Database Rows

$UserRow \triangleq [$
 $subscribed$: BOOLEAN ,
  Forget *cancelled*
 $inTrial$: BOOLEAN ,
 $trialStartTime$: *Nat*,
 $billedForMonth$: *Nat*,
 $hasHadTrialOrSubscription$: BOOLEAN ,
 $hasCancelled$: BOOLEAN ,
 $cancelMonth$: *Nat*
$]$

$StartSubscription(u) \triangleq$
 Not subscribed
 $\land \land database.users[u].subscribed = $ FALSE
  $\land \lor database.users[u].inTrial = $ FALSE
   $\lor database.users[u].trialStartTime = month$

 $\land database' =$
  $[database$ EXCEPT
   $![$"users"$][u].subscribed = $ TRUE,
   $![$"users"$][u].hasHadTrialOrSubscription = $ TRUE,
   $![$"users"$][u].hasCancelled = $ FALSE
  $]$
 Observability required by stub
 $\land events' = Append(events, [type \mapsto $ "startsubscription"$, user \mapsto u])$
 $\land$ UNCHANGED $month$

$CancelSubscription(u) \triangleq$
 Subscribed
 $\land \lor database.users[u].subscribed = $ TRUE
  $\lor \land database.users[u].inTrial = $ TRUE
   $\land database.users[u].trialStartTime < month$
 $\land database' =$
  $[database$ EXCEPT
   $![$"users"$][u].subscribed = $ FALSE,
   $![$"users"$][u].inTrial = $ FALSE,
   $![$"users"$][u].hasCancelled = $ TRUE,
   $![$"users"$][u].cancelMonth = month,$
   Charge cancellation fee
   $![$"billQueue"$] =$
    $Append(database.billQueue,$

$$[user \mapsto u, \, fee \mapsto CancellationFee])$$
$$]$$

     Observability required by stub
     $\wedge \; events' = Append(events, [type \mapsto \text{"cancelsubscription"}, \, user \mapsto u])$
     $\wedge \; \text{UNCHANGED} \; \langle month \rangle$

$StartTrial(u) \; \triangleq$
     $\wedge \; database.users[u].inTrial = \text{FALSE}$
     $\wedge \; database.users[u].subscribed = \text{FALSE}$
     $\wedge \; database.users[u].hasHadTrialOrSubscription = \text{FALSE}$
     $\wedge \; database' = [database \; \text{EXCEPT}$
              $![\text{"users"}][u].inTrial = \text{TRUE},$
              $![\text{"users"}][u].trialStartTime = month,$
              $![\text{"users"}][u].hasHadTrialOrSubscription = \text{TRUE}$
         $]$

     Observability required by stub
     $\wedge \; events' = Append(events, [type \mapsto \text{"starttrial"}, \, user \mapsto u])$
     $\wedge \; \text{UNCHANGED} \; \langle month \rangle$

$CancelTrial(u) \; \triangleq$
     In active trial
     $\wedge \; database.users[u].inTrial = \text{TRUE}$
     $\wedge \; database.users[u].trialStartTime = month$
     And not subscribed
     $\wedge \; database.users[u].subscribed = \text{FALSE}$
     $\wedge \; database' = [database \; \text{EXCEPT}$
              $![\text{"users"}][u].inTrial = \text{FALSE}$
         $]$

     Observability required by stub
     $\wedge \; events' = Append(events, [type \mapsto \text{"canceltrial"}, \, user \mapsto u])$
     $\wedge \; \text{UNCHANGED} \; \langle month \rangle$

$WatchVideo(u) \; \triangleq$
     $\wedge \; \vee \; database.users[u].subscribed = \text{TRUE}$
        $\vee \; database.users[u].inTrial = \text{TRUE}$
       Remove video access at the end of *cancelled* month
       $\vee \; \wedge \; database.users[u].hasCancelled = \text{TRUE}$
          $\wedge \; database.users[u].cancelMonth = month$

     Observability required by stub
     $\wedge \; events' = Append(events, [type \mapsto \text{"watchvideo"}, \, user \mapsto u])$
     $\wedge \; \text{UNCHANGED} \; \langle month, \, database \rangle$

$BillSubscribedUsers \triangleq$
 $\wedge \exists\, u \in USERS :$
  That is subscribed
  $\wedge \vee\ database.users[u].subscribed = \text{TRUE}$
   Subscribed from a trial so bill
   $\vee \wedge database.users[u].inTrial = \text{TRUE}$
    $\wedge database.users[u].trialStartTime < month$
  Ensure users are not double billed
  $\wedge database.users[u].billedForMonth < month$
  $\wedge database' =$
   $[database\ \text{EXCEPT}$
    Add subscription fee
    $![\text{``billQueue''}] =$
     $Append(database.billQueue,$
       $[user \mapsto u,\ fee \mapsto SubscriptionFee]),$
    $![\text{``users''}][u].billedForMonth = month$
   $]$
 $\wedge \text{UNCHANGED } \langle events,\ month \rangle$