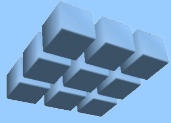


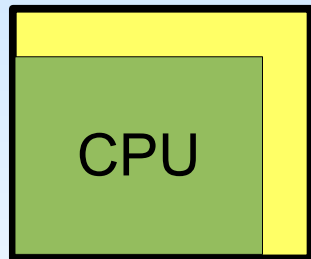
Software Development Tools for Soft Multiprocessors

Steven A. Guccione
Cmpware, Inc.

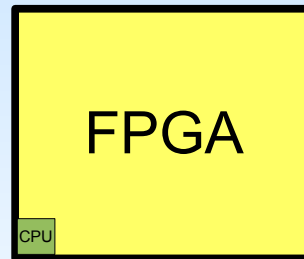


Introduction

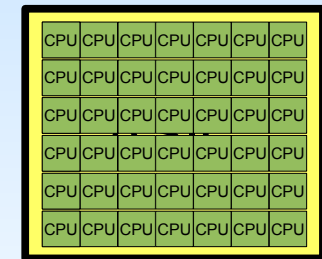
- One billion transistor FPGAs available (2006)
- FPGA design becoming complex
- Emerging trend: soft multiprocessors
 - Large, programmable IP blocks (CPUs)
 - Hundreds of CPUs / thousands of MIPS



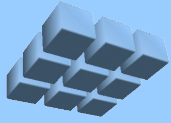
2002 Soft CPU



2006 Soft CPU



2006 Soft MP



Processor Level Modeling

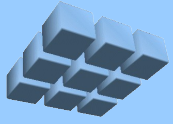
- Models (dynamically) built from:
 - Processors: Store and process data
 - Memory: Local or shared memory
 - Links: Transfer data between processors
 - Networks: A collection of links
- Simulates at the processor level
- Executes at up to 2M instructions / sec
- Quickly change architecture
- Executes software

