Shunt- TCP/IP data exchange between stand-alone SystemVerilog simulations and external applications

Table of Contents

1. Introduction

The Shunt is Open Source Client/Server TCP/IP socket based communication library for SystemVerilog simulation.

- It aims to enable quick and easy development of communication between stand-alone SystemVerilog simulations and/or external applications
- It offers a common SystemVerilog/C API and supports all SystemVerilog data types.

The Shunt is available under a MIT License. It can be used without restriction in an open-source or commercial application.

2. Goals and objectives

- **Portability**. The library supports all known SystemVerilog (SV) 2012 data types and data structures. It should provide consistent behavior for all major simulators.

- **Scalability and flexibility.** The library facilitates the development of communication between multiple stand-alone SV simulations and/or external applications.
- **Memory-Efficiency.** The library should not cause any memory leaks.
- **Simple API model.** The Shunt is aiming to minimize the up-front investment in time and effort by providing a simple, consistent API.
- **Extensibility.** The Shunt should enable a platform to build higher levels abstraction application and libraries.

3. Overview

3.1. Directory structure

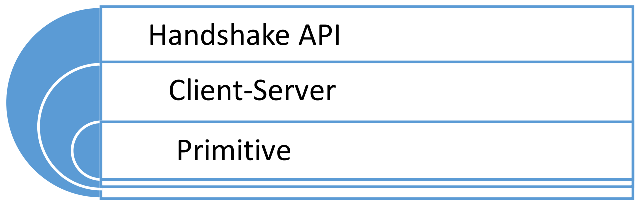
The following diagram illustrates Shunt Directory structure:

```
.
├── bin
├── doc
├── examples
│
└── utils
    │
    ├── c
    │   ├── include
    │   │   ├── shunt_client_server.h
    │   │   ├── shunt_primitives.h
    │   │   └── shunt_user_api.h
    │   └── src
    │       ├── shunt_client_server.c
    │       ├── shunt_primitives.c
    │       └── shunt_user_api.c
    ├── dpi
    │   ├── include
    │   │   ├── shunt_dpi.h
    │   └── src
    │       ├── shunt_dpi.c
    │       ├── shunt_dpi_pkg.sv
    │       └── shunt_hs_pkg.sv
    └── makedir
```

Where is:

- The "utils" is a main Shunt library depository.
  It contains C functions (Reference to utils/c) and corresponding "SV" DPI wrappers (Reference to utils/dpi).
- The "doc" – Shunt Library documentation.
- The "bin" – C domain compiles results
- The "examples" - it contains "SV to SV" and "C to C" communication examples.

3.2. The Shunt hierarchy



The Shunt comprised of 3 layers of abstraction: primitive (PRIM), client-server (SC), and handshake API (HS).
Each layer is self-sufficient. User can build an application on top of each layer.

3.3. Primitive Layer (PRIM)

The first layer contains basic TCP/IP socket initialization, some generic functions, and SV data exchange methods.
Its main purpose is to enable a basic data transfer between initiator and target for all major SV data types.
The PRIM operation doesn't require any memory allocation.

Initiator-Target PRIM exchange operation flow is shown below:

