SPTG: Symbolic Path-Guided Test Case Generator

SPTG is a model-based test generation tool that automatically produces **conformance test cases** from system models mixing **data** and **timing constraints**.
It relies on **path-guided symbolic execution**, which follows a selected consecutive sequence of transitions (the **test purpose path**) while collecting symbolic constraints on inputs and timing.

Key Features

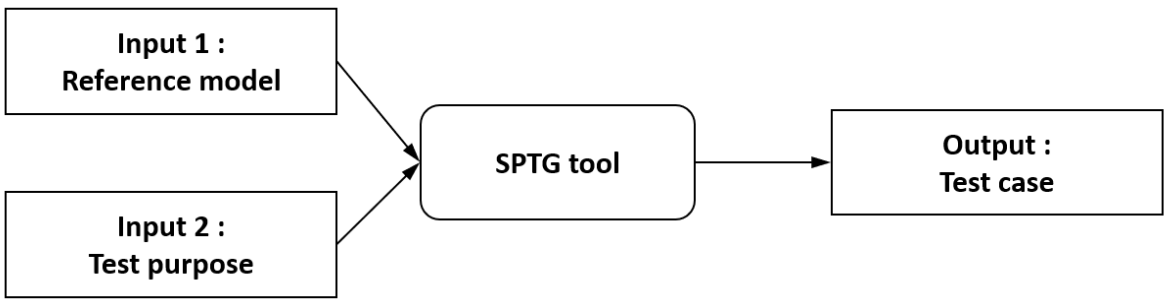
- **Symbolic execution** : Generates test cases along *test purpose paths* by accumulating symbolic constraints on input data and timing conditions.
- **Unified treatment of data, time, and quiescence** : Supports both data and clock variables, and distinguishes between *expected quiescence* (permitted silence within a delay) and *missing outputs* (silence when an output is expected).
- **Deterministic path selection** : Only deterministic paths are used; non-deterministic ones are discarded, ensuring unambiguous, executable test cases that align with the symbolic execution tree.
- **Concise test cases** : Infeasible branches are pruned, and redundant constraints are simplified to keep the test cases minimal.
- **Coverage-oriented testing** : Test purpose paths can be user-defined or automatically selected from reference system model. As an extension of the Diversity symbolic execution platform, SPTG inherits advanced coverage analysis and test selection capabilities.

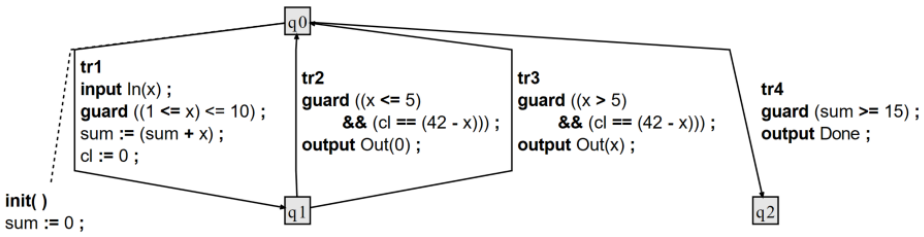
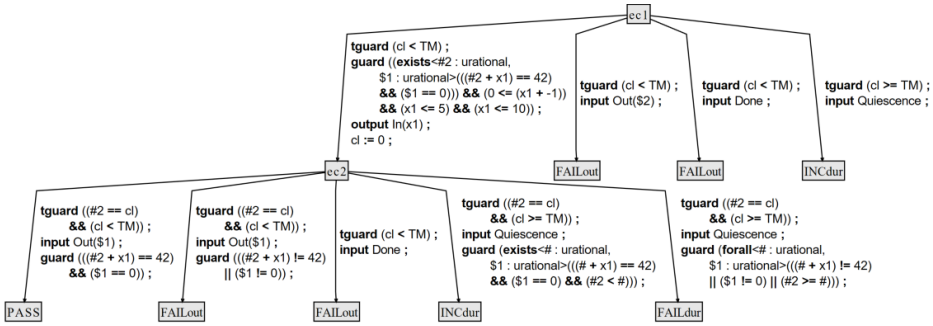
Applications

- **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 described 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*	
Input 2: *Sequence of transitions (path) — Test purpose*	(tr1, tr2)
Output: *Deterministic timed symbolic automaton — Generated test case*	

Using SPTG

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

Excerpt of symbolic execution workflow file
`./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 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 both **XLIA** and **PlantUML** formats.
You can convert the `.puml` output to `.svg` using **PlantUML** (see the PlantUML Conversion Guide) or the online tool PlantText.

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 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
```