An Experimental News Production System with Flexible Role-Based Access Control

Min-Che Ho
Computer Science Department
National Chengchi University
Taipei, Taiwan
fantast@alumni.nccu.edu.tw

Tsai-Yen Li
Computer Science Department
National Chengchi University
Taipei, Taiwan
li@nccu.edu.tw

Abstract **The rapid development of information technology has sped up the production of digital news media. An effective news production system plays an important role in improving workflow efficiency of the production via computer support collaborative work. However, most news production systems developed today target for on-line news web publishing and usually are tailored to a specific organization. In this paper, we have used the University News at National Chengchi University as a target example to design a generic collaborative news production system with flexible access control. We have formally analyzed and modeled the system requirements with the UML language. In addition, we have adopted an augmented role-based access control mechanism to design a news production system that can easily adapt to organizational changes. The implemented system is used a testbed for experimental news production. Preliminary evaluation of the system functions reveals that users can adapt to this system and increase their productivity in the news production process.**

Index Terms**— Collaborative Work, Web-based Information System, News Production System, Role-based Access Control, UML, NewsML**

I. INTRODUCTION

With the rapid development of Internet and information technologies, the channels that people receive information become more diverse. In addition to the traditional paper publications, news can now be published via the Internet in various forms such as web site, e-mail, PDA, and cellular phones. On the other hand, as more news companies merge to form a larger company, news production companies strive to save production manpower in order to remain competitive. Therefore, an automation system for news production that can speed up the production process and allow a news source to be repurposed to another publishing platform becomes crucial in organization and process evolution.

The web publishing paradigm has fundamentally changed the news publishing process. However, for traditional forms of publishing such as printed newspaper, the various roles in the news production process and the concept of gate keeping [10][17] still remain crucial for high-quality news publishing. A typical news production cycle is depicted in Fig. 1 [6]. The cycle starts from clue collection by a news reporter. The reporter then proposes them to a clue review meeting to decide the interviews to be conducted in order to determine the news contents. After an interview, the reporter writes the news articles in time and submitted them to a news editor or a news center director for content review. An accepted article will be stored in the database for further editorial processes such as order and layout editing according to the target publishing form. The major rigorous gate-keeping efforts, called organization-level gate keeping, are kept as part of the production process when the editor reviews the clue and article proposals. In such a process, close and formal collaboration among its team members is crucial for high-quality news articles.

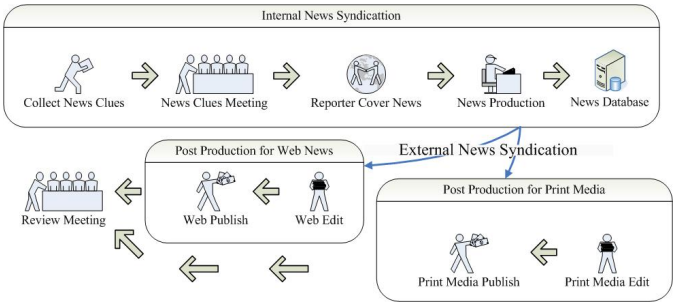

Figure 1. Typical news production process

Since news production is a highly pragmatic process adapting to cultural and organizational characteristics, the process may vary significantly in different companies for different publishing forms. Therefore, a good production system can not only assist its members in the collaborative process but also quickly adapt to potential organization changes. It is especially true for experimental environments such as a university newspaper press service. In this paper, we have used "University News" published weekly by National Chengchi University (NCCU) as an example to design a news production system in the form of computer support collaborative work (CSCW) to assist the traditional production process. This system aims to provide a flexible access control mechanism such that the roles and rights of its members can be easily changed to fit the needs of a specific experiment.

We have conducted a formal analysis of the news production process with the Unified Modeling Language (UML) [17][12] and implemented the system with a Role-Based Access Control (RBAC) approach to allow flexible organizational changes.

This work is partially supported by a grant from National Science Council under the contact of NSC93-2213-E-004-001.

