Program Modeling Concepts: Lesson-2: DATA FLOW GRAPH MODELS

Chapter-6 L2: "Embedded Systems - Architecture, Programming and Design" , Raj Kamal, Publs.: McGraw-Hill, Inc.

1. DFG

Data Flow graph (DFG)

- A data-flow means that a program flow such that specifically the data only determines all the program execution steps and program flows are determined specifically only by the data.

- Programmer predetermines the data inputs and designs the programming steps to generate the data output

Data Flow Graph (DFG) Model for Program Analysis

- A set of data-input generates a set of data-output and another set of input will generate another output.

Example of Data Flow graph (DFG)

- A program for finding an *average* of grades in various subjects will have the data inputs of grades and data output of the *average*.

- Program executes a function to generate the appropriate output.

- The data flow graph model is appropriate to model the program for the average.

Data Flow graph (DFG) Modeling

- A circle represents each process (set of program steps) in DFG.

- An arrow directed towards the circle represents the data input (or set of inputs) and an arrow originating from the circle represents a data output (or a set of outputs).

- Data input along an input edge is considered as token.

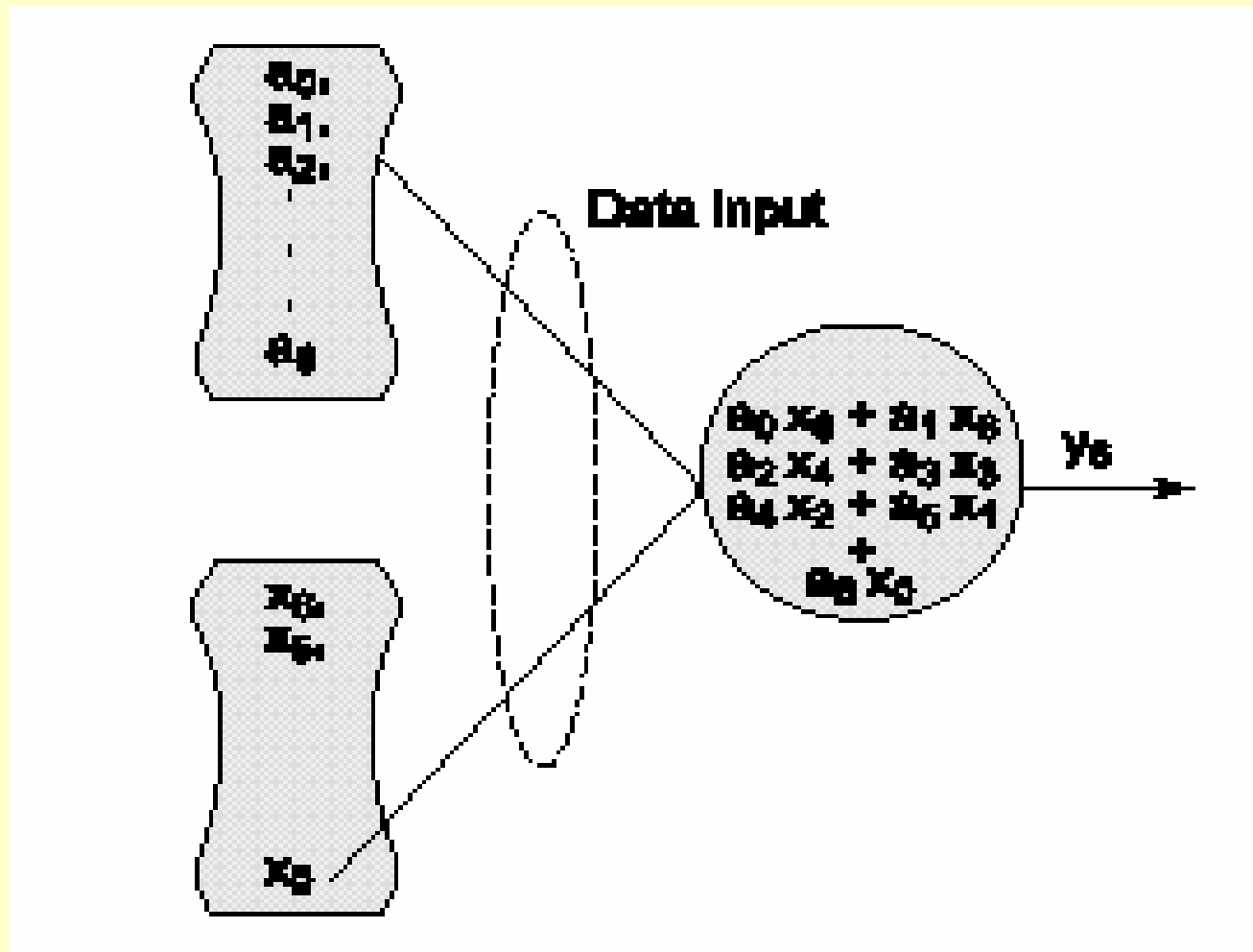- An input edge has at least one token.

