JITTA

JOURNAL OF INFORMATION TECHNOLOGY THEORY AND APPLICATION

ASSURING HOMELAND SECURITY: CONTINUOUS MONITORING, CONTROL & ASSURANCE OF EMERGENCY PREPAREDNESS

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ABSTRACT

This paper examines the potential relationships of Continuous Auditing and Emergency Preparedness to the design, development, and implementation of Emergency Response Management Information Systems (ERMIS). It develops an argument for the integration of emergency response processes and continuous decision process auditing requirements into the system development life cycle of an organization wide ERMIS.

Bartel Van de Walle acted senior editor for this paper.

Turoff, M., M. Chumer, R. Hiltz, R. Klashner, M. Alles, M. Vasarhelyi, and A. Kogan, "Assuring Homeland Security: Continuous Monitoring, Control & Assurance of Emergency Preparedness," *Journal of Information Technology Theory and Application (JITTA),* 6:3, 2004, 1-24.

The state of the art in Information Systems, Auditing (i.e. Continuous Auditing), and the Emergency Preparedness requirements of the society are at the right moment for this integration to occur. This integration would provide for new and robust software and system development foundation enhancements in order to satisfy the unique requirements of an ERMIS with respect to use, decision making, implementation, and costs. Such integration would lead to a pervasive deployment of ERMIS and result in a higher state of readiness than exists currently in organizations. A desirable catalyst in the facilitation of this undertaking is the need for general auditing (as an oversight function) of Emergency Response Preparedness for all organizations (termed an EPTrust assurance audit).

Fundamental advances in software process engineering have created a technological pathway for Information Systems research efforts to pursue broader conceptual issues. A new interdisciplinary professional community of Information Systems Designers, Emergency Response Professionals, and Auditors is proposed to undertake research and development activities to support this endeavor. Such a community must integrate across researchers, developers, and practitioners and as a result a WebCenter devoted to this effort is proposed as an appropriate effort to facilitate this interdisciplinary field by the formation of a new research and development community.

"It's not the strongest of the species that survives, not the most intelligent, but the one most responsive to change."

--Charles Darwin, Origin of the Species, 1859

INTRODUCTION

Homeland security depends critically upon the ability of people and organizations to respond appropriately and reliably in the face of sudden and potentially catastrophic emergencies (Weick 1993). However, the Emergency Preparedness (EP) status of an organization is not always explicit, even to the organization itself or its decision makers, let alone to the public.

Further, EP is subject to an adverse selection problem in that outside observers cannot readily determine whether the lack of information about an organization's EP status is due to security considerations or to actual lack of preparation. In this paper we argue that there is a critical need for an objective, consistent, and publicly available measure of the EP status of an organization. We further discuss the need for the creation of a new assurance product (i.e. EPTrust) which is a set of controls and criteria that auditors can use to measure an organization's degree of EP. The military has a combat readiness reporting scheme, Status of Resources and Training System (SORTS) that quantifies the readiness status of a unit and summarizes the information for the Joint Chiefs of Staff (Brennan 1997). The reporting within SORTS relies on traditional accounting methods for summarizing and consolidating unit readiness information. This provides an indication that similar efforts can be undertaken to identify and report on the EP status of non-military organizations within the oversight function of Homeland Security. In addition current technological advancements suggest that continuous auditing processes instead of traditional auditing methodologies may be successfully integrated into the development of new systems and greatly improve organizational risk and vulnerability assessments. However, the military assumes that a crisis is the normal operational environment and decision processes and human roles are very explicit (i.e. command and control processes structures)--two key factors that often are partially tacit knowledge in organizations.

Auditing is defined as "a systematic process of objectively obtaining and evaluating evidence regarding assertions about economic actions and events to ascertain the degree of correspondence between those assertions and established criteria and communicating the results to interested users" (Auditing Concepts Committee 1972). Thus auditing may be defined as consisting of four main steps: setting up audit objectives based on management's assertions, gathering evidence about the assertion, testing that evidence against objective criteria, and communicating the conclusions reached. In other words, auditing is not concerned with the development of original judgments but with assessing the validity of an assertion already made by another party. Such an assessment can only be made in relation to a model constructed by the auditor of what that assertion "should" be and the validity of the process which was used to produce the assertion.

What is needed is the creation of a new, higher level of assurance, which we label EPTrust. We envisage that this EPTrust will be realized through a joint collaboration of auditors and regulators working with developers, managers of emergency management information systems, emergency response professionals, and other managers.

CONTRIBUTIONS

This paper proposes a new research and development field at the intersection of three major IT/IS components: Information Systems Design (System Development Life Cycle), Emergency Management (The User), and Continuous Auditing (Critical Oversight). It develops the argument that research into the nexus of the three major components would lead to a major improvement in the ability to efficiently develop effective emergency response information systems and bring about the pervasive use of such systems by all types of organizations in our society.

The paper proposes specific steps that can be taken to bring this "integrated" research about including establishing evolving audit standards for measuring the Emergency Preparedness of any organization. These steps include extending foundational software engineering concepts such as hypertext repositories, and creation of a WebCenter dedicated to facilitation of this new research and development community.

Given current societal requirements for mitigating emergencies, recent requirements for auditors to monitor the decision process in organizations, the emergence of continuous auditing alternatives, and the current emphasis on enterprise-wide information systems applications, it is an opportune time for such an effort and such a research community to emerge. To ignore this opportunity and allow the continued divergence of these professional endeavors could result in lost opportunities and additional costs due to funding separate incompatible efforts.

We propose the concept of a Crisis Management system of humans, intelligent agents, and continuous auditing technology that allows for:

- A high level of "self" management in crisis centered decision processes (systematizes decision uncertainty)
- Consistency in the human interface: "functionality" model level (intelligent agents applied to role structures and classes of decisions)
- The internal implementation model of the software (the use of object oriented analysis and design techniques, UML, and Use Case Scenarios).

This paper represents a collaborative effort of three researchers in continuous auditing and four researchers in emergency response information systems and software engineering. It is the first to call for this research and development synergy.

EPTrust would fill a vital gap in homeland security, which depends as much upon on the public's peace of mind as it does on actual planning and preparation. This paper also discusses the steps necessary to undertake a meaningful development of an EPTrust.

The seven observations and factors that comprise the foundation for this paper are highlighted in the following list:

1. Continuous Auditing and "Just in Time" controls - Traditional auditing is done by the sampling of data to which various controls and criteria are applied to look for abnormalities. With the declining costs of computer capacity the concept of Continuous Auditing is the ability to apply such controls on a continuous basis to all the transactions taking place.
2. Mission Oversight and Governance - While one usually thinks of auditing as applied to financial transactions, the Sarbanes-Oxley Act implies a return of the auditing paradigm to the mission of establishing confidence in the decisions of organizations via monitoring of the decision process to establish the occurrence of analysis, oversight, accountability, and other associated decision objectives in a dynamic real time manner.
3. Predetermined Decision Templates - Applying auditing controls to the decision process has the objective of insuring that in a given decision process everyone that should be involved does in fact get involved and all the data, information, communications, and documents that should have been examined and utilized did, in fact, reach the right organizational units and human roles in the organization. This requires a pre definition template of the transactions that must take place for a given decision process.
4. Monitoring Group Decision Processes - Emergency Response Systems require the same decision process monitoring functions and add dynamic real time notification of decision role responsibilities embedded in a group coordination and communication process.
5. Object Oriented System Design and Analysis - The current generation of information systems is focusing on the design of enterprise wide processes that cut across organizational units and applications (Scott and Vessey 2002; Grant 2002; Popovich 2001). Such efforts attempt to integrate all data and functionality by means of new system and software development methodologies employing object oriented concepts.
6. Continuous Auditing Backbone - With such a continuous auditing backbone for general decision processes integrated into enterprise systems, emergency response functionality can be efficiently embedded in enterprise wide systems in any organization.
7. The EPTrust - Developing an EPTrust is an interdisciplinary activity that requires the collaboration of diverse professionals and can lay the foundation for requirements in the development of the actual information systems. The EPTrust also serves to define decision processes unique to the execution of emergency response plans and the added data requirements.