CPU
Model

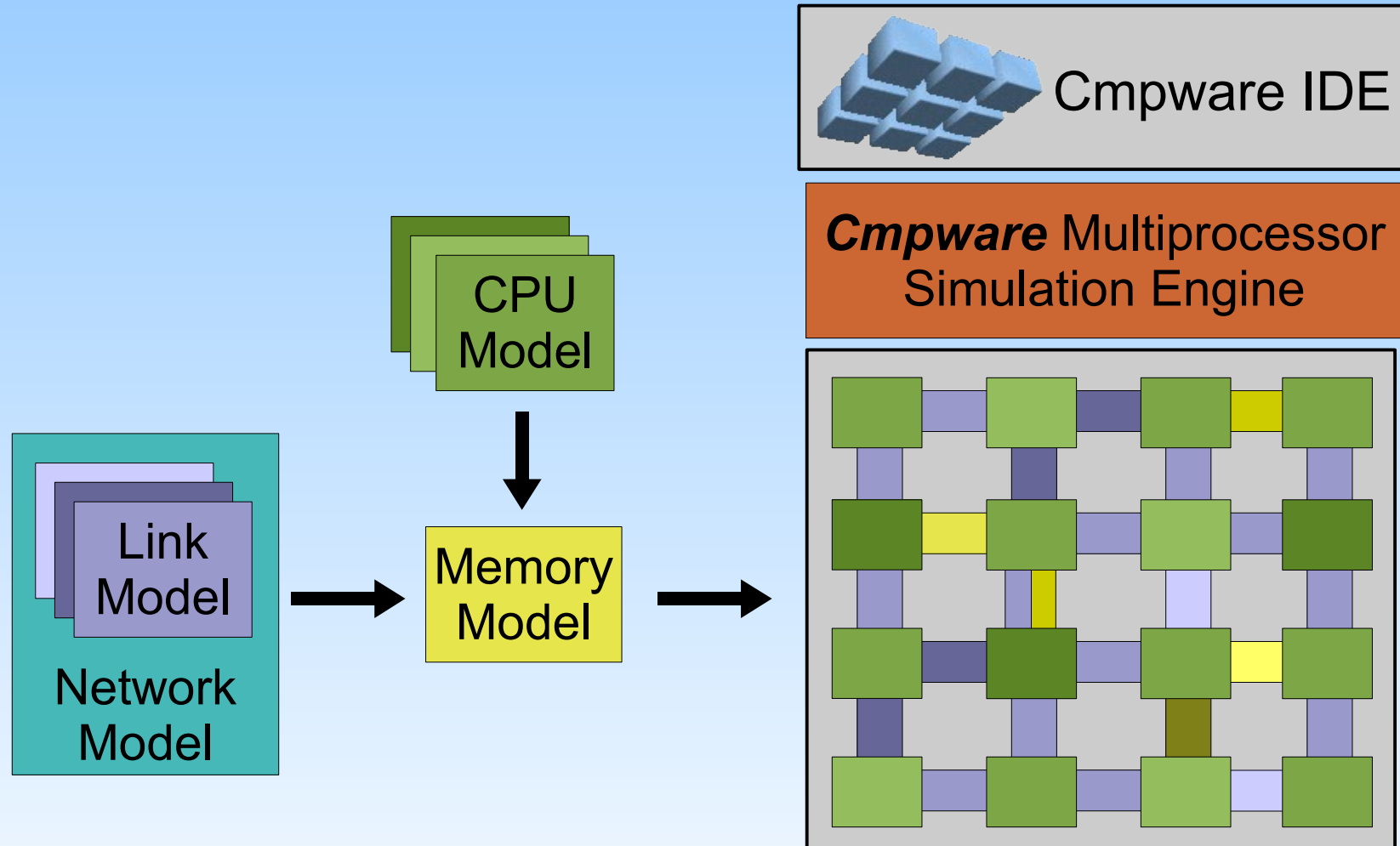
Memory
Model

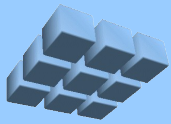
Network
Model

Link
Model



The Multiprocessor Model





The Cmpware CMP-DK

Applications Actions Wed Jan 18, 9:20 AM

Cmpware - Eclipse SDK

File Edit Refactor Navigate Search Project Run Window Help

Variables »5 CMP Array Memory Disassembly C Source code

Ping.c:

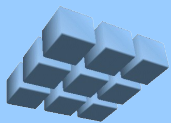
- ▲ int *north = -214748
- ▲ int *east = -2147483
- ▲ int *south = -214748
- ▲ int *west = -2147483
- ▲ int *dev_null = -2147
- ▲ unsigned char *north
- ▲ unsigned char *east
- ▲ unsigned char *south
- ▲ unsigned char *west

main():

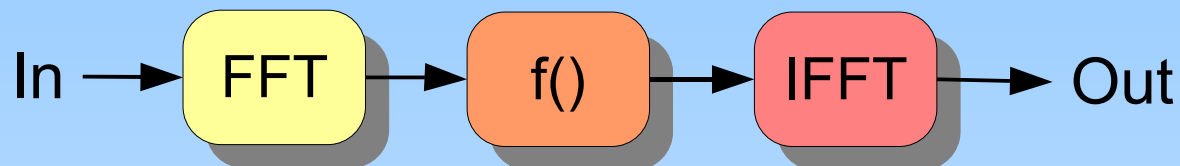
- ▲ int argc = 0
- ▲ char **argv = 0
- ▲ int i = 2

Execution step (cycle = 34)