0-7803-8932-8/05/$20.00 © 2005 IEEE

Due to the characteristics of the production process, we have proposed to modify the symmetric RBAC model to account for process-related constraints such as time and process status. Preliminary experiments on the implemented system have been conducted on the "University News" paper and qualitative user feedbacks are reported in this paper. In the next section, we will review the research pertaining to the process of news productions.

II. Related work

Many systems have been proposed in the literature for news production. For example, the FieldWise system was proposed to assist news reporters of radio stations in using various mobile devices available at the time to locate information for a specific topic and submit an article from anywhere [4]. Since the publishing form emphasizes on its real-time characteristic, the gate-keeping function is performed mainly at a personal level on the reporter.

Although the research on news specific content management is rather limited, the issue has attracted many attentions in recent years. As Castells pointed out, news contents are highly valuable digital contents, and the technologies that can facilitate the production, management, storage, and publishing of news will have great application values [3]. Vogels considered the push model as a better way for news delivery and therefore developed a news delivery system, called Astroblabe, with this feature [15]. It uses a Peer-to-Peer (P2P) architecture to build a collaborative content delivery network to provide publishing and subscription of news services [16].

Most news search mechanisms are keyword based, which may not be effective for novice users who are new to a specific topic or new to an information search mechanism. Yang has proposed to exploit the natures of a news event to overcome the weakness of traditional news classifications [19]. For example, there could be intensive reports of various forms for headline news and news could also be developed for some period of time. He has proposed the algorithms of Group-Average Clustering (GAC) and INCR (single-pass incremental clustering) to facilitate hot news detection and news development tracking.

Access control is an important issue for the design of any systems for computer support collaborative work (CSCW). Access is defined as the right for a subject to perform some operation on an object. For example, a user (subject) may have a right to read (operation) the contents of a file (object). Common access control mechanisms can be divided into three classes: *mandatory*, *discretionary*, and *role-based access control* [9]. The Role-Based Access Control (RBAC), proposed in the 1970's, has been shown to be an effective mechanism that can provide the most flexibility [13]. Instead of being assigned to a specific subject, permissions are assigned to a role, which may in turn be assigned to a user. A user can also assume several roles. Despite its power, the methods for RBAC are not standardized until recent years when the National Institute of Standards and Technology (NIST) defines the four RBAC models: *Flat*, *Hierarchical*, *Constrained*, and *Symmetric* [14].

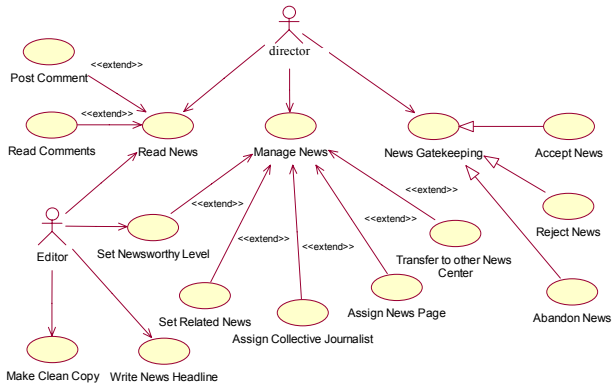

Figure 2. Use case diagram for interview management

The appropriateness of these models for the news production system will be described in details in the system design section (Section IV).

III. News production system analysis

In this section, we will provide a more detail description of the existing news production process and the desirable features for the experimental testbed. We will first introduce the organization of an experimental newspaper production and use the article production process as an example to illustrate the characteristics of such a process.

A. News production organization

A good news production system should be adaptive to potential organizational changes where role assignments may change over time. Two news production organizations commonly implemented in a newspaper firm have been experimented in University News. One form is by organizing the production teams according to the newspaper pages. Each page has an associated editor in charge of reviewing the news clue proposals as well as the news articles. Each reporter belongs to a team for a specific page. For example, University News contains eight pages and therefore divides the practicing student reporters into eight groups for pages such as front page, sports, campus, etc.

Another form of organization is by dividing the production teams into news centers according to certain classification of news contents that could contribute to several pages. Each reporter belongs to a news center, and the director of the news center is in charging of several pages and may reassign an article to another news center if he/she thinks it is more appropriate. There could be also free reporters, who provide contents on an available basis and do not belong to any news centers. Each reporter is responsible for the contents of the news article he/she has created no matter which page or news center the article is assigned to.

