Partitioning Knowledge Bases between Advanced Notification and Clinical Decision Support Systems

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Abstract: Due to the varying rates of change of ephemeral administrative and enduring clinical knowledge in decision support systems (DSSs), the functional partition of knowledge base (KB) components can lead to more efficient and cost-effective system implementation and maintenance. Our prototype loosely couples a clinical event monitor developed by Columbia University Medical Center (CUMC) with a secure notification service proxy developed by IBM Research to form a novel and complex clinical event communication service.

Introduction

Event monitors that generate alert messages based on clinically significant events and related patient data can improve health care quality and reduce costs by supplying personnel with information when and where it is needed. While integrating mobile technologies with DSSs offer the advantages of real-time information delivery, they also increase development, deployment, and technical support costs. The recent implementation of the Health Insurance Portability and Accountability Act (HIPAA) further complicates securing the integrity of data delivered via electronic channels. Our prototype demonstrates that an existing clinical DSS system can be preserved and streamlined while including full-featured notification functions by using middleware technology.

Background

Current implementations of composite DSSs use notification attributes (NAs) to augment clinical knowledge. This information can then be communicated to the notification system, making medico-administrative knowledge useful and independent of each specific clinical alert. Few institutions have implemented large scale automated monitoring of distinct clinical conditions, and to our knowledge, no existing DSSs offer customizable communication modalities, institutional policies management and mechanisms for "fault tolerance".

CUMC's previous event monitor, which was decommissioned in 1999, allowed for only two notification modalities: secure web portal and email. Its successor, *Vigilens* is a server-based DSS permitting secure telemonitoring of clinical data repositories. Besides KB separation, this system allows for a variety of pervasive communication channels, such as Blackberry wireless handheld devices.

System Description

As the amount of clinical conditions and communication modalities increase, so does system complexity, making it difficult to predict whether an event merits urgent notification to a particular user. The escalating number of potential changes in classic notification systems is directly related to the product of several dimensions related to assigning the correct recipients for an alert. In contrast, the described KB partitioning model increases linearly.

Our design extends the traditional publish-subscribe communication model by providing an additional level of abstraction that separates user preferences and role information from the clinical alert. These definitions are applied to filtered incoming content to determine the intended recipients and destinations of an alert. The notification KB encompasses hospital policies for cascading alerts when messages cannot be delivered due to network outages, for example.

NAs that provide clinically relevant information simplify the management of communication methods and allow for the separation of knowledge. By creating a standard interface for event monitors to communicate with other modules, NAs facilitate institution-level management of policies and simplify user-level preference configurations. In our prototype, we implemented forty types of clinical alerts with two types of NAs (urgency, severity) and three states (high, low, unknown).

Conclusion

In summary, the *Vigilens* proof-of-concept study has demonstrated that clinical and notification KBs can be decoupled via NAs, thus enabling stringent security criteria, increased notification flexibility, and potentially reducing the costs of maintaining clinical and administrative rules