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TENOR Follow-On

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Abstract

This paper describes **TENOR** - the Training and Education Network On Request training system developed by the Ontar Corporation- and the advances that have been made since the original TENOR paper was presented at ITEC 2001. TENOR is a multi-media, adaptive training system, where the content and rate of presentation is paced by the capabilities and requirements of the user. Ontar has a demonstration of the system running on an intranet, and will arrange for users to gain access to the dialup network.

The web is an ideal media for providing an adaptive training environment where the material presented to every individual is generated "on-the-fly" and is tailored to the individual's particular needs and capabilities. The entire United States Department of Defense community is actively engaged in distance learning, and all the US military services are making a commitment to it. This also holds true for a growing number of commercial and academic institutions worldwide. The TENOR software advanced distributed learning (ADL) system has several primary advantages over other systems, including: platform and training material flexibility, levels of expertise, customization, an intelligent interface, and lesson updates. Using server-based software, database driven lessons and the decoupling of content and presentation allows TENOR to achieve its objectives and provide superior training and tracking of student progress. The TENOR system has two basic parts, a relational database and a server-based program to access the databases and build the lessons. By utilizing a series of database tables to store both knowledge and formattting information, TENOR is able to provide several advantages over the "hard-coding" of lesson presentation and material.

This paper will examine the details of the system architecture and its database fields, the lessons and modules developed, customization abilities, and unique features such as cross-platform use, links to real-time information, audio capabilities, student-instructor interaction options, and automatic bandwidth adjustments. It will also illustrate how a student will access, logon, and progress through a lesson.

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14. ABSTRACT
This paper describes the Training and Education Network On Request (TENOR), a training system developed by Ontar Corporation, and the advances that have been made since the original TENOR paper was presented at ITEC 2001. TENOR is a multi-media, adaptive training system, where the content and rate of presentation is paced by the capabilities and requirements of the user. Ontar demonstrated the system running on an intranet, and arranged for users to gain access to the dialup network. The web is an ideal media for providing an adaptive training environment where the material presented to every individual is generated "on the fly" and is tailored to the individual's particular needs and capabilities. The entire United States Department of Defense community is actively engaged in distance learning, and all the US military services are making a commitment to it. This paper examines the details of the system architecture and its database fields, the lessons and modules developed, customization abilities, and unique features such as cross-platform use, links to real-time information, audio capabilities, student-instructor interaction options, and automatic bandwidth adjustments. It will also illustrate how a student will access, logon, and progress through a lesson.

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Background

The Ontar Corporation has an architecture and prototype software that implements a unique solution for the training of force protector teams for the US Air Force, using advanced distributed learning (ADL) techniques. This solution is called TENOR, which stands for the Training and Education Network On Request. TENOR uses a unique approach to implementing training over the internet to provide anytime-anywhere training on desktop, laptop or notebook computers and Personal Digital Assistants such as the Palm Pilot and Handspring units. TENOR is a multi-media, adaptive training system in which the content and rate of presentation are paced by the capabilities and requirements of the user.

One year ago, a paper was presented at this meeting, describing the initial goals and basic capabilities of TENOR. To briefly recap, TENOR was developed address the needs of US Air Force force protector teams. These teams are comprised of individuals differing in competency skill levels in the fields of medicine, intelligence, communication and security, and the team members generally originate from different geographical locations and different units with varied operational mission and experience levels. The teams members likely are unfamiliar not only with each other, but also with the details of the deployment location and the tasks to be performed. These troops, however, must be provided with the maximum training and protection available, and often at short notice. To keep within cost and time constraints, training must be accomplished in new and efficient ways. Recent trends and requirements favor accomplishing this training via advanced distributed learning, or ADL, methods. Current web-based ADL is not taking advantage of the many features and benefits of the unique web environment. TENOR is designed to utilize the enormous capabilities of the web and handheld, wireless computers to solve training issues for the military and other organizations that require timely dissemination of information and resolution of problems from remote locations.

Ontar has a demonstration of the TENOR system running on an intranet, and will be happy to arrange for interested parties to gain access to the dialup network.

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ADL for Training

The web is an ideal media for providing an adaptive training environment where the material presented to every individual is generated "on-the-fly" and is tailored to their particular needs and capabilities. The entire US Department of Defense community is actively engaged in distance learning. For example, at the Air Force Command and Staff College at Maxwell Air Force Base, Alabama, over half the trainees are "off site." Similar numbers are reported by most of the United States military's training organizations. All the US military services, and many of those worldwide, are making a commitment to distance learning. Military officials believe ADL will augment recruiting and retention efforts and help develop a more educated, informed and techno-savvy military.

