Reconfigurable Functionality — The OS Perspective

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Monday 26th June 2000

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Motivation

- FPL is good
- Want to bring that goodness to the masses
- Attempts to add FPL into desktop machines
- Lot's of good from at the low–level:
  - Using FPGA on PCI card
  - FPL and processor on one chip
  - FPL inside ALU of processor

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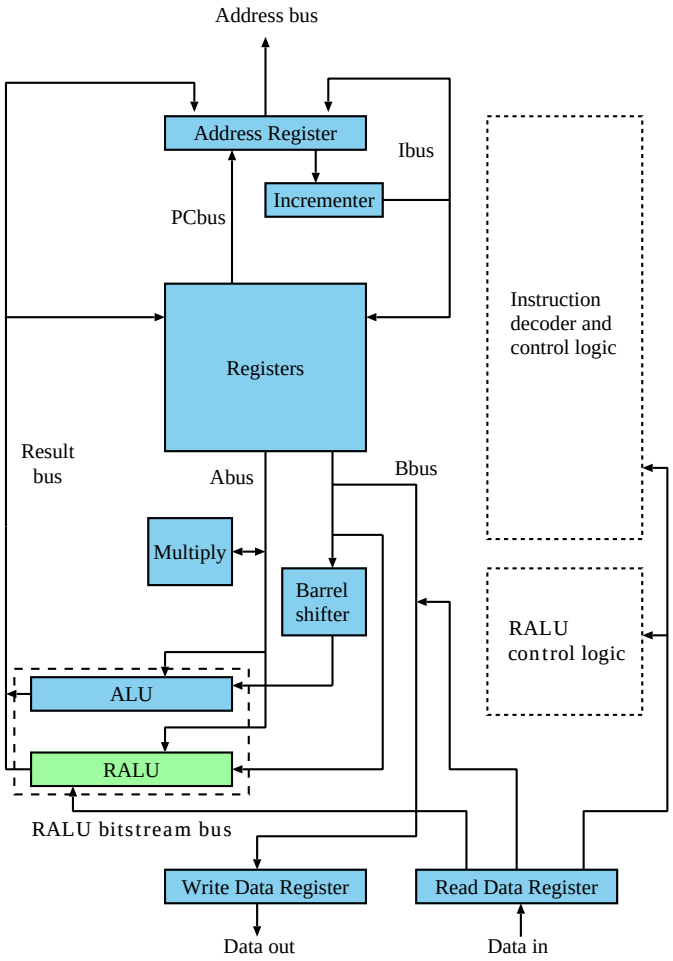
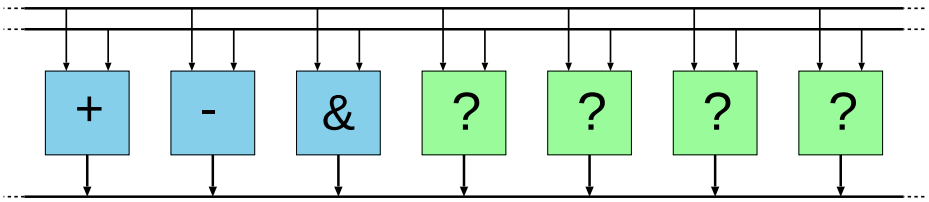
Motivation — Proteus Architecture

- Another attempt to bring FPL inside the processor.
- **Proteus Processor:**



Motivation — Proteus Architecture

- Uses multiple small RFUs:



- Shared between applications
- Attempt to reduce contention
- Currently building s/w model of ProteanARM

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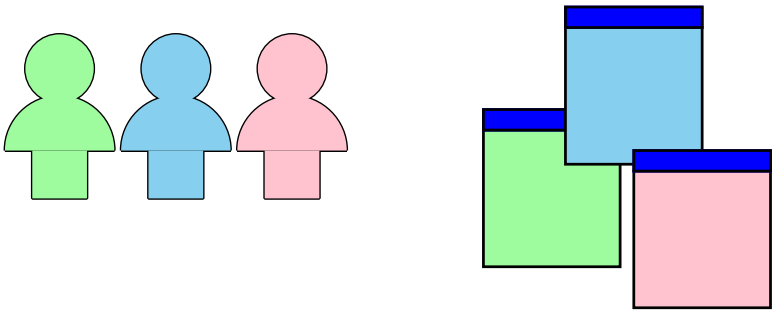
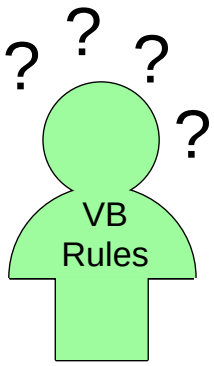
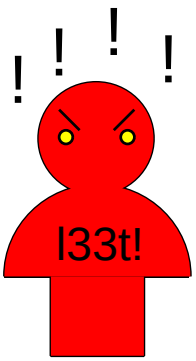
Motivation — What's currently missing?

- Easy to focus on syntax, not semantics
- Consider problems of desktop environment:

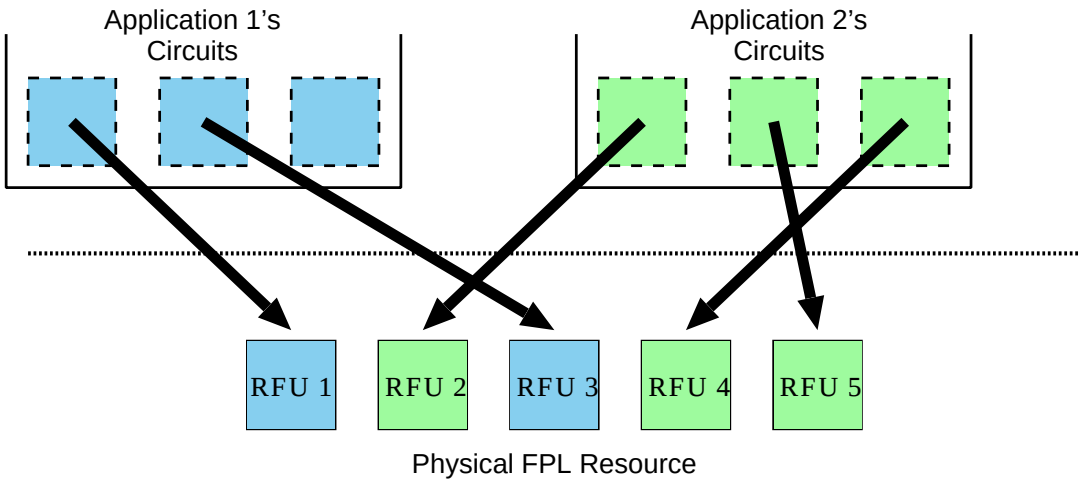






Problems — Resource management

- Single large resource is bad
  - Single large FPL block a area for contention
  - Performance crosstalk between applications
- OS virtualises the resources
- Treat virtual circuitry like virtual memory?



Problems — Security

- Break virtual machine — expose hardware to apps.
- Problems:
  - Division of labour between user and kernel mode
  - FPGA Viruses
  - Denial of Service
- Solved partially in Extendable OS research

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Problems — Context Explosion

- Context switching requires saving state
- Pure overhead
- More state = more overhead
- Typical modern OS may switch up to 100 times a second
- State in RFUs could affect this dramatically

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Problems — Concurrency and Timing

- Concurrency hard to manage
- Loading circuits — what happens if interrupts
  - Delay interrupt?
  - Back off and restart?

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Summary

- Lots of issues when consider what the OS needs
- Must support this model for desktop acceptance
- Needs low–level support
- Look at current OS support in processor design

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