Data Flow graph (DFG) Modeling

- The circle represents the node.

- The node is said to be fired by the tokens from all input edges.

- The output is considered by outgoing tokens, which are produced by the node on firing
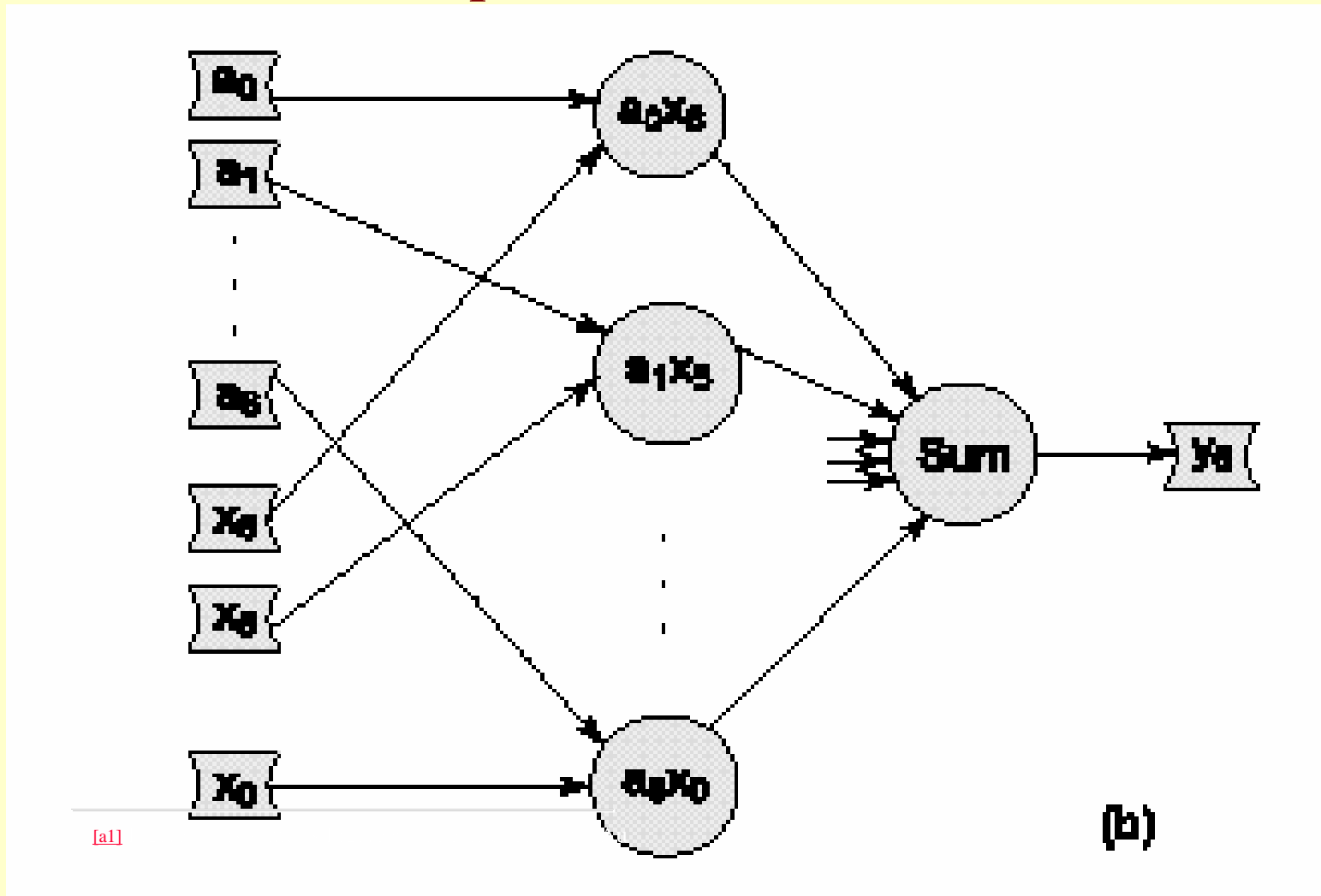
Data Flow graph (DFG) Modeling

- There are no control conditions in steps at DFG

- A DFG does not have any conditions within it so that the program has one data entry point and one data output point.

- There is only one independent path for program flow when program is executed

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Example: DFG model of the steps for finding the 6th FIR Sequence