ADL is also becoming an important component of civilian academic institutions. One recent report finds that 7 in 10 US colleges now offer some form of online learning, including courses, lecture notes, and online study groups. That number is increasing daily. Many institutions are also offering two- and four-year degrees entirely via computer. Commercial firms are also increasing their use of ADL for training and other distributed learning tasks. The TENOR software ADL system developed has several primary advantages over other methods of ADL previously developed. They include:

platform flexibility, which allows TENOR to support multiple platforms by simultaneously formatting the training material for different browser systems, ranging from "traditional" desktop computers to Personal Digital Assistants such as the Palm and Windows PocketPC;

trainee level of expertise, which enables the material presented to the trainee to be created "on the fly." Consequently, the lesson is easily tailored in real time to accommodate the capabilities of the individual trainee;

trainee customization, means the system is customized to the individual trainee throughout his DoD career. As the individual advances, changes jobs, etc., the system tracks the trainee's requirements for future training needs;

training material, which is decoupled form the system as much as possible via an intelligent interface. The experts who implement the training material can easily compose their lessons using text based, audio or video material from a remote site without any need to know or understand the structure of the training material database;

Lesson updates, in which the training material is easily updated via the interface and database structure, and finally,

Flexibility of training material. The TENOR system can accommodate any type of training material, including engineering, maintenance, medical, weapon handling, etc. An expert in any area can interact with the system via the web and create training material for any kind of application.

TENOR achieves its objectives using three general concepts. First, is the server based software. The server hosts the ADL software on a single server, operated and maintained by the training provider. Students connect to this server using standard Internet browser software, which simplifies student requirements. Use of a server provides security and flexibility in the development and updating of training material. The lessons are created in HTML, a widely used standard. In addition, the lessons provide support for generating Javascript language scripts, which adds considerable flexibility and capability to the presentation of lesson material.

Database driven lessons – TENOR defines an architecture where the material that makes up each lesson is stored in a series of database tables. Lesson material is stored in a knowledge database that can consist of text, graphics, or multimedia elements. Additional database tables define the layout of each lesson screen. The lesson screens are generated by the server software when requested, so instead of a static set of lesson material, the screens are dynamic and thus easily updated. Fields are provided to assign bandwidth requirements and expertise level information to each element, which the software can use to customize lesson presentations for each student's ability, requirements, and browser platform.

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Decoupling of content and presentation – a unique advantage of the TENOR architecture is that lesson content and presentation are maintained in separate database tables. This allows lesson displays to be customized to match the limitations of platforms of interest (such as small PDA screens), and also lets multimedia elements be supported on more capable systems. The lesson content creator can provide unique versions for every platform, or a single default version that runs on all platforms.

The Force Protection training module is supposed to provide relevant information for Force Protection personnel about to deploy to a foreign location. The training can be accessed from any computer connected either into the Internet or into an internal DoD server. This allows the training to be accomplished rapidly and efficiently.

The Force Protection module developed in Phase I consists of 1 module with 10 topics, encompassing about 60 screens. There are 4 overview lessons that first must be completed by the student. These lessons provide general instruction that help the students know more about themselves and how they might interact with other members of a Force Protection team. The lessons are summarized briefly below.

AOR Model of Learning – this lesson discusses the way that students learn from experience. It provides a useful review of how the student must pay attention to the lessons of experience, both in this training and throughout life.

Knowing Oneself – this lesson provides access to some personality tests and lets

the student discover what kind of person he is, and how he is likely to interact with others. Since an important component of Force Protection involves human interaction (with other members of the team, as well as with the local authorities and population), this helps the student understand personal strengths and weaknesses when going into this job.

Air Force Core Values – this lesson provides a summary of Air Force Core values. Since Force Protection personnel are likely to come in contact with representatives of foreign countries as well as news media operations, it is valuable to review Air Force core values so that on these potentially visible missions, personnel can conduct themselves in a manner consistent with Air Force standards.

Humanitarian Interventions – this lesson provides an overview of non-governmental organizations that get involved in providing humanitarian assistance abroad. Many Force Protection missions are expected to occur in tandem with humanitarian efforts by these organizations, which may or may not be coordinated with the US government. After completing this lesson Force Protection personnel will be aware of the various organizations, as well as their sponsors and agendas.

After completion of these mandatory top level lessons the student can then select the country or area where the Force Protection training will occur and learn more about it. The overall goal of the "region" training is to provide background information, context, and useful information to a Force Protection person working overseas. These lessons are not scholarly treatises on the country or region in question. The training thus focuses on items such as history, economy, government structure, country infrastructure, roads, facilities, and language. The Phase I effort developed a prototype training module for a single country: Montenegro. A fully developed Force Protection training module would provide training lessons on many countries and regions, so that airmen deploying to any location could get accurate and useful familiarization with the place in which they will be working.

A number of unique features capitalizing on the ability of browser computers were built into the Phase I lessons. For example, a link is provided to an internet service that gives the current weather in the capital of Montenegro. This allows an interested student to check the weather as frequently as he is interested, and start to get an intuition of the current conditions there. Another unique feature added in is audio narration of a number of scenes, created with Ontar's consultant to this project, Don MacCuish. The audio is loaded as a background sound on computers that are capable of playing it during the lessons, adding to the effectiveness of the presentation. For systems with insufficient connection bandwidth (such as a modem connection), the audio is not sent so that the lesson is not bogged down in data transmission delays. These provide a sampling of the powerful options that can be supported in lessons hosted in the TENOR software.