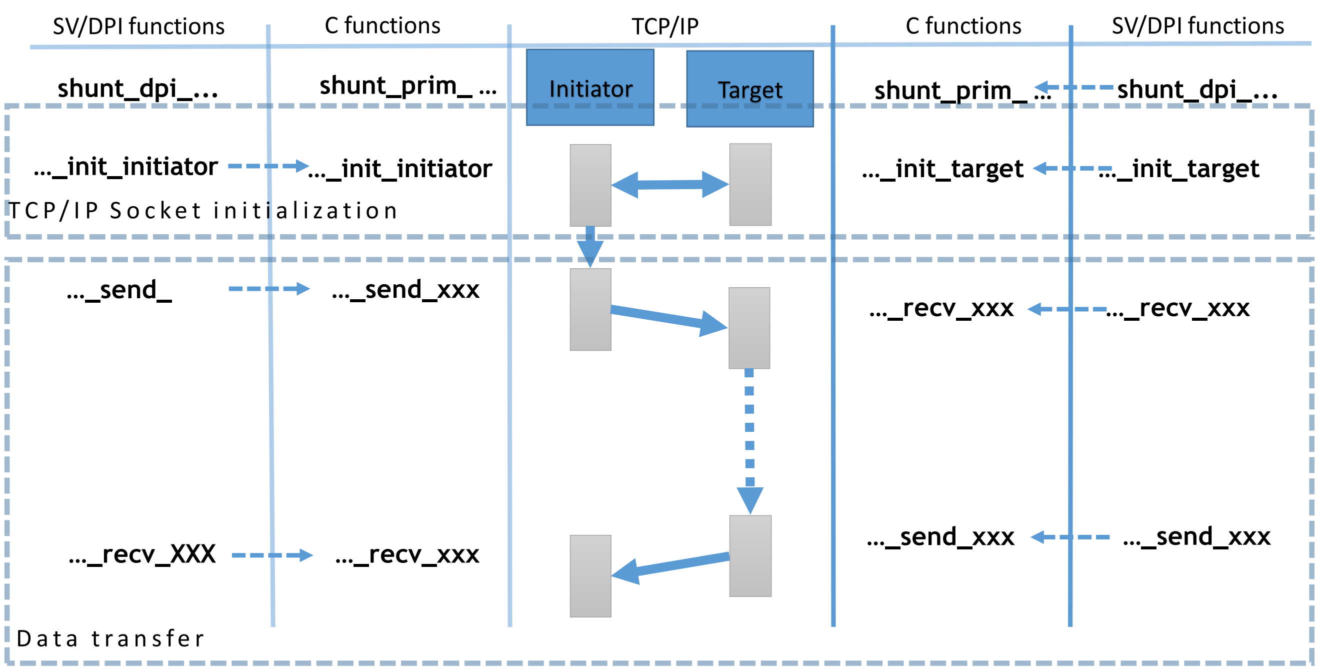


Figure 1 PRIM operation

"C to C"   PRIM examples: Shunt/examples/c/primitives
"SV to SV" PRIM examples: Shunt/examples/sv/sv2c/initiator
(Ref. to xxx_loopback tasks)

3.4. Client-server layer (CS)

The second Layer offers data transfer for one-dimensional arrays.
Also, it contains transaction header structures and methods that can be used to build up a client-server handshake protocol.
User application is responsible for the proper memory garbage collection.

A typical CS layer operation is presented below:

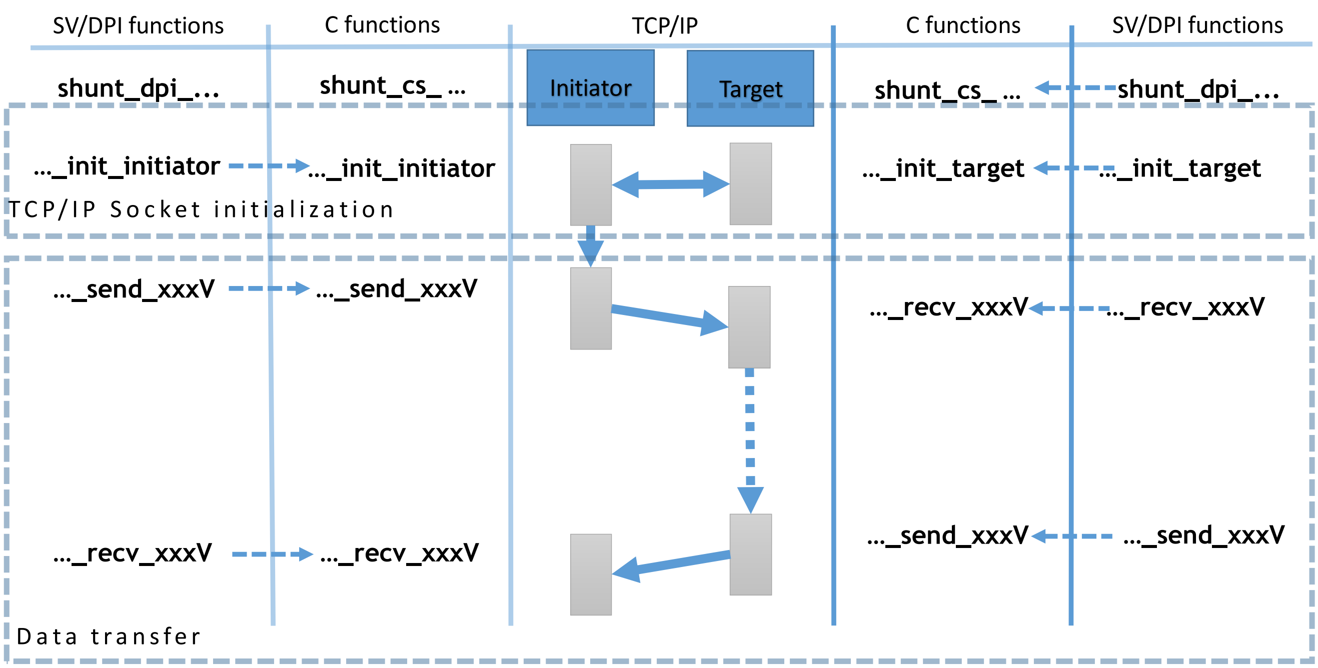


Figure 2 CS Operation

"C to C"   SC examples: Shunt/examples/client_server
"SV to SV" SC examples: Shunt/examples/sv/sv2c/initiator
(Ref. to xxxV_loopback tasks)

3.5. Handshake API layer (HS)

This layer provides framework for TCP/IP handshake communication.
Users can setup their own packet or utilize/extend the predefined header/data payload pair.

```
The HS supports dynamic (vector) and static (array) data structures for all
major SV data types.
The user application is responsible for the proper memory garbage collection
```

```
An example of   Client-Server handshake is presented below:
```

