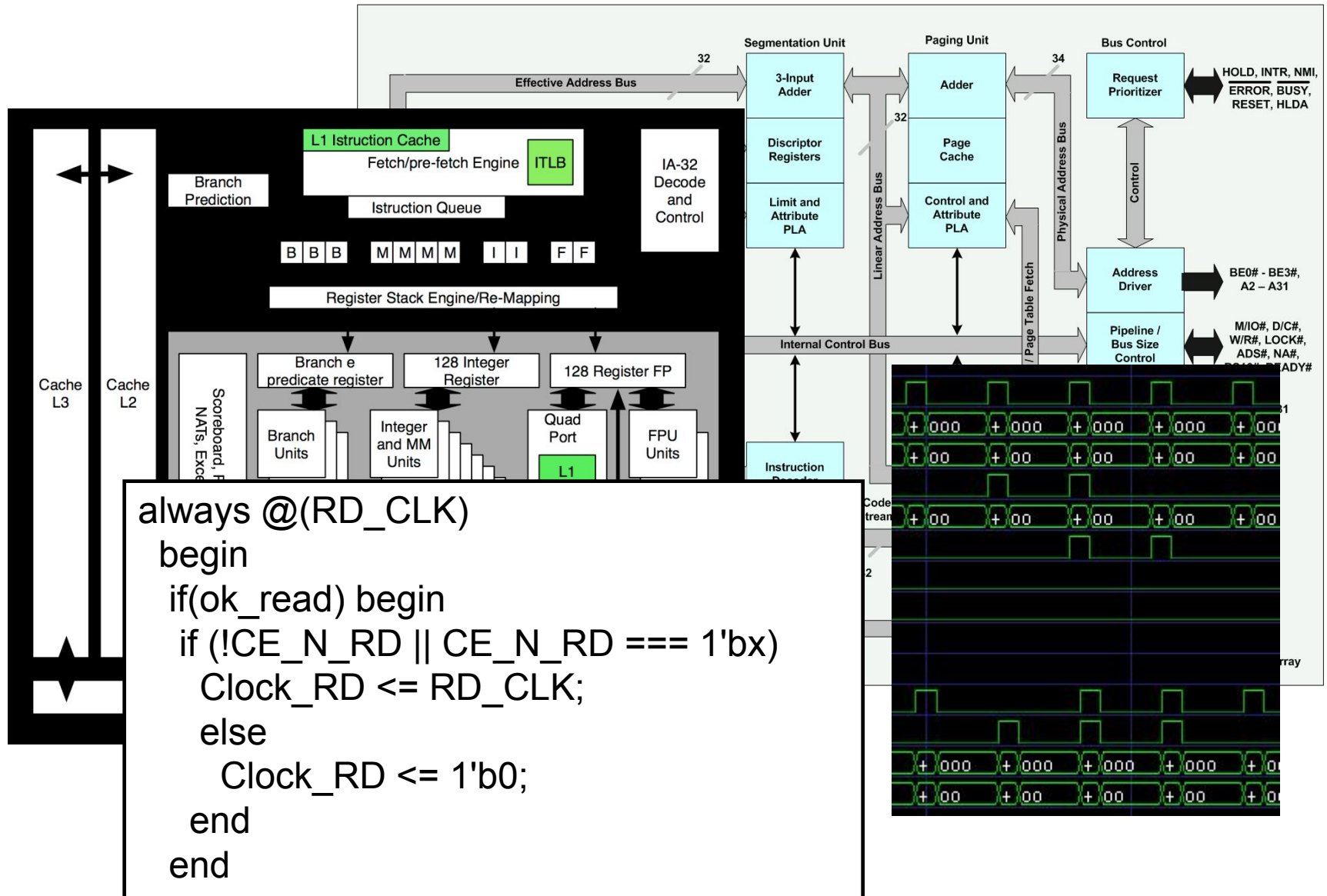


Модели аппаратуры



```

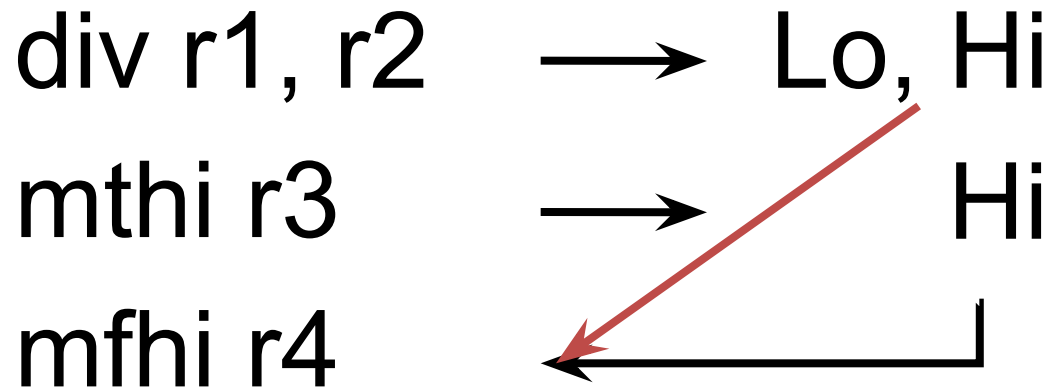
always @(RD_CLK)
begin
  if(ok_read) begin
    if (!ICE_N_RD || CE_N_RD === 1'bx)
      Clock_RD <= RD_CLK;
    else
      Clock_RD <= 1'b0;
    end
  end
end
    
```

Верификация моделей аппаратуры

- Верификация и тестирование занимает до 70% времени разработки:
 - проверяются алгоритмы;
 - проверяется кодирование алгоритмов;
 - проверяется соединение блоков и т.д.



