Towards Regulatory Compliance:
Extracting Rights and Obligation to Align Requirements with Regulations

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Presentation Outline

- Regulations and Requirements
- Traceability in Legal Language
- Modeling Regulatory Semantics
- Case Study: HIPAA Privacy Rule
- Summary & Future Work

Problem Space: From Regulations to Requirements

- Regulations govern the system "environment."
- Regulatory language is often complex and too ambiguous.
- Penalties for non-compliance can be severe:
  - HIPAA: up to $25K per individual, violation. (42 USC 160.404)
  - FCRA: historical civil fine of $10M and $5M in consumer redress (ChoicePoint, 2006); requires security audits every other year for 20 years.
  - SOX: up to $5M and 20 years in prison. (Title XI, Section 1106)
  - COPPA: historical civil fine of $1M. (Xanga.com, 2006)

… To be accountable, companies must demonstrate how their policies and system requirements align with regulations and standards.

Guidance for Lawyers and Engineers

- Develop a systematic method to extract high-level artifacts from regulations:
  - **Rights** describe what people are permitted to do.
  - **Obligations** describe what people are required to do.
- For each of these artifacts, we…
  - Identify relevant constraints.
  - Detect and resolve ambiguities.
  - Ensure traceability from regulations to requirements.

Sounds easy enough?

Traceability and Legal Language – 1

marking rights, obligations and constraints

(1) The covered entity who has a direct treatment relationship with the individual **must**…

(A) Provide notice no later than the first service delivery;

(2) For the purposes of paragraph (1), a covered entity who delivers services electronically **must** provide electronic notice **unless** the individual requests to receive a paper notice.

Obligations are red**;**
Constraints are underlined; and
Modal/ condition keywords are **bold**.

From HIPAA §160.520

Traceability and Legal Language – 2

extracting rights, obligations and constraints

(1) [O_1] The covered entity [C_1] who has a direct treatment relationship with the individual **must**…

(A) Provide notice [C_2] no later than the first service delivery;

O_1: The covered entity **must** provide notice *to the individual*. **(1)(A)**; [$C_1 \wedge C_2$]

C_1: The covered entity has a direct treatment relationship with the individual. **(1)**

C_2: The notice is provided no later than the first service delivery. **(A)**

Traceability and Legal Language – 3

negating constraints for exceptions

(2) For the purposes of paragraph (1), [O_2] a covered entity [C_3] who delivers services electronically **must** provide electronic notice **unless** [C_4] the individual requests to receive a paper notice.

O_2: The covered entity **must** provide electronic notice *to the individual*. **(2)**; $[C_1 \wedge C_2 \wedge C_3 \wedge \neg C_4]$

C_3: The covered entity delivers services electronically *to the individual*. **(2)**

C_4: The individual requests to receive a paper notice. **(2)**

Traceability and Legal Language - 4

interpreting constraints across contexts

(1) [O_1] The covered entity [C_1] who has a direct treatment relationship with the individual **must**…

(A) Provide notice [C_2] no later than the first service delivery;

(2) For the purposes of paragraph (1), [O_2] a covered entity [C_3] who delivers services electronically **must** provide electronic notice **unless**… [C_4]

- From paragraph (1) we extracted O_1: [$C_1 \wedge C_2$]
- Now we carry down C_1, C_2 from paragraph (1) to yield O_2: [$C_1 \wedge C_2 \wedge C_3 \wedge \neg C_4$]

Formal Regulatory Semantics

O_1: The covered entity (CE) **must** provide notice to the individual.

Activity	***Subject***	***Action***	***Object***	***Target***
Transaction	CE	provide	notice	individual

Z Notation:

$$\exists v{:}Activity;\ s{:}CE;\ a{:}Provide;\ o{:}Notice;\ t{:}Individual \bullet$$
$$subject(v,\ s) \land action(v,\ a) \land object(v,\ o)\ \land target(v,\ t)$$

