CYBER SECURITY DIVISION

2013 PRINCIPAL INVESTIGATORS'

Accountable Information Usage

Massachusetts Institute of Technology

Lalana Kagal

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Homeland Security

Science and Technology

Team Profile

Decentralized Information Group

Hal Abelson (PI)
Tim Berners-Lee
Lalana Kagal (PI)
Joe Pato
Gerry Sussman
K. Krasnow Waterman
Daniel Weitzner

PhD students
Masters students
Undergraduates

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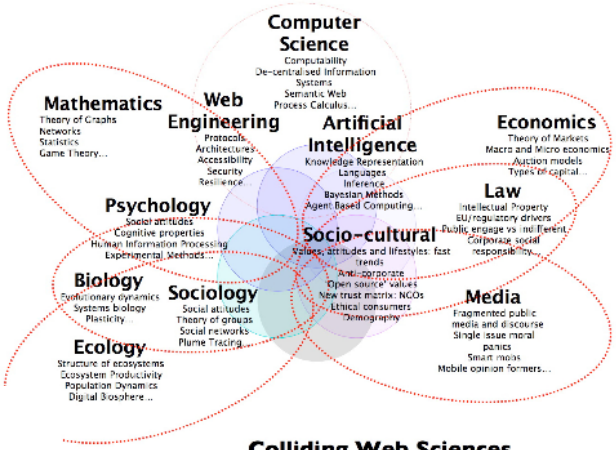

Colliding Web Sciences
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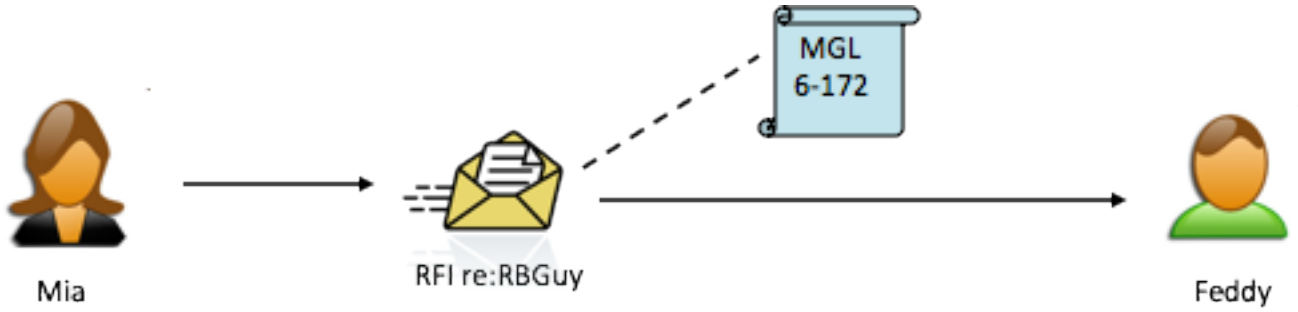
Privacy Awareness in Facebook

