Synopsys Users Group
SILICON VALLEY 2012

Integrating *DesignWare USB3 Device Controller IP* Into a UVM-based Testbench

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Background

- Collaboration project between Paradigm Works and Synopsys
- A plug-n-play type UVM environment for **Any** USB3 Device DUT verification
  - Environment is built with *Synopsys Discovery Verification IPs*
    - Discovery USB3 VIP, Discovery AMBA VIP
  - DUT for the environment development is ***Synopsys DesignWare USB3 Controller IP (DWC_USB3)***
    - Pre-verified IP
- Available as part of Synopsys Discovery USB3 VIP Library

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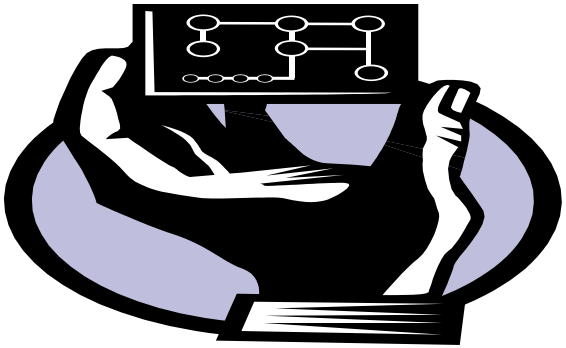
Outline

- DWC_USB3 Device IP integration Process
  - Integrate into the Testbench Module
  - Integrate into the UVM Environment
- DWC_USB3 Device IP Configuration Flow
- DWC_USB3 Device IP Operation Flow
- Plug-n-Play capability of the UVM Environment

DWC_USB3 Controller IP



- USB3 Device Controller
- USB3 Host Controller
- USB3 Dual-Role Device Controller
- USB3 Hub Controller

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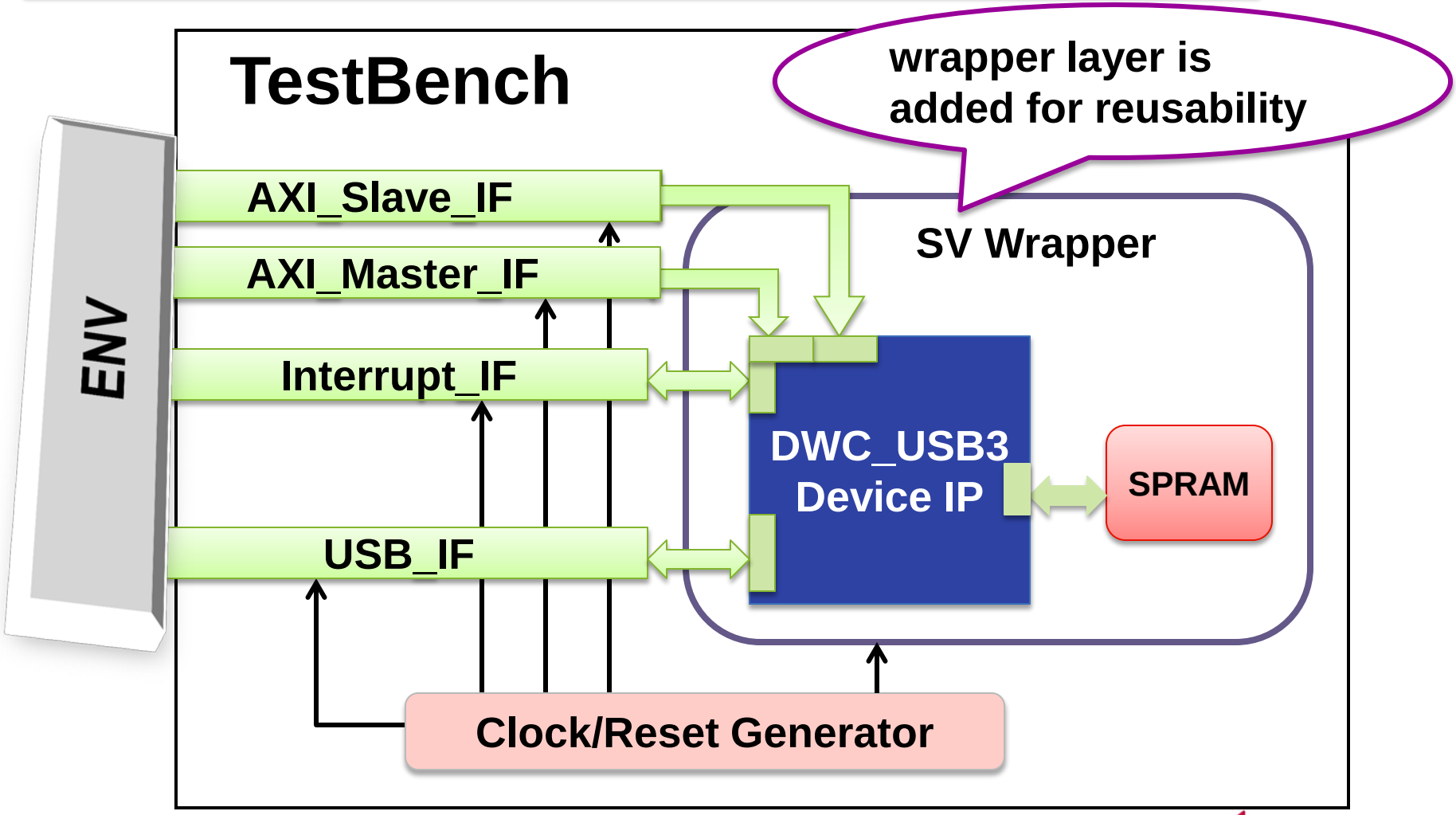
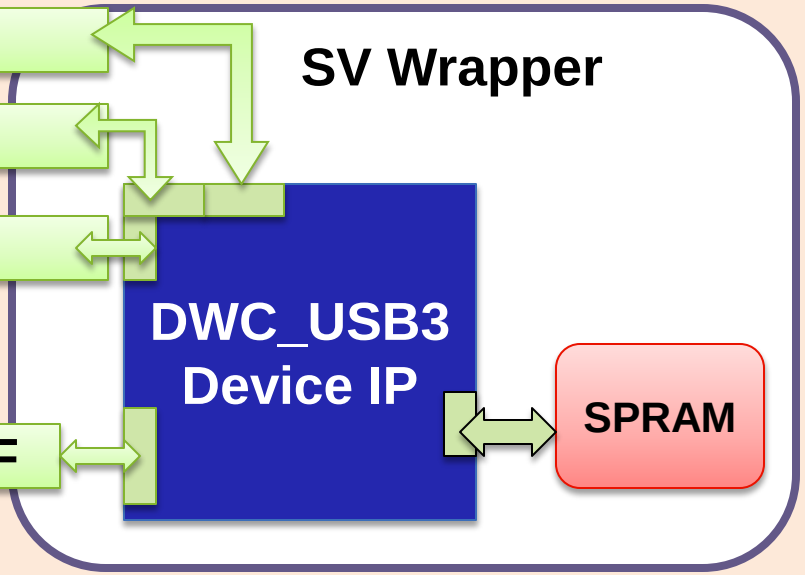
Integration - Module Level



