EE4390 Microprocessors

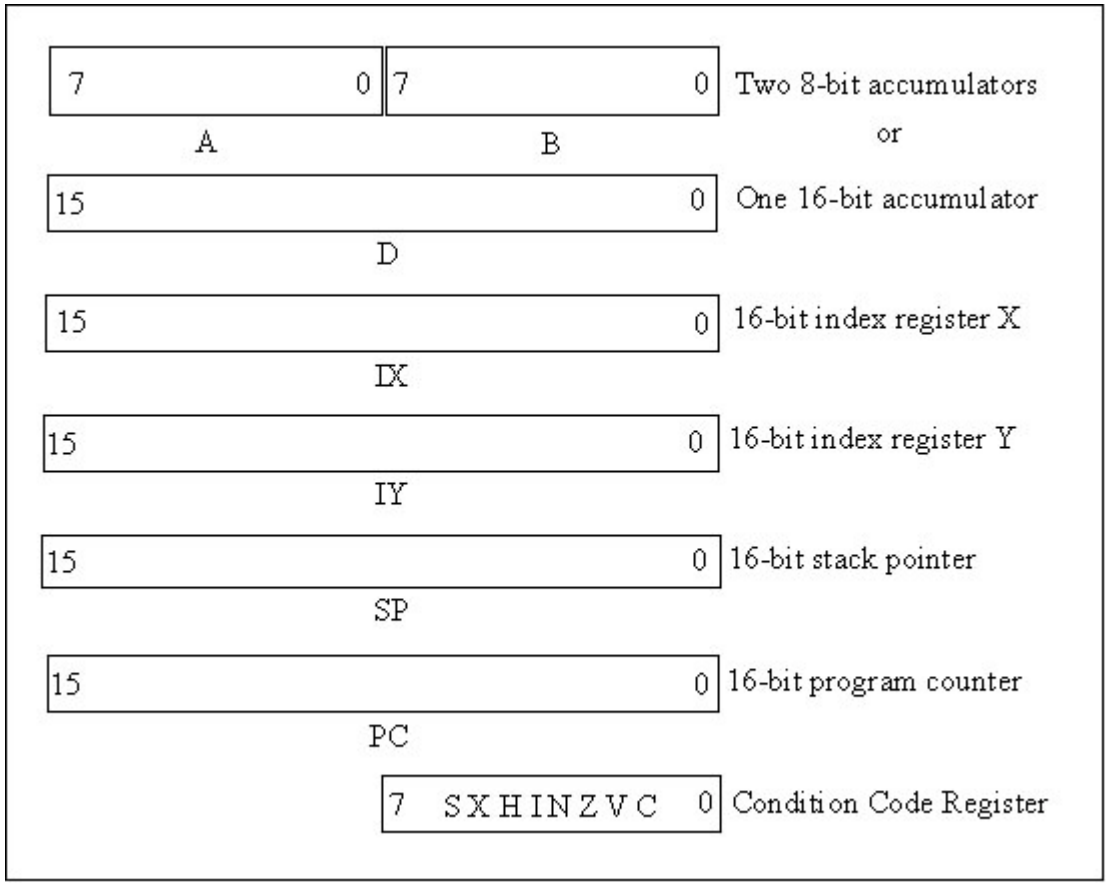
Lesson 4

Programming Model, Assembly Language, Instruction Execution Cycle

Overview

- Programming Model
- Motorola Assembly Language
- Instruction Execution Cycle

Programming Model

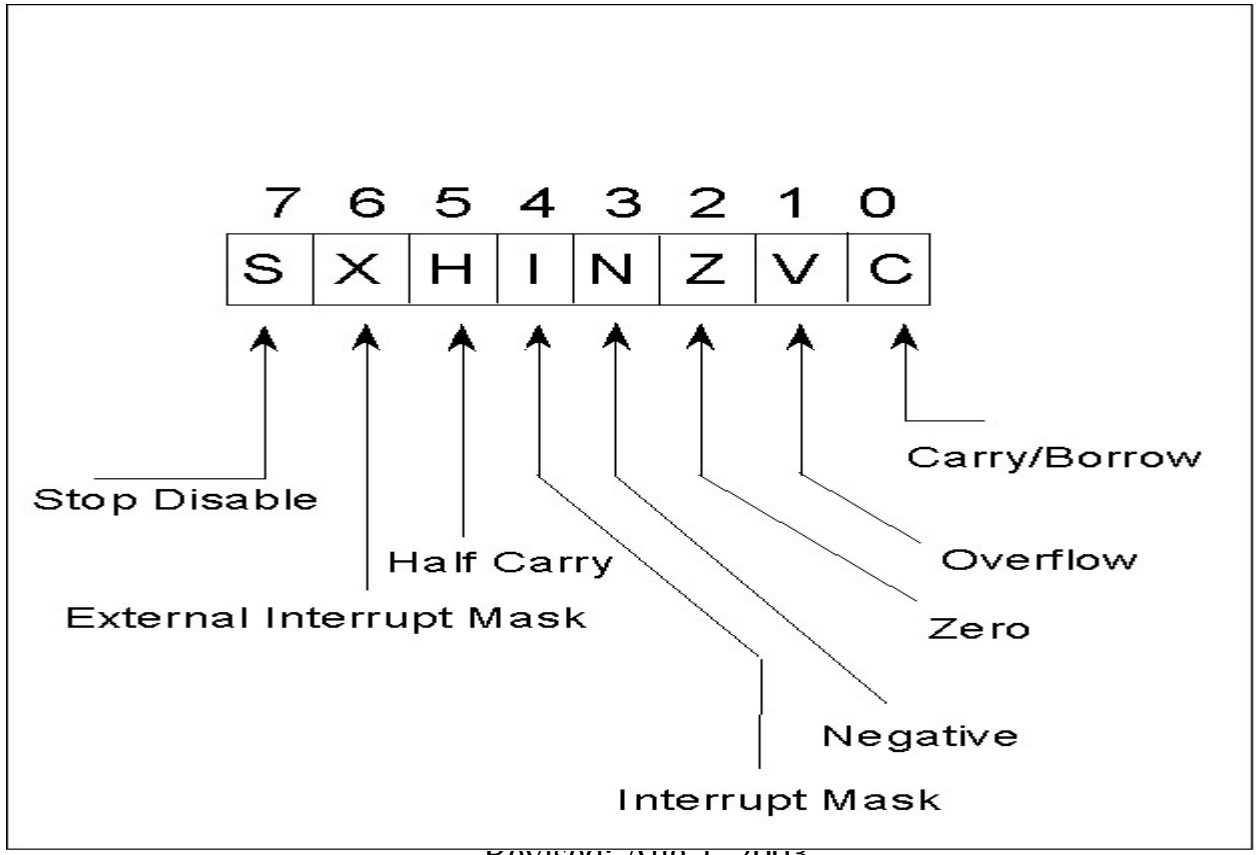


Programming Model (cont)

- A, B: 8-bit accumulators
  - collectively D: 16-bit register
- X, Y: 16-bit index registers
- SP: 16-bit stack pointer
- PC: 16-bit program counter
- CCR: 8-bit Condition Code Register

Programming Model (cont)

- Condition Code Register - Reference Appx A



Programming Model (cont)

- S: disables STOP instruction
