

Simulator On Board Unit

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ASD User Event Presentation
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verum[®]

Context

Customer: Insurance company

Goal: Bonus based on driving behaviour

Device: On Board Unit

Problem: OBU too expensive

Solution: Extra features for car owner

Simulator

Show possible extra features to customer
Vivid demonstration

The screenshot displays the 'Simulator On Board Unit' interface. At the top, there are icons for a car and a van. Below these are control buttons: a blue circular arrow, a green play button, and a grey pause button. A speed limit sign showing '90' is positioned to the right of the play button. On the left side, there are two speed limit control panels. The 'Car' panel shows a blue button with '50' and left/right arrow buttons. The 'Truck' panel also shows a blue button with '50' and left/right arrow buttons. In the center, there is a 'Display' area showing 'No speed limit' and a 'Violations' log with a red background. The log contains the text: '10:52:45 START OF LOG' and '10:52:47 Speed OK'. On the right side, there is a 'Road Authority' map of Eindhoven, showing roads A2, A58, A270, and A67. A 'Roadsign' control panel is located to the right of the map, with radio buttons for 'Off', 'X', '70', and '90' (which is selected). A red asterisk is visible in the top right corner of the map area.

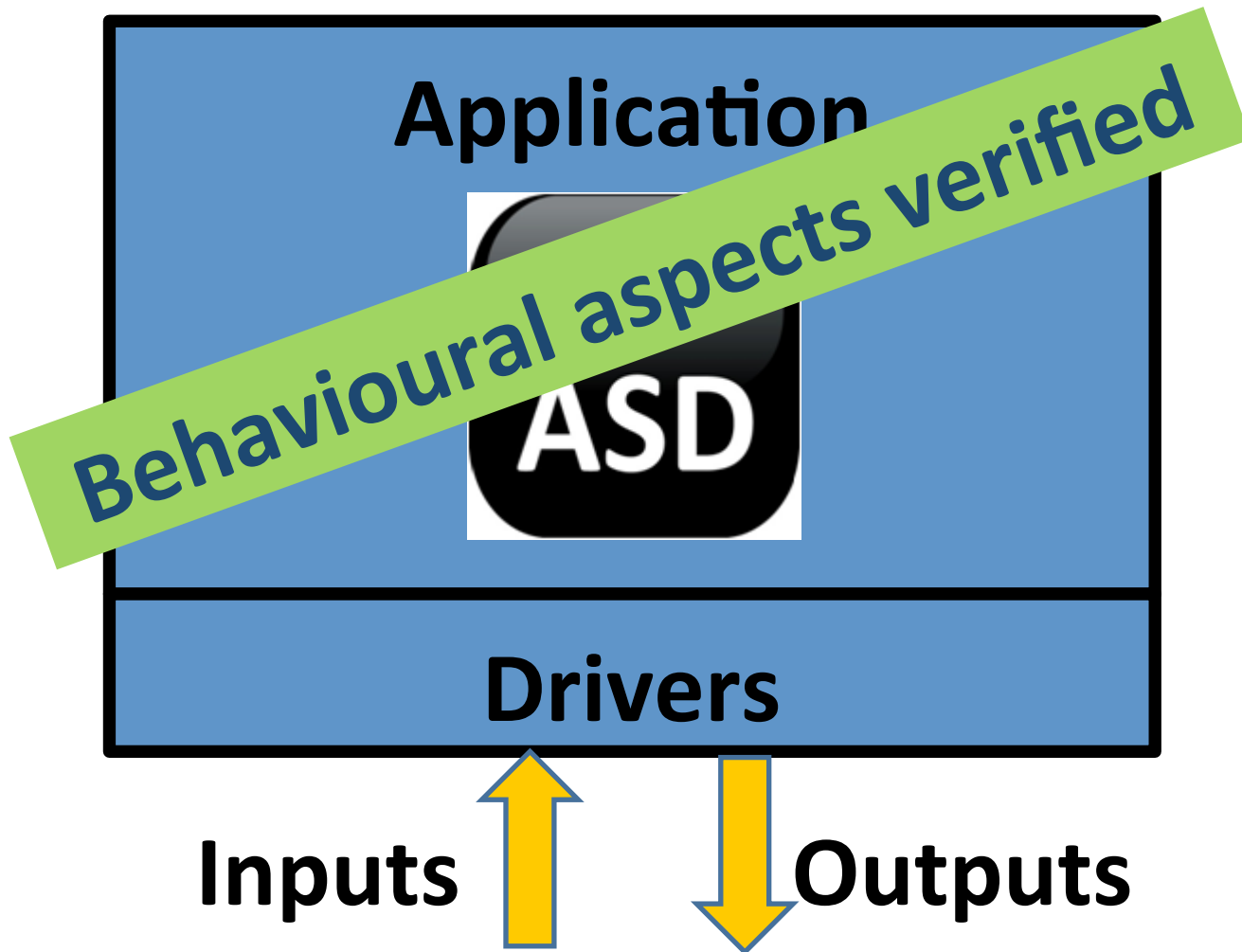
Simulator implementation

Core generated from ASD model

All peripheral code is strictly atomic

Threads for user interface and model execution

Simulator behaviour verified



Atomic drivers

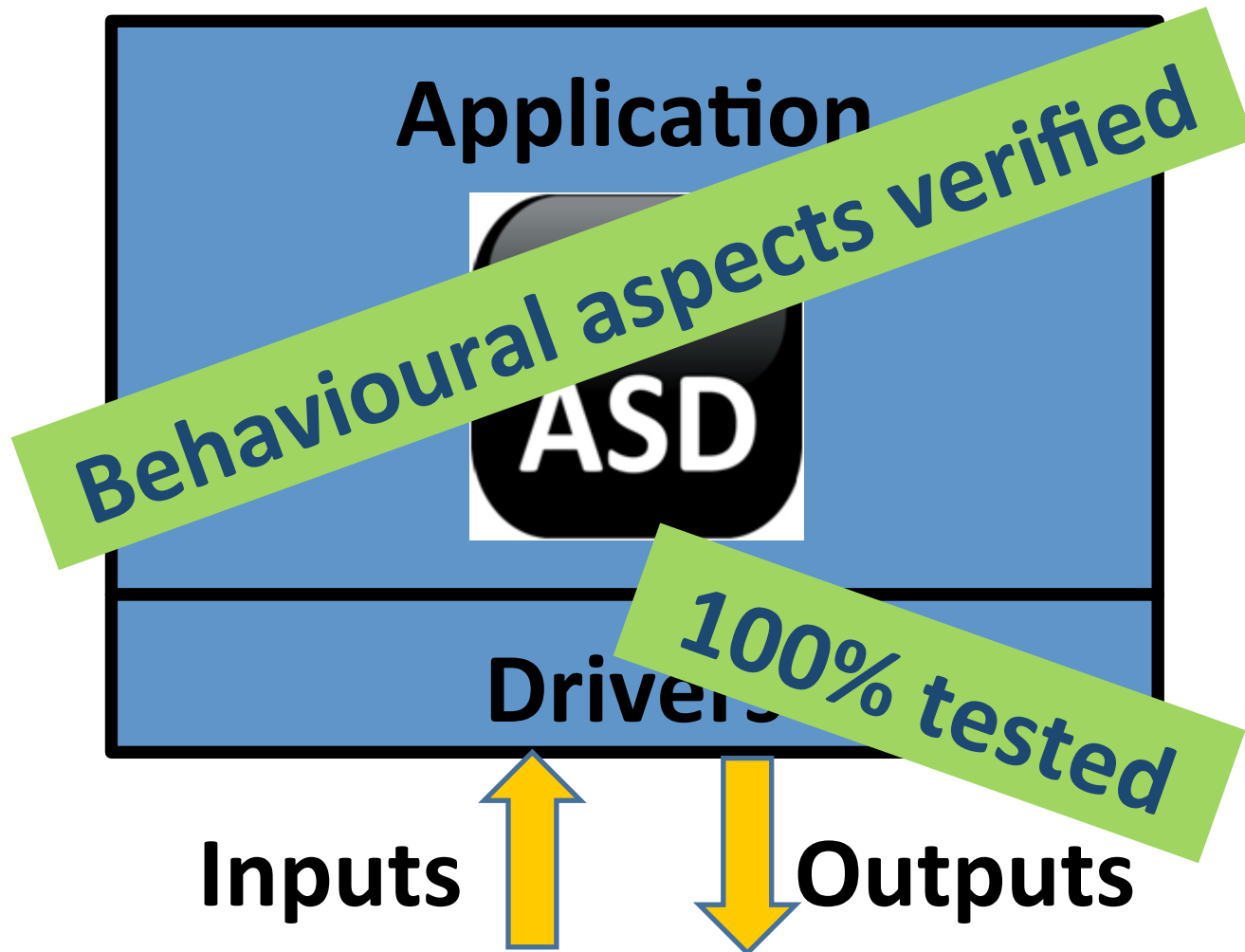


Has no state-behaviour

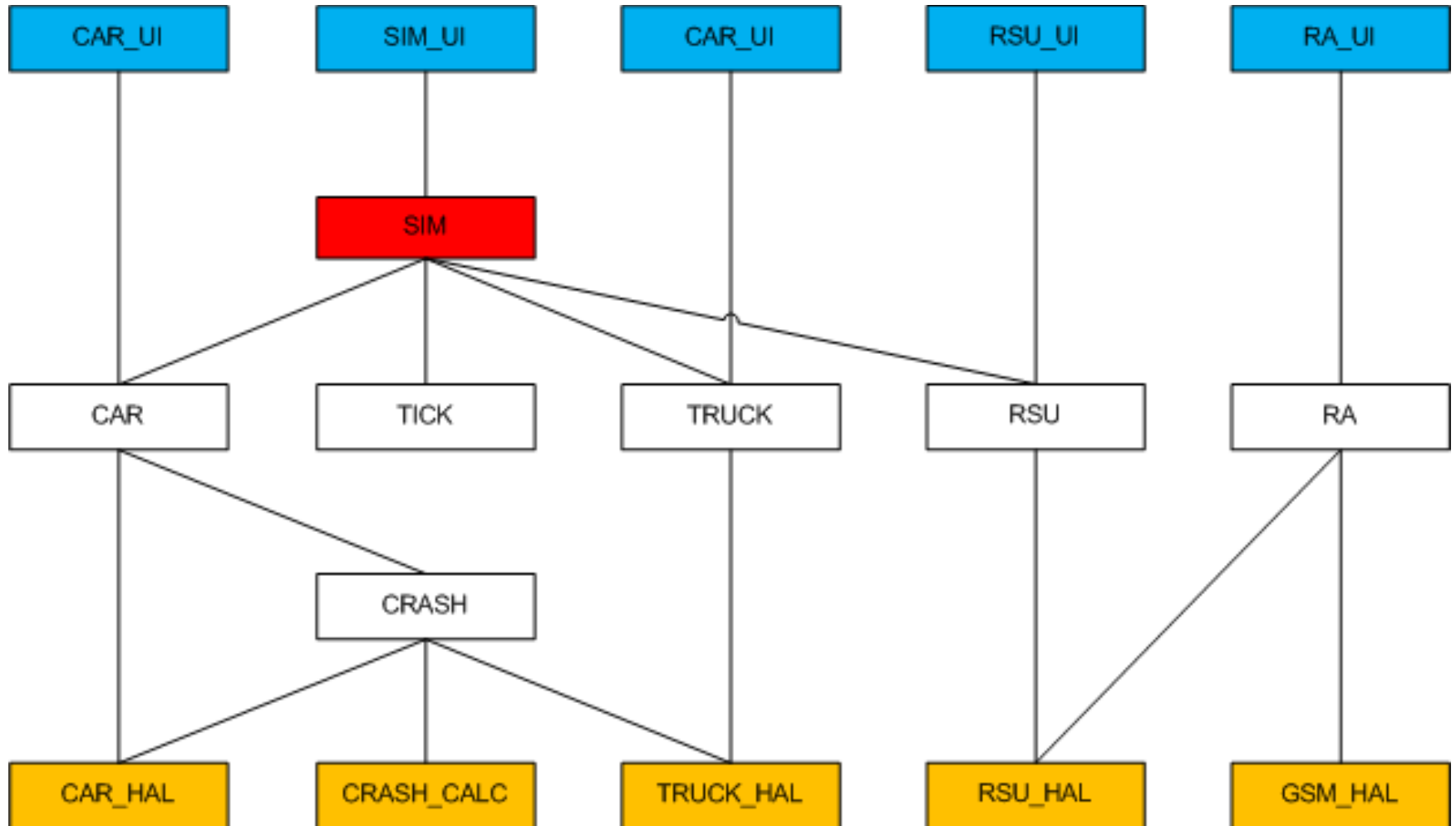
Event / Response have 1 to 1 relation

100% Test coverage possible

Verified & fully tested simulator



ASD model of environment



Notification interface

SIM_UI

Model Explorer

- Models(1)
 - SIM
 - Main Machine
 - Interfaces
 - Application Interfaces
 - Notification Interfaces
 - SIM_UI_N
 - Modelling Interfaces
 - Tags