Integration – Module Level (2)


```
module DWC_usb3_sv_wrapper (
 input clk,
 svt_usb_if  usb
 svt_usb_if  usb_s
 rtl_dut_intr_if   dut_intr_if,
 svt_axi_master_if axi_master_if,
 svt_axi_slave_if  axi_slave_i
);
DWC_usb3 dut(.TxData(dut_pipe3_TxData),.RxValid(dut_pipe3_RxValid),…);
```




```
Data;
Valid;
```

```
spram_model#(`DWC_USB3_RAM0_DEPTH,32) ram0(
   .clk(clk), .rst_n(tb_vcc_reset_n),
   .cs_n(dut_ram0_p1_ce_n),.wr_n(dut_ram0_p1_wr_n),
   .rw_addr(dut_ram0_p1_addr),.data_in(dut_ram0_p1_wdata),
   .data_out(dut_ram0_p1_rdata));
```

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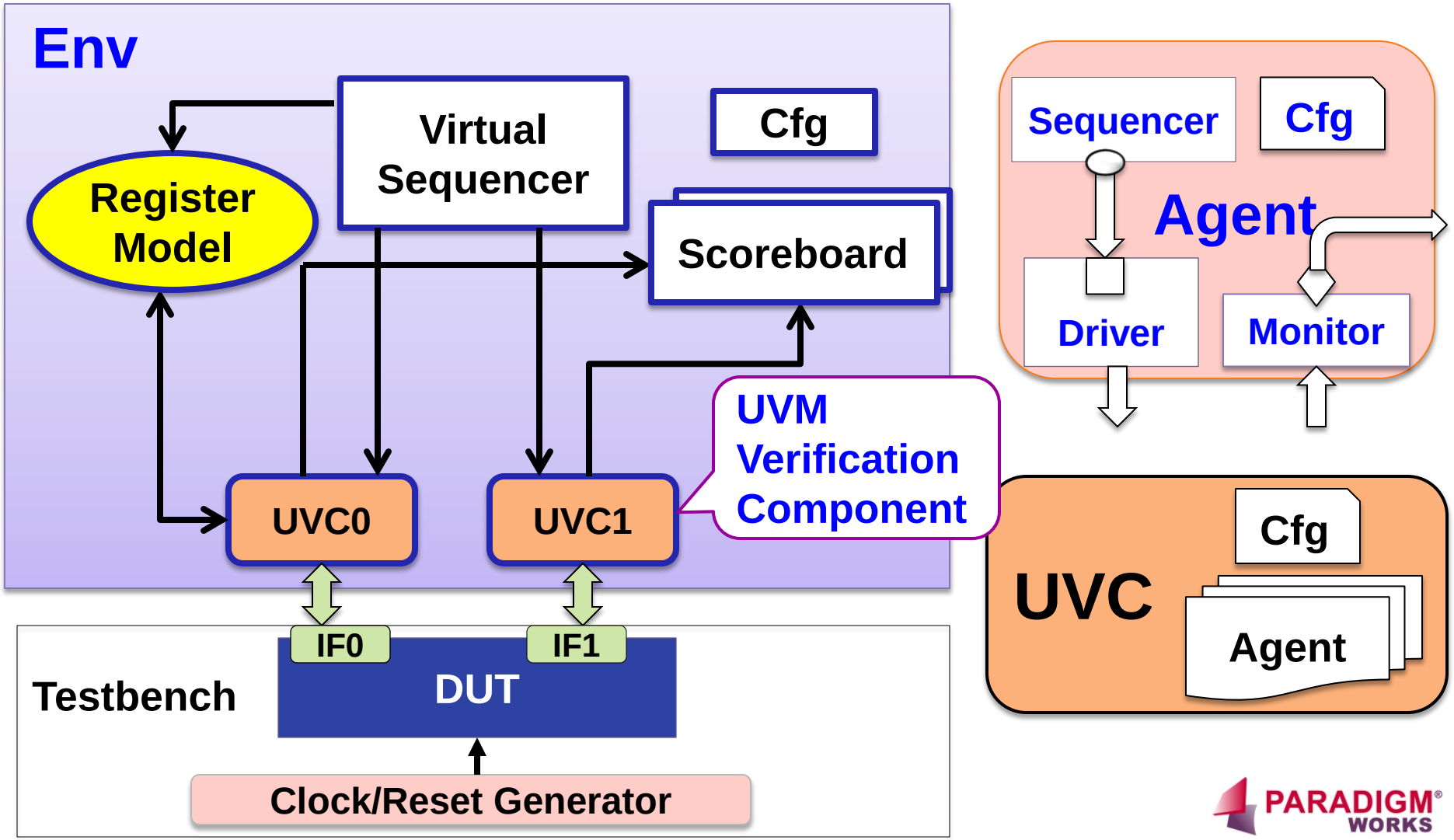
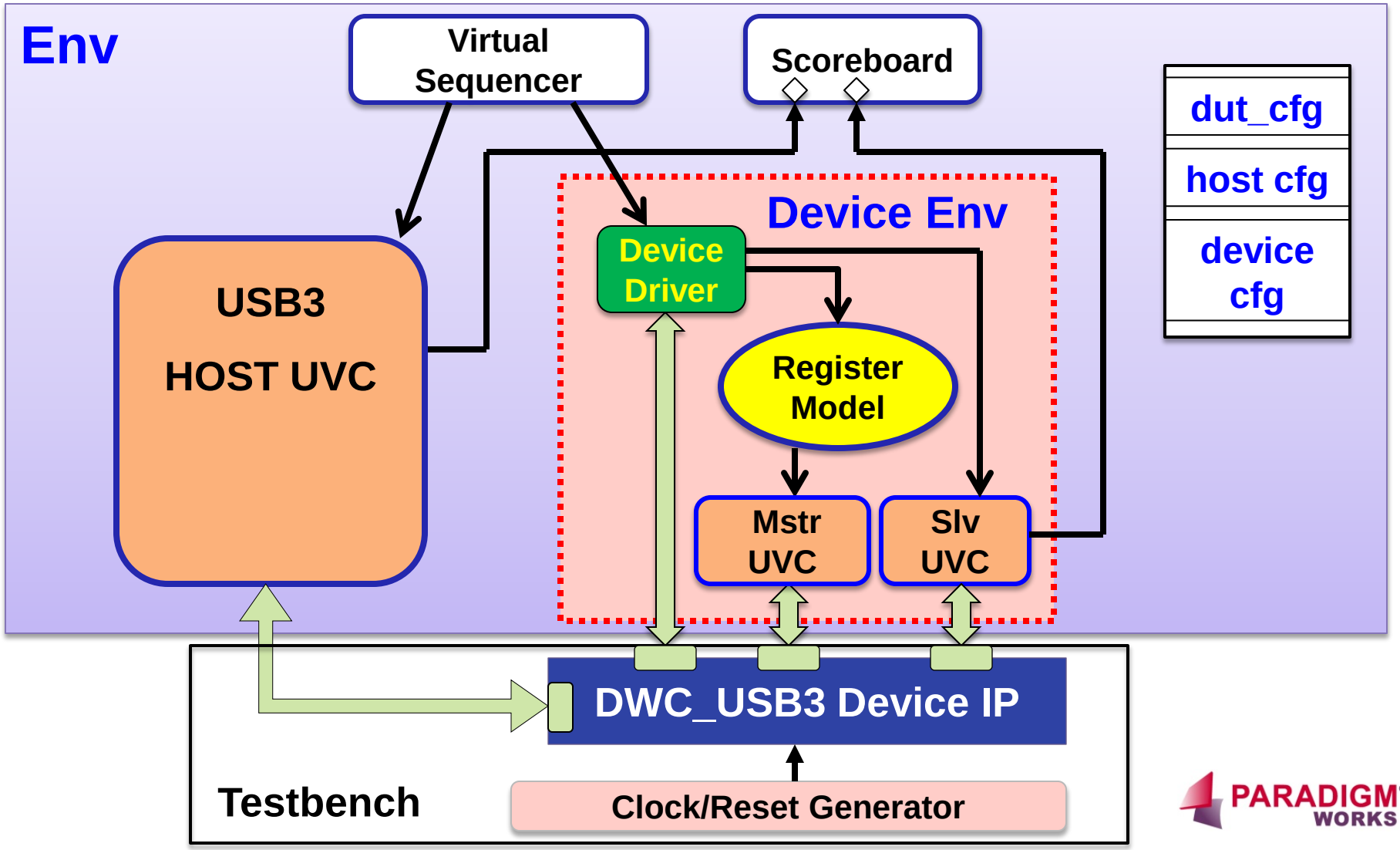
Integration - UVM Env