B. Article production process

In this paper, we have used the organization of news centers as an example to illustrate the production process. The use case diagram of UML for article management is depicted in Fig. 2.

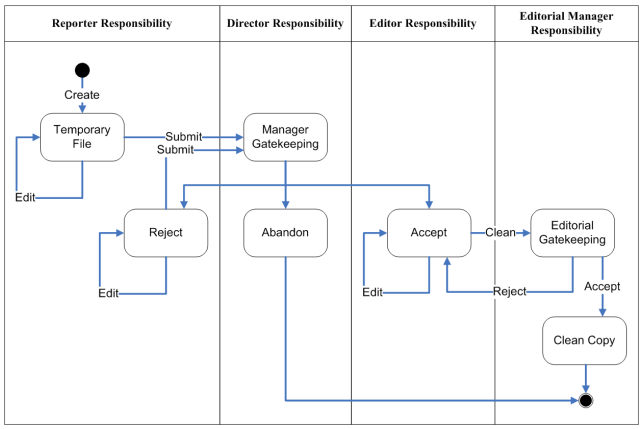

Figure 3. Article activity diagram

The key role in this use case is the director of the news center who will be in charge of reading, managing, and reviewing the news articles written by the reporters of the news center. An article could be assigned to a specific page, merged with another article, reassigned to another news center, etc. The status of an article after review may include acceptance, reject, and revision. The other role in the diagram is the editor who will take the responsibility of cleaning the contents of an article and proposing an appropriate title for it.

Due to the gate-keeping principle in the news production process, it is common for the participants to excise the activities of making proposals, granting approvals, or making revisions. For example, a news clue is proposed to the news center director to decide if the news is valuable for the edition under consideration. The director can also correct the direction of the news clue according to all received proposals or collected relevant information. The process is an iterative one until the gate-keeping criteria have been met or the time is used up. In Fig. 3, we depict the activity diagram in UML for producing a news article [12]. In each activity phase, only the responsible person can edit the contents of the article. The diagram for news clue activity also takes a similar form.

In addition to the news review process described above, functions such as discussion boards and search engines for article development, multimedia content support, article priority assignment, etc. are all desirable features in a CSCW news production system.

IV. RBAC-BASED SYSTEM DESIGN

Although the system requirements for a news production is not completely listed in the previous section, critical requirements such as flexibility for organizational changes and functions for collaborative work support have been identified. In this section, we will focus on the key design issue of access control for such requirements. Specifically, we will use the concept of role-based access control to design the news production system. Before describing the design, we will first present the domain object model of our application.

A. Domain Object Model

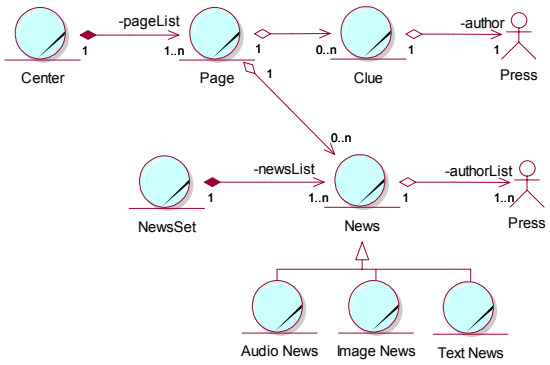

Figure 4. Document Object Model (DOM) of the news production system

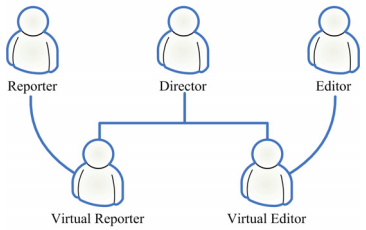

Figure 5. Example of hierarchical RBAC in the system

The domain object model for our news production system is depicted in Fig. 4. As mentioned in the previous section, a news center consists of several news pages, which in turn are composed of several news items. Several types of multimedia articles such as audio, image, and text news items, inherited from the generic news items, are allowed in the current design. A NewsSet is an implicit object containing a collection of news items that could be in various forms or managed by different news centers. The concept is similar to the architecture of NewsML [1], a standard markup language for news syndication. In fact, we have adopted the structure of NewsML to design the detail attributes of each news item such that the news contents can be easily repurposed to a different client platform.

