

# bscan tile flow

## 1. tap tile

注意项：在顶层抽取BSDL时，IO 模块不能是black box[]

### 1.1 script

```
#!/bin/sh
#
exec tessent -shell -log logfiles/$0.log -replace -dofile "$0" -arguments
${1+"$@"}

# Set the context to insert DFT into top-level design
set_context dft -rtl -design_id rtl2

# Set the location of the TSDB. Default is the current working directory.
set_tsdb_output_directory ../tsdb_outdir

# Open the TSDB of all the child cores

# Read the tessent cell library
read_cell_library ../../library/standard_cells/tessent/adk.tcelllib
read_cell_library ../../library/dummy_pad/dummy_pad.tcelllib

# Read hard_macros
read_verilog ../../library/plls/pll.v -blackbox -
exclude_from_file_dictionary

# Read the design view of chip_top
set_design_sources -format verilog -y ../../library/pad_cells -extension v
set_design_sources -format verilog -y ../../library/dummy_pad -extension v
read_verilog ./rtl/tap_t.v
read_verilog ./rtl/tap_t_rtl1_tessent_tap_main.v
read_icl    ./rtl/tap_t_rtl1_tessent_tap_main.icl
set_current_design tap_t

#set_design_level physical_block
set_design_level sub_block

# Define set_dft_specification_requirements to insert boundary scan at chip-
level
# Set memory_test on even if there is not memories at the top level so that
the memory
# clock DRCs are run outside the memory inserted blocks.
#set_dft_specification_requirements -boundary_scan on -memory_test on
set_dft_specification_requirements -logic_test on
```

```
# Toggle the enable to relock the PLL

# Specify the TAP pins using set_attribute_value
set_attribute_value tck -name function -value tck
set_attribute_value tdi -name function -value tdi
set_attribute_value tms -name function -value tms
set_attribute_value trst -name function -value trst
set_attribute_value tdo -name function -value tdo

# Specify all clocks so that the proper BSCAN cells gets inserted
# automatically for them

check_design_rules

# Create and report a DFT Specification
# set spec [create_dft_specification -existing_ijtag_host_scan_in
# tap/host_1_from_so -sri_sib_list occ -tile_ijtag_host_list {r1}]
set spec [create_dft_specification -existing_bscan_host_scan_in
tap/host_bscan_from_so -existing_ijtag_host_scan_in tap/host_1_from_so -
sri_sib_list occ -tile_ijtag_host_list {r1}]

report_config_data $spec

read_config_data -in_wrapper $spec/IjtagNetwork -from_string {
    HostScanInterface(bscan) {
        Interface {
            design_instance : tap;
            scan_interface : host_bscan;
        }
    }
}

read_config_data -in_wrapper $spec -from_string {
    EmbeddedBoundaryScan {
        ImplementationOptions {
            clocking           : gated_tck;
            update_stage      : flop;
            scan_path_retimig : flop;
        }
        HostBscanInterface(tap) {
            Interface {
                ijtag_host_interface : HostScanInterface(bscan);
            }
            EBScanPipeline(p1) {
            }
            SecondaryEBScanInterface(to) {
            }
            EBScanPipeline(p0) {
            }
        }
    }
}
```

```

    }

}

report_config_data $spec
    # ac_init_clock0_present: on;
    # ac_init_clock1_present: on;
    # ac_signal_present: on;
    # ac_mode_en_present: on;

# Segment the boundary scan to be used during logic test
# set_config_value $spec/BoundaryScan/max_segment_length_for_logictest 80

# Add auxiliary mux on the inputs and outputs used for SSN bus and bus_clock
# bus_in {GPIO3_0 GPIO3_1} bus_out {GPIO4_0 GPIO4_1} bus_clock {GPIO3_2}
# read_config_data -in ${spec}/BoundaryScan -from_string {
#     AuxiliaryInputOutputPorts {
#         auxiliary_input_ports : GPIO3_0, GPIO3_1, GPIO3_2;
#         auxiliary_output_ports : GPIO4_0, GPIO4_1 ;
#     }
# }

# report_config_data $spec

# Generate and insert the hardware
process_dft_specification

# Extract IJAG network and create ICL file for the design
extract_icl -create_ijtag_graybox on

# Create patterns(testbenches) to verify the inserted DFT logic
set spec [create_patterns_specification]
process_pattern_specification

# Point to the libraries and run simulation
set_simulation_library_sources -v ../../library/standard_cells/verilog/*.v \
                                -y ../../library/plls \
                                -y ../../library/memories \
                                -extension v

run_testbench_simulations \
    -keep_simulation_data on \
    -simulator vcs \
    -compilation_options "-sverilog +define+debussy -kdb" \
    -simulator_options "-sverilog -debug_access+all -kdb" \
    -use_design_view_per_simulation on

exit

```

## 1.2 spec

```
DftSpecification(tap_t,rtl2) {
```

```
IJtagNetwork {
    HostScanInterface(ijtag) {
        Interface {
            design_instance : tap;
            scan_interface : host_ijtag_1;
        }
        Sib(sri) {
            Attributes {
                tesson_dft_function : scan_resource_instrument_host;
            }
            Sib(occ) {
            }
        }
        Sib(thc) {
            Attributes {
                tesson_dft_function : tile_host_collector;
            }
            Sib(th_r1) {
                to_scan_in_feedthrough : pipeline;
                SecondaryHostScanInterface(r1) {
                }
            }
        }
    }
    HostScanInterface(bscan) {
        Interface {
            design_instance : tap;
            scan_interface : host_bscan;
        }
    }
}
EmbeddedBoundaryScan {
    ImplementationOptions {
        clocking : gated_tck;
        update_stage : flop;
        scan_path_retiming : flop;
    }
}
HostBScanInterface(tap) {
    Interface {
        ijtag_host_interface : HostScanInterface(bscan);
    }
    EBScanPipeline(p1) {
    }
    SecondaryEBScanInterface(to) {
    }
    EBScanPipeline(p0) {
    }
}
}
```

