The COMON Case Study

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SYNCHRON 2011

Outline

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Lurette - Automatic Functionnal Tests of Reactive Sytems

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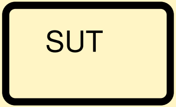
- Black box functionnal test
  - Comparing an implementation and a specification
- Automatical test
  - Generation of stimuli (SUT inputs)
  - Tests results checking (oracle)
- Based on a formal description of
  - *System Under Test* properties
  - Different hypothesis done on the environment
- Reactive Systems
  - The SUT reacts to the environment that it tries to control (feedback)
  - A *realistical* environment must acts the same way

Data Flow - Global View



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The environment can be seen as a

- Non-deterministic reactive system
- Constrainted test vector generator

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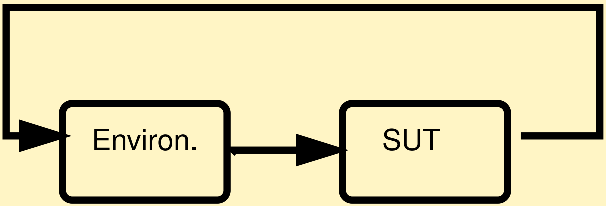

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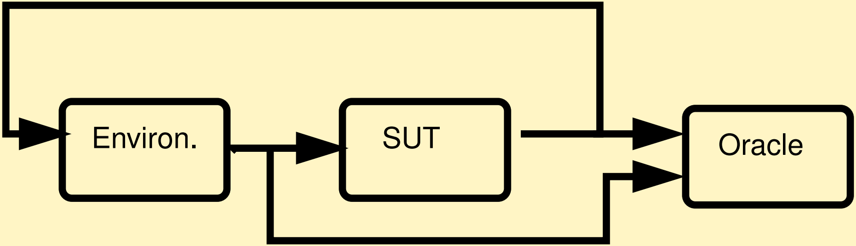

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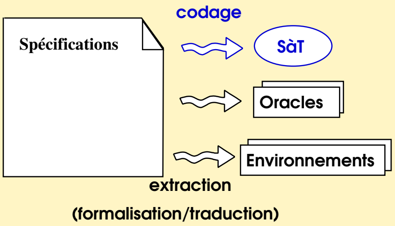

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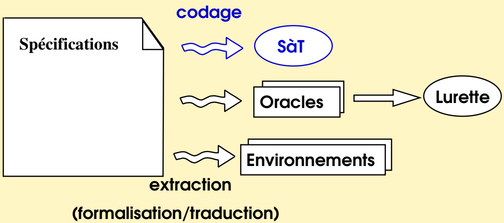

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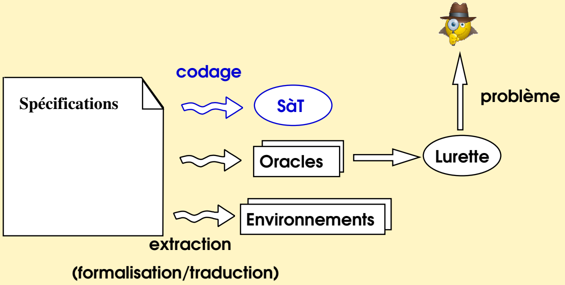

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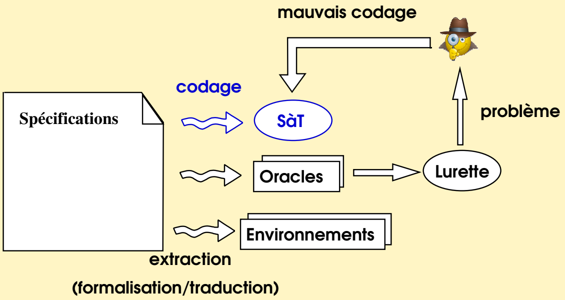

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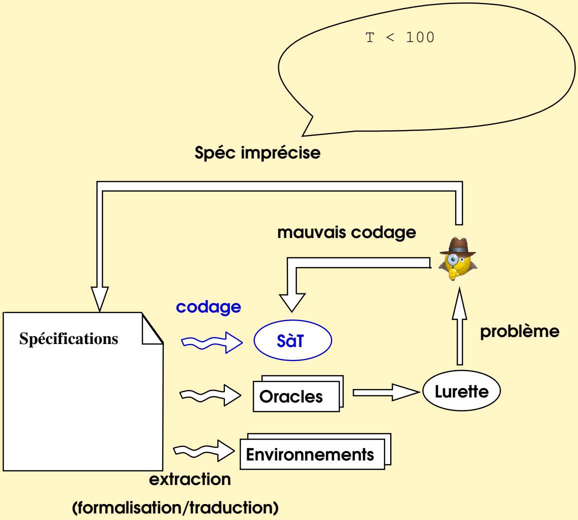

