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# Designing and implementing usable and useful Accountable-eHealth systems

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## Abstract

This tutorial primarily focuses on the technical challenges surrounding the design and implementation of Accountable-eHealth (AeH) systems. The potential benefits of shared eHealth records systems are promising for the future of improved healthcare; however, their uptake is hindered by concerns over the privacy and security of patient information. In the current eHealth environment, there are competing requirements between healthcare consumers' (i.e. patients) requirements and healthcare professionals' requirements. While consumers want control over their information, healthcare professionals want access to as much information as required in order to make well informed decisions. This conflict is evident in the review of Australia's PCEHR system [1]. Accountable-eHealth systems aim to balance these concerns by implementing Information Accountability (IA) mechanisms. AeH systems create an eHealth environment where health information is available to the right person at the right time without rigid barriers whilst empowering the consumers with information control and transparency, thus, enabling the creation of shared eHealth records that can be useful to both patients and HCPs. In this half-day tutorial, we will discuss and describe the technical challenges surrounding the implementation of AeH systems and the solutions we have devised. A prototype AeH system will be used to demonstrate the functionality of AeH systems, and illustrate some of the proposed solutions. The topics that will be covered include: designing for usability in AeH systems, the privacy and security of audit mechanisms, providing for diversity of users, the scalability of AeH systems, and finally the challenges of enabling research and Big Data Analytics on shared eHealth Records while ensuring accountability and privacy are maintained.

## I. AUDIENCE

The intended audience for this tutorial includes a broad range of eHealth researchers in the information management arena, eHealth policy experts and eHealth technology experts.

## II. TUTORIAL OUTLINE

The tutorial is split into four sections: usability, diversity of users, securing accountability mechanisms, and health Big Data and accountability. While discussing each section a prototype [2] will be used to demonstrate the functionality of Accountability-eHealth systems and illustrate the proposed solutions.

### A. Usability

In order to implement AeH systems, we must consider the usability or ease of use of the accountability mechanisms. Usability is an important factor in achieving meaningful use in eHealth systems as it enables the effective, efficient, and safe use of such systems [3]. In this section, we will discuss the features of AeH systems, how they can be designed to meet usability principles, and use a prototype to demonstrate a practical implementation of these principles. This section is divided into the following subsections.

- 1) Usability in eHealth systems
- 2) Design principles of usable security mechanisms
- 3) Designing for usability in AeH systems

### B. Diversity of users

Not all users of an eHealth system have an equal ability to interact with it. As such it is important to provide for diversity of users. In this section, we will discuss some of the methods for providing for diversity of users and enabling users to act on behalf of other users, while ensuring accountability is maintained. This section is divided into the following subsections.

- 1) The diversity of users of an eHealth system
- 2) Practical issues when providing for diversity of users
- 3) Some solutions to providing for diversity in AeH systems

### C. Securing accountability mechanisms

In this section, we'll discuss the security and privacy requirements specific to Accountable-eHealth systems. Out of necessity, the patient usage policies and audit logs used in AeH systems contain significant personal information. Additionally, in order to hold users accountable, the usage policies and audit logs integrity must be provable. This section is divided into the following subsections.

- 1) The privacy implications of usage policies and audit logs
- 2) Securing usage policies and audit logs
- 3) Non-repudiation challenges; proving that usage policies and audit logs haven't been tampered with

### D. Health Big Data and Accountability

A great advantage of an shared EHR system is the potential for improving healthcare through research and data mining on the health information of a population. Analysis of such large datasets could enable the discovery of new treatment options [4], improved population health and better policy making [5]. In this section, we'll discuss the privacy and security implications of Big Data Analytics on eHealth systems, and the possible ways Accountable-eHealth systems could enable such research while maintaining accountability of data users. This section is divided into the following subsections.

- 1) Accountability at scale
- 2) Enabling research on large datasets while maintaining accountability

## III. LECTURERS

### Daniel Grunwell (BIT)

Daniel Grunwell is a research student in the School of Electrical Engineering and Computer Science at the Queensland University of Technology, Brisbane, Australia. Daniel's research focuses on the technical implementation and design of Accountable-eHealth (AeH) systems. Daniel holds a degree in Information Technology from Queensland University of Technology.

### Tony Sahama (B.Sc., M.Phil., PhD., M.Ed(HE))

Tony Sahama is a senior lecturer in the Information Security Discipline, Faculty of Science and Engineering. His research interest is in Health/Medical Informatics in particular, Healthcare Information Technology (HIT) and Clinical Decision Support Systems design and development. Tony holds a PhD in Computer Science (Computer Simulation and Modelling, DACE), Master of Education (Higher Education), M.Phil (Statistical Computation) and B.Sc. (specialised in Applied Statistics and Computer Programming). Tony has experience working with researchers in developing customised technological applications for Clinical Decision Support Systems, Data warehousing, Data Integration and IT applications for healthcare decision making processes. Currently, Tony is supervising 4 research masters and 4 PhD level projects in the Medical Informatics research area. Tony holds professional membership with ACM (SIGBioinformatics), IEEE, IBS, ACS, SSAI and HISA. Further information about Tony's research activities can be retrieved from <http://staff.qut.edu.au/staff/sahama/>.

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