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Portable Stimulus Driven SystemVerilog/UVM verification environment for the verification of a high-capacity Ethernet communication bridge

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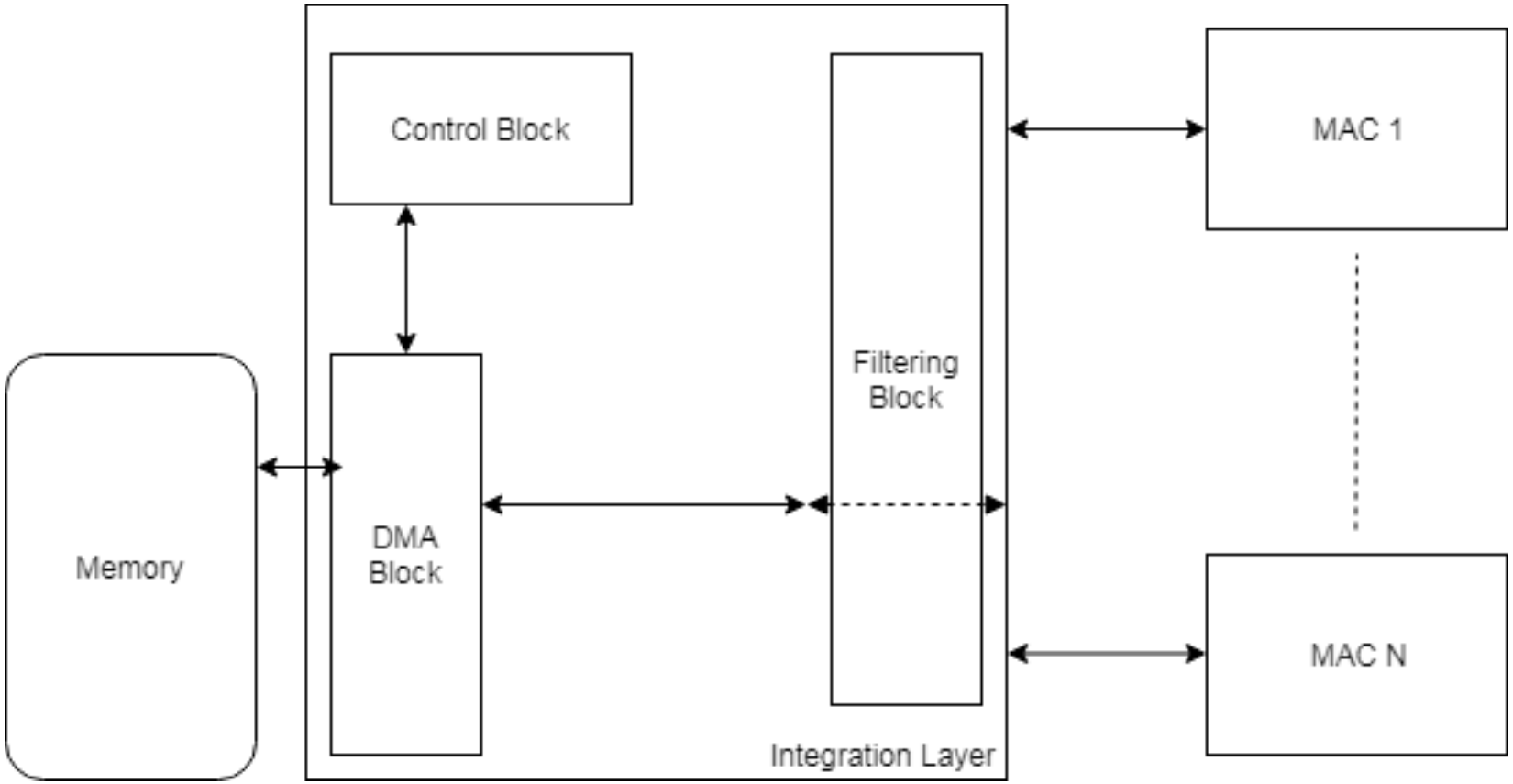
Introduction

- System
- Requirements
- Traditional Approach
- PSS Approach

Example System



Recap of system features

- Bidirectional traffic:
  - TX
  - RX Legal
  - RX Illegal
- Required configuration: MAC configuration, DMA Configuration
- Control block: Configured/Not configured
  - Enables the TX traffic capability of the system
- Filtering block: Configured/Not configured
  - Enables the system capability of discarding illegal traffic

Requirements

- Verify all data paths
  - Different types of packet characteristics
  - Different types of configuration for the blocks
  - Different blocks configured / Different interfaces driven
- Ensure the re-usability of the TB

Traditional approach

- Re-use VIPs between TBs
- Re-use TBs between projects
- Re-use infrastructure from block level TBs
- Create individual testcases for each interesting scenario

