document Standards

The International Press and Telecommunication Council (IPTC), has been developing new formats and standards to capture data and meta-information on news, following the specific needs and requirements of the multimedia news industry. Although most significant information in the news area is stored in traditional text files, the information management in the news context has been modernized and adopted towards a unique set of contents within international cooperation work. The IPTC was established in 1965 by a group of news organizations including the Alliance Européenne des Agences de Presse, ANPA (now NAA), FIEJ (now WAN) and the North American News Agencies (a joint committee of Associated Press, Canadian Press and United Press International) to safeguard the telecommunications interests of the World's Press. [9]

Lately IPTC's activities have primarily focused on developing and publishing Industry Standards for the interchange of news data. Since the development of XML the work on meta-data management has been seriously improved and the IPTC has developed two specific formats for online news management: NITF (News Industry Text Format, current Version 3.2), and NewsML.

NITF uses the extensible Markup Language to define the content and structure of news articles. Because metadata is applied throughout the news content, NITF documents are far more searchable and useful than HTML pages.

The IPTC started to work on an XML-based standard to represent and manage news throughout its entire lifecycle, including production, interchange, and consumer use in 1999. Following requirements definitions, specifications and development, NewsML 1.0 was approved by IPTC in October 2000.

The latest work of IPTC experts focuses on version 2 of NewsML, which provides metadata management for any type of news contents. NewsML can be applied at all stages in the (electronic) news lifecycle. It would be used in and between editorial systems, between news agencies and their customers, between publishers and news aggregators, and between news service providers and end users. Because it is intended for use in electronic production, delivery and archiving it does not include specific provision for traditional paper-based publishing, though formats intended for this

purpose – such as the News Industry Text Format (NITF) can be accommodated.
Similarly it is not primarily intended for use in editing news content, though it may be used as a basis for systems doing this. Multimedia content types such as image formats, audio- and video files are integrated with appropriate markup and description elements in the NewsML language. The need for NewsML came from the continuing growth in production, use and re-use of news throughout the world, with rapid expansion of the Internet being a strong driving force. The IPTC not only provides news exchange formats to the news industry but also creates and maintains sets of topics to be assigned as metadata values to news objects in NewsML or NITF, like text, photographs, graphics, audio- and video files and streams. This allows for a consistent coding of news metadata over the course of time – thus making these sets the IPTC NewsCodes.
Modern multimedia services integrate content types of text, images, audio data and streams and current video formats such as MPEG2, MPEG4, MPEG7 and multimedia broadcasting technologies and initiatives like MHP and DVB for providing future interactive digital news access via television, internet and mobile devices. [6]

3 The application architecture

The application architecture provides a model for developers to create a flexible and reusable multimedia news system. By breaking up an application into layers, developers only have to modify or add a specific layer, rather than have to rewrite the entire application over, if they decide to change technologies or scale up. In the term "N-layer," "N" implies any number -- like 2-layer, or 4-layer; basically, any number of distinct layers used in modern multimedia news system's architecture. Application architectures are part of Layer 7 of the OSI model (Figure 1).

