TLM 2.0 Approximately Time (AT) System Example – Out Of Order Transactions

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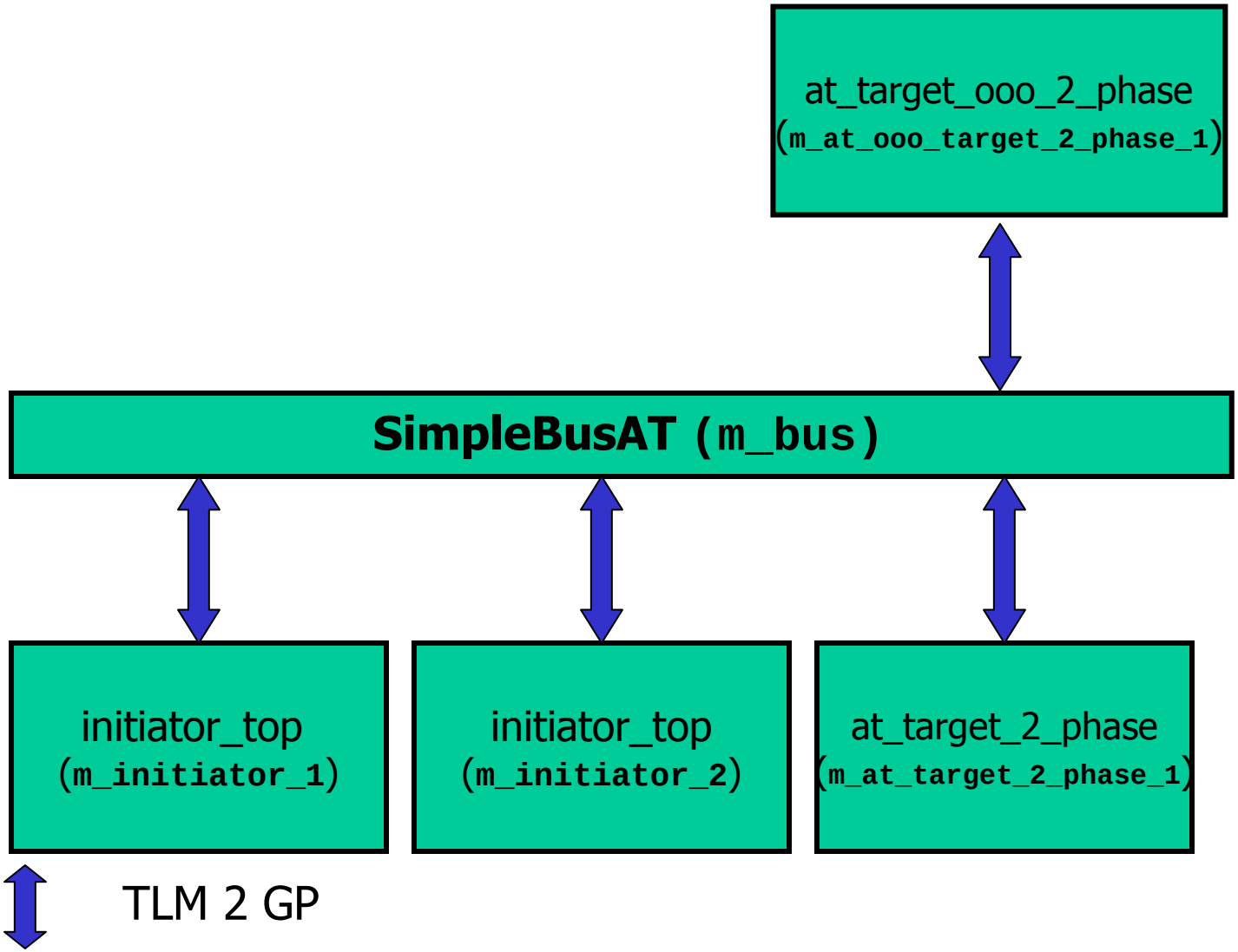
AT System Example - Annotated Timing

- **The Goal is to Illustrate:**
  - **Application of TLM 2.0 in a real system**
  - **Show out of order REQ and RESP phases**
    - **Target**
    - **Initiator**
- **Possible Applications:**
  - **Architectural exploration**
  - **Early software development**

Example Block Diagram



How to run this example (Linux)

- Set **`SYSTEMC_HOME`**
- **`cd examples/tlm/at_ooo/build-unix`**
- **`make clean`**
- **`make`**
- **`make run`**