DFG for a set of processes of the same sequence for an FIR filter with ten inputs and 10 coefficients
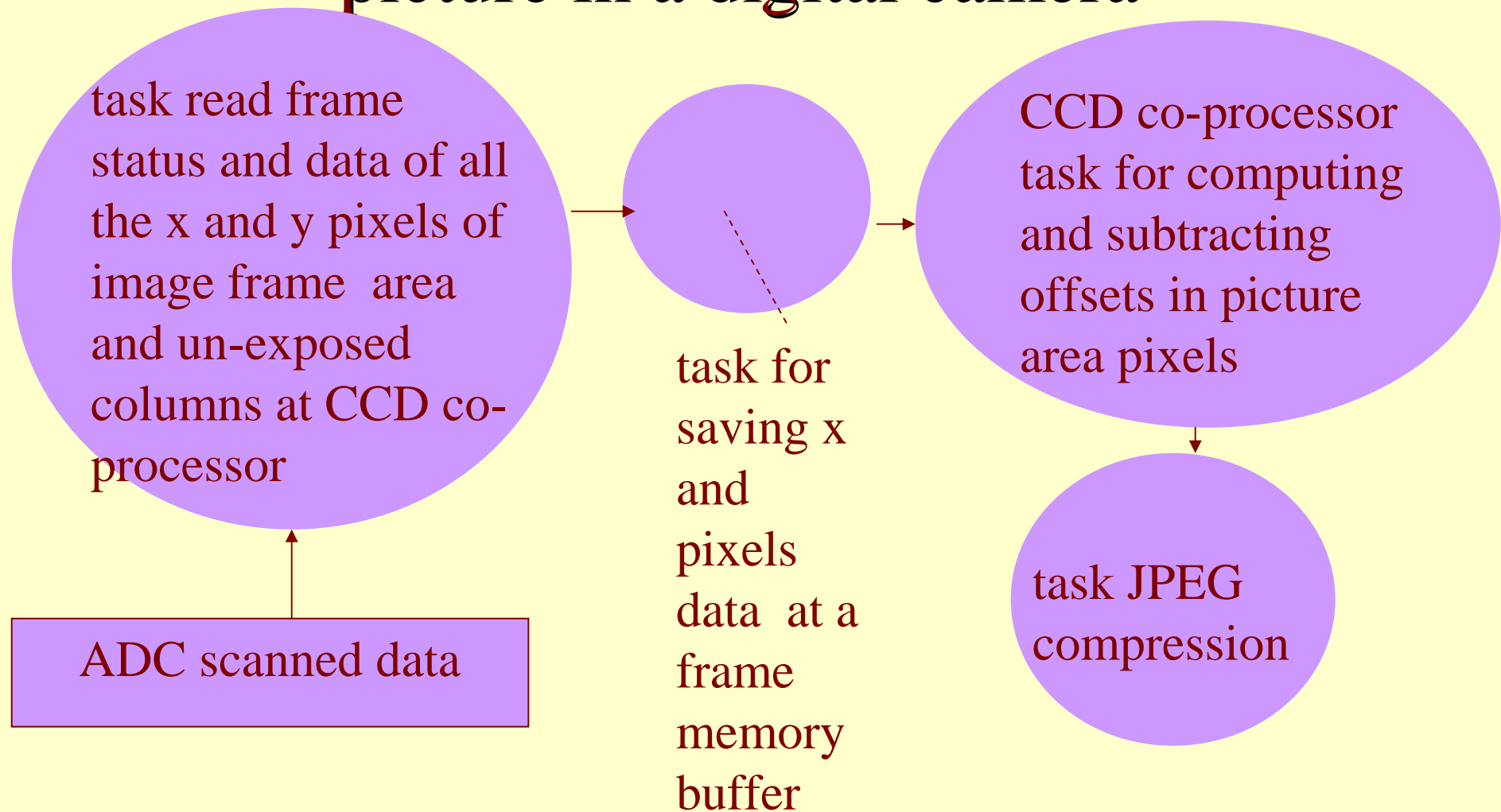

(b)

[a1]

Data Flow graph (DFG) Modeling

- Data flow graph models help in a simple code design.

- A simple code design can be defined as that in which the program mostly breaks into DFGs.

- A DFG models a fundamental program element having an independent path.

Data Flow graph (DFG) Modeling

- A DFG gives that unit of a system, which has no control conditions and thus a single path for the program flow.

DFG model for program for saving a picture in a digital camera

task read frame status and data of all the x and y pixels of image frame area and un-exposed columns at CCD co-processor

ADC scanned data

task for saving x and pixels data at a frame memory buffer

CCD co-processor task for computing and subtracting offsets in picture area pixels

task JPEG compression

Data Flow graph (DFG) Modeling

- A unit gives the program context and helps in analyzing a program in terms of complexity. A more complex program would have a lower number of DFG processes than a simple program.

2. ADFG

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Acrylic Data Flow Graph (ADFG)

- When there is only one set of values of each of the inputs and there is only one set of values of the output<u>s</u> for the given input, a DFG is then be also known as ADFG

- All inputs are instantaneously available in ADFG.

Examples of non-acrylic data input

(a) An event

(b) A status flag setting in a device and

(c) Input as per output condition of the previous process

Summary

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We learnt

- A programming task is simplified by representing the code for its each process by a circle, using the data input from an incoming arrow(s) and generating data output along an outgoing arrow(s).

- DFG model program translates and executes as a single process sequential model program.

We learnt

- A program executes as per the input (message or event or set of events) and input determines the output

- There are no control conditions within the process in DFG.

End of Lesson 2 of Chapter 6

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