Soar Agents for a Driving Simulator

Soar Workshop XIX

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The Simulator Task

- DaimlerChrysler Programmable Packaging Simulator
- Ergonomics Task
- Interfacing to the Onyx

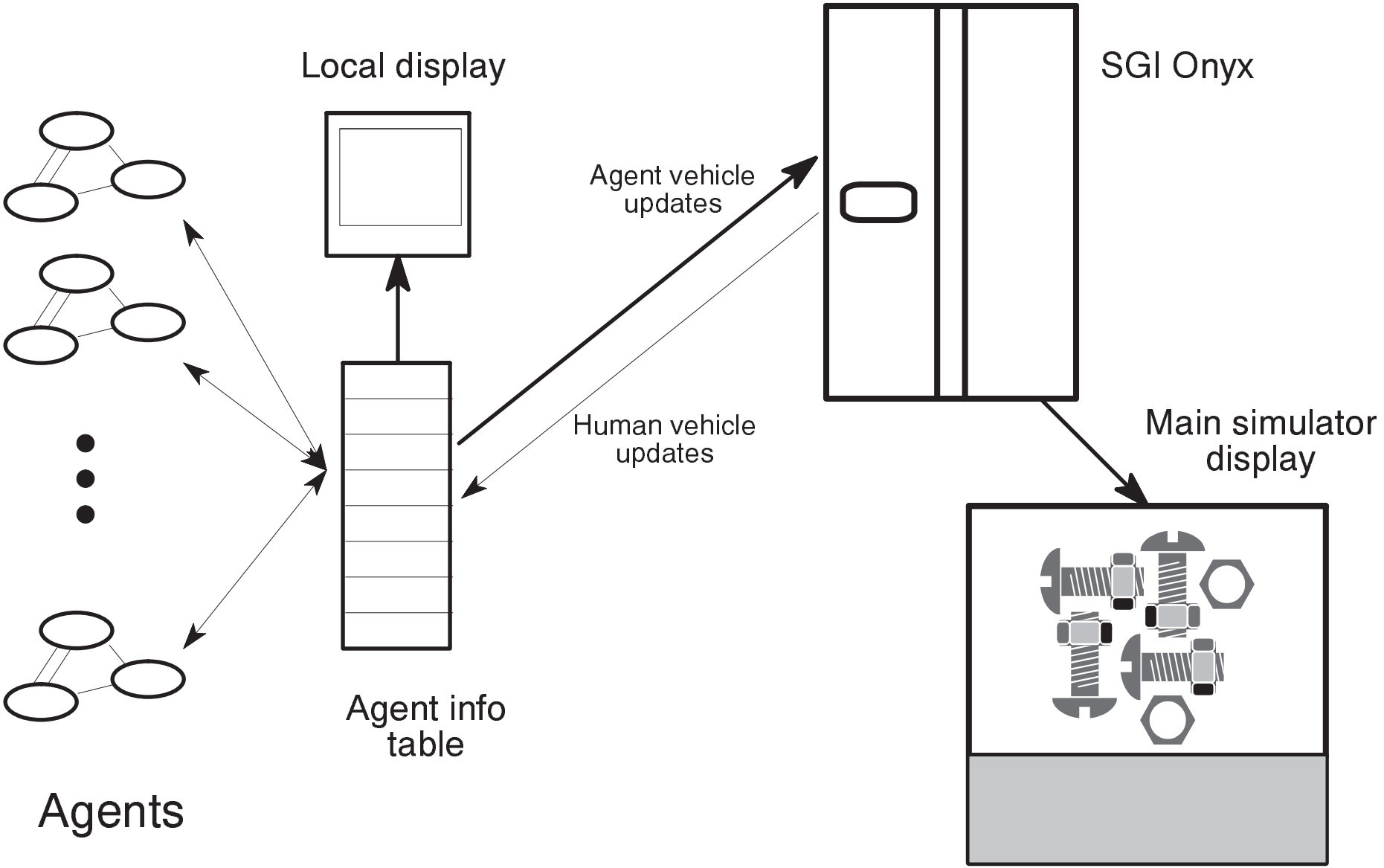
Similar Efforts

- Path-following vehicles
- Manually controlled vehicles
- U-Iowa
- NAVLAB

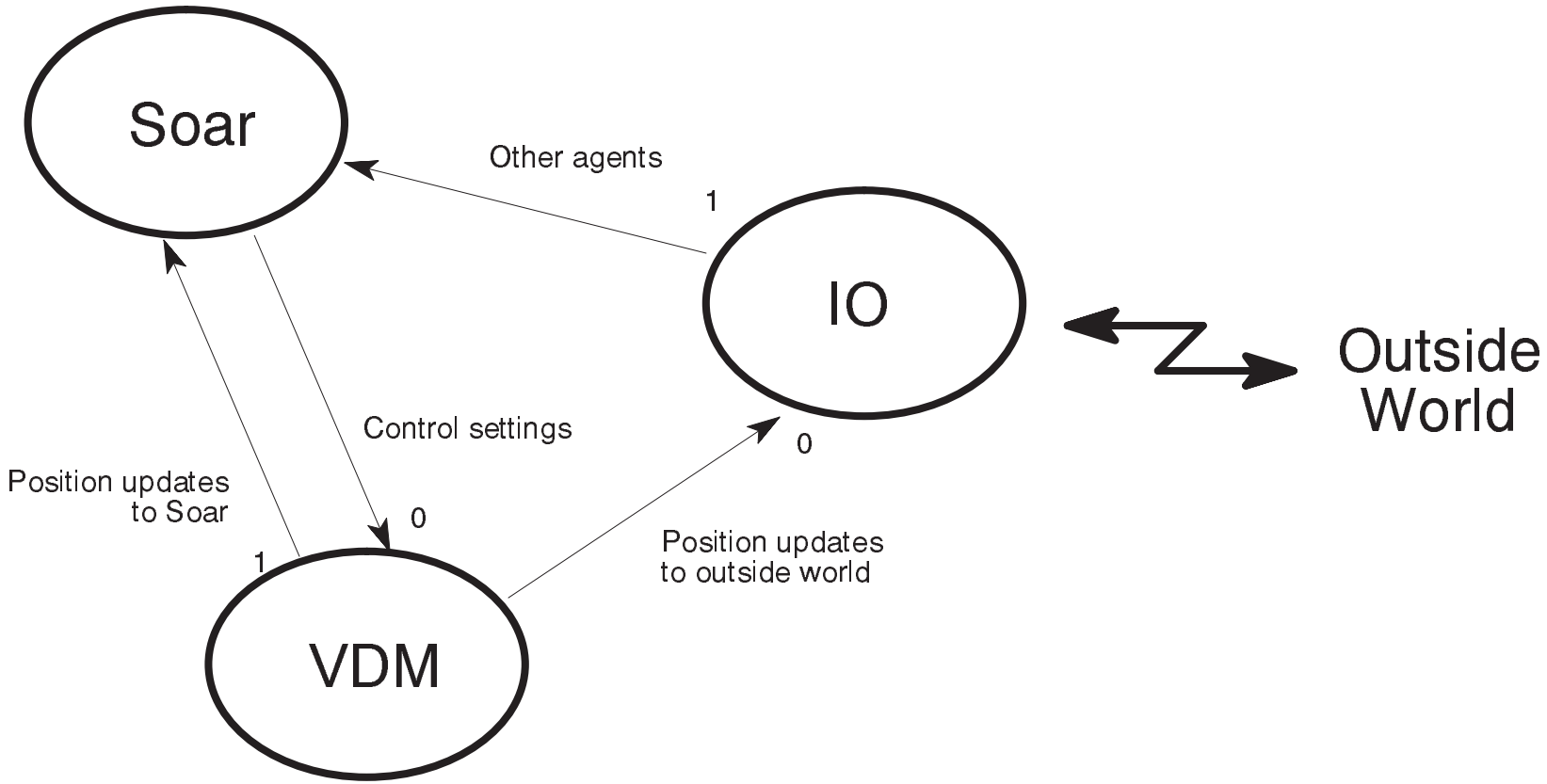
Advantages of Running Simulated Vehicles With Soar

- Possible to program agents with arbitrarily complicated behaviors and reasoning depth
- Easy to include agents exhibiting wide variety of behaviors in simulator
- It's never been done before!

Overall System Architecture



Agent Architecture



Current High-Level Operators

- cruise
  - normal-cruise
  - seek-slot
    - seek-left
    - seek-right
    - pullout

Current Atomic Operators

wheel {left|right|<number>}
wheel-tap {left|right}
thrust {plus|minus}
gas {plus|minus}
brake {plus|minus}
lane {left|right}