Integration – DWC_USB3 Device Verification Env



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Configuration - Device Driver

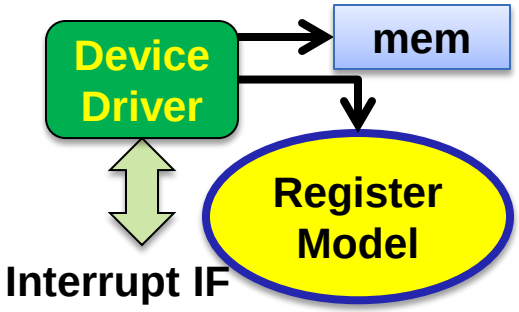
Device Driver extends uvm_component

```
build_phase()
```

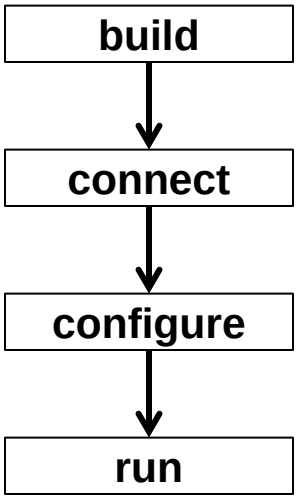
```
connect_phase()
```

```
configure_phase() {
  // Start Interrupt Service
  // Do Power On Reset sequence
  // Do USB Reset sequence
  // Do Connect Done sequence
}
```

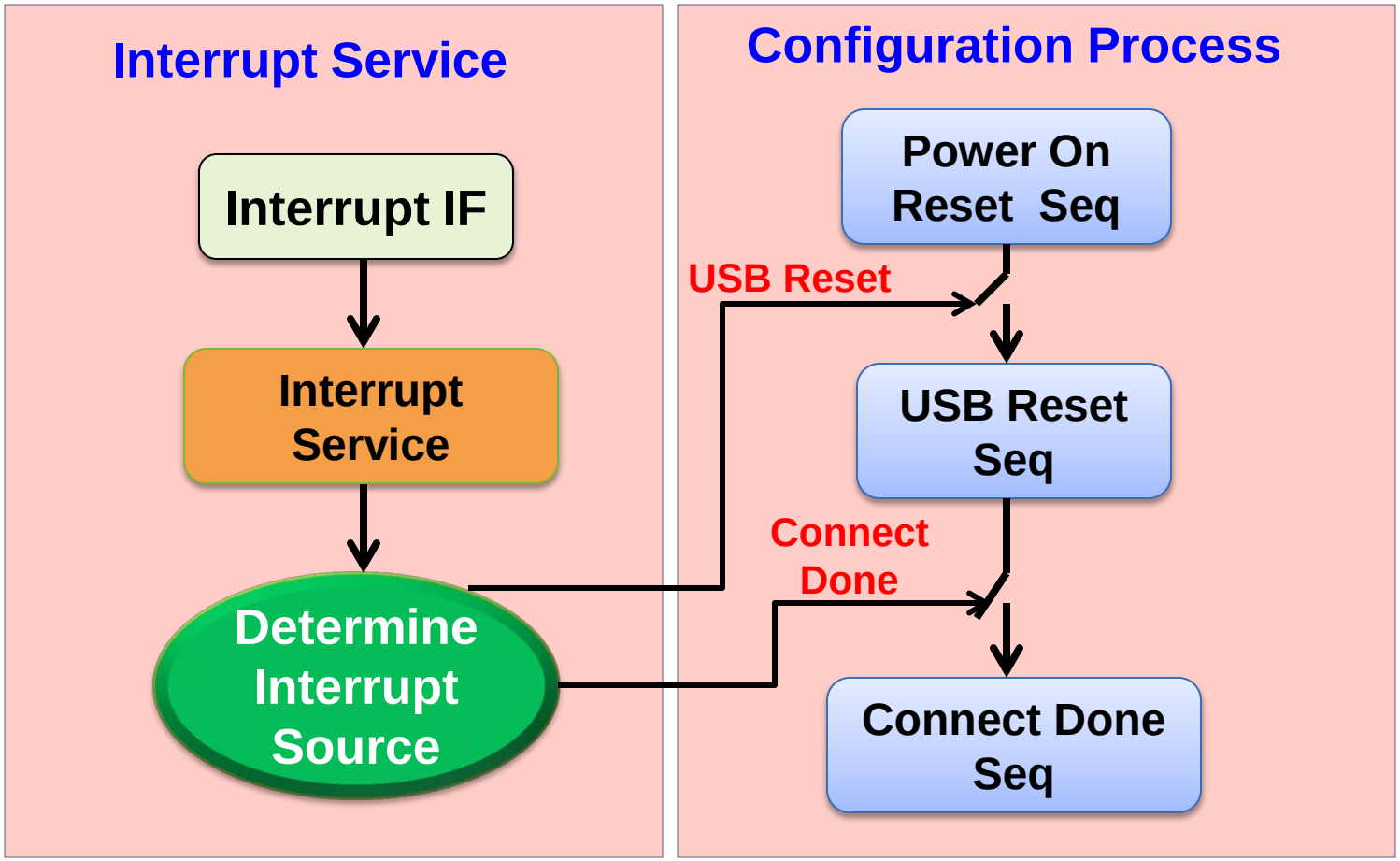
```
run_phase() {
  // Get device response from sequencer
  // Write transfer info to memory
  // Issue transfer and wait for it to complete
}
```



