Designing and Developing in a low-bandwidth environment using high-bandwidth solutions: the "hybrid" approach

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Abstract: This paper describes the challenge faced by our development team, of producing a full-featured, computer-based product that would use all possible interactivity tools and tracking systems, to implement effective New Employee Orientation in our agency. The program would make use of video clips and animated characters, but there were serious bandwidth constraints put on the delivery phase of the project.

Under these circumstances, the development team decided to try a "hybrid" approach, by which critical contents that needed to be updated often were placed on a web server, and media that was more permanent in nature, like video clips and sound files, were copied onto a CD-Rom to be sent to future users.

This lengthy and complex process proved to give the best results, and the final product displayed optimum performance with minimum bandwidth usage, providing at the same time the best option for easy and fast content update.

This paper includes a description of the initial situation, an account of the different possibilities explored, and a discussion of the solution developed.

Introduction

This paper describes the design, development and implementation of a computer-based training system to deliver new employee orientation in a state government agency, with potential target users disseminated all over the state, as well as in other states in the nation. A description of the initial situation will be provided, together with an account of the different possibilities explored. Finally, the best solution arrived at will be discussed.

The problem

New employees hired by this government agency were required to go through a new employee orientation process, to get acquainted with procedures, policies, and the philosophy of the agency. The usual way this requirement was met, was by delivering a complete stand-up, instructor-led intensive NEO (New Employee Orientation) program.

Given the fact that not all individuals would be hired at the same time and, equally important, at the same place, NEOs had to be scheduled taking into account the agency's budget:

instructors had to be flown to different offices all over the state, and new employees had to be send from smaller offices to the main ones where classes would be held. In this scenario, some new employees would only have a chance of attending their NEO months, or even years, after they had been hired. The problem was even worse with new hires that worked in offices outside the state.

Possible approaches

Different possibilities offered by new communications technologies were explored, to determine a cost effective, bandwidth-sensible solution, to offer CBT (Computer-based Training) as an alternative solution to the NEO need.

The first solution researched was the design, development, and implementation of an online, web-based NEO program, so that new employees would go through the process of learning about the organization, its philosophy, and its policies, directly from their desktops.

Advantages of this approach were:

- The information would be available to each employee at all times, so that they would go through the NEO experience at their own convenience.
- The content of the NEO program could be revised, updated, and changed very easily, so that new hires would always have the most recent version available to them.
- All kinds of personal and performance data could be collected by the system, to be subsequently recorded by registrar.

Disadvantages of this approach were:

- NEO, in its instructor-led version, made intensive use of video clips that were considered an important part of the orientation process. These videos, even using a streaming tool like Real Media or Media Player, would have a negative impact on bandwidth performance.
- NEO, in its computer-based version, would be designed using MS Agent animated characters as friendly hosts and guides, in order to try to make up for the lack of the human-human interaction that characterizes instructor-led courses. Animated characters, with recorded audio files as their voices, would also pose bandwidth problems for our users.

The second solution researched was the design, development, and deployment of a CD-Rom based NEO program, using Authorware, so that new employees would receive, in their first day in the agency, an NEO package containing print materials, together with a CD-Rom, which they would use in their computers to go through the different modules of the computer-based version of the new employee orientation.

Advantages of this approach were:

- Bandwidth-intensive media, like video clips, voice, and sounds, could reside on an external storage medium (a CD-Rom), so that speed and performance of that media would depend on CD player speed, rather that on bandwidth limitations.

- Personal and performance data could still be captured by the system, using an Authorware TMS tool to send data back and forth between the computer-based program and a database residing on the agency's server.

A main disadvantages of this approach was:

- CD-Roms are, pretty much like print material, a permanent storage medium. This means that once recorded, CD-Roms could not be updated as webpages could. In those circumstances, whenever information contained in the computer-based NEO would change, the whole recording and delivery process would have to be repeated, and older CD-Roms would have to be discarded.

Toward the final solution:

At this point, an objective and thorough analysis of all areas and components of the computer-based NEO project allowed the development team to draw the following conclusions:

a) None of the two solutions researched met all the requirements needed for the implementation of this project, i.e. a low-bandwidth solution deployed in an efficient way, with low-cost maintenance and update of materials.
b) Both solutions, however, had their advantages, that would have made them an excellent option for this project, had it not been for the disadvantages.

In order to combine the best options available, while at the same time producing a solution that would pay attention to both the needs of the target audience and the limitations of bandwidth availability, a "hybrid" approach was followed, and successfully implemented.

The hybrid solution that would be used to develop the computer-based NEO program made use of the following tools:

- Macromedia Authorware as the design platform.
- Web Packager as the packaging tool.
- Authorware Web Player as the interface between content and users.
- A web browser as part of the implementation tools.
- A CD-Rom as part of the delivery media.

The solution is called a "hybrid" one, basically because it is a combination of the different tools and storage media mentioned above, so that content is delivered in different ways and from different sources, according to how bandwidth intensive they are.

The process started at the design phase, where content analysis, and objective specification processes were performed. These tasks were performed based both on current instructor-led materials, as well as on the results of a survey administered to key informants,

where topics to be included in NEO had been identified. Also, video clips used in the instructor-led version of NEO were analyzed, and those considered essential for the program were kept and integrated into the content of each module. Finally, two MS Agent characters were identified as the most suitable for this specific program: Merlin, who would act as the general presenter of this NEO, and Peedy, who would guide the user through some of the modules. Scripts were written for both animated characters, so that their lines complemented the content of each lesson.