SIM (SIM.im)

SIM Application Interfaces Notification Interfaces Modelling Interfaces

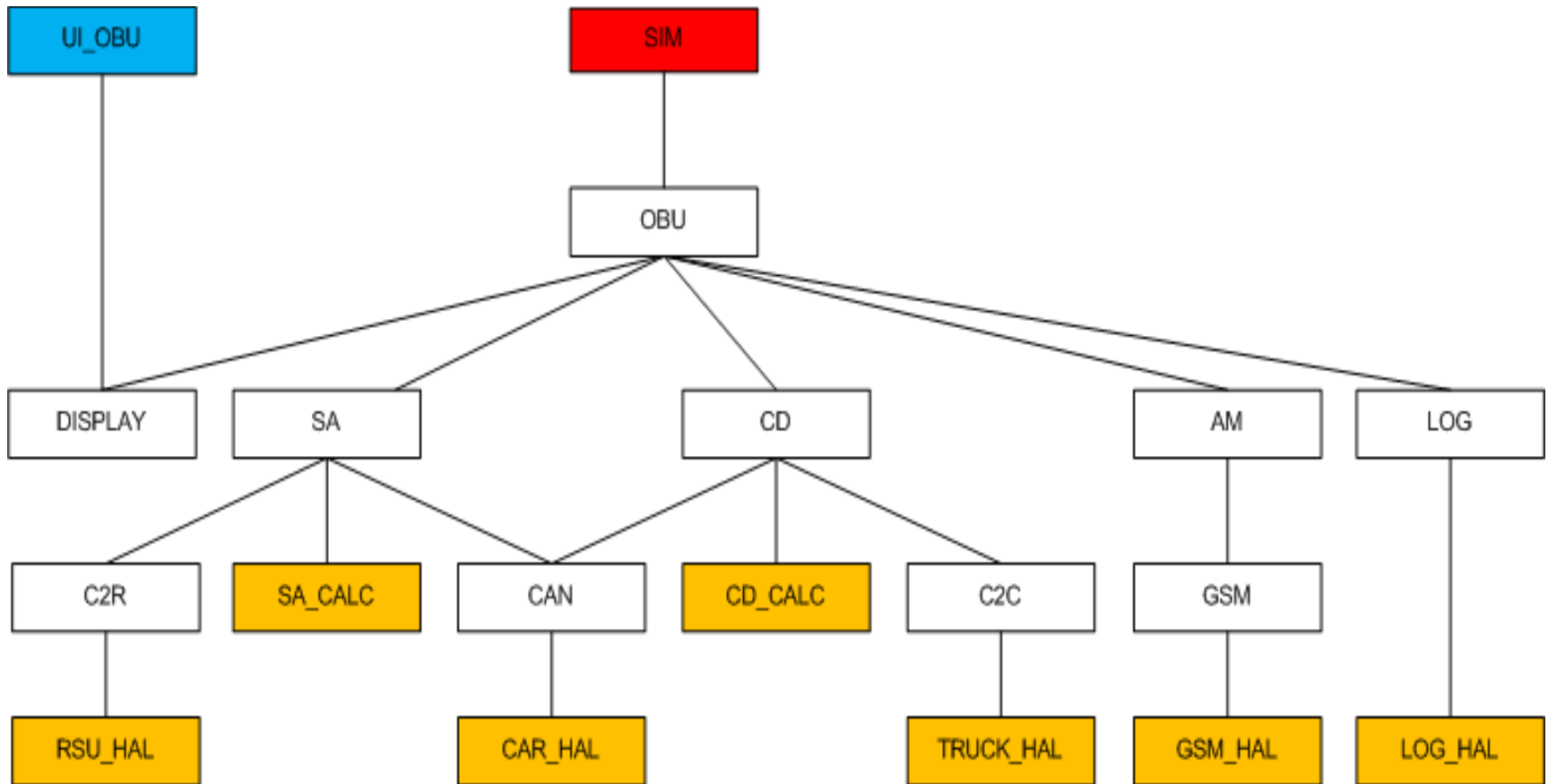
SIM_UI_N

Broadcast

	Event	Yoking Threshold	Comments
1	Run([in]enabled:bool)	1	Button RUN enable/disable
2	Pause([in]enabled:bool)	1	Button PAUSE enable/disable