UVM Phasing



Configuration – configure_phase



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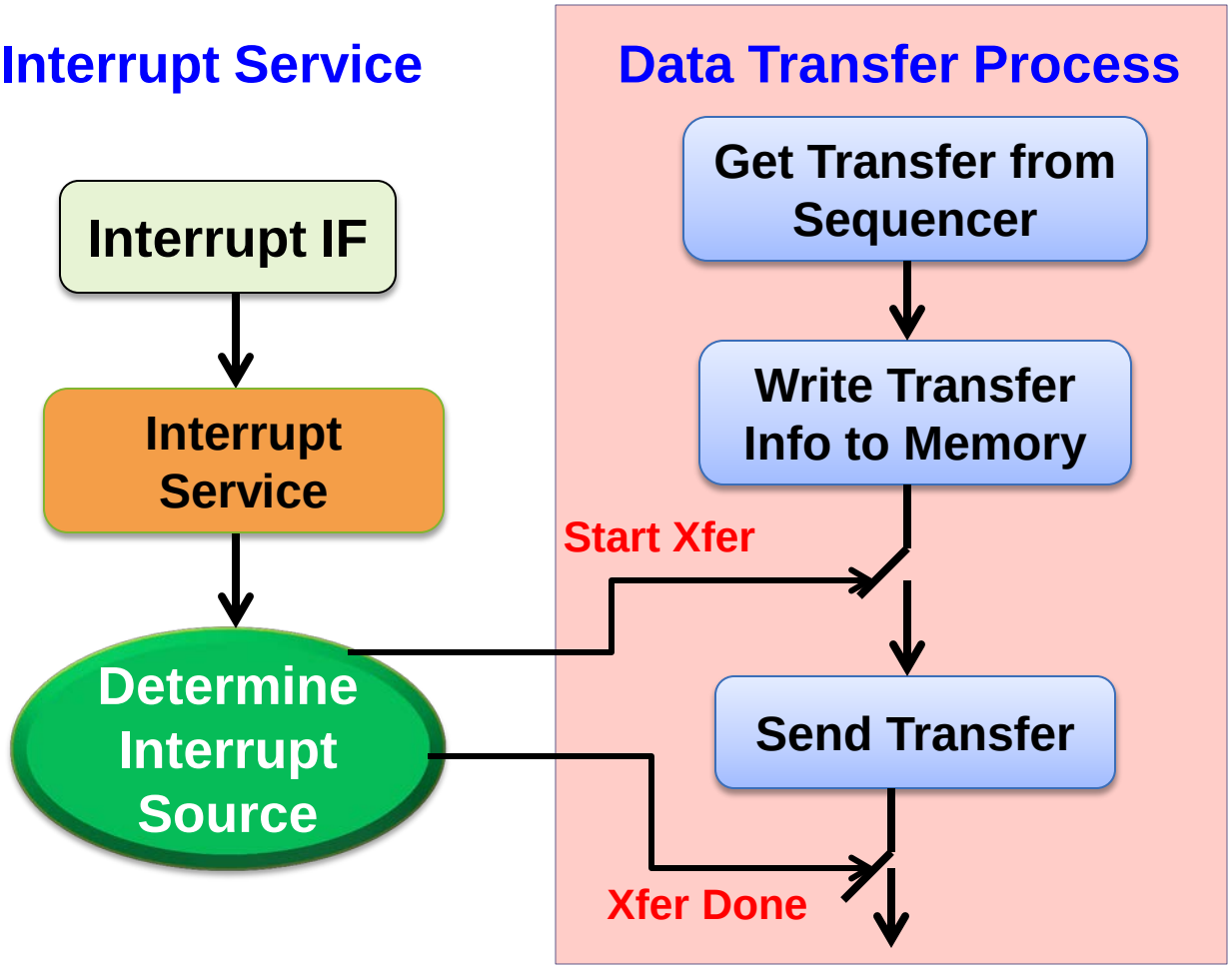
Operation – run_phase