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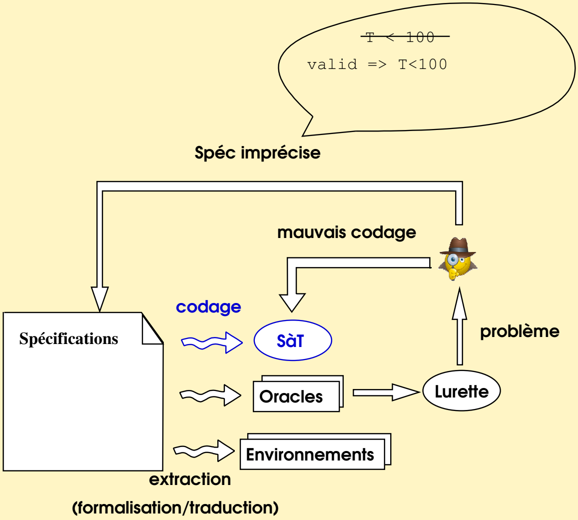

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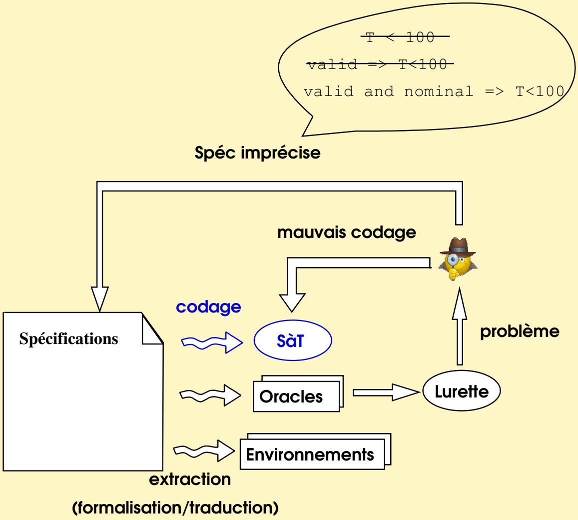

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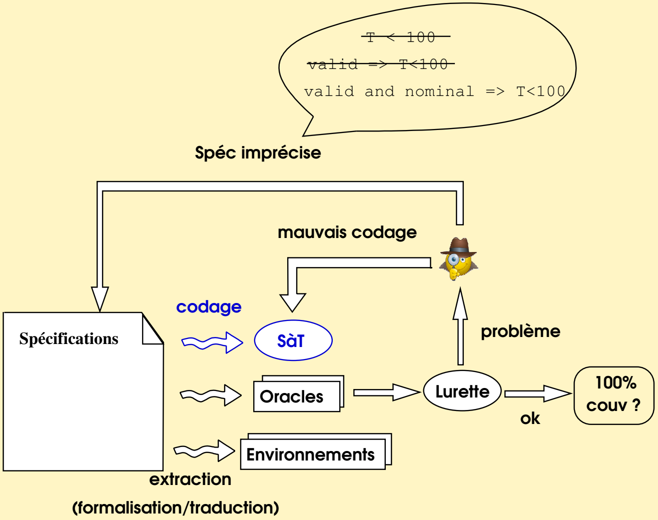

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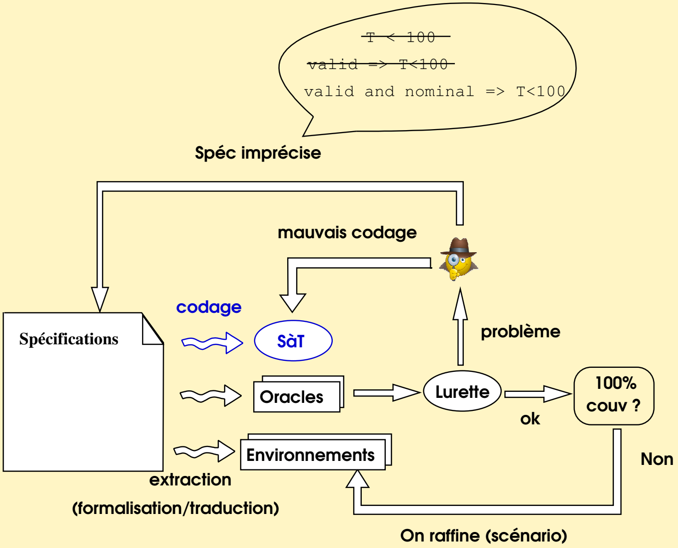

