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Security and Privacy in Healthcare Environments

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Objectives and Issues

- **Objectives**
  - Security, privacy, and safety of patients and staff
  - Security, privacy, and safety for processes and facilities in hospitals, clinics, etc.
- **Issues**
  - Vulnerabilities to malicious behavior, hostile settings, terrorism attacks, natural disasters, tampering
  - Reliability, security, and privacy issues can affect timeliness and precision of patient information

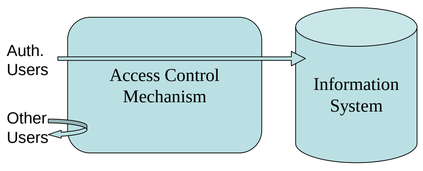
Objectives and Issues – cont.

- **Issues – cont.**
  - Collaboration over networks should be secure, private, trustworthy, reliable, consistent, correct and anonymous
    - Collaborators include physicians, nurses and staff; pharmacies; emergency personnel and law enforcement agencies; government and community leaders

Measures

- **Example Measures**
  - No of incidents per day, etc., in a ward, hospital, etc.
  - No of non-emergency calls due to malfunctions, failures, or intrusions
  - No of false fire alarms, smoke detections, pager activations, etc.
  - No of cases of wrong data values, lost or delayed messages, etc.
  - Timeliness, accuracy, precision

Access Control



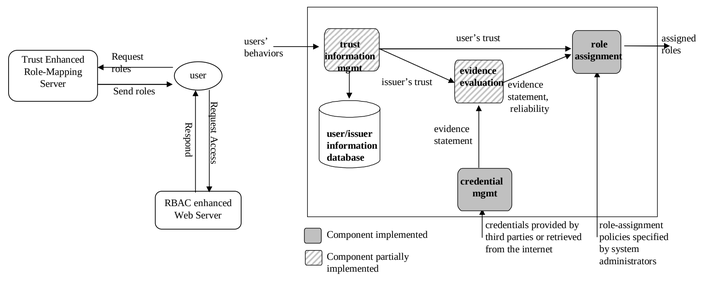
- **Authorized Users**
  - Validated credentials

    AND
  - Cooperative and legitimate behavior history
- **Other Users**
  - Lack of required credentials

    OR
  - Non-cooperative or malicious behavior history

Using Trust and Roles for Access Control

- **Approach: “add” trust to role-based access control (RBAC)**
  - Cooperates with traditional RBAC
  - Authorization based on evidence, trust, and roles (user profile analysis)



Architecture of TERM Server

Integrity Checking Systems

- **Integrity Assertions (IAs)**
  - Predicates on values of database items
- **Examples** (IAs would detects errors)
  - Coordinate shift in a Korean plane shot down by U.S.S.R.
  - Human error: potassium result of 3.5 reported to ICU as 8.5
- **Types of IAs**
  - Allowable value range
  - Relationships to values of other data
  - Conditional value

Privacy and Anonymity

- **Privacy**
  - Protecting sensitive data from unauthorized access
  - Controlled dissemination of private data
  - Health Insurance Portability and Accountability Act (HIPAA)
  - Patients rights to request a restriction or limitation on the disclosure of protected health information (PHI)
  - Staff rights
- **Anonymity**
  - Protecting identity of data sources

Emerging Technologies: Sensors and Wireless Communications

- **Challenge:**
  - Develop sensors that monitor and detect violations in medical care environments before a threat to health or life occurs
    - -Bio sensors to detect anthrax, viruses, toxins, bacteria
    - -Ion trap mass spectrometer
    - -Neutron-based detectors
    - -Electronic sensors, wireless devices

More on Our Research

- **Collaboration**
  - Prof. Clement McDonald, M.D., Regenstrief Institute for Health Care, Indiana University School of Medicine
  - Prof. Arif Ghafoor, Electrical and Computer Enginering, Purdue
  - Prof. Mike Zoltowski, Electrical and Computer Enginering, Purdue
- **Web Site:** http://www.cs.purdue.edu/homes/bb/
- **Current support :** over one million dollars (NSF, Cisco, Motorola, DARPA)
- **Selected Publications:**

- B. Bhargava and L. Lilien, "Private and Trusted Collaborations," Proc. Secure Knowledge Management (SKM): A Workshop, Amherst, NY, Sept. 2004.
- A. Bhargava and M. Zoltowski, “Sensors and Wireless Communication for Medical Care,” Proc. Intl. Workshop on Mobility in Databases and Distributed Systems (MDDS), Prague, Czechia, Sept. 2003.
- B. Bhargava, Y. Zhong, and Y. Lu, "Fraud Formalization and Detection,” Proc. Intl. Conf. Data Warehousing and Knowledge Management (DaWaK), Prague, Czechia, Sept. 2003.
- E. Terzi, Y. Zhong, B. Bhargava, Pankaj, and S. Madria, "An Algorithm for Building User-Role Profiles in a Trust Environment", in Proc. DaWaK 2002, Aix-en-Provence, France, Sept. 2002.

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