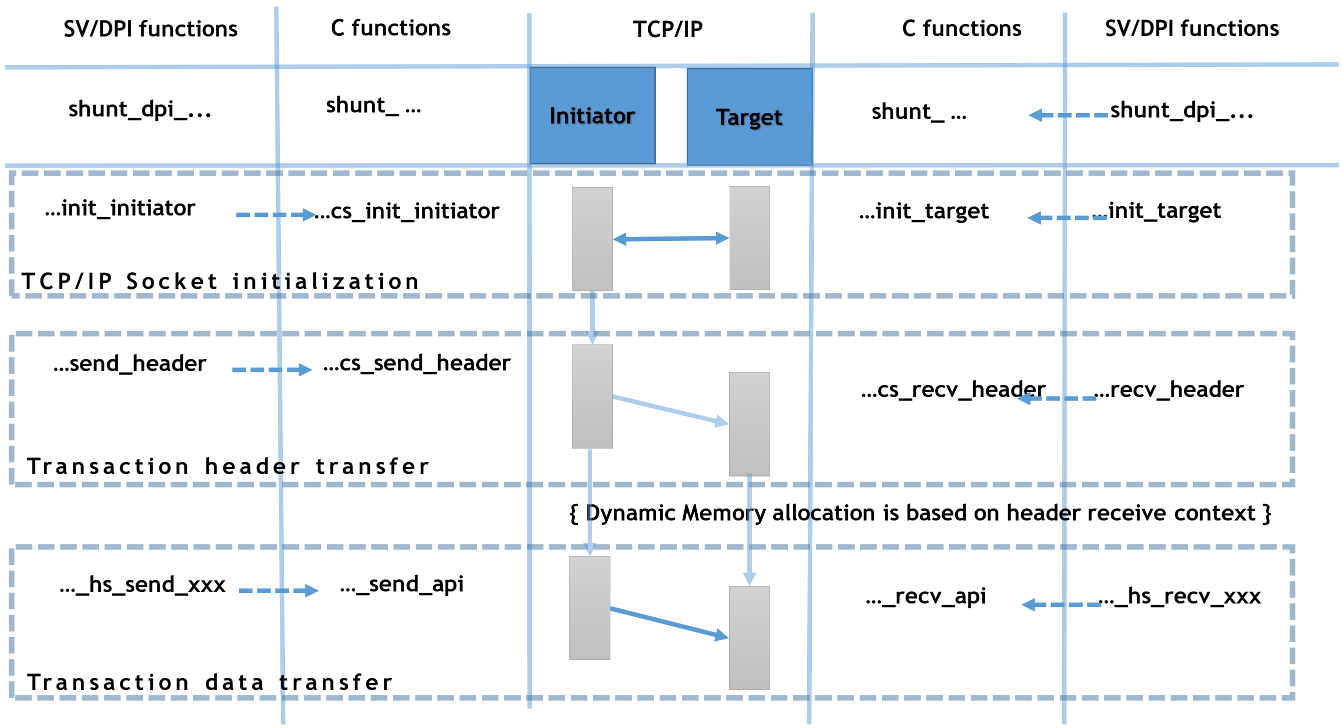


Figure 3 HS Operation

"C to C"   HS examples: Shunt/examples/c/user_api/
"SV to SV" HS examples: Shunt/examples/SV/handshake

4. Getting Started

4.1. Library Installation

Download Shunt from https://github.com/xver/Shunt
Setup following variables:

- "SHUNT_HOME"   to the SHUNT home directory.
- "SHUNT_SVDPI" to the location of svdpi.h file

4.2. Library compilation

- Go to "$SHUNT_HOME/utils/makedir/utils/makedir"
- Run "make clean;make all"
- Compile result will be placed under ${SHUNT_HOME}/bin as a "libutils.so"

4.3. Compile and run C examples

- Go to example makedir root directory.
  (Example: $SHUNT_HOME/examples/c/primitives/makedir)
- To compile the library and launch test run "make all"

4.4. Compile and run SV examples

The Shunt includes a complete Makefile structure for the C portion of the library, but ONLY Makefile target place holders for SV domain.

- Edit "Makefile" initiator/target "compile_sv" under initiator/target local makedir
  (Example: $SHUNT_HOME/examples/sv/sv2c/initiator/makedir)
- Edit "run" file placeholder. Setup run command for appropriate source.
- Go to example makedir root directory run "make all" and ./run
  (Example: $SHUNT_HOME/examples/sv/sv2cmakedir)

5. Library version scheme and roadmap

The Shunt is adopting semantic versioning scheme as:

- It starts at 1.0.0
- Bug fixes, Patch release - the last   number increment, e.g. 1.0.1.
- Minor release   - the middle number increment, e.g. 1.1.0.
- Major release   - the first number increment, e.g. 2.0.0.

Minor releases:

- Add makefile targets for all major SV simulators
- SV Queue and Associative array support

Major releases:

- Add UVM and TLM 2.0 support.
- TCP/IP client-server optimization

6. Contact information

If you have any questions please contact us at icshunt.help@gmail.com