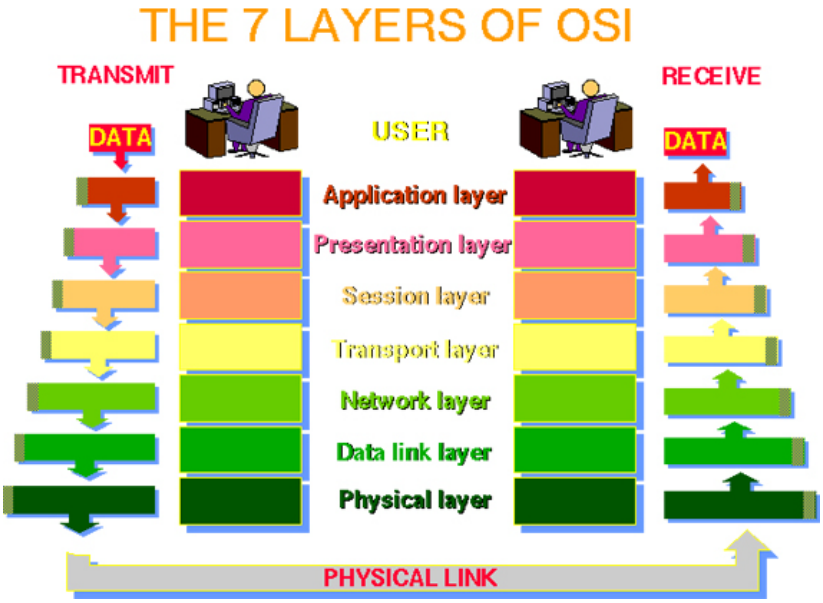

Fig. 1. The Layers of OSI (**O**pen **S**ystem **I**nterconnection) application architecture [12]

Robert Chartier [2] has proposed a very interesting schema of application architecture named *N-Tier Approach,* conceived after OSI application architecture (Figure 2). Sure, the terms "tier" and "layer" are used synonymously.

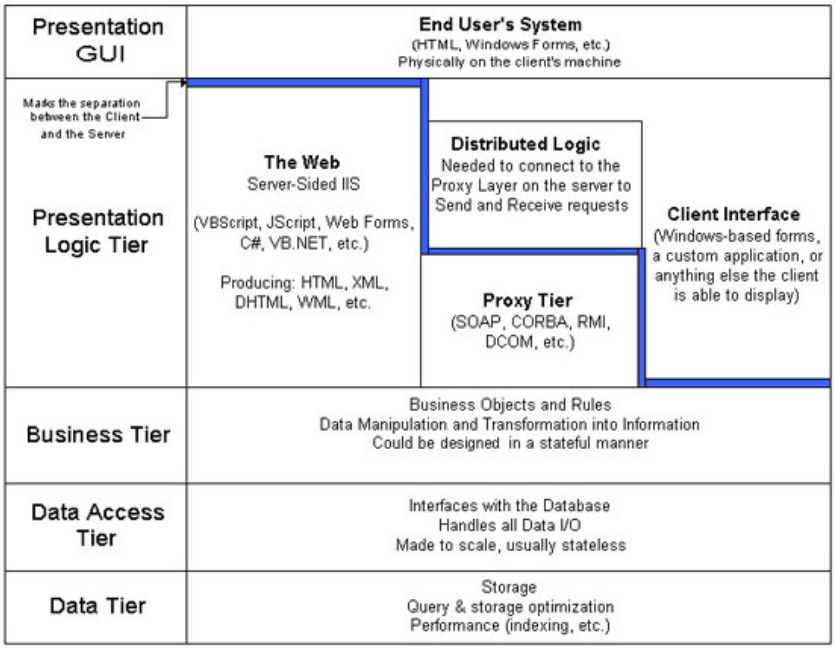

Fig. 2. Chartier's N-Tier model [2]

3.1 The Data Link Tier

The Data link tier is usually an essential part. Developing a multimedia news system without a data layer is possible, but for most applications the data layer should exist. So what is this layer? Basically, it is your Database Management System (DBMS) -- SQL Server, Access, Oracle, MySql, plain text (or binary) files, whatever you like. This layer can be as complex and comprehensive as high-end products such as SQL Server and Oracle, which do include the things like query optimization, indexing, etc., all the way down to the simplistic plain text files (and the engine to read and search these files). Some more well-known formats of structured, plain text files include CSV, XML, etc.. Notice how this layer is only intended to deal with the storage and retrieval of information. It doesn't care about how you plan on manipulating or delivering this data. This also should include your stored procedures. Do not place business logic in here, no matter how tempting (Figure 2).

3.2 The Presentation Layer

Let's see to the Presentation Tier in Figure 2. This layer consists of our standard ASP documents, Windows forms, etc. This is the tier that provides an interface for the end user into your application. That is, it works with the results/output of the Business Layer to handle the transformation into something usable and readable by the end user. It has come to my attention that most applications have been developed for the Web with this layer talking directly to the Data Access Layer and not even implementing the Business layer. Sometimes the Business Layer is not kept separated from the other two layers. Some applications are not consistent with the separation of these layers, and it's important that they are kept separate. A lot of developers will simply throw some SQL in their ASP (using ADO), connect to their database, get the record set, and loop in their ASP to output the result. This is usually a very bad idea. I will discuss why later.