Snapshot of the Current Input Link

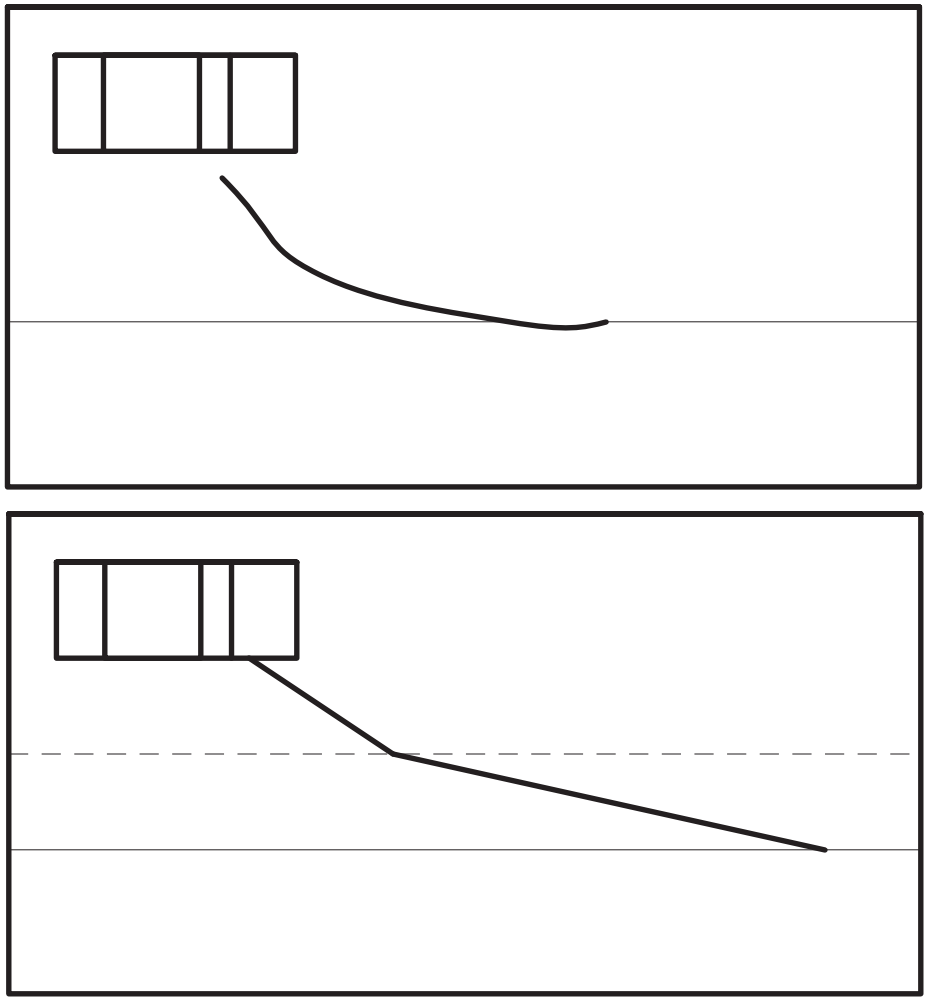
```
(I2 ^agents I354 ^current I356 ^events I353 ^me I355)

  (I356 ^approach-angle 45 ^drift left ^half-slot 1.5 ^is-lane-left true
        ^lane-error 2.81 ^lane-number 0 ^lane-width 4.5 ^min-pref 2.94693
        ^min-turn 2.94693 ^pullout-angle 14.2559 ^pullout-at 15.0254
        ^seg-speed 20. ^segment 6 ^steering-error -8.1 ^surface 5.
        ^turning-radius 424242)

  (I355 ^a_x -0.091181 ^a_y 0.031719 ^a_z 0. ^brake 60 ^d_t 0.169 ^gas 0
        ^pitch 0. ^roll 0. ^speed 12.0203 ^v_angle -0.521973 ^wheel 0
        ^x 87.4105 ^y -44.4109 ^yaw -115.215 ^z 0.)

  (I354 ^agent A182)
    (A182 ^distance 0.00 ^x 0.00 ^y 0.00 ^z 0.00)

  (I353 ^event E173)
    (E173 ^type bend ^accel -886.682 ^accel-lead-distance 25.7607 ^bend 30.
         ^closetime 0.00949644 ^distance 13.611 ^half-slot 1.5
         ^max-radius 1.92749e-38 ^next-seg 7 ^turn-lead-distance 6.
         ^turn-speed 3.6 ^waypoint 6)
```

Partial Trace of an Agent Run

```
    42:       O: O164 (seek-slot)
(New segment)
    43:       ==>S: S7 (operator no-change)
    44:          O: O167 (match-speed-gas)
    45:          ==>S: S8 (operator no-change)
    46:             ==>S: S9 (state no-change)
    47:          O: O177 (match-speed-gas)
    48:          O: O181 (match-speed-gas)
    49:          O: O184 (seek-right)
    50:          O: O189 (seek-right)
    51:          O: O195 (match-speed-gas)
    52:          O: O199 (match-speed-gas)
    53:          O: O202 (seek-right)
    54:          O: O207 (seek-right)
    55:          O: O211 (seek-right)
    56:          O: O216 (seek-right)
    57:          O: O221 (match-speed-gas)
    58:          O: O225 (match-speed-gas)
    59:          O: O229 (match-speed-gas)
    60:          O: O233 (match-speed-gas)
    61:          O: O236 (seek-right)
    62:          O: O241 (match-speed-gas)
    63:          O: O245 (match-speed-gas)
    64:          O: O248 (seek-right)
```

Conclusions

- Possible to get away with a range of behavior, given a decent vehicle model
- .1--.2-sec. d-cycle times required to keep vehicle on track
- Tcl not ideal for R-T applications!



Plans and To-Do List

- Integrate with DaimlerChrysler simulator
- Simplify; replace most agents with standard models to reduce load on machines running non-human vehicles
- Concentrate on higher-level operators in Soar, leaving simple control manipulations to C or Tcl routines