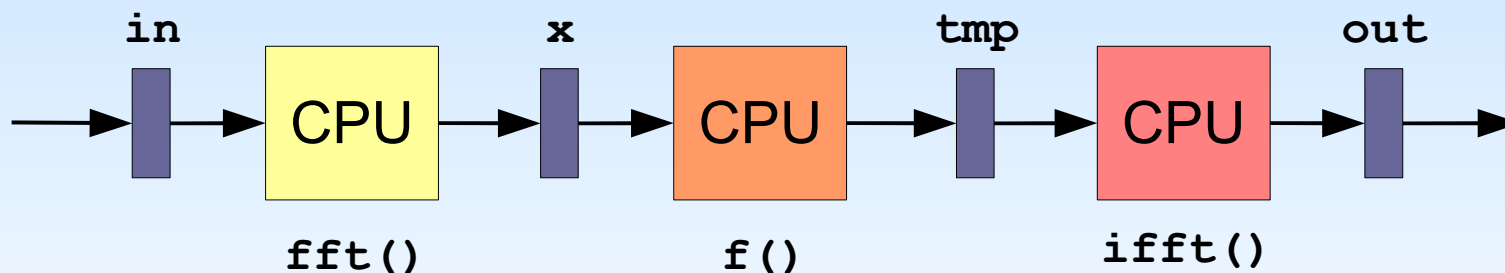
Cmpware - Eclipse SDK 32°F

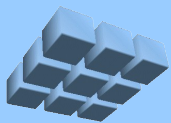


Filtering Example: Task Level Parallelism

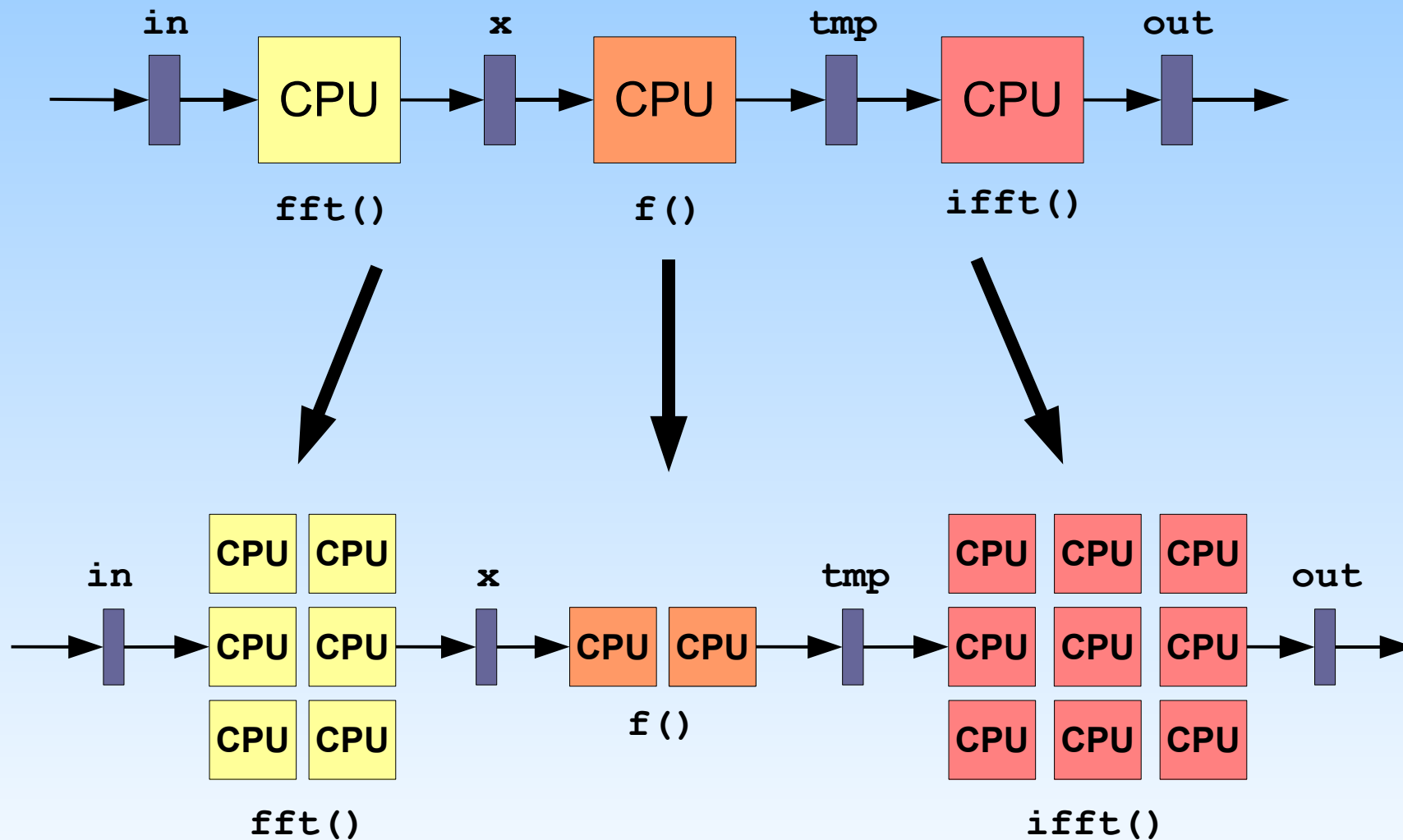


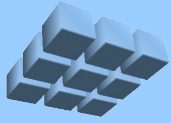
```
volatile int *x, *in, *tmp, *out;  
  
*x = fft(*in);  
*tmp = f(x);  
*out = ifft(tmp);
```





Filter Example: Sub-Task Level Parallelism





Conclusions

- Soft multiprocessing solves HW design problems (but creates SW design problems!)
- Good SW development tools essential
- Cmpware CMP-DK:
 - Quickly build and program multiprocessors
 - Redefine multiprocessor in seconds
 - Speeds simulation (2M+ instructions / second)
 - Complete Eclipse development environment
 - Standard models for NIOS, MicroBlaze, Sparc (LEON), MIPS32 and more