Interface

track_speeds: int[NUM_TRACKS][2]
signals: int[NUM_TRACKS][2]
lamps: bool[NUM_LAMPS]
points: bool[NUM_POINTS]
cross_light: int
gate: bool
bell: bool

track_contacts: int[NUM_TRACKS][2]
cross_contacts: int[NUM_CONTACTS]

Environment

Controller

train_setup: int[NUM_TRAINS]
speeds: int[NUM_TRAINS][4]

schedule: int[NUM_TRAINS]

User

destination: int[NUM_TRAINS]

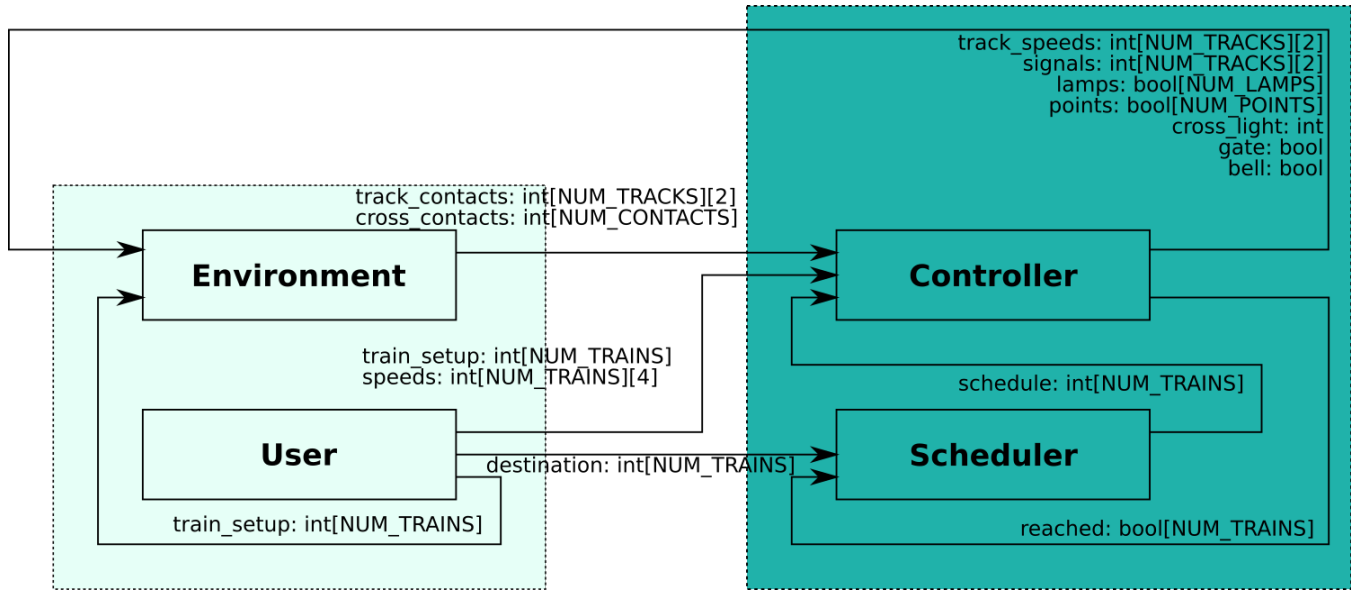**Scheduler**

train_setup: int[NUM_TRAINS]

reached: bool[NUM_TRAINS]

Errors:

- collision_error
  - -1: no error
  - other values: a single track with multiple trains
- train_speed_mismatch_error[NUM_TRAINS]
  - -1: no error
  - 1: the front and rear wagon have different speeds
- train_point_changed_error[NUM_TRAINS]
  - indicates, that a point was changed while the train was standing on it,
    i.e., the front passed the point, but the rear not yet.
  - -1: no error
  - other values: the point that has the error
- wagon_error_message[NUM_TRAINS][2]
  - -1: no error
  - 1: point not set correctly
  - 2: wagon uses wrong direction on KH_LN_2 or KH_LN_7, because the corresponding point was set wrongly
  - 3: wagon position under min of track (indicates a mistake in the environment)
  - 4: wagon position over max of track (indicates a mistake in the environment)
  - 5: diamond point set to send a train backwards through IC or OC. May cause further unexpected behavior
- wagon_error_pos[NUM_TRAINS][2]
  - NOTE: The meaning depends on wagon_error_message.
  - if wagon_error_message is 0
    - this error can be ignored
  - if wagon_error_message is 1, 2 or 5
    - the point on which the error occurs
  - if wagon_error_message is 3 or 4
    - the track on which the error occurs

Environment:

- `track_contacts: int[NUM_TRACKS][2]`

  - 0: no signal
  - 1: forwards
  - 2: backwards
  - 3: uni
- `cross_contacts: int[NUM_CONTACTS]`

  - 0: no signal
  - 1: closing
  - 2: opening

User:

- `train_setup: int[NUM_TRAINS]`

- index: train number
- value: track number, (negative: train stands against main travel direction)
- `destination: int[NUM_TRAINS]`

  - index. train number
  - value: track number
- `speeds: int[NUM_TRAINS][4]`

  - index: train number
  - index: 0-3
  - value: 1-127

Controller:

- `track_speeds: int[NUM_TRACKS]`

  - 0: off
  - 1 to 127: forward speed
  - -1 to -127: backward speed
- `signals: int[NUM_TRACKS][2]`

  - 0: off
  - 1: red
  - 2: yellow
  - 3: green
- `lamps: bool[NUM_LAMPS]`

  - true: on
  - false: off
- `cross_light: int`

  - 0: off
  - 1: red
  - 2: yellow
- `bell: bool`

  - true: on
  - false: off
- `points: bool[NUM_POINTS]`

  - true: branch
  - false: straight
- `gate: bool`

  - true: down
  - false: up
- `reached: bool[NUM_TRAINS]`

  - index: train number
  - value: true: destination reached; false: destination not yet reached

Scheduler:

- `schedule: int[NUM_TRAINS]`

  - index: train number
  - value: next save track on the way to destination

Controller-Environment Interface

```
scchart environment {

  //------------------------------------------------------------\\
  //--                       INPUTS                          --\\
  //------------------------------------------------------------\\
  // Initial track of the trains
  input int train_setup[NUM_TRAINS];
  // Speed of all tracks
  input int track_speeds[NUM_TRACKS];
  // State of all switches
  input bool points[NUM_POINTS];
  // State of all signals
  input int signals[NUM_TRACKS][2];

  //------------------------------------------------------------\\
  //--                       OUTPUTS                         --\\
  //------------------------------------------------------------\\
  // State of all contacts of the railway
  output int track_contacts[NUM_TRACKS][2];

  //------------------------------------------------------------\\
  //--               RAILWAY  CONSTANTS                      --\\
  //------------------------------------------------------------\\
  const int NUM_TRACKS = 48;
  const int NUM_TRAINS = 11;
  const int NUM_POINTS = 30;
  const int NUM_LAMPS = 24;
  const int NO_TRACK = -1;

  //------------------------------------------------------------\\
  //--               RAILWAY   INTERFACE                     --\\
  //------------------------------------------------------------\\
  const int OFF = 0, RED = 1, YELLOW = 2, GREEN = 4;
  const int ON  = 1, OFF = 0, FWD    = 1, REV   = 2, BRAKE = 3;

  const int DOWN = 0, UP = 1;
  const int NONE = 0, UNI = 3;

  const int STRAIGHT = 0, BRANCH = 1;

  const int IC_JCT_0 = 0 , IC_LN_0  = 1 , IC_LN_1 = 2 , IC_LN_2 = 3;
  const int IC_LN_3  = 4 , IC_LN_4  = 5 , IC_LN_5 = 6 , IC_ST_0 = 7;
  const int IC_ST_1  = 8 , IC_ST_2  = 9 , IC_ST_3 = 10, IC_ST_4 = 11;
  const int IO_LN_0  = 12, IO_LN_1     = 13, IO_LN_2 = 14;

  const int KH_LN_0  = 15, KH_LN_1     = 16, KH_LN_2 = 17, KH_LN_3 = 18;
  const int KH_LN_4 = 19, KH_LN_5     = 20, KH_LN_6 = 21, KH_LN_7 = 22;
  const int KH_LN_8 = 23, KH_ST_0     = 24, KH_ST_1 = 25, KH_ST_2 = 26;
  const int KH_ST_3 = 27, KH_ST_4  = 28, KH_ST_5 = 29, KH_ST_6 = 30;
  const int KIO_LN_0 = 31, KIO_LN_1 = 32;

  const int OC_JCT_0 = 33, OC_LN_0     = 34, OC_LN_1 = 35, OC_LN_2 = 36;
  const int OC_LN_3  = 37, OC_LN_4     = 38, OC_LN_5 = 39, OC_ST_0 = 40;
  const int OC_ST_1  = 41, OC_ST_2     = 42, OC_ST_3 = 43, OC_ST_4 = 44;
  const int OI_LN_0  = 45, OI_LN_1     = 46, OI_LN_2 = 47;

  initial state init;
}
```