1. PROJECT

ROOT_OBJECTS
--|examples_AADL\AirConditioner|--,
--|examples_AADL/Common\Data_Model|--,
--|examples_AADL/Common\Base_Types|--,
--|examples_AADL/Common\Math|--,
--|examples_AADL/Common\Gui|--

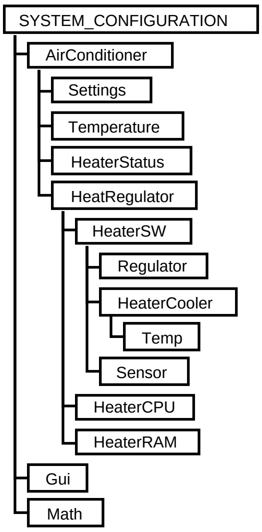
END

1.1. Project Description

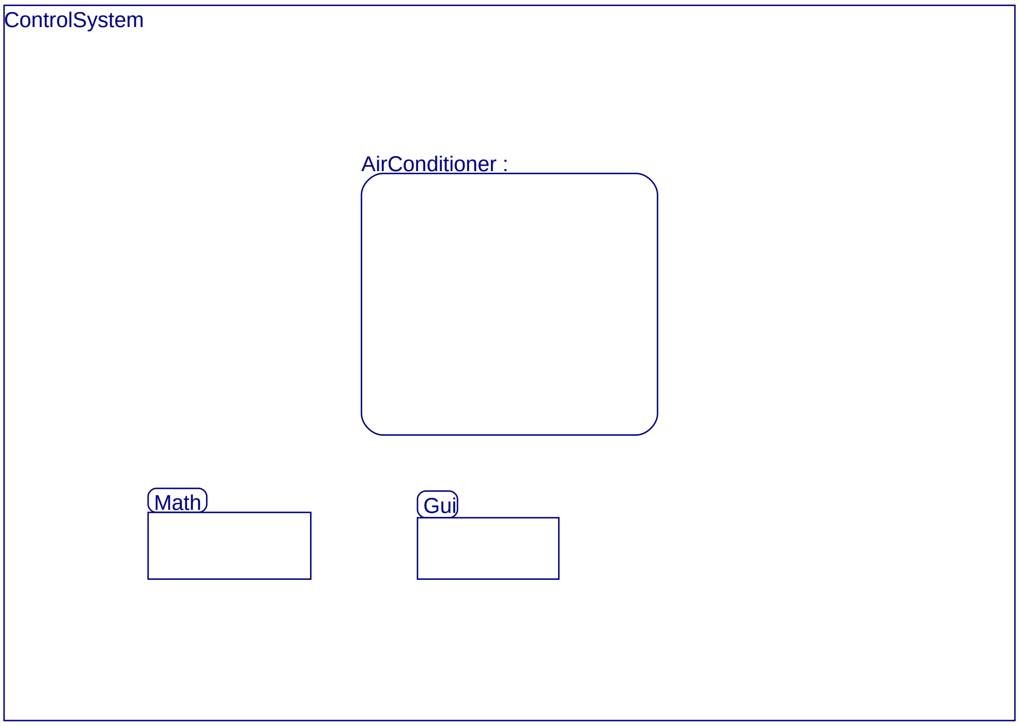
CLOSED LOOP CONTROLLER

This model simulates a closed loop air conditioner.
It is implemented by three threads:
- The "regulator" control software reads the set point (desiredTemp)
and the feedback (measuredTemp) and computes the command for the
heater/cooler actuator.
- The "heatercooler" emulates by software the effect of the actual
device by increasing or decreasing the value of the temperature
according to the received command.
- The "sensor" introduces a measurement error by adding a random
to the measured temperature before sending it back to the regulator.

