

# Comprehending RTL codes of Open-C910 about PFU

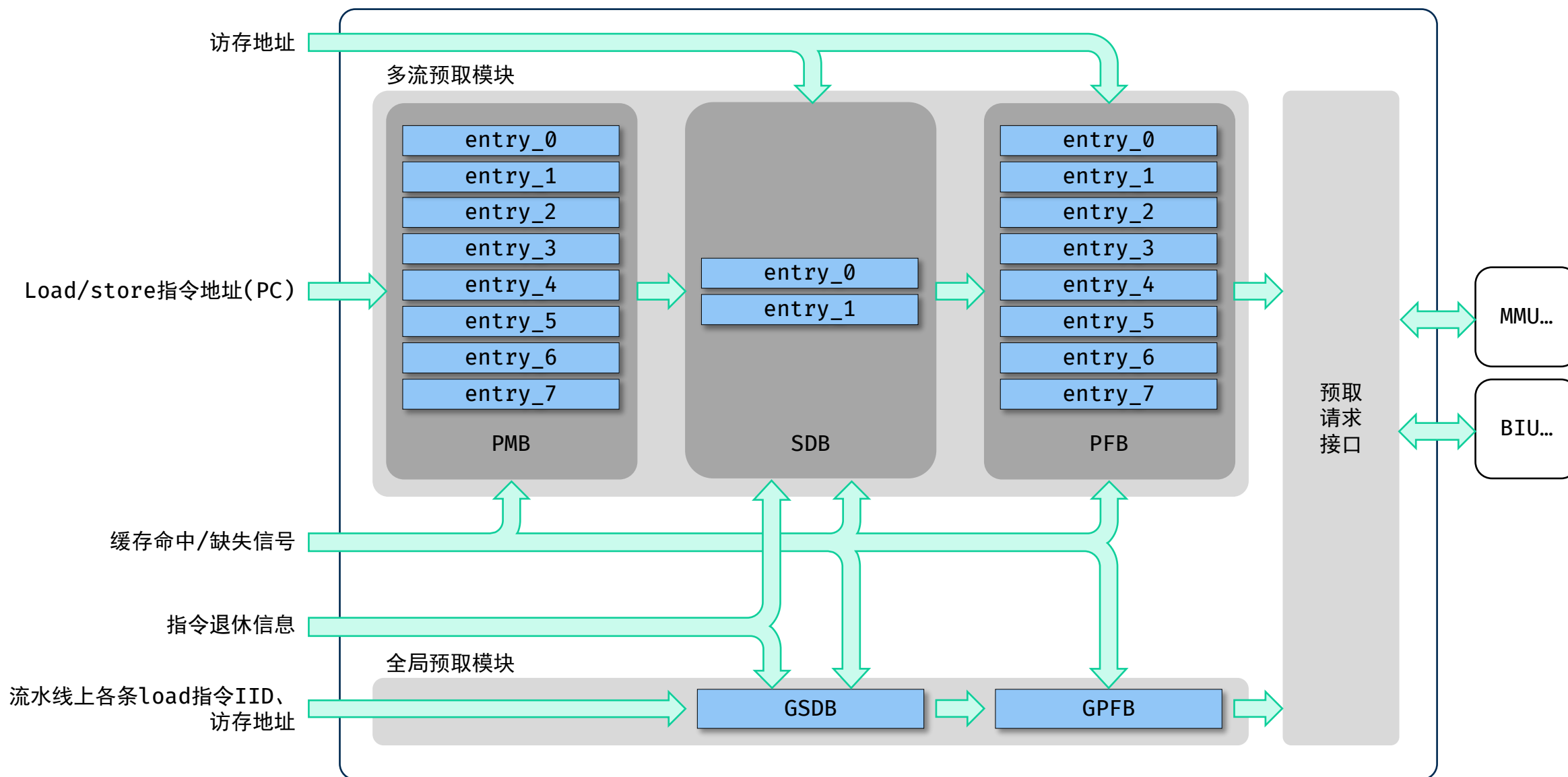