These seven factors require close collaboration among researchers, developers, and practitioners in the areas of Information Systems Analysis and Design, Auditing, and Emergency Response. A promising route to bringing this about is an open WebCenter that would facilitate the exchange of information and knowledge among those professionals having a mutual interest in Emergency Preparedness.

The following sections of this paper cover the indicated topics:

The Objectives of Auditing: What is auditing and what are some recent redirections for the field that are related in function to Emergency Response?

Concepts Underlying a Continuous Trust Service: The new technology of Continuous Auditing and the necessity for an EPTrust standard.

Emergency Preparedness Environment: An overview of some high level requirements.

Broader Impacts of Assuring EP: The potential societal consequences of the observations in this paper.

Related Work in Software Process Engineering: Fundamental synergies exist between the auditing concepts presented in this paper and software process research, which will be reviewed in order to map fundamental software engineering concepts into the synthesis presented here.

EP as an object oriented development challenge: A summary of the research and development activities need in this area.

Emergency Response Decision Framework: the nature of decisions in emergencies.

Creating a WebCenter: The required properties of a WebCenter for bringing this effort to fruition.

Conclusions: A summary of the challenges that need to be faced and a highlighting of some of the related observations.

THE OBJECTIVES OF AUDITING

As the scholar of auditing, Professor Theodore Limperg of the University of Amsterdam, stated more than seventy years ago, auditing is a way of inspiring confidence in society about economic transactions and the manner in which organizations are managed and governed. Post 9/11, there is a much greater awareness amongst the general public that the integrity of society itself, not to mention their own lives and well being, depends on the ability of first responders and other organizations, both private and public, to plan for and respond to unprecedented emergencies. While auditing was initially focused on financial reporting, the complexities of organizations (structures and processes) resulted in expanding the auditing focus towards the decisions and decision processes for valuing financial transactions/data/information, and the assessment of risk. It is a short step from that towards validating the governance structure to include delegation of authority, oversight, responsibility, and advisement for decisions. The events associated with major scandals such as Enron, Worldcom, Parmelat, and others have produced a demand to return to the ethical underpinnings of auditing which includes basic "objective" assessment and uncompromising values that serve the public interest.

In the U.S. the Sarbanes-Oxley Act of 2002 was passed following a number of accounting scandals such as Enron in which values were compromised and private (not public) interests were served. Its objective is "To protect investors by improving the accuracy and reliability of corporate disclosures made pursuant to the securities laws…." Section 404 of the Act requires attestation of the control systems in the firm that affect financial reporting. Minimal requirements (to be implemented by the end of 2003) include the certification of internal processes used to generate financial reports that are filed as a matter of public record. At a later date, not yet established, the law will require the real-time disclosure of any event that might affect performance (http://www.optimizemag.com/issue/020/law.htm, retrieved March 21, 2004).

The control level assurance mandated by Section 404 of the Sarbanes-Oxley Act further extends the domain of auditing, from accounting rules compliance towards a more holistic assessment of how organizations act and perform. Incidents such as the December 3, 1984 Union Carbide India Limited pesticide plant tragedy in Bhopal, India and the Chernobyl tragedy (http://www.chernobyl.info) are relevant indicators of how a normal operation can be immediately converted into a disaster when not managed for emergency preparedness. Because public organizations serve the public interest, assurance of emergency preparedness is a logical outcome of this progression. The Public needs assurance(s) that, post 9/11, first responders, and the organizations they work for, are well prepared to address successfully any emergency.

While not all political/legislative processes are completely deductive in nature, it would seem to be a logical extension of Section 404 that the best way to do this is to assure decision processes. This would require the creation of a system that monitors the roles and events associated with decision processes and alerts all involved including those with oversight responsibilities whenever a process is not followed. All documents generated, analyzed, and reviewed by various "roles" in the organization require tracking (and auditing) as to whether they were produced and if they reached all the appropriate professionals and managers (role fillers). This tracking logically extends to actions (events) that took place, and what roles initiated the actions (events). This ERMIS decision process, transaction monitoring system was proposed in earlier works and was reviewed in (Turoff, Chumer, Van de Walle, and Yao 2004; Turoff 2002). The only real difference is the fact that emergency response activity actions may have to be taken before functions such as analysis and oversight can be completed. Given the tight time constraints in emergency response scenarios more activity occurs in parallel than sequentially. These approaches have close similarities with software process engineering which is discussed in a later section.

The advent of integrated information systems and more responsive information technology allow for ongoing monitoring and control of organizational operations and thus facilitate the creation of close-to-the event reporting and assurance. We propose to apply the new technology of Continuous Auditing (CA), (Alles, Kogan, and Vasarhelyi 2002, 2004) which allows audit controls to be executed continuously rather than on a sample basis. Associated with this is the need for a new audit trust product to provide audit standards and controls for Emergency Response, as was done for Information Systems with the development of the System Reliability Standards (SysTrust) product of the American Institute of Certified Public Accountants (AICPA, 1997). The objective of an "EPTrust" is to address the problem of monitoring, controlling, and assuring emergency preparedness at the local, state, and federal government levels, first responders, and private sector firms. Making use of CA technology to implement an EPTrust standard would mean that policy makers and the public could be assured that organizations they depend upon have workable EP plans integrated into their Information Systems.

CONCEPTS UNDERLYING A CONTINUOUS TRUST SERVICE

Continuous Auditing can be defined as "a methodology that enables independent auditors to provide written assurance on a subject matter using a series of auditors' reports issues simultaneously with, or a short period of time after, the occurrence of events underlying the subject matter." (AICPA/CICA, 1999, p. xiii). This generic definition can be used to incorporate a EP Continuous Trust Service. The basic assertions from management on EP preparedness that cover a pre-prescribed scope of needed EP basic assertions (standards of emergency preparedness) are tested and the auditor issues written assurance on process owner assertion simultaneously with, or a short period after these assertions. Figure 1 illustrates the relationships between continuous monitoring, continuous auditing, and continuous reporting. It is actually discrete transactions executed in very short time intervals that underlie these three functions. However, with respect to human perception and effective representation we may term these discrete processes as "continuous" ones.

Continuous Monitoring is a process by which online/real time systems are used to manage the performance of corporate processes, on (or close to) a real-time basis. Continuous monitoring typically results in a timely detection of significant variances from expected performance with resulting rapid intervention and corrective action. For this purpose, a continuous monitoring process must be based on:

- Effective models of expected performance, including clear definitions of what constitute significant deviations from expected performance;
- Metrics that accurately and completely measure the desired aspects of performance on a timely basis; and
- Effective controls that operate within the desired tight time constraints.