### 1.3 icl

\*注意CLAMP, HIGHZ命令时是mux到bypass register  
 \*且必须要描述这两个指令，否则process pattern spec时会报错。

```
Module tap_t_rtl1_tessent_tap_main {
    TCKPort          tck;
    ScanInPort       tdi;
    ScanOutPort      tdo   { Source IRMux;
        Attribute forced_high_output_port_list = "tdo_en";
        Attribute forced_low_dft_signal_list = "tms_disable";
    }
    DataOutPort      tdo_en {
        Attribute associated_scan_port_list = "tdo";
        Attribute connection_rule_option = "allowed_no_destination";
        Attribute function_modifier = "tdo_enable_active_high";
    }
    TMSPort          tms   {
        Attribute forced_low_dft_signal_list = "tms_disable";
    }
    TRSTPort         trst  {
        Attribute connection_rule_option = "allowed_tied_high";
    }
    ToCaptureEnPort capture_dr_en;
    ToShiftEnPort    shift_dr_en;
    ToUpdateEnPort   update_dr_en;
    ToResetPort      test_logic_reset { ActivePolarity 0; }
    ToSelectPort     host_1_to_sel { Source host_1_to_sel_int;
        Attribute connection_rule_option = "allowed_no_destination";
    }
    LogicSignal      host_1_to_sel_int { instruction == HOSTIJJTAG_1;      }
    ScanInPort       host_1_from_so {
        Attribute connection_rule_option = "allowed_no_source";
    }
    ScanInPort       host_bscan_from_so {
        Attribute connection_rule_option      = "allowed_no_source";
        Attribute tessent_bscan_pipeline_stages = "0";
    }
    ToSelectPort     host_bscan_to_sel { Source bscan_select_int;
        Attribute connection_rule_option = "allowed_no_destination";
        Attribute tessent_bscan_function  = "select";
    }
    LogicSignal      bscan_select_int {
        (instruction == EXTEST) ||
        (instruction == INTEST) ||
        (instruction == EXTEST_PULSE) ||
        (instruction == EXTEST_TRAIN) ||
        (instruction == SAMPLE) ||
        (instruction == PRELOAD) ;
    }
}
```

```
DataOutPort      force_disable { Source force_disable_int;
    Attribute connection_rule_option = "allowed_no_destination";
    Attribute tessent_bscan_function = "force_disable";
}
LogicSignal force_disable_int { instruction == HIGHZ; }
DataOutPort      select_jtag_input { Source select_jtag_input_int;
    Attribute connection_rule_option = "allowed_no_destination";
    Attribute tessent_bscan_function = "select_jtag_input";
}
LogicSignal select_jtag_input_int { instruction == INTEST; }
DataOutPort      select_jtag_output { Source select_jtag_output_int;
    Attribute connection_rule_option = "allowed_no_destination";
    Attribute tessent_bscan_function = "select_jtag_output";
}
LogicSignal select_jtag_output_int {
    (instruction == EXTEST) ||
    (instruction == EXTEST_PULSE) ||
    (instruction == EXTEST_TRAIN) ||
    (instruction == CLAMP) ||
    (instruction == HIGHZ) ;
}
DataOutPort      extest_pulse { Source ext_test_pulse_int;
    Attribute connection_rule_option = "allowed_no_destination";
    Attribute tessent_bscan_function = "extest_pulse";
}
LogicSignal ext_test_pulse_int { instruction == EXTEST_PULSE; }
DataOutPort      extest_train { Source ext_test_train_int;
    Attribute connection_rule_option = "allowed_no_destination";
    Attribute tessent_bscan_function = "extest_train";
}
LogicSignal ext_test_train_int { instruction == EXTEST_TRAIN; }
DataOutPort fsm_state[3:0]{
    Attribute connection_rule_option = "allowed_no_destination";
    Attribute function_modifier = "tap_fsm_state";
    RefEnum    state_encoding;
}

Enum state_encoding {
    test_logic_reset    = 4'b1111;
    run_test_idle      = 4'b1100;
    select_dr          = 4'b0111;
    capture_dr         = 4'b0110;
    shift_dr           = 4'b0010;
    exit1_dr           = 4'b0001;
    pause_dr           = 4'b0011;
    exit2_dr           = 4'b0000;
    update_dr          = 4'b0101;
    select_ir          = 4'b0100;
    capture_ir         = 4'b1110;
    shift_ir           = 4'b1010;
    exit1_ir           = 4'b1001;
```

```
pause_ir          = 4'b1011;
exit2_ir         = 4'b1000;
update_ir        = 4'b1101;
}

ScanInterface tap_client {
    Port tdi;
    Port tdo;
    Port tms;
}
ScanInterface host_ijtag_1 {
    Port host_1_from_so;
    Port host_1_to_sel;
}

ScanInterface host_bscan {
    Port host_bscan_to_sel;
    Port host_bscan_from_so;
    Port capture_dr_en;
    Port shift_dr_en;
    Port update_dr_en;
    Port test_logic_reset;
    Attribute      tessent_is_bscan_host = "true";
}
Instance fsm Of tap_t_rtl1_tessent_tap_main_fsm  {
    InputPort tck  = tck;
    InputPort tms  = tms;
    InputPort trst = trst;
}
ScanRegister instruction[3:0] {
    CaptureSource  4'b0001;
    ResetValue     4'b1000;
    ScanInSource   tdi;
    RefEnum        instruction_opcodes;
}
Enum instruction_opcodes {
    BYPASS          = 4'b1111;
    CLAMP           = 4'b0000;
    EXTEST          = 4'b0001;
    EXTEST_PULSE    = 4'b0010;
    EXTEST_TRAIN    = 4'b0011;
    INTEST          = 4'b0100;
    SAMPLE          = 4'b0101;
    PRELOAD         = 4'b0101;
    HIGHZ           = 4'b0110;
    HOSTIJTAG_1     = 4'b0111;
    IDCODE          = 4'b1000;
}
ScanRegister bypass {
    CaptureSource  1'b0;
```

```

    ScanInSource  tdi;
}
ScanRegister device_id[31:0] {
    CaptureSource  4'b0000,16'b0000000000000000,11'b000000000000,1'b1;
    ScanInSource  tdi;
}
ScanMux IRMux SelectedBy fsm.irSel {
    1'b0 : DRMux;
    1'b1 : instruction[0];
}
ScanMux DRMux SelectedBy instruction {
    4'b1111      : bypass;
    4'b0000      : bypass;
    4'b0001      : host_bscan_from_so;
    4'b0010      : host_bscan_from_so;
    4'b0011      : host_bscan_from_so;
    4'b0100      : host_bscan_from_so;
    4'b0101      : host_bscan_from_so;
    4'b0110      : bypass;
    4'b0111      : host_1_from_so;
    4'b1000      : device_id[0];
    'bX          : bypass;
}
Attribute           keep_active_during_scan_test = "true";
Attribute           abc = 1;
Attribute           tessent_instruction_reg      = "instruction";
Attribute           tessent_bypass_reg        = "bypass";
Attribute           tessent_device_id_reg     = "device_id";
Attribute           tessent_instrument_container =
"tap_t_rtl1_ijtag";
Attribute           tessent_use_in_dft_specification = "false";
Attribute           tessent_instrument_type       =
"mentor::ijtag_node";
Attribute           tessent_instrument_subtype   = "tap_controller";
Attribute           tessent_signature          =
"d7c6347c88a60873d82843c778bd6818";
}
Module tap_t_rtl1_tessent_tap_main_fsm {
    TCKPort      tck;
    TMSPort      tms;
    TRSTPort     trst;
    ToIRSelectPort irSel;
    ToResetPort   tlr;
}