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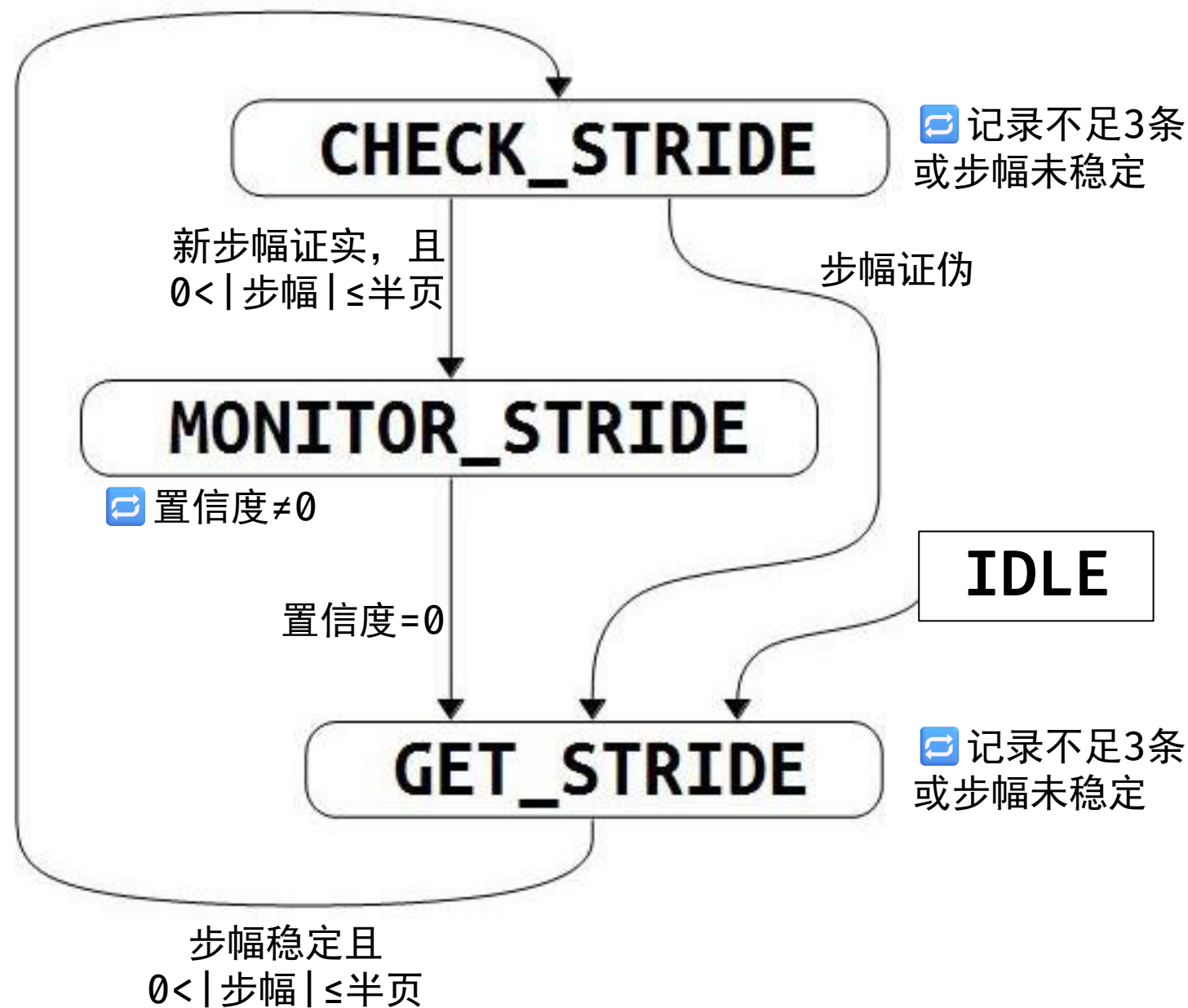
# Top