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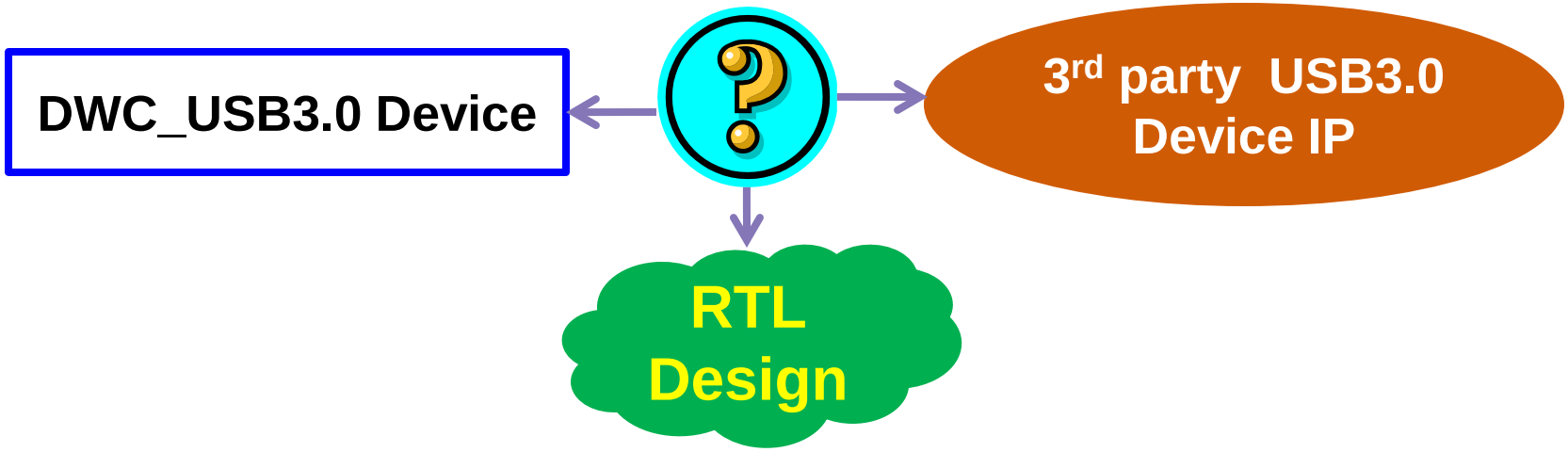
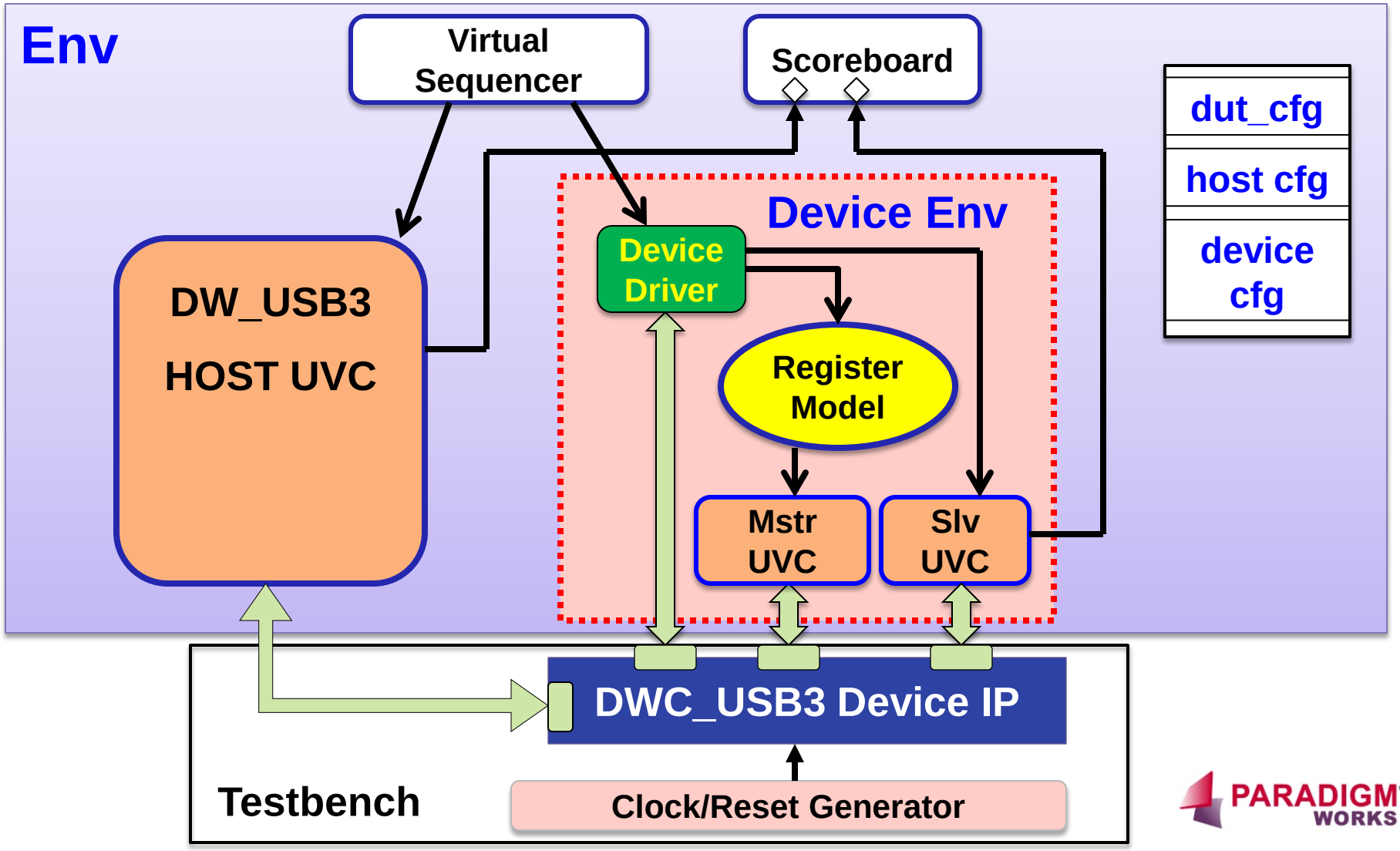
Reuse