The monitoring process compares actual performance to benchmarks of performance. The actions that ensue from this comparison comprise control.

If monitoring is close to real-time, or at least in sufficient time for management action, this process may be called "continuous monitoring." In this regard, it must be kept in mind that all transactions should take place

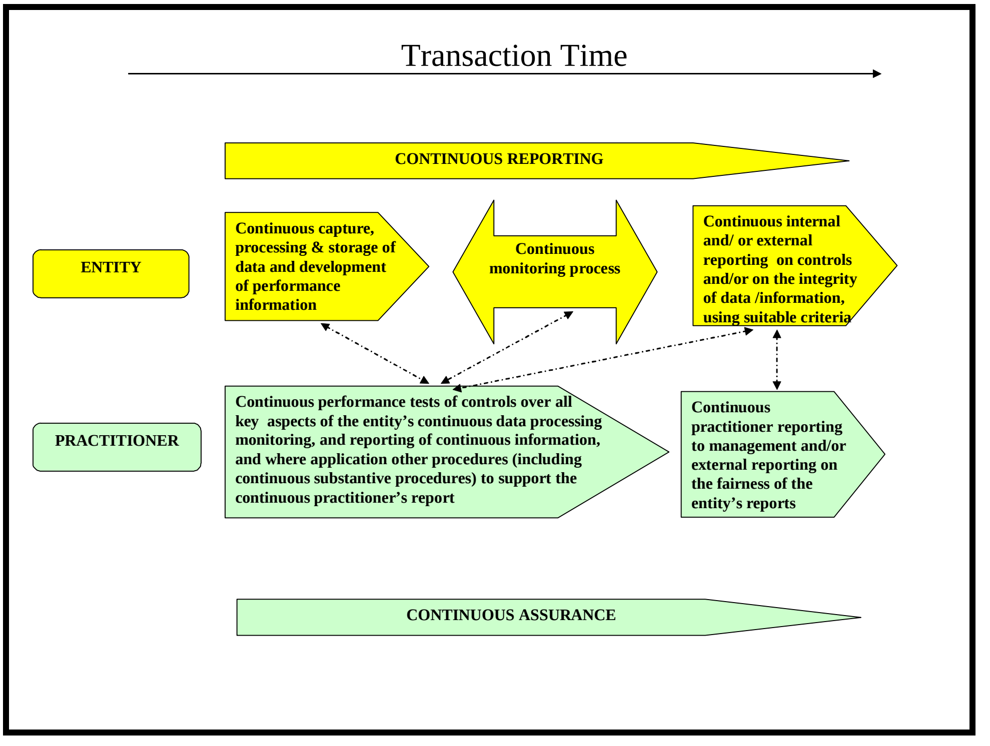

Figure 1: Continuous Monitoring, Auditing, and Reporting

within specified time constraints and must be evaluated in relation to the constraints. Most transactions are context specific, both in time and space. The time component is perhaps even more of a constraint in the EP environment, which by its very nature is a race against time. Thus events in an EP situation are time dependent. An example of this is the conflict for resources that can cause cascading problems (e.g. power loss causing communication or transportation interruptions). A time sensitive tool such as continuous monitoring is essential in the EP environment.

Continuous Assurance is a type of auditing which produces results simultaneously with, or a short time after, the occurrence of relevant events. The results of the continuous assurance (audit) can form the basis of internal or external reports on:

- Controls over the specified system (including controls over continuous monitoring processes) and/or
- Specified subject matters, typically related to key aspects of performance.

Continuous assurance will typically produce "evergreen" (always updated except in exception cases) reports (AICPA, 1999), with warnings when substantive discrepancies are found. On the other hand the continuous audit results in a report that current auditors can use to help in the evaluation of processes that traditional audit methodologies do not address, or to facilitate and/or accelerate traditional auditing procedures (Vasarhelyi, Alles, and Kogan 2004).

Continuous Reporting is the dynamic creation of real time reports. In the real-time economy, corporate IT systems provide a continuous stream of data that measures characteristics of corporate processes. These streams of data, when subjected to an effective continuous monitoring process, can be used for the creation of close to real-time reports for internal management of the firm as well as potentially being used for continuous external (Web) reporting (Alles, Kogan, and Vasarhelyi 2004). Taken together, these emerging technologies provide a base for the construction of a comprehensive, real time EP monitoring, reporting and assurance system.

However, they need to be overlaid on a thoroughly thought through EP control framework.

EMERGENCY PREPAREDNESS ENVIRONMENT

The total EP environment presents an unprecedented challenge for monitoring, control measurement, and integration of manual and automated controls in the assessment of system reliability. A major objective of the EP environment is the need to make explicit the decision process for each set of related actions that take place in an emergency process and for each stage of the process. Data in an emergency contains a great deal of subjective input and requires dynamic updating as the estimates and the quality of the data undergo change. Decisions in emergency situations are made quickly with "best available quality" data. The people and the intelligent agents designed to conduct analysis on both quality of the data and on the anticipated data changes must be sensitive to the constraints and temporal nature of decisions that have to be made.

Associated with this is the need to develop internal quality control measures/indices. The complexity of comprehensive EP measures will further expand the difficulty of traditional control and monitoring measurements. This effort is a challenging undertaking, but worthwhile because it will bring about a pervasive emergency response readiness in our society. By merging the new audit requirements for the completeness of decision processes into enterprise wide design efforts we make the addition of an Emergency Response System an integrated extension to existing systems rather than multiple independent development efforts. Furthermore, it lays a consistent foundation for emergency response systems. This standardization of the continuous auditing software will enhance organizational cooperation when it is necessary.

While certain aspects of EP, such as business continuity, are already being assessed by auditors or consultants, such assessments are primarily for internal control purposes or as a byproduct of a financial audit. However, these internal reports are not useful to society unless the metrics are consistent. They do not provide the full assurance as demanded by policy makers and the general public, and perhaps most problematic of all, they are predominantly conducted in the private sector and not focused on local and state government bodies that would be at the forefront of a homeland security emergency. An EPTrust would have to incorporate a wide range of topics each related to specific Auditing and CA assessments spanning many diverse areas, including (Turoff, Chumer, Van de Walle, and Yao 2004):

- Currency of training and response team assessment - The existence of a trained emergency response team comprising all the necessary professionals and levels of management on duty call 24 hours a day, seven days a week (24/7).
- Organizational resource turbulence assessment - The understood consequences and recovery plan for the replacement and loss of any particular physical facility or human resources
- Knowledge management assessment - The preservation of knowledge necessary to operate the organization
- Governance structure assessment - The decision authorities for the delegation of roles and the assignment of roles during an emergency
- Current resource information assessment - The backup and security of all critical data for the operation of the organization
- Inter-organizational communication assessment - An understanding of the resulting requirements for outside coordination with other organizations and the requirements for outside resources based upon the size and nature of the event being dealt with.
- Continuous risk and threat assessment - The integration of an on going threat assessment and planning process to verify the currency of response plans

9/11 has created a need to rethink assumptions about what is entailed in providing assurance about EP and even what is EP itself. An EPTrust will require advanced auditing techniques that will continuously monitor and test controls, procedures, and capabilities across organizations. The EPTrust would be based upon the emerging Continuous Auditing (CA) methodology described in the prior sections. However, while the CA technology has been evolving in corporate systems, it is still in its early stages of maturity. The Sarbanes-Oxley act has reinforced the need for reliable corporate controls. It also requires methodologies to quantify multiple controls even when they may overlap or complement each other. Therefore multiple control reliability becomes salient.