3.3 The Proxy Tier and the Distributed Logic

"Proxy" by definition is "a person [object] authorized to act for another". [13] This "object," in the context, is referring to any sort of code that is performing the actions for something else (the client). The key part of this definition is "act for another." The Proxy Layer is "acting" on behalf of the Distributed Logic layer (or end-user's requests) to provide access to the next tier, the Business Tier. Why would anyone ever need this? This facilitates our need for distributed

computing. Basically it comes down to you choosing some standard method of communication between these two entities. That is, "how can the client talk to the remote server?" This is where we find the need for the Simple Object Access Protocol (SOAP). SOAP is a very simple method for doing this. Without too many details, SOAP could be considered a standard (protocol) for accessing remote objects. It provides a way in which to have two machines "talking" or "communicating" with each other. (Common Object Request Broker Architecture [CORBA], Remote Method Invocation [RMI], Distributed Component Object Model [DCOM], SOAP, etc., all basically serve the same function.) [4]

3.4 The Client Interface

In the Figure 2 we notice that the end-user presentation (Windows forms, etc.) is connected directly to the Business Tier. A good example of this would be the applications over the Local Area Network (LAN). This is the typical, non-distributed, client-server application. Also notice that it extends over and on top of the Distributed Logic layer. This is intended to demonstrate how you could use SOAP (or some other type of distributed-computing messaging protocol) on the client to communicate with the server and have those requests be transformed into something readable and usable for the end user. [4]

3.5 The Business Tier

This is basically where the brains of the application reside; it contains things like the business rules, data manipulation, etc. For example, if you're creating a search engine and you want to rate/weight each matching item based on some custom criteria (say a quality rating and number of times a keyword was found in the result), place this logic at this layer. This layer does NOT know anything about HTML, nor does it output it. It does NOT care about ADO or SQL, and it shouldn't have any code to access the database or the like. Those tasks are assigned to each corresponding layer above or below it. We must gain a very basic understanding of Object-Oriented Programming (OOP) at this time. To clarify, let's look at an example, such as a shopping cart application. Think in terms of basic objects. We create an object to represent each product for sale. This Product object has the standard property getters and setters: *getSize*, *getColor*, *setSize*, *setColor*, etc. It is a super simple implementation of any generic product. Internally, it only knows how to return information (getters) and understands how it can validate the data you pump into it (only for its limited use). It is self-contained (encapsulation). The key here is to encapsulate all the logic related to the generic product within this object. If you ask it to "getPrice," it will return the price of the single item it represents. Also if you instruct it to "validate" or "save," it has the brains to be able to handle this, return any errors, etc.

We can plug this Product object into another object, a "Cart" object. This cart can contain and handle many Product objects. It also has getters and setters, but obviously on a more global scale. You can do something like "for each product in myCart", and enumerate (loop through) each product within. Now, when you call "getPrice" for the Cart object, it knows that it must enumerate each product that it has, add up the price for each, and return that single total. When we fire the "saveCart" method, it will loop for each "product" and call its "saveProduct" method, which will then hit the Data Access Tier objects and methods to persist itself over to the Data Tier.

We could also take our simple Product object, and plug it into our "Sale" object. This Sale object contains all of the items that are available for a particular sale. And the Sale object can be used for things like representing all the items on sale at a given outlet or the like. I'm sure you are beginning to understand the advantage of using an OOP environment. [2]

3.6 Data Access Tier

This layer is where you will write some generic methods to interface with your data. For example, we will write a method for

creating and opening a Connection object (internal), and another for creating and using a Command object, along with a stored procedure (with or without a return value), etc. It will also have some specific methods, such as "saveProduct," so that when the Product object calls it with the appropriate data, it can persist it to the Data Tier. This Data Layer, obviously, contains no data business rules or data manipulation/transformation logic. It is merely a reusable interface to the database.

4 Principles for multimedia news on the Web

Interactive multimedia features can be challenging for users: Where do I have to click? How do I stop and restart this animation? What navigation options do I have? Multimedia content producers should take a look at their work from a user's perspective.