Customer Need

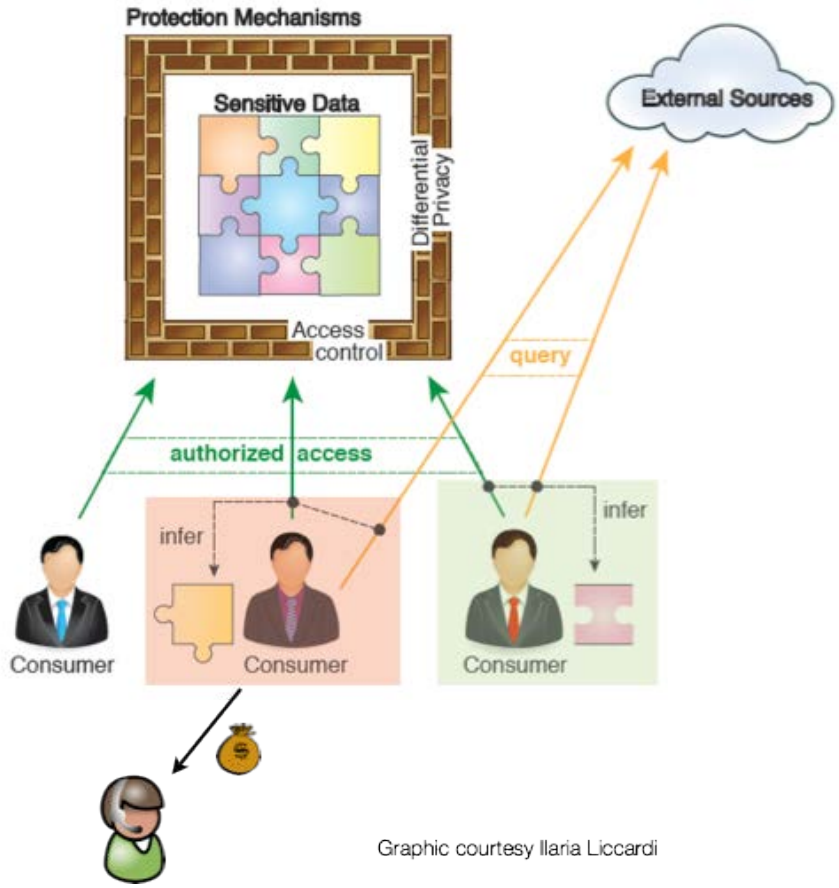
- Useful for policy compliant information sharing and exchange in decentralized environments such as
  - DHS Fusion
  - Emergency responders
  - Health Information Exchange
  - Juvenile Justice



Best Paper Award: *K. Krasnow Waterman and S. Wang. Prototyping fusion center information sharing; implementing policy reasoning over cross-jurisdictional data transactions occurring in a decentralized environment. In IEEE Conference on Homeland Security Technologies (IEEE HST 2010), November 2010.*

Approach

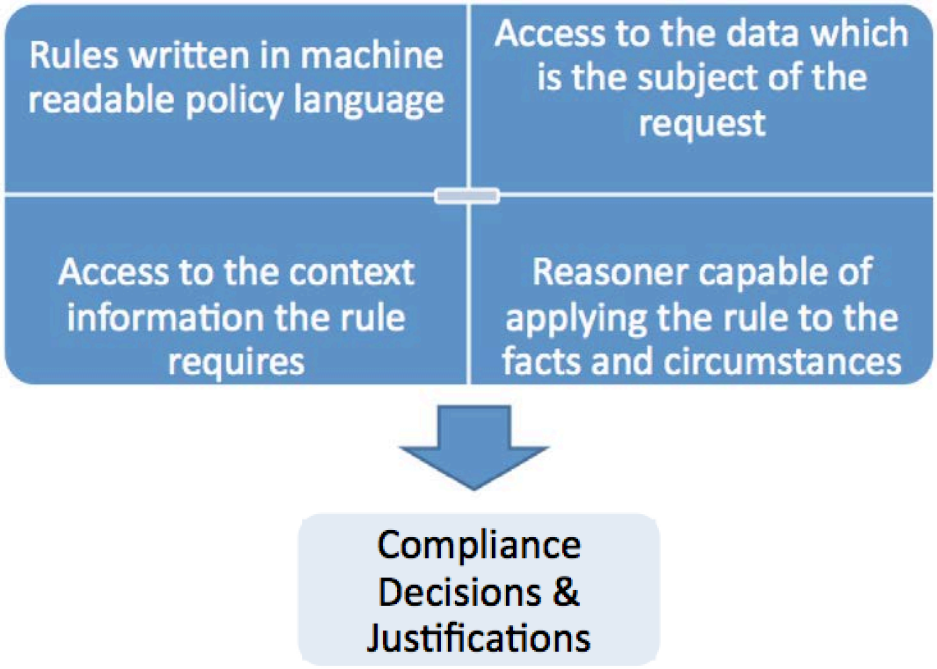
- **Information Accountability**: When information has been used, it should be possible to determine what happened, and to pinpoint use that is inappropriate. This requires the ability to
  - express information use policies
  - monitor / reason over information use
  - provide redress
- Moves focus from “what you know” about me to “what you do with it”
- Not just access control but usage control