One of the most serious difficulties with Emergency Response Systems is that they are normally only used in an emergency and hence people are not often well trained in their use (Dynes and Quarantelli 1979; Hale 1997). If we build a system to be used regularly in everyday decision processes as a group coordination system, we provide everyone with an on the job understanding of the roles and events in a decision process. As a result the training problem on the mechanics of the system is eliminated. If we go further and use it for all types of normal business emergencies in organizations we go a lot further in establishing the emergency readiness of the employees.

There are many occurrences, especially in private organizations that justify emergency response reactions (See Table 1). The ability for an organization to create role-event templates tailored to emergency processes will further the organization's understanding of these processes. In an actual emergency the implementation of these templates will monitor and notify people of the analysis and decision process taking place about the event and their resulting responsibilities. These two factors (monitoring and notification) will greatly alleviate training demands and insure a reduction of errors in carrying out emergency processes. The only training that might be necessary is for the understanding of the consequences of the alternative responses to an emergency situation. The creation of the decision and role templates normally is the responsibility of those who plan the response to a given situation. The resulting templates would indicate who is authorized to take on the role, what they have to do, and how their actions and results are related and transferred to other relevant roles in a dynamic manner (Turoff, Chumer, Van de Walle, and Yao 2004).

BROADER IMPACTS OF ASSURING EP

The principles described in this paper can have substantive impact in offering a methodology and a Trust product whereby organizations and localities can be evaluated and rated in terms of emergency preparedness. The obvious objective is to provide policy makers and decision makers, as well as the organizations themselves, assurance about the state of their emergency preparedness. The EPTrust will also have a motivational role by providing measures for comparing organizational EP efforts and facilitating benchmarking. This situation will result in the evolutionary improvement of the organizational state of the art for emergency preparedness. The effort to create the EPTrust has to involve emergency preparedness professionals and auditors with an Emergency Preparedness orientation working together to establish the EPTrust.

Negative Emergencies	Positive Emergencies
Strike, court case, cost overrun, budget cut, delivery delay, new regulation, terrorist action, supply shortage, natural disaster, takeover threat, production delay, product malfunction, loss of key employee, loss of key customer, regulatory investigation, new competitive product, bad public news stories	Responding to an RFP, winning a large contract, developing a new product, creating a new plan, taking over another company, estimating a future budget, too many orders for a product (employee shortage, raw material shortage, production or delivery problems), negotiating a contract, organizational committees and task forces

Table 1: Emergency Response Applications

An associated practical goal is that a created EPTrust would be endorsed by the American Institute of Certified Public Accountants (AICPA) as one it its Trust services and published as a set of Principles and Criteria for attestation on Emergency Preparedness (EP), as well as a proposed methodology of issuing opinions (certificates) on emergency preparedness. This would allow a consistent measurement of the relative status of "Preparedness" across all organizations.

On a wider view of assurance methodology, society could substantially benefit from the evolution from black or white audit opinions to system health assessment with different tones of gray. Furthermore, this research area would provide a valuable input for the development of methodologies that can link the documentation of controls, the monitoring of its functioning, the assessment of the effectiveness of the resulting control systems, and the methodologies of attestation and presentation of the results through media of public access like the Web (Turoff, 1997). Successful work here would resolve a major problem emerging in the implementation of Sarbanes-Oxley section 404 on implementation.

RELATED WORK IN SOFTWARE PROCESS ENGINEERING

Many EP features include active system components that operate when there are no emergencies and lend themselves to automatic monitoring and control. Some of the EP features are passive (available in emergencies only) and behavioral (e.g. cooperation and dynamic assignment of responsibilities among human roles). The view we have of the system software requirements is that the EP requirements should be integrated with enterprise wide systems.

The software process research community is a subset of software engineering that concerns itself with the activities surrounding the design and development of software artifacts. The software process community research effort grew out of a need to understand "What is a good architectural rationale for integration of a diverse collection of [software] tools?" (Osterweil 2003).

"A software process is a partially ordered set of tasks performed to develop software. A software process model *is a description of a software process. If the description is sufficiently formalized, it is possible to execute process models for simulation, analysis and enactment. Enactment, in turn, is a computer-supported activity involving one or more developers." (Noll and Scacchi 1999).*

Software processes research has branched out to various areas such as non-collocated collaboration processes, open source software development (OSSD) processes, and hyperlinked augmented processes. Therefore, their fundamental incentives align with the work proposed in this paper; i.e., integration of discipline specific tools among large and diverse stakeholder groups using hyperlinked augmented technologies.

Osterweil is one of the software process community's spokespersons and is noted for asserting "software processes are software too" (Osterweil 1987), which infers strong correlations between detailing processes and building software artifacts. He has suggested since the mid-1980s that the development of software products is actually the execution of a process by a collection of human and/or software agents (Osterweil 1986; Osterweil 1987). Osterweil also notes that the first 15 years of research in software process has not resulted in process abstraction mechanisms as powerful as those employed by human agents, which may indicate software processes may just be a subtype of human process. Specifically, processes are very sensitive to the scarcity or abundance of resources, processes have an abundance of exceptions requiring substantial flexibility in their handling, and processes necessitate care when specifying real-time constraints (e.g., as with those found in an emergency).

Software process researchers use narrative models of the processes, semi-structured hypermedia models (e.g., (Monk and Howard 1998)), reenactment simulators, and formal computational process models at the community and infrastructure levels to examine process engineering (Scacchi and Mi 1997). Recent web-based OSSD projects such as Mozilla (a Web information artifact consumer), Apache HTTP server, and NetBeans (an integrated development environment) have utilized large numbers of dispersed developers to accomplish impressive software development using dynamic software processes (Jensen and Scacchi 2004). Apache HTTP server and NetBeans-based (Java) Web applications can be configured into a typical information infrastructure, but they have been developed within separate "virtual enterprises" (Noll and Scacchi 1999).

Therefore, for these virtual enterprises to collectively maintain a Web infrastructure using the OSSD process approach they must be able to synchronize their shared process activities and artifacts (Jensen and Scacchi 2004). However, issues associated with organizations supporting these enterprises are also part of any interaction in open source projects. Issues such as market share, database versioning, adoption issues, and control of standards and/or technological trajectories are typical obstacles. The efforts of these associated organizations and volunteers are massive and instructive. Yet, projects go on for "years" without standardized processes, which inhibits integration (Reis and Fortes 2002).