- X: enables nonmaskable interrupt
- H: half carry flag from lower nibble to upper nibble
- I: enable maskable interrupts

- N: negative flag
- Z: zero flag
- V: overflow flag
- C: carry flag

- Flag activities:
  - 1 : sets
  - 0 : resets
  - - : no change
  - △ : determined by operation

Motorola Assembly Language

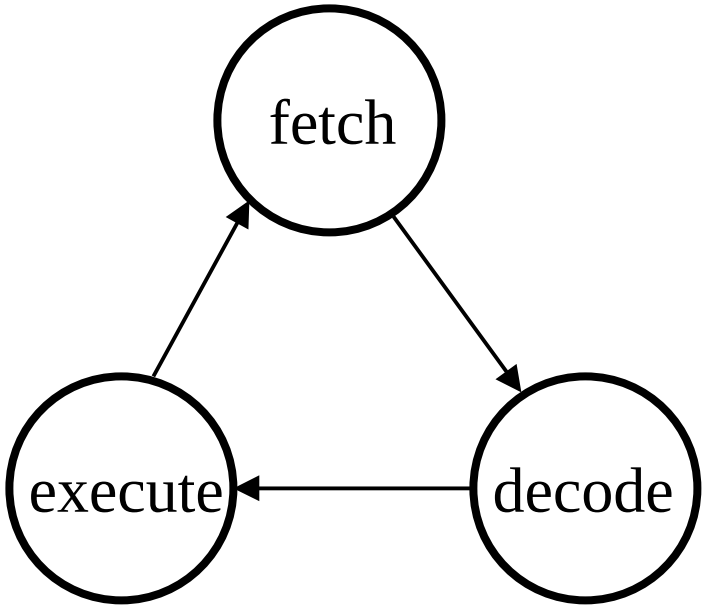
Label	Op-Code	Operand(s)	Comment
start:	LDAA	#FC	;load acc A

- Label: name for a memory location
- Op-Code: mnemonic, action part of instruction
- Operand: access to data for instruction via addressing mode
- Comment: “;” indicates comment follows
  - can also be used at the beginning of a line