- What is your Device DUT?



Reuse – DWC_USB3 Variation



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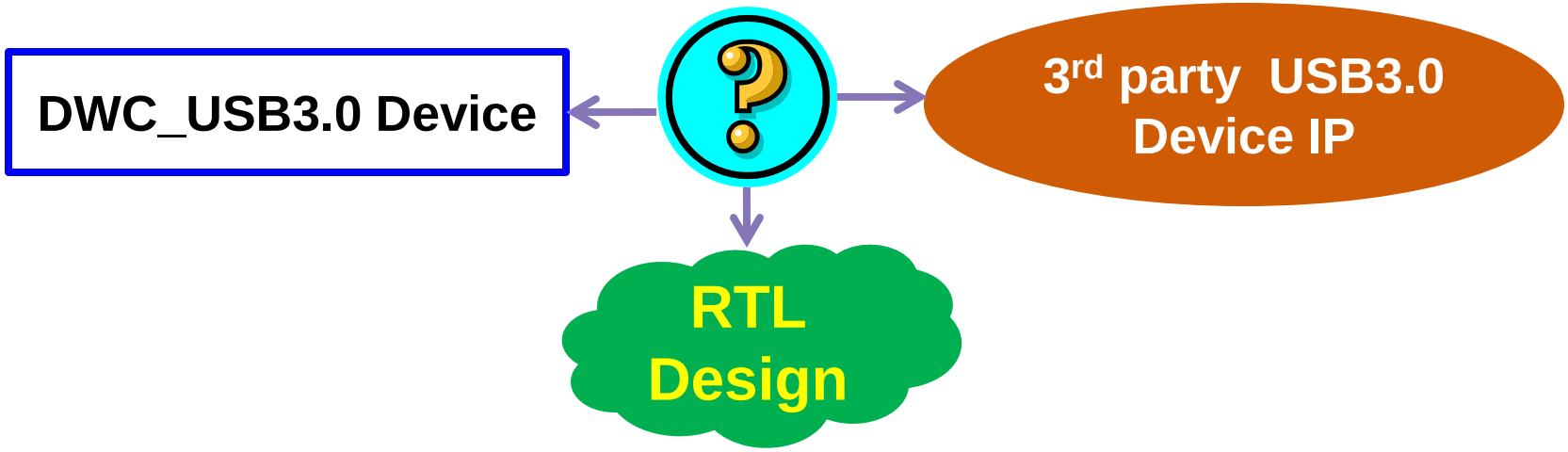
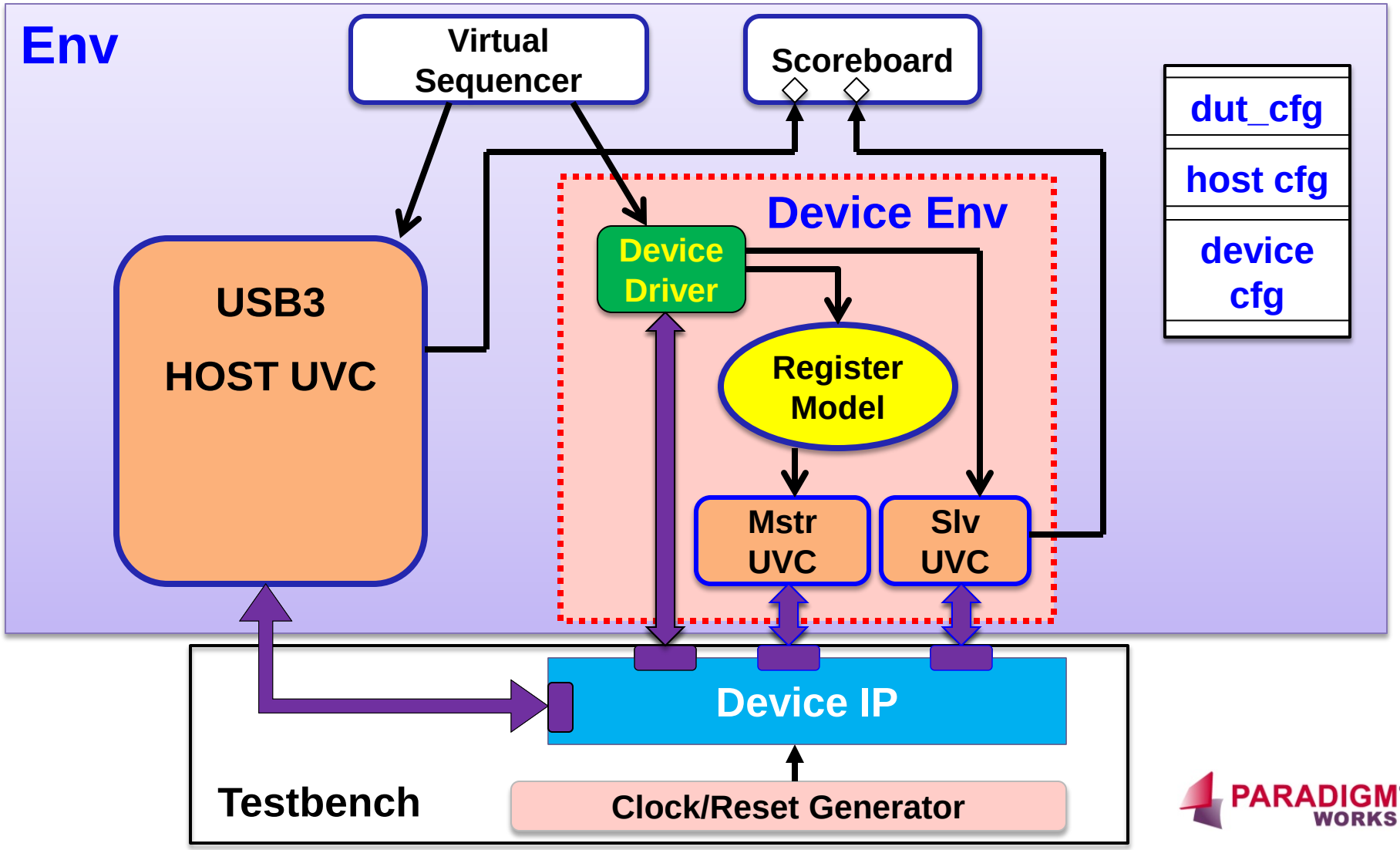


Reuse – 3rd Party IP or RTL Design



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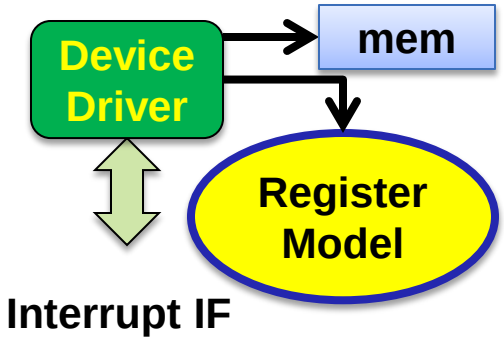
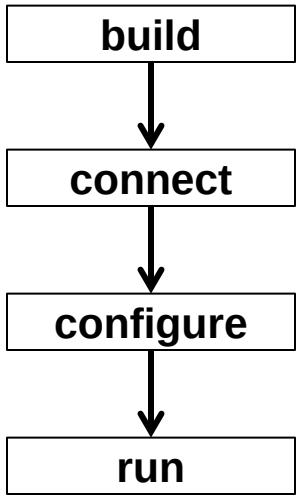


UVM Phasing



Summary

- Plug-n-Play UVM environment for USB3 Device DUT Verification
- DWC_USB3 Device IP to help develop the environment
- Env and pre-defined tests (Test Suite) will be part of Synopsys Discovery USB3 VIP Library (Availability TBD)
- Currently Available
  - DesignWare USB3 Controller IP (DWC_USB3)
  - Discovery AMBA VIP
  - Discovery USB VIP

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Thank You !

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