The OSSD Mozilla Project with millions of lines of code is arguably one of the largest efforts of its kind (http://www.mozilla.org/). It is also one of the fastest growing having begun in 1998 with the Navigator 5 codebase donation from Netscape (Reis and Fortes 2002). The software process for this project had "massive organizational requirements" and new software tool support. The project is instructive for a combined interorganizational Dynamic Emergency Response Management Information System (DERMIS, Turoff, Chumer, Van de Walle, and Yao 2004). For example, most of the Netscape codebase was rejected because it did not meet the new standards established by the World Wide Web Consortium (W3C) (Reis and Fortes 2002); a scenario that could easily happen with security issues having become salient for the public. Reis and Fortes go on to list these demands on process and tool support:

- Effective version control
- A well-defined protocol for integrating source code changes
- A high degree of accountability for who may integrate this code
- high modularity
- Custom development tools
- Good communication channels

This paper is focusing on improving the accountability and communication aspects for DERMIS projects in the future. Trends in OSSD reflect an "ad-hoc requirements process" (Reis and Fortes 2002), which is mirrored in many Agile methods (e.g., eXtreme Programming (Beck and Fowler 2000)) that are growing in popularity. These trends undermine accountability and convolute communication. Our proposed Continuous Auditing design suggestions are intended to counterbalance the accountability issues—essentially providing expert opinions in the area of auditing and accounting similar to an Expert Systems (Walls, Widmeyer and El Sawy 1992) design process.

The communication challenges associated with software process have been attacked using on-line narrative reports, case studies, best practices, and experience reports (Scacchi 2000). Such hypermedia repositories facilitate the collaboration of dispersed developers in the OSSD processes. Thus, DERMIS projects spanning multiple boundaries are likely to be "produced by loosely coupled 'virtual enterprises' composed of development teams from different organizations who collaborate on specific projects across an information infrastructure…" that must support the "…ability to access, integrate, communicate and update software products, processes, staff roles, tools and repositories" (Noll and Scacchi 1999). The WebCenter described later in this paper will become part of this information infrastructure.

Internet based virtual enterprises built on information infrastructures are integrated at multiple levels (Noll and Scacchi 1999) via hypermedia functionality with software process modeling facilitated by "knowledge-based models of multi-agent business processes" (Scacchi and Mi 1997) allowing for analysis through process simulation (Scacchi 2000; Choi and Scacchi 2001) resulting in "simple implementation" strategies (Noll and

Scacchi 1999). Software process enactment guides, monitors, and controls the process by having a process interpreter or engine execute a formal process description. The interpreter can perform three functions (Noll and Scacchi 1999):

- **Guidance** involves leading developers through the process by issuing prompts or notifications as to what tasks should be performed at a given time.
- **Monitoring** allows managers and developers to assess the current state and progress of the process.
- **Control** means ensuring the process is followed by restricting developer actions to those that conform to the process description.

The aforementioned functionality can theoretically be leveraged by Information System analysts and designers in the RD&D efforts of DERMIS within an EPTrust context. We examine this context in the next section.

EP AS AN OBJECT ORIENTED DEVELOPMENT CHALLENGE

Traditional methods in the design of Information Systems rely on the ability of designers and developers to create a representation (model) of what the users require in order to do their jobs (Valacich, George, and Hoffer 2004). Historically the perceived failure of Information Systems (Clegg et al, 1996) has been the inability to involve the end user early in the requirements gathering process and later during requirements modeling as well as in subsequent validations of emerging models. According to (Clegg et al, 1996) "end user involvement" as a factor was present during successful information system implementation suggesting that it is a "sufficient" condition of implementation success bordering very closely on being a "necessary" condition. However, is there another factor that when combined with "end user involvement" strengthens the success of the implemented system? This paper in introducing "continuous auditing" is making a case for it as another "necessary" condition in implementation success. Furthermore it is argued that to establish the EPTrust both conditions (end user involvement and continuous auditing) should be vigorously integrated into the System Implementation and Software Engineering processes.

The trick comes in selecting the most appropriate modeling technique and then integrating these two conditions (end user involvement and continuous auditing) into the model. We suggest that during design, implementation, and use the metaphors of "roles" and "events" are integral to the ERMIS and therefore should be included as model components. This further suggests that object oriented modeling techniques such as those found in the Unified Modeling Language (UML) are the most appropriate to use to actualize both metaphors. The challenge in the analysis portion of an ERMIS development life cycle is converting the "how to" of the user (to include first responders and auditors) into the "what is to be done" in the system by incorporating the UML components of use cases, class diagrams, state diagrams, and sequence diagrams. These four model components are as essential to object oriented design underlying intelligent agents as system "actors".

This development challenge could be addressed through a collaborative effort focusing on incorporating the framework components of a DERMIS (Turoff, Chumer, Van de Walle, and Yao 2004) with the components of continuous auditing, as an oversight and just in time management process, into an object oriented model. This model can, in turn, be generic enough to begin the development of an ERMIS and flexible enough to incorporate local conditions (as additional requirements) in an effort to create and maintain an EPTrust. One way of doing this is through a WebCenter as recommended in the paper in order to bring together expertise in a collaborative framework.

EMERGENCY RESPONSE DECISION FRAMEWORK

By definition, an "emergency" means that an event has occurred that makes it impossible for an organization to "conduct business as usual." Historically, a response to crisis situations, even natural disasters, always has a high degree of unpredictability with respect to the specific actions that must be taken, where they will happen, what resources will or can be assigned, and who will be responding (Turoff, 2002). Plans function as guides but do not ever predict the details. Because of the time constraints on reactions, authority always flows to those on the front lines. This is not a fault of lack of planning but a real property of the nature of a crisis (Hardeman, Pauwels, Rojas-Palma, and Van de Walle 1998; Weick 1993; Dynes and Quarantelli 1997; Horseley and Barker 2002). What needs to be planned is the process and how feedback will be provided in the real situation that allows people to adapt and innovate in response to the given conditions of the moment (Turoff, Chumer, Van de Walle, and Yao 2004).

In emergencies people must make life and death decisions and take actions based upon incomplete information. People in a crisis environment can operate under such stress given the morale associated with the mission they are engaged in; however, when their information does not provide what they know should be available the "rigidity threat syndrome" is likely to set in (Rice 1990; Staw, Sandelands and Dutton 1981). When this happens people revert to established rules of behavior, and the creativity and improvisation that are essential to successful crisis response, are compromised. This also occurs when critical information is present but hidden in the noise due to information overload, a phenomenon which is quite common in computer based communication systems, and likely to be exacerbated in emergency situations (Hiltz and Turoff, 1985; Turoff 1993; Turoff, Hiltz, Bahgat, and Rana, 1993; Turoff, Hiltz, Bieber, Whitworth and Fjermestad 2001).

With the existence of terrorist type risks and the sensitivity of wide area networks to even natural phenomena, the nature of crisis situations today can extend far beyond a local area and involve the actions and resources of many different agencies and organizations from the governmental and private sectors. The missions of coordination, command, and control have necessitated the growing use of computers to track, update, organize, and facilitate the timely exchange of information on all the interrelated activities taking place. Local governments in small communities and rural areas often have to rely on resources from individuals and private concerns. For example, in most natural disasters earth moving equipment belonging to local contractors is a much-valued resource. Typically in natural disasters boundaries disappear between organizations and everyone helps. In the context of larger disasters such cross-organizational cooperation needs to be institutionalized and made part of the official process. Thus, decision support transaction systems need to be able, in emergencies, to integrate across organizations. This is why they must be designed as group communication systems based upon the role event (or entity-practitioner) model for emergency management professionals or the entity-practitioner model for auditors. The problem of knowledge today is the incompatible linguistics of the different professions and that is one of the key challenges for the proposed objective of establishing a new interdisciplinary community.