This design phase was followed by the development of module interface, layout, and navigation system, using Authorware. These processes were completed taking into account that the "hybrid" approach would require uncluttered, "clean" screens that would be gradually and steadily sent over a network. This meant that each screen had to be as least graphic intensive as possible, but at the same time it had to be appealing enough to keep users interested.

During this phase also, those video clips identified as necessary by the content analysis process carried out during the design stage, were digitally treated and converted to .mpg files.

At the same time, the whole script that both Merlin and Peedy would follow was recorded in a studio, and those analogue tapes were digitally treated to convert them to .wav files. Later on, the same files were treated with MS Linguistic Information Sound Editing Tool (LISET), to improve synchronization between lip movement and voice. This process transformed sound files into their final .lwv format.

All video clips in .mpg format, and all sound files in .lwv format, were then placed on a CD-Rom, where they would be found by the NEO program when required by one of the modules.

During this development stage, an Authorware knowledge object called "Find CD Drive" was used, so that the NEO program would identify the CD drive on the local computer. Once this drive was identified, a variable containing that information would be stored by the program, and used as the path for all video and sound files.

In this way, each time a user reached a screen that required a video clip or a sound file to be played, the path to the video clip or sound would contain the variable mentioned above, and the program would go to the local CD drive and look for a CD-Rom containing that media.

This seemingly simple process, gave the development team the main advantage this hybrid approach would provide: wherever the main program were, or whatever its final format was, the media files could be played from a local CD drive, bypassing the network completely.

However, this would not address the issue of content update. Namely, what would the advantage of playing media from a CD-Rom be, if the main program were still shipped on a CD-Rom, which would become obsolete as soon as the content changed?

In order to address that issue, a further step needed to be taken at the development stage. Once the main program produced with Authorware was ready, it had to be packaged for the web. This was performed using Web Packager, a tool that comes with Authorware.

The package-for-the-web process started by taking the .a5p file produced by Authorware, and turning that into an .a5r file, by packaging it without runtime. Once the .a5r file was created, Web Packager was used to virtually "chop down", or "slice" the whole file into very small pieces with an .aas extension. The main, or "index" file had an .aam extension, and an .html file was created to complement the set of necessary files.

This whole process now gave the development team another perspective: now they had a web page (the .html file created by Web Packager), placed on a web server and accessible through a network (either intranet or internet) that, when opened, would call the web (or hybrid) version of the NEO program, and recreate the exact content, layout, functionality, and navigation system the program would have in its .exe version on a CD-Rom.

Now, for this program to be played through a web page, the browser utilized had to have the Authorware Web Player plug-in installed. Once this plug-in was installed on the browser, it would be activated immediately when the page opened.

Finally, after all this work, and almost magically, the NEO program was now able to play through a network (either intranet or internet), with all the capabilities, functionalities, and flexibility that Authorware offered. Whenever drag-and-drops, text entry, and feedback capabilities were needed, the hybrid version of the NEO program would do it equally well as its CD-Rom based counterpart. At the same time, whenever video or audio were required, the hybrid version of NEO, playing from the web, would detect the local drive and would play the media from that location immediately.

The last part of this process would be the delivery phase, which would consist in sending each new employee a student package containing print material, as well as a job aid an the CD-Rom. The job aid would tell them how to run the CD-Rom, which would install MS Agent, the animated characters Merlin and Peedy, and the Authorware Web Player plug-in on their systems. The same CD-Rom would contain all the media (video clips and sound files) necessary for the NEO program to run properly. The job aid would also include the URL of the website users would access to start the NEO program.

By having contents on one central point (the web server), the development team had now the possibility of quickly updating contents in Authorware, repackaging that module for the web, and uploading that to the web server. Both bandwidth requirements and ease of content update needs could now be completely fulfilled.

Conclusion

Our development team was faced with the challenge of producing a full-featured product that would use all possible interactivity tools and tracking systems, to provide an acceptable solution to the agency in order to implement effective New Employee Orientation. The prospects of using online learning tools for this projects were not good, due to bandwidth constraints,

which made it impossible to use the video clips and animated characters that were considered a very important and necessary part of the NEO program

The development team, after a detailed analysis of the situation and of the tools available, decided to try a "hybrid" approach, by which contents that were more likely to change often were placed on a web server, where users would access them, and media that was not likely to change at all, like video clips and sound files, were copied onto a CD-Rom that would eventually be sent to prospective users.

This approach, although complex and lengthy, proved to give the best results, with optimum program performance, minimum bandwidth usage, and the best option for easy and fast content update.

Bibliography

Bradshaw, J. (Ed.) (1997). *Software Agents*. Cambridge, MA: MIT Press.

Cassell J. (2000). *Embodied Conversational Agents*. Cambridge, MA: MIT Press.

Jennings, N., Sycara, K., & Wooldridge, M. (1998). A Roadmap of Agent Research and Development. *Autonomous Agents and Multi-Agent Systems*, 1, 275–306

Kellogg, O. (1998). Authorware 5 Attain Authorized. Berkeley, CA: Macromedia Press.

Microsoft Corp. (1999). *Microsoft Agent Software Development*. Redmond, VA: Microsoft Press.

Sloman, A., & Poli, A. (1995). SIM_AGENT: A toolkit for exploring agent designs. In *Intelligent Agents Vol II* (ATAL-95), Eds. Mike Wooldridge, Joerg Mueller, Milind Tambe, Springer-Verlag pp 392–407.