CERIAS

:: An Object-Oriented Multimedia System for Delivering K-12 Information Security Curriculum

:: Project Overview

Educational research has shown that the use of multiple sensory stimuli facilitates and extends the information processing ability of learners with a variety of learning styles; in addition, dual-encoding theory posits that multiple representations are more effective for purposes of long-term retention (Smith and Ragan, 1999). Specifically, the use of video is effective for addressing attitudinal change and allows humanization of seemingly abstract and impersonal topics such as information security. These factors, along with practical concerns such as sustainability and efficiency, highlight the utility of interactive multimedia as an ideal tool for end-user training and awareness initiatives. For the K-12 audience who may have little or no experience with the topic, engaging and exciting the prospective learner is the key to changing behavior.

Unfortunately, despite the great benefit to the user, the burden of creating interactive multimedia materials can be both time consuming and costly. Using an object-oriented design approach to both the system and the educational materials, these costs can be reduced over time. Object-oriented systems allow for reusability of multimedia components and coding such as exercises, screen layouts, and graphics. Ideally, once a learning object is created it can be reused or repurposed to a particular audience. The system created for CERIAS's K-12 initiative takes advantage of benefits of both interactive multimedia and object-oriented design. Using Macromedia Flash and XML in an object-oriented design, the K-12 Information Security Modules deliver multimedia lessons to the user using predefined XML instructions created by an instructor. The system, graphics, and exercises used in the module can be reused or repurposed allowing the instructor to extend an existing lesson plan when new topics arise or even tailor the system to a particular audience easily and quickly.

Iconography

The icons used to represent the current modules were created by a Computer Graphics Technology 411 groups. CGT 411 groups participate in semester long projects sponsored by outside businesses, Purdue organizations, or Purdue Faculty/Staff. The icons shown are part of a library of icons illustrating information security principles. Currently, each icon represents one of the modules in the application. These icons are consistently positioned in the top left side of the applications designated module content area for the entire length of the module. The icons allow the user to see a graphical representation of the concept and remind them that each lesson they take in the module is related to that concept.

Icons created by:
Brad Kennedy, Bryan Foss, Bobbi Henderson, and Jason Norman

:: Adaptation and Extension
Fast Module Deployment with Flexibility

The use of XML (eXtensible Markup Language) allows for quick extension and adaptation of the system. XML itself is highly extensible. New tags can be created as needed, so standard naming conventions like modules, objectives, and lessons can be used to define content. In the CERIAS system these tags are predefined in templates used to create modules. So to add a new lesson to a module one might type:

```
<lessons>
    <content media="video"path="CONTENT\INTRO\VIDEO\INTRO01.FLV"/>
</lessons>
```

The Flash application, using predefined settings, interprets this XML and displays the desired video with the module at whatever point in the module it is requested. There are certain rules to XML to which the instructor must adhere. These rules are few and easy to understand. There are also many free tools such as Architag's X-Ray2 XML editor that enforce XML rules and can aid the instructor in the module creation process. In addition to adding modules, objectives, and lessons, the color of module layout components, text, instructions, and much more can all be controlled using predefined XML tags.

:: User Benefits
Self-paced Multimedia Lessons with Simple Navigation

The user benefits in many ways from the use of Macromedia Flash and XML in this system. Since educational "objects" can be tailored, updated, and replaced without sacrificing the integrity of the larger module, the instructor can make the "objects" more engaging and the information more pertinent to the user. Exercises included in this system can be repurposed and offer the user opportunities to practice and test concepts, principles, and skills. The system's navigation has been simplified and can be controlled by two buttons that allow the user to move forward and backward through the module. Additional navigation is provided for moving through objectives or selecting a different module, but that navigation is secondary and its use is not required to complete the module. Modules are color-coded and identified by a logo in the top left side of the content areas. Along with objective and lesson titles for each objective and lesson counters the user is always kept aware of what area they are in and how far they have progressed.

In addition to the benefits of the actual modules themselves, the whole system can be deployed via the web or standard storage media; the application runs independently from CD requiring no additional software or installation. The user simply navigates to the application start file and dbl-clicks to begin.

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