3	Stop([in]enabled:bool)	1	Button STOP enable/disable
4	Finished([in]state:bool)	1	Finish flag visibility on/off
5	Heartbeat([in]state:bool)	1	Heartbeat icon visibility on/off

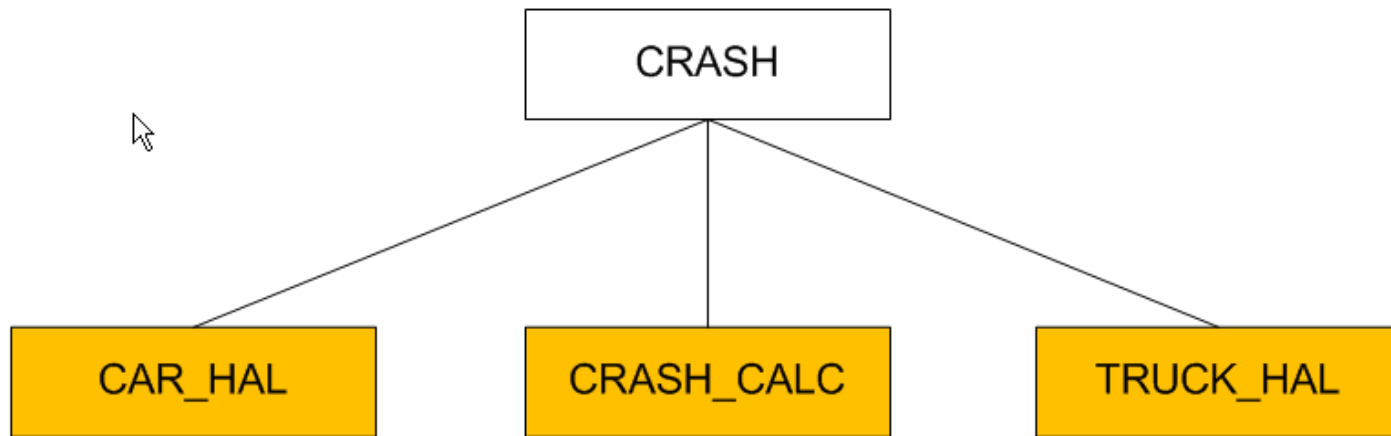


ASD model of On Board Unit



Design issue: calculations

Calculations are performed by foreign components.