- 软件预取 ✖ 硬件预取 ✔
- 多模式（全局+多流）
- 多数据流（8个不同步长的数据流）
- 步骤：计算步幅、预取控制、请求预取

# Top



# GSDB



# GSDB

## GET\_STRIDE

addr\_cmp\_info\_vld  
&&  
normal\_stride

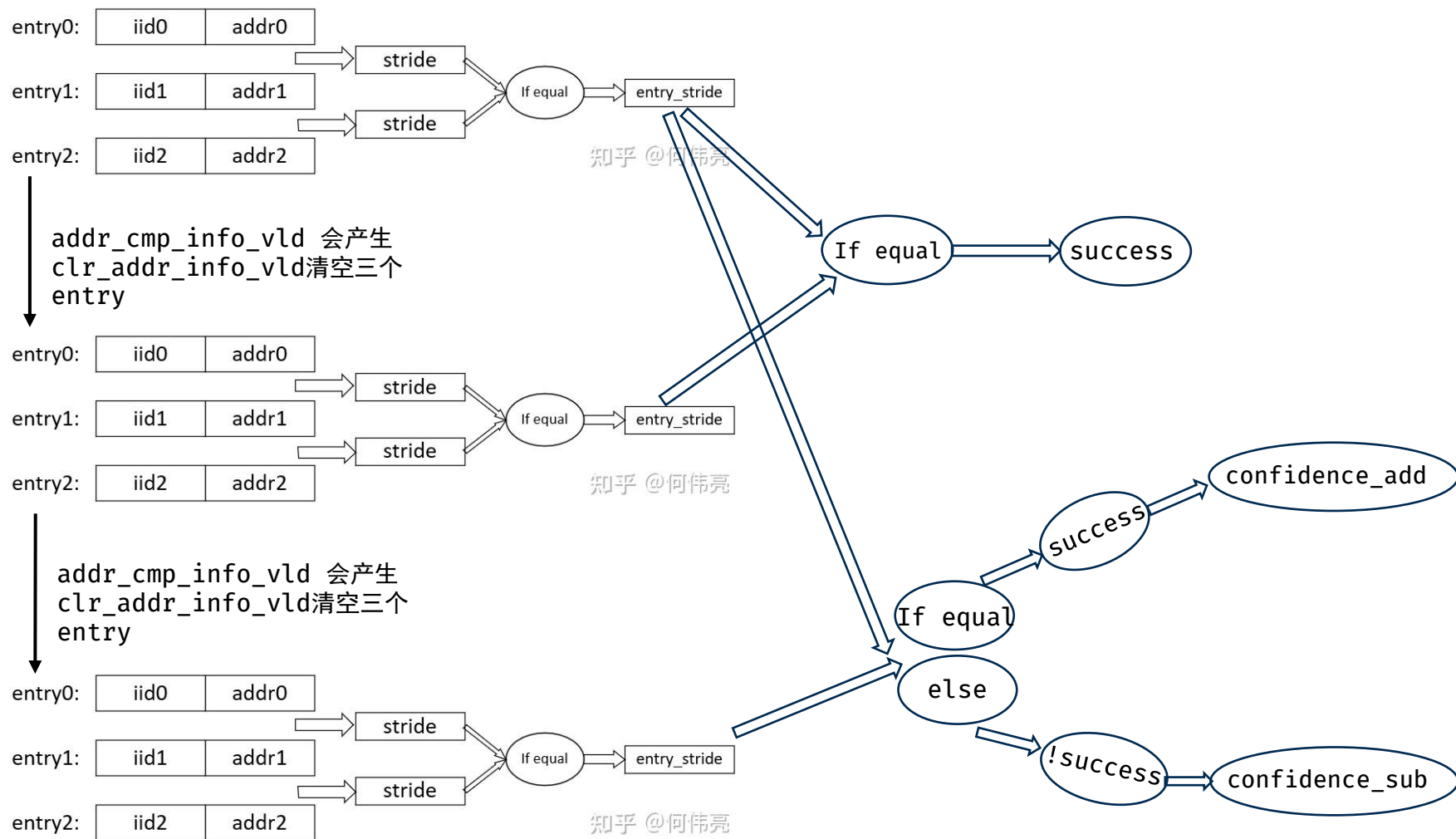
## CHECK\_STRIDE

addr\_cmp\_info\_vld  
&&  
check\_stride\_success

## MONITOR\_STRIDE

addr\_cmp\_info\_vld  
&&  
confidence\_min

## GET\_STRIDE



# GSDB

## Maintain newest iid

```
always @(posedge pfu_gsdb_clk or negedge cpurst_b)
begin
    if (!cpurst_b)
        pfu_gsdb_newest_pf_inst_vld <= 1'b0;
    else if(pfu_gsdb_create_dp_vld || pfu_gsdb_newest_pf_inst_flush_uncmit) //IDLE状态 或 刷新未提交
        pfu_gsdb_newest_pf_inst_vld <= 1'b0;
    else if(pfu_gsdb_vld && pfu_gsdb_pf_inst_vld) //非IDLE状态, 预取指令有效
        pfu_gsdb_newest_pf_inst_vld <= 1'b1;
end
```

```
//pfu_gsdb_newest_pf_inst_set有效时, 用加载指令id更新最新的预取指令id
always @(posedge pfu_gsdb_pf_inst_vld_clk or negedge cpurst_b)
begin