How to run this example (MSVC)

- Open a explorer window on **`examples/tlm/at_ooo/build-windows`**
- Launch **`at_ooo.sln`**
- Select **‘Property Manager’** from the **‘View’** menu
- Under **‘at_ooo > Debug | Win32’** select **‘systemc’**
- Select **‘Properties’** from the **‘View’** menu
- Select **‘User Macros’** under **‘Common Properties’**
- Update the **‘SYSTEMC’** entry and apply
- Build and run

Expected Output (1of3)

Approximately line #2976 of log file

REQ for first transaction

Approximately line #3023 of log file

REQ for second transaction

Approximately line #3043 of log file

```
Info: select_initiator.cpp: 1824 ns - initiator_thread
      Initiator: 101 starting new transaction for Addr:0x10000100
      Initiator: 101 nb_transport_fw (GP, BEGIN_REQ, 0 s)
Info: select_initiator.cpp: 1824 ns - initiator_thread
      Initiator: 101 ACCEPTED (GP, BEGIN_REQ, 0 s)
      Initiator: 101 transaction waiting end-request on backward-path
Info: at_target_ooo_2_phase.cpp: 1824 ns - nb_transport_fw
      Target: 202 nb_transport_fw (GP, BEGIN_REQ, 0 s)
      Target: 202 out of order transaction moved to response PEQ
      Target: 202 with Addr: 0x00000100 and a delay of 780 ns
      Target: 202 UPDATED (GP, END_REQ, 20 ns
. . .
Info: select_initiator.cpp: 1834 ns - initiator_thread
      Initiator: 102 starting new transaction for Addr:0x10000200
      Initiator: 102 nb_transport_fw (GP, BEGIN_REQ, 0 s)
Info: select_initiator.cpp: 1834 ns - initiator_thread
      Initiator: 102 ACCEPTED (GP, BEGIN_REQ, 0 s)
      Initiator: 102 transaction waiting end-request on backward-path
. . .
Info: at_target_ooo_2_phase.cpp: 1844 ns - nb_transport_fw
      Target: 202 nb_transport_fw (GP, BEGIN_REQ, 0 s)
      Target: 202 transaction moved to response PEQ
      Target: 202 with Addr: 0x00000200 and a delay of 80 ns
      Target: 202 UPDATED (GP, END_REQ, 20 ns)
```

Expected Output (2of3)

Router has "modified" address

```
Info: select_initiator.cpp: 1864 ns - nb_transport_bw
      Initiator: 102 nb_transport_bw (GP, END_REQ, 0 s)from Addr:0x00000200
      Initiator: 102 transaction waiting begin-response on backward path
      Initiator: 102 ACCEPTED (GP, END_REQ, 0 s)
Info: at_target_ooo_2_phase.cpp: 1924 ns - begin_response_method
      Target: 202 Starting response method for Addr: 0X00000200
Info: memory.cpp: 1924 ns - print
      ID: 202 COMMAND: WRITE Length: 04
      Addr: 0x0000000000000200 Data: 0xEFFFFDFF
Info: at_target_ooo_2_phase.cpp: 1924 ns - begin_response_method
      Target: 202 nb_transport_bw (GP, BEGIN_RESP, SC_ZERO_TIME)
Info: at_target_ooo_2_phase.cpp: 1924 ns - begin_response_method
      Target: 202 ACCEPTED (GP, BEGIN_RESP, 0 s)
Info: select_initiator.cpp: 1924 ns - nb_transport_bw
      Initiator: 102 nb_transport_bw (GP, BEGIN_RESP, 0 s)from Addr:0x00000200
      Initiator: 102 transaction moved to send-end-response PEQ
      Initiator: 102 ACCEPTED (GP, BEGIN_RESP, 0 s)
Info: select_initiator.cpp: 1931 ns - send_end_rsp_method
      Initiator: 102 starting send-end-response method
      Initiator: 102 nb_transport_fw (GP, END_RESP, 0 s)
Info: select_initiator.cpp: 1931 ns - send_end_rsp_method
      Initiator: 102 COMPLETED (GP, END_RESP, 0 s)
Info: at_target_ooo_2_phase.cpp: 1931 ns - nb_transport_fw
      Target: 202 nb_transport_fw (GP, END_RESP, 0 s)
      Target: 202 COMPLETED (GP, END_RESP, 0 s)
...
```

RESP for second Transaction (out of order)

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Expected Output (3of3)

