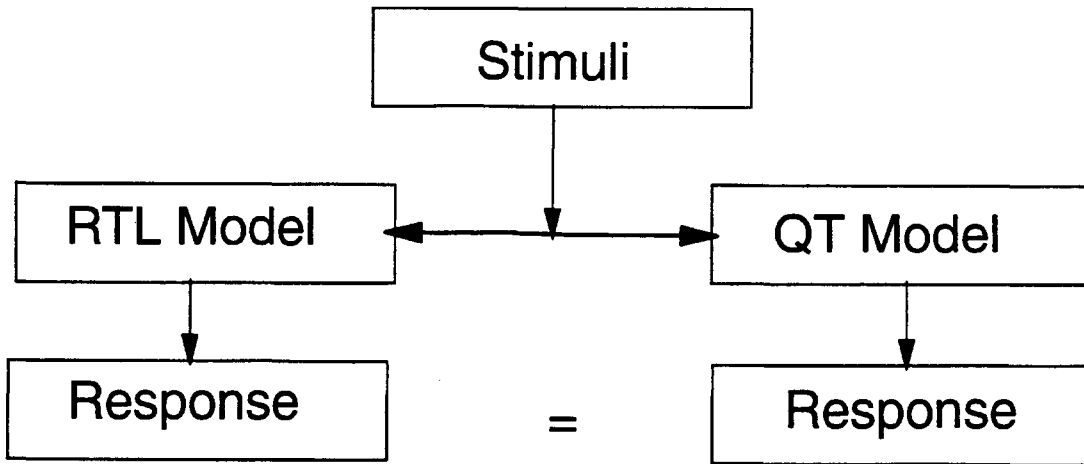


## Model Validation Methodology



## Results

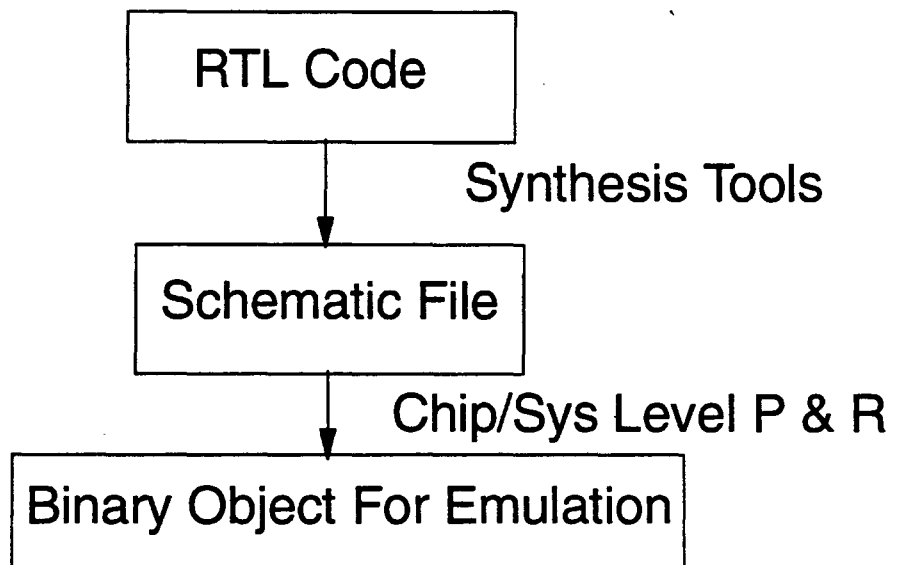
- Pentium processor time to market was improved by saving a few months of production ramp in 1993.
- Emulation speed of 300 KHz was achieved and trillions of simulation clocks were run pre-silicon.
- Booted all major OSs and ran dozens of applications pre-silicon.
- Found several Pentium processor errata and OS incompatibilities pre-silicon.
- Debugged hardware development tools and product engineering tools pre-silicon.

## Implementation Methodology

- Separate memory elements from logic elements e.g caches, ROMs.
- Implement memory elements on external memory boards.
- Partition logic design between Quickturn machines.

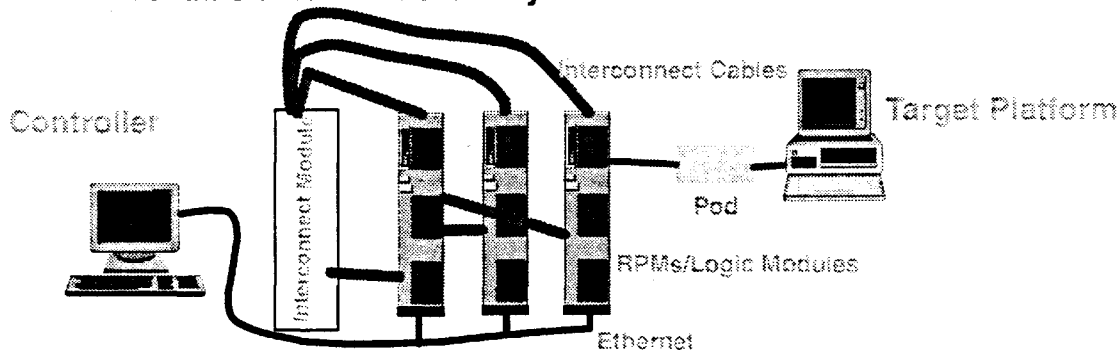
Function	# of RPMs
Floating Point	3
Caches	4
Integer	7
Total	14

## Implementation Process



## Our Preferred Choice

- "Software Breadboarding" offered by Quickturn RPM machines.
  - + Flexible enough to incorporate changes.
  - + Acceptable simulation speed in order of 100's of KHz.
  - First time ever in the industry effort.



Pentium™ Processor Design

## Project Requirements

- Boot operating systems.
- Run real world applications.
- Flexible environment which is an extension of the design/test environment.
- Easy to incorporate design changes.
- Debug/trace support equivalent to RTL in the hardware.

## Why These Goals?

- Microprocessor CPU designs are too complex to adequately validate at chip level.
- Regression tests do not guarantee complete backward compatibility. Any test depends on author's ability to "create" system level stress.
- RTL does not model the complete system.

## What Were The Possible Solutions?

- **Software Simulation & Accelerators.**
  - + Flexible, changes can be easily accommodated.
  - Slow. Simulation speed in the order of tens of hertz.
  - Impractical to model the entire system.
- **Hardware Prototyping.**
  - + Fast. Simulation speed can be in Mhz range.
  - Inflexible. Difficult to incorporate changes.
  - Large effort comparable to CPU design itself.
- **Combination of software simulation & hardware prototyping**

# Pre-Silicon Validation of Pentium CPU

Wern-Yan Koe  
Harish Nayak  
Nazar Zaidi  
Azam Barkatullah

## Pentium CPU Validation Goals

- Ensure backward compatibility with previous generation of processors.
- Run real world operating systems and applications pre-silicon to validate the design.