    if (!cpurst_b)
        pfu_gsdb_newest_pf_inst_iid[6:0] <= 7'b0;
    else if(pfu_gsdb_newest_pf_inst_set)
        pfu_gsdb_newest_pf_inst_iid[6:0] <= ld_da_iid[6:0];
end
```

```
//满足最新的预取指令提交的条件, 最新的预取指令提交标志设为1
always @(posedge pfu_gsdb_clk or negedge cpurst_b)
begin
    if (!cpurst_b)
        pfu_gsdb_newest_pf_inst_cmit <= 1'b0;
    else if(pfu_gsdb_newest_pf_inst_set)
        pfu_gsdb_newest_pf_inst_cmit <= 1'b0;
    else if(pfu_gsdb_newest_pf_inst_cmit_set)
        pfu_gsdb_newest_pf_inst_cmit <= 1'b1;
end
```

```
//=====
//          Maintain newest iid
//=====
```

```
//-----older-----
//比较newest_pf_inst存放的最新iid和load指令的iid
ct_rtu_compare_iid x_lsu_gsdb_newest_inst_cmp (
    .x_iid0
        (pfu_gsdb_newest_pf_inst_iid[6:0]
        ),
    .x_iid0_older
        (pfu_gsdb_newest_pf_inst_iid_older_than_ld_da), //比较结果
    .x_iid1
        (ld_da_iid[6:0]
        )
);

//提交命中标志