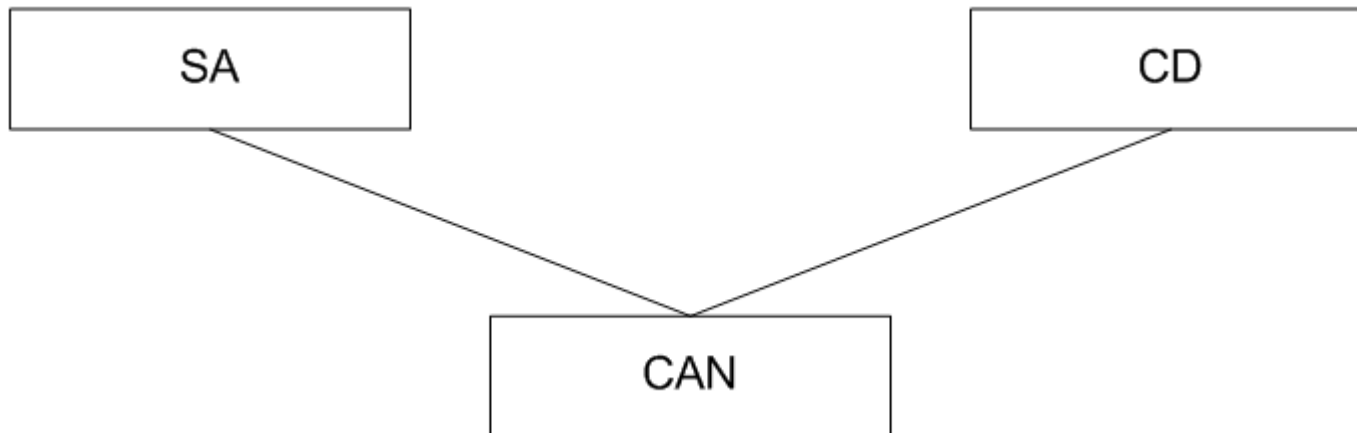


A lot of time was spend trying to achieve calculations within the design models.

Attempts to do the calculations within the design models did not satisfy.

Design issue: multiple notifications

Implementation of broadcasting messages to multiple components was abandoned after several attempts to implement it.



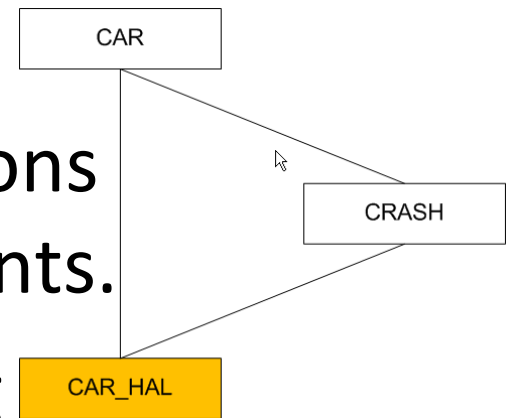
Instead separate notification channels are used.

Design issue: referenced data

The simulated environment is connected via hardware abstractions implemented as foreign components.

Development time was lost on using referenced data in the foreign components by more than one component.

These verified and compiled correctly but failed in the actual deployment phase.



Design issue: model verification

Verification of all models affected by a change in one of the models is very error prone.

The chances you forget to verify one of the affected models is high.

This can easily lead to the situation where a second change results in unexpected verification results due to not starting from the “all verified” situation.

Design issue: verification time

Verification time of the design model of the OBU increased dramatically while implementing all interactions with other components.

In fact it became unworkable and a complete design change was needed to fix this.

The change was from a design based on notifications to one with requests having valued responses and performed round-robin.

Design issue: validation

During validation a lot of unwanted behavior popped up when scenarios were mixed.
To fix this behavior many changes had to be made to almost all components.