1.2. Design Tree



1.3. AADL Diagram

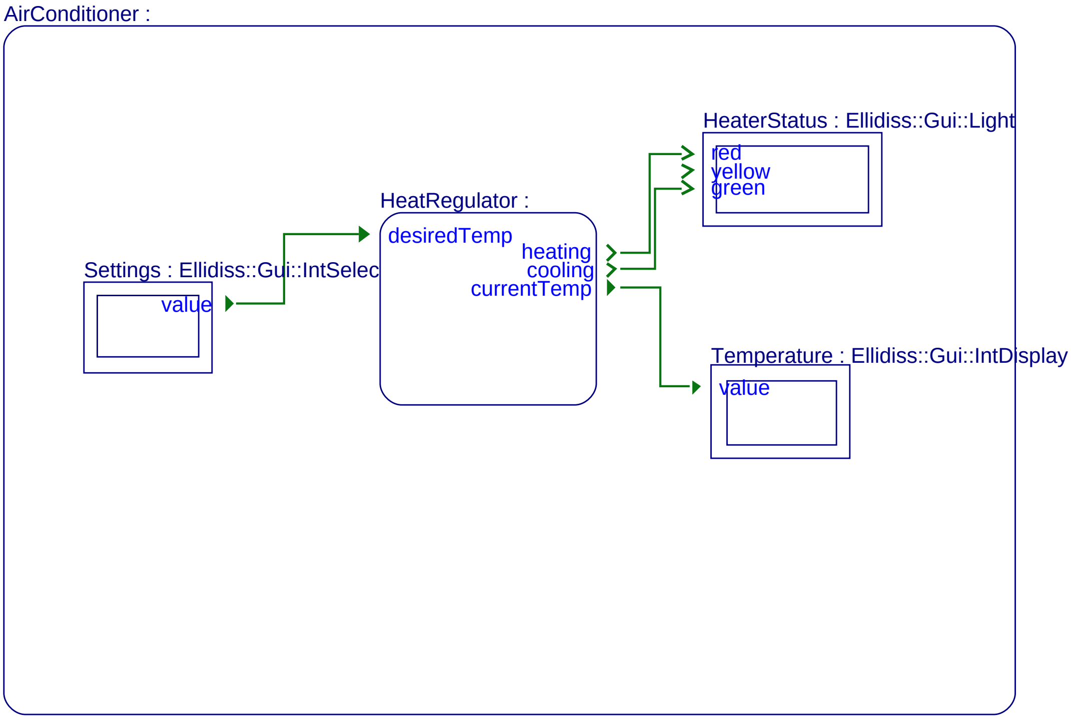


2. SYSTEM AirConditioner IS

2.1. Statement of the Problem (text)

The system is composed of a main control subsystem (HeatRegulator), an external input device (Settings) and two external (HeaterStatus and Temperature). The HeaterStatus device indicates if the system is heating or cooling and the temperature current measured temperature.

2.2. AADL Diagram


AirConditioner :
HeaterStatus : Ellidiss::Gui::Light
red
yellow
green
HeatRegulator :
desiredTemp
heating
cooling
currentTemp
Settings : Ellidiss::Gui::IntSelec
value
Temperature : Ellidiss::Gui::IntDisplay
value

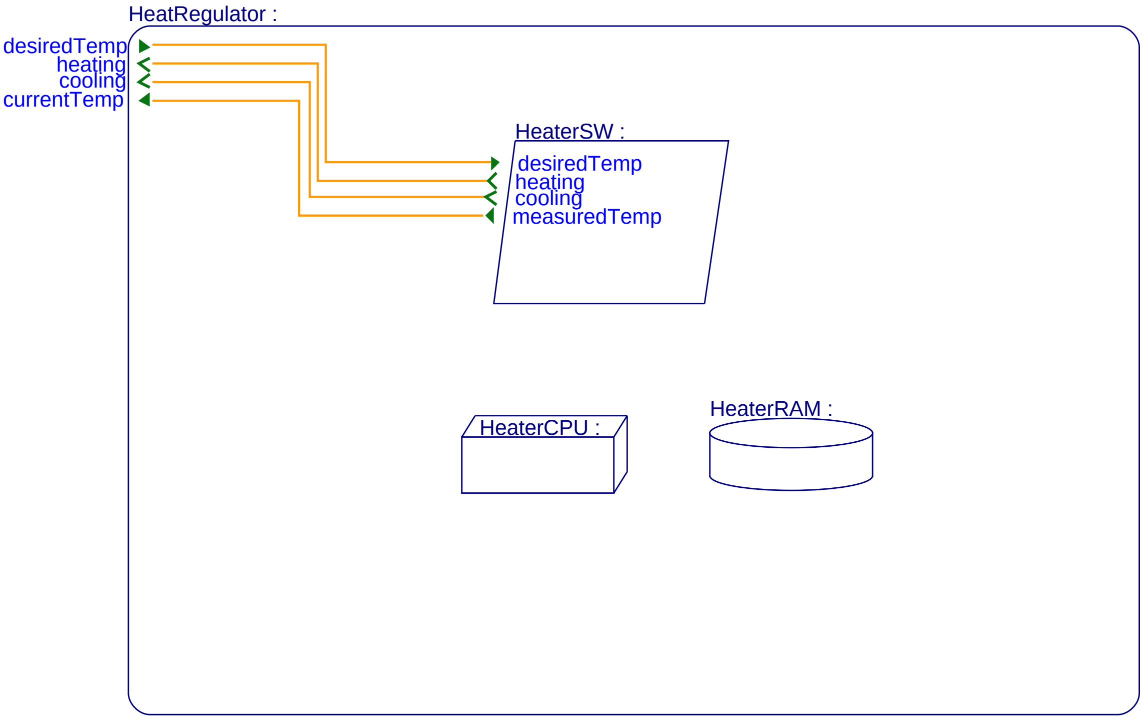
2.3. BEHAVIOR

3. SYSTEM HeatRegulator IS

3.1. Statement of the Problem (text)

The HeatRegulator system is implemented by a software application represented by the HeaterSW process, and an hardwa
of a processor and memory.

