Software Patterns for Fault Injection in CPS Engineering

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Sept. 12 – 15, 2017, Limassol, Cyprus

Motivation

Model-Driven Engineering and Domain-Specific Languages are two key technologies to meet the software productivity challenge and develop trustworthy systems, especially for CPS.

- CPS typically subject to dependability constraints
- Fault injection is an effective technique to assess the dependability, either implemented in hardware (HIFI) or software (SWIFI)

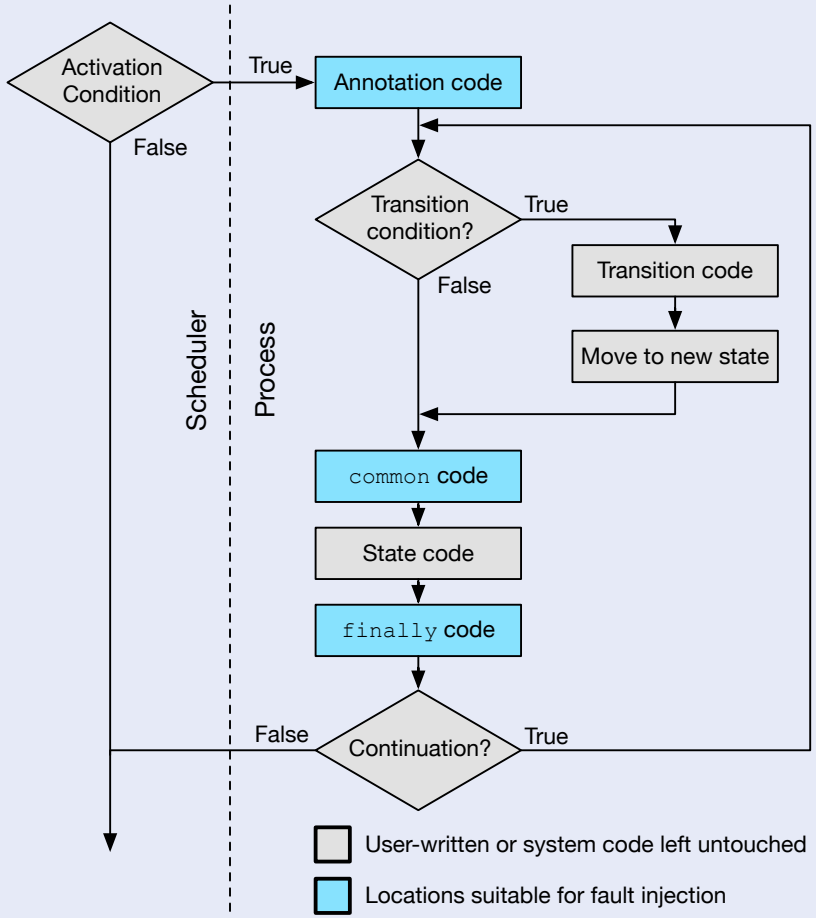
A central challenge in MDE is to make it possible to seamlessly integrate the verification activity within the design flow and to fully, or partially automate it.

CPAL

CPAL sample

```
processdef P(params) {
  common {
    code
  }

  state Warning {
    code
  }
  on (cond) {code} to Alarm_Mode;
  after (time) if (cond) to Normal_Mode;

  finally {
    code
  }
}

process P: inst[period,offset][cond](args);

@cpal:time:inst{
    annotation code
}
```

Elementary execution step



Fault Injection Patterns

Software patterns

Capture structures, ideas, or key techniques known to expert practitioners, and ultimately solve recurring problems.

Fault category

- Global state
- Activation arguments
- Local instance variables
- Control flow disruption

Injection patterns

- External fault injector(s)
- Fault injection as pre/post conditions
- Annotation-based fault injection

Fault Injection Patterns

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	Global state	Act. args.	Local vars.	Control flow
External process(es)	✓			✓
Pre/post conditions	✓	✓	✓	
Annotation-based	✓			✓

Key feature: automated generation of fault injection code based on code transformation.

Thank you for your attention