B. Standard RBAC models

As mentioned in Section II, the RBAC model is a flexible access control model suitable for permission assignment in complex applications. Four models have been defined by the National Institute of Standards and Technology, NIST). The flat RBAC model is the simplest one that requires all many-to-many relations between users, roles, and permissions to be specified explicitly. For example, a news reporter may belong to two news centers at the same time and be granted the rights of creating news articles for both centers.

However, like the concept of objects, many roles also possess the “is-a” relation and can be easily specified in a hierarchical fashion according to company organization. Therefore, the hierarchical RBAC model, based on the implementation of flat RBAC, is proposed to satisfy this need. For example, in addition to the basic rights of a regular user, such as reading discussion boards, a reporter also has the rights of creating and

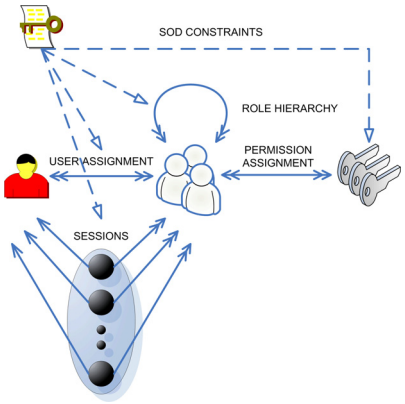

Figure 6. Symmetric RBAC with dynamic Separation Of Duty (SOD) [14]

managing news articles. The director of a news center can possess all the rights of a reporter and some others specific to the role of director. However, sometimes we do not want a supervisor to have rights exceeding the task of supervision [13]. In this case, we can design virtual roles, such as the virtual reporters and virtual editors depicted in Fig. 5, and let both supervisor and supervisee to inherit from them to share their common rights.

Although one can enumerate all legal user-role-permission relations, sometimes it is easier to specify the conflicting roles that are not supposed to happen at the same time for the same person. For example, a person who is in charge of accounting usually cannot also play the role of auditor. Specifying such an undesirable conflicting relation is equivalent to adding constraints to generic role assignment rules. This type of access control model is called the constrained RBAC mode. If the constraints are symmetrically specified on the role-permission relations in addition to the user-role assignment, the type of RBAC model is called the symmetric RBAC mode. We illustrate the symmetric RBAC model with dynamic Separation of Duty (SOD) in Fig. 6. Note that the constraints can be applied to both the user and permission assignments. The dynamic SOD means that the constraints can be dynamically determined at run time.

Although the four RBAC models described above can satisfy the need of most enterprises, we have found that it falls short when we would like to express constraints based on process flow, object status, and time. For example, in a news production process, a news director will be granted the right of managing an article merely according to the ownership of the article. In addition, as depicted in Fig. 3, an article can be edited only by one person according to the status of the article in the process flow. The dates that one is allowed to edit an article may also be limited to the life cycle of the article. Therefore, we have designed an augmented symmetric RBAC model as describe below to account for these constraints.

C. *Design of the augmented symmetric RBAC model*

We have chosen to implement the symmetric RBAC model

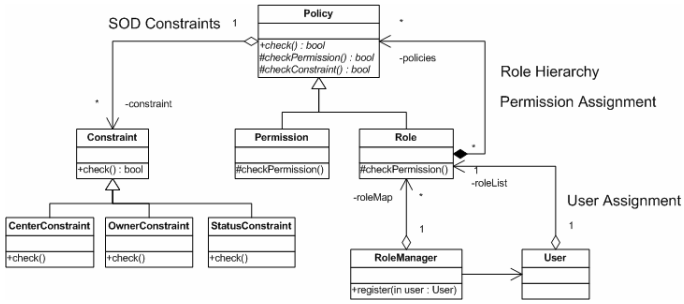

Figure 7. Class diagram of the access control mechanism

```
POLICY_CHECK(user, object, operation)
  RESULT←false;
  // check if the user is allowed to operate on this object
  if CHECK_PERMISSION(user object, operation) then
    // if there are any addition constraints
    if CHECK_CONSTRAINT(user, object) then
      RESULT←true;
  return RESULT;
```

Figure 8. The policy check procedure

for the news production system under consideration. According to the description in the previous subsection, we also have to augment the model with additional dynamic constraints based on process flow, object status, and dates. Similar needs and solutions have also been found in [2][8][11]. The class diagram of our access control design is shown in Fig. 7.

