

Some notes on the Tamworth 1870 accident scenario

To appreciate the attached fragments of an LSD account, you need to have the picture of the accident scenario with signalmen E and H and points labelled A and B in mind. The 'driver' agent here is the driver of the Irish Mail train. (This is the artefact that, in conjunction with the referent - in your imagination! - informs the LSD account.) Note that there are many physical factors, relating to lengths of trains, location and distances between points, feasibility of observation of various kinds etc, about which the artefact gives useful insight *not in* the LSD account. Some of this information is so obvious that we wouldn't dream of identifying it explicitly when we develop the account. For instance, the Irish mail train encounters the points at B before it reaches the points at A (isn't that obvious?) - and it doesn't come up the river either (but even that could be different in some surreal computer game).

Standard protocols ("from training manual")

```
agent driver {
  oracle distantSignal
  handle speed_of_train
  protocol
    distant_signal==CAUTION --> speed_of_train = SLOW
}
```

.. this is OK if you don't consider brake failure or icy etc - otherwise:

```
agent driver {
  oracle distantSignal
  handle brakePos
  derivate speed_of_train = f(brakePos, ... )
                                ## '...' on RHS for environmental factors
  protocol
    distant_signal==CAUTION --> brakePos = ON
}
```

```
agent signalmanH {
  oracle next_train, homeSignal_status, home2signal_status, pointB_status
  derivate
    next_kind_of_train is typeof(next_train)
    status_or_next_train is
      f(next_kind_of_train, schedule) // STOPPING, THROUGH
  handle home2signal_status, pointB_status
  derivate homeSignal_status
  protocol (next_kind_of_train == STOPPING) --> pointB_status = TOPLATFORM
  ....
}
```

... but need to refine the idea of next_train as a function of the time (timenow) and the schedule

```
agent signalmanH {
  oracle
    timenow
    next_train, homeSignal_status, home2signal_status, pointB_status
  derivate
```

```

        next_train is f(timenow, schedule)
        next_kind_of_train is typeof(next_train)
        status_or_next_train is
            f(next_kind_of_train, schedule) // STOPPING, THROUGH
    handle home2signal_status, pointB_status
    derivate home1signal_status
    protocol (next_kind_of_train == STOPPING) --> pointB_status = TOPLATFORM
        .....

```

```

agent watchH{
    state timenow
    derivate timenow is actualtime
}

```

Some fairly complex derivate or maybe procedural component is needed to determine whether `next_train` is STOPPING or not (probably routinely defined by a dependency if the schedule is being followed in normal operation)

Anomalous situations

The above discussion raises the issue of non-standard contexts. Already have such an issue to consider in connection with the unreliable watch. Deal with this by attributing different roles to the watch - the classification of observables becomes dependent on context.

For a watch, have two contexts - watch can be going or stopped.

```

agent watchH {
    state timenow, status (= GOING, STOPPED)
    agent watchHgoing {
        state error (= +/- n seconds )
        derivate timenow is time + error
            ## watch could be slow or fast
            LIVE is (status == GOING)
    }

    agent watchHstopped {
        state timenow = time0
        derivate LIVE is (status == STOPPED)
    }
}

agent watchHmech {
    handle status
    oracle powersourceOK
    derivate status is (powersourceOK) ? GOING : STOPPED
}

```

With a clockwork clock, might want to take into account the responsibility for winding it - and so invoke agency of `signalmanH` again here.

Actually (of course!) the roles of the signalmen are affected by whether there is or isn't a train present at the station. As in the case of the Railway Arrival-Departure Animation, it is necessary to instantiate some observables that are only meaningful if and when there *is* a train in the station.

```

agent train_at_station {
    state    position
            speed
            platform

    derivate
        LIVE is f(position, ...)
        ## "at station" might mean between points A and B, or perhaps
        ## should mean between points A and the distant signal
        ## cf observable 'engaging' that features in the RA-DA

animation
}

```

Can now frame roles for the signalmen according to whether trains are present or not etc., bearing in mind that there may be more than one train present at the station at any one time. Something more complex but along the lines of the account of watch roles is what's needed here.

There are aspects of the analysis of the accident scenario that provoke reflections about possible actions that might not be part of the training manual. Perhaps signalman E could have diverted the express back on to the main track for instance, by shifting the points at A. (Reflecting on this afterwards, it seems clear that the express would not necessarily have been travelling too fast for such a diversion to work in principle - after all, it negotiated the points at A. It isn't necessarily the case that the train entered the river at speed either - the momentum of a train going at a few miles per hour would be quite sufficient to cause catastrophe if the buffers were too weak or close to the river bank etc.)

How could we model such an interventionary action on the part of E?

```

agent signalmanE {
    oracle  is_train_at_station
           train_at_station
           pos_train_at_station
           speed_train_at_station
           kind_train_at_station
           ## could make into state observables of "train_at_station"

agent
           ## or better "train" agent "at station" here
    handle ptsAstatus
    privilege
        (kind_train_at_station==THROUGH) && (pos_train_at_station==SIDELINE)
        --> ptsAstatus = ...
}

```

Note the issues here about what signalmanE can observe. Does he know that the train on the SIDELINE is a THROUGH train: from the schedule? because it's going unusually fast? because he recognises that it is the Irish Mail? etc.

Might also ask - is he *supposed* to be able to observe such things? - i.e. is it part of his job description? If it were, then this would be a flaw in the railway system conception, since a train going the other way could interrupt his observation. A related question goes along the lines: the telegraph was presumably intended to allow communication between the two signalmen - this being the case, what was the intended role for communication between the signalman before the telegraph was introduced? - and how was this to be accomplished?

The above discussion indicates how developing an LSD account can serve a purpose that is primarily provocative rather than functional, stimulating us to ask questions that might otherwise not occur to us. In general, the development of an account and an EM artefact may usefully proceed together.