As other countries or regions are added as additional modules to the Force Protection training, they will likely not follow this lesson structure exactly. Each country around the world has unique features that are important for Force Protection personnel to be aware of, and training must be customized for those areas.

Database & Features Overview

The basic TENOR system has two parts. First a relational database is used to store both the basic knowledge elements and its structure into lessons. Secondly, a server based program accesses the various databases and builds the training lessons on the fly as the student works through them. The sever software is coupled with a relatively small static site to handle initial connections and provide features that change infrequently and do not need to be created on the fly. The internet browser is used as the client platform for the learning system. The lesson presentation uses existing HTML standards for display text and multimedia information, for maximum compatibility across browser software and indeed for platform independence. This approach combines a wide range of display and interaction capability with existing off-the-shelf solutions to provide a powerful system at greatly reduced costs.

Using a series of database tables to store both knowledge and formatting information provides several advantages over the "hard-coding" of lesson presentation and material. First, it provides some separation between the knowledge content and the display of that knowledge. This allows the sever flexibility in adapting the presentation to the capabilities (and limitations) of the various possible browser platforms that a trainee might use. TENOR is implemented as a DLL that runs on a server with either Microsoft Internet Information Server 4 or 5 (IIS), or the Microsoft Personal Web Server (PWS). The server also requires the establishment of an appropriate ODBC database DSN so that the database tables can be accessed within the software.

Central to the TENOR system is the definition and use of the databases used to store the learning content and lesson structure. Ontar made a conscious decision early on to use standard relational database technology to implement this feature. There are many COTS database products that can serve this need, with capabilities ranging from limited to truly enormous. To limit the constraints imposed by selecting a proprietary database system (and then being locked into its use on the server), the software interface to the databases was designed to use the Open Database Connectivity (ODBC) convention. This convention provides a generalized API to the database content, at the cost of some performance on the server end. The advantages of database vendor-independence were judged to outweigh performance issues. In concept any relational database software that has an ODBC interface can be used for the TENOR databases.

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The database tables are accessed within the code using the ODBCDirect object model within the Microsoft DAO (Data Access Objects) framework. The tables are registered as ODBC data sources on the server, and the resulting DSN (Data Source Name) string provides access to them through ODBC drivers installed in Windows. A series of data structures are defined within the TENOR server code, and when they are needed, separate subroutines have been written to populate the structures with the current values from the tables. Connections established to ODBC databases are used and then removed as quickly as possible, since maintaining open database connections can have a large impact on server performance.

In TENOR, the student must select which module to use, and then which lesson within that module to work on. The lists of possible modules and lessons are generated from those currently defined in the TENOR database tables ("topic list" and "topic structure" tables). Only modules that apply to the current student (as determined from the student database entries) are displayed, and the lesson lists are modified by the progress so far of the student. Once a lesson is selected, the server software loads the lesson definition tables first ("lesson overview and "lesson structure" tables for that lesson). The browser and platform type is determined, and then the browser type table ("layout option" table) is used to select the appropriate tables for screen layout definition ("screen structure" table). For every screen in the lesson, the screen elements are loaded from any of the knowledge databases ("knowledge element" tables) and formatted using the selected "screen structure" table. Status is maintained on where the student is and has been, so that backward and forward screen motion can be accomplished. When the student session is completed, progress is recorded in both the student database, as well as in a database table that tracks the work within the individual lesson more closely.

Five general types of database tables are defined in the TENOR system: knowledge database, the lesson structure tables, the lesson presentation tables, test databases, and the student database. TENOR is started by using a browser to launch the TENOR.ASP file located at the root of the TENOR directory created on the host server. For the Ontar server hosting TENOR, this means that the browser uses http://10.0.0.2/tenor/tenor.asp as its starting URL. The student then logs in with a user name and password. He will see 6 buttons, which provide access to generic support functions, including forums and help. Once the student has selected a training module to work on, the screen is displayed. This is

done by TENOR first querying the database tables that describe the selected module to determine what lessons it contains, and the list of lessons is displayed on the screen. Lessons that have already been completed by the student are highlighted with an asterisk. Once the student clicks on the "Begin Lesson" button, he can start working. Now the student can interact with the server while taking a lesson. He can: get help; move to any point within a lesson; replay and review a segment of the current lesson; compose a question and send it to an "instructor"; exchange comments and questions with other students; terminate the lesson; search the TENOR knowledge database for additional material; take a test; configure the defaults for the training session, based on the student's current computer parameters; resume a lesson; bookmark the lesson; exit the lesson. Embedded audio tracks narrate the content on the screen, if the browsing platform has the correct hardware and necessary bandwidth. Even simple handheld PDA units can effectively present text and graphics to the user.

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Conclusion

Ontar Corporation has completed an extensive investigation of the best methods for hosting an ADL learning system using Internet technology. This has resulted in the development of TENOR. TENOR is a unique, advanced database system that achieves the objectives of providing superior, timely, cost-effective training, while using the latest innovations in desktop and wireless computer technology.