```

## 2. io tile

## 2.1 script

```
#!/bin/sh
#\!
exec tessent -shell -log logfiles/$0.log -replace -dofile "$0" -arguments
${1+"$@"}

# Set the context to insert DFT into top-level design
set_context dft -rtl -design_id rtl1

# Set the location of the TSDB. Default is the current working directory.
set_tsdb_output_directory ../tsdb_outdir

# Open the TSDB of all the child cores

# Read the tessent cell library
read_cell_library ../../library/standard_cells/tessent/adk.tcelllib
read_cell_library ../../library/dummy_pad/dummy_pad.tcelllib

# Read hard_macros
read_verilog ../../library/plls/pll.v -blackbox -
exclude_from_file_dictionary

# Read the design view of chip_top
set_design_sources -format verilog -y ../../library/pad_cells -extension v
set_design_sources -format verilog -y ../../library/dummy_pad -extension v
read_verilog ./rtl/io_a_t.v
set_current_design io_a_t

set_design_level physical_block
#set_design_level sub_block

# Define set_dft_specification_requirements to insert boundary scan at chip-
level
# Set memory_test on even if there is not memories at the top level so that
the memory
# clock DRCs are run outside the memory inserted blocks.
#set_dft_specification_requirements -boundary_scan on -memory_test on
set_dft_specification_requirements -boundary_scan on

set_boundary_scan_port_options -pad_io_ports {BP_A0 BP_A1 BP_A2 BP_A3}

# Toggle the enable to relock the PLL

# Specify the TAP pins using set_attribute_value
# set_attribute_value tck -name function -value tck
# set_attribute_value tdi -name function -value tdi
# set_attribute_value tms -name function -value tms
# set_attribute_value trst -name function -value trst
# set_attribute_value tdo -name function -value tdo
```

```

# Specify all clocks so that the proper BSCAN cells gets inserted
# automatically for them

check_design_rules

# Create and report a DFT Specification
# set spec [create_dft_specification -existing_ijtag_host_scan_in
# tap/host_1_from_so -sri_sib_list occ -tile_ijtag_host_list {r1}]
set spec [create_dft_specification]

report_config_data $spec

read_config_data -in $spec/EmbeddedBoundaryScan -from_string {
    ImplementationOptions {
        clocking           : gated_tck;
        update_stage       : flop;
        scan_path_retiming : flop;
    }

    InternalBScanCells {
        InternalBScanCell(pipe0) {
            insert_before_port : BP_A0 ;
            safe_value         : 0;
            type               : observation;
        }
        InternalBScanCell(pipe1) {
            insert_after_port   : BP_A3 ;
            safe_value         : 0;
            type               : observation;
        }
    }
}

report_config_data $spec

# Segment the boundary scan to be used during logic test
# set_config_value $spec/BoundaryScan/max_segment_length_for_logictest 80

# Add auxiliary mux on the inputs and outputs used for SSN bus and bus_clock
# bus_in {GPIO3_0 GPIO3_1} bus_out {GPIO4_0 GPIO4_1} bus_clock {GPIO3_2}
# read_config_data -in ${spec}/BoundaryScan -from_string {
#     AuxiliaryInputOutputPorts {
#         auxiliary_input_ports  : GPIO3_0, GPIO3_1, GPIO3_2;
#         auxiliary_output_ports : GPIO4_0, GPIO4_1 ;
#     }
# }

# report_config_data $spec

# Generate and insert the hardware

```

```

process_dft_specification

# Extract IJAG network and create ICL file for the design
extract_icl -create_ijtag_graybox on

# Create patterns(testbenches) to verify the inserted DFT logic
set spec [create_patterns_specification]
process_pattern_specification

# Point to the libraries and run simulation
set_simulation_library_sources -v ../../library/standard_cells/verilog/*.v \
                               -y ../../library/plls \
                               -y ../../library/memories \
                               -extension v

run_testbench_simulations \
    -keep_simulation_data on \
    -simulator vcs \
    -compilation_options "-sverilog +define+debussy -kdb" \
    -simulator_options "-sverilog -debug_access+all -kdb"

exit