In this environment the key objective for emergency response systems is giving first responders the ability to know that their information and communication processes are providing the best possible understanding of reality now, and that they have the information they need to make a decision and/or take an action (Hale 1997). This implies a new set of specific requirements for the technology of Dynamic Emergency Response Management Information Systems (DERMIS, Turoff, Chumer, Van de Walle, and Yao 2004).

In order to be able to express the controls necessary in Emergency Preparedness situations we must have a conceptual model from which we may build virtual representations of decision and action processes that are involved. Our model of the decision-action process relies on the Virtual Organization Theory developed by Mowshowitz (1997, 2002) in which his concept of requirements represents both the uncontrolled external events and the internal events generated by responder roles. The responder roles which people and agents are assigned to are the satisfiers as they assume responsibility, accountability, authority, and oversight (Turoff 2002; Turoff, Chumer, Van de Walle, and Yao 2004).

In a crisis roles must exist on a continuous and real time basis. Different people at different times will have the same roles and in some cases they may even share the same roles when the volume of action and response becomes too demanding for only one person. The two metaphors that are the foundation for the virtual model are *events* and *roles*. Both of these represent the framework for collecting, specifying, and prototyping the interrelationships among audit controls for emergency decision and action process. Typical Events and Roles associated with just the function of requesting resources are outlined in (Turoff, Chumer, Van de Walle, and Yao 2004). This represents a template of the events that can be associated and linked to the initial request for a resource of any type (e.g. medical units, fire, police, construction equipment, etc.). Roles are defined by such things as their ability or privilege to generate events, react to these events, and report on information or analysis. In an emergency response system built with these concepts, roles would be designed into the software and the software would handle the tracking of assignments of people to roles and the sharing of the roles by different people (Turoff, Chumer, Van de Walle, and Yao 2004).

Table 2 illustrates the requirements for an event-role object dealing with resource requests that requires a comprehensive set of relationships between decisions, roles, information, and data. While decisions are made locally the implications of those decisions for the consumption of resources can cause risks that must be dealt with by individuals responsible for analyzing what is taking place and exercising possible oversight to counter lower level decisions.

The approach we plan in developing EPTrust involves the following major tasks:

- Developing a virtual model that will act as a knowledge database for collecting the requirements, organizing them, and providing for them in the above framework. This model will be consistent with the virtual enterprise and process models described earlier.
- Working initially with auditors who have experience in the area of emergency response with respect to the security audits of information systems or natural disasters response planning and recovery audits.
- Developing a web-based center for working nationally with professionals in auditing and emergency response and providing them useful professional services.
- Developing a scenario generation model that can illustrate sequences of events and the interplay of the underlying relationships in given situations. Event models and relationships have been used in prior software process modeling and scenario simulations (Scacchi 2000; Osterweil 2003).
- Approaching emergency response professionals through their organizations to begin to extend the development of requirements.

Uncontrolled / Controlled Events	Roles
Request Resource, Allocate (or deny, delay, partial allocation of) resource; Trigger a “maintenance of resource” as a new root event; Resource in transit to destination; Arrival of resource at desired location; Status change in condition of resource; Status change in condition of situation; Recycle of current incident event for more of the same; Resource reassigned before completion; Completion of original root event transaction for this resource; Resource in transit to normal location	Request resources: people things, information, data; Allocate, delay, or deny resources; Report and update situation; Analyze situation; Edit, organize, and summarize information; Maintain resources (logistics); Acquire more or new resources; Oversee, consult, advise; Alert all with a need to know; Assign roles and responsibilities when needed; Coordinate among different resource areas; Prioritize and strategize setting (e.g., command and control)

Table 2: Possible Event and Role Types for a resource request event

- Developing Web based seminars and training programs for both auditors and emergency response professionals (Hiltz and Turoff 2002).

The development of specific audit controls for emergency response would have two very significant derivatives in the areas of developing the appropriate information technology for emergency response.

The first derivative is the ease by which a Virtual Command and Control Center (i.e., “virtual enterprise” as described earlier (Sacchi 2000)) could be designed to meet interoperability functions across a wide range of participating organizations (Roos 2002; Turoff, Chumer, Van de Walle, and Yao 2004; Turoff 2002). Such a Center could be capable of functioning regardless of where the critical professionals are, as long as they have a portable computer or a PDA and Web access.

The second is the ease with which intelligent agents can be designed and implemented with any ERMIS utilizing the monitoring of the decision process and EPTrust in a continuous auditing mode. Clearly rule based agents can be incorporated to carry out alerts to the users on the status and conditions of any ongoing crisis and problem. Tailored filtering of the delivery of information based upon self determined profiles of each human role in the system is also a good role for agents. Probabilistic agents can be designed to help formulate dynamic groups of individuals who are dealing with the same or related problems and help establish dynamic problem solving groups (Van de Walle, 2003; Van de Walle and Turoff 2001; Turoff, 1997). It is also possible agents can suggest solutions, but only where an individual human role and/or group must review the situation and make the final determination and authorization. Crisis situations are too unpredictable with respect to unique details at a given moment to trust fully automated decisions.

To be specific, the kinds of issues that must be systematically dealt with in the construction of an EP system include:

- What data/information desirable or helpful to making a decision can be made available before the decision must be made?
- Are all those involved in making or advising on the decision aware of and have access to the available data/information?
- Are those involved in the process all of those that should be involved?

Clearly, these types of questions have answers that can, and must, be assured on an ongoing basis if confidence in the entire EP system is to be established and maintained. Further, it should also be clear that if a virtual model can be designed that will handle the tracking verification of the decision process in an emergency environment as part of a monitoring and control information infrastructure, then it can also track and verify the normal decision process in any organization. The recent experiences with Enron and other such scandals have led to a call for auditors to take responsibility to ensure that decision processes follow an assured meta process where those that need to be involved and the information they need to make reasonable decisions are in fact included in any decision making process. There are no specific accepted technologies or guidelines for effectively auditing decision processes. An effort of this sort will produce processes, procedures and findings that while focusing on EP will have a much wider application to business controls in general.

There are a significant number of applied research questions that follow logically from this approach:

- The design of virtual command and control centers that allow those involved to begin to interact no matter where they are
- Designing interfaces that encourage creativity or improvisation, motivating users to perform and concentrate on problem solving rather than mechanics, and reducing information overload
- Creating online communities spanning different professional areas.
- Investigations and development of decision scenarios that can be used to exercise designs for decision event templates and the associated design of roles.

- Development of smart tools to aid in the filtering and self organization of information flows and dynamic group formulation in emergency response systems
- Facilitating "quick trust" in ER teams that are geographically, organizationally, and temporally dispersed.

