SPTG: Symbolic Path-Guided Test Case Generator

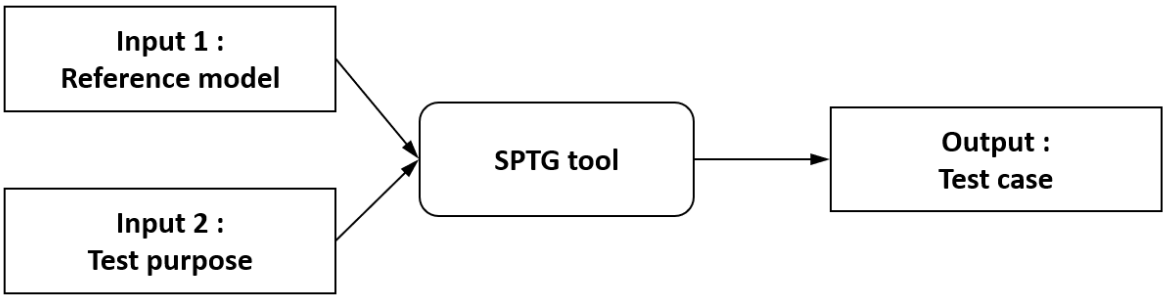
SPTG is a model-based test generation tool that automatically produces **conformance deterministic test cases** from system models combining both **data** and **timing constraints**. It relies on **path-guided symbolic execution**, which explores a selected sequence of transitions (the **test purpose path**) and incrementally builds the corresponding **symbolic constraints** over inputs and timing. These constraints are then solved using an **SMT solver** to determine **feasible symbolic paths**, ensuring that each generated test case corresponds to an **executable behavior** of the system under test.

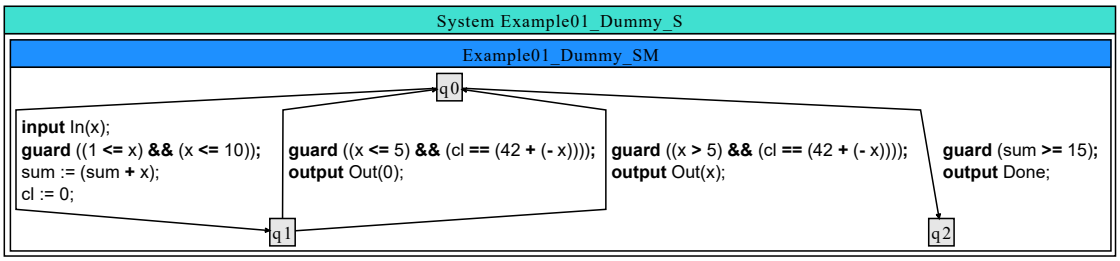
Applications

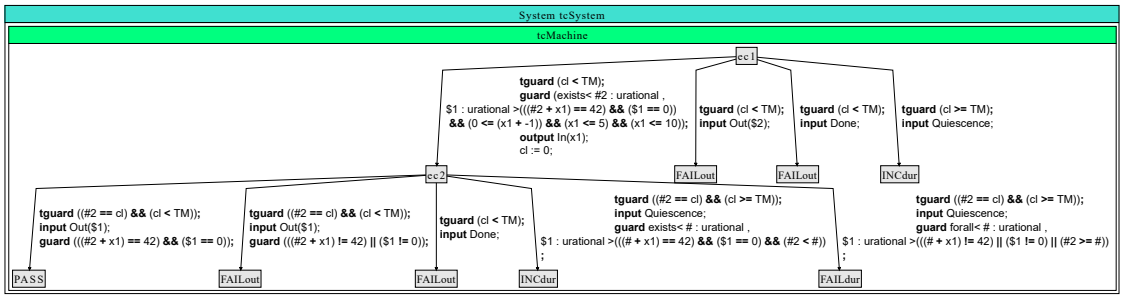
- **Model-Based Testing (MBT)** of systems with combined data and timing behaviors.
- **Offline generation** of efficient and deterministic test suites from formal models.
- **Teaching and demonstration** of symbolic execution and model-based test generation principles.