Graphic courtesy Ilaria Liccardi

Approach

- An accountable information system is able to determine
  - Whether each use of data was/is compliant
  - with the relevant rules (laws, regulation, or policy)
  - for particular data, parties, and circumstances



Technologies

- (Distributed) Domain knowledge: Linked Data technologies
  - Web standards for developing and maintaining structured data
- Rules: AIR Rule Language
  - Production rules (if-then-else) over any set of vocabularies
  - Modular development of rules and ability to traverse from rule to rule (linked rules)
- Reasoner: AIR Reasoner
  - Fetch data from any addressable source as needed during processing
  - Produce plain language explanations
  - Produce full statement of dependencies
- System
  - Input, rules, and output are all in the same form (Linked Data)

Data Model

- Linked Data provides information management at Web-scale
  - By leveraging Web protocols and technologies
  - Network Effect: Exponential value of being part of the Web
  - All specifications for Linked Data are open Web standards
  - Reuse of existing well developed and studied Web technology
  - Applications
    - Biomedical research
    - Counter terrorism
    - Providing transparency in government

The New York Times

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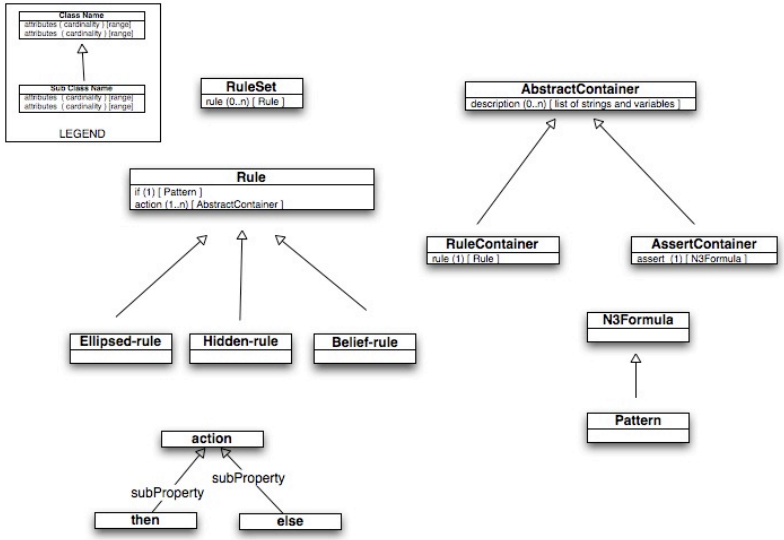
Air Rule Language & Reasoner

- machine-readable rule/policy language
- based on Linked Data technologies
- focused on justification generation, ease of specification, rule reuse, and builtins for use of distributed data
- Has been used in various projects for information accountability, policy compliance, trust frameworks, access control, etc.
- More info: http://dig.csail.mit.edu/2009/AIR/



Benefits

- Automates policy compliance checking of information transactions
- Allows information to be shared safely
- Operates in an inherently decentralized fashion
  - Fetches data and rules from distributed sources as needed during processing
- Instead of usual YES/NO answer that policy tools provides, the system provides justifications
  - Plain language explanations
  - Full statement of dependencies