How do users interact with interactive multimedia infographics? How do they scan, browse, read and interpret them? And what do these experiences mean for journalists and designers producing multimodal news presentations for the Web? [14]

Our research findings produced practical hints on how to create better interactive graphics, bearing in mind users' expectations, behavior and reception strategies. These are five principles that producers and journalists should seek to follow:

Principle 1: *Avoid an information overload*

Combinations of text and visualizations always risk providing more information than users can cognitively process in an organized way. But producers are tempted to put as much of their material as possible into a single feature: extensive photo galleries, timelines with full agency reporting on the different stages of an event, multilayer maps, eye witnesses reports in picture and audio. From a user perspective, interacting with such a packed multimedia feature means solving various tasks, often simultaneously: 1) Finding, understanding and interacting with the navigation options (including internal links inside the feature), 2) Getting an overview on every page and an orientation of the user's actual position inside the feature, 3) Interpreting information from various presentation modes (text, graphic, photo and animation) and integrating them into a coherent mental representation.

This bundle of tasks -- some of them operational, some of them content-orientated -- is often more than the user can handle. Sometimes users won't find all of the navigation options. Or they ignore parts of the content. And sometimes the overload can lead to irritation, disorientation and finally to a drop-out.

Principle 2: *Have users' expectations concerning interaction functionality in mind*

Users tend to interpret any salient graphical element as clickable. That presents a problem for producers and designers, who may want to decorate or fill space. In text-dominated forms the standards for hyperlinks are widely accepted: Links are underlined or in a different color or both. But standards are still developing for interactive graphics. Currently, links can hide behind every element: Buttons, legends, keys, points on a map, words. Many producers try to establish consistency by using similar marks for clickable points and standardized navigation systems. This helps users, especially frequent ones. Nevertheless, the only way many users explore interactive graphics is with an extensive trial and error mouse excursion.

Principle 3: *Be careful using animation*

Animation tends to attract (or distract) users. Blinking, flashing or fading arrows, dots and circles are guaranteed magnets for attention and clicks. If there is text competing with animation, the text will lose. Animation will also raise expectations of functionality, as in the example below. Producers should make sure that users do not click in vain on elements with animation. Give users functionality. When using animation it also might seem necessary to add some explanatory text or legends. But users can have trouble integrating that information when an infinite animation loop is grabbing attention. It can be helpful to let users start

and restart the animation, which leads to the next principle.

Principle 4: *Let users fully control the interaction*

If using video, audio or animation, give users clearly marked buttons to start, stop and restart. When using online media, users are not in a lean-back position as when watching TV or listening to the radio. Interactivity and non-linearity are characteristics of Web-based media that users expect. Be careful with automatically starting multimedia or audio sequences. Anyone who has ever been surprised by an unexpected video or sound when entering a website knows the experience of frantically searching for the off button, or just leaving the page by clicking the browser's back button. Users, of course, have the same experience. So producers should clearly mark when a click starts an animation, video or sound, *and* clearly mark how to stop. Giving users control over their interaction requires a navigation system that allows orientation within the graphic. That includes a clearly marked "home" button. Users tend to see Flash graphics as an independent website, regardless of whether the images are integrated in a page or are separate in a pop-up window.

Principle 5: *Involve users in designing and testing your graphics*

It's the usability, stupid. Ask a sample of typical users to click through the graphic and to comment spontaneously on it. Watch carefully, ask for their navigation strategies and expectations, take notes. Even with just three or four users testing the site, you will find elements that are unexpectedly problematic for users. This simplified think-aloud test and other methods from usability testing have proved useful for evaluating interactive and multimedia presentations -- and for identifying user needs. Why is a user-oriented perspective helpful? Newspaper design and presentation have been ingrained by decades of use. But design standards for online news sites have changed in just a few years. Users and producers have developed expectations about positions of home buttons, navigation bars and link labeling. Interactive graphics are still in an early stage of this evolution. Integrating animations, text and audio in a user-controlled system is still a challenge, especially when it comes to telling a coherent, navigable news story. And technology is evolving fast: the shift to broadband access allows producers to integrate heavier multimedia content and to create new forms of presentation. Although the interactive news business is still experimenting with that, standards are rising. Our analysis of the interactive produced by the leading news sites found some trends: these sites have set up their own standards for interactive news presentation. They tend to differ between the sites, but not that much. Top navigation bars are widely used sometimes combined with a browser-like linear back-and-forth navigation.