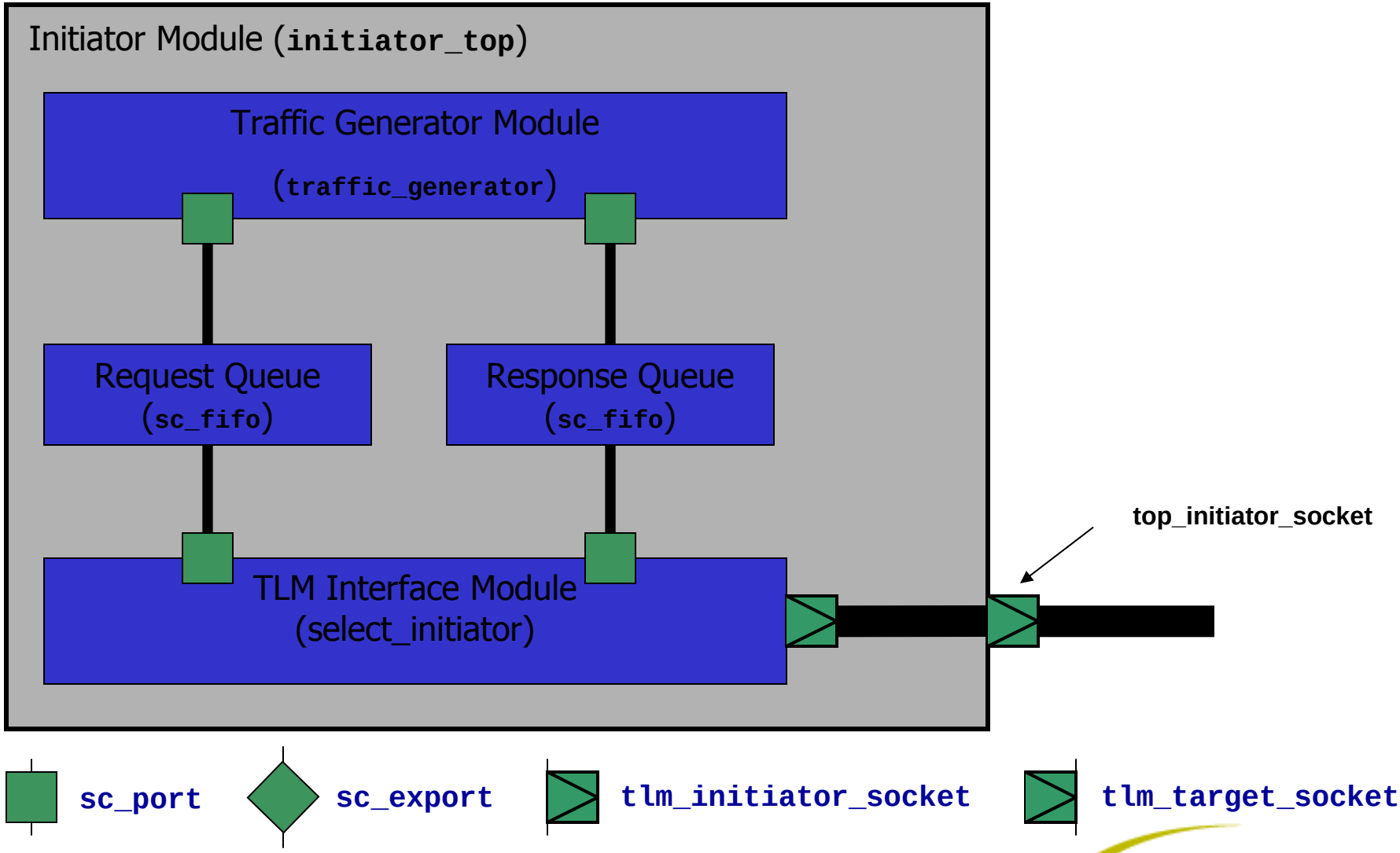
Router has "modified" address

Approximately line #3043 of log file

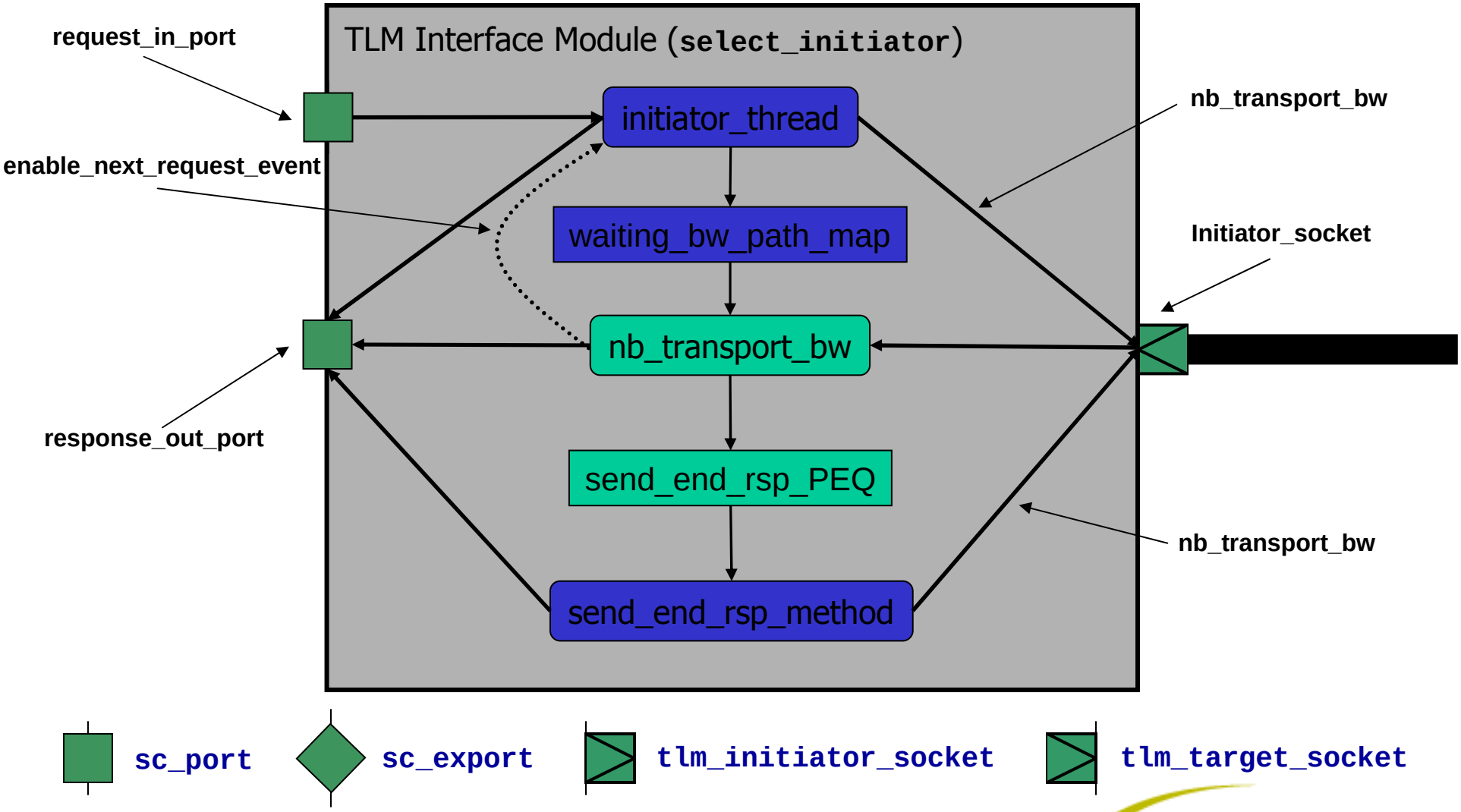
RESP for first Transaction (out of order)

```
Info: at_target_ooo_2_phase.cpp: 2604 ns - begin_response_method
      Target: 202 Starting response method for Addr: 0X00000100
Info: memory.cpp: 2604 ns - print
      ID: 202 COMMAND: WRITE Length: 04
      Addr: 0x0000000000000100 Data: 0xEFFFFEFF
Info: at_target_ooo_2_phase.cpp: 2604 ns - begin_response_method
      Target: 202 nb_transport_bw (GP, BEGIN_RESP, SC_ZERO_TIME)
Info: at_target_ooo_2_phase.cpp: 2604 ns - begin_response_method
      Target: 202 ACCEPTED (GP, BEGIN_RESP, 0 s)
Info: select_initiator.cpp: 2604 ns - nb_transport_bw
      Initiator: 101 nb_transport_bw (GP, BEGIN_RESP, 0 s)from Addr:0x00000100
      Initiator: 101 transaction moved to send-end-response PEQ
      Initiator: 101 ACCEPTED (GP, BEGIN_RESP, 0 s)
Info: select_initiator.cpp: 2611 ns - send_end_rsp_method
      Initiator: 101 starting send-end-response method
      Initiator: 101 nb_transport_fw (GP, END_RESP, 0 s)
Info: select_initiator.cpp: 2611 ns - send_end_rsp_method
      Initiator: 101 COMPLETED (GP, END_RESP, 0 s)
Info: at_target_ooo_2_phase.cpp: 2611 ns - nb_transport_fw
      Target: 202 nb_transport_fw (GP, END_RESP, 0 s)
      Target: 202 COMPLETED (GP, END_RESP, 0 s)
```