CREATING A WEBCENTER

A definite challenge to our approach is the need to develop a new interdisciplinary community comprising auditors, information systems designers and developers, and emergency preparedness professionals and managers. It is not only the research communities in these three professional groups that we have to bring into the effort. We need to bridge the gap that often exists between researchers and practitioners. Conceptual approaches that are developed in a research environment have to be tested and evaluated in realistic environments. The specifics of EPTrust controls and criteria and decision process templates are two key items that need input from the communities of practice. We also need reviews of proposed results from these same communities. We need also to create an atmosphere of ownership and acceptance among the professionals and the management of the organizations that will utilize the results. The problem of developing new interdisciplinary activities that cut across different disciplines has been recognized as a major problem for a long time (Figure 2):

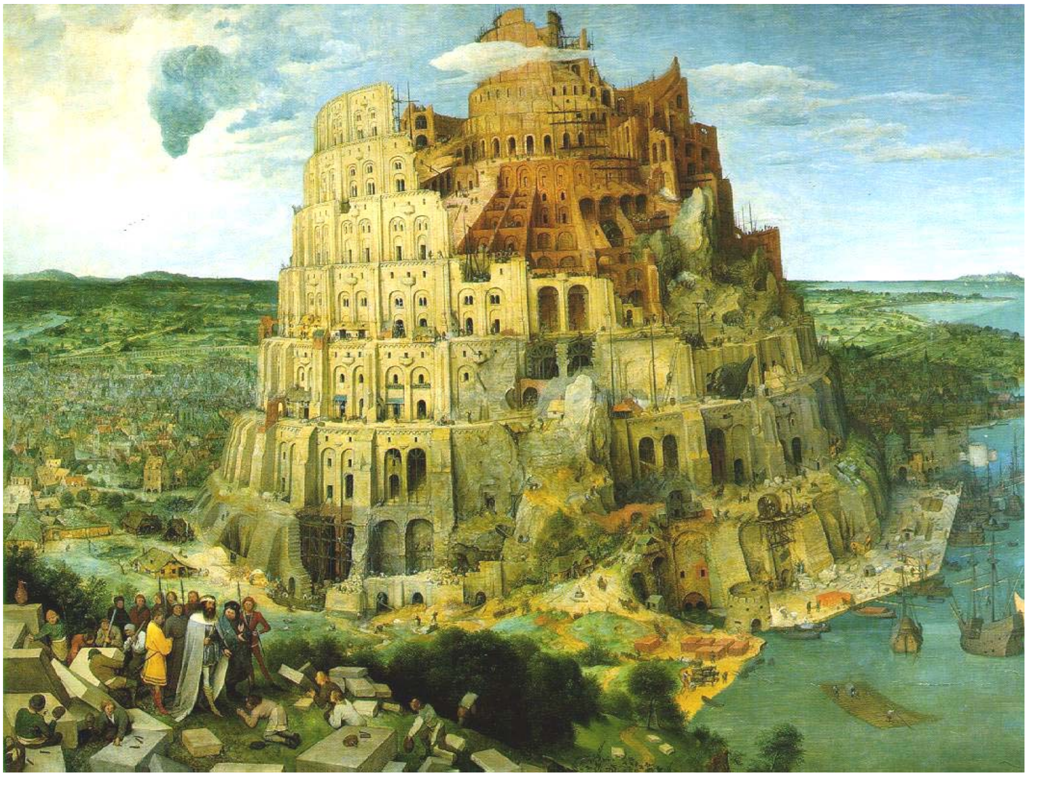

Figure 2: The Problem of Knowledge
(Communication between disciplines!)
Pieter Bruegel the Elder (1525/30-1569 Brussels)
The Tower of Babel, Wood, H 114 cm, W 155 cm, Inv.no. 1026
Image reprinted permission of Kunsthistorisches Museum, Vienna.
URL: <http://www.khm.at/>

We believe that the formation of an online WebCenter to attract and provide service for research and development personnel from these different communities, and working through the existing professional organizations, is the best possible approach for the near future. There are also significant problems in getting organizations to share experiences in coping with real disasters, particularly private firms. However, a WebCenter that employed a Delphi approach (Linstone and Turoff 1975; Turoff and Hiltz 1995), allowing anonymous contributions of lore or tacit knowledge from disaster experience, might well accumulate a knowledge base useful for the creation and evolution of an EPTrust.

With the spread of the Internet and the World Wide Web, groups of people from different corners of the world who share similar interests can exchange information and interact with each other via computer networks. Even before the Web there were demonstrations of forming new research communities using the ARPANET and Group Communications (Hiltz and Turoff, 1978, 1993; Hiltz 1984) During the last five years, NJIT has constructed and operated and evaluated a WebCenter for the research community that studies Asynchronous Learning Networks (ALN) (Zhang 2004). ALN refers to online ("e-learning") courses and learning groups that incorporate extensive participant interaction to build, share, and evaluate knowledge on a topic. There have now been thousands of published studies and more become available every day.

The overall purposes of the WebCenter for Learning Networks Effectiveness Research (http://www.ALNResearch.org) are to increase the quality, quantity, and dissemination of research on the topic, and to build a stronger virtual community of researchers in the field. The functionality that was developed for this application would be just as applicable to forming and facilitating a new research community of professionals in Continuous Auditing, Emergency Response Information Systems, and Emergency Management. The basic functionality of the ALN WebCenter that would be useful for a professional community in Emergency Preparedness and Assurance (EPA) includes:

1. A database of contributed empirical research articles on the topic; each article includes abstract, database entry (synthesis of the article), and comments from readers.
2. Other publications: contains abstracts of contributed theses, books, qualitative research, technology related research, and other publications that relate to the research area.
3. Resources: contains pointers to other web-based resources of interest to others in the field.

It should be noted that for all of the above, any member of the community can fill out a web-based Contribution form to suggest a new entry to the knowledge base; this is then reviewed by the system administrators to assure appropriateness before being added.

4. Tutorials: contains web-based tutorials on measuring learning effectiveness and streaming videos on lectures of basic research methodology. (Appropriate tutorials for the ER community would obviously be different).
5. Discussions: contains different discussion forums on the topic.

The above features serve the information needs of a knowledge-based online community; but members also have social needs to be motivated, to make social contacts, and to feel that they are actually part of a "community." In addition, as the knowledge base grows, they may feel overwhelmed by the amount of material available, and need assistance in filtering to find entries of particular interest to them.

"Technology may support a knowledge sharing environment, but getting users to participate in effective ways is key" (Brazelton and Gorry 2003, p23).

Thus, one of the goals of the WebCenter software is to help community members to find people they are looking for and establish connections with them. This can be done by providing ways to help members recognize other people in the community and by providing a friendly, warm virtual environment to motivate community members to start to communicate with each other.

Features that support these social networking goals include:

6. Member directory: contains member-contributed profiles, including a member's picture, contact information, research interests, and participation in the community.

7. Providing visibility/awareness of people and their activities will foster familiarity among members, help build self-esteem and responsibility (Erickson, Smith, Laff, and Bradner 1999; Girgensohn and Lee 2002). Whenever a person posts in the community, her ID (login name) and email is linked together with the postings and the id is linked to the individual's profile, which also shows all the postings that the member contributes to the community.

To help members find the most relevant materials as the database of shared knowledge grows, a recommender system is provided. In applications of recommendation systems, there are two main filtering technologies: Information Filtering (IF) and social filtering, also called collaborative filtering (CF). Information filtering classifies streams of new content into categories and notifies members of new entries that match their stated long-term information needs or preferences.

8. The Collaborative filtering (CF) system builds a database of user opinions and behavior on available items and uses them to predict users' preferences related to new materials. It also calculates similarities between users preferences to create "neighbor groups" and generate recommendations to a specific user based on the ratings that are given by other users in his/her neighbor group (Zhang 2004).

In the emergency response situation helping researchers to form new interdisciplinary groups would be a primary objective of this type of recommender system.