SPTG implements the **symbolic path-guided test generation approach** developped in:
👉 https://doi.org/10.1016/j.scico.2025.103285 *(Open Access)*

SPTG Tool I/O Flow



Description	Content
Input 1: *Timed symbolic automaton : Reference system model*	

Description	Content
Input 2: *Sequence of transitions (path) : Test purpose*	`(tr1, tr2)`
Output: *Deterministic timed symbolic automaton : Generated test case*	

Using SPTG

```
PATH_TO_SPTG/bin/sptg.exe
PATH_TO_SPTG/examples/example02_dummy/workflow_4_testcase_generation.sew
```

Excerpt of symbolic execution workflow file `PATH_TO_SPTG/examples/example02_dummy/workflow_4_testcase_generation.sew`

```
project 'location of input reference model' [
    source = "."
    model  = "example02_dummy.xlia"
] // end project
...
path#guided#testcase#generator testcase_genertor {
    trace 'input test purpose' [
        transition = "tr1"
        transition = "tr2"
    ] // end trace
    vfs 'location and name of generated test case' [
        folder = "output"
        file#tc       = "testcase.xlia"
        file#tc#puml  = "testcase.puml"
    ] // end vfs
    ...
}
```

This workflow instructs SPTG to generate a **test case** from the **reference system model** (`example02_dummy.xlia`) using the **sequence of transitions** `(tr1, tr2)` that define the *test purpose*.

> **Note:**
> The input reference model automaton is encoded in the **XLIA language**, the input language of the **Diversity** symbolic execution platform. **SPTG** extends Diversity with dedicated functionality for symbolic path-guided test generation.See model_specification for more details.

SPTG generates the resulting **test case automaton** in the follwoing formats:

- specification langauge **XLIA** the same langauge used to express the reference model (`PATH_TO_SPTG/examples/example02_dummy/output/testcase.xlia`)
- in graphical format **PlantUML** (`PATH_TO_SPTG/examples/example02_dummy/output/testcase.puml`).
- In addition, SPTG generates the test case automaton in JSON format with guards expressed in SMT-LIB format (`PATH_TO_SPTG/examples/example02_dummy/output/testcase_smt.json`).

You can visualize `.puml` files using PlantUML or the online tool PlantText.

You can convert a file `.puml` to a file `.svg` (see the PlantUML Conversion Guide).

Tutorials are available on:

📓 Model specification for SPTG

📓 Test case generation using SPTG

📓 Test purpose selection (inherited from the Diversity platform)

Compilation Instructions

To compile SPTG, navigate to the `Release` directory of the `org.eclipse.efm.symbex` module:

```
cd PATH_TO_SPTG/org.eclipse.efm.symbex/Release/
```

Then build the project:

```
make all -j4
```

During compilation, the process automatically overwrites the existing `sptg.exe` in the `bin` directory using:

```
cp -f sptg.exe ../../bin/sptg.exe
```

If you wish to preserve the existing executable, rename it before compilation as follows:

```
mv ../../bin/sptg.exe ../../bin/sptg_old.exe
```

PlantUML: PUML to SVG Conversion Guide

A quick reference for converting `.puml` files to `.svg` images via the command line.

Prerequisites

1. **Java Runtime Environment (JRE):** Required to execute PlantUML.
2. **PlantUML JAR File:** The standalone application.

1. Download PlantUML

Get the latest stable release of `plantuml.jar` from the official github site:
👉 https://github.com/plantuml/plantuml/releases

2. Conversion Command

Navigate to the folder containing both `plantuml.jar` and your `.puml` file.

Use the `-tsvg` flag to generate an SVG image:

Command	Action
`java -jar plantuml.jar -tsvg yourfile.puml`	Converts the input file (`.puml`) to an SVG output (`.svg`).

Example

```
# Generates 'MyDiagram.svg'
java -jar plantuml.jar -tsvg MyDiagram.puml
```