Issues

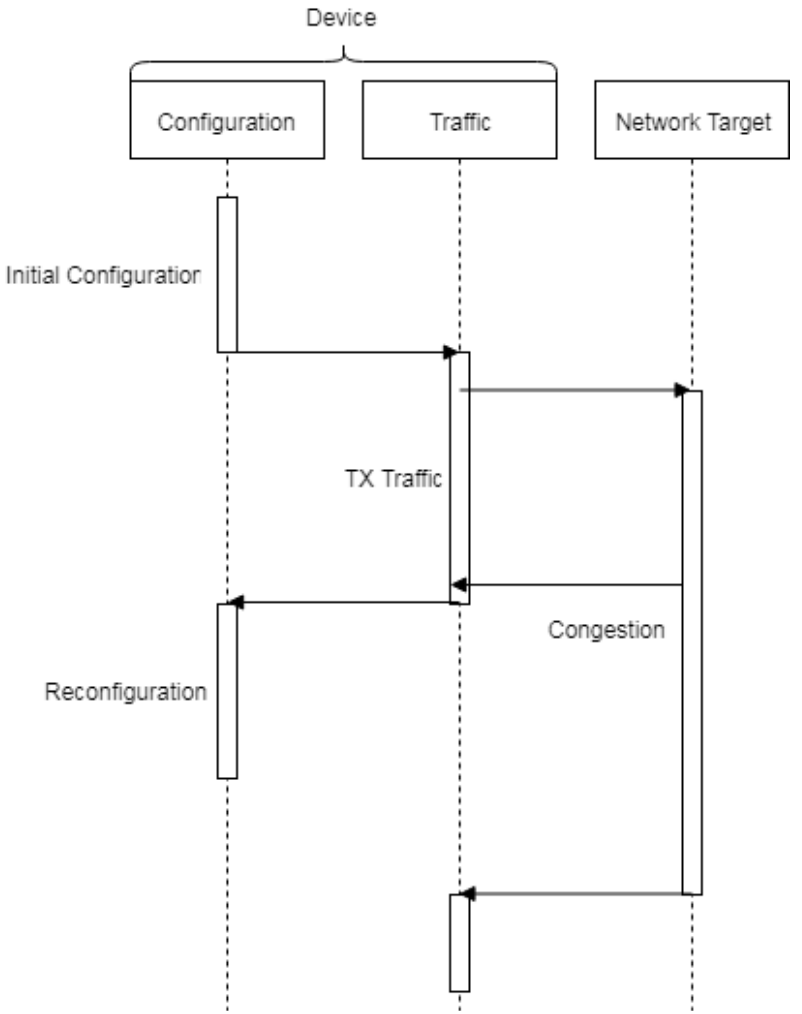
- Creating dependencies between TBs
  - Different layers of integration
  - Missing good management of what can be re-used
    - Compatibility between block level TBs
    - Block level specific implementation
- A huge number of testcases implemented
  - Small deviations in traffic/configuration -> New scenario
  - Directed testcases -> Non-reusable logical layer sequences

Idea behind PSS approach

- Break the functionality of the system into modular actions
- Offer a software view when simulating RTL
  - A system feature translates into multiple software actions
  - Each software action has a correspondent in hardware stimuli
  - Hardware stimuli take a different form on each layer of integration
- The PSS model puts constraints on the implementation quality
  - Increase re-usability
  - Lower debug time

PSS as an abstraction layer

- Better control for directed scenario definition
- Better planning for verification strategy
- Ease testcase portability across multiple layers of integrations and platforms



Guidelines

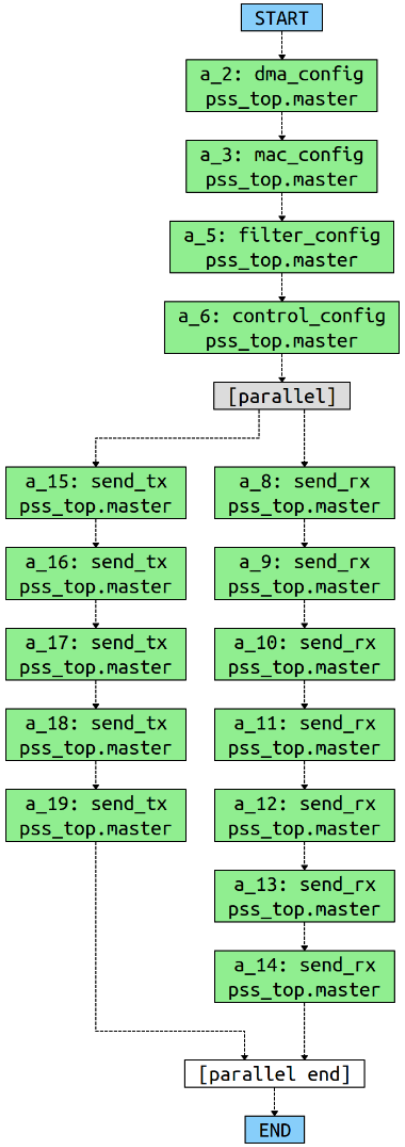
- Encapsulate run-time configuration in actions
- SystemVerilog/UVM sequence layering should be used to bridge gaps between transaction level sequences and system level actions
- Synchronization and timing should translate into actions on PSS layer and event triggers on SV layer
- Coverage and logical constraints -> PSS Layer
- Protocol constraints -> SV Layer