assign pfu_gsdb_newest_pf_inst_cmit_hit0 = {rtu_yy_xx_commit0,rtu_yy_xx_commit0_iid[6:0]}
                                         == {1'b1,pfu_gsdb_newest_pf_inst_iid[6:0]};
assign pfu_gsdb_newest_pf_inst_cmit_hit1 = {rtu_yy_xx_commit1,rtu_yy_xx_commit1_iid[6:0]}
                                         == {1'b1,pfu_gsdb_newest_pf_inst_iid[6:0]};
assign pfu_gsdb_newest_pf_inst_cmit_hit2 = {rtu_yy_xx_commit2,rtu_yy_xx_commit2_iid[6:0]}
                                         == {1'b1,pfu_gsdb_newest_pf_inst_iid[6:0]};

//提交的条件
assign pfu_gsdb_newest_pf_inst_cmit_set = (pfu_gsdb_newest_pf_inst_cmit_hit0
                                           || pfu_gsdb_newest_pf_inst_cmit_hit1
                                           || pfu_gsdb_newest_pf_inst_cmit_hit2) //三者有一个命中
                                           && pfu_gsdb_newest_pf_inst_vld;

//最新预取指令是否早于加载指令
assign pfu_gsdb_newest_pf_inst_older_than_ld_da = pfu_gsdb_newest_pf_inst_vld
                                                    && (pfu_gsdb_newest_pf_inst_iid_older_than_ld_da
                                                    || pfu_gsdb_newest_pf_inst_cmit);

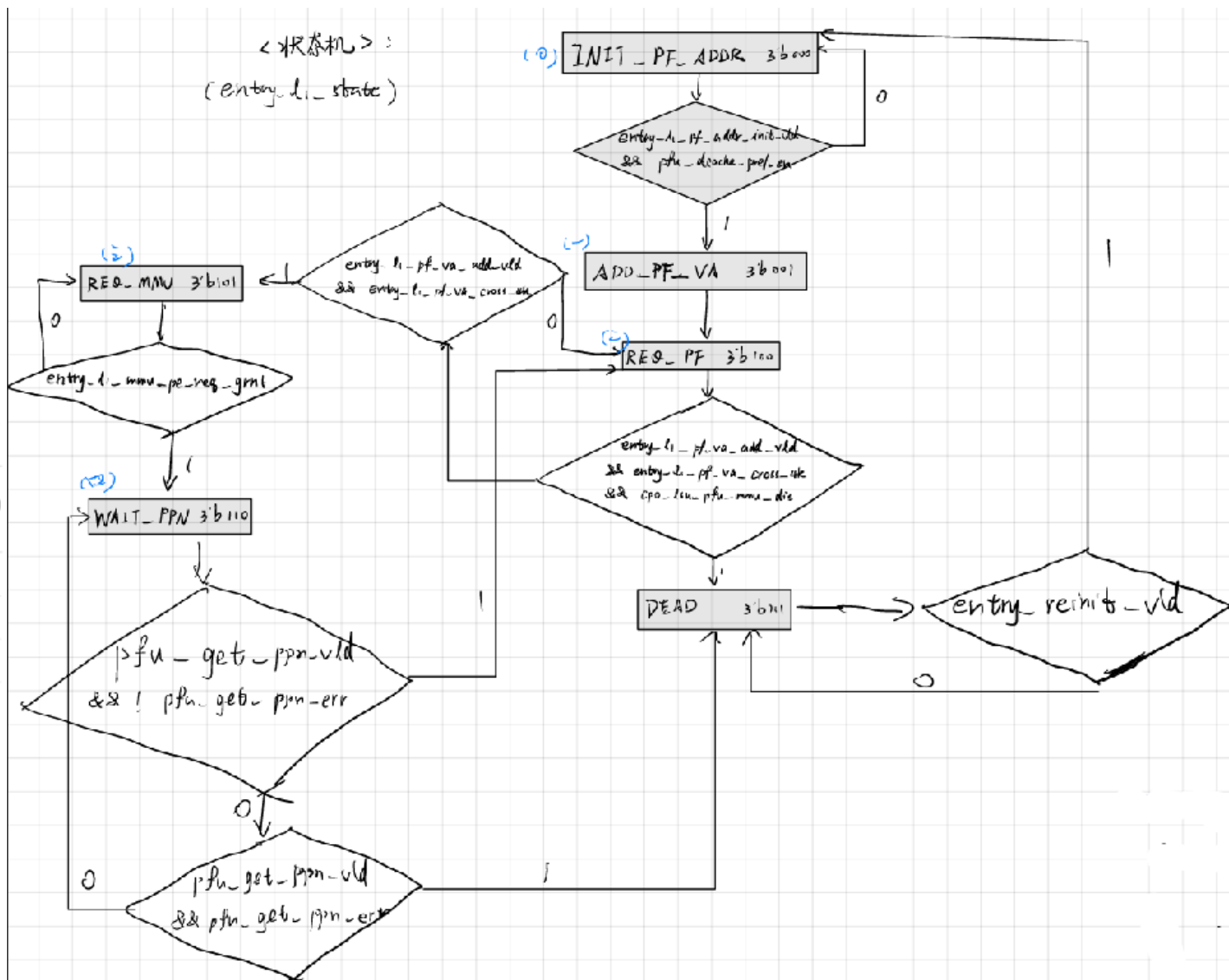
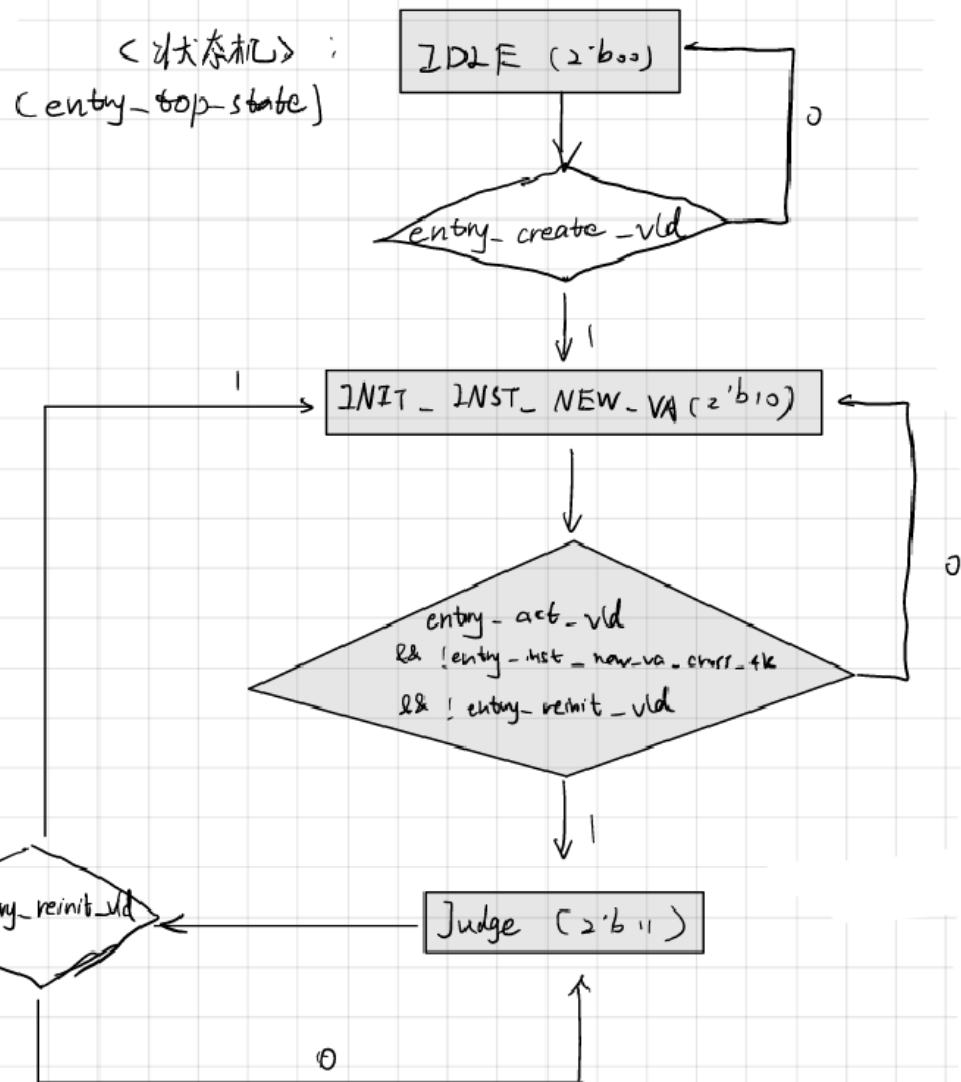
//-----newest_pf_inst_set-----
//更新最新预取指令ID的条件, newest_pf_inst存储所有经过da阶段的指令中最新指令的iid
assign pfu_gsdb_newest_pf_inst_set = pfu_gsdb_vld //非IDLE状态
                                     && pfu_gsdb_pf_inst_vld //预取指令有效
                                     && (!pfu_gsdb_newest_pf_inst_vld //newest_pf_inst存储非最新指令
                                     || pfu_gsdb_newest_pf_inst_older_than_ld_da);

//未提交的指令遇到刷新
assign pfu_gsdb_newest_pf_inst_flush_uncmit = rtu_yy_xx_flush //刷新操作
                                                && !pfu_gsdb_newest_pf_inst_cmit; //指令未提交
```