```

## 2.2 spec

```

DftSpecification(io_a_t,rtl1) {
    EmbeddedBoundaryScan {
        pad_io_ports : BP_A0, BP_A1, BP_A2, BP_A3;
        ImplementationOptions {
            clocking : gated_tck;
            update_stage : flop;
            scan_path_retiming : flop;
        }
        InternalBScanCells {
            InternalBScanCell(pipe0) {
                insert_before_port : BP_A0;
                safe_value : 0;
                type : observation;
            }
            InternalBScanCell(pipe1) {
                insert_after_port : BP_A3;
                safe_value : 0;
                type : observation;
            }
        }
    }
}

```

### 3. chip

详细说明参考tessent文档BSDL Extraction部分

- BSDL不能抽取在CHIP LEVEL创建的Boundary Scan cells，工具会报错
- CHIP LEVEL代码需要把all block的BSCAN给连好
- block需要提供tcd\_bscan文件
- BondingConfig只能存在于block level, 顶层不支持再划分bypass

#### 3.1 rtl

```

module chip_top(
    // Port Declarations
    input wire      BP_A00,
    input wire      BP_A01,
    input wire      BP_A02,
    input wire      BP_A03,
    input wire      BP_A10,
    input wire      BP_A11,
    input wire      BP_A12,
    input wire      BP_A13,
    input wire      TDI,
    input wire      TRST,
    input wire      TMS,
    input wire      TCK,
    output wire     TDO
);

tap_t tap_t(
    .tdi      (TDI_core),
    .tms      (TMS_core),
    .tck      (TCK_core),
    .trst     (TRST_core),
    .tdo      (TDO_core),
    .tdo_en   (TDO_core_en),

    //input
    .to_bscan_from_scan_out      (to_bscan_from_scan_out
), // input

    //output
    .to_bscan_to_select         (to_bscan_to_select
), // output
    .to_bscan_to_clock          (to_bscan_to_clock
);

```

```

), // output
    .to_bscan_to_capture_en          (to_bscan_to_capture_en
), // output
    .to_bscan_to_shift_en           (to_bscan_to_shift_en
), // output
    .to_bscan_to_update_en          (to_bscan_to_update_en
), // output
    .to_bscan_to_scan_in            (to_bscan_to_scan_in
), // output
    .to_bscan_to_force_disable     (to_bscan_to_force_disable
), // output
    .to_bscan_to_select_jtag_input (to_bscan_to_select_jtag_input
), // output
    .to_bscan_to_select_jtag_output (to_bscan_to_select_jtag_output
) // output
    // .to_bscan_to_ac_init_clk0      (to_bscan_to_ac_init_clk0
), // output
    // .to_bscan_to_ac_init_clk1      (to_bscan_to_ac_init_clk1
), // output
    // .to_bscan_to_ac_signal         (to_bscan_to_ac_signal
), // output
    // .to_bscan_to_ac_mode_en       (to_bscan_to_ac_mode_en
) // output
);

```

```

io_a_t io_a_t0(
    .BP_A0                      (BP_A00
), // input
    .BP_A1                      (BP_A01
), // input
    .BP_A2                      (BP_A02
), // input
    .BP_A3                      (BP_A03
), // input
    .bscan_select                (to_bscan_to_select
), // input
    .bscan_force_disable         (to_bscan_to_force_disable
), // input
    .bscan_select_jtag_input     (to_bscan_to_select_jtag_input
), // input
    .bscan_select_jtag_output    (to_bscan_to_select_jtag_output
), // input
    .bscan_clock                 (to_bscan_to_clock
), // input
    .bscan_capture_en            (to_bscan_to_capture_en
), // input
    .bscan_shift_en              (to_bscan_to_shift_en
), // input
    .bscan_update_en             (to_bscan_to_update_en
), // input

```

```
.bscan_scan_in          (to_bscan_to_scan_in
), // input

    .bscan_scan_out        (bscan_scan_out_t0 ) // output
);

io_a_t io_a_t1(
    .BP_A0                (BP_A10
), // input
    .BP_A1                (BP_A11
), // input
    .BP_A2                (BP_A12
), // input
    .BP_A3                (BP_A13
), // input
    .bscan_select          (to_bscan_to_select
), // input
    .bscan_force_disable   (to_bscan_to_force_disable
), // input
    .bscan_select_jtag_input (to_bscan_to_select_jtag_input
), // input
    .bscan_select_jtag_output (to_bscan_to_select_jtag_output
), // input
    .bscan_clock            (to_bscan_to_clock
), // input
    .bscan_capture_en       (to_bscan_to_capture_en
), // input
    .bscan_shift_en          (to_bscan_to_shift_en
), // input
    .bscan_update_en         (to_bscan_to_update_en
), // input
    .bscan_scan_in           (bscan_scan_out_t0
), // input

    .bscan_scan_out          (to_bscan_from_scan_out ) // output
);

ipad TDI_inst (
    .PAD (TDI),
    .C(TDI_core)
);

ipad TCK_inst (
    .PAD (TCK),
    .C(TCK_core)
);

ipad TMS_inst (
    .PAD (TMS),
    .C(TMS_core)
);
```

```

ipad TRST_inst (
    .PAD (TRST),
    .C(TRST_core)
);

opad TDO_inst (
    .PAD (TDO),
    .I(TDO_core),
    .OEN(TDO_core_en)
);

endmodule

```

## 3.2 script

```

#!/bin/sh
#\!
exec tessent -shell -log logfiles/$0.log -replace -dofile "$0" -arguments
${1+"$@"}

# Set the context to insert DFT into top-level design
set_context dft -rtl -design_id rtl1

# Set the location of the TSDB. Default is the current working directory.
set_tsdb_output_directory ../tsdb_outdir

# Open the TSDB of all the child cores
open_tsdb ../../tap_t/tsdb_outdir
open_tsdb ../../io_a_t/tsdb_outdir

# Read the tessent cell library
read_cell_library ../../library/standard_cells/tessent/adk.tcelllib
read_cell_library ../../library/dummy_pad/dummy_pad.tcelllib

# Read hard_macros
read_verilog ../../library/plls/pll.v -blackbox -
exclude_from_file_dictionary

# Read the design view of chip_top
set_design_sources -format verilog -y ../../library/pad_cells -extension v
set_design_sources -format verilog -y ../../library/dummy_pad -extension v
read_verilog ./rtl/chip_top.v

#read_design tap_t -design_id rtl1 -view interface -verbose
read_design tap_t -design_id rtl2 -verbose
read_design io_a_t -design_id rtl1 -verbose
set_current_design chip_top