Validation

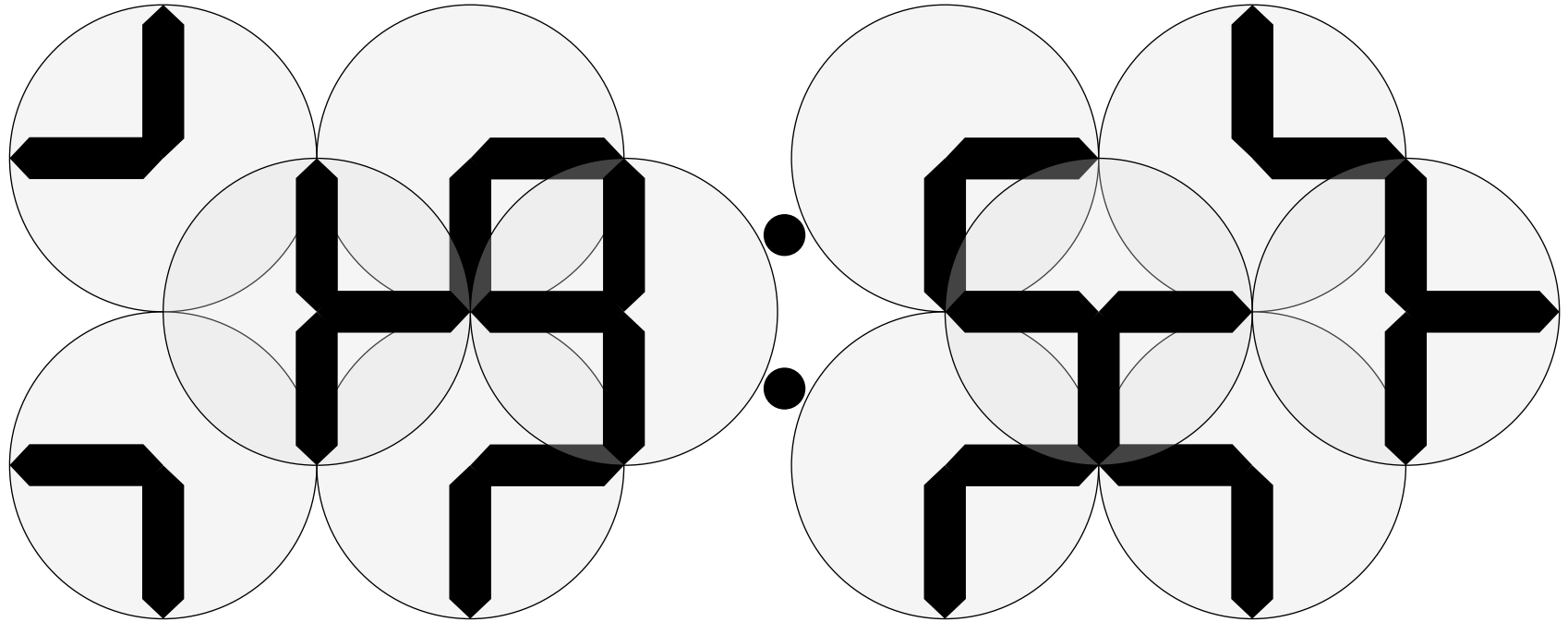
- Demo

Analog / Digital Clock

Create 7-segment display the analogue way

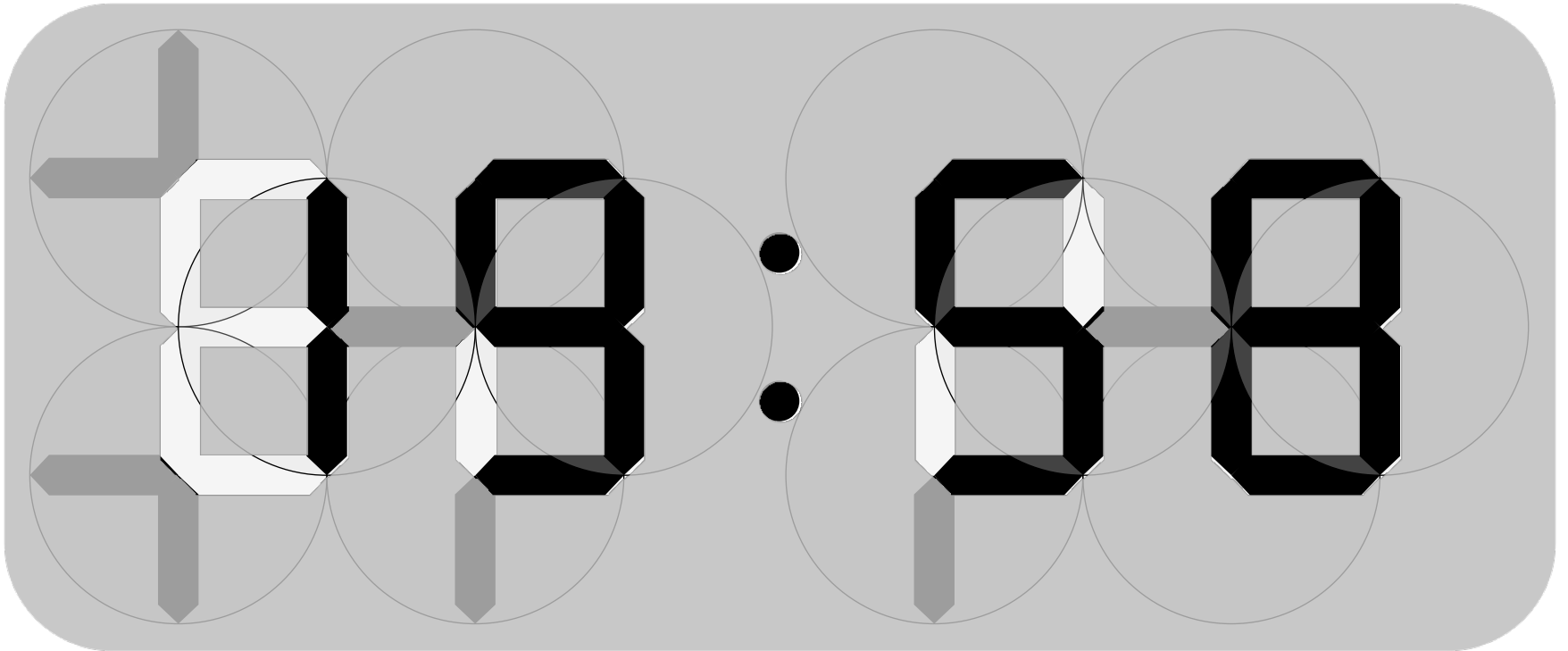