Initiator Module



TLM Interface Module



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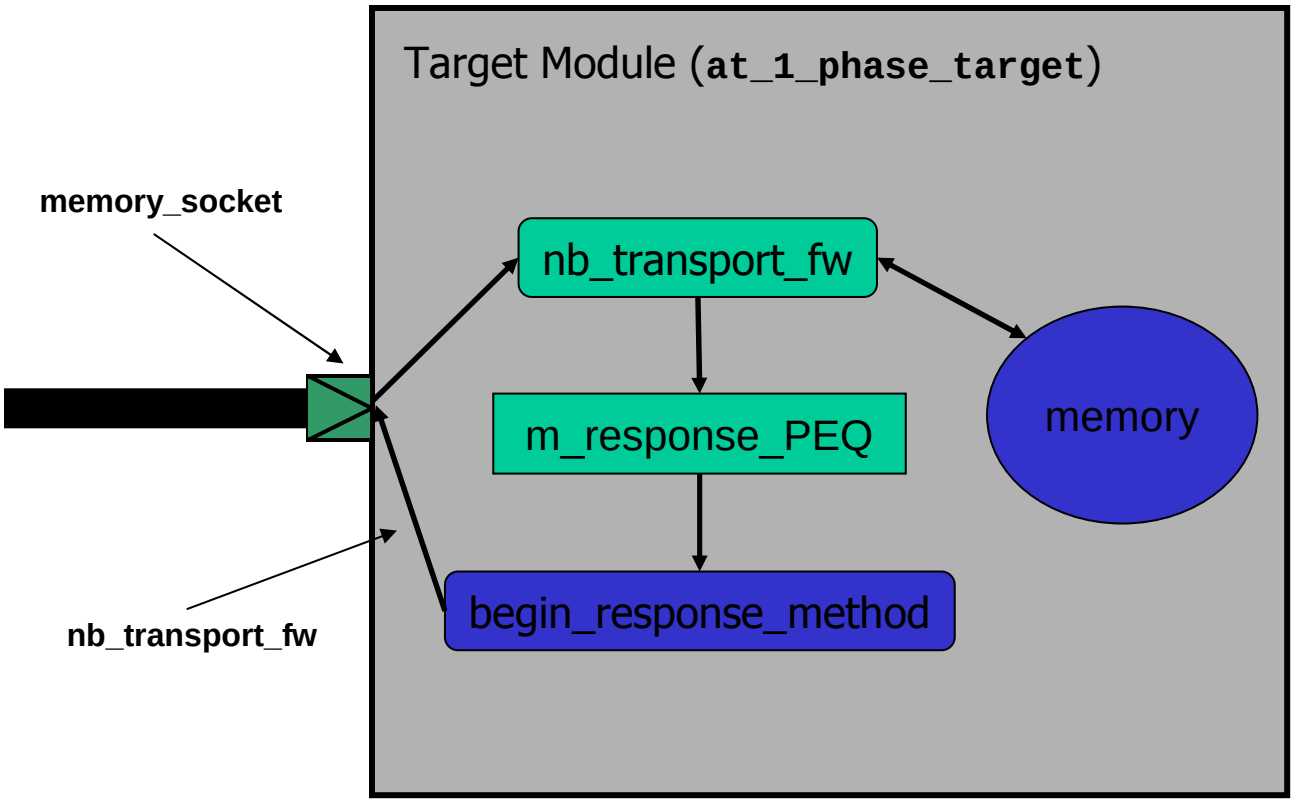
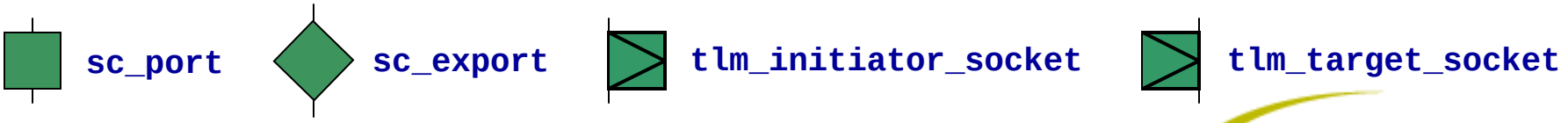