Policy is the base class for checking access control, and the role and permission classes are all derived from the policy class. We use the Composite Pattern [5] to implement the hierarchical RBAC model. Permission is a terminal class but a role object can recursively contains other roles as well as specific permissions. In addition, we use a Template Method pattern to implement the access control mechanism as well as the additional constraints imposed in our system. As shown in Fig. 8, the CHECK_PERMISSION and CHECK_CONSTRAINT methods in the template CHECK_POLICY method are all abstract methods in the Policy class and should be implemented by each derived Role and Permission classes. We have included the Constraint class in the Policy class in order to implement symmetric RBAC. We can then derive several types of constraints required by the system as mentioned in the previous subsection. For example, a StatusConstraint object can be used to limit the access right of a reporter according to the status of the article. An OwnerConstraint object can be used to limit the right of deleting an article in the discussion board according to its ownership.

V. IMPLEMENTATION AND EXPERIMENTS

A. *Implementation*

We have implemented the news production system for web-based environments. On the server side, we have used Java-based standards such as the Java Servlet 2.3, JSP 1.2, JSTL 1.0, and Java Bean to implement the system. We also have adopted Struts 1.1 as the application framework of our system architecture. In addition, we have used the Apache

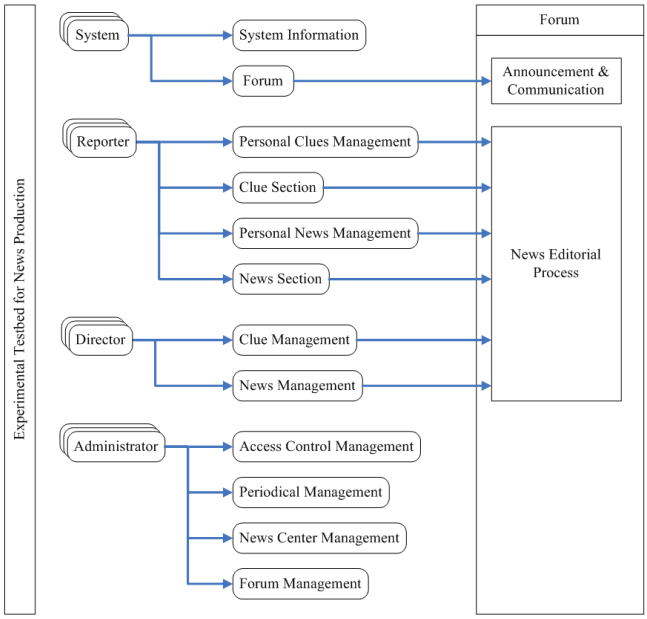

Figure 9. Information architecture of the news production web site

HTTP server and Tomcat application server for the web services. The information architecture of the news production web site is depicted in Fig. 9. The functions of the system are divided into four sections: system, reporters, directors, and administrators. The system section provides system-wide announcements and discussion boards. The reporters and directors sections provide functions for the respective users to access the articles in a collaborative way. The administrator section provides the major functions of creating users, roles, permissions, as well as their appropriate relations. The access to the modules in the web site is also controlled by the RBAC mechanism such that different users may see different interfaces according to the roles they assume.

B. *Experiments*

The implemented system is put into practice in two stages. In the first stage, we evaluate the system in a smaller group of students (23 people) taking the course of digital media production at NCCU. All students have the experience of participating in the University News press. In this experiment, they are divided into groups and play various roles (such as reporters and directors) in the news production process. A questionnaire survey is conducted after the experiments. About 78% of people agreed that the functions in clue management and article management satisfy the needs of an on-line news production system. Most people agreed that this CSCW type of production process can greatly shorten the work hours as well as the time that one needs to spend in the editor's room. More detail data are reported in [7]. In the second stage, the system is used in the real production process of the weekly University News. The preliminary feedbacks from the users are satisfactory despite many new desirable features are expected in the future edition of the system.

