

Refinement via Normative Patterns

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Patterns provide ways of extending a given norm specification with specific conditions, which enhance flexibility (i.e., enable additional executions of the STS) while preserving functionality.

Relaxation Patterns

The first set of *relaxation* patterns focus on the alteration of antecedents and consequents of norms to promote collaboration among agents. We have the following relaxation patterns.

Release of liability refines a commitment to make its antecedent / consequent more general or more specific. Consider the following commitment:

$C(\text{PHYSICIAN}, \text{HOSPITAL}, \text{true}, \text{operate AND clinic})$: the physician is committed to the hospital to operating upon patients as well as doing clinic duty.

One refinement of the commitment is the following:

$C(\text{PHYSICIAN}, \text{HOSPITAL}, \text{emergency}, \text{operate AND clinic})$: the physician is committed to doing the same tasks only in emergencies (i.e., the antecedent is more specific).

Another refinement of the commitment is the following:

$C(\text{PHYSICIAN}, \text{HOSPITAL}, \text{true}, \text{operate})$: the physician is only committed to operating upon patients (i.e., the consequent is more general).

Expansion refines an authorization to make its antecedent / consequent more general or more specific. Consider the following authorization:

$A(\text{PHYSICIAN}, \text{HOSPITAL}, \text{consent}, \text{own_patients_EHR})$: the physician is authorized by the hospital to access her own patients provided there is consent.

One refinement of the authorization is the following:

$A(\text{PHYSICIAN}, \text{HOSPITAL}, \text{consent}, \text{own_patients_EHR OR other_patients_EHR})$: the physician is authorized to access her own patients as well as other patients (i.e., the consequent is more general) provided there is consent.

Accessibility refines a prohibition to make its antecedent / consequent more general or more specific. Consider the following prohibition:

$P(\text{PHYSICIAN}, \text{HOSPITAL}, \text{true}, \text{share_PHI_colleague OR share_PHI_family})$: the physician is prohibited by the hospital from sharing a patient's PHI with colleagues or with the patient's family.

One refinement of the prohibition is the following:

$P(\text{PHYSICIAN}, \text{HOSPITAL}, \text{true}, \text{share_PHI_colleague})$: the physician is only prohibited from sharing a patient's PHI with colleagues (i.e., the consequent is more specific).

Amendment Patterns

The relaxation patterns provide additional functionality that is not available before. However, they might open up new vulnerabilities if a violation due to the additional functionality is not properly handled. The following *amendment* patterns address these challenges to improve security and privacy related concerns while promoting collaboration.

Responsibility limits the subject of the norm only to the intended functionality provided by the relaxation pattern by specifying a complementary commitment. Consider the authorization from the Expansion pattern:

$A(\text{PHYSICIAN}, \text{HOSPITAL}, \text{consent}, \text{own_patients_EHR})$

Now, consider the following refinement:

$A(\text{PHYSICIAN}, \text{HOSPITAL}, \text{consent}, \text{own_patients_EHR OR other_patients_EHR})$

$C(\text{PHYSICIAN}, \text{HOSPITAL}, \text{own_patients_EHR OR other_patients_EHR}, \text{logout})$

An additional commitment is provided to make sure that the physician logs out from the computer after she finishes reviewing a patient's EHR.

Limitation limits the subject of the relaxed norm by specifying a complementary prohibition. Consider the prohibition from the Accessibility pattern:

$P(\text{PHYSICIAN}, \text{HOSPITAL}, \text{true}, \text{share_PHI_colleague OR share_PHI_family})$

Now, consider the following refinement:

$P(\text{PHYSICIAN}, \text{HOSPITAL}, \text{true}, \text{share_PHI_colleague})$

$P(\text{PHYSICIAN}, \text{HOSPITAL}, \text{true}, \text{publish_PHI_online})$

An additional prohibition is provided to make sure that the physician does not publish a patient's PHI online.