

ITR Collaborative Research: Context-Aware Computing with Applications to Public Health Management

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Research Objectives

- System architecture to provide comprehensive support for context-aware applications:
 - Peer-to-peer and mediated semantic data integration
 - Dynamic data as collected by sensor networks and web services
 - Matching of user profiles to services
 - Competitive environment management
 - Security and privacy
 - Performance and scalability (e.g., caching and data aggregation)
- Testing against operational scenarios of public health management applications:
 - Daily operations of health care providers
 - Epidemic occurrences (e.g., meningitis)
 - Crisis situations (e.g., terrorist attacks, natural disasters)

Approach

- Data Integration and Context-Aware Services
- Mobile Context Management and Services
- Resource and Context Discovery in Mobile P2P Networks
- Fair and Efficient Resource Arbitration Mechanisms
- Data Management for Ad-Hoc Networks
- Data Management for Sensor Networks
- Data Authentication and Privacy

Broader Impact

- Improved technology infrastructure for the public health sector and for homeland security nationwide:
 - Patient quality and safety
 - Provider capacity
 - Epidemic / emergency response times and procedure error rate
 - Infectious disease data reporting
- Impact on several courses, including:
 - Data and Web Semantics (UIC, graduate, new)
 - Introduction to Systems Security (Brown, undergraduate, new)
 - Parallel and Distributed Database Systems (Northwestern, existing graduate course)
- Human resource development:
 - 2 postdoctoral fellows
 - 15 graduate students
 - 5 undergraduate students

Significant Results

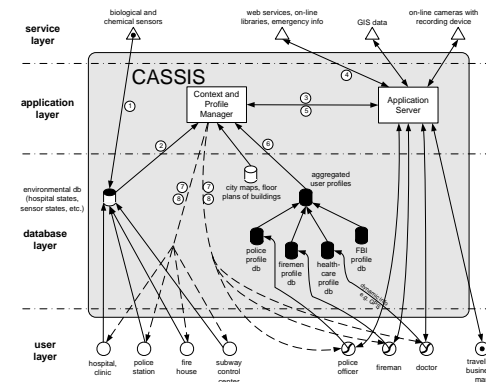
- Peer-to-Peer Semantic Integration of XML and RDF Data Sources [Cruz, Xiao, Hsu, AP2PC 2004]
- Opportunistic Resource Exchange in Inter-Vehicle Ad-Hoc Networks (Best paper award) [Xu, Ouksel, Wolfson, MDM 2004, Best Paper Award]
- Personal Service Areas for Location-Based Wireless Web Applications [Pashtan, Heusser, Scheuermann, IEEE Internet Computing, 2004]
- An Economic Model for Resource Exchange in Mobile Peer-to-Peer Networks [Wolfson, Xu, Sista, SSDBM, 2004].
- Multicast Authentication in Fully Adversarial Networks [Lysanskaya, Tamassia, Triandopoulos, IEEE Security and Privacy, 2004]
- Health cost benefit model (business case, proposed metrics, evaluation methodology) and scenario workflows (out of clinic, clinic, remote care workflows, public health emergency) [Lippitt, Hamilton, 2004]

A Day in the Life of Dr. Fred Rachman

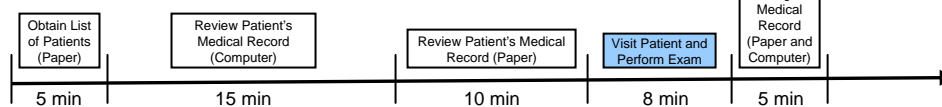
Dr. Fred Rachman
 Director of Chicago's
 Health Services

"I have a patient record for every encounter."
 "I can be reached anytime."
 "My tablet/laptop combo works for me, I don't work for it. It knows where I am and what I need."
 "Bottom line — I can spend more time with my patients with better information, faster response and easier access to tools."

CASSIS in a Public Health Emergency Scenario



Bottlenecks in Provider Activity



Bottom line – lives saved, less permanent disabilities, fewer injuries