```

```
set_design_level chip

# Define set_dft_specification_requirements to insert boundary scan at chip-level
# Set memory_test on even if there is not memories at the top level so that the memory
# clock DRCs are run outside the memory inserted blocks.
#set_dft_specification_requirements -boundary_scan on -memory_test on
#set_dft_specification_requirements -bsdl_extraction on

# Toggle the enable to relock the PLL

# Specify the TAP pins using set_attribute_value
set_attribute_value TCK -name function -value tck
set_attribute_value TDI -name function -value tdi
set_attribute_value TMS -name function -value tms
set_attribute_value TRST -name function -value trst
set_attribute_value TDO -name function -value tdo

# Specify all clocks so that the proper BSCAN cells gets inserted automatically for them
# add_clocks PLL_1/pll_clock_0 -reference REF_CLK -freq_multiplier 16
# add_clock REF_CLK -period 48ns
# add_clock INCLK -period 10ns

check_design_rules

set_system_mode setup
set_dft_specification_requirements -bsdl_extraction on
check_design_rules
extract_icl -create_ijtag_graybox on

set_context patterns -ijtag -rtl
set spec [create_patterns_specification -bscan_sim_views ijtag_graybox]
report_config_data $spec
process_patterns_specification
set_simulation_library_sources \
-Y ../../library/pad_cells/ \
-Y ../../library/dummy_pad/ \
-extensions {v} \
-V ../../library/standard_cells/verilog/adk.v
run_testbench_simulations \
-keep_simulation_data on \
-simulator vcs \
-compilation_options "-sverilog +define+debussy -kdb" \
-simulator_options "-sverilog -debug_access+all -kdb"
```

## 4. tcd\_bscan

集成第三方IP(比如serdes phy) BSCAN[]

```
# 读第三方.v文件
read_verilog xxx.v

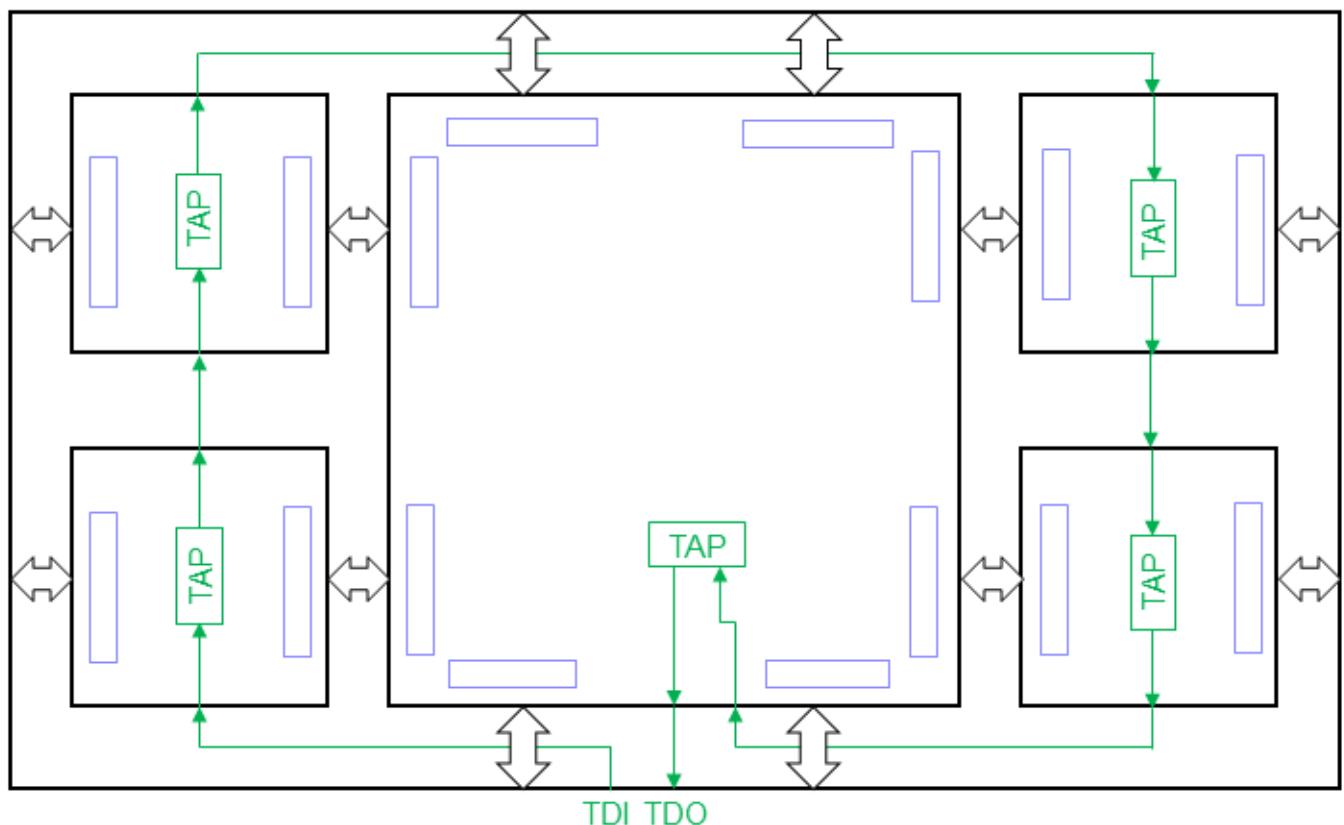
# 读第三方tcd bscan描述
read_core_descriptions xxx.tcd_bscan
```