Idea: Heino Peters

Analog / Digital Clock



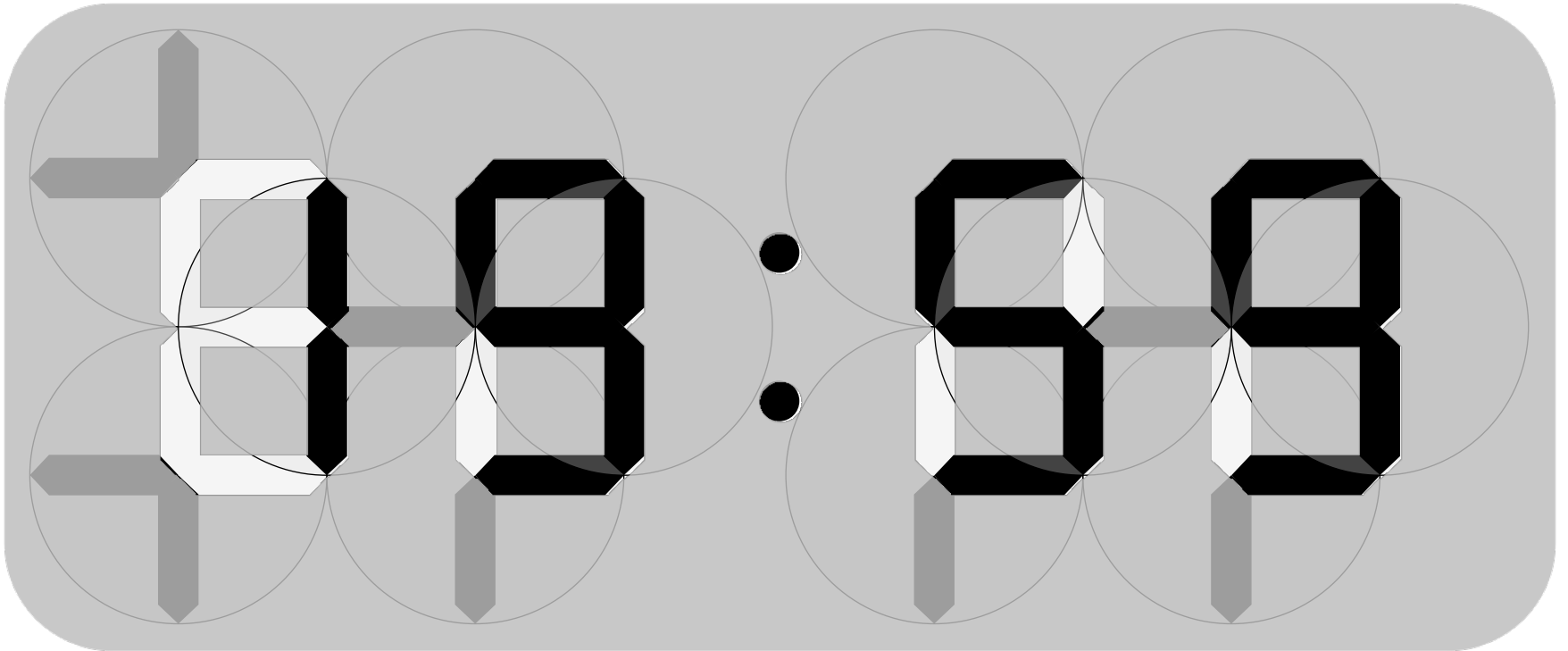
19:58

Analog / Digital Clock



19:59

Analog / Digital Clock



20:00

