Overall Research Goal(s):
The overall goals include 1) to understand how security properties vary with policies that govern the behavior of collaborations (individuals and organizations); and 2) to enable identification of policies that achieve desired tradeoffs between security and user preferences. We try to answer the research questions that how to verify whether a set of policies 1) is consistent and realizable through the preferences of the collaborators? and 2) achieves specified security properties?

Broad Impact:
The research provides a way to formalize and resolve conflicts among policies. Other existing approaches force conflict resolution to be done during the design phase, either by identifying all needed exceptions or providing a total ordering of all policies. But our approach allows runtime resolution of conflicts using partial ordering of policies and knowledge of agent abilities and preferences, which is able to incorporate situation specific conditions, compared with design-phase resolution.

Specific Research Goals:
Our first goal is to design and conduct better experiments. We have conducted an experiment that comparing our formalism with another norm formalism (Nomos3) and a non-formalism approach (state diagrams). During the analysis phase of the experiment, we have discovered multiple bias factors and found that the deliverables had too many variations, which made the analysis difficult.

Second, we would formalize more norm components and norm types. We have formalized commitment norms as a tuple of subject, object, and antecedent, consequent and deadline conditions. The next step is to add context and expiration condition. The context of a norm is the organization establishing the norm. The expiration condition is the condition that makes the antecedent false, after the antecedent has taken effective. We would also formalize other types of norms, including authorization and prohibition.

Finally, we would improve the treatment of norm precedence via connections with non-monotonic logics. We have defined a norm precedence, which is a set of dominance relations, to resolve conflicts. However, the dominance relation is not transitive and more problems arise when the relations incur a cyclic ordering among norms. Our goal is to improve the relations such that they can handle more complicated situations.

Proposed Data Collection (if applicable):
The experiment includes the part where participants answer questions about their experience with norms, state diagrams, software engineering, etc. The data will be collected using an online form and it will help us better understand and classify the results we get during the experiment phase.

During the experiment phase, we would ask the participants to answer objective questions about a given set of policies. The participants’ answers will show how well they comprehend the policies, whether using our norm formalism or not.

Success Criteria:
The research goals are satisfied if 1) the experiment shows that participants comprehend policies better, i.e. answer more questions correctly, using our norm formalism; 2) we are able to formalize complicated enough examples using the new formalism of norms, the new
norm types, and the improved norm precedence. The examples are real-world scenarios of the usage of HIPAA (Health Insurance Portability and Accountability Act).

**Anticipated Difficulties, Limitations, and Criticisms:**
What will make the above specific research goals difficult to achieve? How do you plan on dealing with these difficulties if they arise?
The first difficulty is to design what kind of policies are provided to participants in the experiment. The policies should not be concerned about common knowledge, otherwise the results would depend less on norm formalism than on participants’ regular reasoning ability. One solution is to use made-up and security-related policies. Another solution is to use legal rules that are uncommon to people, such as the various situations where a covered entity may or may not use or disclose an individual’s PHI (protected health information) to a health care provider.