3.2. AADL Diagram



3.2.1. Actual_Processor_Binding

```
(reference(HeaterCPU)) applies to HeaterSW
```

3.2.2. Actual_Memory_Binding

```
(reference(HeaterRAM)) applies to HeaterSW
```

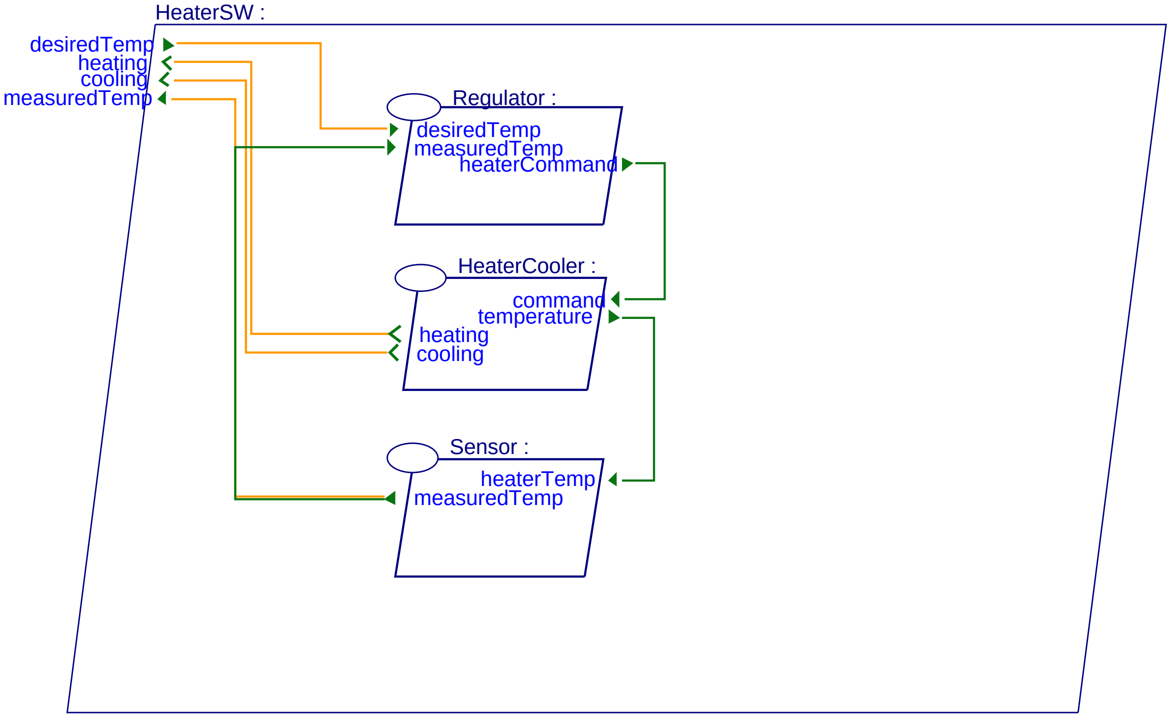
3.3. BEHAVIOR

4. PROCESS HeaterSW IS

4.1. Statement of the Problem (text)

The regulation software executes three periodic threads whose behavior is specified with an AADL Behavior Annex subclau
behavior of the temperature regulation can be simulated in AADL Inspector.