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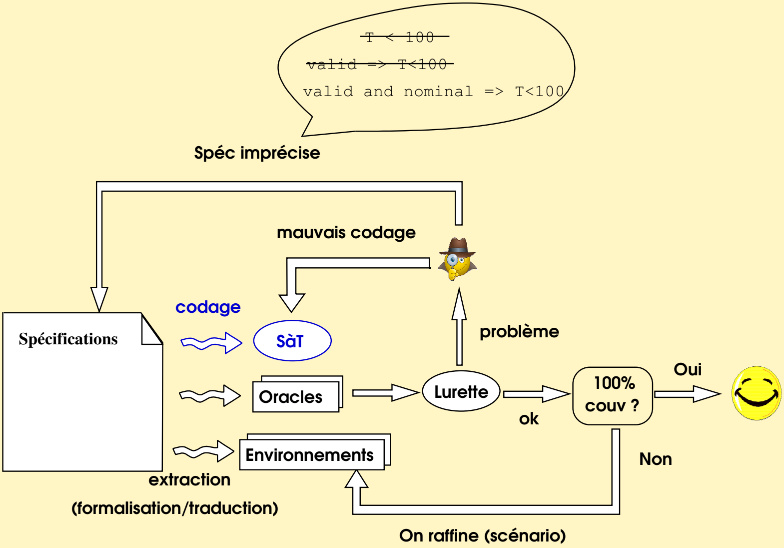

Outline

COMON - Continuous Test Chain

Control-Command for civil nuclear systems

- ATOS WorldGrid
- Rolls-Royce Civil Nuclear
- Corys
- VERIMAG

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		N2
		Interface
N1CL	Interface	N1
	Interface	Interface
		N0

COMON - Continuous Test Chain

Control-Command for civil nuclear systems

- ATOS WorldGrid ADACS : visualization
- Rolls-Royce Civil Nuclear SCADE : simulation
- Corys ALICES : simulation
- VERIMAG Lurettte : test manager

		N2 <- ATOS
		Interface
RRCN -> N1CL	Interface	N1 <- ALICES
	Interface	Interface
		N0 <- ALICES

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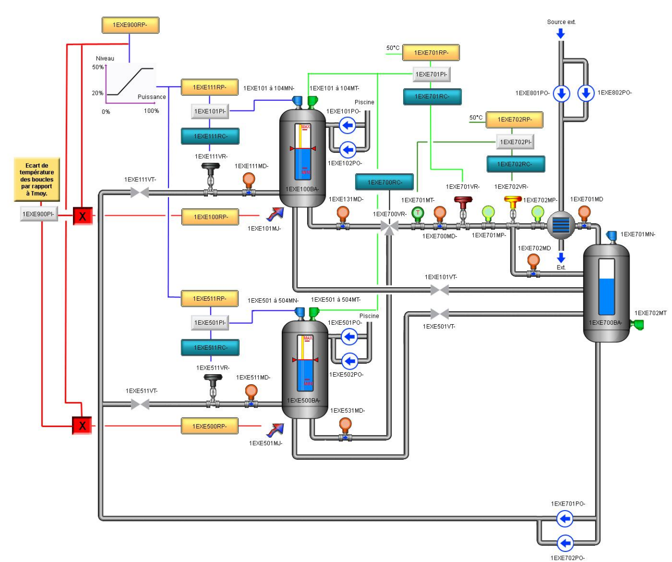
- The central point in this approach is obtaining, testing and validating an executable model earlier.

Experiments done during this case study



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- Formalisation from natural language into
  - Lustre for the oracles
  - Lutin for the environments/stimulators
- Macrolibrary of generic nodes to help writing oracles and stimulators
  - Checking that a numerical value remains in a specific range
  - Calculating different system states (situation) :
    - nominal, low power, 2/3-1/3, loop 1, emergency
  - Detecting the stability of a variable
  - Doing an action and waiting for the stabilitry
  - etc.

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An oracle supervising threshold crossings

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alarm_raised = timer(alarm, 5.0);
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NB : it is the same for low, very high and very low thresholds

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- We extracted different system situations from the natural language description : `nominal`, `low power`, `emergency`
- Then we expressed relations between these properties :
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```
node oracle_situation(nominal, low_power, emergency : bool)
returns(ok:bool);
 ok = true ->
      (pre nominal => nominal or low_power) and
      (pre low_power => low_power or nominal or emergency) and
      (pre emergency => emergency or low_power);
```

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- Yet, the need of a scenario where the operator orders dont change too quickly

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  - switch anyway after 200 cycles (or after a `reset`)

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```
node(n:int; reset:bool) returns(P1,P2,P3,P4,P5,P6) =
 let Emergency = two_false(P1,P2) or three_false(P3,P4,P5,P6) in
 let nb_failures = (if P1 then 1 else 0)+...+(if P6 then 1 else 0) in
  loop {
    { (not Emergency and nb_failures = n) |> nb_failures = n }
    fby loop 200 {maintain(P1) and ... maintain(P6) and not reset}
  }
```

Failures-i.lut ; Failure Demo

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-> operator.lut ; Operator demo

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Demo !

- The 4 systems communicate
- Lurette pilots the tests
- Use the 2 scenarios presented before
- Use (most of) the oracles presented before