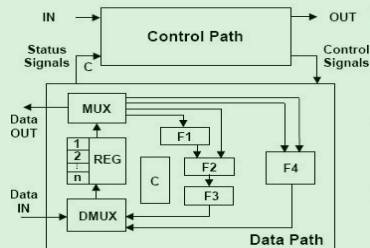
Пример ошибки



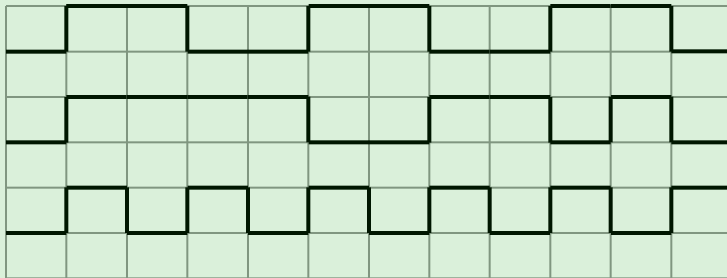
Уровни верификации микропроцессоров

Модульный уровень

Тестируется модель отдельного модуля

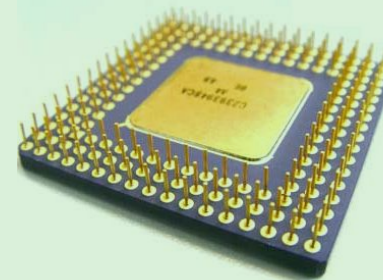


через входные и выходные сигналы



Системный уровень

Модель микропроцессора тестируется целиком



с помощью тестовых программ

```
lui s1, 0xdead
ori s1, s1, 0x0
lui s3, 0xbeef
ori s3, s3, 0xf
add v0, a0, a2
sub t1, t3, t5
add t7, s1, s3
```

Инструментальная поддержка

MicroTESK - Komdiv64 Test Program Generator - <Unknown>.section

File Generation Window Help

Komdiv64

- cp1
 - arithmetic
 - abs.s
 - abs.d
 - abs.ps
 - addsub.ps
 - add.s
 - add.d
 - add.ps
 - div.s
 - div.d
 - madd.s
 - madd.d
 - madd.ps
 - maddsub1.ps
 - maddsub2.ps
 - msub.s
 - msub.d
 - msub.ps
 - mul.s
 - mul.d
 - mul.ps
 - neg.s
 - neg.d
 - neg.ps
 - nmadd.s
 - nmadd.d
 - nmadd.ps
 - nmsub.s
 - nmsub.d
 - nmsub.ps
 - recip.s

Group ARITHMETIC (cp1.arithmetic)

Test	Subgroup or Instruction	Equivalence Class	Situations
✓	abs.s	ABS_Equivalence_Class	1/1
✓	abs.d	ABS_Equivalence_Class	1/1
✓	abs.ps	ABS_Equivalence_Class	1/1
✓	addsub.ps	ADD_Equivalence_Class	1/1
✓	add.s	ADD_Equivalence_Class	1/1
✓	add.d	ADD_Equivalence_Class	1/1
✓	add.ps	ADD_Equivalence_Class	1/1
✓	div.s	DIV_Equivalence_Class	1/1
✓	div.d	DIV_Equivalence_Class	1/1
✓	madd.s	MADD_Equivalence_Class	1/1
✓	madd.d	MADD_Equivalence_Class	1/1
✓	madd.ps	MADD_Equivalence_Class	1/1
✓	maddsub1.ps	MADD_Equivalence_Class	1/1
✓	maddsub2.ps	MADD_Equivalence_Class	1/1
✓	msub.s	MADD_Equivalence_Class	1/1
✓	msub.d	MADD_Equivalence_Class	1/1
✓	msub.ps	MADD_Equivalence_Class	1/1
✓	mul.s	MUL_Equivalence_Class	1/1
✓	mul.d	MUL_Equivalence_Class	1/1
✓	mul.ps	MUL_Equivalence_Class	1/1
✓	neg.s	NEG_EquivalenceClass	1/1
✓	neg.d	NEG_EquivalenceClass	1/1
✓	neg.ps	NEG_EquivalenceClass	1/1
✓	nmadd.s	MADD_Equivalence_Class	1/1
✓	nmadd.d	MADD_Equivalence_Class	1/1
✓	nmadd.ps	MADD_Equivalence_Class	1/1
✓	nmsub.s	MADD_Equivalence_Class	1/1
✓	nmsub.d	MADD_Equivalence_Class	1/1
✓	nmsub.ps	MADD_Equivalence_Class	1/1
✓	recip.s	RECIP_Equivalence_Class	1/1

Top Groups: 0/0 (100%) Leaf Groups: 0/0 (100%) Instructions: 38/38 (100%) Situations: 38/38 (100%)

Generator Console

```
Generating file: test_00000.S
Creating package: test_00000
Moving file: test_00000.S to C:\Documents and Settings\root\Desktop\tests\test_00000
Generating file: test_00001.S
Creating package: test_00001
Moving file: test_00001.S to C:\Documents and Settings\root\Desktop\tests\test_00001
Generating file: test_00002.S
Creating package: test_00002
Moving file: test_00002.S to C:\Documents and Settings\root\Desktop\tests\test_00002
```

Top Groups: 0/0 (100%) Leaf Groups: 11/11 (100%) Instructions: 191/191 (100%) Situations: 191/191 (100%)