4.2. AADL Diagram



4.3. BEHAVIOR

5. THREAD Regulator IS

5.1. Priority

8

5.2. Compute_Execution_Time

2ms..2ms

5.3. Deadline

20ms

5.4. Period

20ms

5.5. BEHAVIOR

5.5.1. Behavior Description

The Regulator thread makes the différence between the desired temperature (Settings)

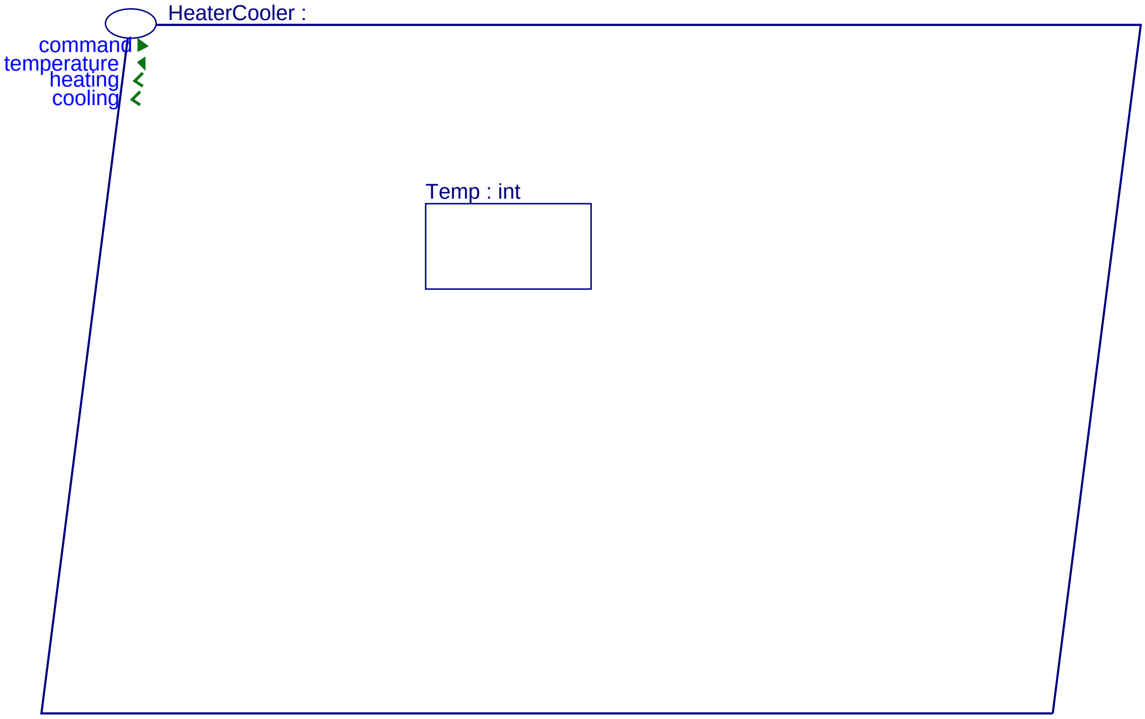
and the measured temperature (Sensor), and applies a gain to produce the HeaterCooler command.

5.5.1.1. Behavior Specification (aadl)

```
VARIABLES diff, gain : int;
STATES s : INITIAL COMPLETE FINAL STATE;
TRANSITIONS t : s -[ON DISPATCH]-> s
  { gain := 2;
    diff :=  desiredTemp - measuredTemp;
    heaterCommand := diff * gain };
```

6. THREAD HeaterCooler IS

6.1. AADL Diagram



6.1.1. Priority

```
6
```

6.1.2. Compute_Execution_Time

```
5ms..5ms
```

6.1.3. Deadline

```
20ms
```

6.1.4. Period

```
20ms
```

6.2. BEHAVIOR

6.2.1. Behavior Description

If received command is positive or null then the temperature is increased (heating), otherwise it is decreased (cooling).

6.2.1.1. Behavior Specification (aadl)

```
STATES s : INITIAL COMPLETE FINAL STATE;
TRANSITIONS t : s -[ON DISPATCH]-> s
  { if (command >= 0) heating!; Temp := Temp + 1 end if;
    if (command < 0) cooling!; Temp := Temp - 1 end if;
    temperature := Temp };
```

7. DATA Temp IS

7.1. BEHAVIOR

8. THREAD Sensor IS

8.1. Priority

```
10
```

8.2. Compute_Execution_Time

```
1ms..1ms
```

8.3. Deadline

```
20ms
```

8.4. Period

```
20ms
```

8.5. BEHAVIOR

8.5.1. Behavior Description

Measured temperature is obtained by adding an error value to the theoritical temperature.

The error function (err) is provided by the Math package.

8.5.1.1. Behavior Specification (aadl)

```
VARIABLES e : int;
STATES s : INITIAL COMPLETE FINAL STATE;
TRANSITIONS t : s -[ON DISPATCH]-> s
  { err!(2,e); measuredTemp := heaterTemp + e };
```

9. PROCESSOR HeaterCPU IS

9.1. Scheduling_Protocol

```
(HPF)
```

9.2. BEHAVIOR

10. MEMORY HeaterRAM IS

10.1. BEHAVIOR