工具就能自动识别了。

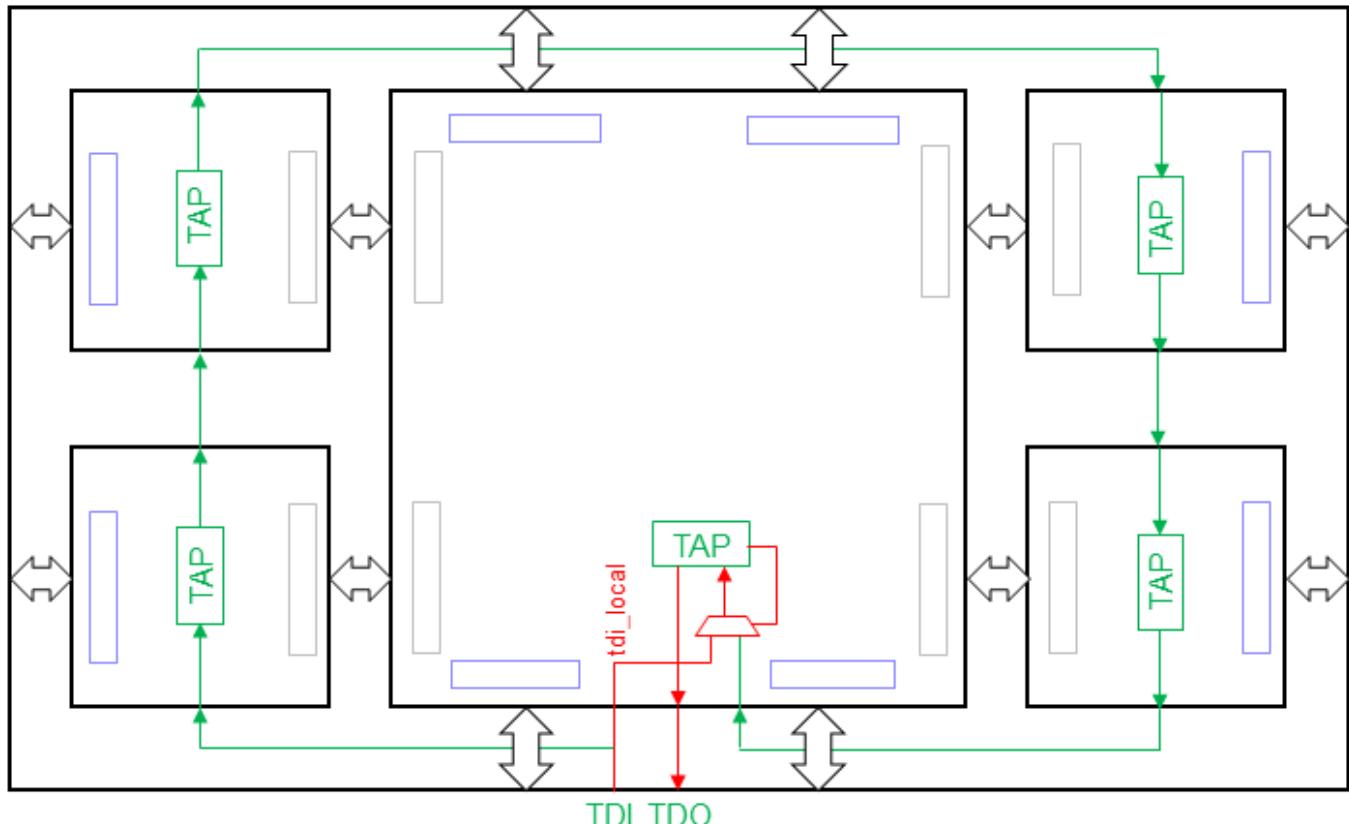
注：有的第三方只提供了IP的BSDL文件，需要根据BSDL文件，手动的写出对应的tcd\_bscan文件给工具。

## 5. 多DIE互联

传统菊花链连接方式



**DEVICE\_ID BYPASS**



## 6. bsdI抽取

详细说明参考tessent文档BSDL Extraction部分

- BSDL不能抽取在CHIP LEVEL创建的Boundary Scan cells，工具会报错
- CHIP LEVEL代码需要把all block的BSCAN给连好
- block需要提供bcd\_bscans文件
- BondingConfig只能存在于block level, 顶层不支持再划分bypass

顶层不能单独存在PORT(JTAG PORT除外)，存在的话不支持BSDL抽取flow, 这种情况下可以直接使用正向的BondingConfig来生成对应的BSDL文件。