Current Status

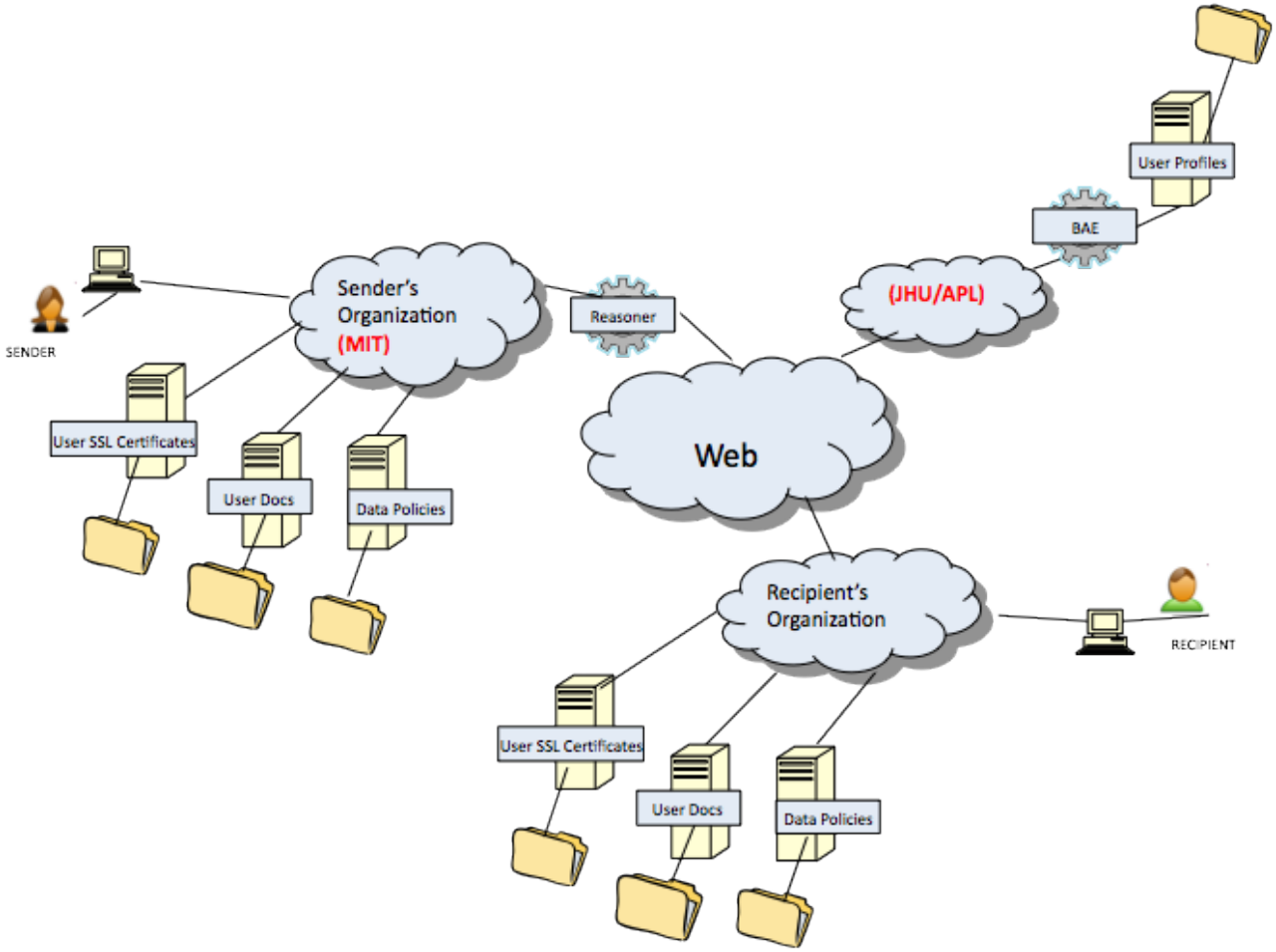
- Current project
  - FICAM Interoperability
  - HIPAA scenario demonstration (Added task)
  - Reasoner Scalability

Task 1: FICAM Backend Attribute Exchange Interoperability

- Demonstrated ability to interoperate with DHS Identity Management Testbed
- Able to serve appropriate certificates, create appropriate signatures
- Able to fetch the Distinguished Name from JHU
- Able to convert RDF -> SOAP and SOAP -> RDF
- MIT tools able to use the JHU served sender and receiver attributes in the reasoning to achieve decisions

Ian Jacobi, Daniela Miao, K. Krasnow Waterman, Lalana Kagal, "Transitioning Linked Data Accountable Systems to the Real-World with Identity, Credential, and Access Management (ICAM) Architectures", *In IEEE Conference on Homeland Security Technologies (IEEE HST 2013), October 2013.*