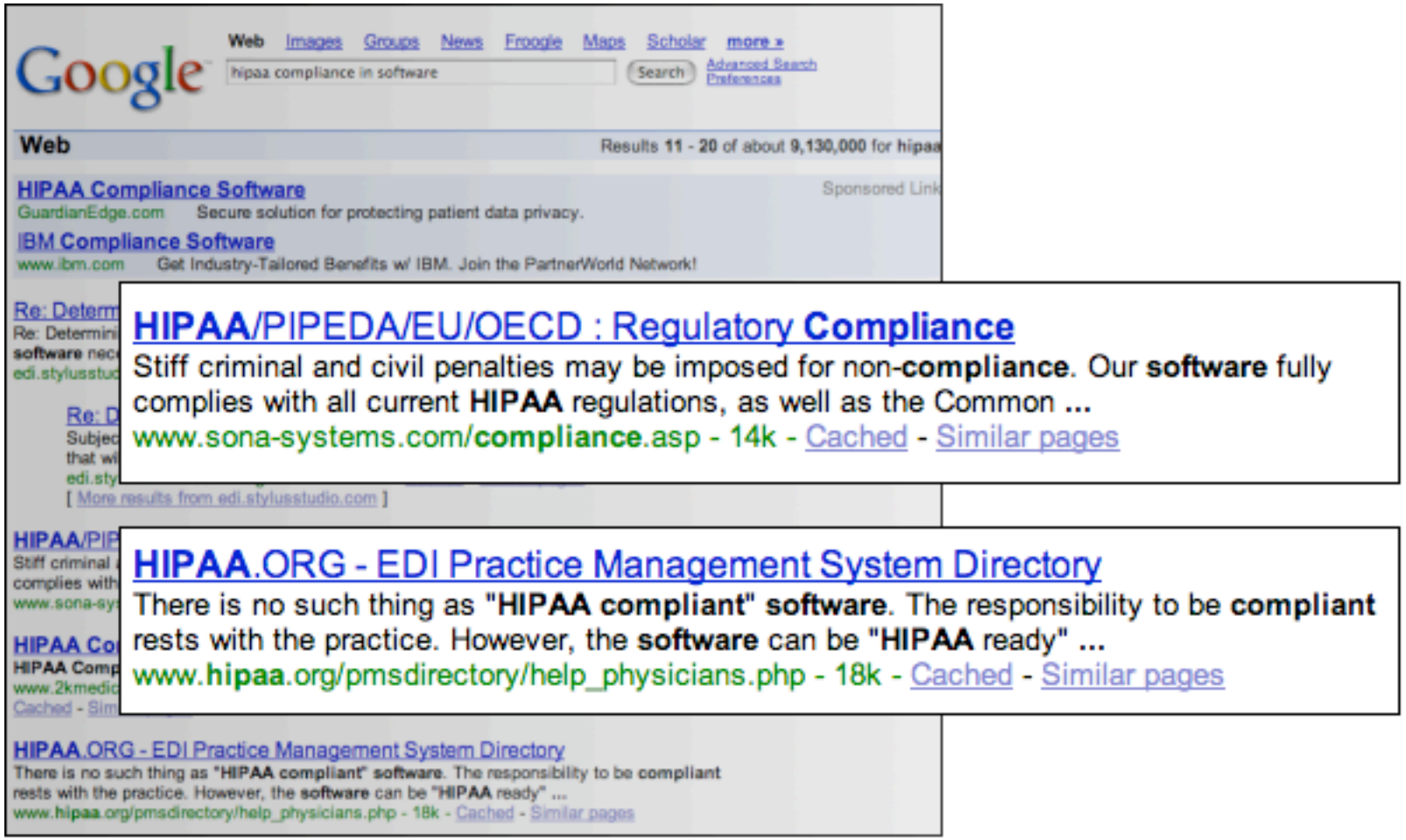
Description Logic:

$$Activity \sqcap hasSubject.CE \sqcap hasAction.Provide \sqcap$$
$$hasObject.Notice \sqcap hasTarget.Individual$$

Case Study

The HIPAA Privacy Rule

Compliance Controversy?



Analysis Results: An Overview

Section Description	*R*	*O*	*C*	*Refs*
164.520: Notice of privacy practices	9	17	54	37
164.522: Requests to restrict access to health information	7	19	19	9
164.524: Access of individuals to health information	20	26	67	29
164.526: Amendment of health information	10	18	42	23

KEY: Rights (*R*); obligations (*O*); constraints (*C*); and cross-references (*Refs*) to other paragraphs.

Normative Phrases - 1

Phrase	***N***	***Modality***
does not have a right to	1	Anti-Right
has a right to	7	Right
is not required to	3	Anti-Obligation
may	16	Right
may not	2	Obligation
must	39	Obligation
retains the right to	1	Right

Anti-rights and anti-obligations state that a right or obligation does not exist.