CONCLUSIONS

It is clear that Enterprise Wide Systems are not easy undertakings and the literature clearly contains failures, (e.g., Gartner Group & Standish Group International reports a 50% complete failure rate, and The Risk Digest (http://catless.ncl.ac.uk/Risks) has several high profile cases) as well as success stories. In recent years the literature has an increasing emphasis on trying to understand what are the CSF (Critical Success/Failure/Risk Factors) underlying major software developments (Nah, Lau and Kuang 2001; Schmidt, Lyytinen, Keil and Cule 2001; Peffers and Gengler 2003). Certainly among the chief failure reasons are the lack of involvement of knowledgeable users early in the process, and leaving the interface functionality and design as the last problem to be resolved after the internal software structure has been determined. The years of delay and cost overruns for systems such as the new FAA airplane control systems is an example of this (Bass, Clements and Kazman 1998). The approach we have been proposing to crisis management systems necessitates obtaining a comprehensive understanding of the human meta process for analysis and resulting decisions as the fundamental structure of Crisis Management Systems (Turoff 2002; Turoff, Chumer, Van de Walle, and Yao 2004). It is the understanding and incorporation of this understanding into the fundamental software structure of a transaction system for decision making that makes the resulting application, interfaces, and uses of intelligent agents a much easier process than otherwise possible.

Most of today's crisis management systems are paste ups of databases and message systems with very little dynamic flexibility for large groups of users. In such systems, the bigger the scope of the disaster, the more rigid will be the nature of the response by the Information System such as at the near disastrous Rancho Seco Nuclear power plant near Sacramento, California (Smeloff and Asmus 1997). Like enterprise wide design, this rigidity represents a significant challenge and implies new types of development efforts supported by software process research. But also like enterprise wide systems efforts, we must develop such systems and the consequence of doing it wrong is too great to ignore; we must invest in doing it right.

Given the wide scale introduction in organizations of enterprise-wide process design in the development of information systems, the incorporation of a continuous auditing backbone would have a number of highly beneficial impacts for society as a whole. Emergency Preparedness Systems built upon this foundation would be far cheaper to implement than stand alone EP systems. Employees would already be trained in the use of these systems for normal organizational processes and they would be far more likely to be able to adapt quickly to any emergency. EP systems integrated into the day-to-day operation can serve all types of emergencies.

This approach would make EP systems pervasive in society as a whole. The resulting need to integrate Information Systems across databases, document systems, and communication systems will greatly improve the flexibility of organizations and their ability to respond to normal free enterprise emergencies (competitors, shortages, legal actions, takeovers, etc.) as well as those brought about by nature and terrorism.

It should be clear that underlying our proposal is an “open system” approach to handling crises where very large teams of professionals and managers in different organizational units or different agencies all have open access to what is taking place. In an emergency too many things are happening in parallel and no one person can be the gatekeeper on the flow of information across units. For example, when someone is assigned to do an analysis of the consumption of a valuable resource such as medical personnel or police, that person must have access to everything taking place at that moment with respect to that resource. Groups will form up around the problems of the moment and no one can predict who will be involved at what moment. Historically, reducing emergency reactions to separate isolated groups has always tended to lead to major mistakes in terms of a lack of timely decisions.

In the future most organizations will have enterprise wide process systems, continuous audit systems and emergency response systems. If these are different incompatible systems it will represent a huge waste of resources and opportunity. What would be worse is if they were inconsistent and actually produced conflicts and uncertainties that could very well confound a crisis. Inconsistencies in processes, policies, and technologies that exist across different organizations seem to be one of the causes of many major response problems in recent events such as the World Trade Center collapse.

A significant concern about our approach is the temptation to over-automate the process. Once the meta decision process is captured and dynamically available, the further automation of actual decisions becomes very easy and therefore tempting. The approach we feel is needed is to leave complex decisions and problem coping to the emergency response managers and professionals on the scene. Auditing controls during the crises will largely focus on the decision process only and require making such decision processes very explicit as opposed to being tacit in nature. The controls will have to deal with each type of decision that takes place. The tracking of events and resources for determining exception situations during the crises and generating the appropriate alerts might also be considered a form of audit controls as well as expected decision support tools. In the preparedness or recovery state before or after a crisis very detailed controls will be needed to measure the extent of preparedness or recovery.

The best use of computer intelligence is to aid the people in making sure they are kept aware of who needs or wants to be involved with a particular problem at a particular time, and to greatly reduce information overload by aiding the filtering and flow direction of information and communications. Furthermore rigid and inflexible designs will impede creative problem solving in an emergency and bring about the threat-rigidity syndrome (Turoff, Chumer, Van de Walle, and Yao 2004). On the positive side the decision process tracking templates for both normal and emergency decisions will make it much easier to incorporate intelligent agents into the process. This means the ability of larger groups to act as open coordination bodies.

Typically in emergency response situations hundreds to thousands of individuals represent the community size that has to be involved as a function of the primary coordinators of activities (Hiltz and Turoff 1978, 1993). No human can track who needs to be involved in a given situation at a given time. Developing indicators and assessments based upon dynamic information seeking behavior of humans and agents as to who is really involved with a given problem will be a continuing research challenge. It is similar to the problem of trying to assess what a customer might want to buy based upon what they have bought or looked at in the past.

Even given the research and development challenges in the implementation of what we have presented, what we can do in terms of current knowledge and the development of an EPTrust and improved audit controls for EP will have a startling impact on the pervasiveness of EP in our society. Furthermore it will improve the understanding of the EP process to all the segments of the society and meaningfully improve the confidence of the society in our state of preparedness.

ACKNOWLEDGMENT

This paper is a joint effort of a team in Emergency Response Information Systems from the Information Systems Department at NJIT and a team of researchers in continuous auditing from the Rutgers Newark Department of Accounting Information Systems.

An earlier version of this paper appeared in the Proceedings of ISCRAM 2004 (First International Workshop on Information Systems for Crisis Response and Management (See: http://www.iscram.org)

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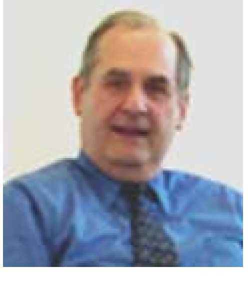

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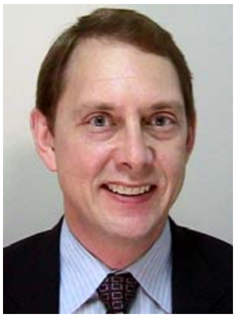

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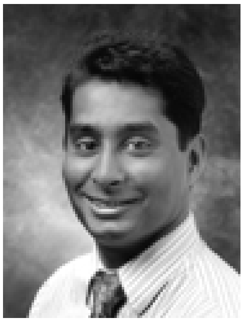

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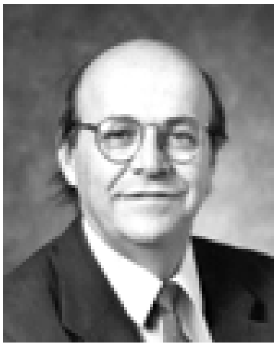

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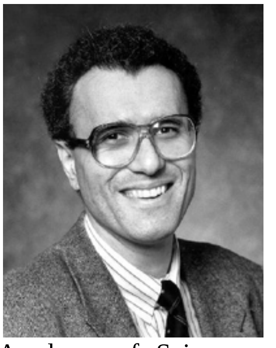

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