### 6.1 BSDL文件举例

```
-- BSDL Version 2001

entity chip_top is
generic (PHYSICAL_PIN_MAP : string := "DEFAULT_PACKAGE_NAME");

port (
    -- Port List
    BP_A00      : in  bit;
    BP_A01      : in  bit;
    BP_A02      : in  bit;
    BP_A03      : in  bit;
```

```
BP_A10          : in  bit;
BP_A11          : in  bit;
BP_A12          : in  bit;
BP_A13          : in  bit;
TDI             : in  bit;
TRST            : in  bit;
TMS             : in  bit;
TCK             : in  bit;
TDO             : out bit);

use STD_1149_1_2001.all;

attribute COMPONENT_CONFORMANCE of chip_top: entity is
"STD_1149_1_2001";

--Pin mappings

attribute PIN_MAP of chip_top: entity is PHYSICAL_PIN_MAP;

constant DEFAULT_PACKAGE_NAME: PIN_MAP_STRING :=
  "BP_A00      : I1      , " &
  "BP_A01      : I2      , " &
  "BP_A02      : I3      , " &
  "BP_A03      : I4      , " &
  "BP_A10      : I5      , " &
  "BP_A11      : I6      , " &
  "BP_A12      : I7      , " &
  "BP_A13      : I8      , " &
  "TDI         : I9      , " &
  "TRST        : I10     , " &
  "TMS         : I11     , " &
  "TCK         : I12     , " &
  "TDO         : O1      " ;

attribute TAP_SCAN_RESET  of TRST      : signal is true;
attribute TAP_SCAN_IN     of TDI       : signal is true;
attribute TAP_SCAN_MODE   of TMS       : signal is true;
attribute TAP_SCAN_OUT    of TDO       : signal is true;
attribute TAP_SCAN_CLOCK  of TCK       : signal is (1.00e+07, BOTH);

attribute INSTRUCTION_LENGTH of chip_top: entity is 4;

attribute INSTRUCTION_OPCODE of chip_top: entity is
  "IDCODE      (1000), " &
  "BYPASS      (1111), " &
  "EXTEST      (0001), " &
  "EXTEST_PULSE (0010), " &
  "EXTEST_TRAIN (0011), " &
  "SAMPLE      (0101), " &
  "PRELOAD     (0101), " &
  "HIGHZ       (0110), " &
```

```

    "CLAMP      (0000) " ;

attribute INSTRUCTION_CAPTURE of chip_top: entity is "0001";

attribute IDCODE_REGISTER of chip_top: entity is
  "0000"          & -- version
  "0000000000000000" & -- part number
  "000000000000"   & -- manufacturer's identity
  "1";           -- required by 1149.1

attribute REGISTER_ACCESS of chip_top: entity is
  "DEVICE_ID ( IDCODE )," &
  "BOUNDARY ( EXTEST, EXTEST_PULSE, EXTEST_TRAIN, SAMPLE, PRELOAD ),"
&
  "BYPASS ( BYPASS, HIGHZ, CLAMP ) " ;

--Boundary scan definition
attribute BOUNDARY_LENGTH of chip_top: entity is 14;

attribute BOUNDARY_REGISTER of chip_top: entity is
  -- num   cell           port       function      safe [ccell
disval rslt]
  " 13   (bc_0        , *        , internal    , X
), "&
  " 12   (BC_0        , *        , internal    , 0
), "&
  " 11   (BC_2        , BP_A00    , input      , X
), "&
  " 10   (BC_2        , BP_A01    , input      , X
), "&
  "  9   (BC_2        , BP_A02    , input      , X
), "&
  "  8   (BC_2        , BP_A03    , input      , X
), "&
  "  7   (BC_0        , *        , internal    , 0
), "&
  "  6   (BC_0        , *        , internal    , 0
), "&
  "  5   (BC_2        , BP_A10    , input      , X
), "&
  "  4   (BC_2        , BP_A11    , input      , X
), "&
  "  3   (BC_2        , BP_A12    , input      , X
), "&
  "  2   (BC_2        , BP_A13    , input      , X
), "&
  "  1   (BC_0        , *        , internal    , 0
), "&
  "  0   (bc_0        , *        , internal    , X
) ";

```

```
end chip_top;
```

## 6.2 第三方TAP抽BSDL

在chip层抽BSDL时，需要能够识别到tap controller。它是由ICL里面的属性决定的。类似如下的ICL描述：

```
Attribute tessent_instrument_type      =
"mentor::ijtag_node";
Attribute tessent_instrument_subtype    =
"tap_controller";
Attribute tessent_signature             =
"7f9f11188d689c2876eccd7c615da355";
```

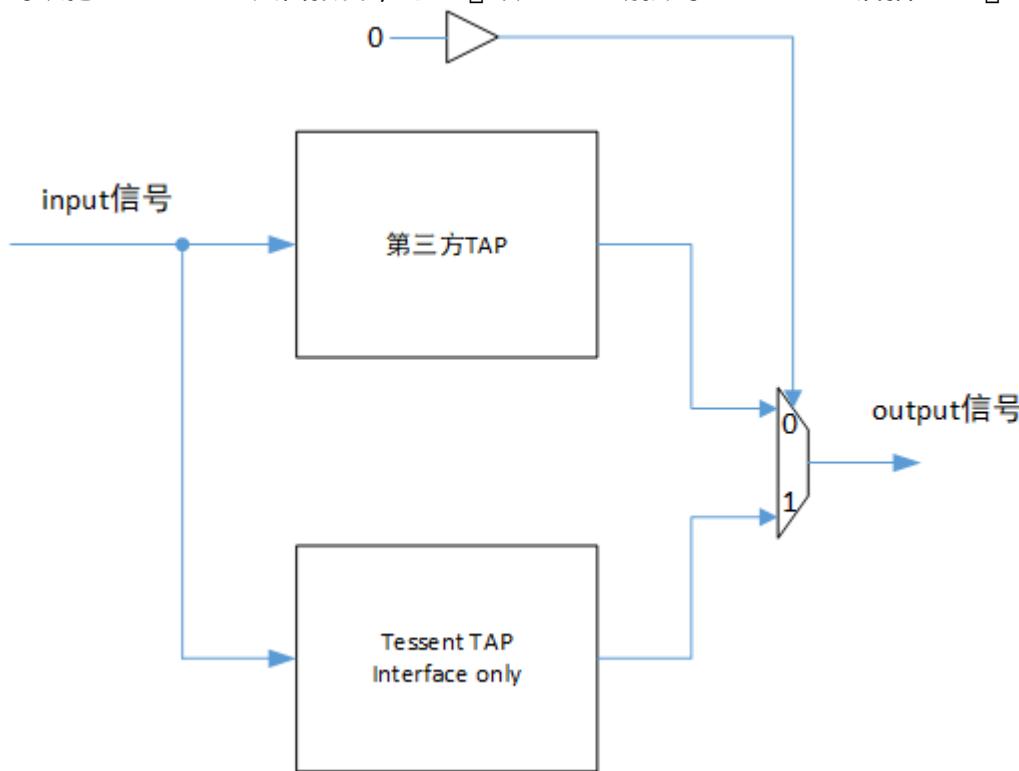
signature会保护module name, port name, ScanRegister name等,signature不对会报如下错误。

```
// Error: The TDI 'TDI' could not be traced to a TAP controller. (BSCAN1-1)
// Error: There was 1 BSCAN1 violation (Boundary Scan extraction TAP
controller identification).
// Error: Rules checking unsuccessful, cannot exit SETUP mode.
```