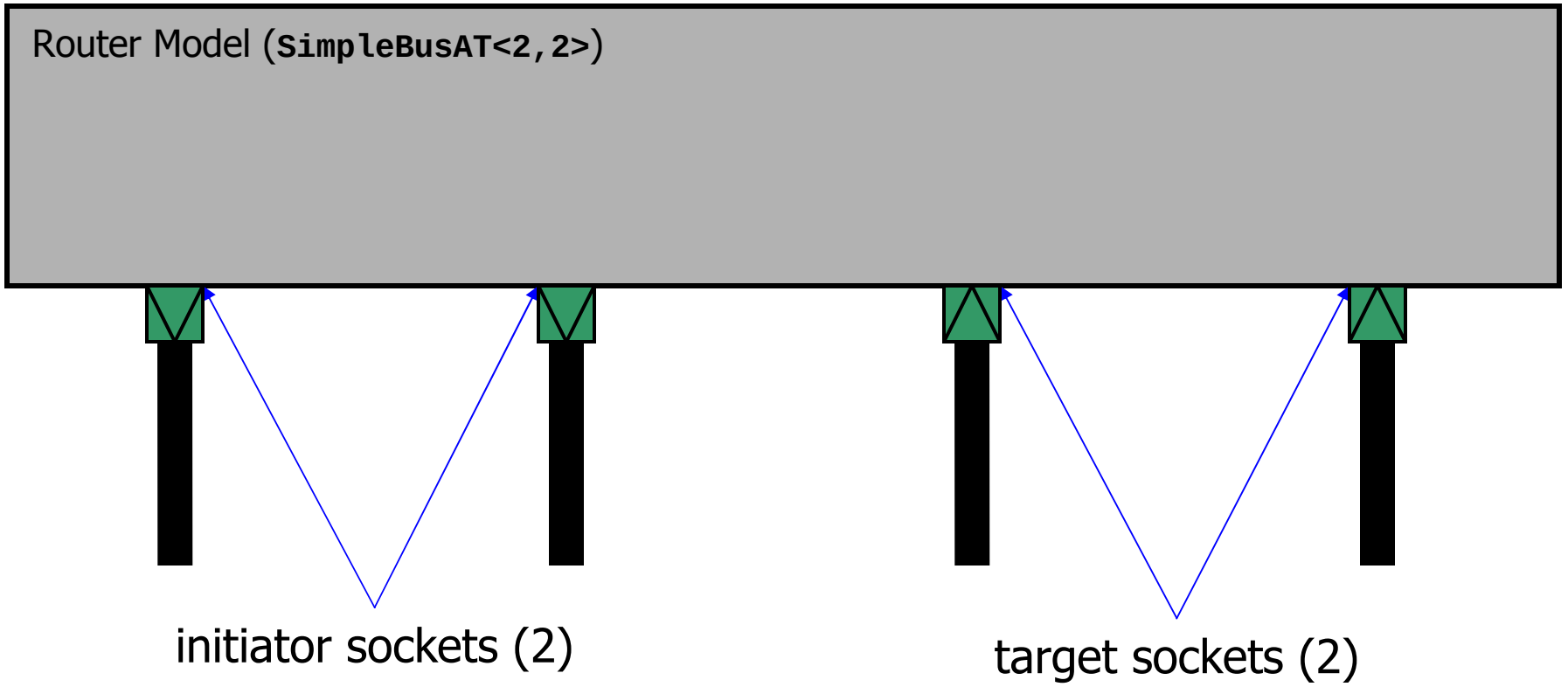
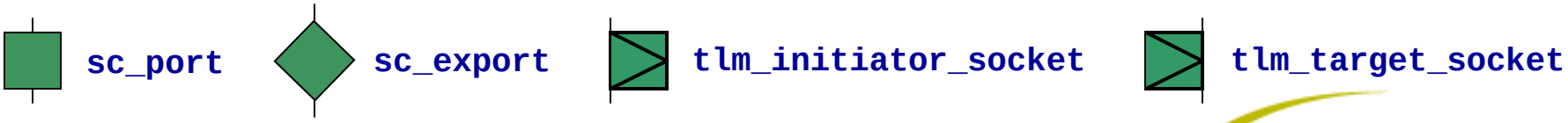
Target Module





Router Component





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