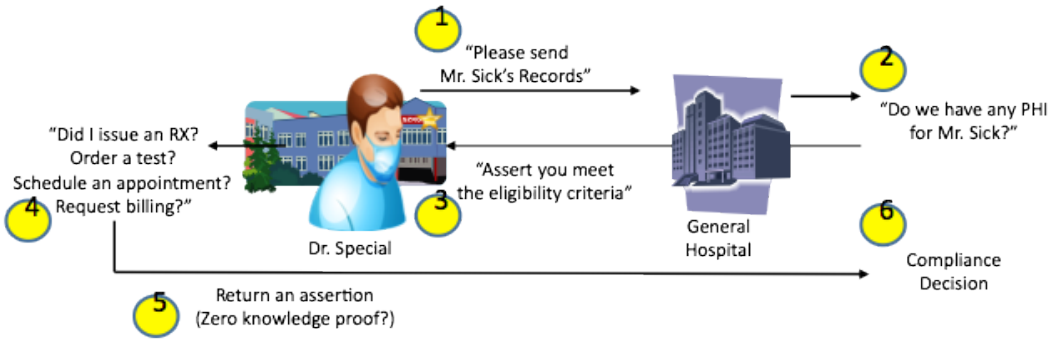
FICAM Backend Attribute Exchange Interoperability – System Design