Normative Phrases – 2

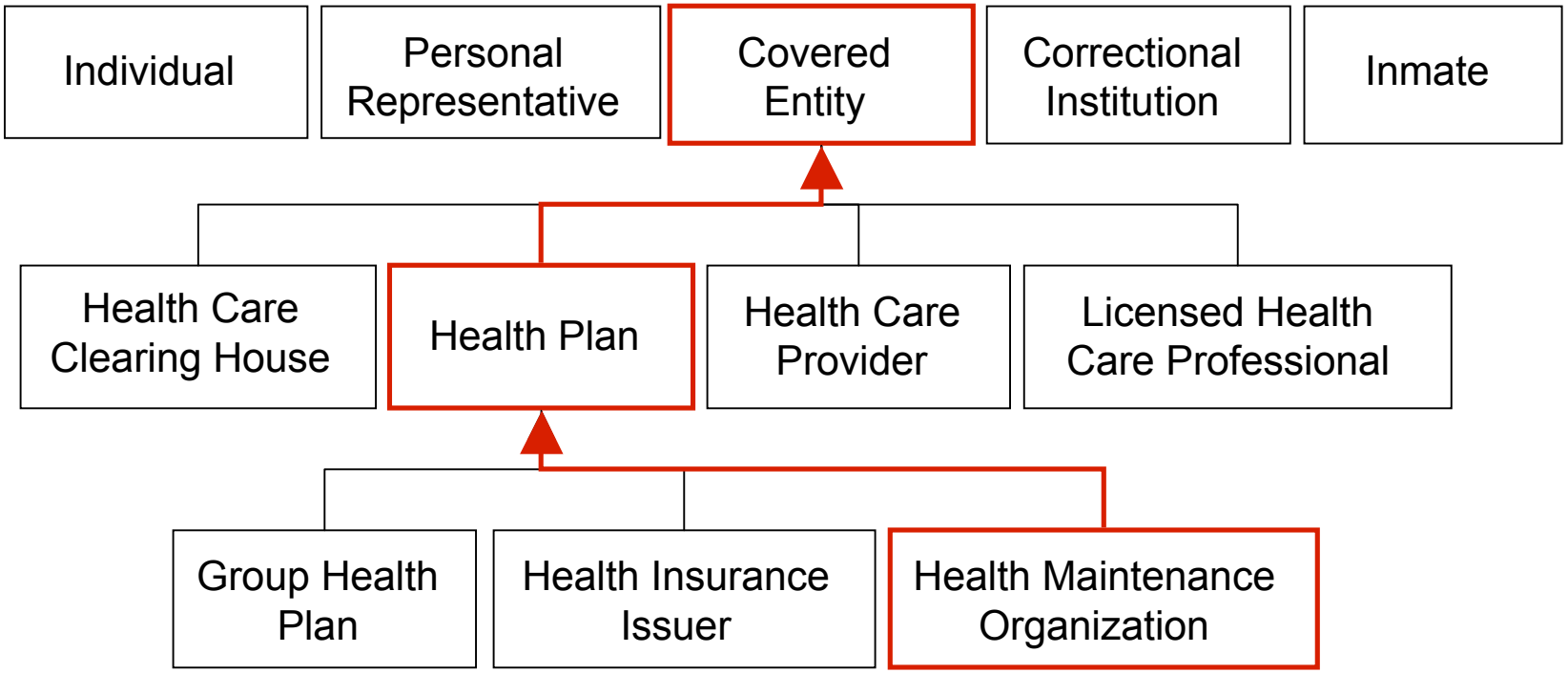
delegating rights and obligations

Phrase	***N***	***Modality***
may deny	3	Right
may not require	1	Obligation
may require	4	Right
must deny	1	Obligation
must permit	13	Obligation
must request	1	Obligation

Stakeholders have rights and obligations to assign rights and obligations to others.

Stakeholder Classification Hierarchy

- Stakeholders must satisfy all of the obligations in their classification hierarchy.



Prioritizing Rights and Obligations

- **Right:** An individual **has a right to** adequate notice from the CE of the uses and disclosures of PHI. (a)(1)
- **Anti-Right:** An inmate **does not have a right to** notice from the CE of the uses and disclosures of PHI. (a)(1), (a)(3)

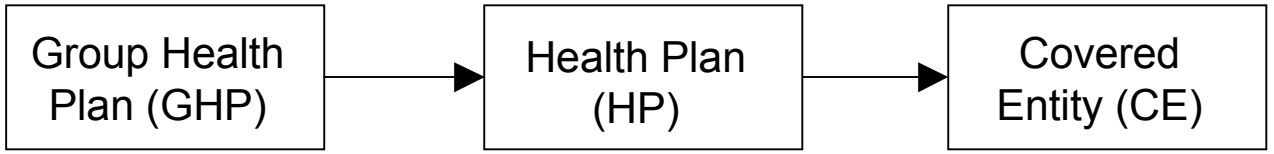
… *If an inmate is also an individual, should they receive notice under the law?*