所以导致第三方的TAP目前是不支持直接抽取BSDL的，抽取BSDL时需要用tessent的TAP。

但可以有一个变通方案，在RTL例化的时候也加一个tessent的TAP。

可以把tessent TAP只留接口，吃ICL，设置case切换到tessent TAP后抽BSDL。



## 6.3 带TcdBscan分段抽取BSDL

无需再配置BondingConfig spec，只需要case相应seg段的enable信号就行。

```
set_dft_specification_requirements -bsdl_extraction on
```

```

add_primary_inputs [get_pins cphy_t0/bs_bypass]
add_input_constraints [get_pins cphy_t0/bs_bypass] -C0; # 工具自动根据此值的状态，来抽取成对应的BSDL文件。

set_attribute_value [get_pins cphy_t0/BS_BYPASS_PORT] -name
unused_tcd_bscan_external_port -value yes; # 设置对应假PORT不出现在BSDL文件中

check_design_rules

```

## 6.4 多DIE抽取BSDL

tessent多DIE合封，抽一个整体的BSDL[]需要设置一个main DIE, 它得有额外的TDI\_LOCAL信号，用于在BYPASS/IDCODE模块兼容IEEE JTAG标准。

当PACKAGE PIN与多个DIE线与时，不会输出该PIN的BSDL[]相当于不测。

### 抽取多DIE BSDL

```

read_verilog multi_die.v
set_current_design multi_die
set_design_level chip

extract_icl
check_design_rules

set_system_mode setup
set_dft_specification_requirements -bsdl_extraction on
read_bsdl die.bsdl
check_design_rules

```

## 7. BondingConfiguration

可能某inst不用或powerdown, 有多种封装形态，此时需要配置BondingConfigurations[]生成对应的BSDL文件。

TcdBscanSegment指定inst中具体segment段选择，比如可以让某些bscan cell不上bscan chain, 直接bypass掉，也可以全部上bscan chain.

工具会自动生成指定bonding configuration的BSDL文件。

```

DftSpecification(module_name,id) {
    EmbeddedBoundaryScan {
        BondingConfigurations {
            BondingConfiguration(name) {
                enable_signal           : port_pin_or_net_name ;
                bypassed_logical_groups : logical_group_name, ... ;
                active_logical_groups   : logical_group_name, ... ;
            }
        }
    }
}

```

```

        TcdBscanSegment(instance_name) {
            segment_selection : segment_selection_name;
        }
    }
}
}
}
```

```

DftSpecification(module_name,id) {
    BoundaryScan {
        BondingConfigurations {
            BondingConfiguration(name) {
                enable_signal          : pin_or_net_name ;
                part_number_code       : binary ; // default: 16'h0
                version_code           : binary ; // default: 4'h0
                unused_ports           : port_name_pattern, ... ;
                bypassed_logical_groups: logical_group_name, ... ;
                active_logical_groups  : logical_group_name, ... ;
                TcdBscanSegment(instance_name) {
                    segment_selection : segment_selection_name;
                }
            }
        }
    }
}
```

疑问，如果只是抽BSDL[]也可以这样用吗？

## 8. bypass segment

如果芯片想支持BSCAN分段bypass[]就必须设置>1个Logic group, 这样在Bonding config中就可以配置哪些logic group是bypass或者是active[]

为了支持多段bypass[] 最好中间插入dummy port, 只是为了方便加logic group[]可以把一段功能PORT给bypass掉。

集成TcdBscanSegment时，segment select只能选择其它一种来生成对应BSDL文件

所以为了适应多segment bypass[]建议每个模块就是一个segment[]  
比如每个PHY BSCAN是一个tcdbscan segment, 这样就可实现多个PHY同时bypass的BSDL配置。

如果顶层IO没有分segment的话，只是集成模块的tcdbscan[]可以不加enable\_signal  
tile flow都推荐segment在模块内部进行划分，顶层只负责把所有的tcdbscan给串起来，这样便于bypass各个模块的bscan，利于BSDL自动生成。

```

BondingConfigurations {
    BondingConfiguration(name) {
        TcdBscanSegment(phy1) {
            segment_selection : bypass;
        }
    }
}
```

```

TcdBscanSegment(phy2) {
    segment_selection : bypass;
}
}
}
}

```

## 8.1 模块带1个**bypass segment**结构

推荐, 一个模块只分一个**segment**

```
# pin order:
DUMMY_PORT // 加假PORT方便把PORT0 PORT1 BYPASS掉
FUNC_PORT0
FUNC_PORT1
```

```
graph LR
bscan_scan_in --> DUMMY_PORT\n_BC_CELL
DUMMY_PORT\n_BC_CELL --> MUX
DUMMY_PORT\n_BC_CELL --> FUNC\n_BC_CELL0
FUNC\n_BC_CELL0 --> FUNC\n_BC_CELL1
FUNC\n_BC_CELL1 --> MUX
MUX --> bscan_scan_out
```

## 8.2 模块带2个**bypass segment**结构

不推荐

如果不加DUMMY PORT, 无法实现功能PORT 分段BYPASS解耦。

```
# pin order:
DUMMY_PORT // 加假PORT方便把PORT0 PORT1 BYPASS掉
FUNC_PORT0
FUNC_PORT1
DUMMY_PORT2 // 加假PORT方便把PORT2 PORT3 BYPASS掉
FUNC_PORT2
FUNC_PORT3
```

```
graph LR
bscan_scan_in --> DUMMY_PORT\n_BC_CELL
DUMMY_PORT\n_BC_CELL --> MUX
DUMMY_PORT\n_BC_CELL --> FUNC\n_BC_CELL0
FUNC\n_BC_CELL0 --> FUNC\n_BC_CELL1
FUNC\n_BC_CELL1 --> MUX
MUX --> DUMMY_PORT2\n_BC_CELL
DUMMY_PORT2\n_BC_CELL --> MUX2
DUMMY_PORT2\n_BC_CELL --> FUNC\n_BC_CELL2
FUNC\n_BC_CELL2 --> FUNC\n_BC_CELL3
FUNC\n_BC_CELL3 --> MUX2
MUX2 --> bscan_scan_out
```