Implementation

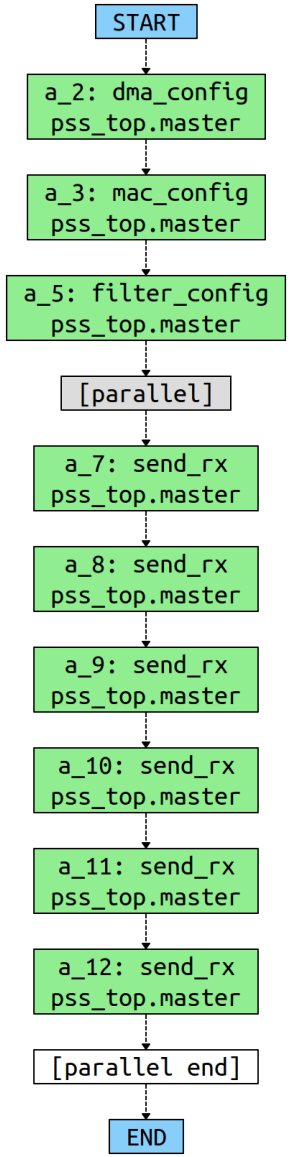
```
enum line_rate_e {l_10G, l_25G, l_100G};
enum cfg_interface_e {SERIAL, PARALLEL, HIGHSPEED};
typedef bit[47:0] uint48_t;

// Display controller definition
component master_c {

     action mac_config {
          rand line_rate_e line_rate;
          rand cfg_interface_e cfg_interface;
          rand bool enable_rx;
          rand bool enable_tx;
          rand bool enable_tx_fc;
          rand bool enable_rx_fc;
          rand bool strip_header;
          rand bool check_crc;
          rand bool pause_watermark_high;
          rand bool pause_watermark_low;
     };
.............................
```

```
component master_cpu_c {


     action config_0 {
          rand int in [2..5] arg;

          exec body SV = """\
                    config_0 seq = config_0::type_id::create
("seq_0");\
                    seq.local_arg = {{arg}};""";
     };

.............................

     action setup {
          activity {
               sequence {
                    do config_0;
                    do config_1;
                    parallel {
                         do config_2;
                         do config_3;
                    };
               };
          };
     };
.............................
};
```

Generated Scenarios 1

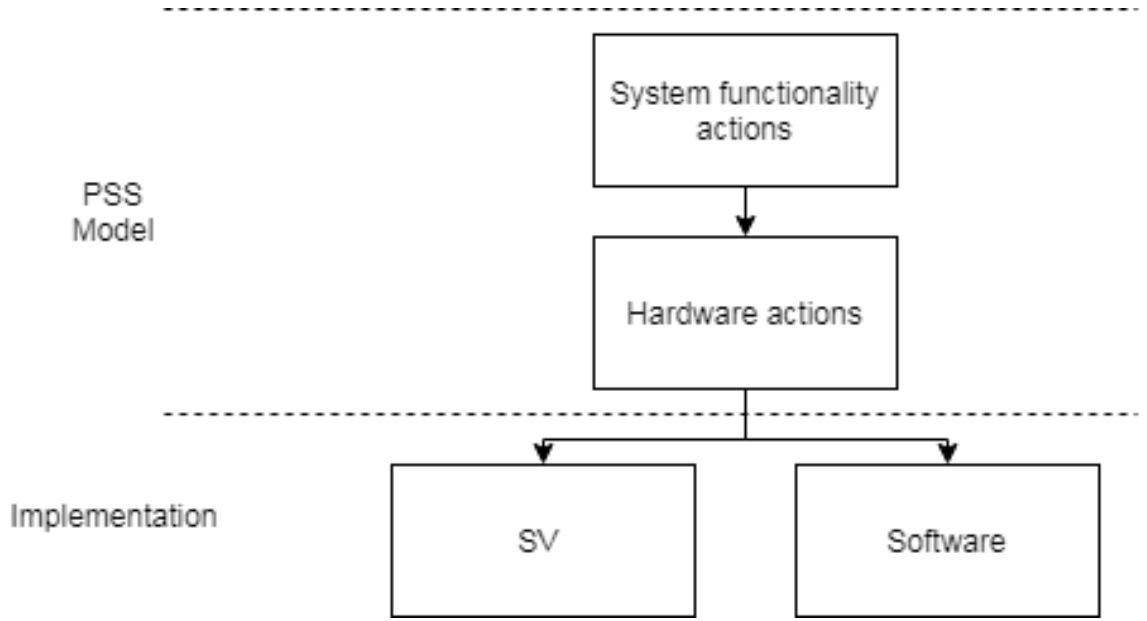


Generated Scenarios 2



Project Application

- Replace directed testcases with PSS based test generation
- Ease debug with scenario flow view
- A tighter infrastructure for verification which favors re-use



Conclusions

- PSS standard has all the necessary features to accommodate a higher abstraction layer over a SV/UVM environment.
- Due to extensive support for PSS tools, this approach bridges the communication gap between verification engineers and system architects
- A general recipe can be defined for VE development flow

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Questions

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