VI. Conclusions

Traditional newspaper production adheres to the rigorous gate keeping principle compared to most real-time news publishing on the web. The production process for different companies may vary greatly according to their organizational nature. We have conducted a formal analysis on the production process and designed a flexible access control mechanism with augmented constraints that can adapt to potential organization variations. We have implemented such a system to provide a collaborative environment for the production team to conveniently work together in the production process. Preliminary experiments have also been conducted to demonstrate the effectiveness of our system.

References

[1] T. Allday, "NewsML – enabling a standards-led revolution in news publishing?" EBU TECHNICAL REVIEW, June, 2001.
[2] D. Basin, J. Doser, and T. Lodderstedt, "Model driven security for process-oriented systems," *Proc. of SACMAT' 03*, Como, Italy, June 2-3, 2003.
[3] P. Castells, F. Perdrix, E. Pulido, M. Rico, R. Benjamins, J. Contreras and J. Lorés, "Neptuno: semantic web technologies for a digital newspaper archive," *Proc. of ESWS'2004*, Heraklion, Greece, May 2004.
[4] H. Fagrell, K. Forsberg, and J. Sanneblad, "FieldWise: a mobile knowledge management architecture," *Proc. of CSCW'00*, December 2-6, 2000.
[5] M. Fowler, *Analysis Patterns*, Addison-Wesley, 1996.
[6] K. Forsberg, *Mobile Newsmaking*, Licentiate Thesis, Department of Informatics, Göteborg University, Sweden, December, 2001.
[7] M.C. Ho, *An experimental testbed for news production with flexible access control policy*, Master thesis, Computer Science Department, National Chengchi University, Taipei, Taiwan, 2004.
[8] J.B.D. Joshi, E. Bertino, B. Shafiq, and A. Ghafoor, "Dependencies and Separation of Duty Constraints in GTRBAC," *Proc. of SACMAT' 03*, Como, Italy, June 2-3, 2003.
[9] B. W. Lampson, M. Abadi, M. Burrows, and E. Wobber, "Authentication in distributed systems: theory and practice," *ACM Transactions on Computer Systems*, 10(4):265--310, November 1992.
[10] K. Lewin "Channels of group life," *Human Relations*, 1: 143-153, 1947.
[11] G. Neumann, and M. Strembeck, "An approach to engineer and enforce context constraints in an RBAC environment," *Proc. of SACMAT' 03*, Como, Italy, June 2-3, 2003.
[12] I. Ray, N. Li, R. France and D.K. Kim, "Using UML to visualize role-based access control constraints," *Proc. of SACMAT' 04*, Yorktown Heights, New York, June 2-4, 2004.
[13] R.S. Sandhu, , J. Edward Coyne, Hal L. Feinstein, and C. E. Youman, "Role-based access control model," *IEEE Computer*, 29(2), February 1996.
[14] R.S. Sandhu, D. Ferraiolo, and R. Kuhn, "The NIST model for role-based access control: towards a unified standard," *Proc. of ACM Workshop on RBAC*, July 2000.
[15] R. van Renesse, K. Birman, and W. Vogels, "Astrolabe: a robust and scalable technology for distributed system monitoring, management, and data mining," *ACM Trans. on Computer Systems*, 21(2), May 2003.
[16] W. Vogels, R. Chris, R. van Renesse, and K. Birman, "A collaborative infrastructure for scalable and robust news delivery," *Proc. of the IEEE Workshop on RESH*, Vienna, Austria, July 2002.
[17] Unified Modeling Language, URL: http://www.uml.org/
[18] D. M. White "The 'Gate Keeper': A Case Study in the Selection of News," *Journalism Quarterly,* 27: 383-390, 1950.
[19] Y. Yang, J. Carbonell, R. Brown, T. Pierce, B.T. Archibald and X. Liu, "Learning approaches for Detecting and Tracking News Events," *IEEE Intelligent System*, 14(4):32-43, 1999.