Specification of **Nicebook:** A New Social Network

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Your team is in charge of designing **Nicebook**, a groundbreaking application that is destined to bring the next big revolution in online social networking. Your investors, however, are concerned about various privacy issues that have plagued existing social networks in the past and would like to see strong evidence that **Nicebook** will not suffer from a similar fate. Thankfully, you have acquired excellent modeling and reasoning skills from 17-614, and decide to demonstrate the high quality of **Nicebook** through a formal analysis of its design.

After an initial market analysis, your business team has come up with the following specification of **Nicebook**.

Basic Concepts

The social network consists of a set of *users*, each of whom owns one or more pieces of *content*. Each user is allowed to upload two different types of content: *photos* and *comments*. A comment is attached to a photo or another comment; in other words, a comment can contain any number of nested comments.

Each user has zero or more *friends*. In **Nicebook**, friendship is a symmetric relation; meaning, if user Alice is a friend of Bob, then Bob must also be a friend of Alice. It is not possible for a user to be its own friend.

Every photo can be associated with one or more *tags*, each of which references another user in the social network. A user can be tagged only by its friends.

Operations

Nicebook provides the following operations for the user to view or modify various content on the network:

- addPhoto: Upload a photo to be published on a user's account.

- removePhoto: Remove an existing photo from a user's account.

- addComment: Add a comment to a photo or another comment.

- removeComment: Remove an existing comment.

- addTag: Add a tag to an existing photo on a user's account.

- removeTag: Remove a tag from a photo.

For simplicity, in this version of **Nicebook**, we will omit operations related to user and friendship management. In other words, we assume that the social network has a fixed set of users and friendships among them.

Privacy Control

One of the key selling points of **Nicebook** is that it promises better user privacy than any other social networks in existence today. The social network provides four distinct *privacy levels* that determine the extent to which a piece of content is made accessible: OnlyMe, Friends, FriendsOfFriends, and Everyone. Each user's account is associated with a set of *privacy settings*, which can be configured with different privacy levels to control access to the user's content. These settings include:

- Each piece of content owned by a user is associated a privacy level that determines who is able to view that content on the user's account.

- Each user has a setting that controls who is able to view content that is published on the user's account by other users.

- Each user has a setting that controls who is able to add a comment to content that is owned by the user.

Again, for simplicity, we will assume that the privacy settings are static, meaning each content is assigned a fixed privacy level at the time of its upload.