- Two approaches to handle exceptions:
  - DeMorgan's Law applied to constraints
  - Defeasible rules with defeaters

Comparing Rights and Obligations…

- O_2: The CE **must** provide the notice to any person or individual. (c)
- O_8: The HP **must** provide the notice to any person or individual. (c), (c)(1)(i)
- O_4: The GHP **is not required to** provide notice to any person. (a)(2)(iii)

Recall from the stakeholder hierarchy that:



From HIPAA §160.520

Hierarchies of Obligations

O_7: The CE must provide the notice to any person.

O_{10}: The HCP must provide notice to the individual.

O_{13}: The CE **must** provide electronic notice to the individual.

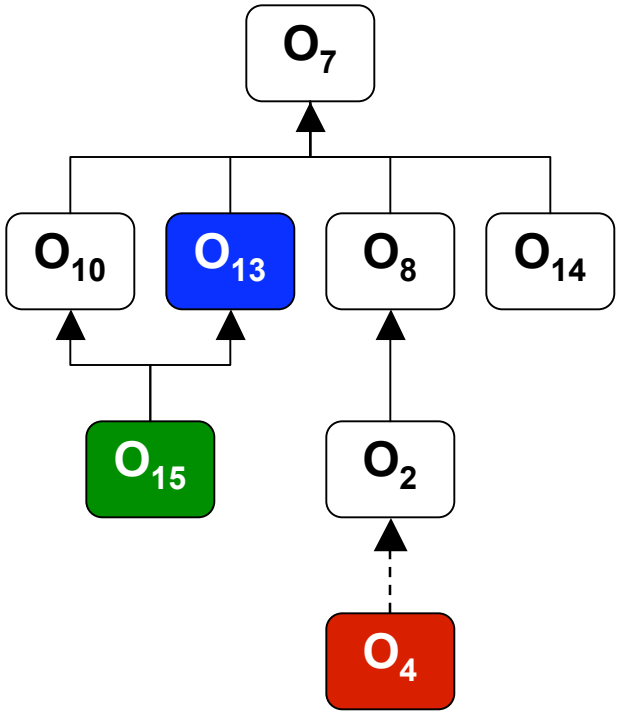
O_8: The HP must provide the notice to any person or individual.

O_{14}: The CE must provide a paper notice to the individual.

O_{15}: The HCP **must** automatically provide electronic notice to the individual.

O_2: The GHP must provide notice to any person.

O_4: The GHP **is not required to** provide the notice to any person.



From HIPAA §160.520

Detecting and Resolving Ambiguities

- Activities have a ***subject***, ***action*** and ***object***.
- Transactions have ***target***
  (e.g., with whom the action is performed)
  - The CE must provide notice. (to whom?)
- Verb phrases can masquerade as nouns
  (e.g., denial means "to deny," disclosure means "to disclose")
  - The individual may request an amendment from the CE.
    (who amends what?)

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    (who amends what?)

The formal models enable automatically detecting these ambiguities so that engineers can resolve them.

Implied Rights and Obligations

delegations, provisions, purposes

- The CE **requires** the individual to request an amendment in writing.
  - Implied obligation: The individual **must** request an amendment in writing.
- The individual **has a right** to receive notice from the CE.
  - Implied obligation: The CE **must** provide the notice to the individual.
- The CE **must** post the notice for the individual to read.
  - Implied right: The individual **has a right to** read the notice.

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  - Implied obligation: The CE **must** provide the notice to the individual.
- The CE **must** post the notice for the individual to read.
  - Implied right: The individual **has a right to** read the notice.

Using formal models of rights and obligations, we can infer implies rights from obligations and vice versa.

In Summary…

- Systematic methodology to extract stakeholder rights and obligations from regulations.
  - Manage traceability and cross-referencing.
  - Multiple viewpoints from implied rights/ obligations.
  - Techniques to compare, prioritize rights and obligations.
  - Detect and resolve ambiguities/ under-specifications.
- Limitations
  - Applied to a narrow domain: information privacy.
  - The normative phrases are exhaustive.
- Current and Future Work
  - Evaluate the method with others, in other domains.
  - Derive software artifacts (the last mile).