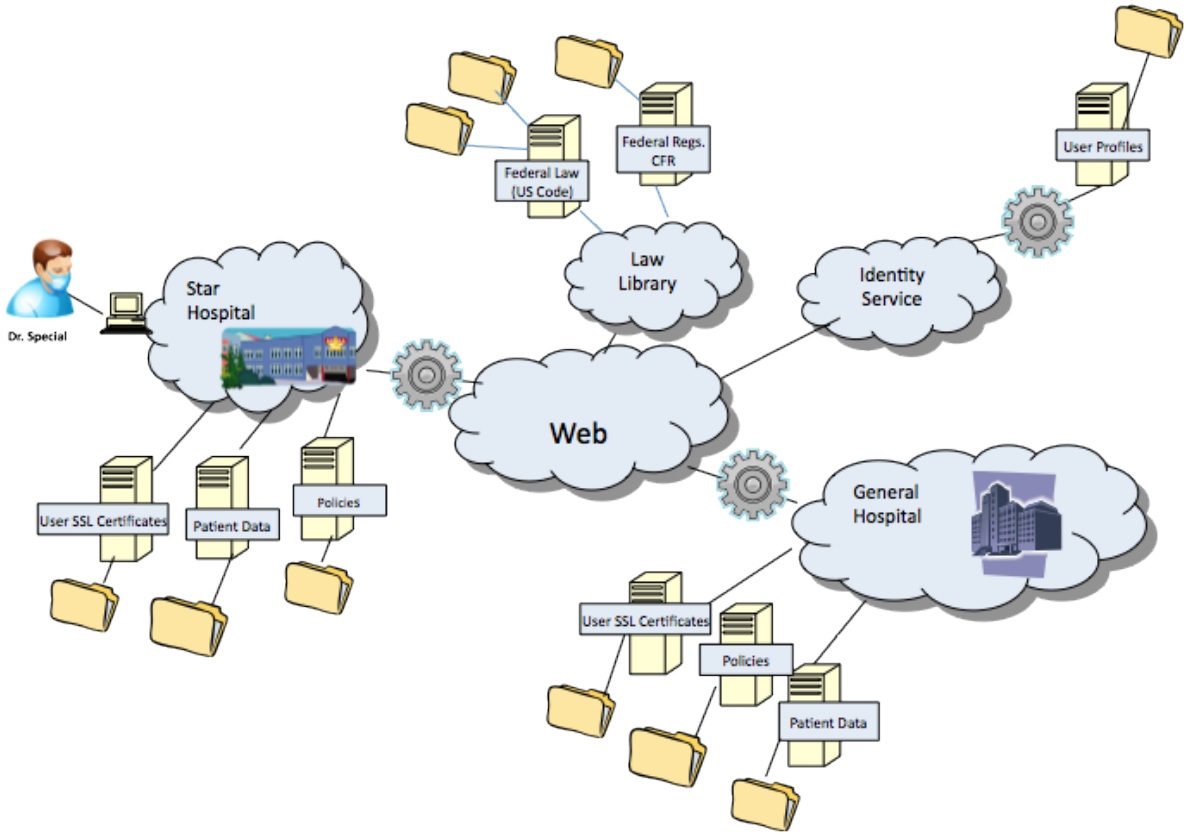
Task 2: HIPAA Scenario Development

- Showing one path of the HIPAA Privacy Rule
- Request for disclosure without patient consent or referral
  - Used when patient is unconscious or incompetent
  - Used when patient-signed consent form is unavailable
- Using as many real components as possible
  - Data standards
  - Anonymized records

- Scenario (developed in collaboration with SHARPS performer Vanderbilt)
  - Dr. Special requests disclosure of Mr. Sick's primary care electronic health Record from General Hospital

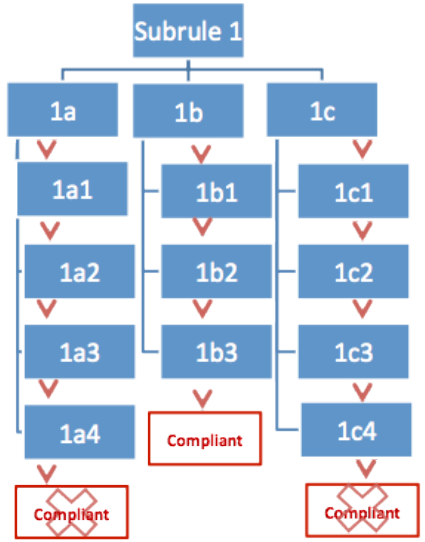


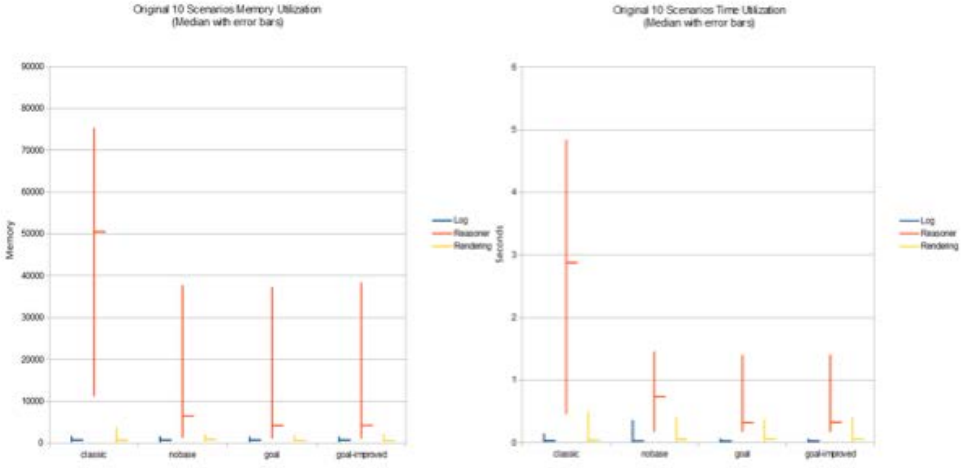
HIPAA Scenario – System Design



Task 3: Reasoner Scalability

- AIR reasoner is a production-rule system in python
- Forward chained reasoning
- RETE algorithm for pattern matching
- Truth Maintenance System (TMS) for dependency tracking
  - the reasoner maintains the premises (rules and facts) of each conclusion





Next Steps

Year 2:

- NIEM interoperability
- Enhanced capabilities for handling incompleteness
- Pilot Implementation/Demonstration Project

Contact Information

Lalana Kagal
lkagal@csail.mit.edu

Hal Abelson
hal@csail.mit.edu