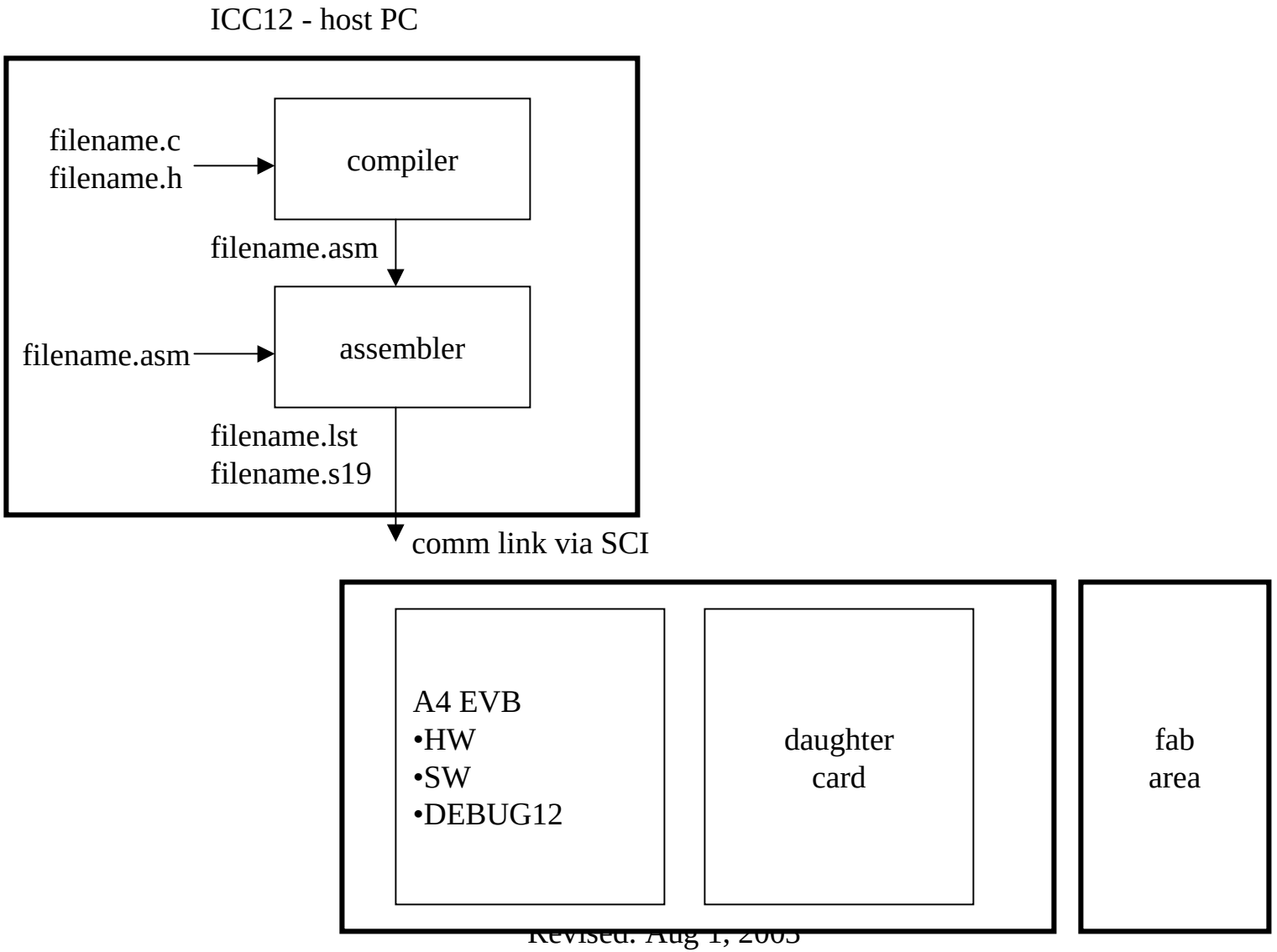
Assembly vs C

- Assembly:
  - better HW control, faster
- C:
  - more readable
  - Top-Down Design
  - more efficient programming
  - do not need to know HW details

Instruction Execution Cycle



“The Big Picture”



ICC12 Specific Items

```
.area name(abs)

.org $1000

_main::

loop::

;sample program
```

Sample Code

```
; File Name: introlab.s
; File Created: 04-08-02
; File Modified: 04-13-02
; Author(s): Abbie Wells
; Introductory Lab Exercise to demonstrate uses of the
; HC12 Teaching Platform and familiarize the user with
; assembly code.  Basic arithemetic operations will be
; performed, results and CCR contents stored to memory,
; and CCR contents displayed to the LEDs.
  .area introlab(abs)
  .org $4100
_main::

  PORTT = $00AE                    ; Create label for Port T
  DDRT = $00AF                     ; Create label for DDRT
  TSCR = $0086                     ; Create label for TSCR

; Initialize Port T to be an output port
```

Memory Map - A4 Evaluation Board

Table 3-5. Factory-Configuration Memory Map

Address Range	Description	Location
$0000 - $01FF	CPU registers	on-chip (MCU)
$0800 - $09FF $0A00 - $0BFF	user code/data reserved for D-Bug12	1K on-chip RAM (MCU)
$1000 - $1FFF	user code/data	4K on-chip EEPROM (MCU)
$4000 - $7FFF	user code/data	16K external RAM (U4, U6A)
$8000 - $9FFF $A000 - $FD7F $FD80 - $FDFF $FE00 - $FE7F $FE80 - $FEFF $FF00 - $FF7F $FF80 - $FFFF	available for user programs* D-Bug12 program D-Bug12 startup code* user-accessible functions D-Bug12 customization data* available for user programs* reserved for interrupt and reset vectors	32K external EPROM (U7, U9A)
*Code in these areas may be modified. Requires reprogramming of the EPROMs — refer to **Appendix E Customizing the EPROMs**.		