5 Conclusion

Today, multimedia business applications on the Internet are still in evolution. There is incredible market for the business person savvy enough to tap into it. This new systems has its own rules, requirements, and specifications. It offers possibilities no other media offers, interactivity being one of them. Implementing the Internet in business has its own administrative demands. It must be integrated to existing company policies and marketing strategies and must be managed efficiently for it to be profitable. Finding your way through the numerous services, software offers, hardware options and so on is not always easy since much of the information is found in numerous places and is very technical. Added to that, there are several myths that make the Internet appear intimidating. In addition, the security aspect is crucial, both for businesses and customers. All these dimensions bring new challenges to integrating the Internet into regular business operations and taking full advantage of what it has to offer. The specialized comprehensive guides that provide a step-by-step method to managers who want to implement and use these new systems to bring their companies into the future, are very important. It is geared towards

managers of all levels who want to take full advantage of the potential the Internet has to offer. We hope that our research will be relevant for them.

References

[1] M.C. Angelides, *Handbook of Internet and Multimedia Systems and Applications*, CRC Press, 1998.

[2] R. Chartier, *Application Architecture*: *An N-Tier Approach - Part 1***,** Available at: http://www.15seconds.com/issue/011023.htm, 15.07.2009.

[3] *Multimedia News Systems Infrastructure*, Available at: http://encyclopedia.jrank.org/articles/pages/6824/Multimedia-News Systems-Infrastructure.html#ixzz0OxcS2KaM, 10.07.2009.

[4] A. Messina, M. Montagnuolo, "A Generalised Cross-Modal Clustering Method Applied to Multimedia News Semantic Indexing and Retrieval," *Proceedings of International World Wide Web Conference (IW3C2), WWW 2009,* April 20–24, 2009, Madrid, Spain, Available at: http://www2009.org/proceedings/pdf/p321.pdf, 05.08,2009.

[5] A. Puri, *Multimedia Systems, Standards, and Networks*, CRC Press, 2000.

[6] K. Terplan, *Web-based Systems and Network Management*, CRC Press Online, 1999.

[7] http://www.merriam-webster.com/dictionary/Tier, 15.08.2009.

[8] *The Dubai Mall unveils retail world's most sophisticated multimedia systems*, http://www.thedubaimall.com/en/news/media-centre/news-section/the-dubai-mall-unveils-retail-worlds-most-sophisticated-multimedia-systems.html, 7.08.2009.

[9] *Document Standards in Multimedia News Systems*, http://encyclopedia.jrank.org/articles/pages/6730/Document-Standards-in-Multimedia-News-Systems.html, 9.07.2009.

[10] *Multimedia News Release*, http://www.highbeam.com/doc/1G1-131622917.html.

[11] *Intelligent Building Solutions for Enterprise Mobility*, http://www.highbeam. com/ doc/1G1-94037690.html, 10.08.2009.

[12] *OSI Layers***,** http://www.webopedia.com/quick_ref/OSI_Layers.asp, 12.07.2009.

[13] http://www.m-w.com/cgi-bin/dictionary?Proxy, 5.07.2009.

[14] http://www.ojr.org/ojr/stories/050915schumacher/, 23.07.2009.

Ioan I. ANDONE is a professor of Business Intelligent Systems at the Faculty of Economics and Business Administration, The "Alexandru Ioan Cuza" University of Iasi, Romania. His current research deals with Information Systems, Use of Intelligent Technologies in Business, Accounting, Auditing, and Knowledge Management. He is interested also in understanding both the design and implementation of multimedia new systems in different business settings. He has published 34 books and over 170 articles or book chapters on business information systems, accounting, knowledge technologies and business modeling. He is the PhD supervisor on Accounting Information Systems at the "Alexandru Ioan Cuza" University.