# GPFB

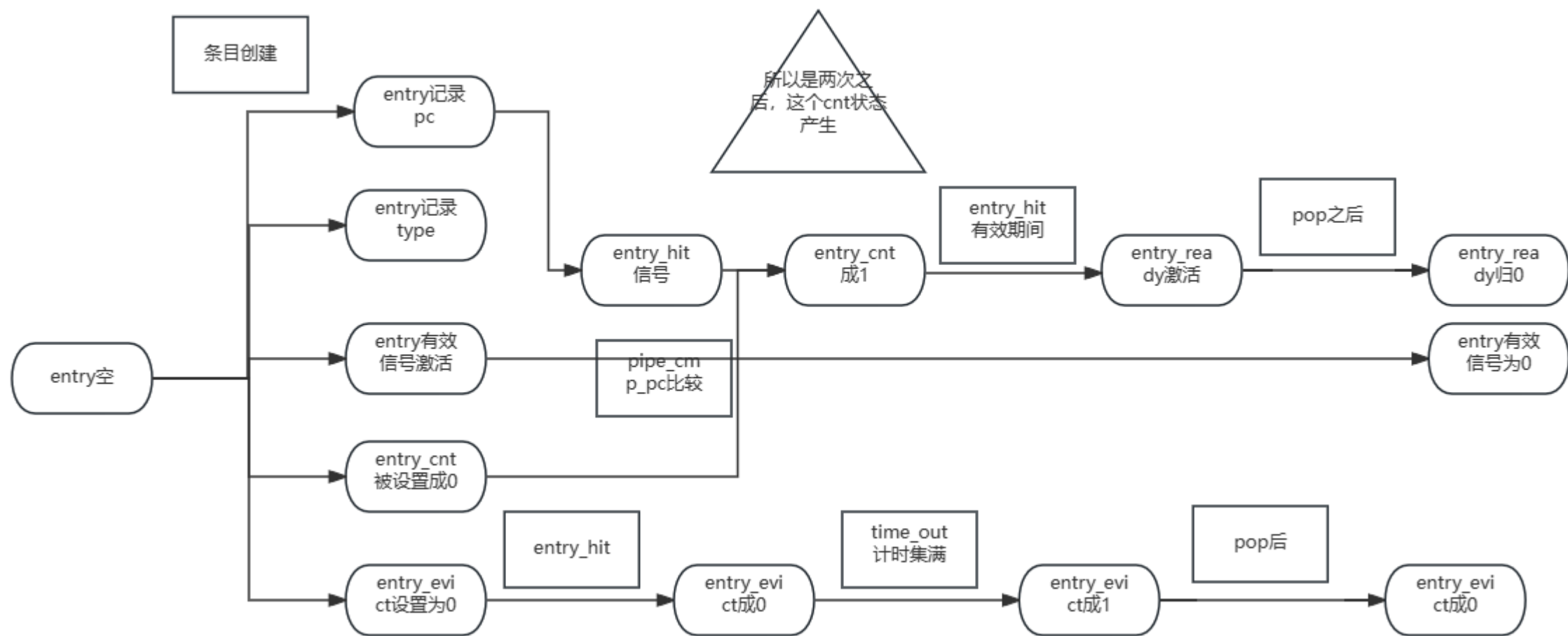
## TSM

## L1SM (L2SM与之同构)



疑问：谁来决定预取到L1DCache还是L2Cache？

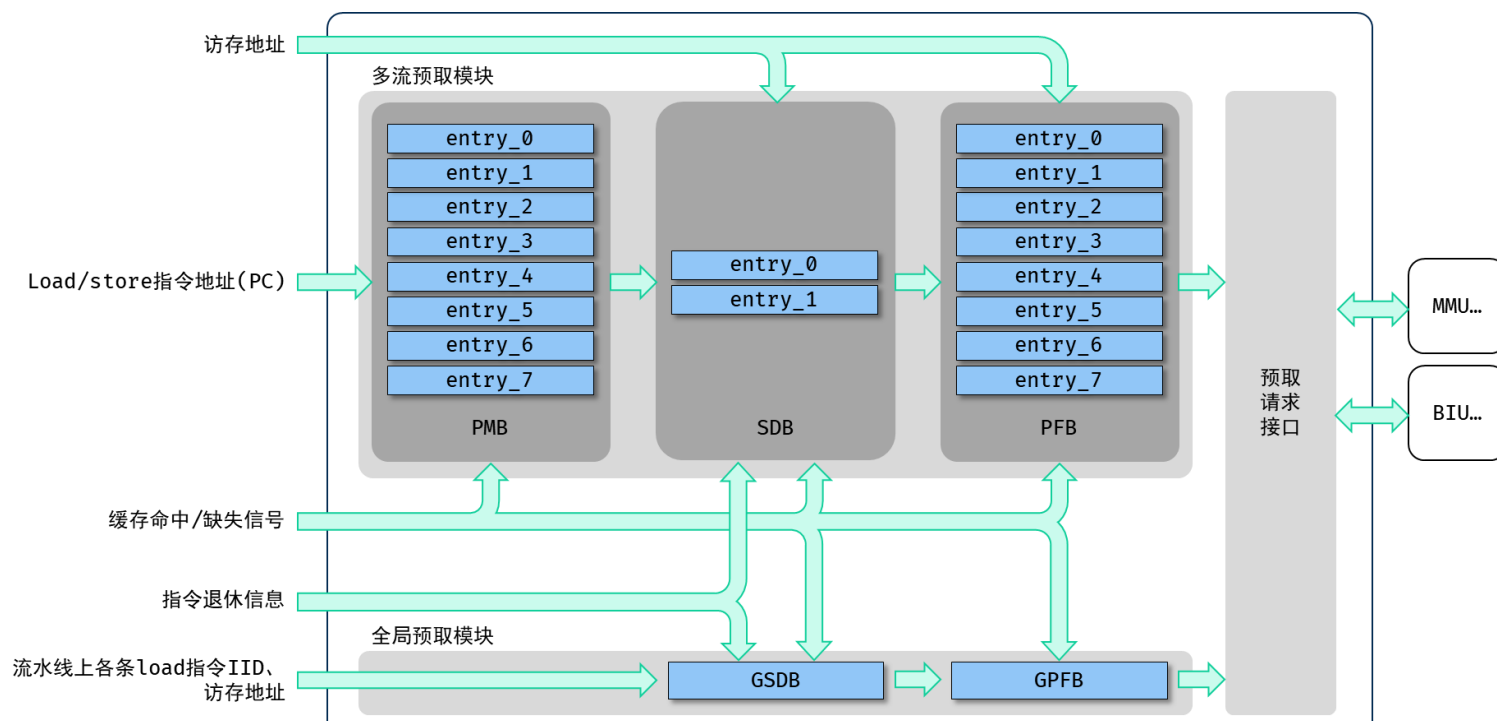
# PMB





# SDB

- SDB有2项，相比GSDB超级加倍。
- SDB每一项只为一条指令服务，用pc区分指令。表项填满时，只有已收录的指令才能进入SDB。
- 计数器控制逐出僵尸表项。
- 疑惑：为什么设计成沙漏形？



# PFB

- PFB有8项，是GPFB的超级加倍。
- 每条数据流只针对特定一条指令，根据pc区分指令。
- 计数器控制逐出僵尸表项。
- L1 cache只支持1、2、4、8四种预取深度，L2 cache只支持4、8、16、32四种预取深度
- L1 cache只支持load预取，不进行store预取；L2 cache则两者都支持。
- SDB置信度取值0~7，初值6。

: wq 